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An Experimental Evaluation of a Full-Scale Single-Sided Linear Induction Motor with Different Reaction Rails

Volume II: Supplementary Data

Garrett AiResearch Manufacturing Company

2525 W. 190th St.
Torrance,
California 90509

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R.J.A. Bevan

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16. Abstract

This document presents supplementary data to Volume I: Test Results. It contains computer plots of all valid onboard data processed for 125 test runs, including baseline reaction rail tests for the 10- and 5-pole SLIM with dc and ac excitation, and solid iron reaction rail tests for the 10-pole SLIM with 26- and 18-mm airgaps and with dc and ac excitation.

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CONTENTS

SECTION 1

DATA PLOT CROSS-REFERENCE

Volume II contains computer plots of all valid onboard data processed for 125 of the test runs within the block of run numbers 981 to 1189, inclusive. Test runs numbered below 981 were preliminary efforts associated with vehicle checkout and acceptance testing rather than formal testing.

The graphed data in Volume II may be useful to other LIM researchers, but it should be used only in conjunction with Volume I, which provides the supporting and explanatory text.

The plotted data in Sections 2, 3, 4, and 5 is arranged as follows:

Section 2

Baseline reaction rail tests, 10-pole SLIM, dc excitation

Baseline reaction rail tests, 10-pole SLIM, ac excitation

Section 3

Baseline reaction rail tests, 5-pole (trailing) SLIM, ac excitation

Baseline reaction rail tests, 5-pole (leading) SLIM, ac excitation

Section 4

Solid iron reaction rail tests, 10-pole SLIM, 26-mm airgap, dc excitation

Solid iron reaction rail tests, 10-pole SLIM, 26-mm airgap, ac excitation

Section 5

Solid iron reaction rail tests, 10-pole SLIM, 18-mm airgap, dc excitation

Solid iron reaction rail tests, 10-pole SLIM, 18-mm airgap, ac excitation

All data plots bear figure numbers, which are referenced in Table 1-1. Ready accessibility to any data plot of interest is facilitated by cross referencing of figure number with section page number, as well as test criteria and applicable parameters (thrust, voltage, speed, slip, and so on).

TABLE 1-1

DATA PLOT CROSS-REFERENCE

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 10-Pole SLIM						Real Current
2-1	1042	B*	10	2-2	Braking Force	Speed
2-2	1044	B	10	2-3	Braking Force	Speed
2-3	1042	B	10	2-4	Vertical Force	Speed
2-4	1044	B	10	2-5	Vertical Force	Speed
2-5	1042	B	10	2-6	Pitching Moment	Speed
2-6	1044	B	10	2-7	Pitching Moment	Speed
2-7	981 to 1046	B	10	2-8	Efficiency	Slip
2-8	981 to 1046	B	10	2-9	Power Factor	Slip
2-9	981 to 1046	B	10	2-10	Current	Slip
2-10	981 to 1046	B	10	2-11	Thrust	Slip
2-11	981 to 1046	B	10	2-12	Thrust per pole	Slip
2-12	981 to 1046	B	10	2-13	Vertical Force	Slip
2-13	981 to 1046	B	10	2-14	Pitching Moment	Slip
2-14	981 to 1046	B	10	2-15	Voltage	Slip
2-15	981 to 1046	B	10	2-16	Efficiency x Power Factor	Slip
2-16	981 to 1046	B	10	2-17	Imaginary Current	Real Current
2-17	981 to 1046	B	10	2-18	Thrust	Slip
2-18	981 to 1046	B	10	2-19	Ideal and Measured Power Loss	Slip
2-19	981 to 1046	B	10	2-20	A-Phase Power	Slip
2-20	981 to 1046	B	10	2-21	B-Phase Power	Slip

* B: baseline reaction rail

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 10-Pole SLIM						
2-21	981 to 1046	B	10	2-22	C-Phase Power	Slip
2-22	981 to 1046	B	10	2-23	Vertical Force	Slip
2-23	981 to 1046	B	10	2-24	Pitching Moment	Slip
2-24	981 to 1046	B	10	2-25	A-Phase Voltage	Slip
2-25	981 to 1046	B	10	2-26	B-Phase Voltage	Slip
2-26	981 to 1046	B	10	2-27	C-Phase Voltage	Slip
2-27	981 to 1046	B	10	2-28	A-Phase Current	Slip
2-28	981 to 1046	B	10	2-29	B-Phase Current	Slip
2-29	981 to 1046	B	10	2-30	C-Phase Current	Slip
2-30	981	B	10	2-31	Flux Power, kVAR Voltage	Pole Pole Pole
2-31	983	B	10	2-32	Flux Power, kVAR Voltage	Pole Pole Pole
2-32	984	B	10	2-33	Flux Power, kVAR Voltage	Pole Pole Pole
2-33	991	B	10	2-34	Flux Power, kVAR Voltage	Pole Pole Pole
2-34	992	B	10	2-35	Flux Power, kVAR Voltage	Pole Pole Pole
2-35	993	B	10	2-36	Flux Power, kVAR Voltage	Pole Pole Pole
2-36	994	B	10	2-37	Flux Power, kVAR Voltage	Pole Pole Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 10-Pole SLIM						
2-37	995	B	10	2-38	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-38	996	B	10	2-39	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-39	999	B	10	2-40	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-40	1000	B	10	2-41	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-41	1008	B	10	2-42	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-42	1009.1	B	10	2-43	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-43	1009.2	B	10	2-44	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-44	1010	B	10	2-45	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-45	1011	B	10	2-46	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-46	1015	B	10	2-47	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-47	1016	B	10	2-48	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 10-Pole SLIM						
2-48	1017	B	10	2-49	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-49	1018	B	10	2-50	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-50	1021	B	10	2-51	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-51	1022	B	10	2-52	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-52	1023	B	10	2-53	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-53	1024	B	10	2-54	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-54	1025	B	10	2-55	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-55	1027	B	10	2-56	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-56	1028	B	10	2-57	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-57	1031	B	10	2-58	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
2-58	1036	B	10	2-59	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-1	1048 to 1084	B	5T*	3-2	Efficiency	Slip
3-2	1048 to 1084	B	5T	3-3	Power Factor	Slip
3-3	1048 to 1084	B	5T	3-4	Current	Slip
3-4	1048 to 1084	B	5T	3-5	Thrust	Slip
3-5	1048 to 1084	B	5T	3-6	Vertical Force	Slip
3-6	1048 to 1084	B	5T	3-7	Pitching Moment	Slip
3-7	1048 to 1084	B	5T	3-8	Voltage	Slip
3-8	1048 to 1084	B	5T	3-9	Efficiency x Power Factor	Slip
3-9	1048 to 1084	B	5T	3-10	Imaginary Current	Real Current
3-10	1048 to 1084	B	5T	3-11	Thrust	Slip
3-11	1048 to 1084	B	5T	3-12	Ideal and Measured Power Loss	Slip
3-12	1048 to 1084	B	5T	3-13	A-Phase Power	Slip
3-13	1048 to 1084	B	5T	3-14	B-Phase Power	Slip
3-14	1048 to 1084	B	5T	3-15	C-Phase Power	Slip
3-15	1048 to 1084	B	5T	3-16	Vertical Force	Slip
3-16	1048 to 1084	B	5T	3-17	Pitching Moment	Slip
3-17	1048 to 1084	B	5T	3-17	A-Phase Voltage	Slip
3-18	1048 to 1084	B	5T	3-18	B-Phase Voltage	Slip
3-19	1048 to 1084	B	5T	3-19	C-Phase Voltage	Slip
3-20	1048 to 1084	B	5T	3-20	A-Phase Current	Slip
3-21	1048 to 1084	B	5T	3-21	B-Phase Current	Slip
3-22	1048 to 1084	B	5T	3-22	C-Phase Current	Slip

*T: trailing

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-23	1049	B	5T	3-24	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-24	1050	B	5T	3-25	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-25	1051	B	5T	3-26	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-26	1055	B	5T	3-27	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-27	1059	B	5T	3-28	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-28	1062	B	5T	3-29	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-29	1063	B	5T	3-30	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-30	1064	B	5T	3-31	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-31	1065	B	5T	3-32	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-32	1070	B	5T	3-33	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-33	1071.1	B	5T	3-34	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-34	1071.2	B	5T	3-35	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-35	1072	B	5T	3-36	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-36	1073	B	5T	3-37	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-37	1074.1	B	5T	3-38	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-38	1074.2	B	5T	3-39	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-39	1074.3	B	5T	3-40	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-40	1075	B	5T	3-41	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-41	1076	B	5T	3-42	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-42	1077	B	5T	3-43	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-43	1080.1	B	5T	3-44	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-44	1080.2	B	5T	3-45	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-45	1081	B	5T	3-46	Flux Power, kVAR Voltage	Pole Pole Pole
3-46	1082	B	5T	3-47	Flux Power, kVAR Voltage	Pole Pole Pole
3-47	1083	B	5T	3-48	Flux Power, kVAR Voltage	Pole Pole Pole
3-48	1084.1	B	5T	3-49	Flux Power, kVAR Voltage	Pole Pole Pole
3-49	1084.2	B	5T	3-50	Flux Power, kVAR Voltage	Pole Pole Pole
3-50	1085 to 1112	B	5L*	3-51	Efficiency	Slip
3-51	1085 to 1112	B	5L	3-52	Power Factor	Slip
3-52	1085 to 1112	B	5L	3-53	Current	Slip
3-53	1085 to 1112	B	5L	3-54	Thrust	Slip
3-54	1085 to 1112	B	5L	3-55	Thrust per Pole	Slip
3-55	1085 to 1112	B	5L	3-56	Vertical Force	Slip
3-56	1085 to 1112	B	5L	3-57	Pitching Moment	Slip
3-57	1085 to 1112	B	5L	3-58	Voltage	Slip
3-58	1085 to 1112	B	5L	3-59	Efficiency x Power Factor	Slip
3-59	1085 to 1112	B	5L	3-60	Imaginary Current	Real Current
3-60	1085 to 1112	B	5L	3-61	Thrust	Slip

*L: leading

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-61	1085 to 1112	B	5L	3-62	Ideal and Measured Power Loss	Slip
3-62	1085 to 1112	B	5L	3-63	A-Phase Power	Slip
3-63	1085 to 1112	B	5L	3-64	B-Phase Power	Slip
3-64	1085 to 1112	B	5L	3-65	C-Phase Power	Slip
3-65	1085 to 1112	B	5L	3-66	Vertical Force	Slip
3-66	1085 to 1112	B	5L	3-67	Pitching Moment	Slip
3-67	1085 to 1112	B	5L	3-68	A-Phase Voltage	Slip
3-68	1085 to 1112	B	5L	3-69	B-Phase Voltage	Slip
3-69	1085 to 1112	B	5L	3-70	C-Phase Voltage	Slip
3-70	1085 to 1112	B	5L	3-71	A-Phase Current	Slip
3-71	1085 to 1112	B	5L	3-72	B-Phase Current	Slip
3-72	1085 to 1112	B	5L	3-73	C-Phase Current	Slip
3-73	1085.1	B	5L	3-74	Flux Power, kVAR Voltage	Pole Pole Pole
3-74	1085.3	B	5L	3-75	Flux Power, kVAR Voltage	Pole Pole Pole
3-75	1086	B	5L	3-76	Flux Power, kVAR Voltage	Pole Pole Pole
3-76	1087	B	5L	3-77	Flux Power, kVAR Voltage	Pole Pole Pole
3-77	1088	B	5L	3-78	Flux Power, kVAR Voltage	Pole Pole Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-78	1089	B	5L	3-79	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-79	1090.3	B	5L	3-80	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-80	1090.4	B	5L	3-81	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-81	1091.1	B	5L	3-82	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-82	1092	B	5L	3-83	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-83	1093.1	B	5L	3-84	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-84	1094.1	B	5L	3-85	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-85	1095	B	5L	3-86	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-86	1096	B	5L	3-87	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-87	1097	B	5L	3-88	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-88	1098.1	B	5L	3-89	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Baseline Reaction Rail Tests, 5-Pole SLIM						
3-89	1098.2	B	5L	3-90	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-90	1101	B	5L	3-91	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-91	1102.1	B	5L	3-92	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-92	1103	B	5L	3-93	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-93	1104	B	5L	3-94	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-94	1105	B	5L	3-95	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-95	1106.1	B	5L	3-96	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-96	1106.3	B	5L	3-97	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-97	1111	B	5L	3-98	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-98	1112.1	B	5L	3-99	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
3-99	1112.3	B	5L	3-100	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Solid Iron Reaction Rail Tests, 10-Pole SLIM, 26-mm Airgap						
4-1	1119	S*	10	4-2	Braking Force	Speed
4-2	1120	S	10	4-3	Braking Force	Speed
4-3	1119	S	10	4-4	Vertical Force	Speed
4-4	1120	S	10	4-5	Vertical Force	Speed
4-5	1119	S	10	4-6	Pitching Moment	Speed
4-6	1120	S	10	4-7	Pitching Moment	Speed
4-7	1121 to 1154	S	10	4-8	Efficiency	Slip
4-8	1121 to 1154	S	10	4-9	Power Factor	Slip
4-9	1121 to 1154	S	10	4-10	Current	Slip
4-10	1121 to 1154	S	10	4-11	Thrust	Slip
4-11	1121 to 1154	S	10	4-12	Thrust per Pole	Slip
4-12	1121 to 1154	S	10	4-13	Vertical Force	Slip
4-13	1121 to 1154	S	10	4-14	Pitching Moment	Slip
4-14	1121 to 1154	S	10	4-15	Voltage	Slip
4-15	1121 to 1154	S	10	4-16	Efficiency x Power Factor	Slip
4-16	1121 to 1154	S	10	4-17	Imaginary Current	Real Current
4-17	1121 to 1154	S	10	4-18	Thrust	Slip
4-18	1121 to 1154	S	10	4-19	Ideal and Measured Power Loss	Slip
4-19	1121 to 1154	S	10	4-20	A-Phase Power	Slip
4-20	1121 to 1154	S	10	4-21	B-Phase Power	Slip
4-21	1121 to 1154	S	10	4-22	C-Phase Power	Slip

*S: solid iron

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Solid Iron Reaction Rail Tests, 10-Pole SLIM, 26-mm Airgap						
4-22	1121 to 1154	S	10	4-23	Vertical Force	Slip
4-23	1121 to 1154	S	10	4-24	Pitching Moment	Slip
4-24	1121 to 1154	S	10	4-25	A-Phase Voltage	Slip
4-25	1121 to 1154	S	10	4-26	B-Phase Voltage	Slip
4-26	1121 to 1154	S	10	4-27	C-Phase Voltage	Slip
4-27	1121 to 1154	S	10	4-28	A-Phase Current	Slip
4-28	1121 to 1154	S	10	4-29	B-Phase Current	Slip
4-29	1121 to 1154	S	10	4-30	C-Phase Current	Slip
4-30	1121	S	10	4-31	Flux Power, kVAR Voltage	Pole Pole Pole
4-31	1122	S	10	4-32	Flux Power, kVAR Voltage	Pole Pole Pole
4-32	1123.1	S	10	4-33	Flux Power, kVAR Voltage	Pole Pole Pole
4-33	1123.2	S	10	4-34	Flux Power, kVAR Voltage	Pole Pole Pole
4-34	1124.1	S	10	4-35	Flux Power, kVAR Voltage	Pole Pole Pole
4-35	1125	S	10	4-36	Flux Power, kVAR Voltage	Pole Pole Pole
4-36	1126	S	10	4-37	Flux Power, kVAR Voltage	Pole Pole Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Solid Iron Reaction Rail Tests, 10-Pole SLIM, 26-mm Airgap						
4-37	1127	S	10	4-38	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-38	1128	S	10	4-39	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-39	1129.1	S	10	4-40	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-40	1131.1	S	10	4-41	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-41	1132	S	10	4-42	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-42	1133.1	S	10	4-43	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-43	1137	S	10	4-44	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-44	1138	S	10	4-45	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
4-45	1139	S	10	4-46	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Solid Iron Reaction Rail Tests, 10-Pole SLIM, 18-mm Airgap						
5-1	1081	S	10	5-2	Braking Force	Speed
5-2	1081	S	10	5-3	Vertical Force	Speed
5-3	1081	S	10	5-4	Pitching Moment	Speed
5-4	1181	S	10	5-5	Vertical Force	$(\text{Current})^2$
5-5	1156 to 1189	S	10	5-6	Efficiency	Slip
5-6	1156 to 1189	S	10	5-7	Power Factor	Slip
5-7	1156 to 1189	S	10	5-8	Current	Slip
5-8	1156 to 1189	S	10	5-9	Thrust	Slip
5-9	1156 to 1189	S	10	5-10	Thrust per Pole	Slip
5-10	1156 to 1189	S	10	5-11	Vertical Force	Slip
5-11	1156 to 1189	S	10	5-12	Pitching Moment	Slip
5-12	1156 to 1189	S	10	5-13	Voltage	Slip
5-13	1156 to 1189	S	10	5-14	Efficiency x Power Factor	Slip
5-14	1156 to 1189	S	10	5-15	Imaginary Current	Real Current
5-15	1156 to 1189	S	10	5-16	Thrust	Slip
5-16	1156 to 1189	S	10	5-17	Ideal and Measured Power Loss	Slip
5-17	1156 to 1189	S	10	5-18	A-Phase Power	Slip
5-18	1156 to 1189	S	10	5-19	B-Phase Power	Slip
5-19	1156 to 1189	S	10	5-20	C-Phase Power	Slip
5-20	1156 to 1189	S	10	5-21	Vertical Force	Slip
5-21	1156 to 1189	S	10	5-22	Pitching Moment	Slip

TABLE 1-1 (Continued)

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Solid Iron Reaction Rail Tests, 10-Pole SLIM, 18-mm Airgap						
5-22	1156 to 1189	S	10	5-23	A-Phase Voltage	Slip
5-23	1156 to 1189	S	10	5-24	B-Phase Voltage	Slip
5-24	1156 to 1189	S	10	5-25	C-Phase Voltage	Slip
5-25	1156 to 1189	S	10	5-26	A-Phase Current	Slip
5-26	1156 to 1189	S	10	5-27	B-Phase Current	Slip
5-27	1156 to 1189	S	10	5-28	C-Phase Current	Slip
5-28	1156.1	S	10	5-29	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-29	1157	S	10	5-30	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-30	1162.1	S	10	5-31	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-31	1162.5	S	10	5-32	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-32	1163.1	S	10	5-33	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-33	1164.2	S	10	5-34	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-34	1165.1	S	10	5-35	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-35	1156	S	10	5-36	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

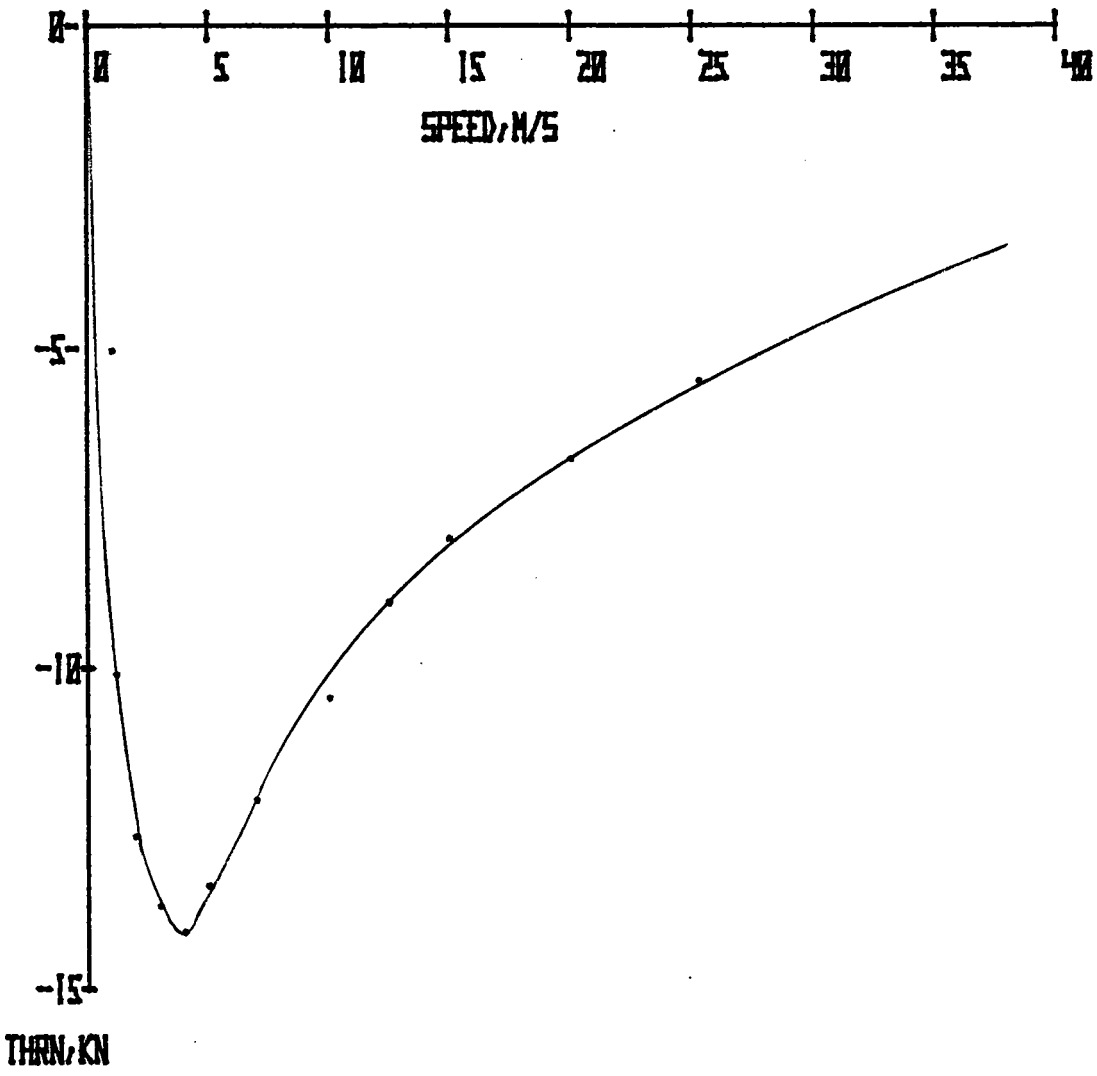
TABLE 1-1 (Continued

Figure Number	Run Number	Type Rail	Poles	Page Number	Ordinate	Abscissa
Solid Iron Reaction Rail Tests, 10-Pole SLIM, 18-mm Airgap						
5-36	1168	S	10	5-37	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-37	1170	S	10	5-38	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-38	1172	S	10	5-39	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-39	1176	S	10	5-40	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole
5-40	1189	S	10	5-41	Flux	Pole
					Power, kVAR	Pole
					Voltage	Pole

SECTION 2

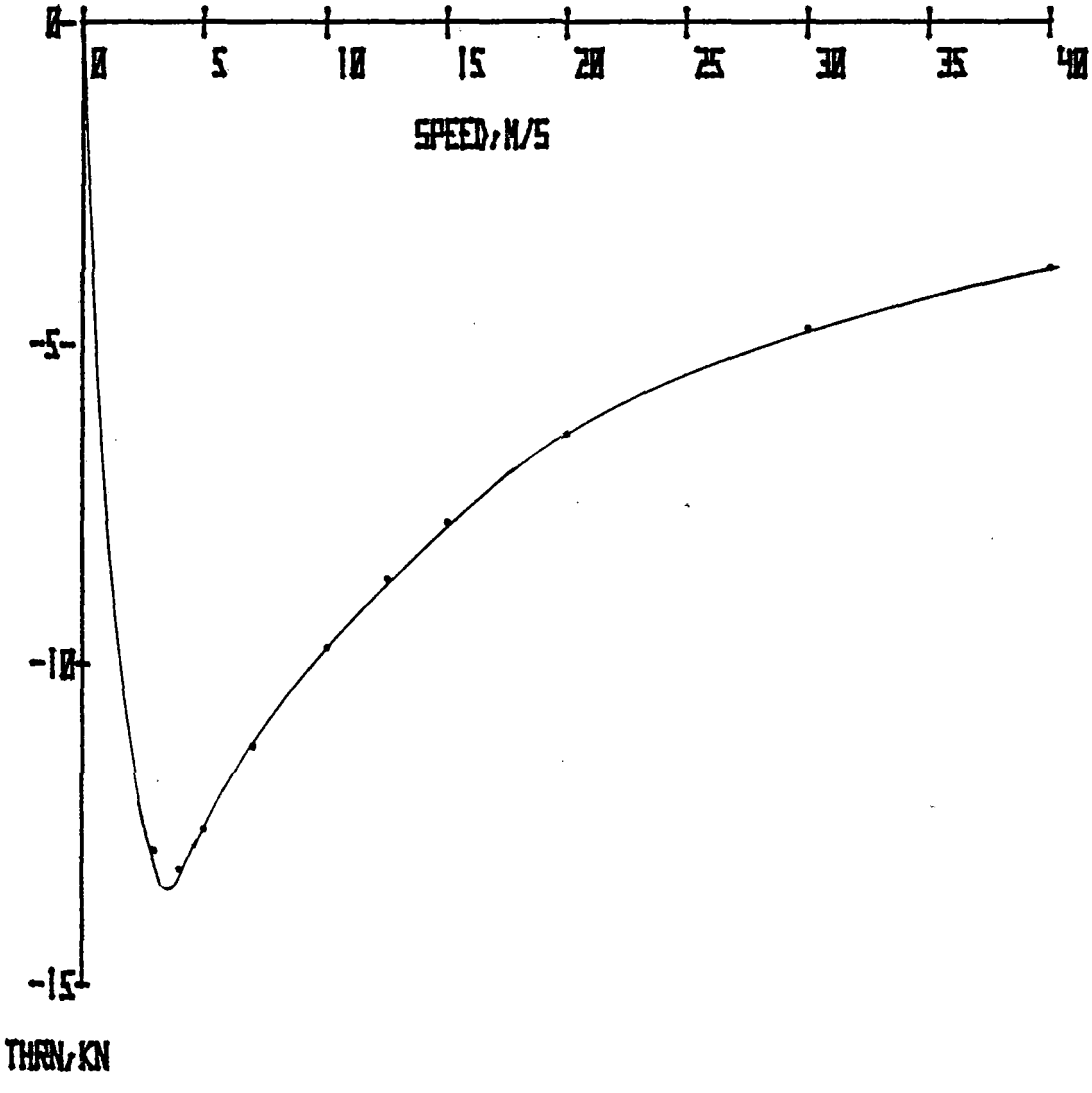
BASELINE REACTION RAIL TEST DATA, 10-POLE SLIM

Figures 2-1 through 2-6 reflect test data acquired with dc excitation, while the ac excitation mode is applicable to data in Figures 2-7 through 2-58.



DC EDDY CURRENT TEST-BASELINE REACTION RAIL
BRAKING FORCE VS SPEED
10 POLES I=1.71 KA RUN 1042

Figure 2-1



DC EDDY CURRENT TEST-BASELINE REACTION RAIL
BRAKING FORCE VS SPEED
10 POLES I=1.71 KA RUN 1044

Figure 2-2

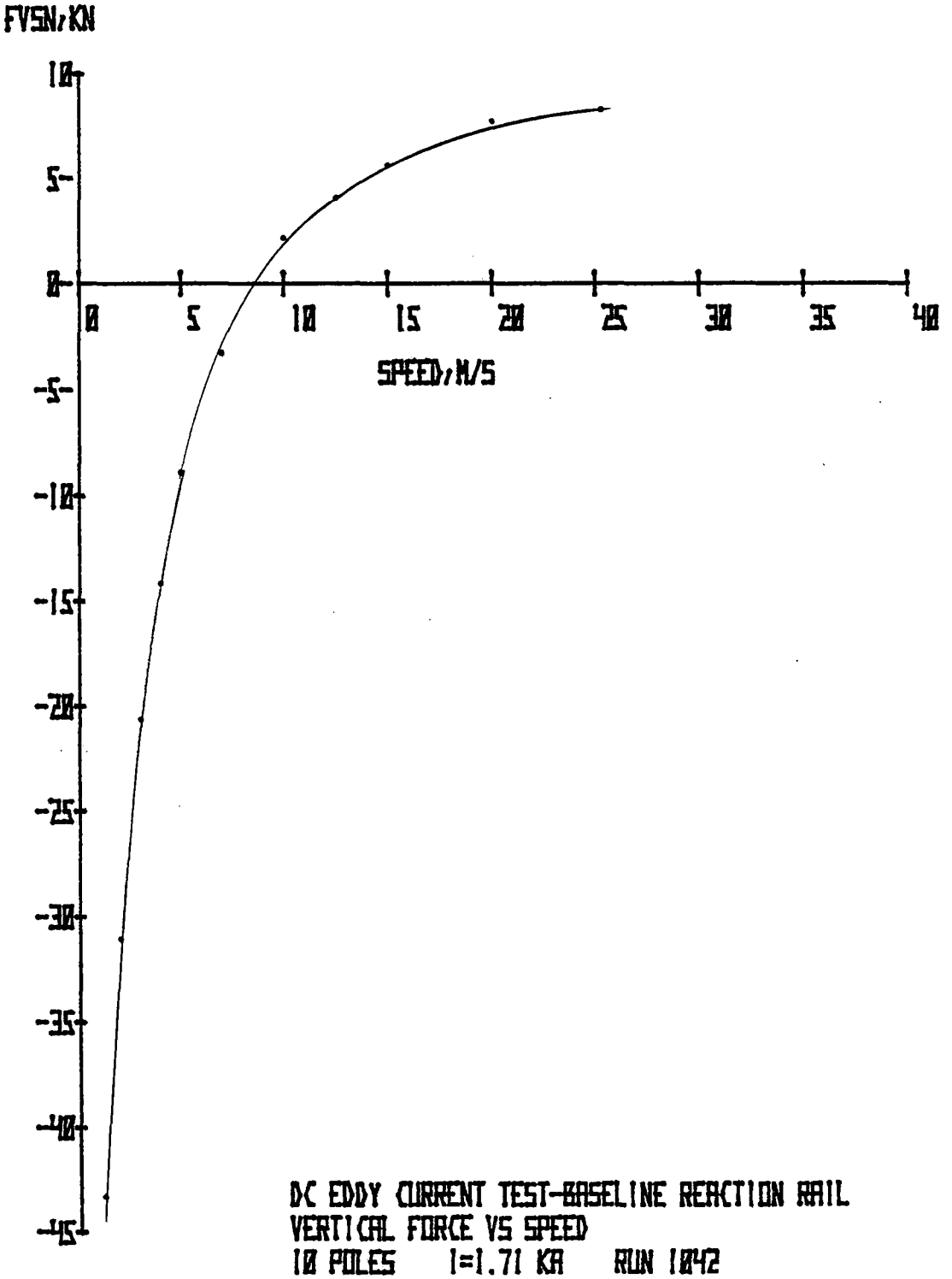

FVSN, KN
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0
5
10
15
20
25
30
35
40
SPEED, M/S
DC EDDY CURRENT TEST-BASELINE REACTION RAIL
VERTICAL FORCE VS SPEED
10 POLES I=1.71 KA RUN 1042

Figure 2-3

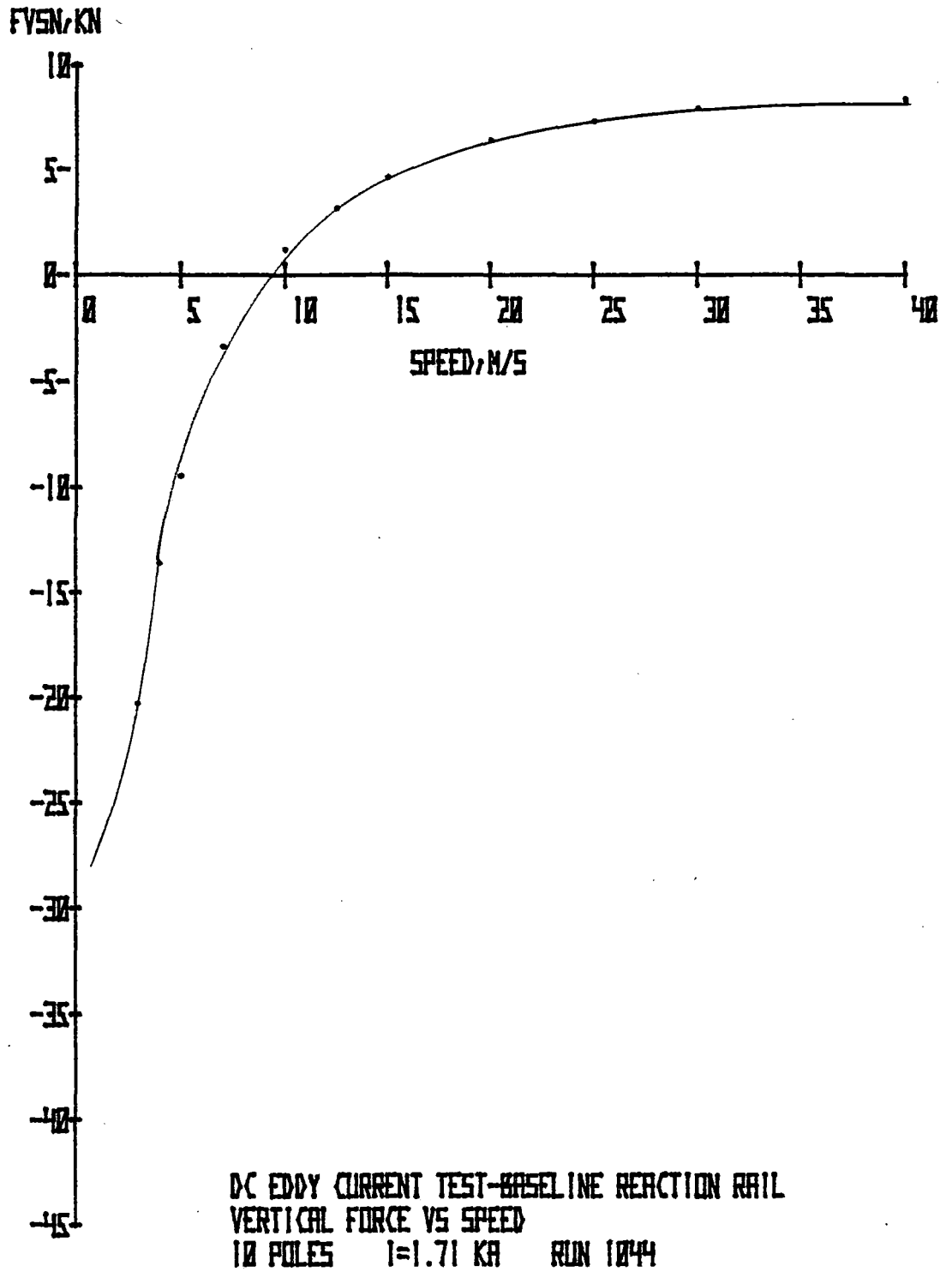

FVSN, KN
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0
5
10
15
20
25
30
35
40
SPEED, M/S
DC EDDY CURRENT TEST-BASELINE REACTION RAIL
VERTICAL FORCE VS SPEED
10 POLES I=1.71 KA RUN 1044

Figure 2-4

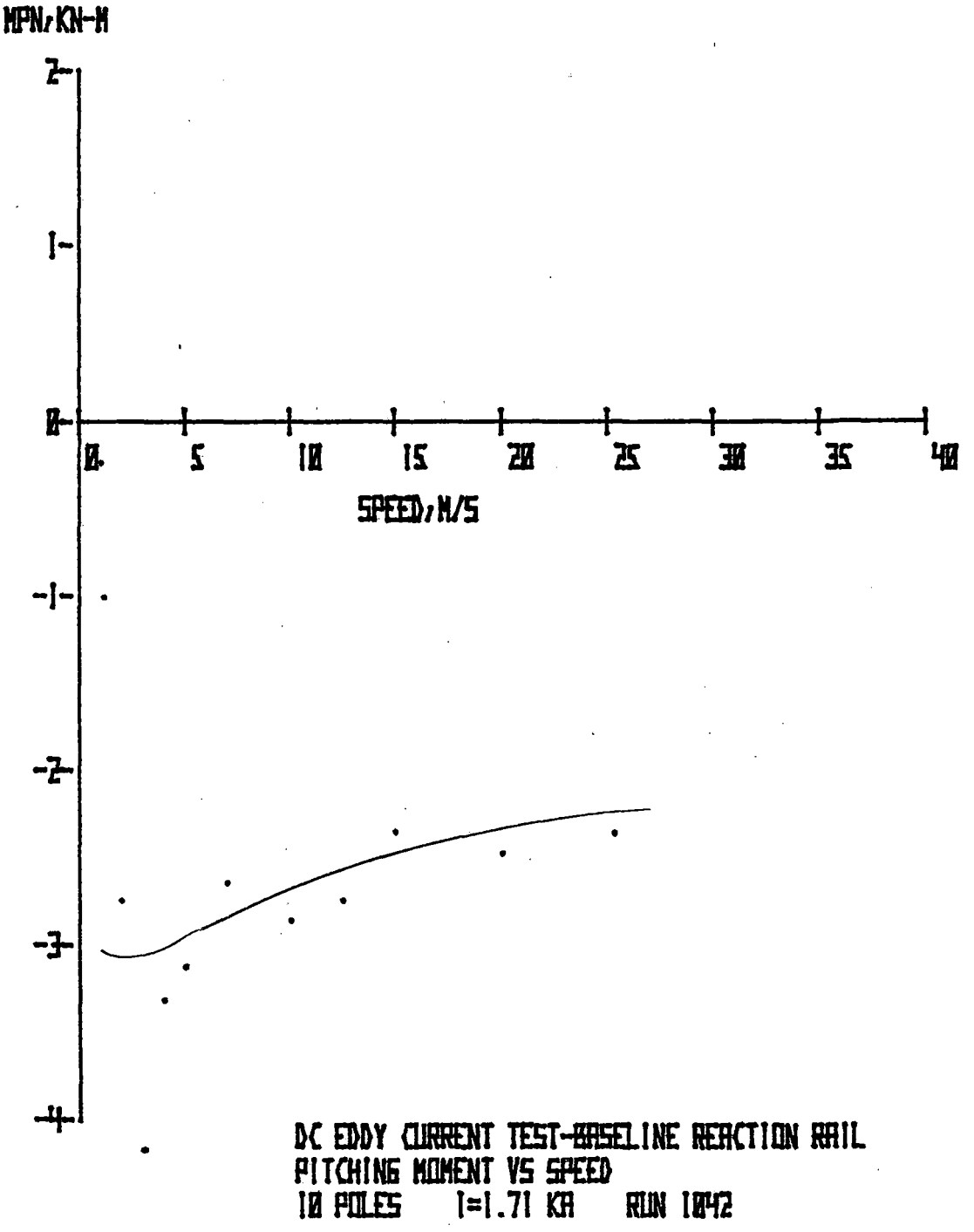

MPN/KN-M
2
1
0
-1
-2
-3
-4
0.
5
10
15
20
25
30
35
40
SPEED/M/S
DC EDDY CURRENT TEST-BASELINE REACTION RAIL
PITCHING MOMENT VS SPEED
10 POLES I=1.71 KA RUN 1042

Figure 2-5

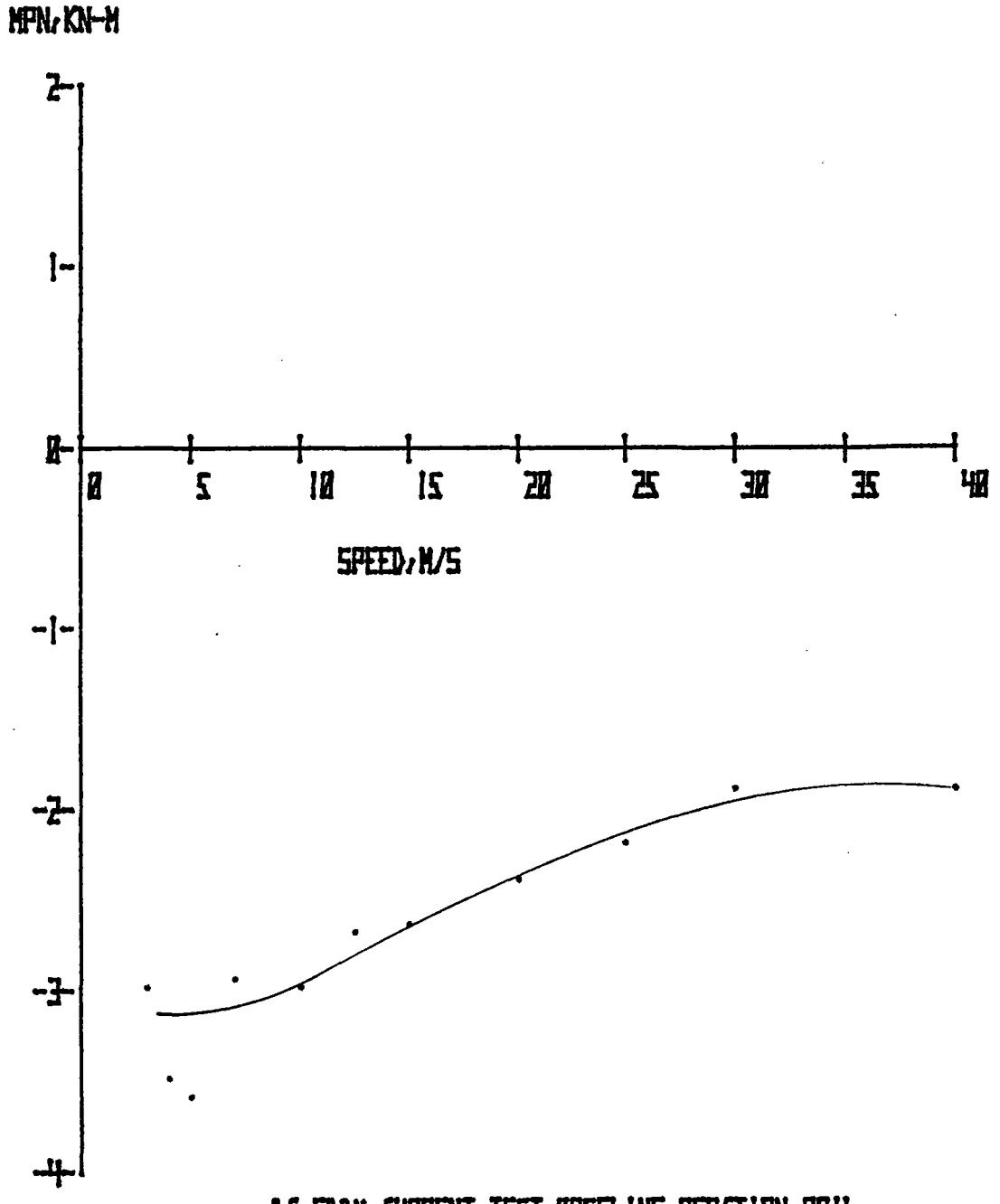

MPN, KN-M
2
1
0
-1
-2
-3
-4
0
5
10
15
20
25
30
35
40
SPEED, M/S
DC EDDY CURRENT TEST-BASELINE REACTION RAIL
PITCHING MOMENT VS SPEED
10 POLES I=1.71 KA RUN 1044

Figure 2-6

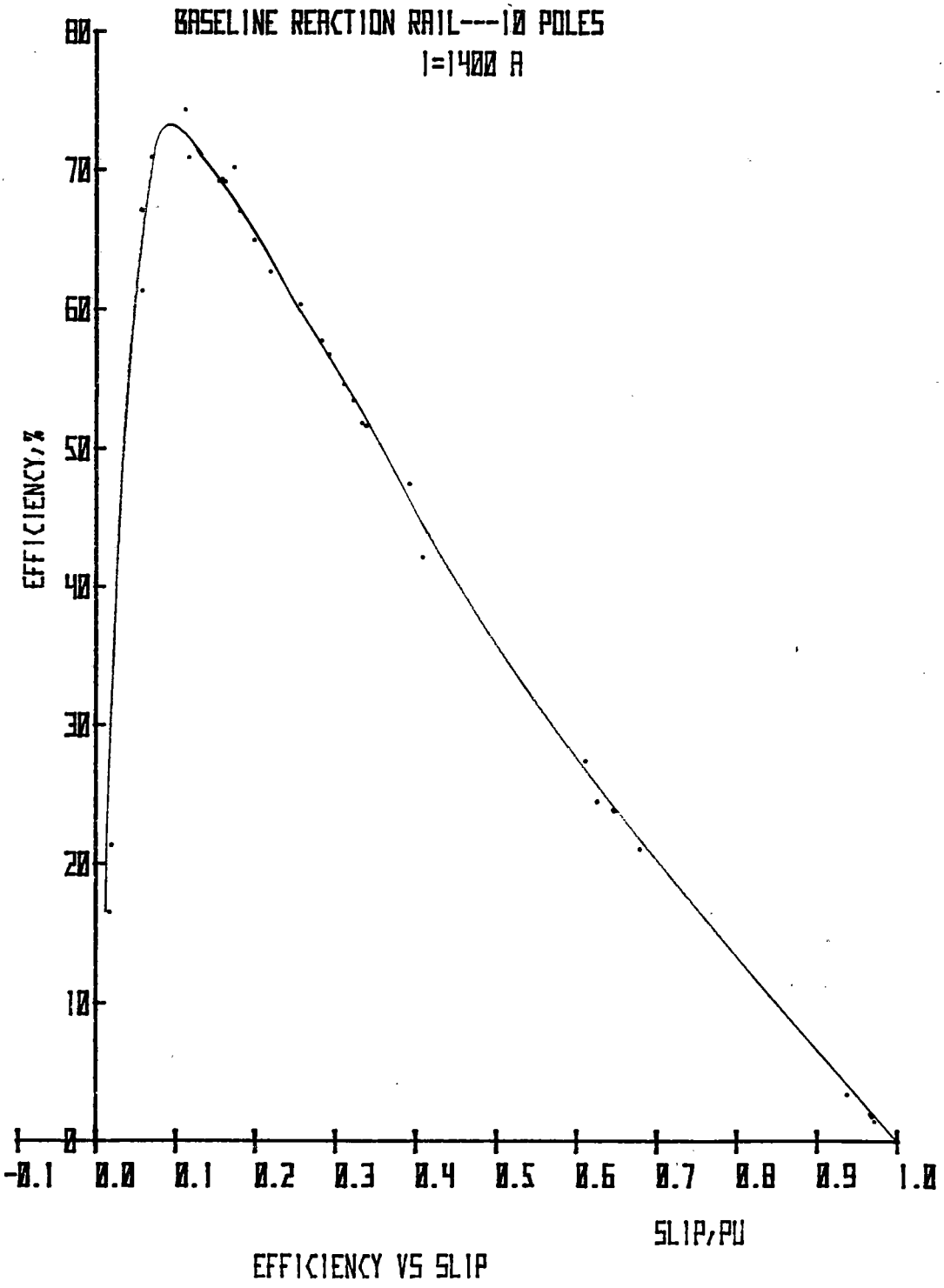
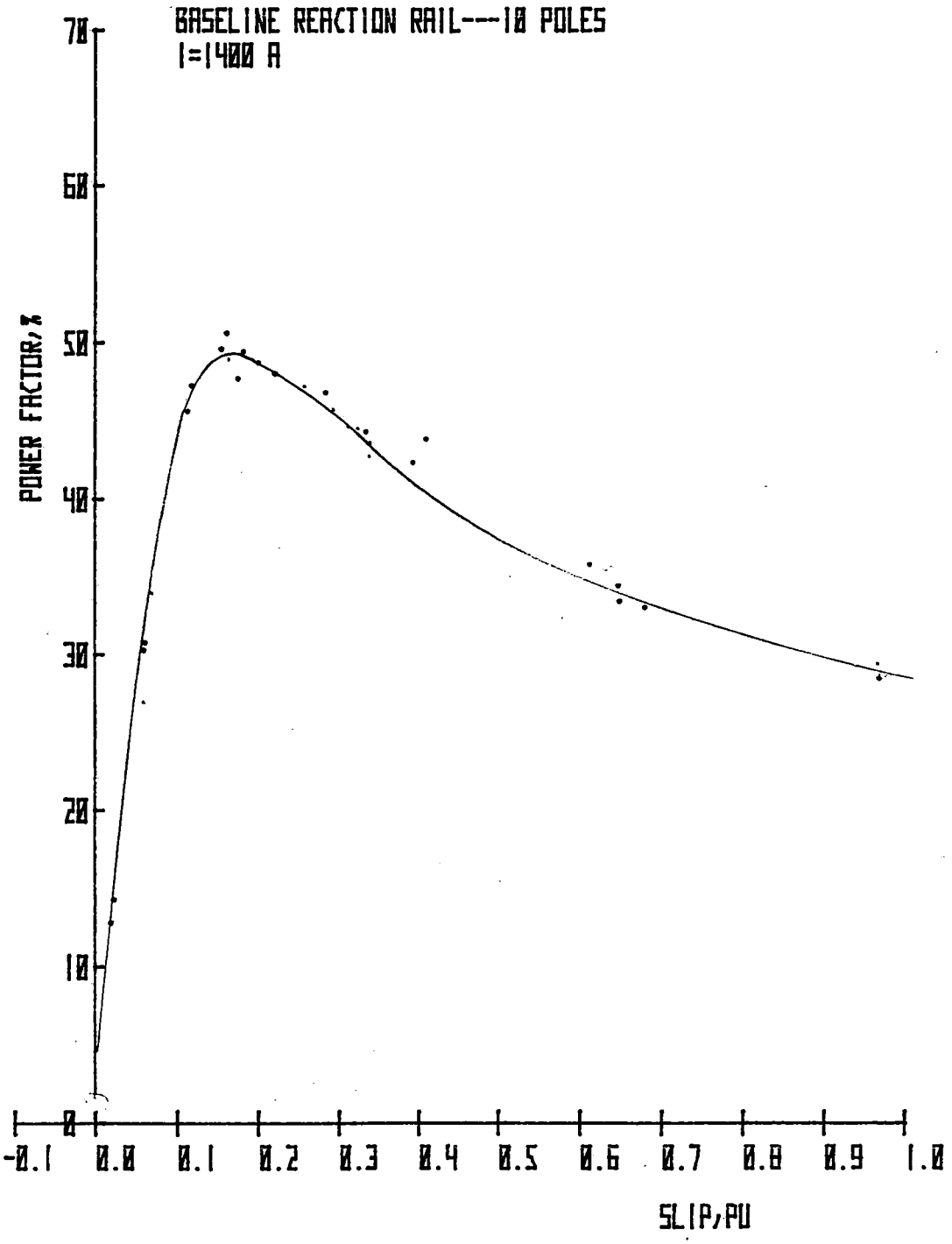
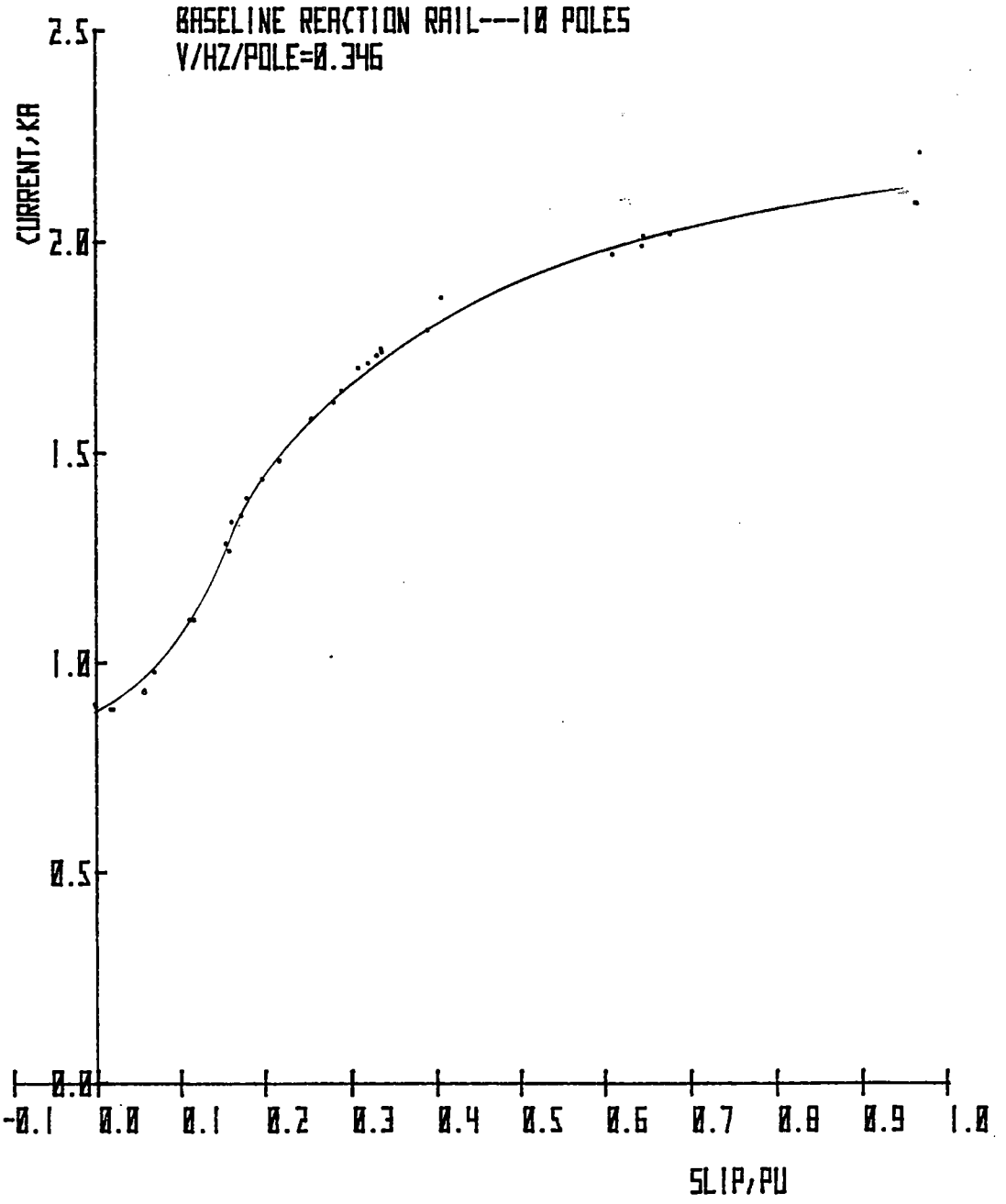

BASELINE REACTION RAIL---10 POLES
I=1400 A
80
70
60
50
40
30
20
10
0
EFFICIENCY,%
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
SLIP,PU
EFFICIENCY VS SLIP

Figure 2-7



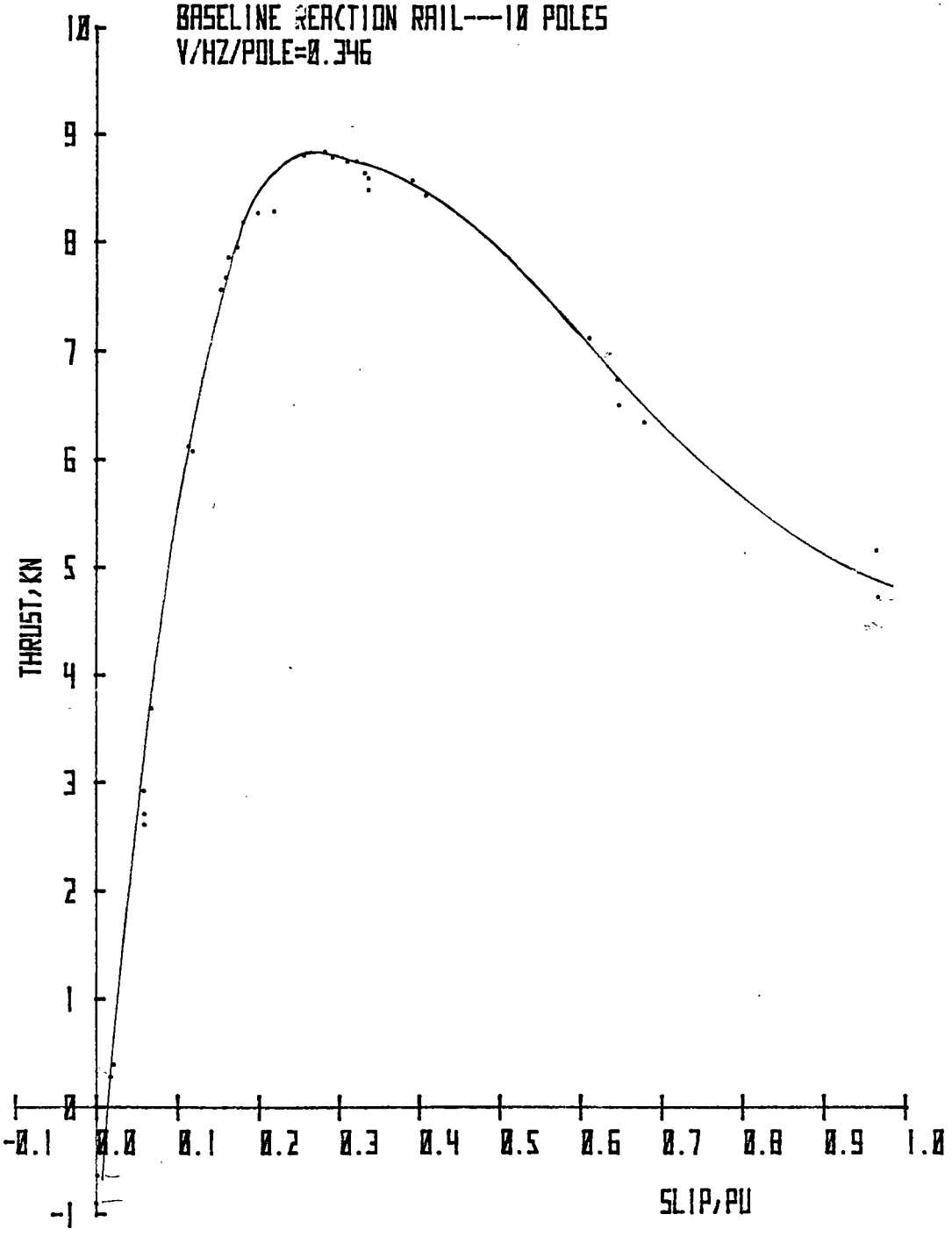
POWER FACTOR VS SLIP

Figure 2-8



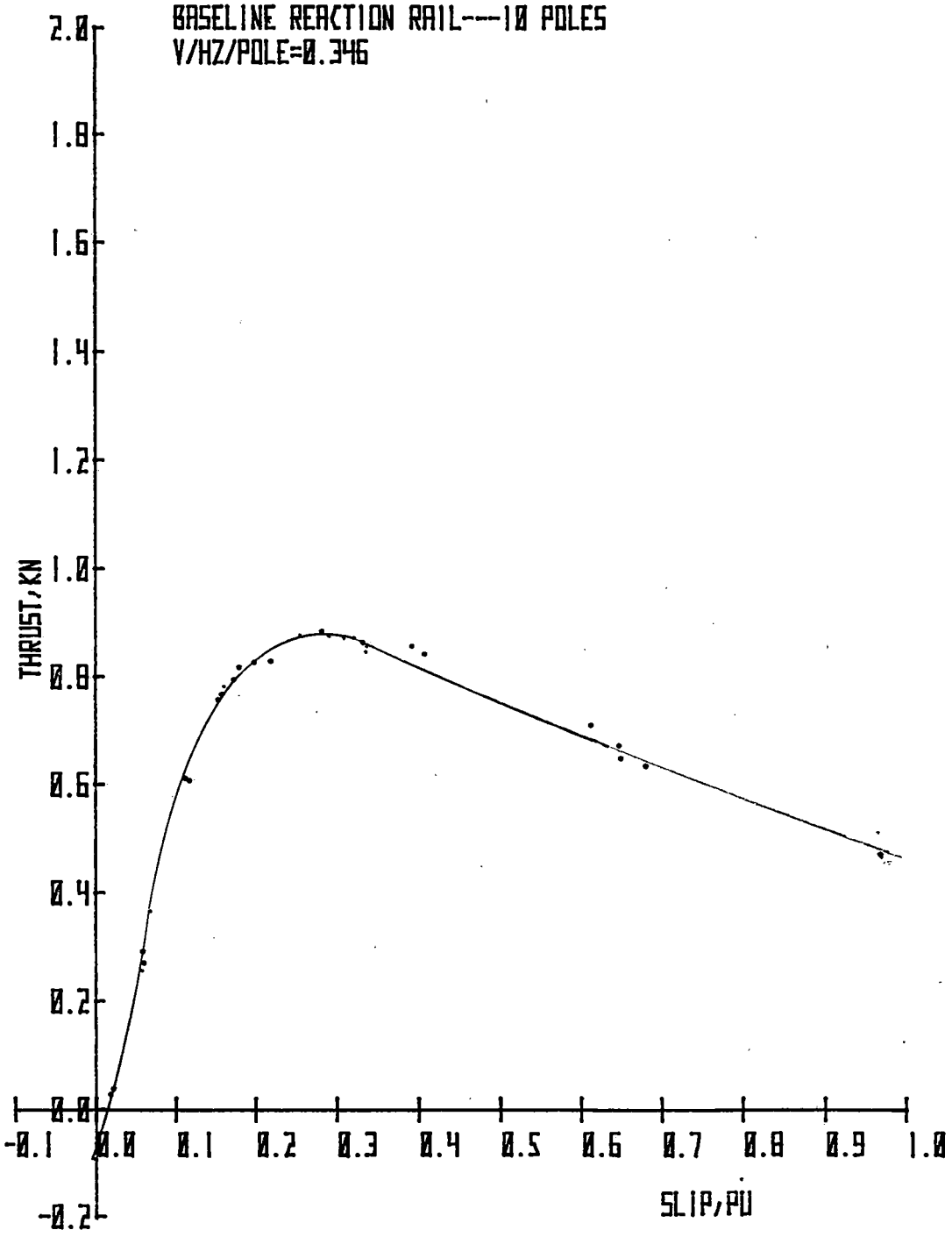
MEAN LINE CURRENT VS SLIP

Figure 2-9



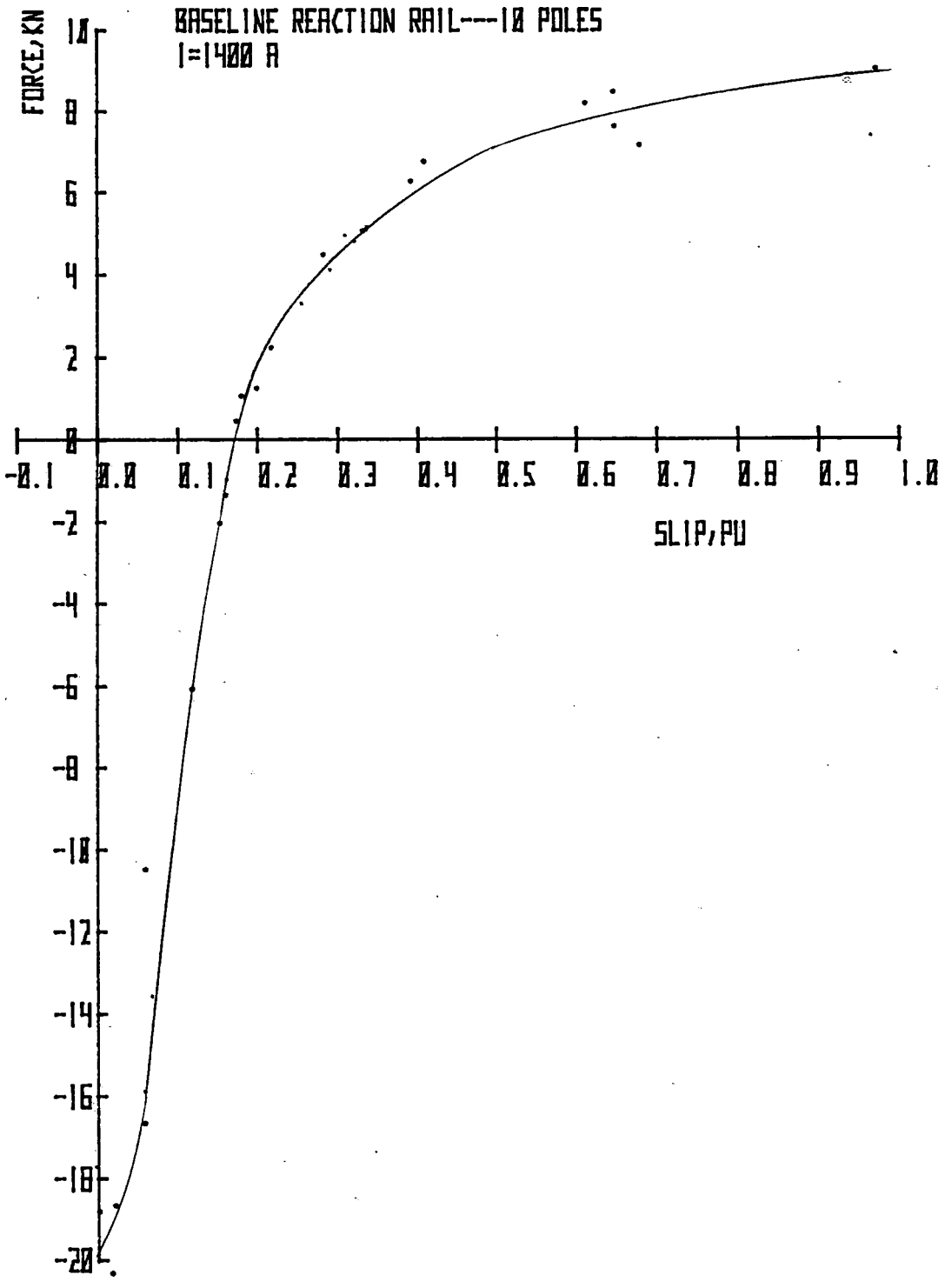
THRUST VS SLIP

Figure 2-10



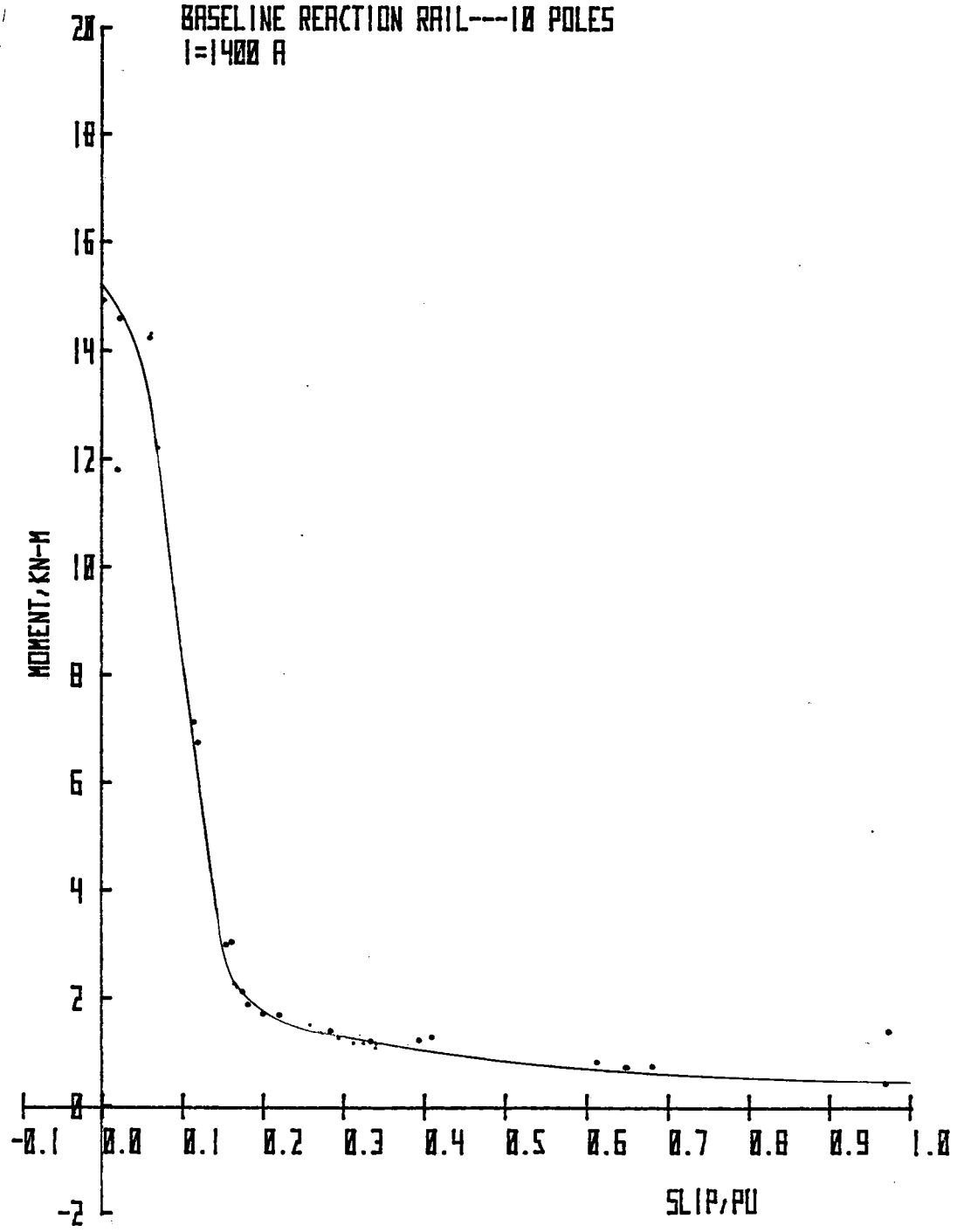
THRUST PER POLE VS SLIP

Figure 2-11



TOTAL VERTICAL FORCE VS SLIP

Figure 2-12



PITCHING MOMENT VS SLIP

Figure 2-13

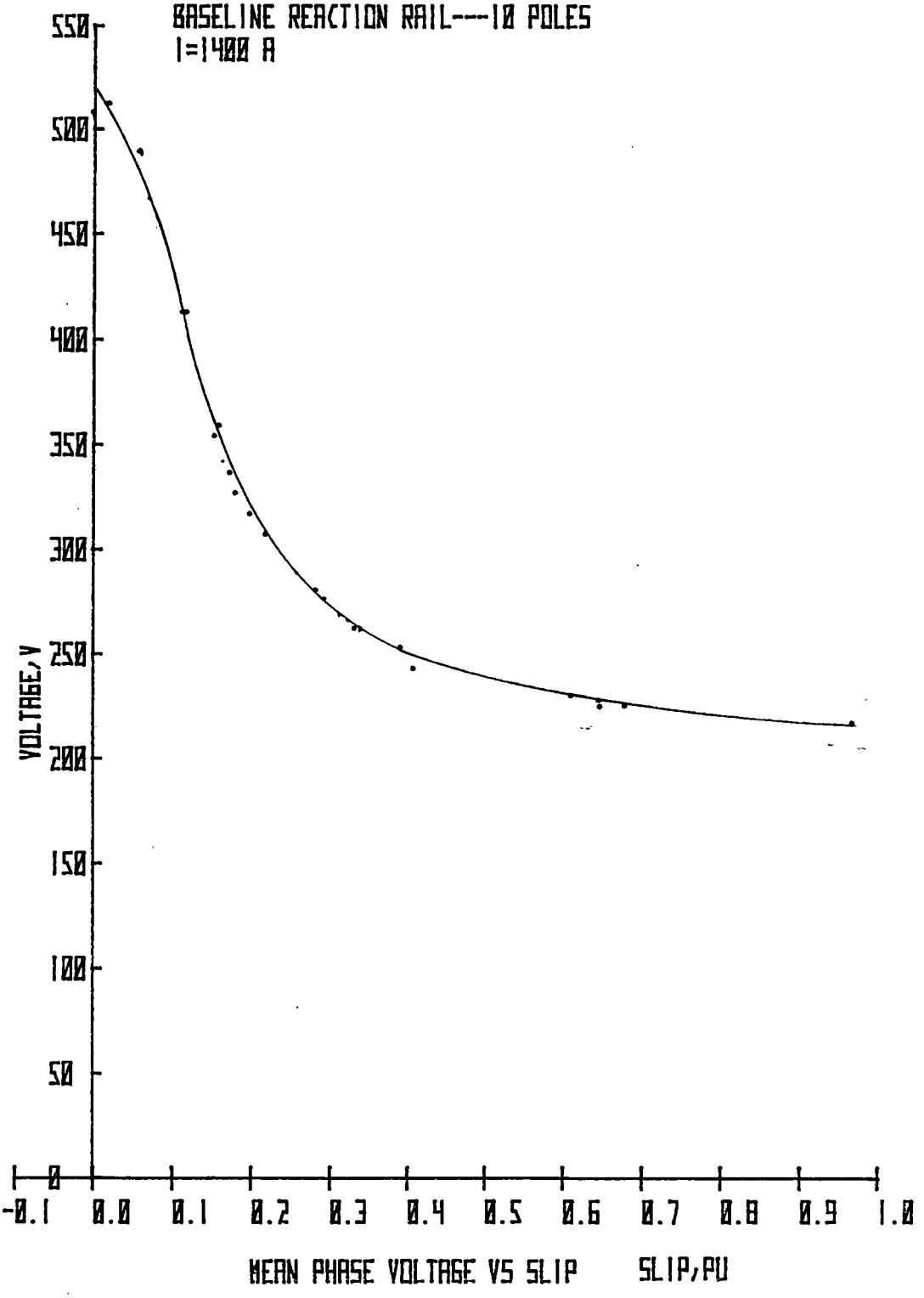
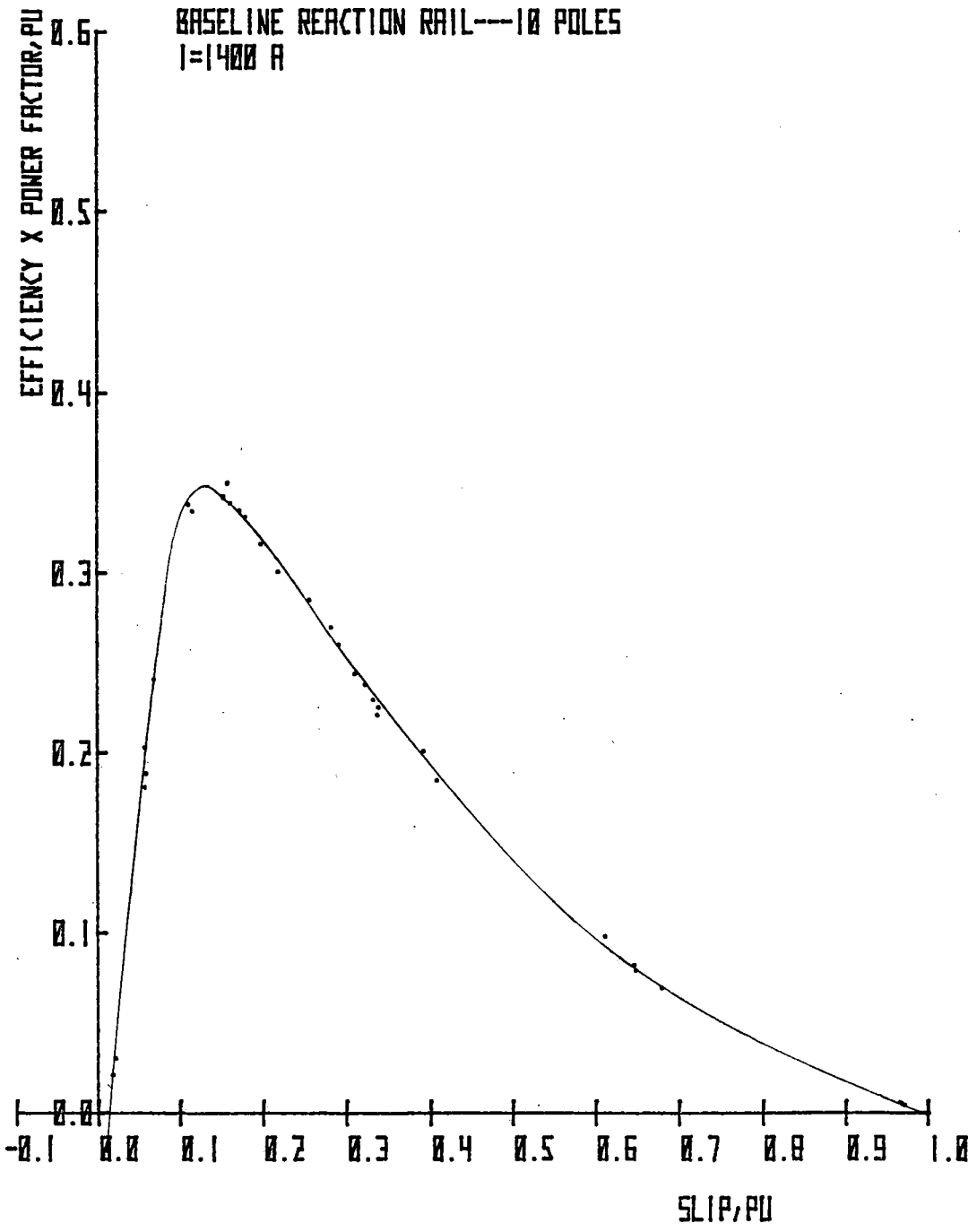
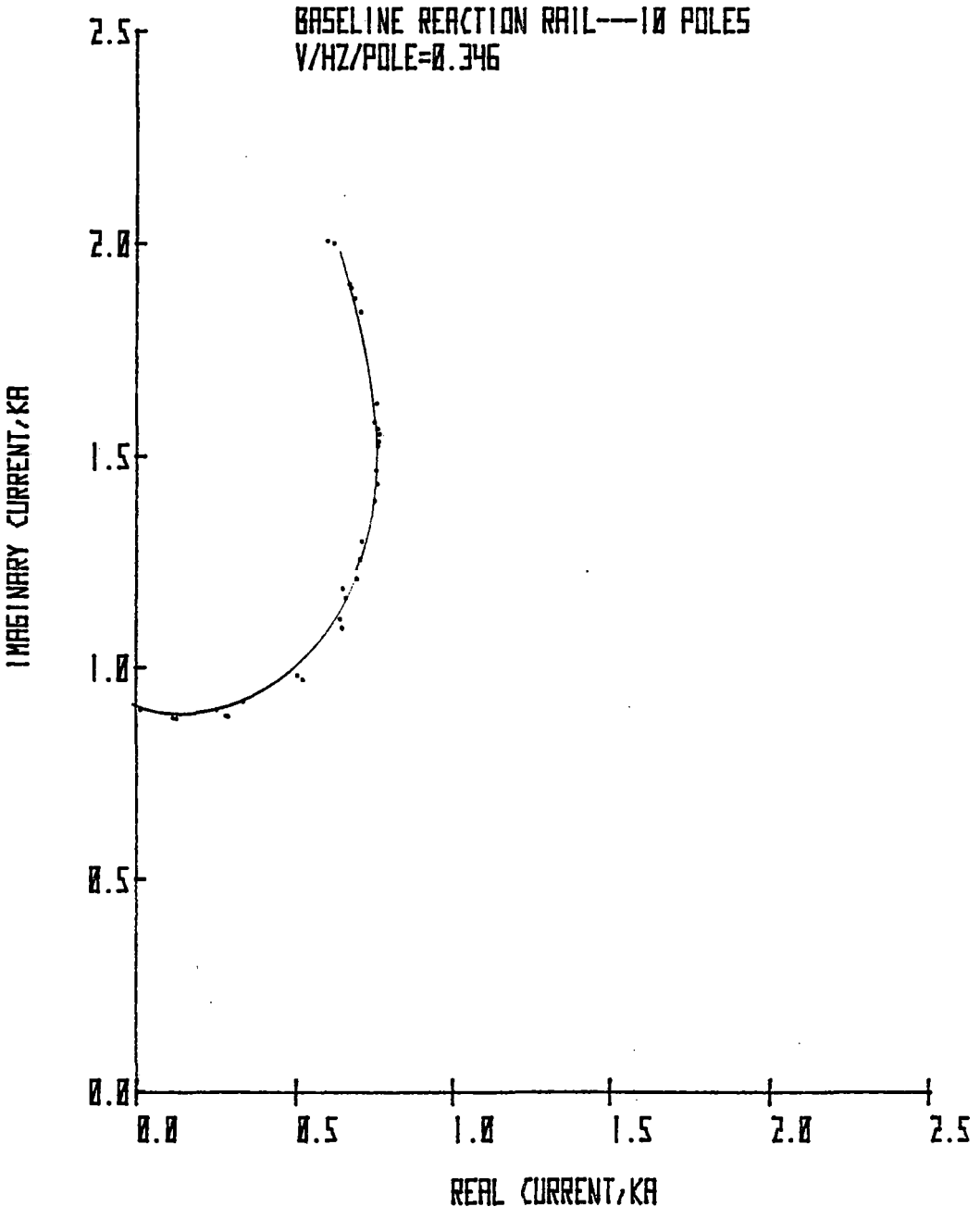

BASELINE REACTION RAIL---10 POLES
I=1400 A
550
500
450
400
350
300
250
200
150
100
50
0
VOLTAGE,V
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
MEAN PHASE VOLTAGE VS SLIP
SLIP,PU

Figure 2-14



EFFICIENCY X POWER FACTOR VS SLIP

Figure 2-15



LIM CURRENT LOCUS

Figure 2-16

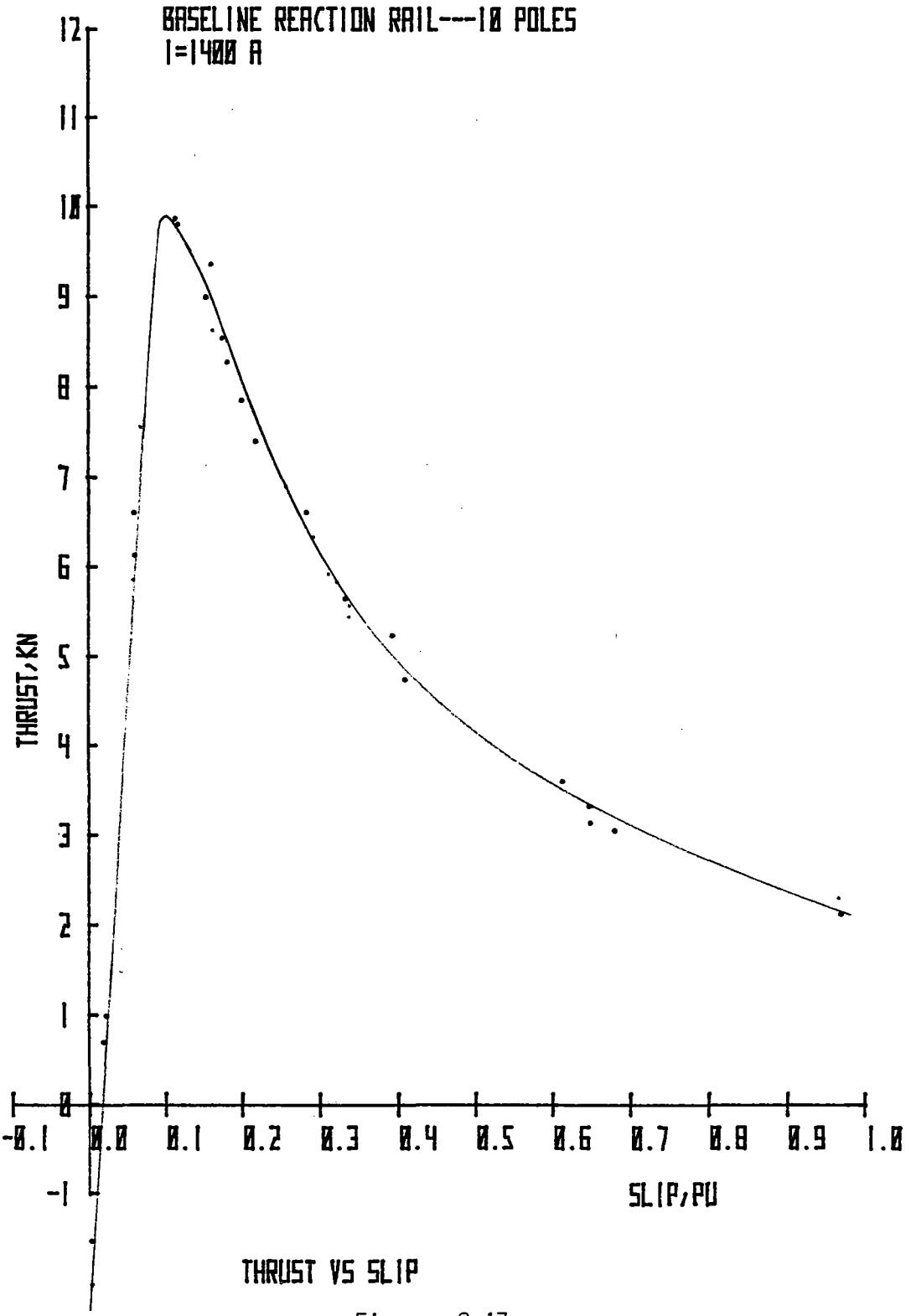

BASELINE REACTION RAIL---10 POLES
I=1400 A
THRUST,KN
SLIP,PU
THRUST VS SLIP

Figure 2-17

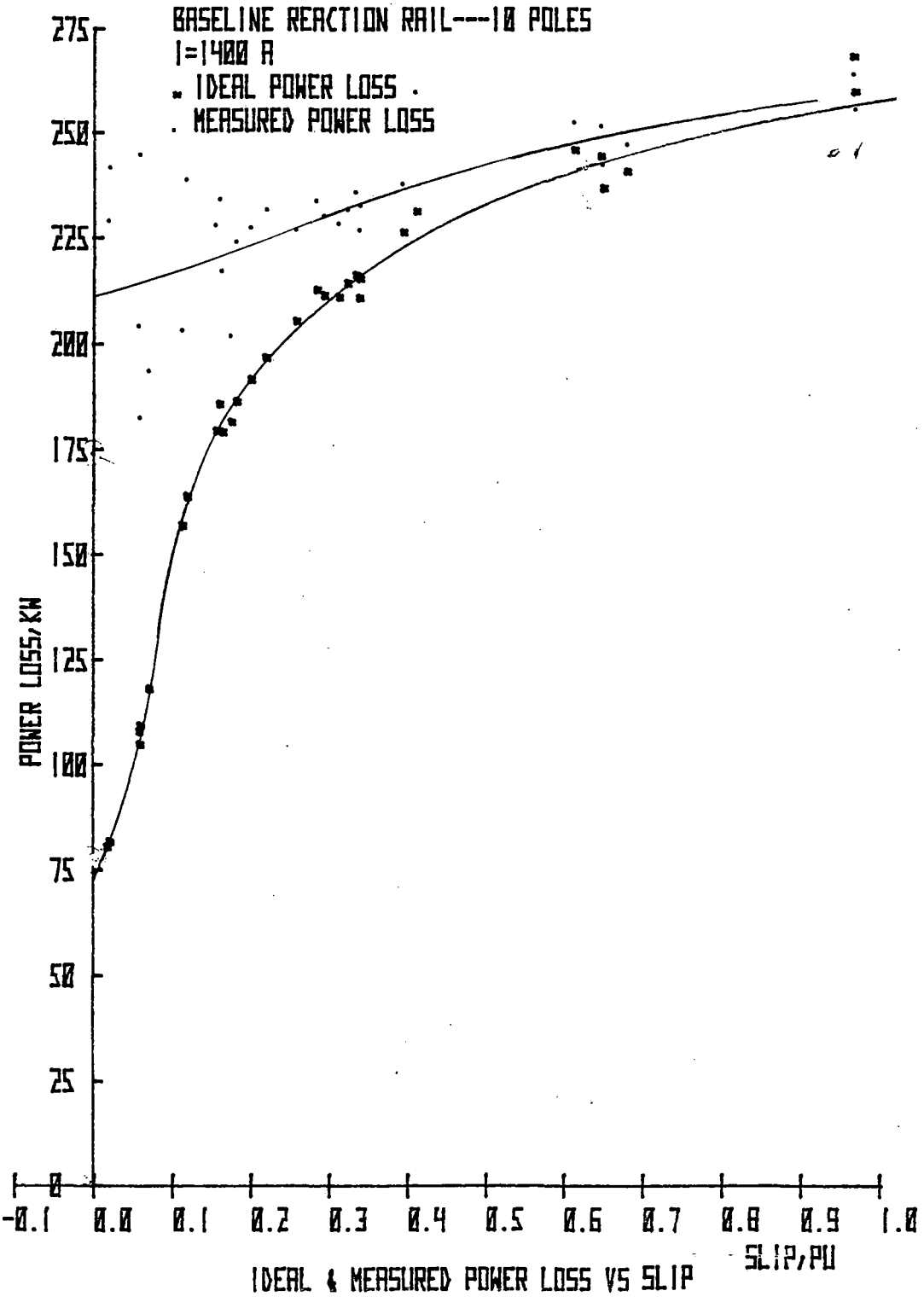
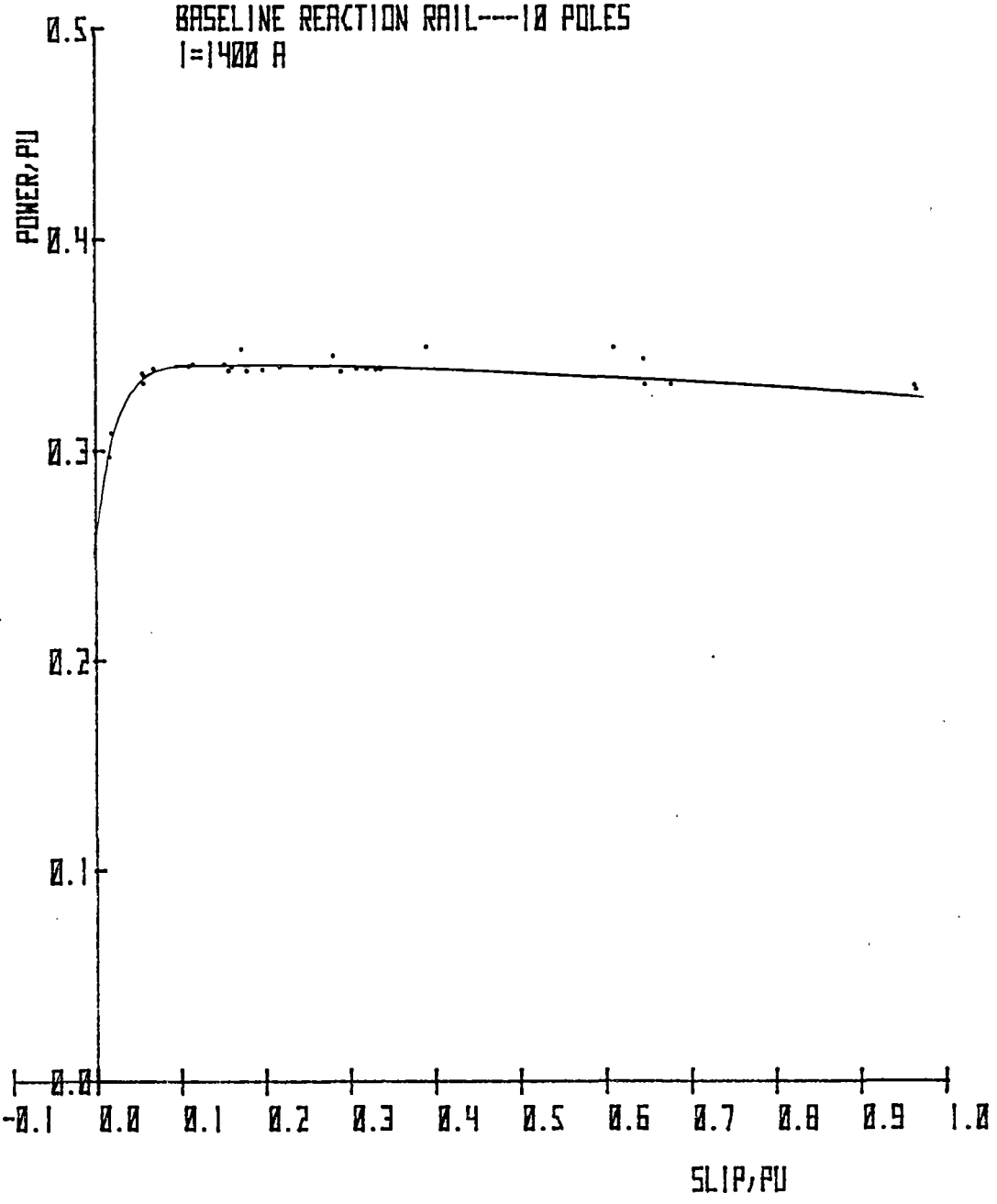
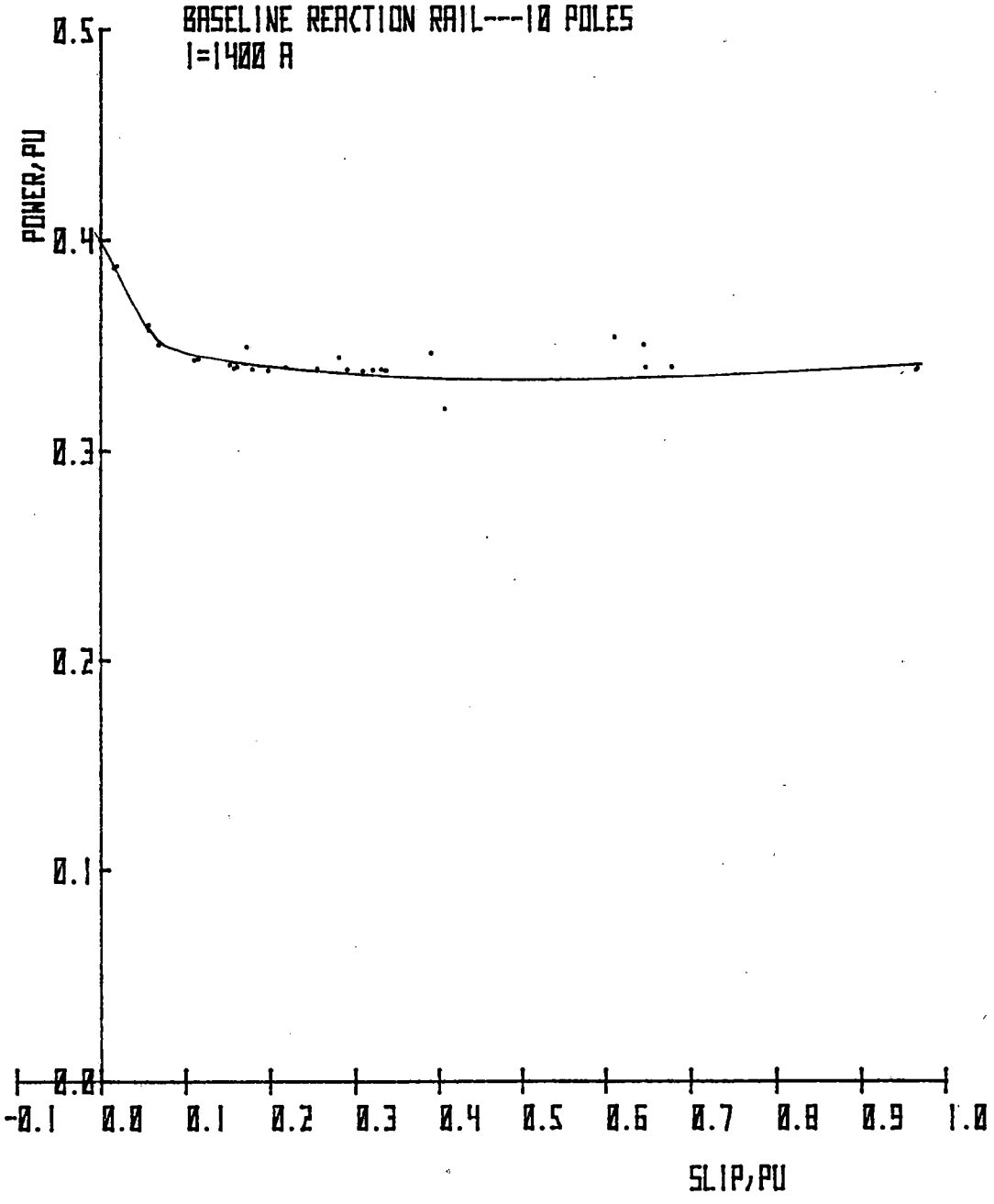

BASELINE REACTION RAIL---10 POLES
I=1400 A
* IDEAL POWER LOSS .
. MEASURED POWER LOSS
275
250
225
200
175
150
125
100
75
50
25
0
POWER LOSS, KW
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
SLIP, PU
IDEAL & MEASURED POWER LOSS VS SLIP

Figure 2-18



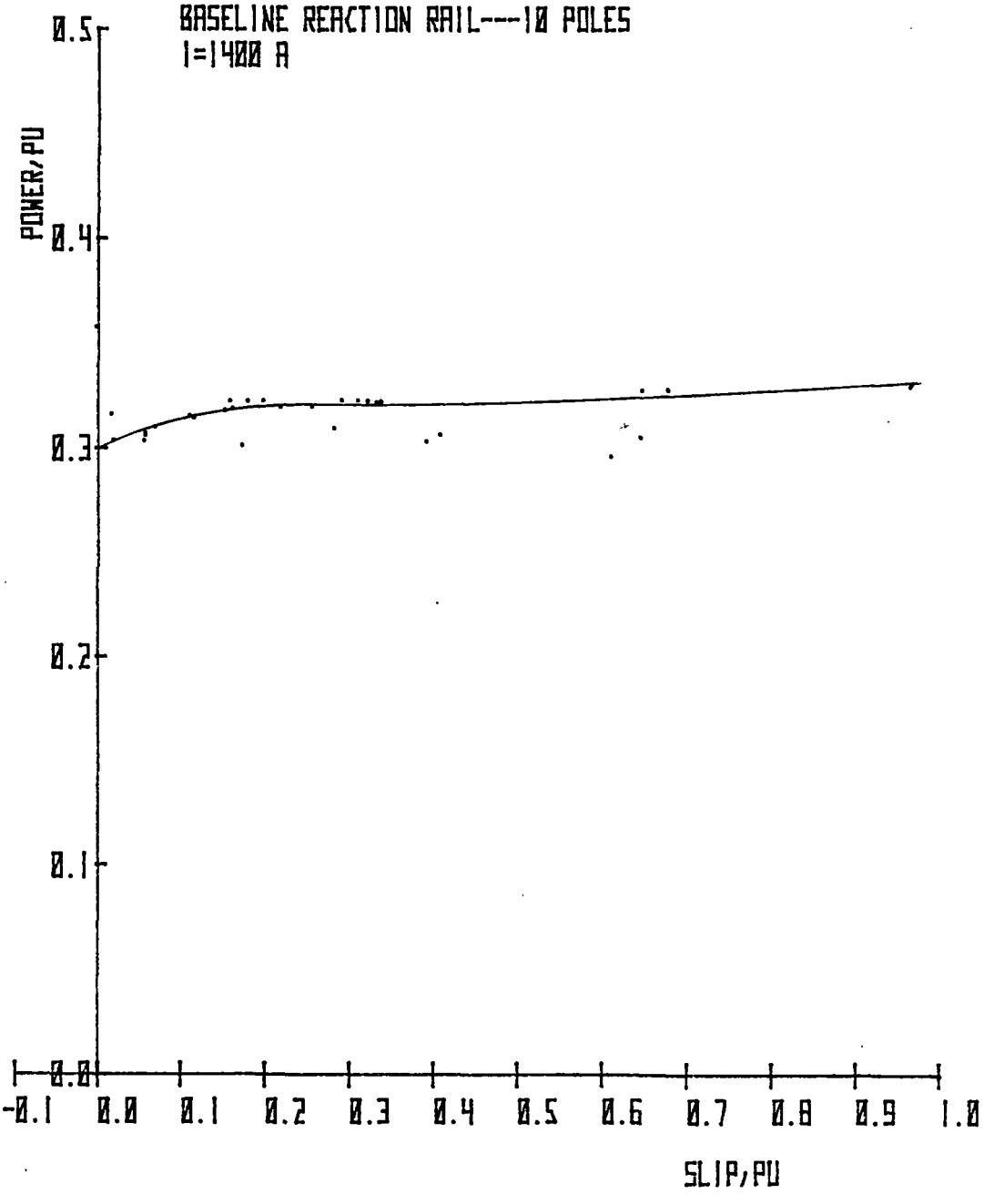
A PHASE POWER VS SLIP

Figure 2-19



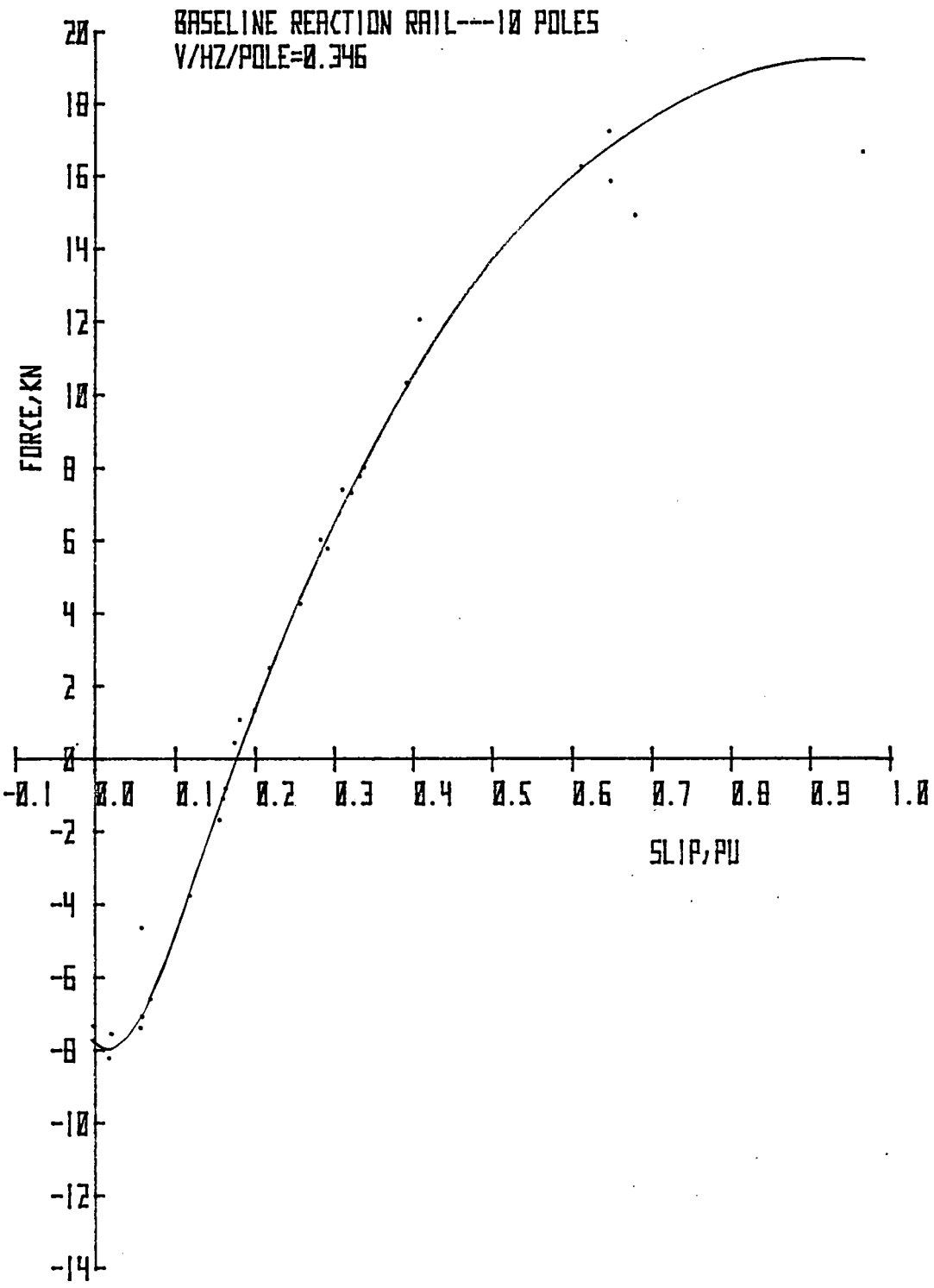
B PHASE POWER VS SLIP

Figure 2-20



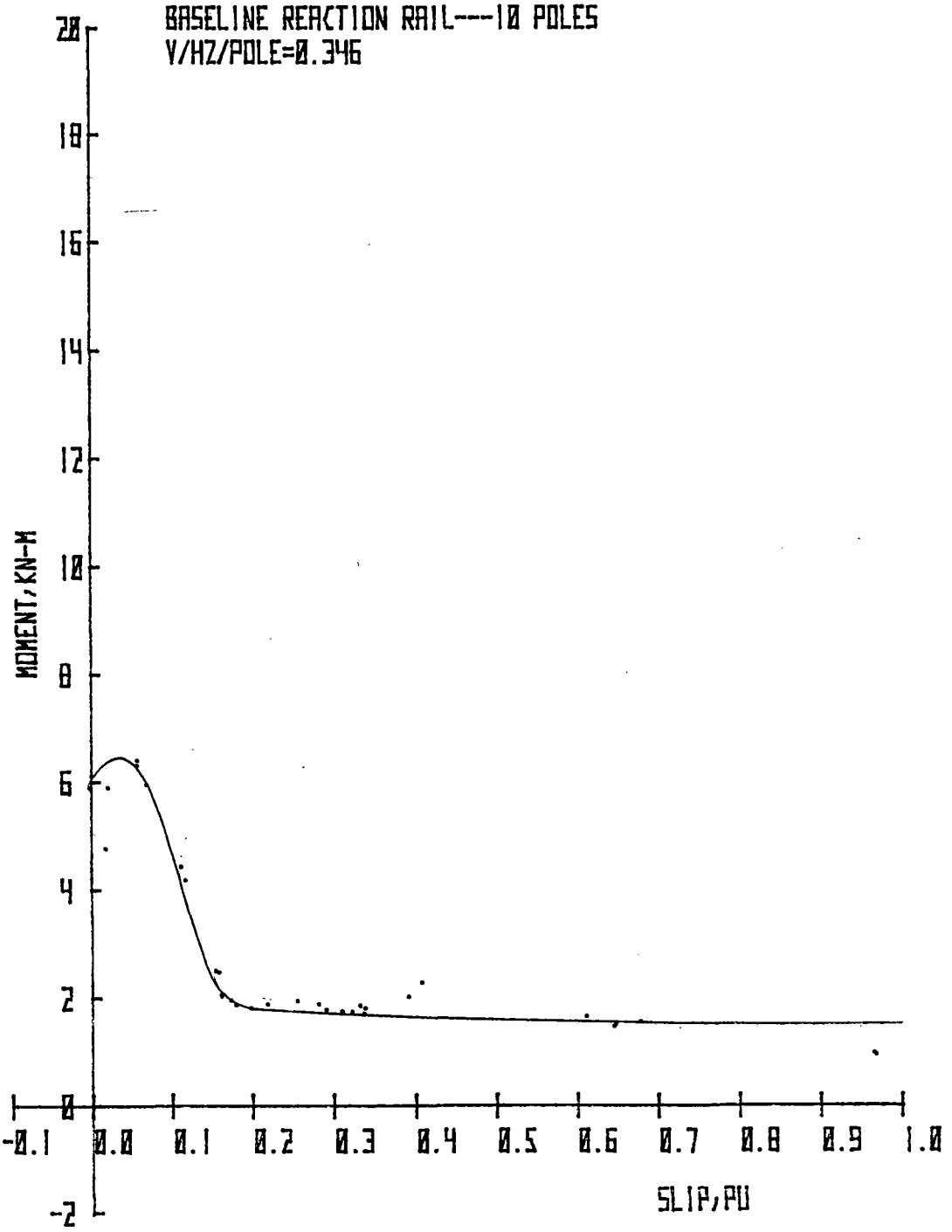
C PHASE POWER VS SLIP

Figure 2-21



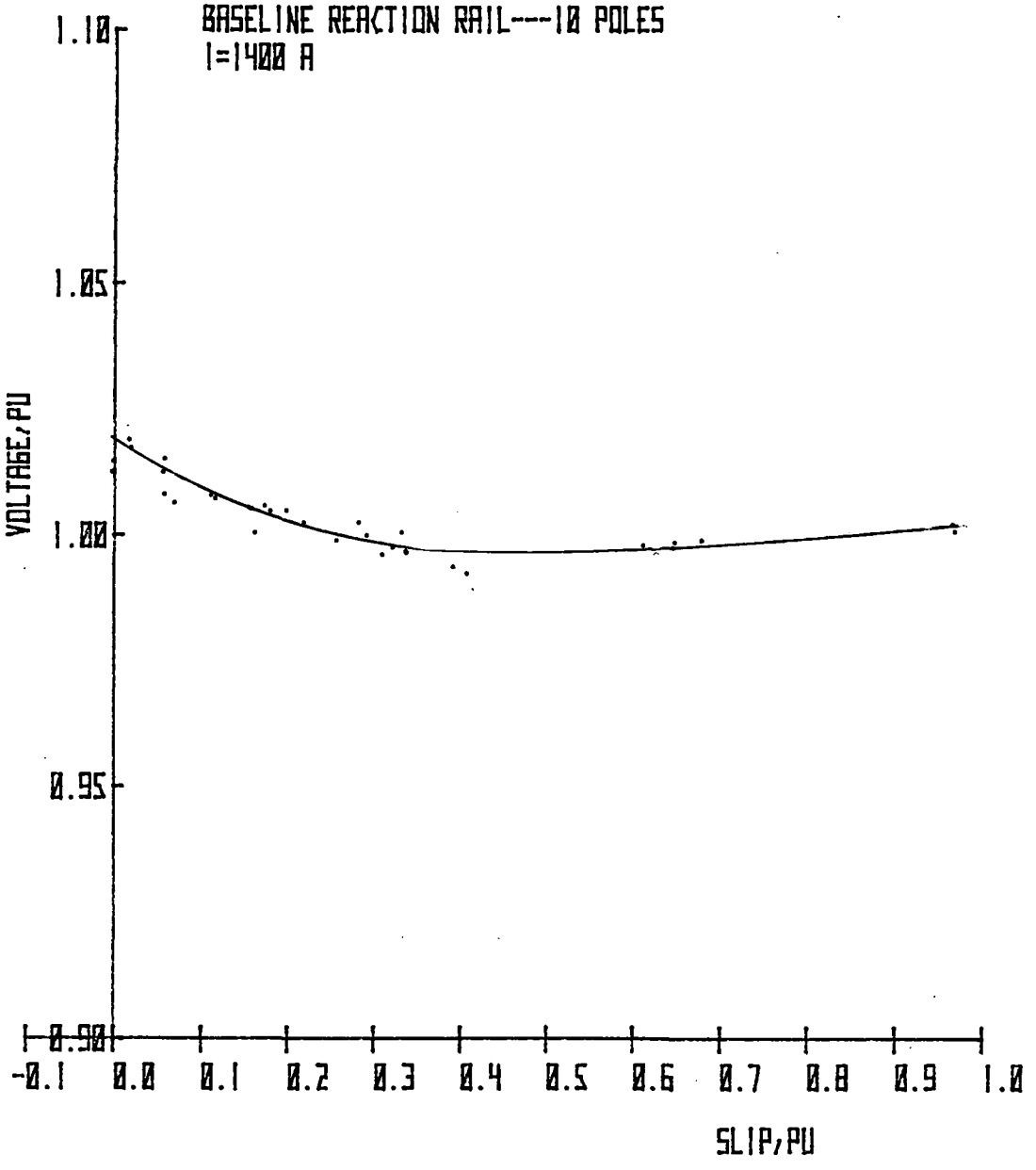
TOTAL VERTICAL FORCE VS SLIP

Figure 2-22



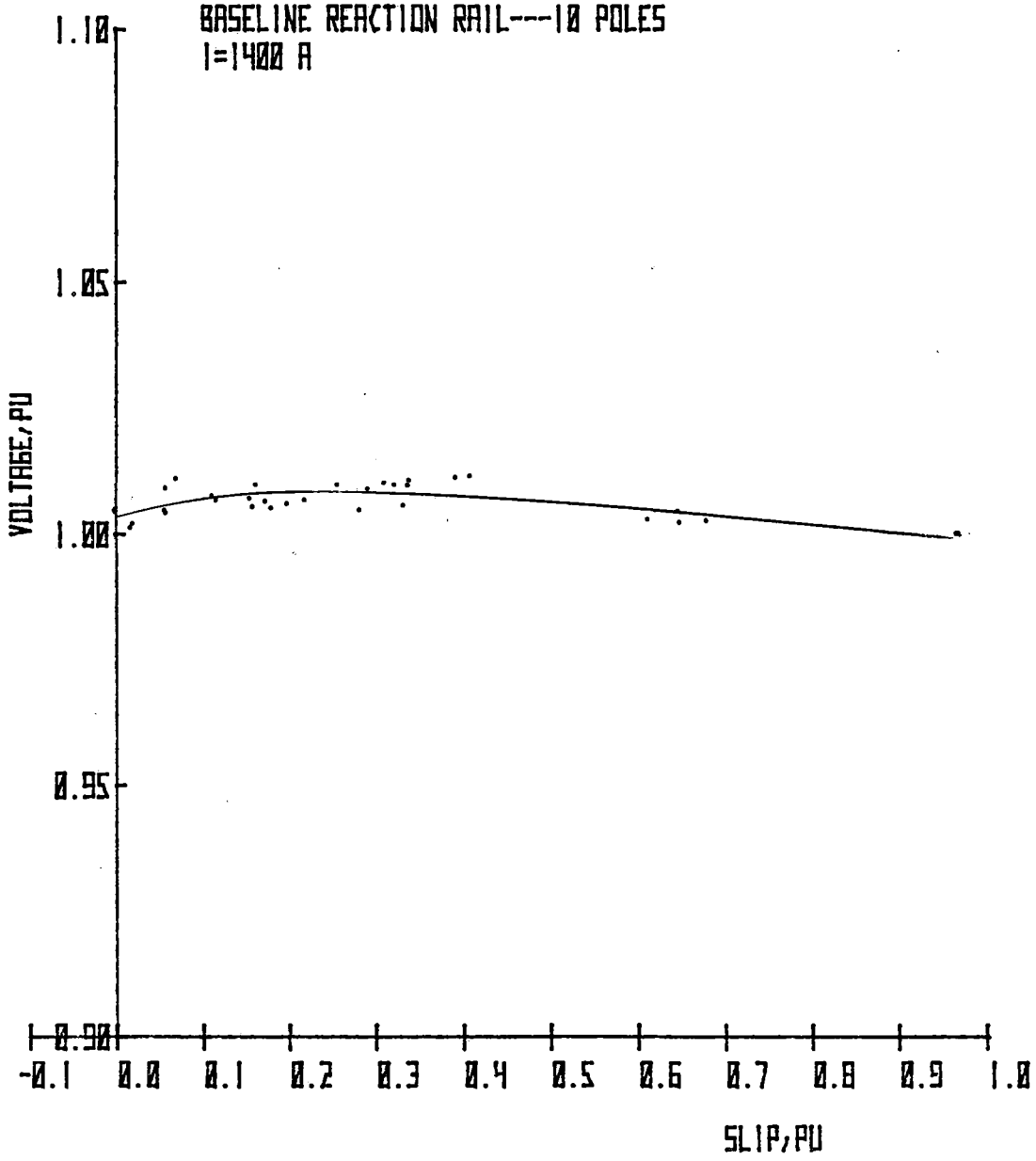
PITCHING MOMENT VS SLIP

Figure 2-23



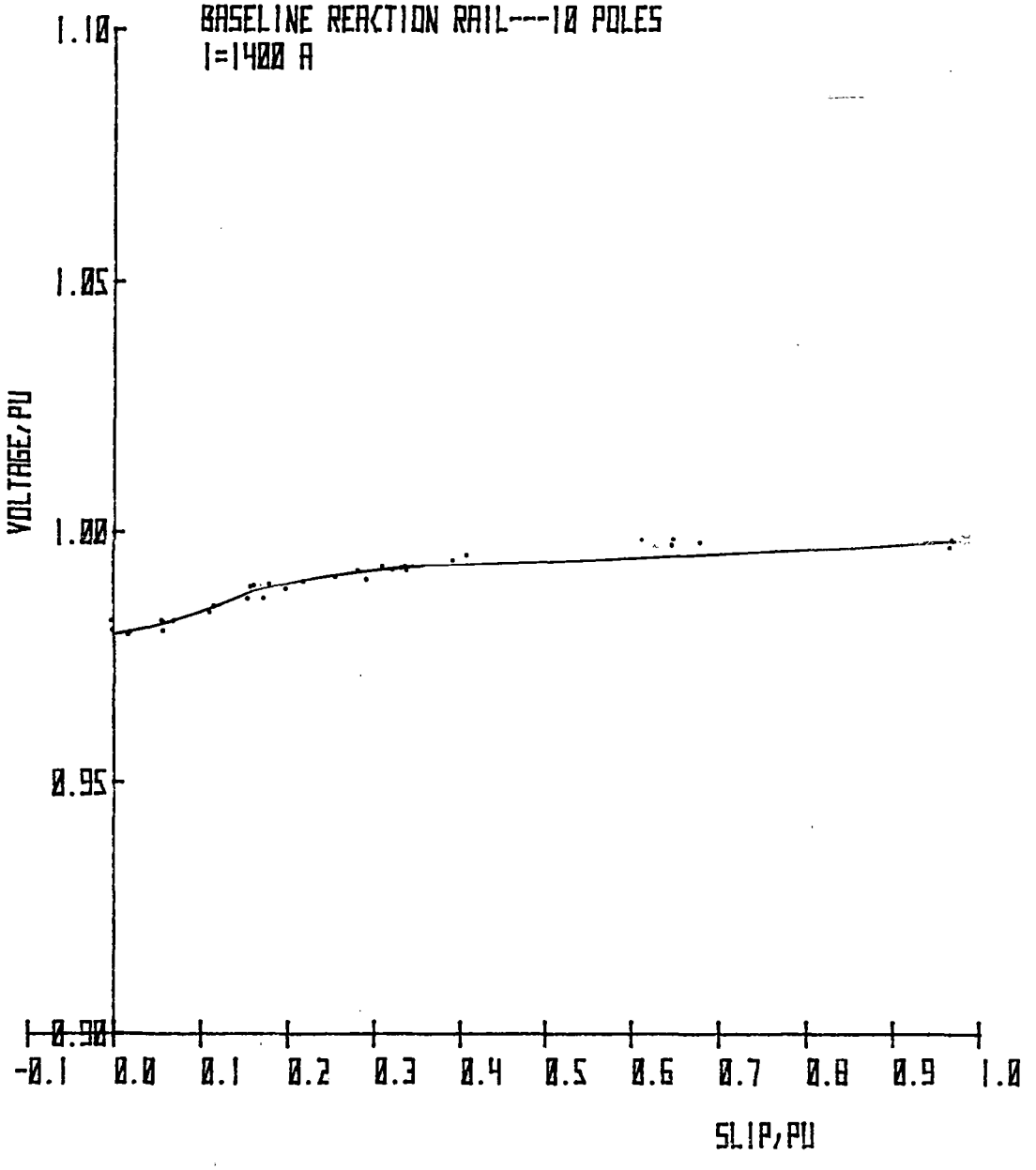
A PHASE VOLTAGE VS SLIP

Figure 2-24



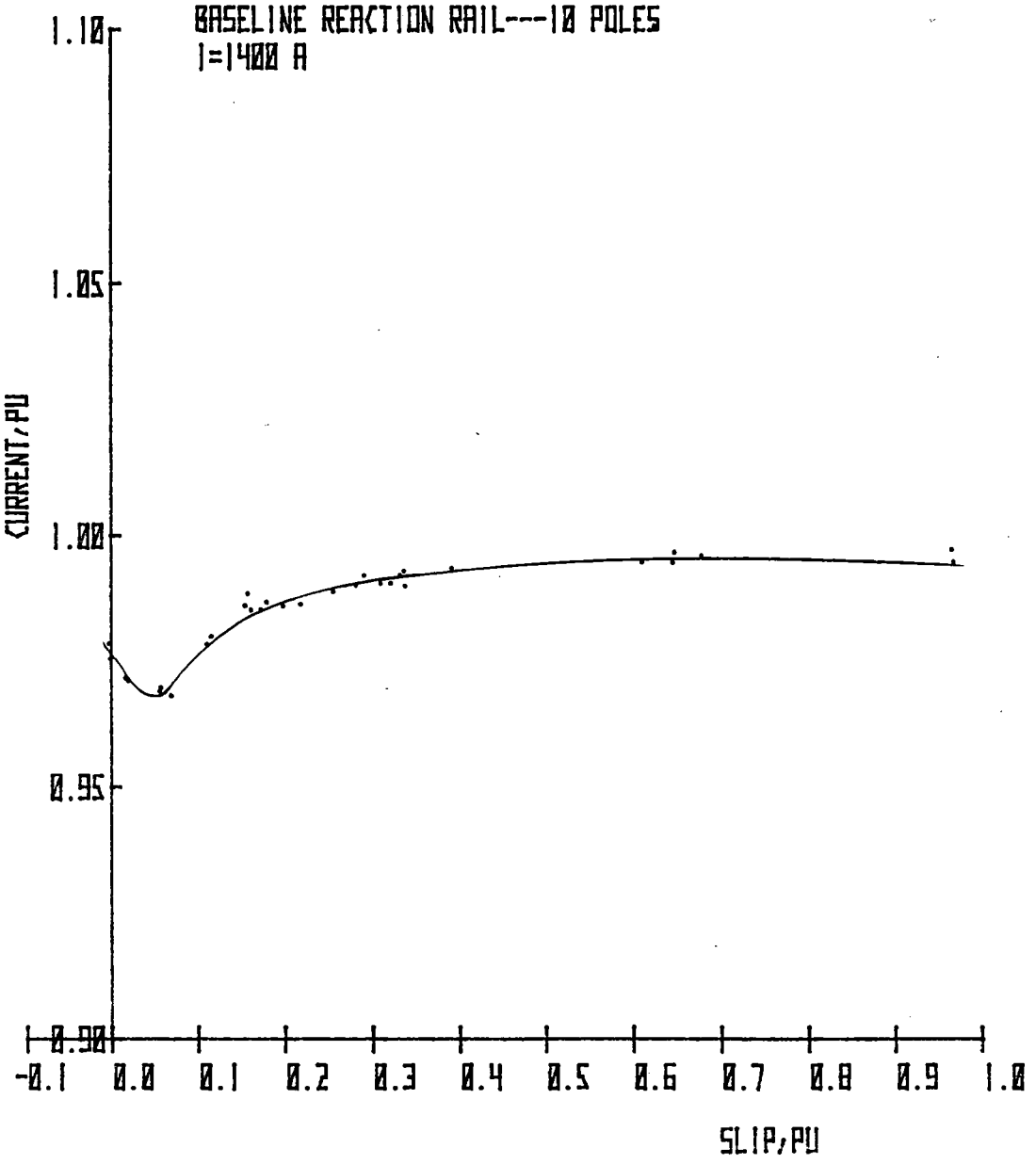
B PHASE VOLTAGE VS SLIP

Figure 2-25



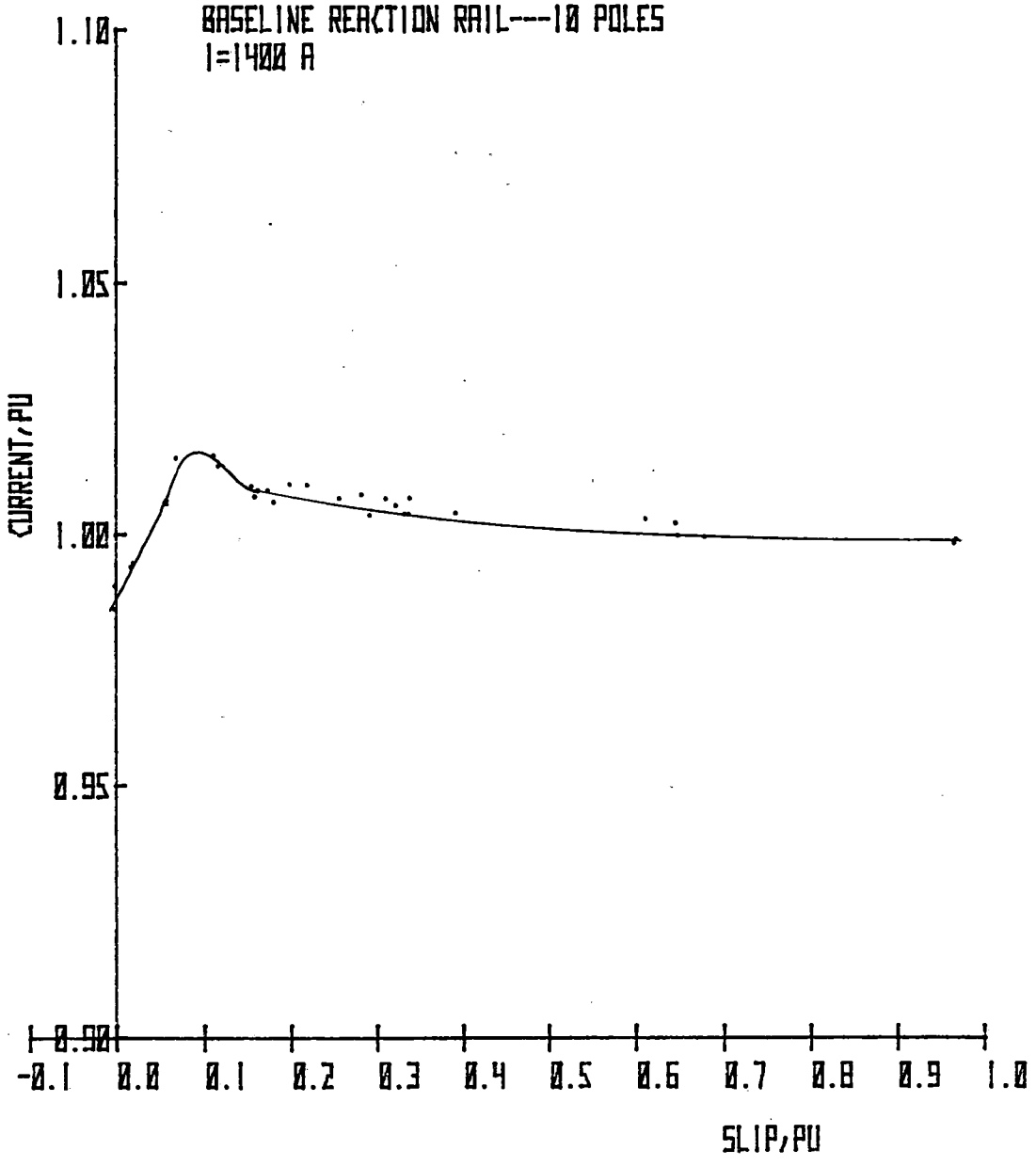
C PHASE VOLTAGE VS SLIP

Figure 2-26



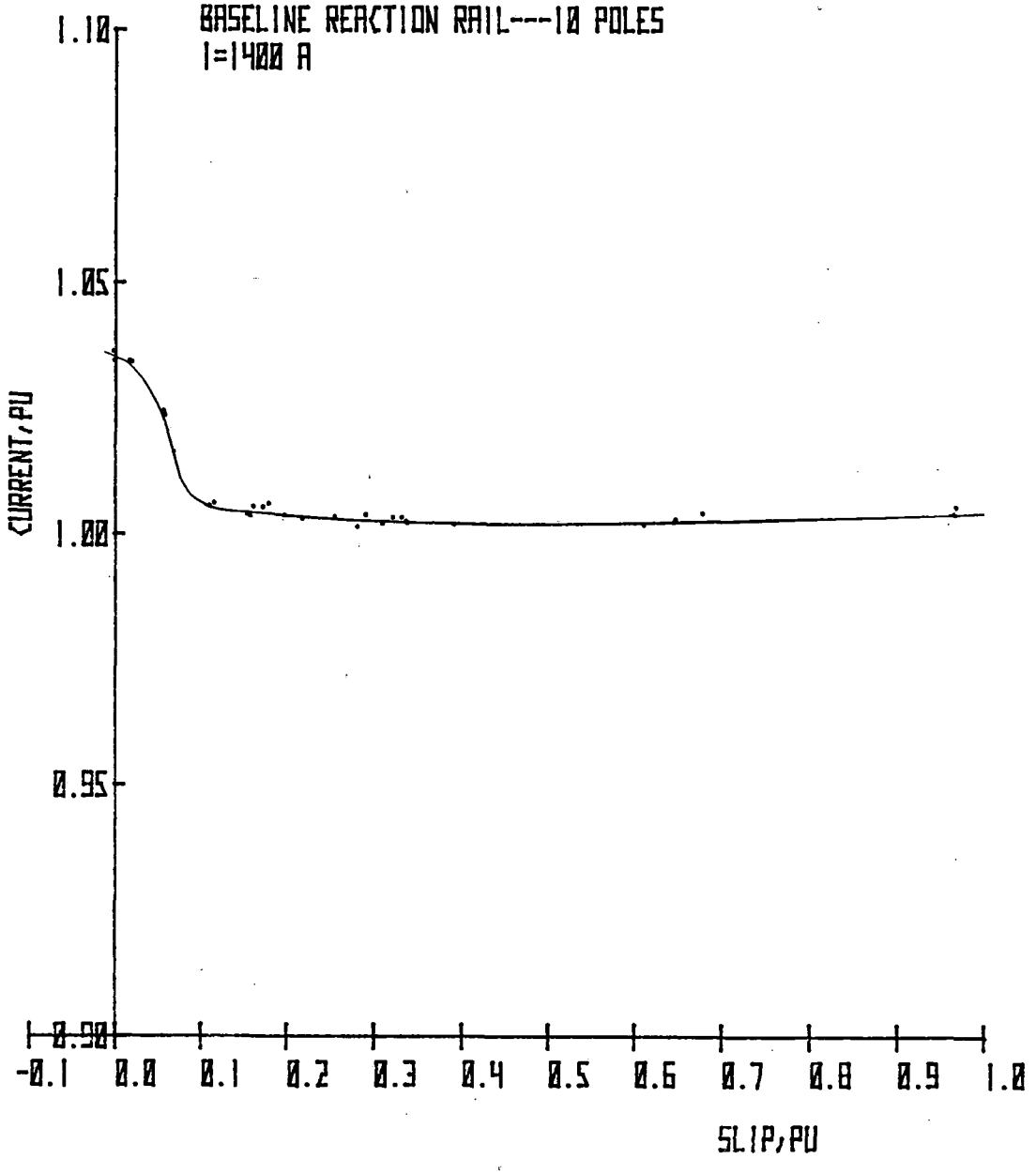
A PHASE CURRENT VS SLIP

Figure 2-27



B PHASE CURRENT VS SLIP

Figure 2-28



C PHASE CURRENT VS SLIP

Figure 2-29

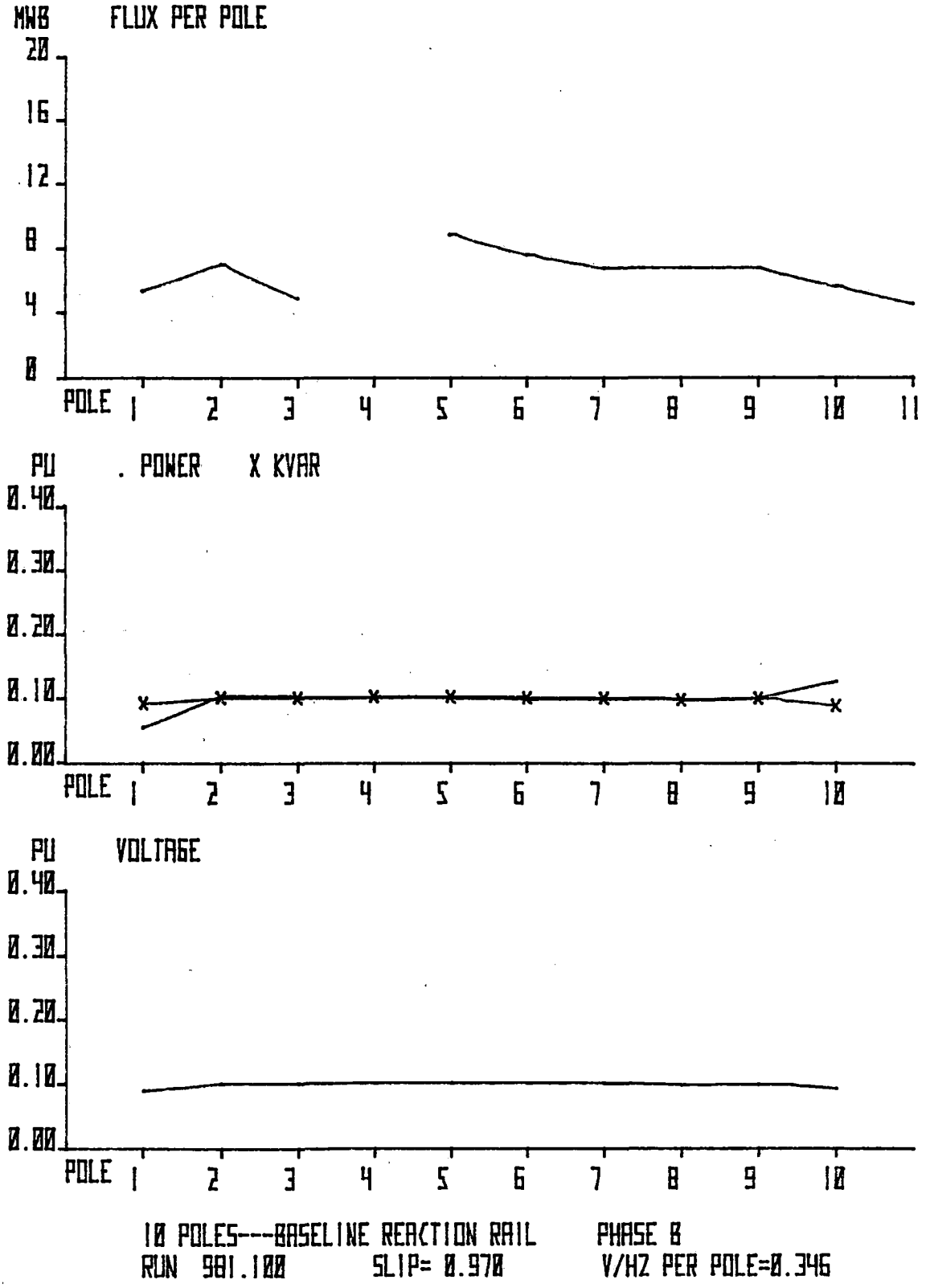

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 981.100 SLIP= 0.970 V/HZ PER POLE=0.346

Figure 2-30

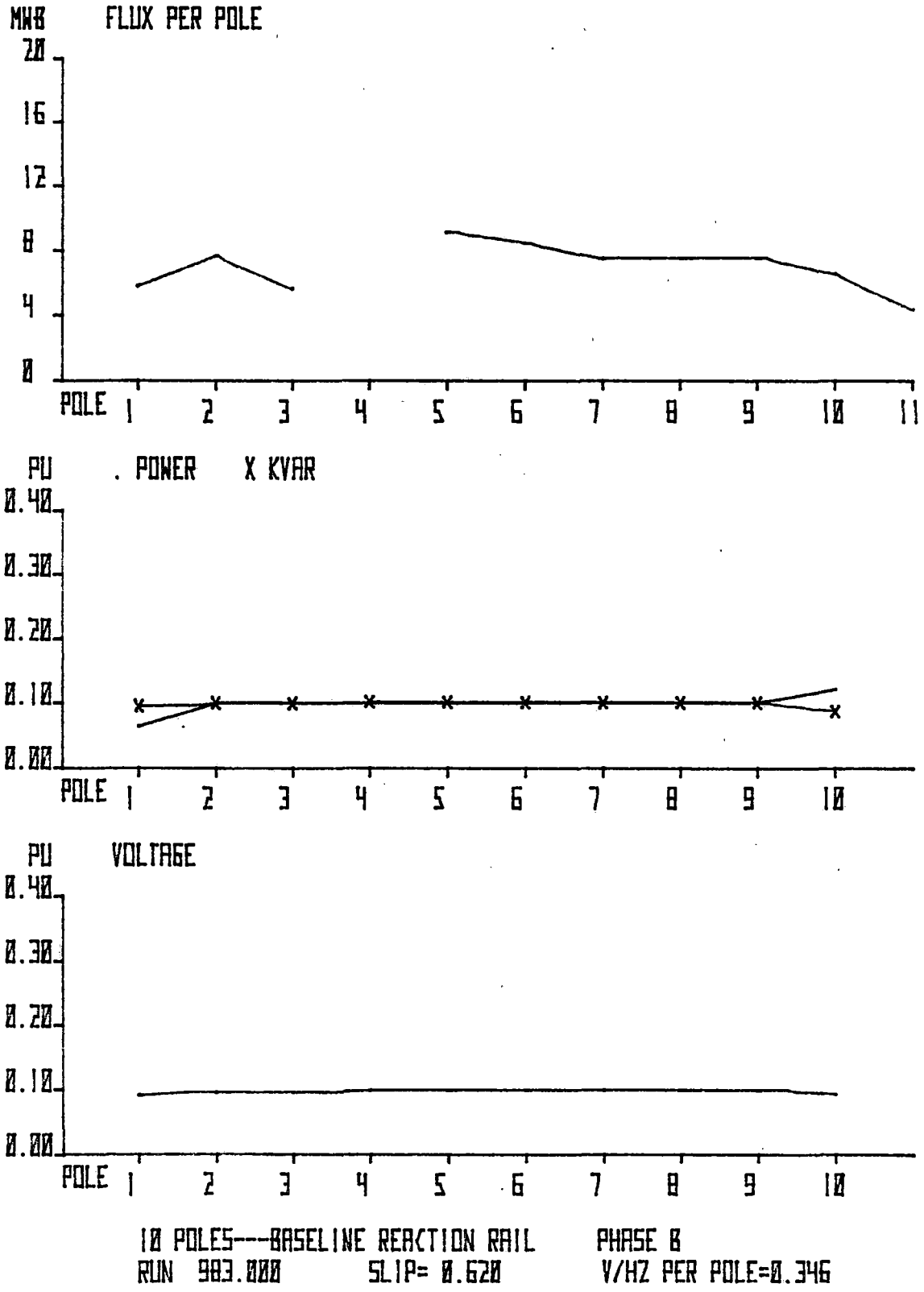

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 983.000 SLIP= 0.620 V/HZ PER POLE=0.346

Figure 2-31

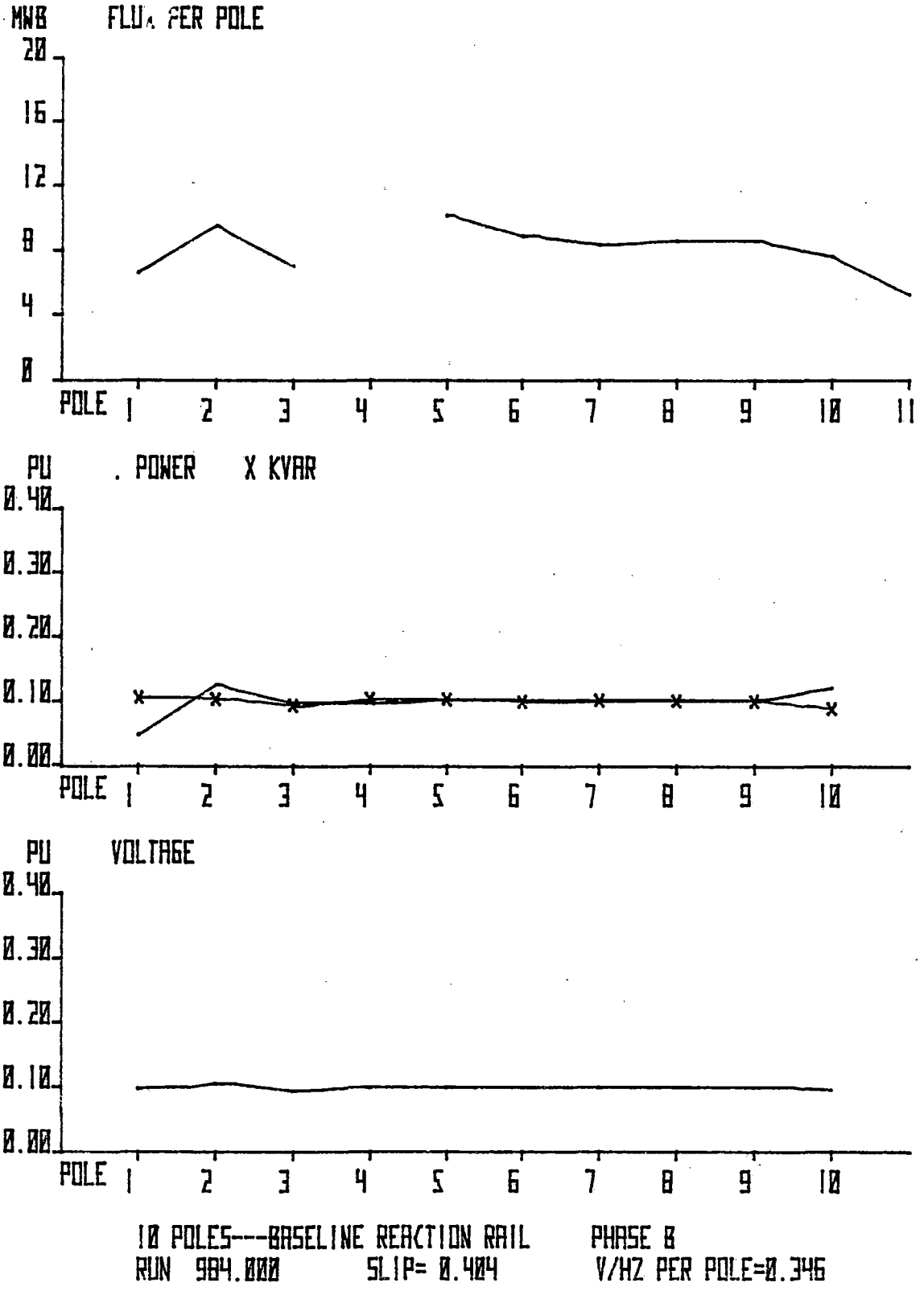

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 984.000 SLIP= 0.404 V/HZ PER POLE=0.346

Figure 2-32

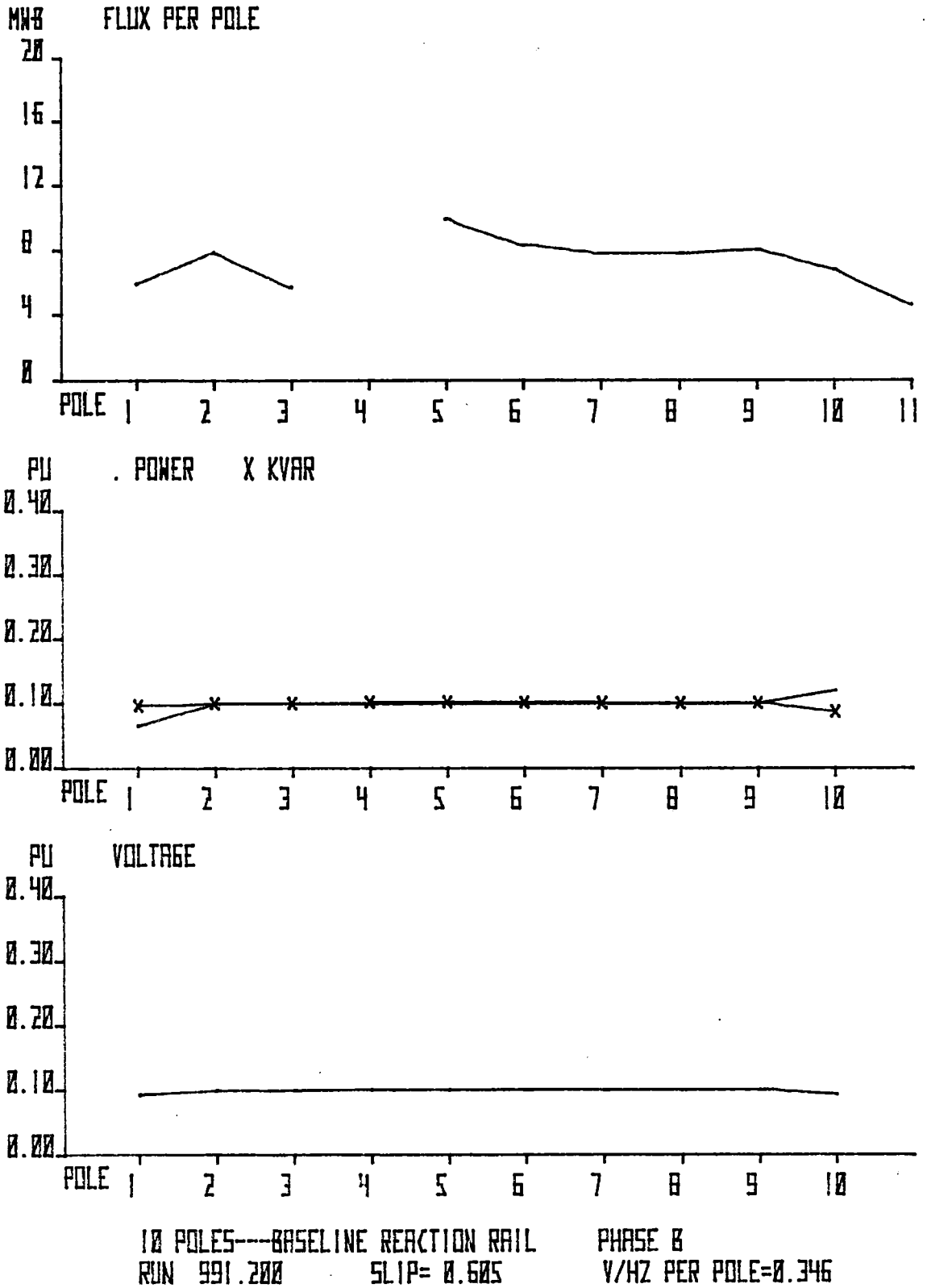

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 991.200 SLIP= 0.605 V/HZ PER POLE=0.346

Figure 2-331

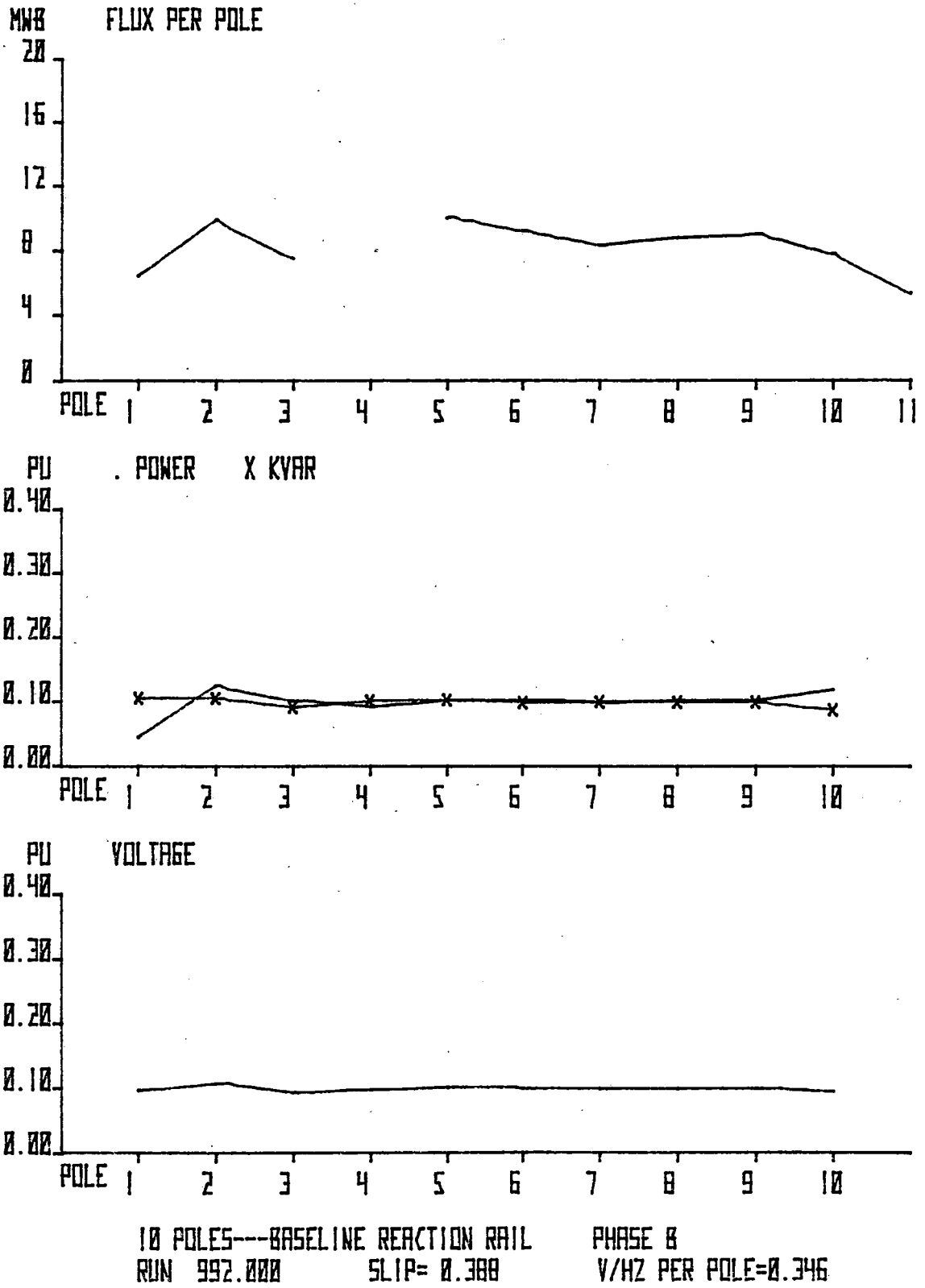

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 992.000 SLIP= 0.388 V/HZ PER POLE=0.346

Figure 2-34

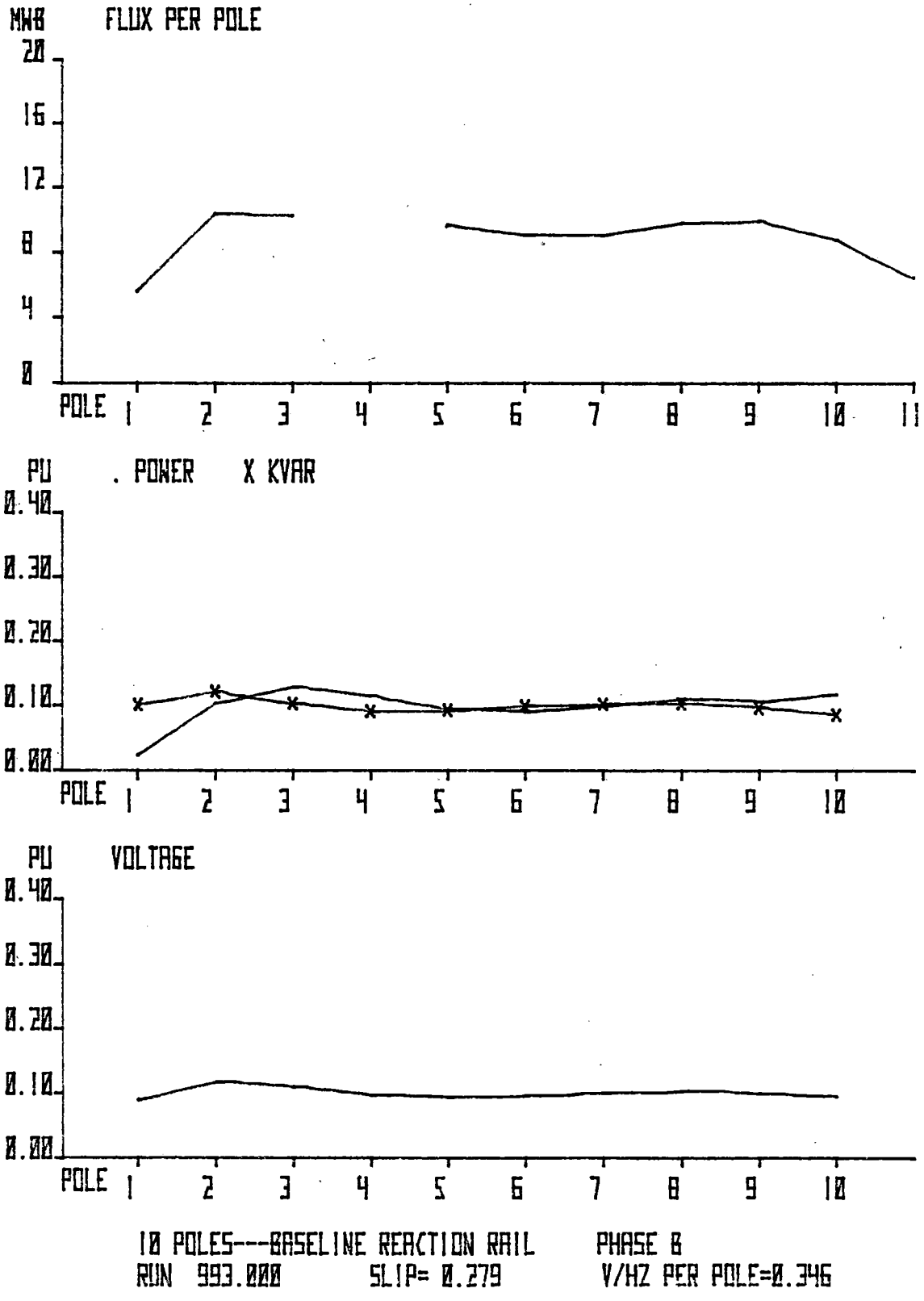

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 993.000 SLIP= 0.279 V/HZ PER POLE=0.346

Figure 2-35

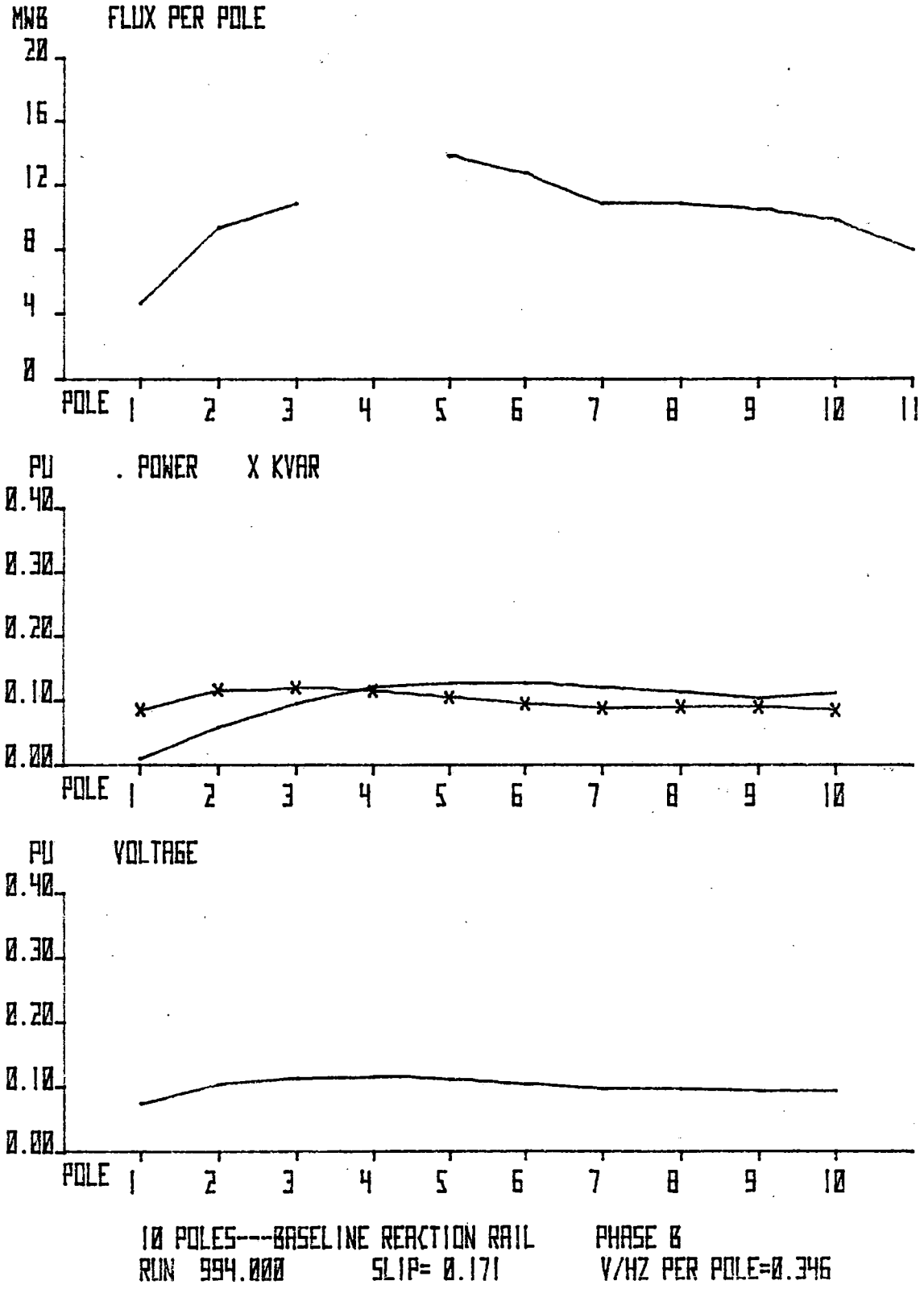

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 994.000 SLIP= 0.171 V/HZ PER POLE=0.346

Figure 2-36

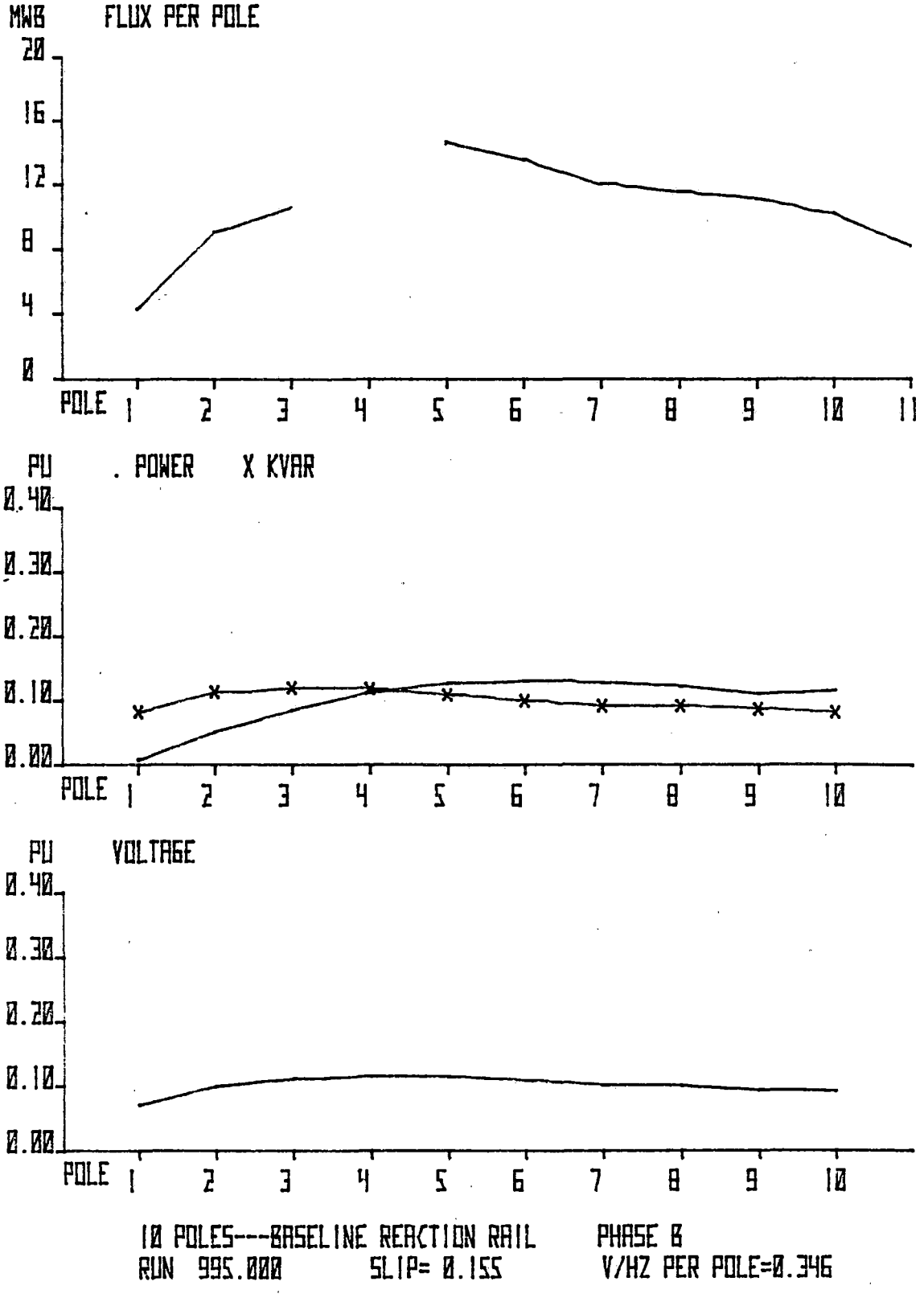

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 995.000 SLIP= 0.155 V/HZ PER POLE=0.346

Figure 2-37

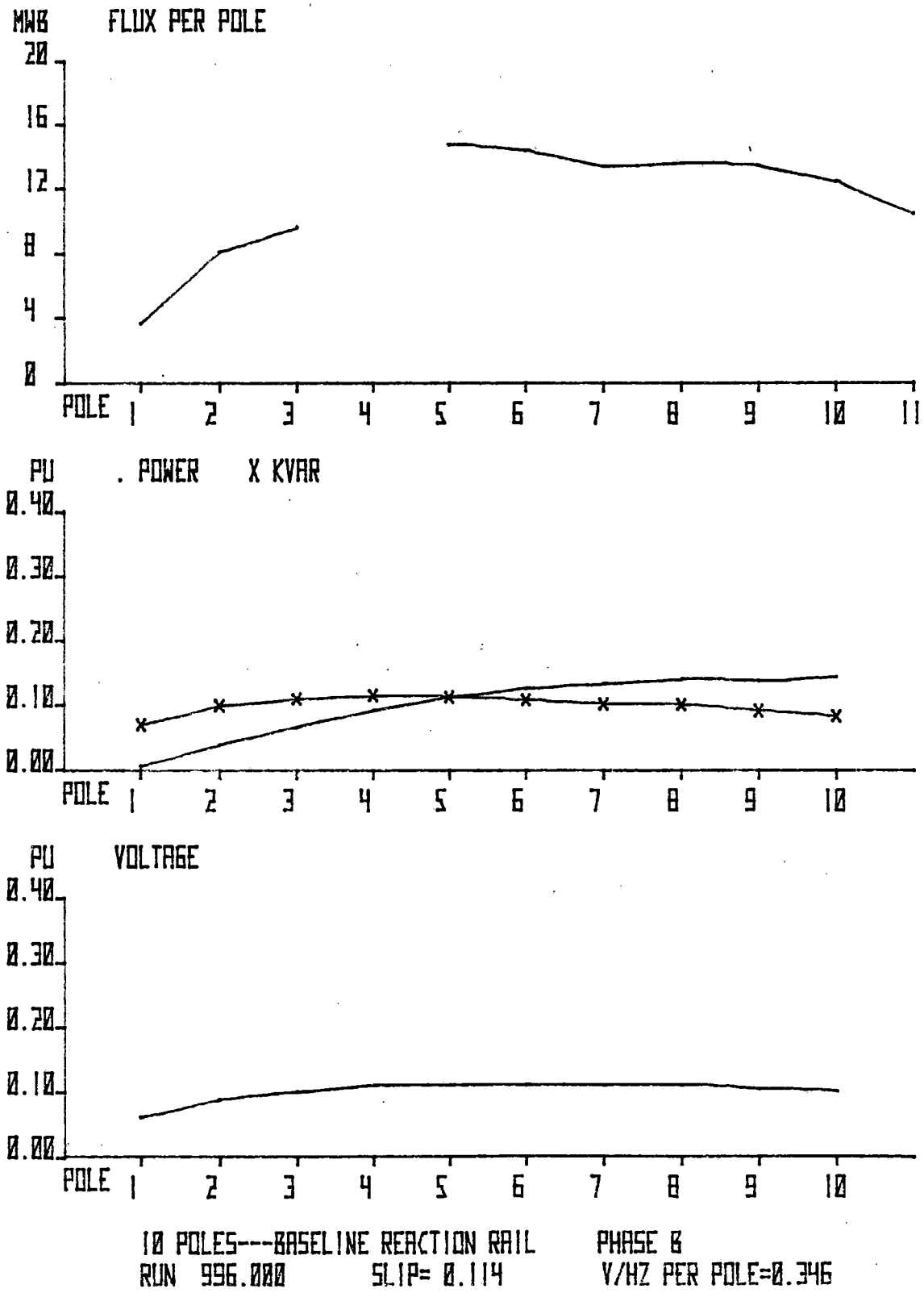

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 996.000 SLIP= 0.114 V/HZ PER POLE=0.346

Figure 2-38

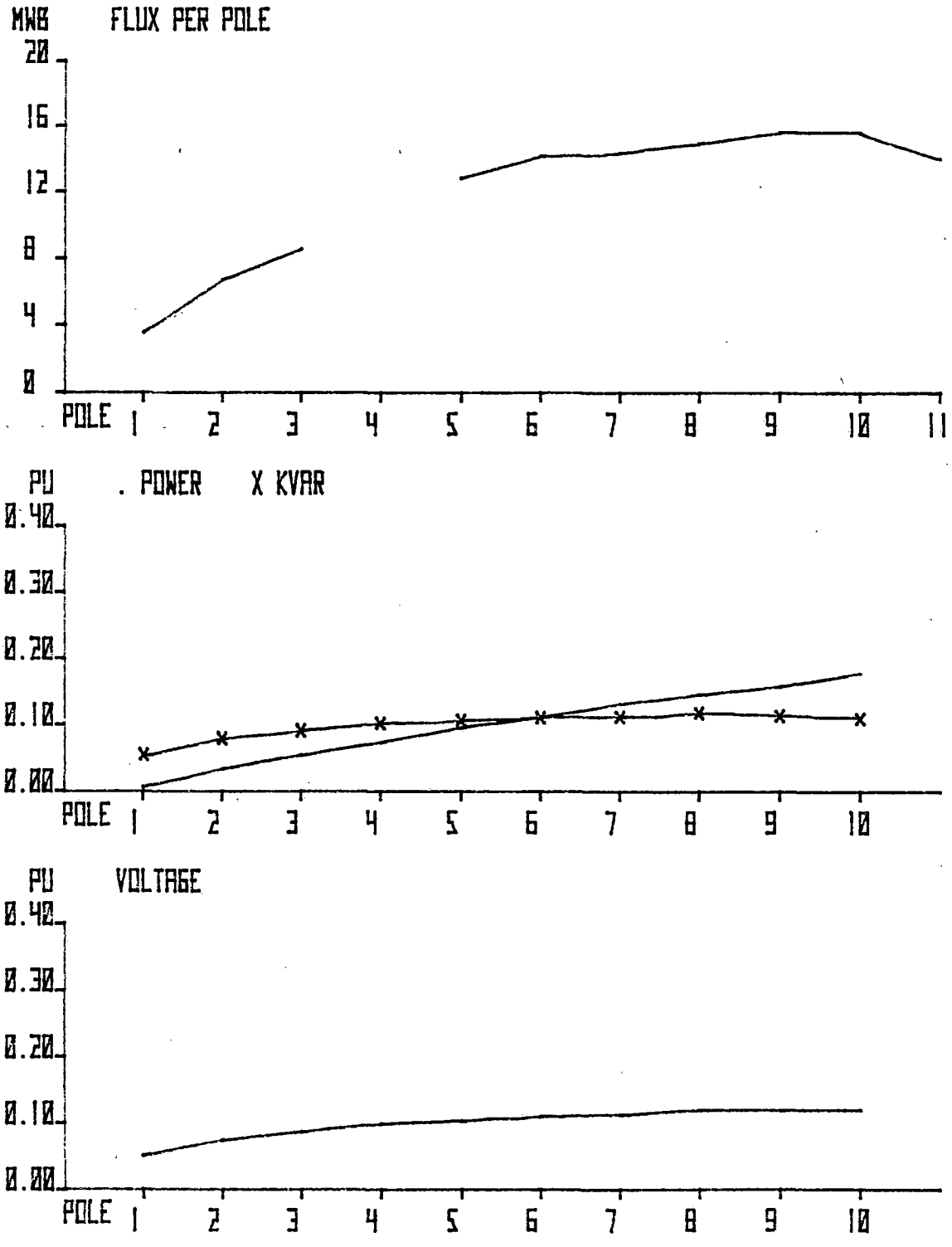

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 999.000 SLIP= 0.056 V/HZ PER POLE=0.346

Figure 2-39

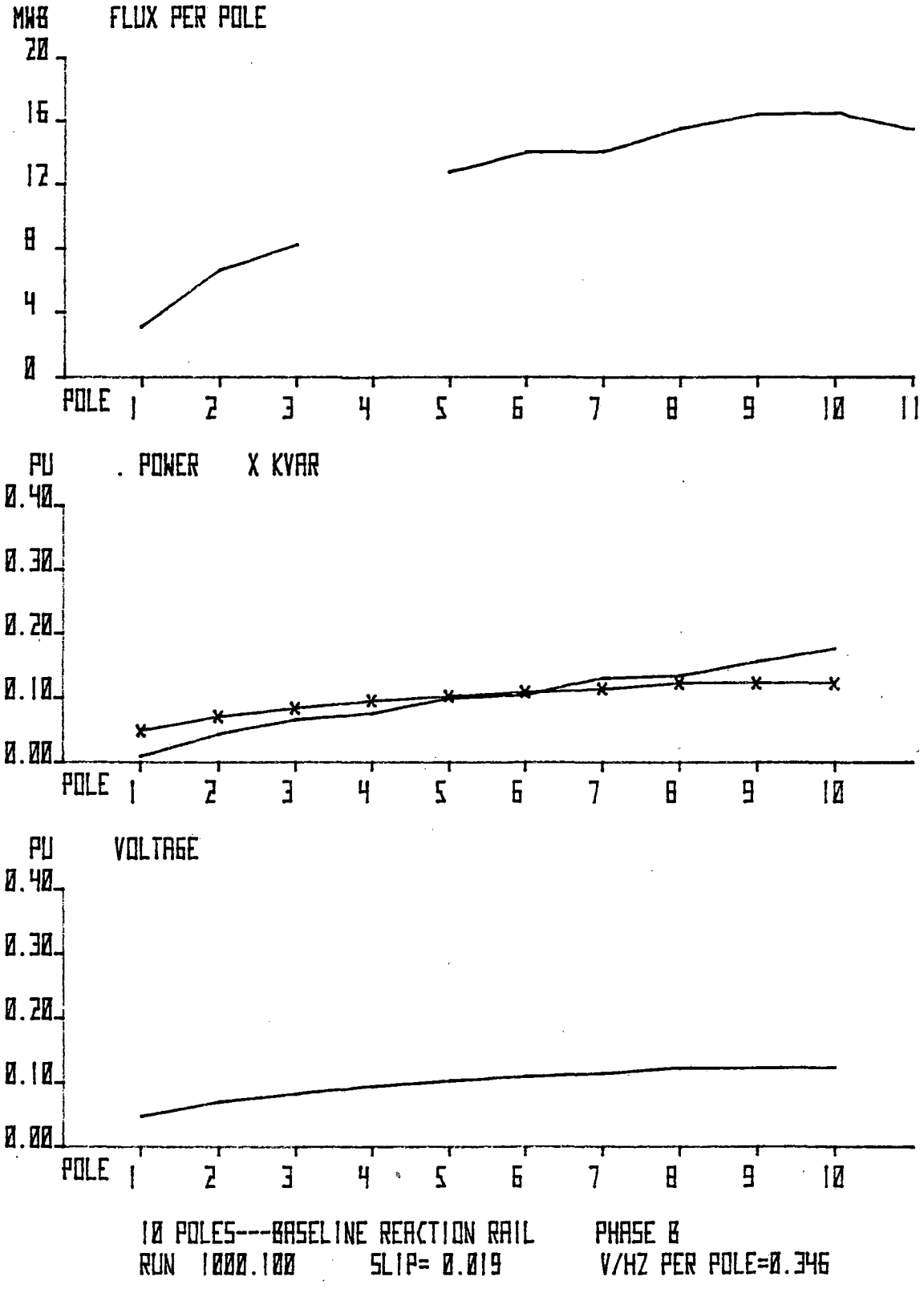

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1000.100 SLIP= 0.019 V/HZ PER POLE=0.346

Figure 2-40

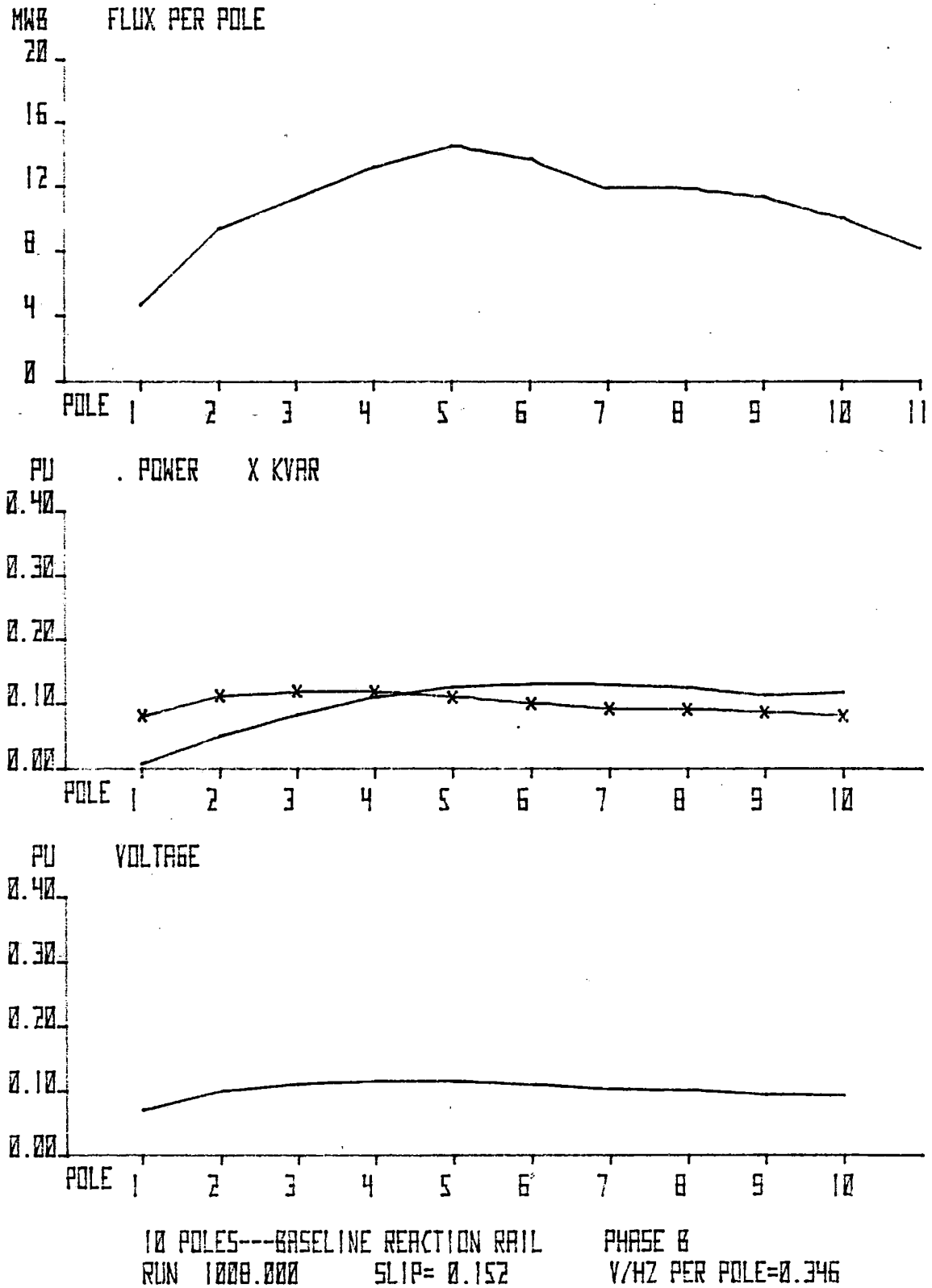

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1000.000 SLIP= 0.152 V/HZ PER POLE=0.346

Figure 2-41

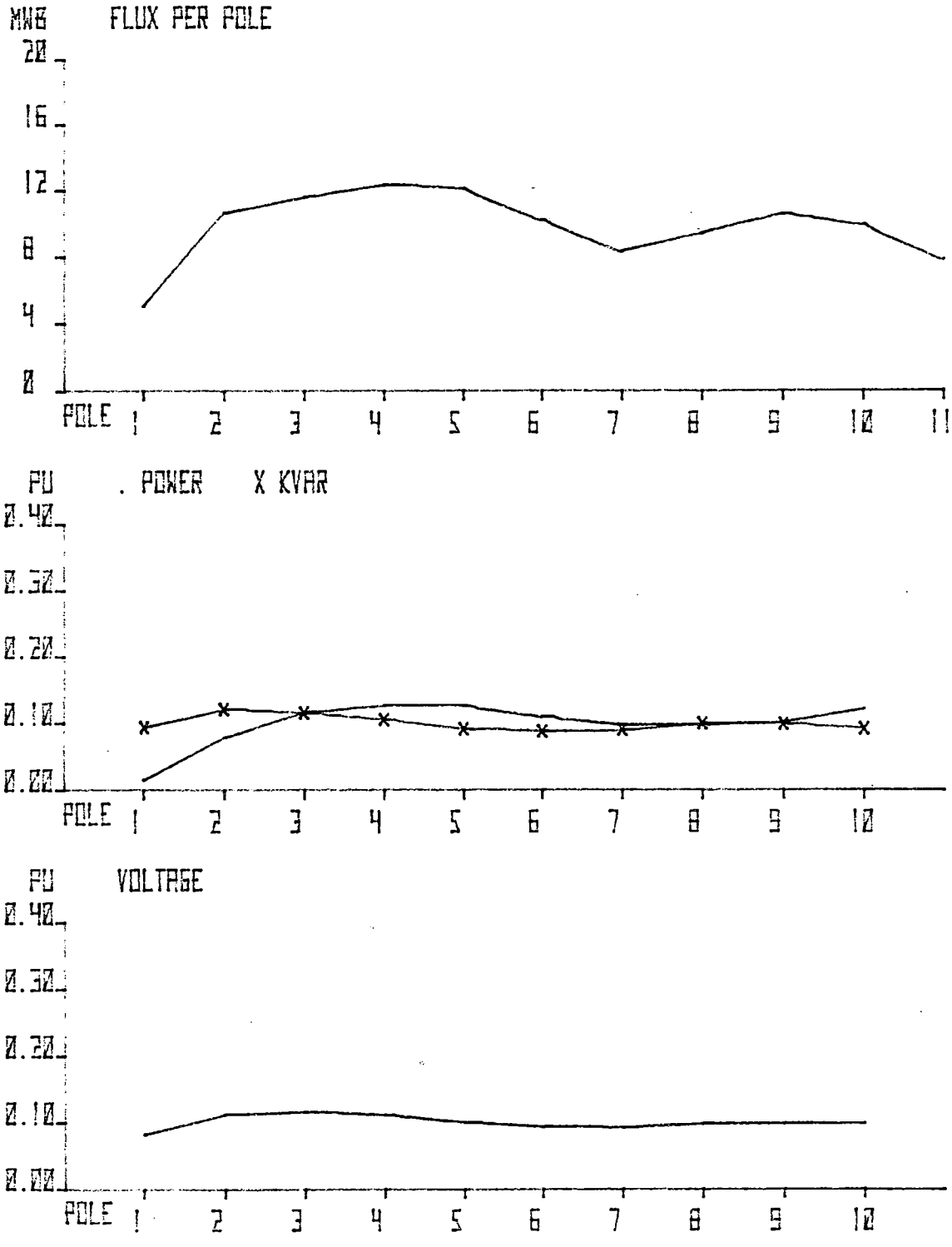

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1009.100 SLIP= 0.215 V/HZ PER POLE=0.346

Figure 2-42

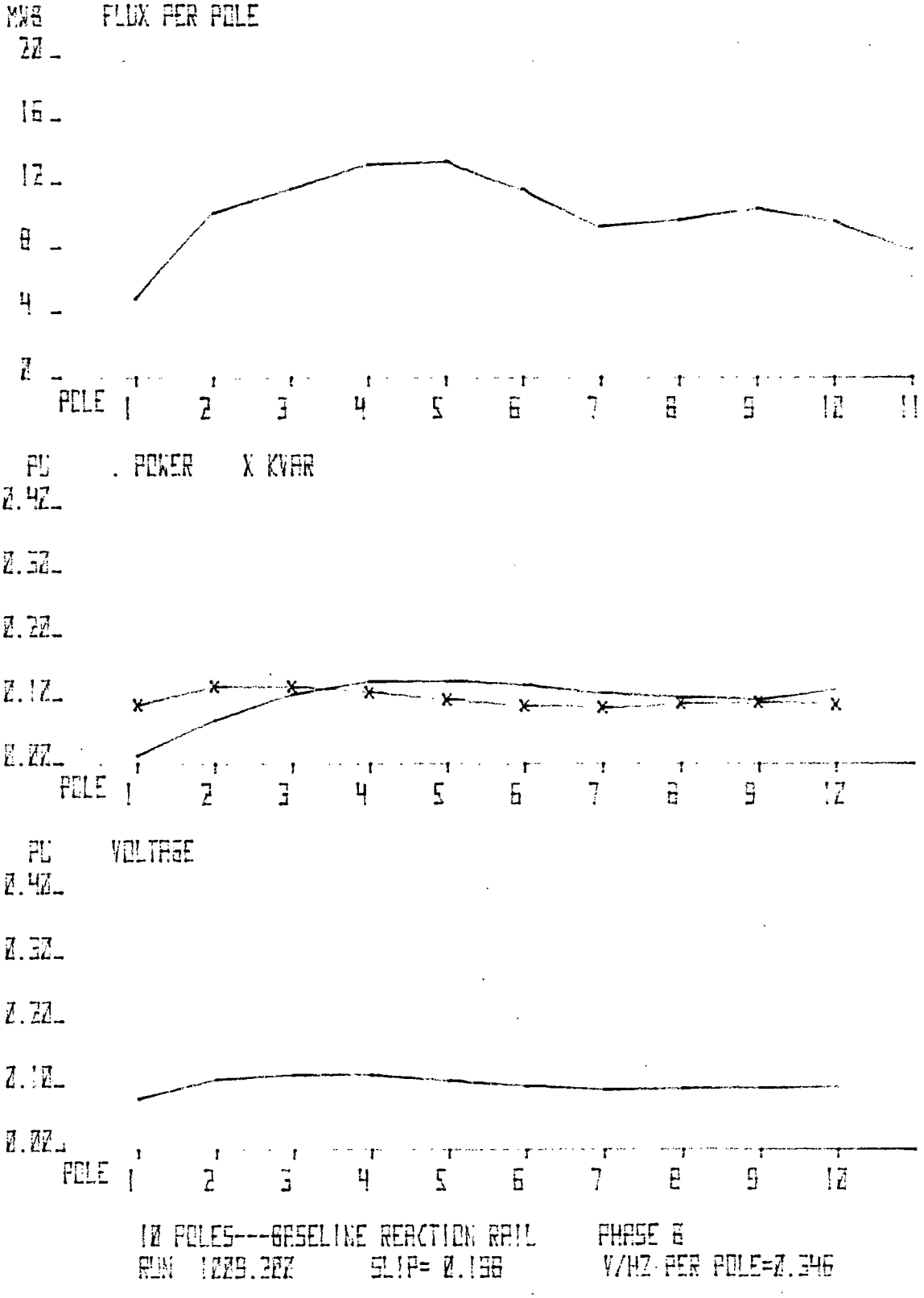

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1029.20Z SLIP= 0.156 V/HZ PER POLE=0.346

Figure 2-43

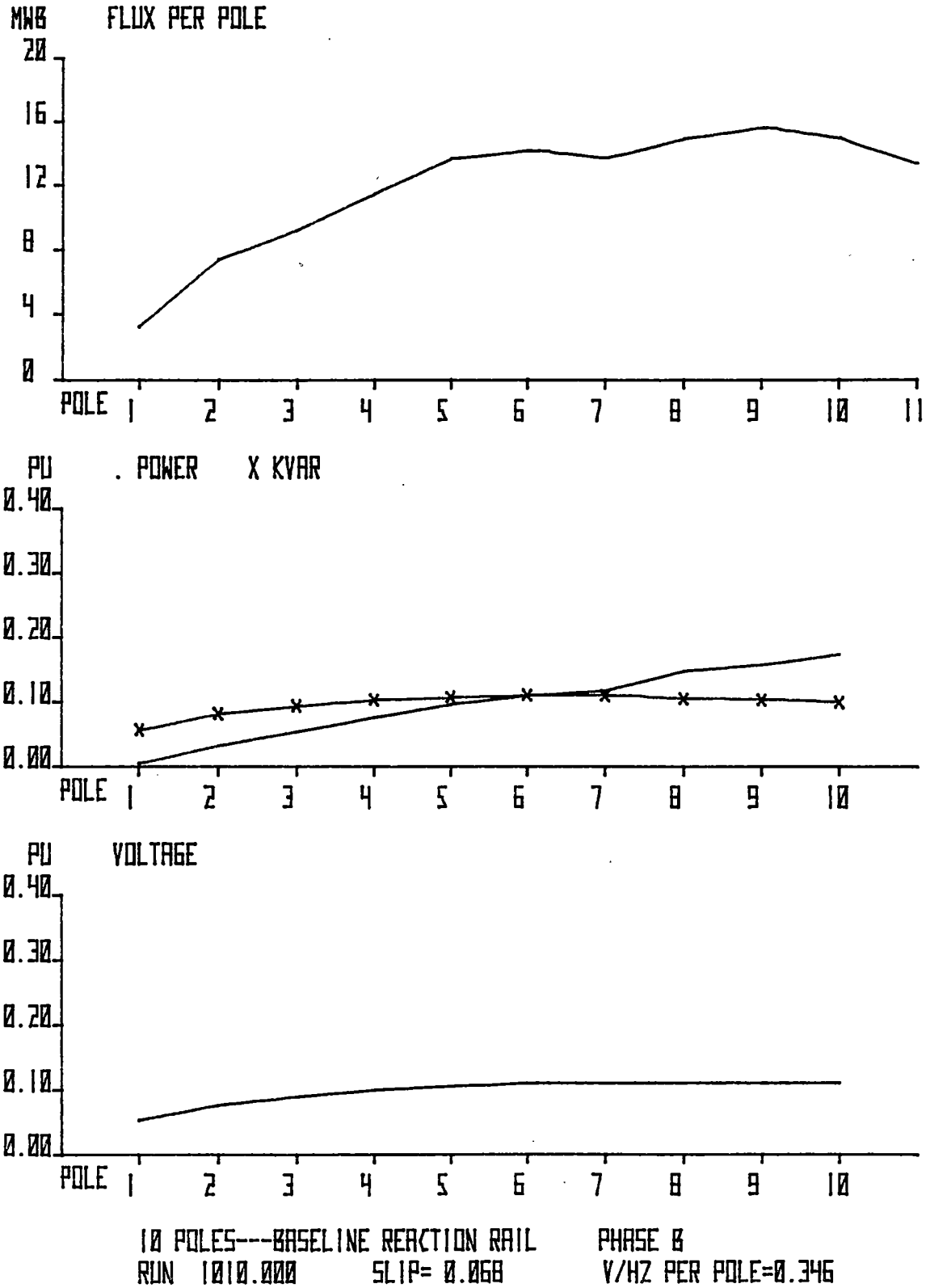

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1010.000 SLIP= 0.068 V/HZ PER POLE=0.346

Figure 2-44

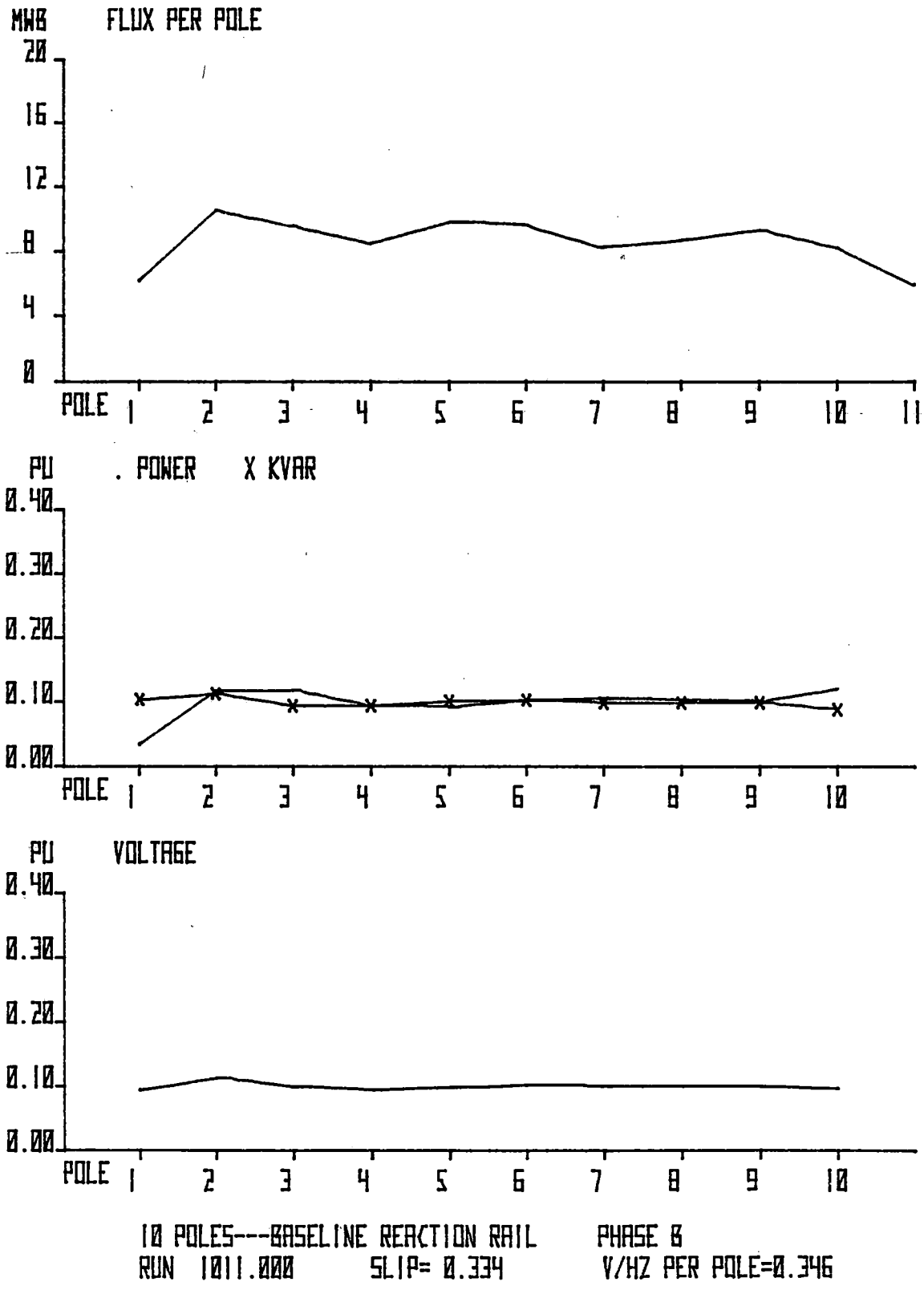

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1011.000 SLIP= 0.334 V/HZ PER POLE=0.346

Figure 2-45

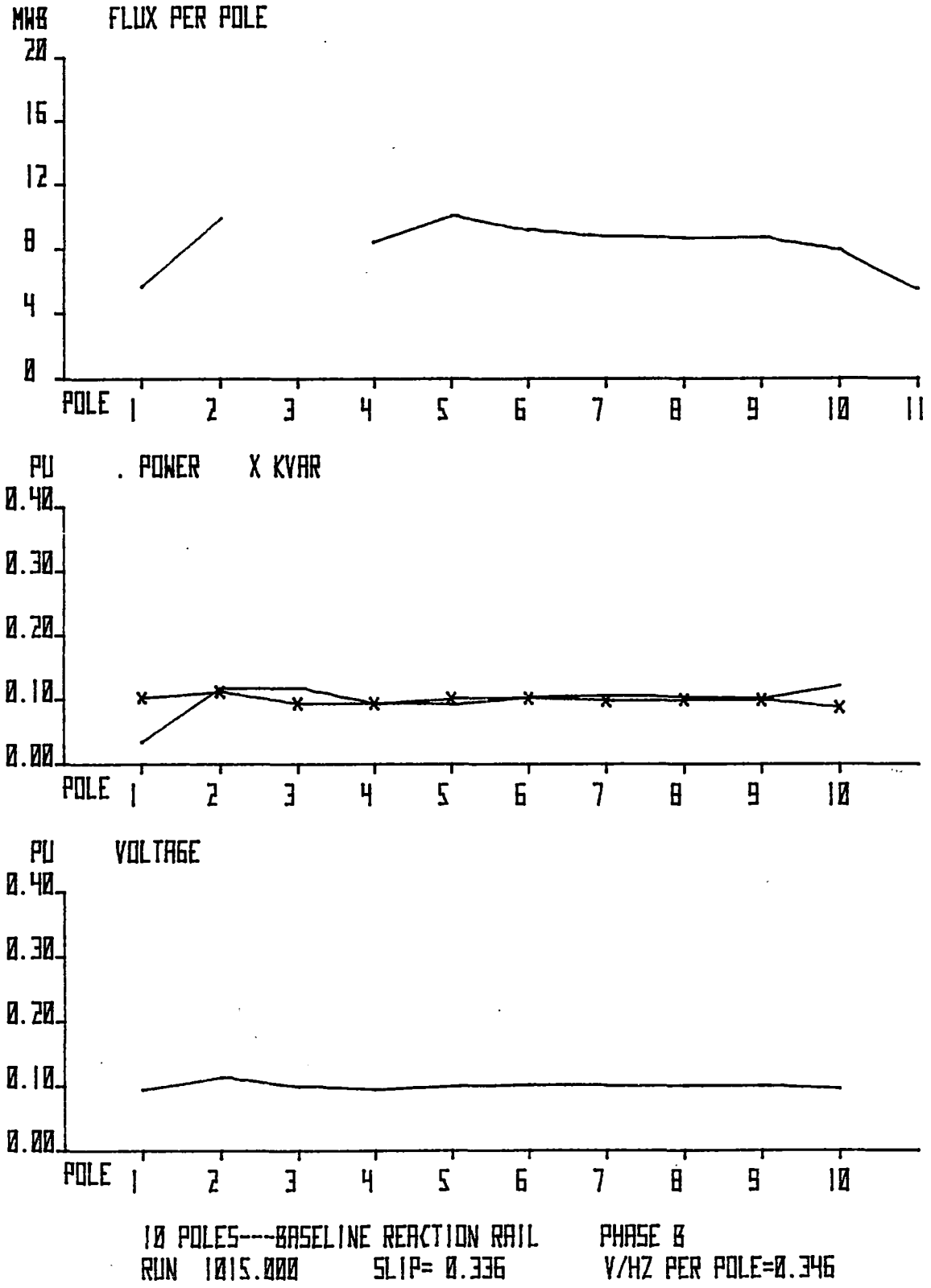

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1015.000 SLIP= 0.336 V/HZ PER POLE=0.346

Figure 2-46

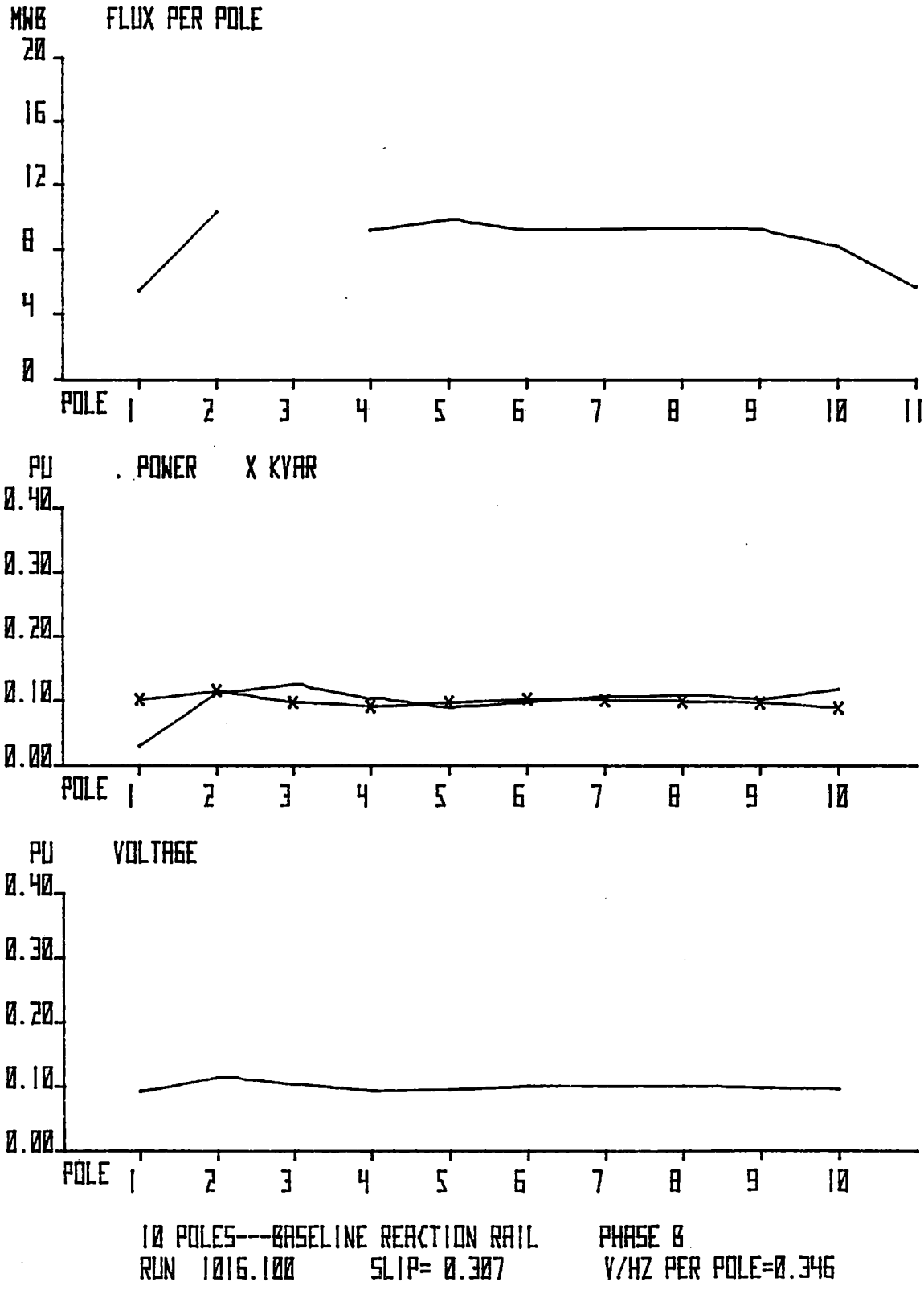

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1016.100 SLIP= 0.307 V/HZ PER POLE=0.346

Figure 2-47

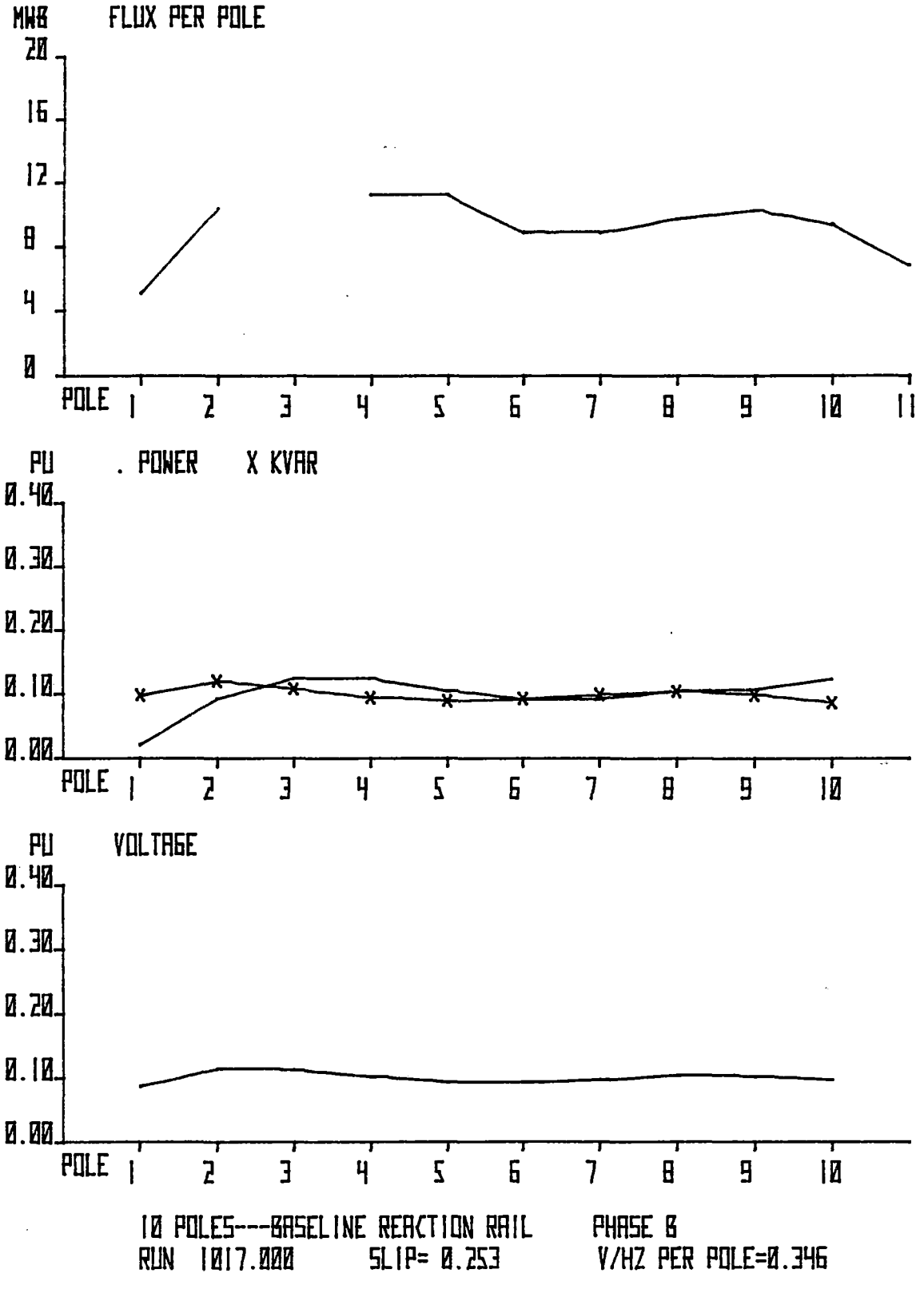

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1017.000 SLIP= 0.253 V/HZ PER POLE=0.346

Figure 2-48

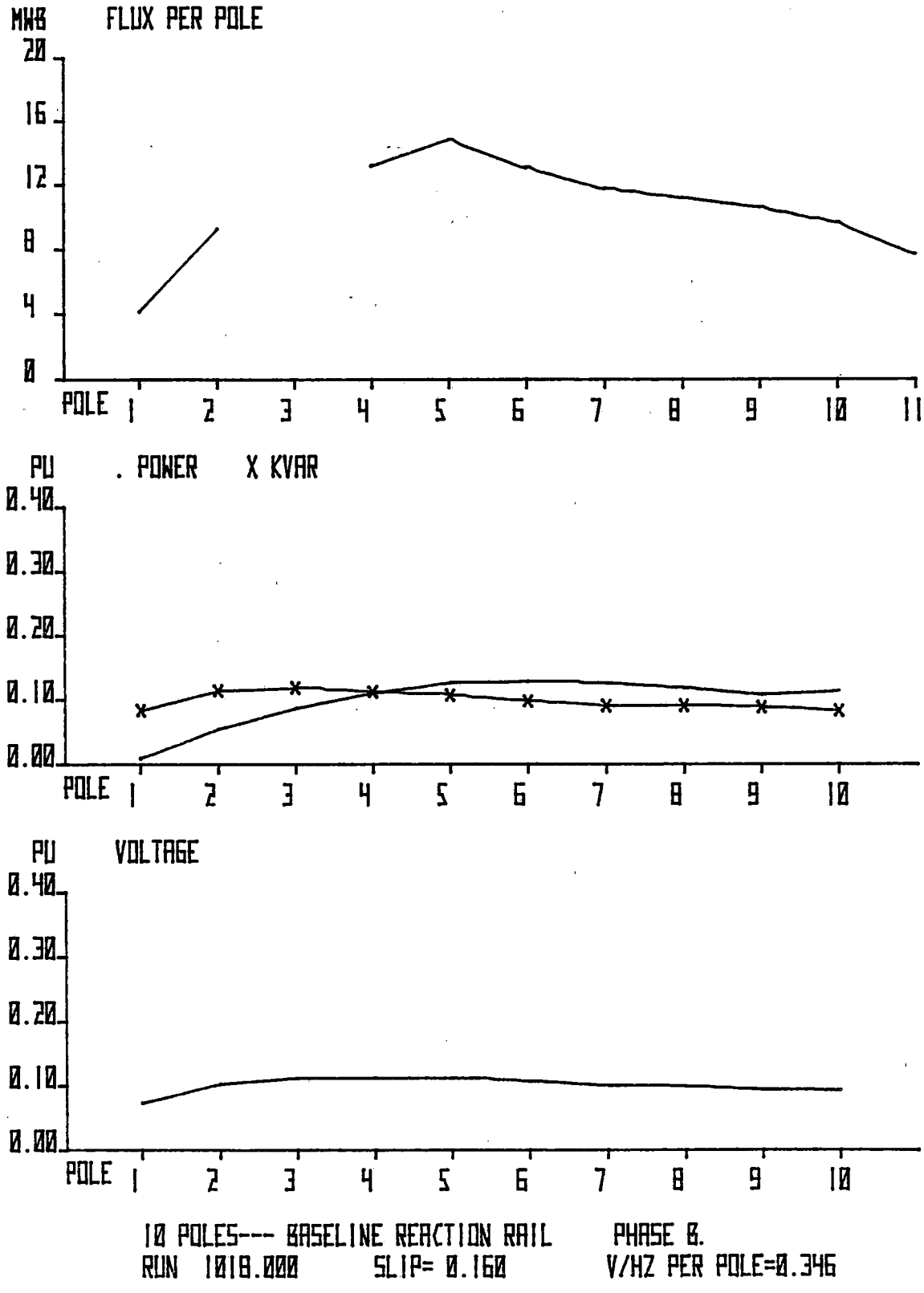

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES--- BASELINE REACTION RAIL PHASE B.
RUN 1018.000 SLIP= 0.160 V/HZ PER POLE=0.346

Figure 2-49

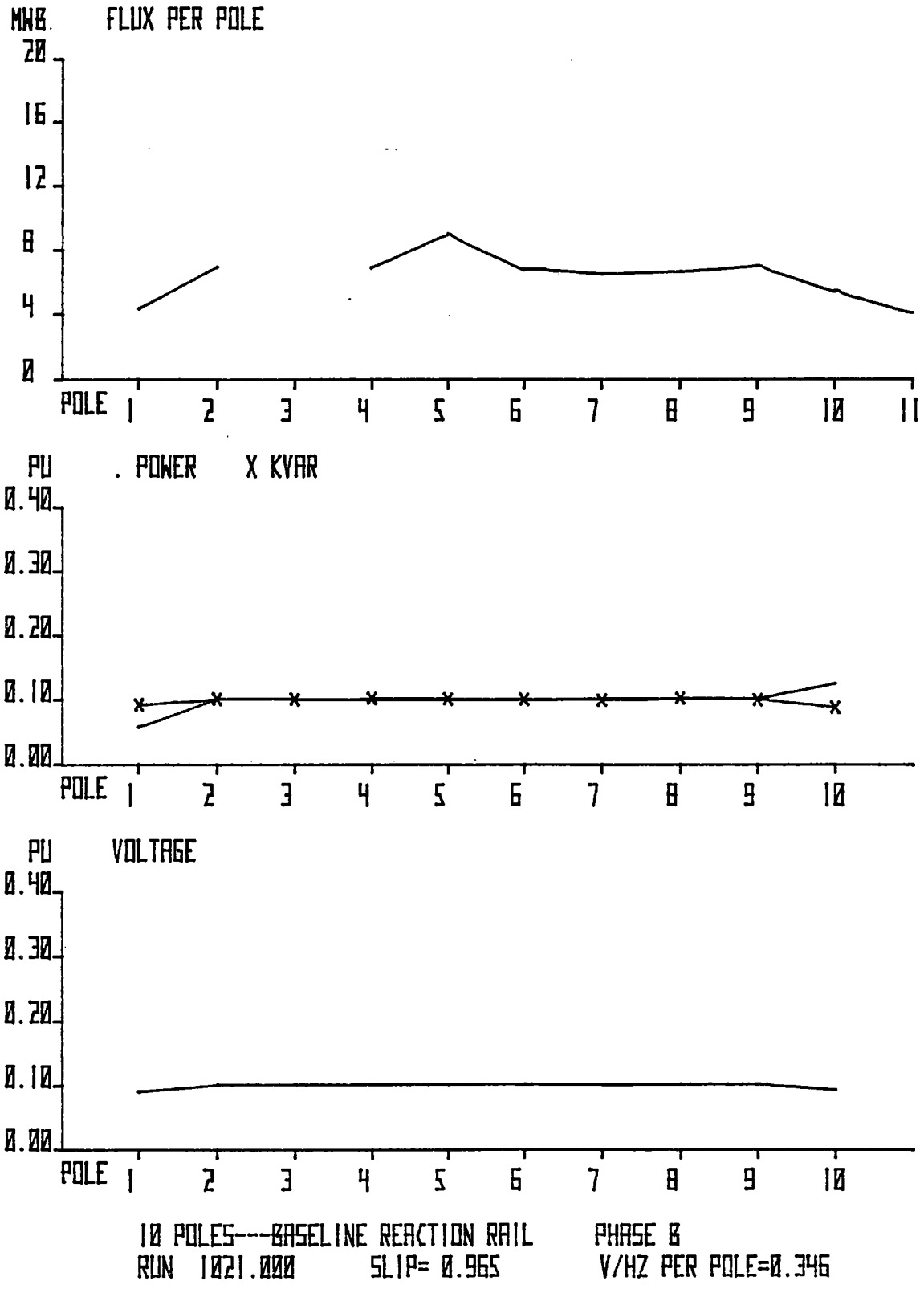

MWB. FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE B
RUN 1021.000 SLIP= 0.965 V/HZ PER POLE=0.346

Figure 2-50

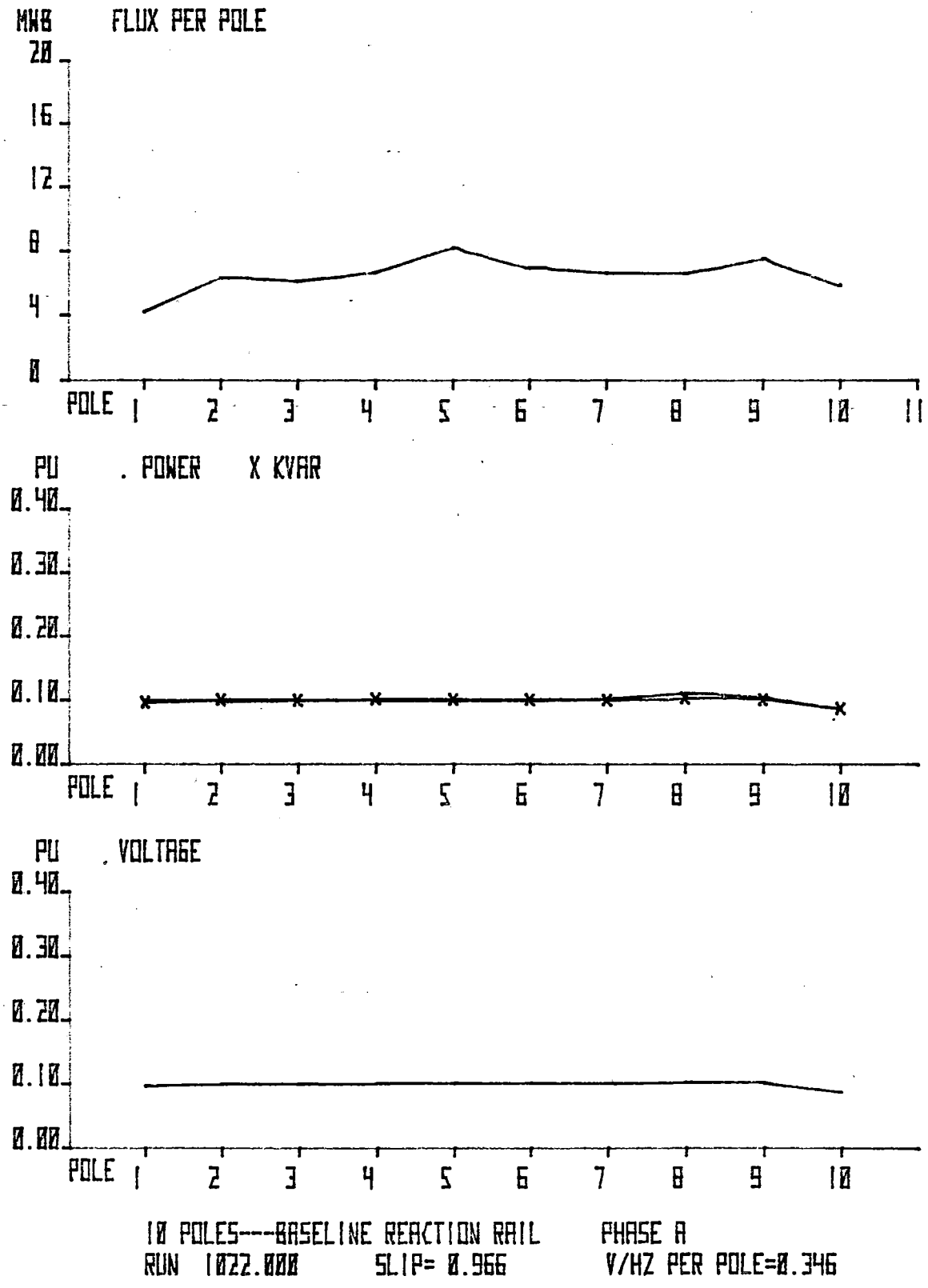

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU . VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE A
RUN 1022.000 SLIP= 0.966 V/HZ PER POLE=0.346

Figure 2-51

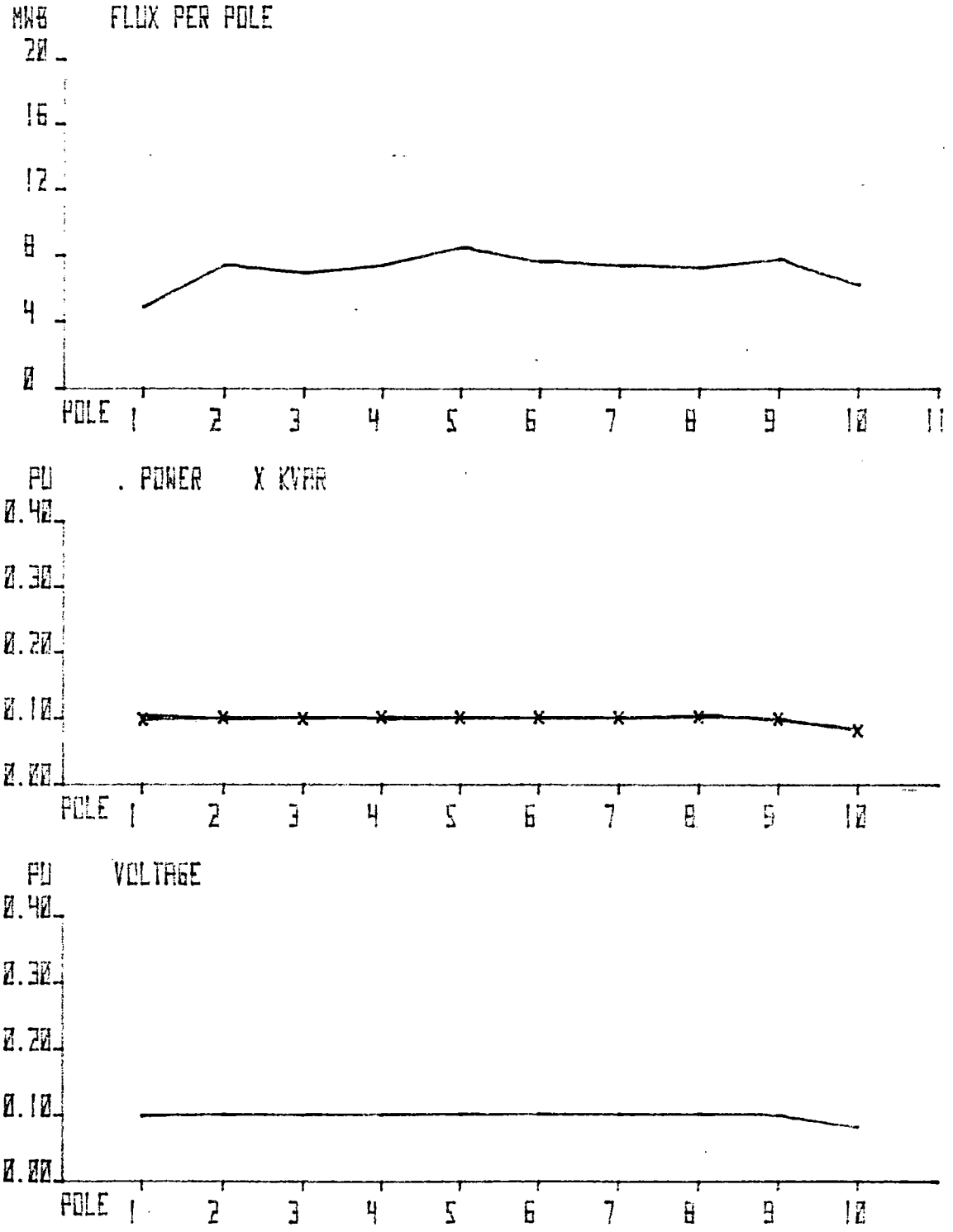

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE A
RUN 1023.100 SLIP= 0.641 V/HZ PER POLE=0.346

Figure 2-52

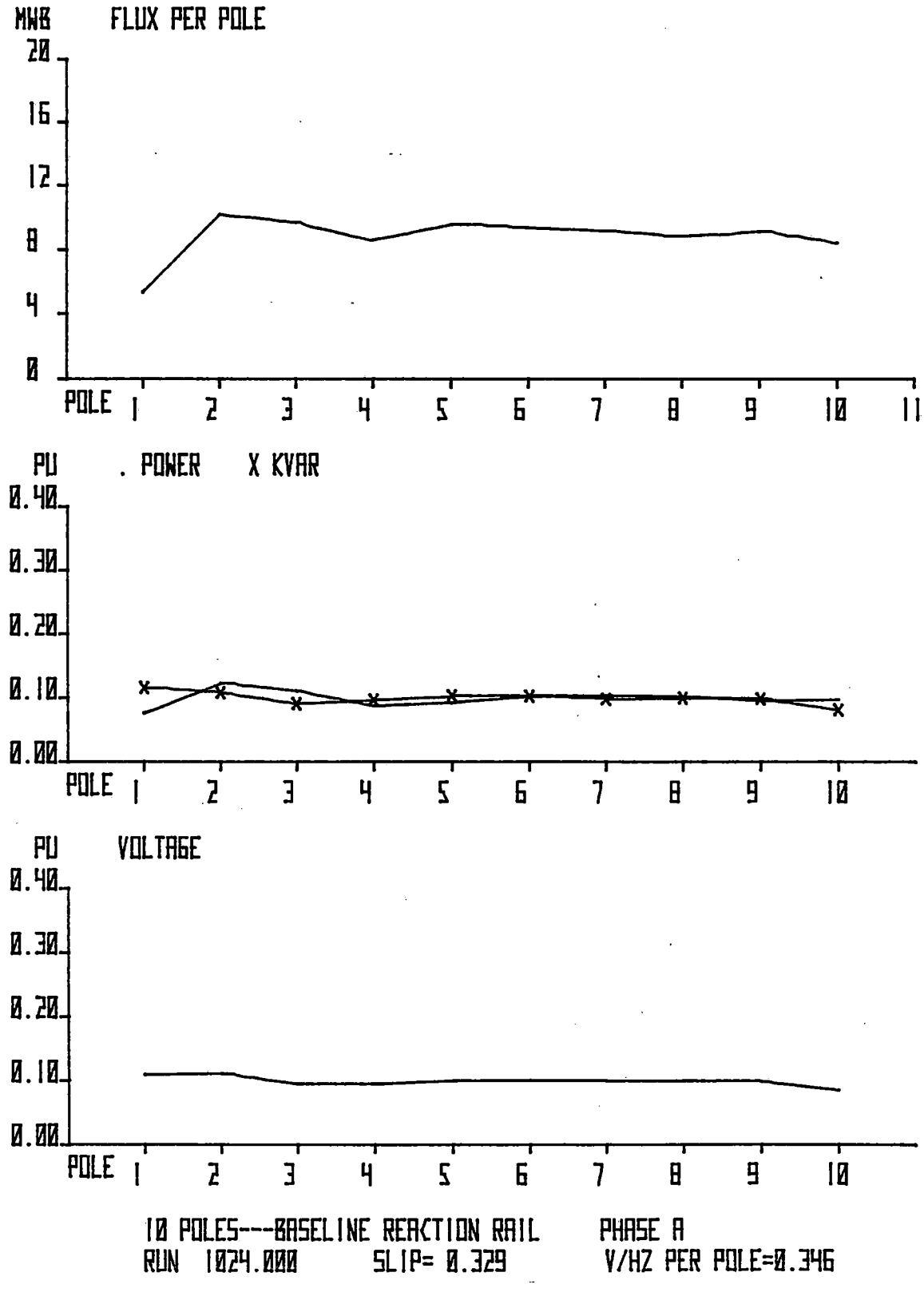

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE A
RUN 1024.000 SLIP= 0.329 V/HZ PER POLE=0.346

Figure 2-53

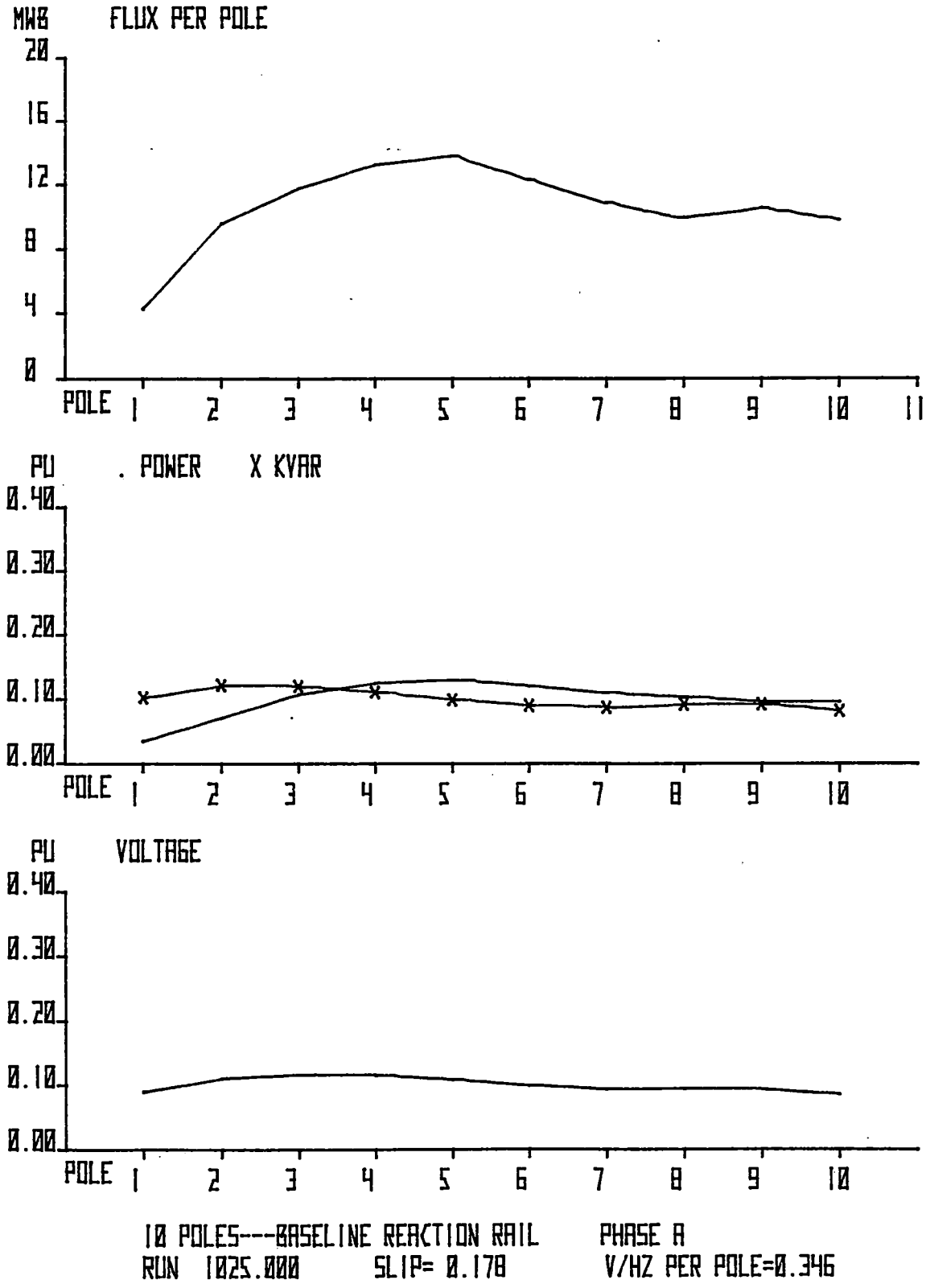

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE A
RUN 1025.000 SLIP= 0.178 V/HZ PER POLE=0.346

Figure 2-54

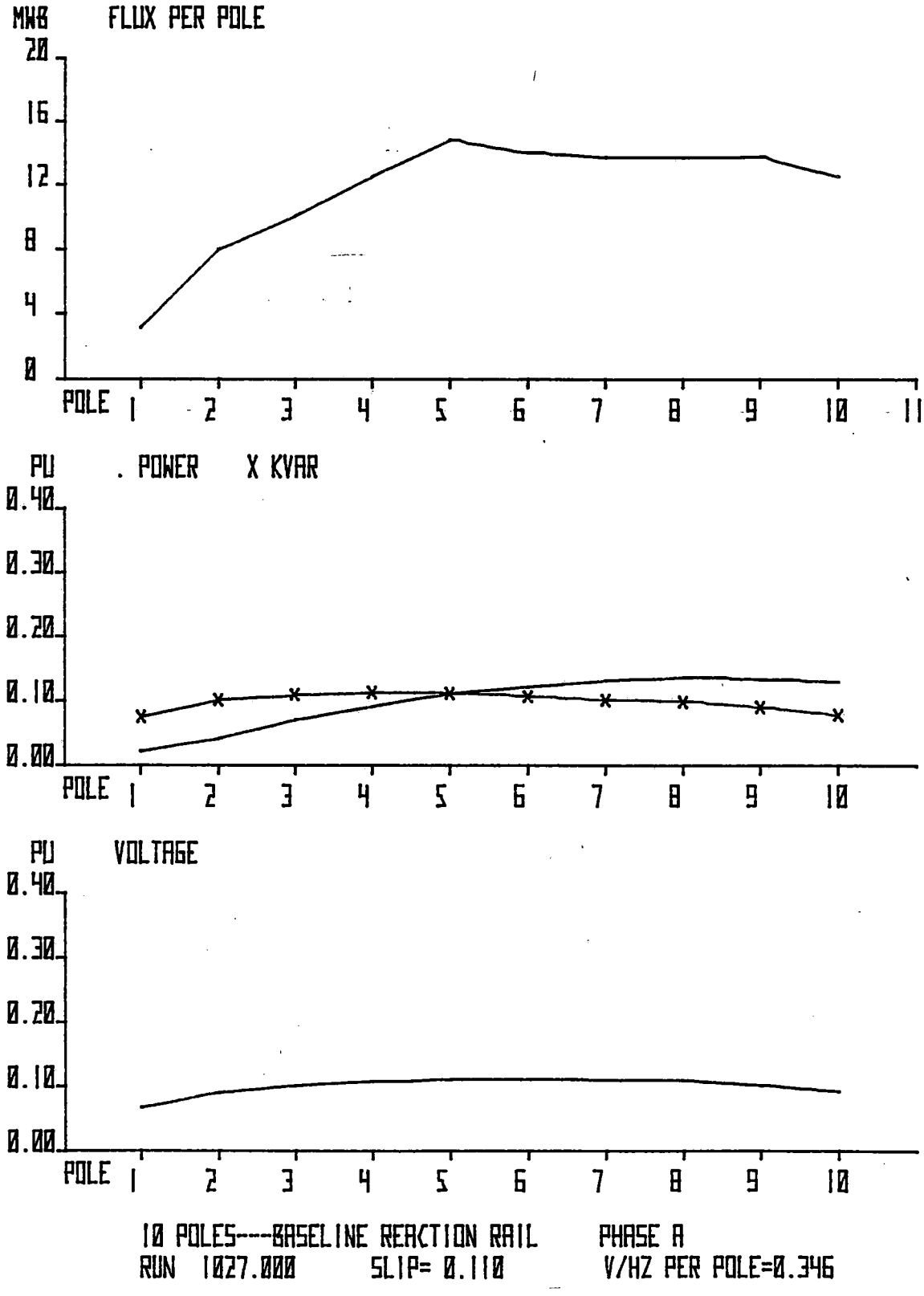

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE A
RUN 1027.000 SLIP= 0.110 V/HZ PER POLE=0.346

Figure 2-55

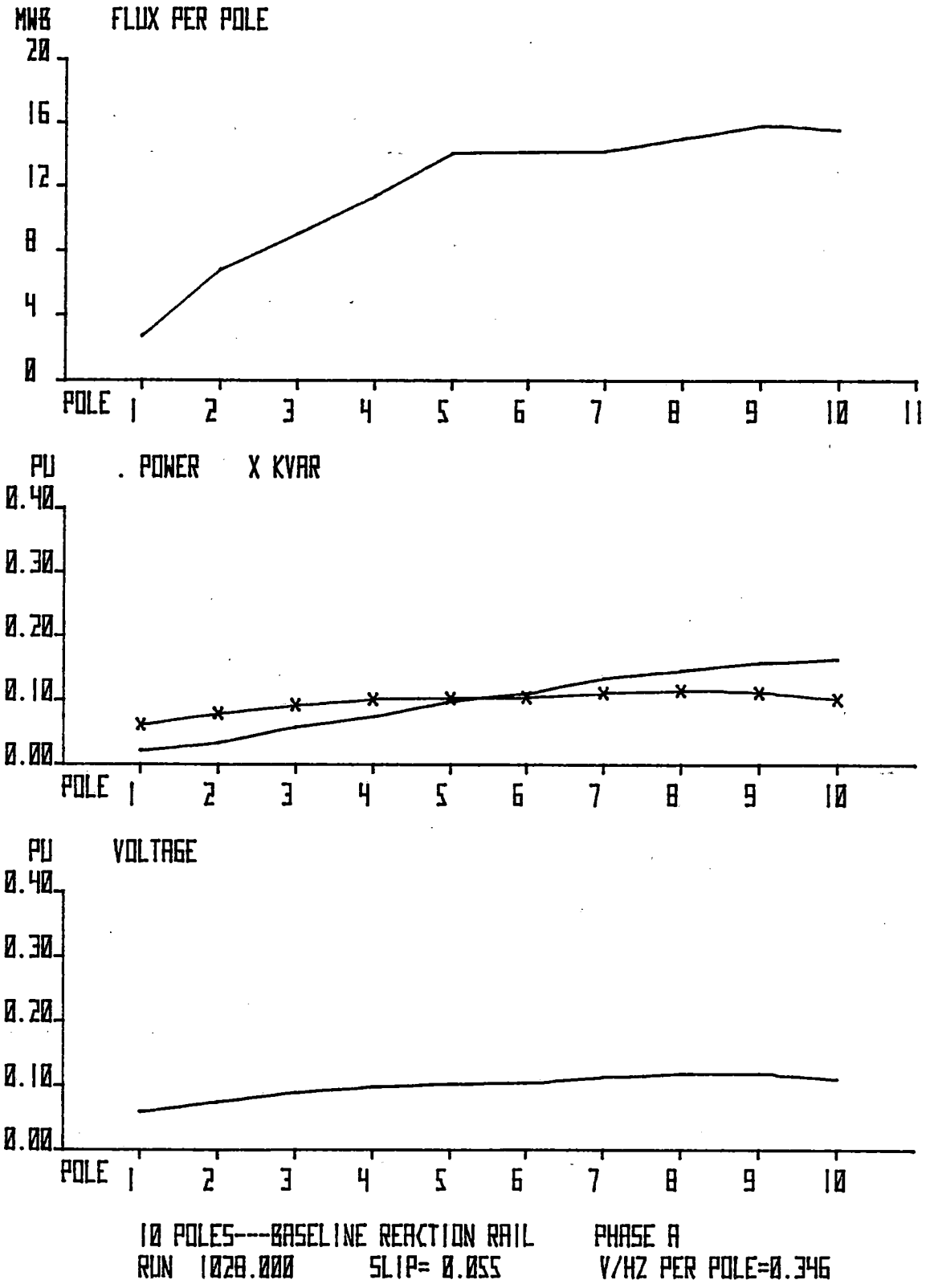

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE A
RUN 1028.000 SLIP= 0.055 V/HZ PER POLE=0.346

Figure 2-56

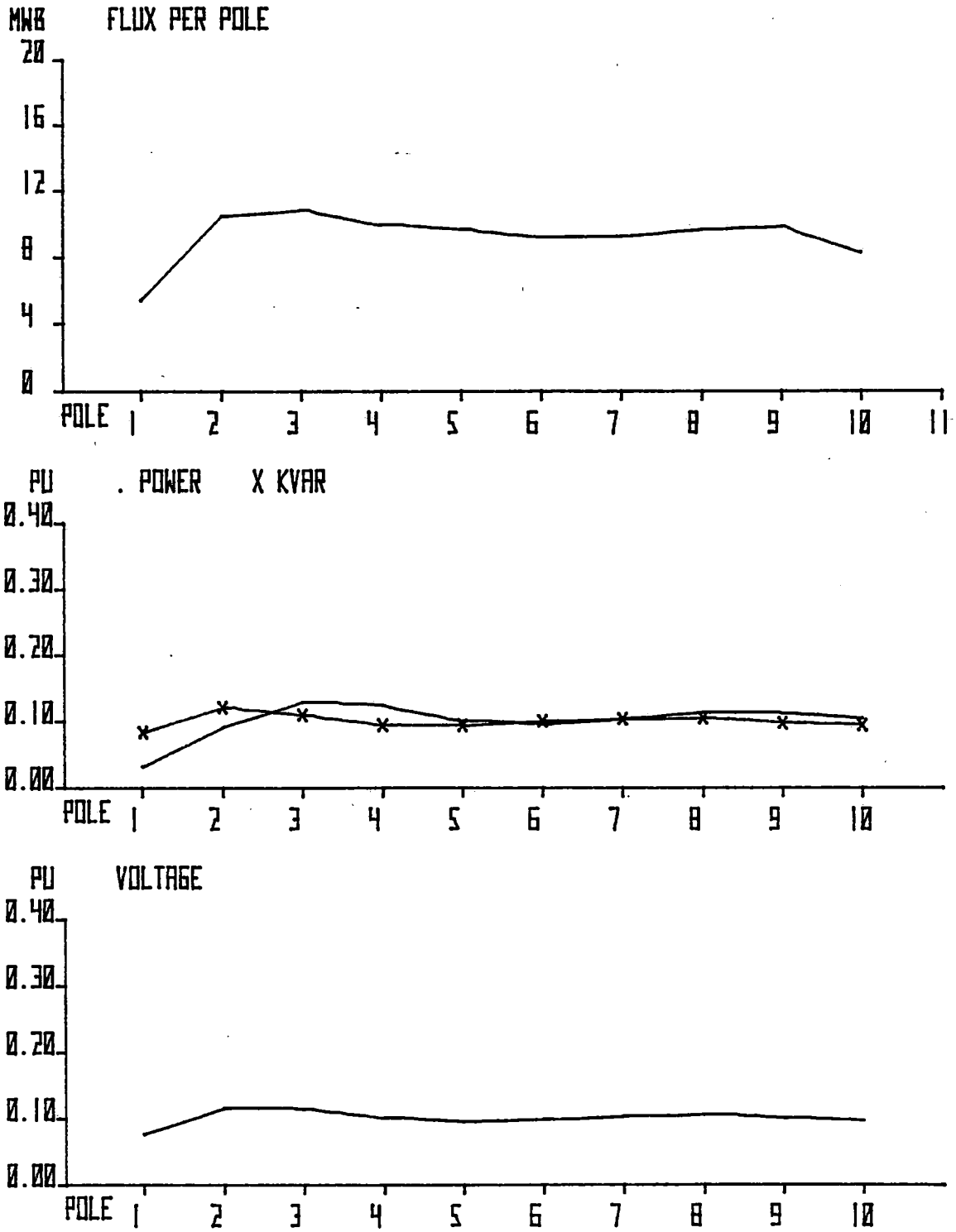

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE C
RUN 1031.000 SLIP= 0.288 V/HZ PER POLE=0.346

Figure 2-57

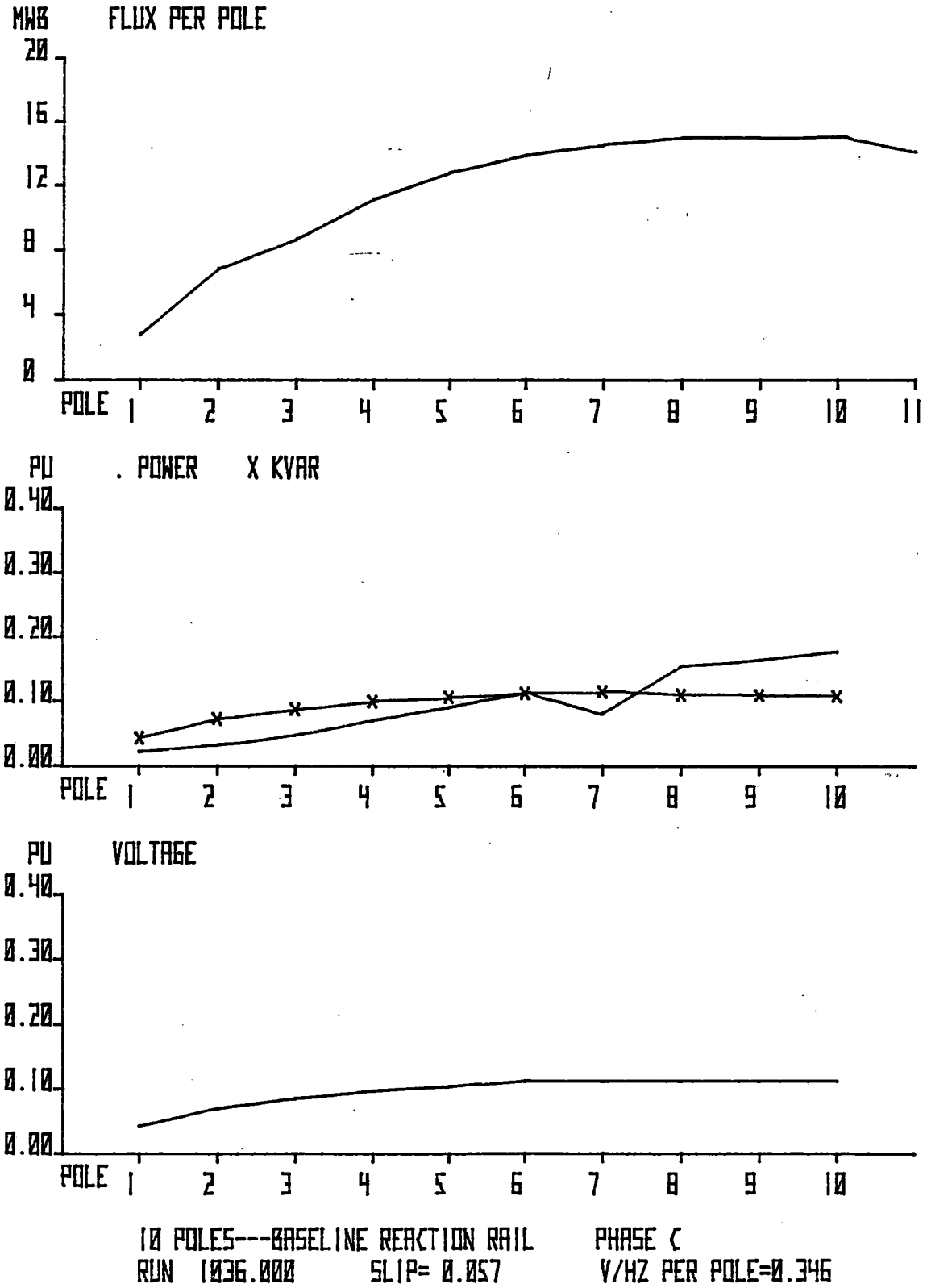
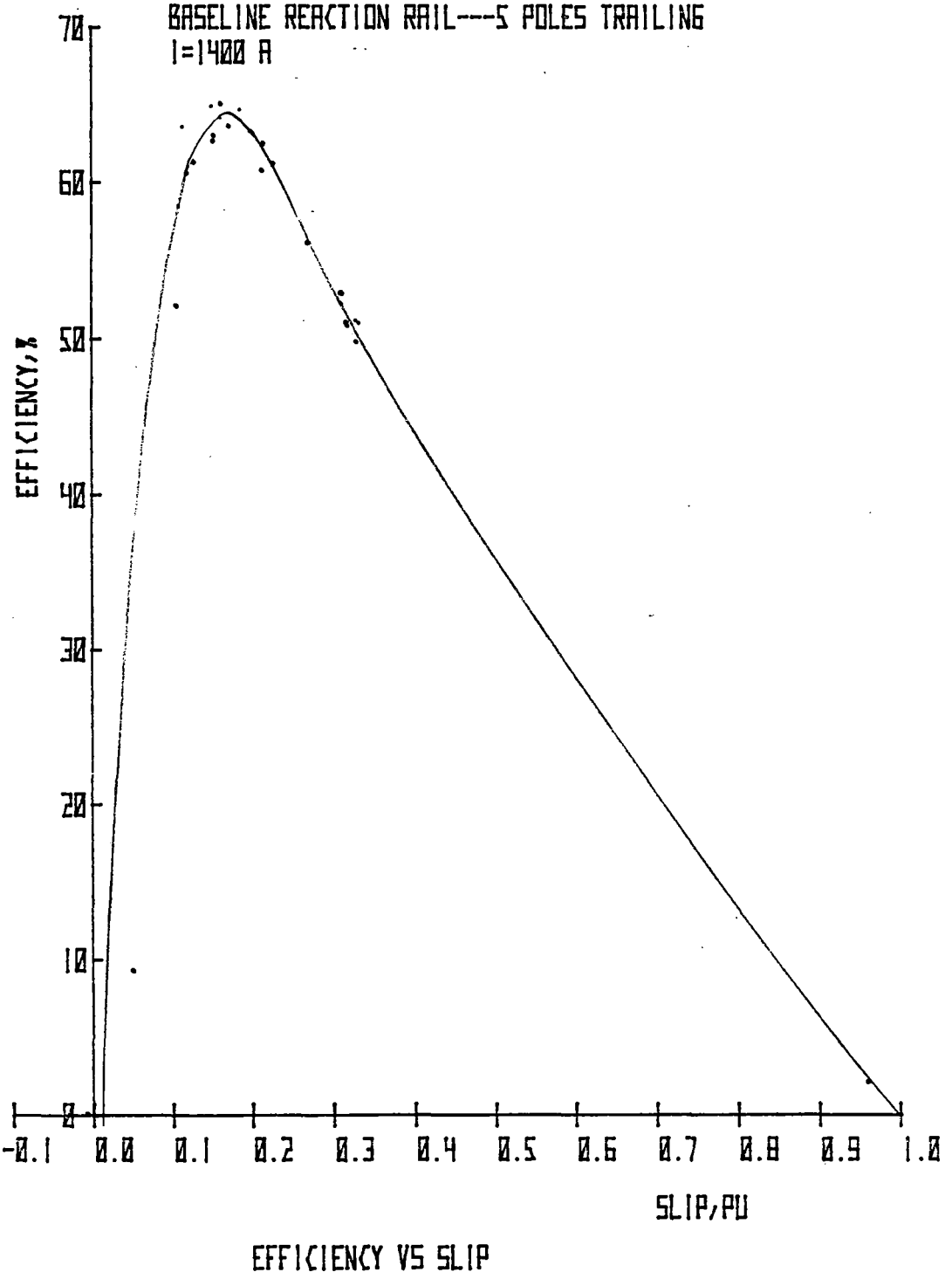

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---BASELINE REACTION RAIL PHASE C
RUN 1036.000 SLIP= 0.057 V/HZ PER POLE=0.346

Figure 2-58

SECTION 3

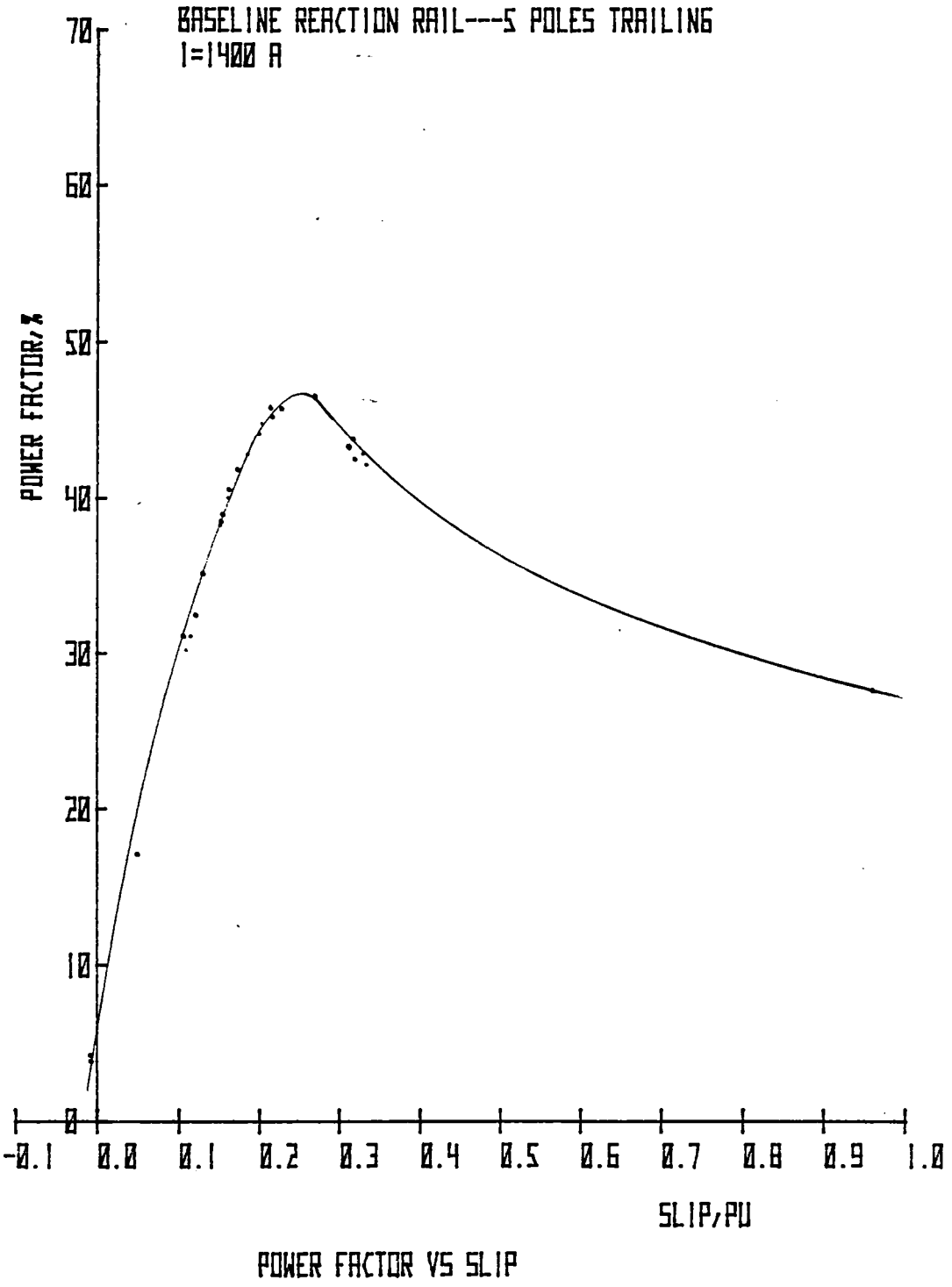
BASELINE REACTION RAIL TEST DATA, 5-POLE SLIM

Figure 3-1 through 3-49 provide test data on the SLIM in the 5-pole (trailing) configuration, and Figures 3-50 through 3-99 on the SLIM in the 5-pole (leading) configuration.



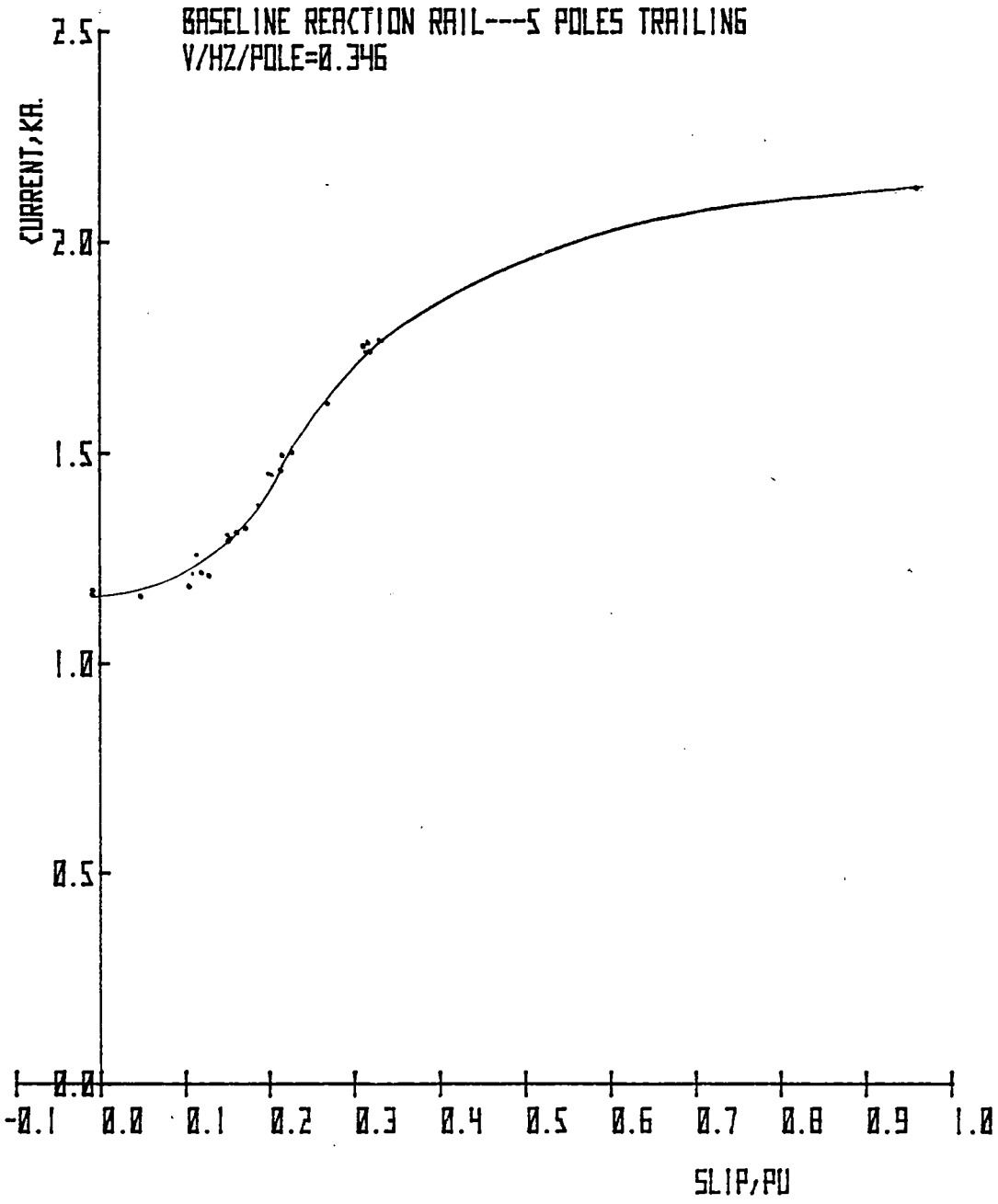
EFFICIENCY VS SLIP

Figure 3-1



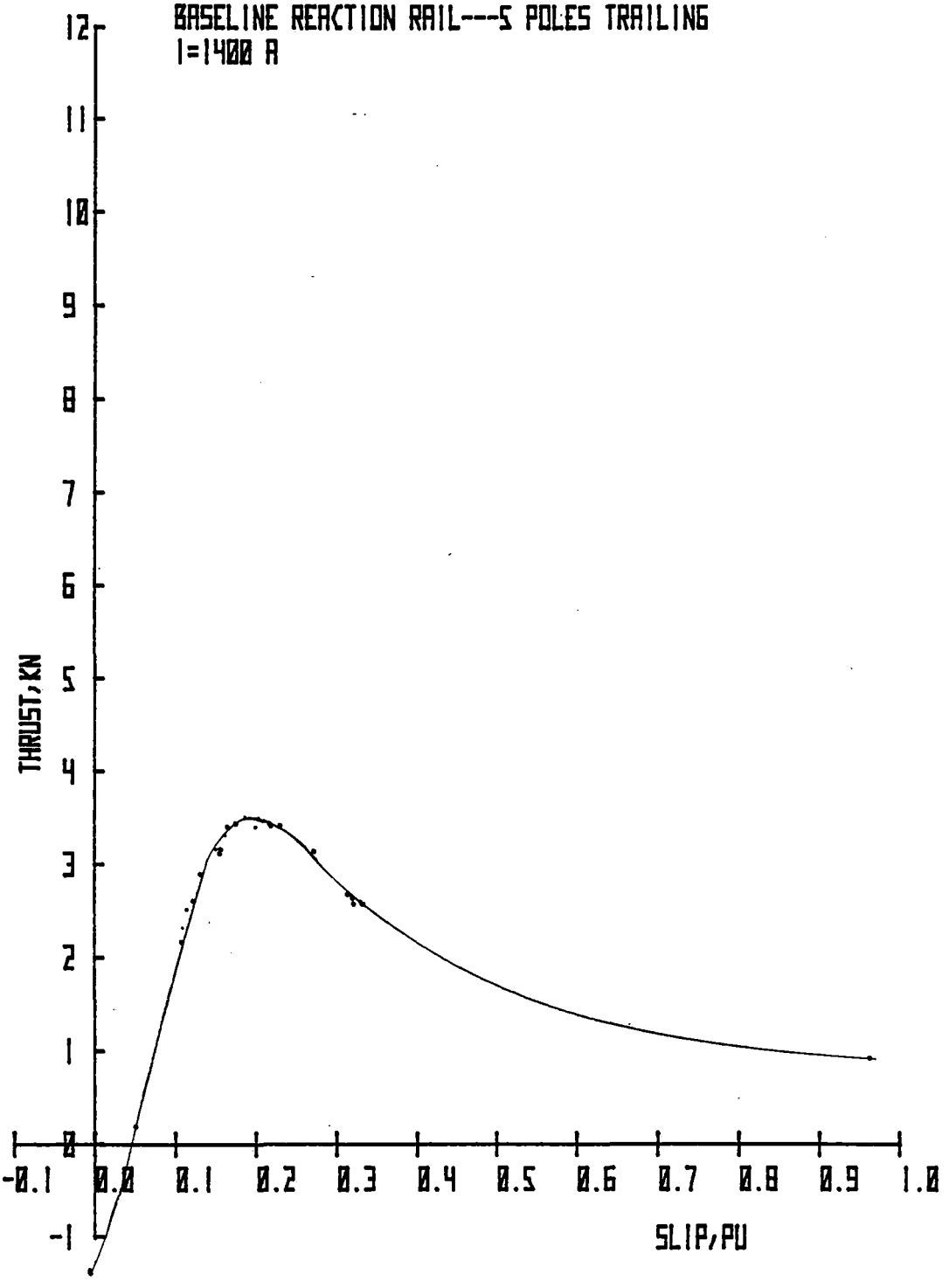
POWER FACTOR VS SLIP

Figure 3-2



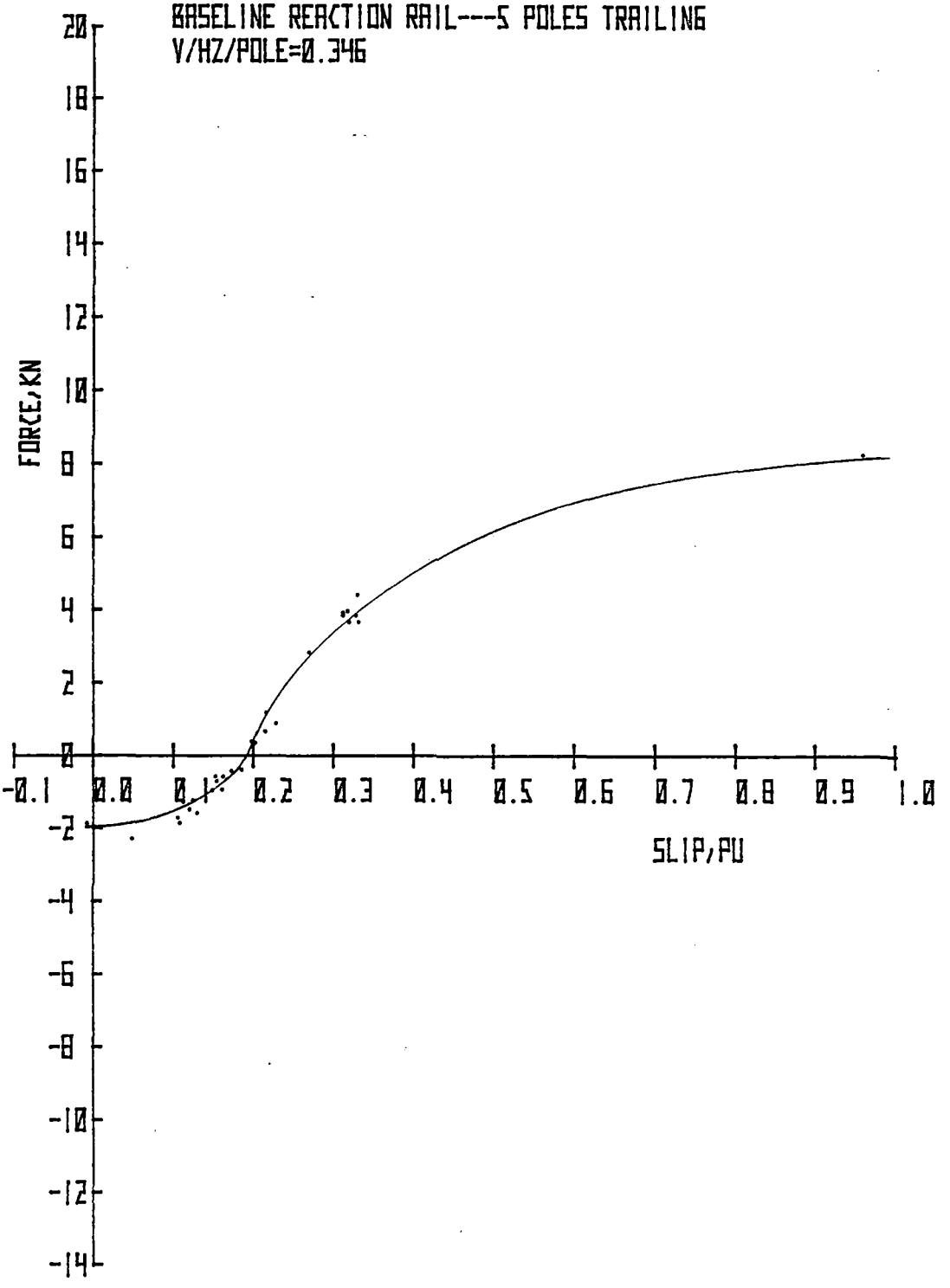
MEAN LINE CURRENT VS SLIP

Figure 3-3



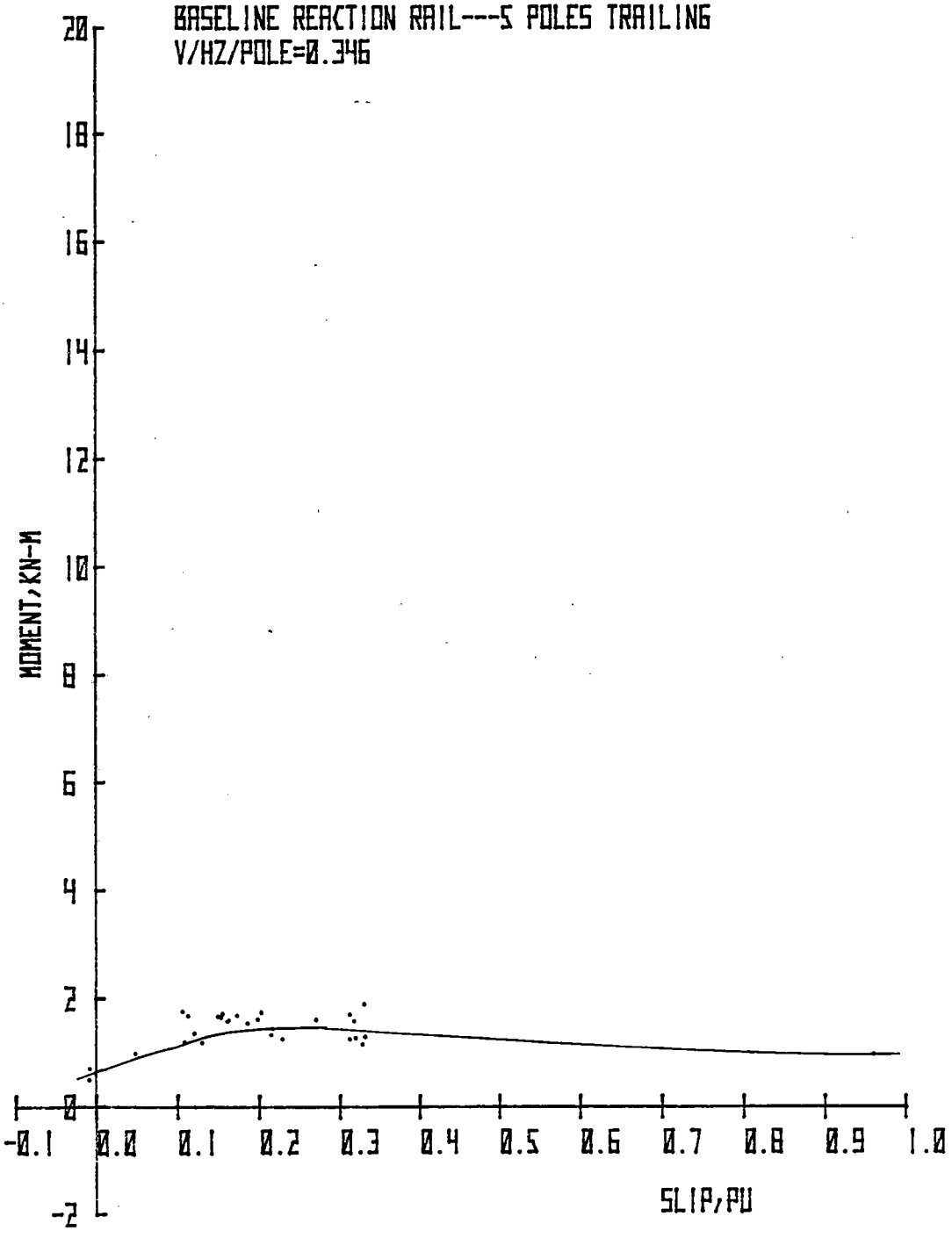
THRUST VS SLIP

Figure 3-4



TOTAL VERTICAL FORCE VS SLIP

Figure 3-5



PITCHING MOMENT VS SLIP

Figure 3-6

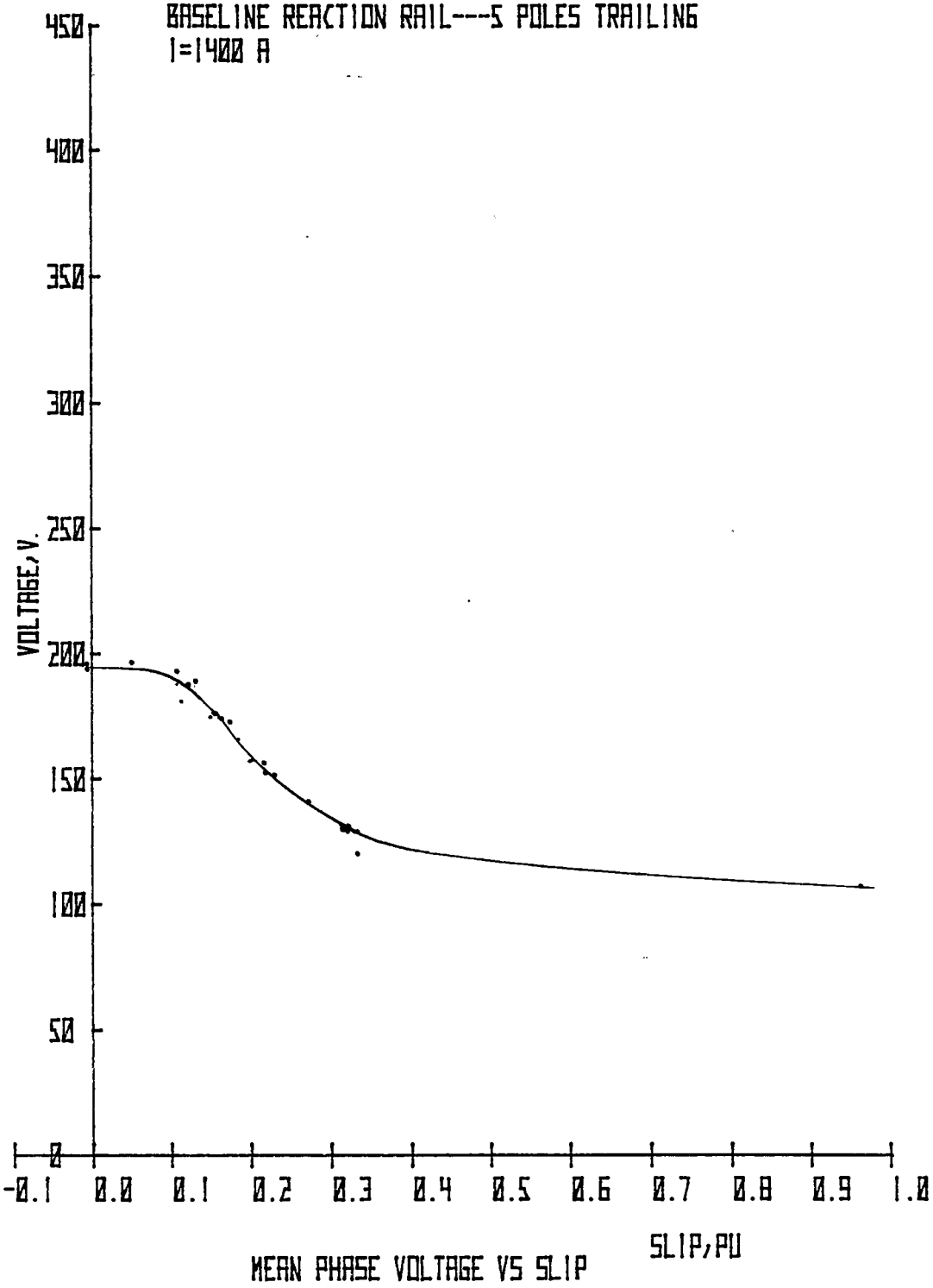
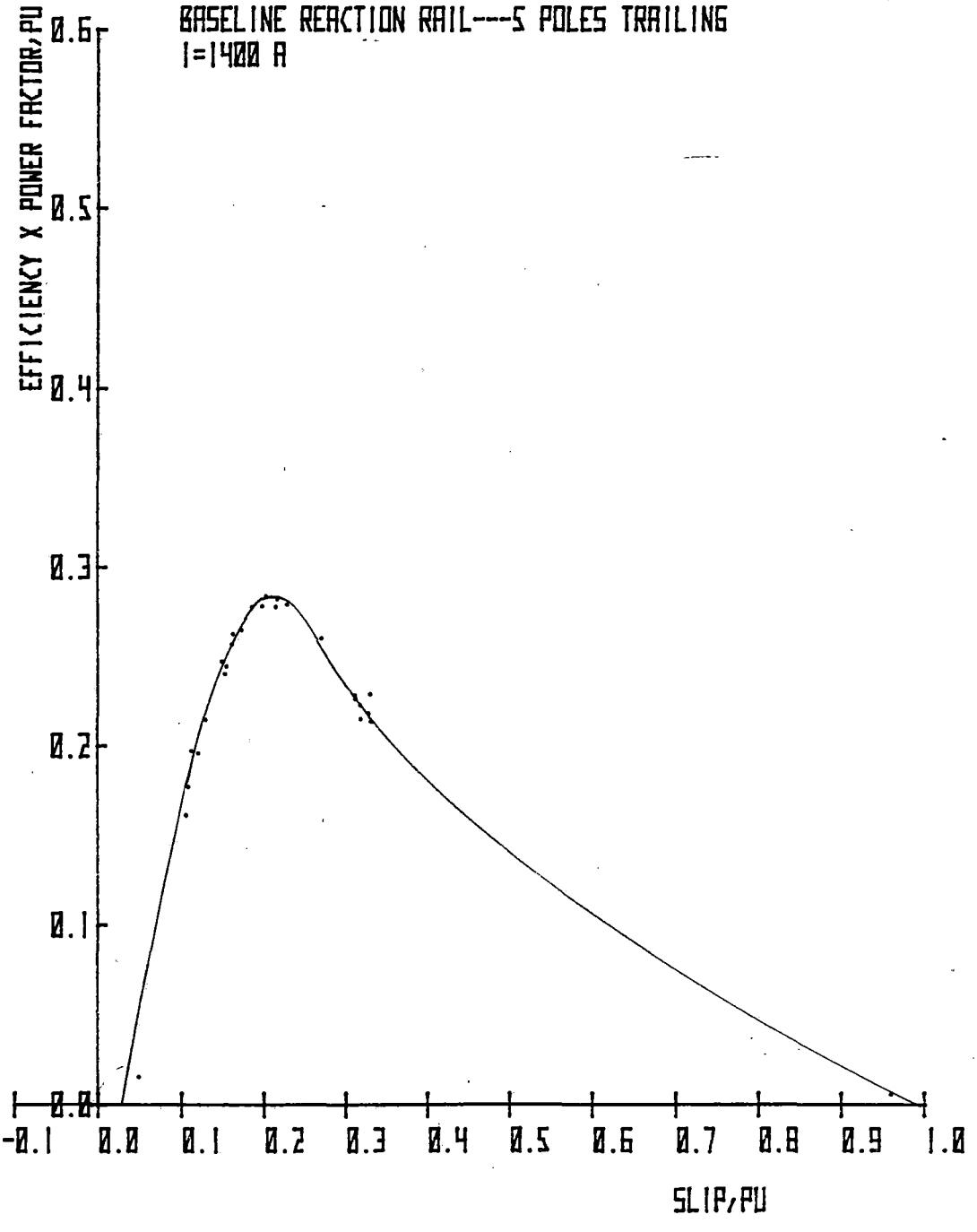

BASELINE REACTION RAIL---5 POLES TRAILING
I=1400 A
450
400
350
300
250
200
150
100
50
0
VOLTAGE, V.
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
SLIP, PU
MEAN PHASE VOLTAGE VS SLIP

Figure 3-7



EFFICIENCY X POWER FACTOR VS SLIP

Figure 3-8

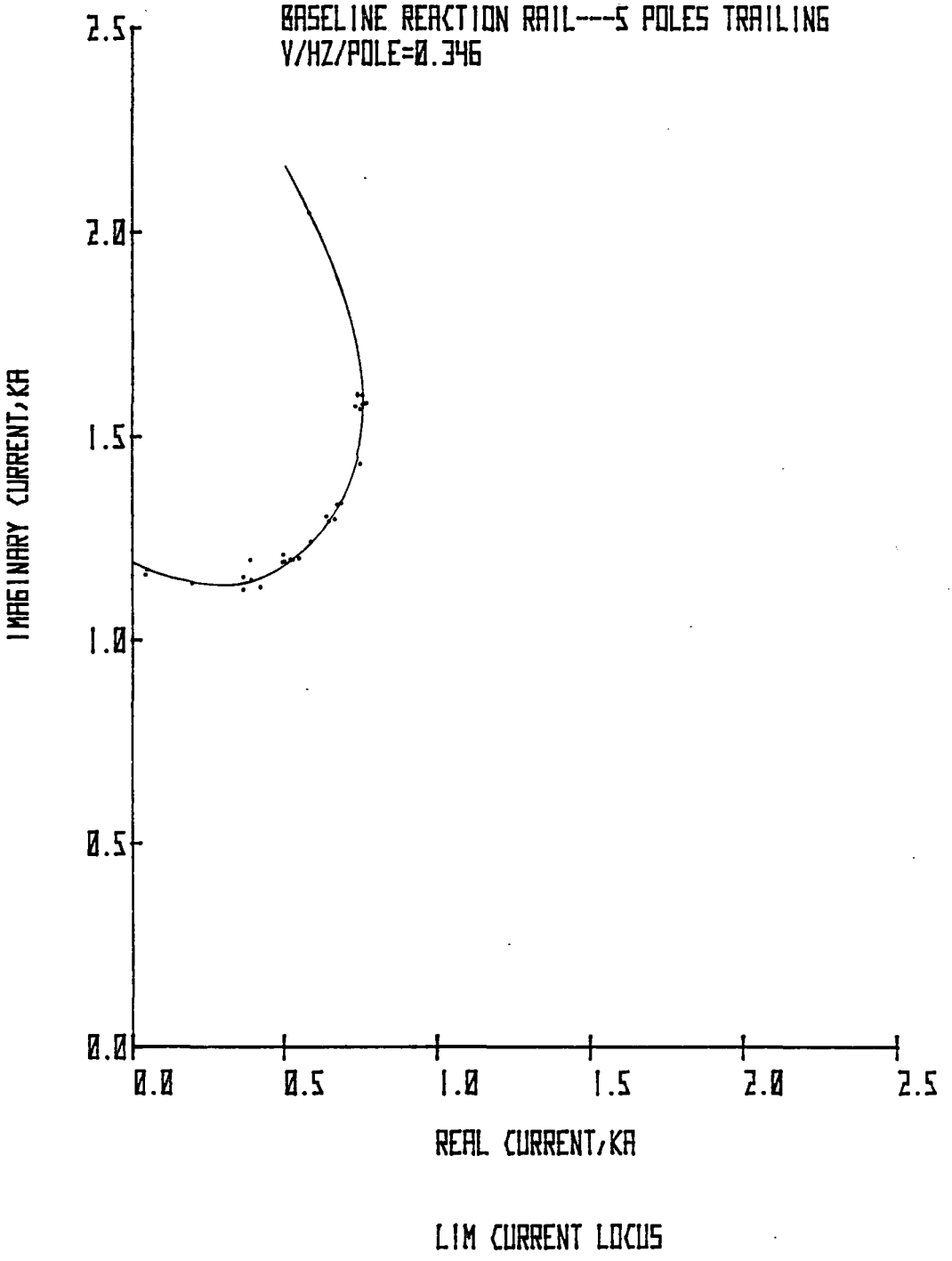
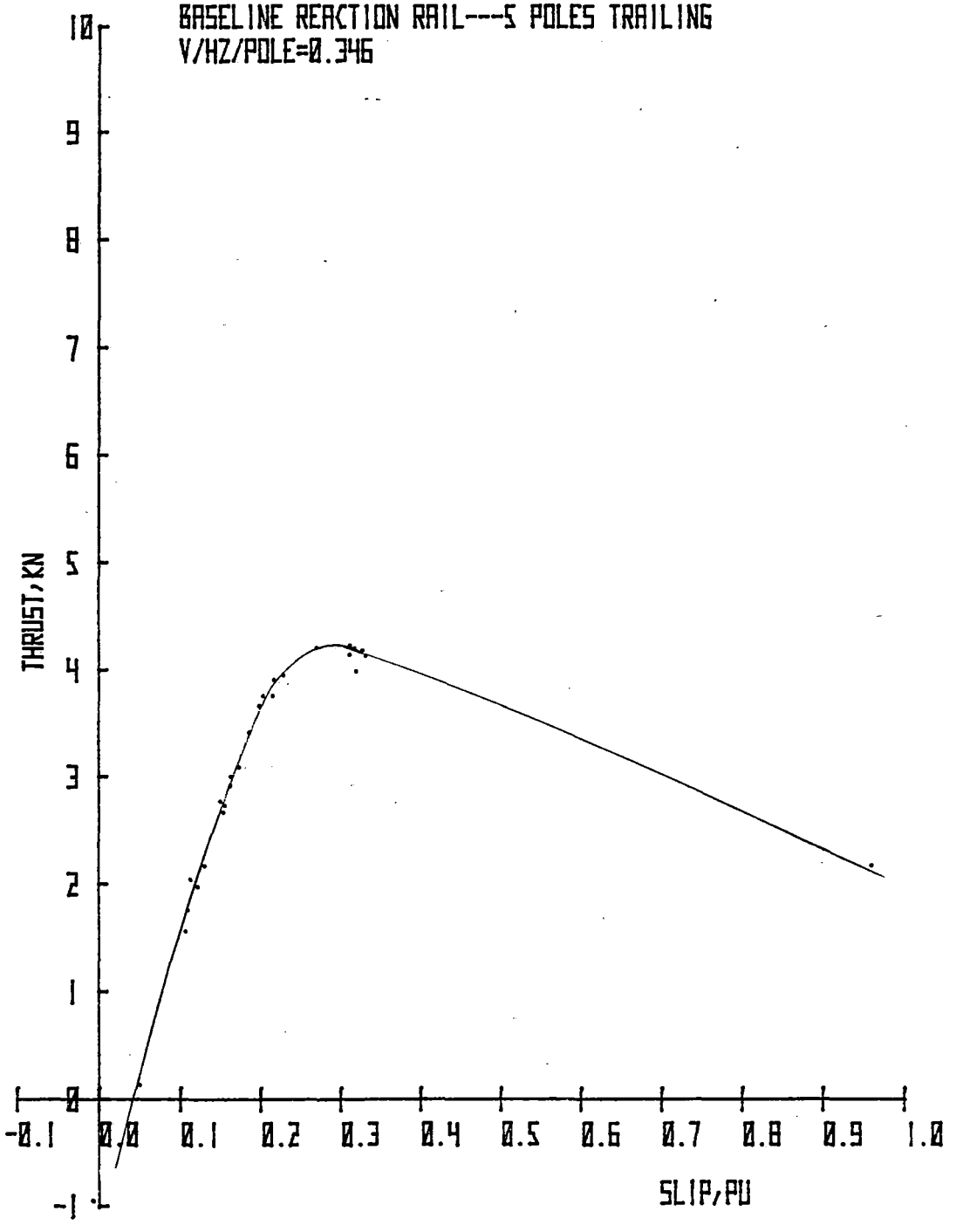
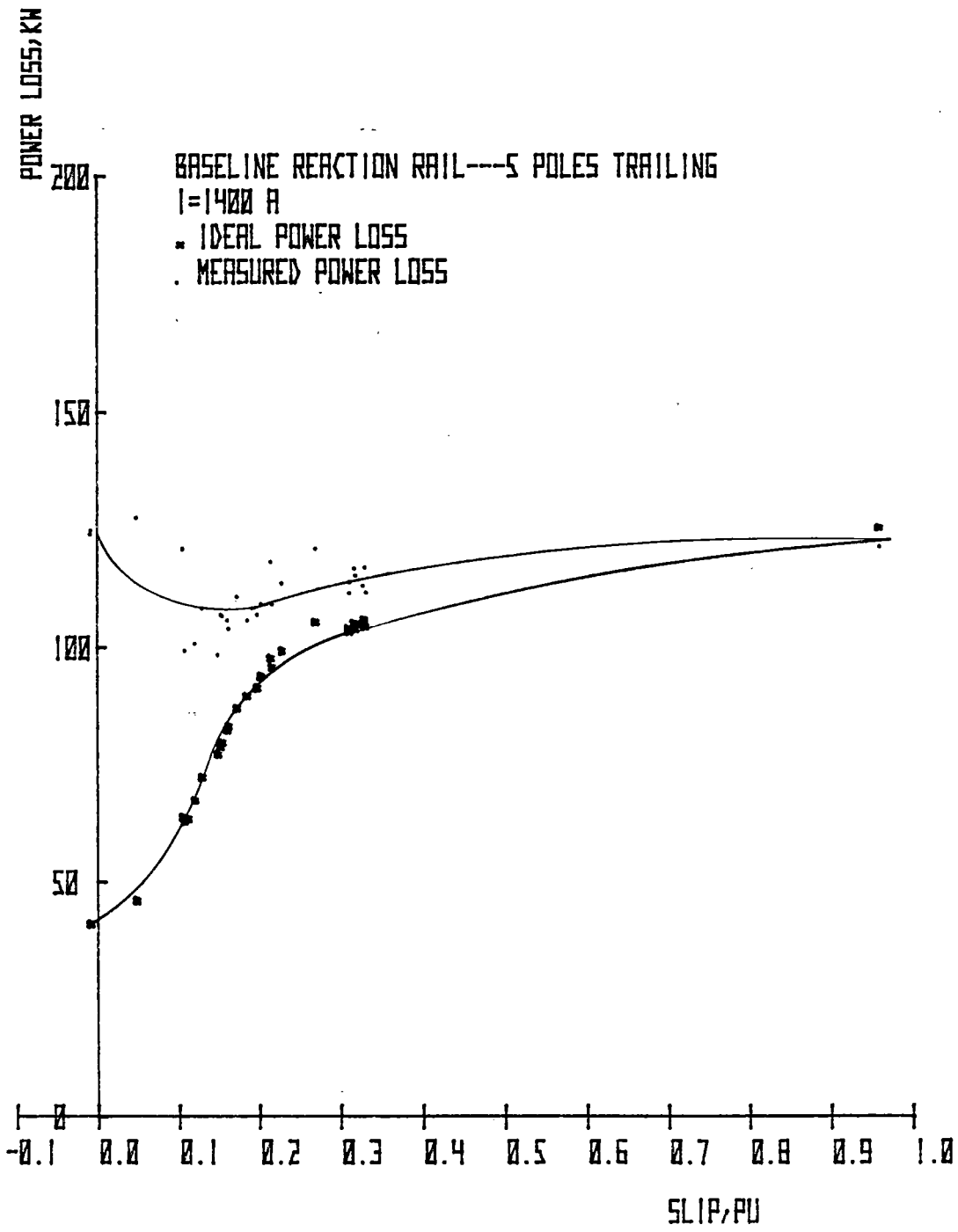

BASELINE REACTION RAIL---5 POLES TRAILING
V/HZ/POLE=0.346
IMAGINARY CURRENT,KA
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
REAL CURRENT,KA
LIM CURRENT LOCUS

Figure 3-9



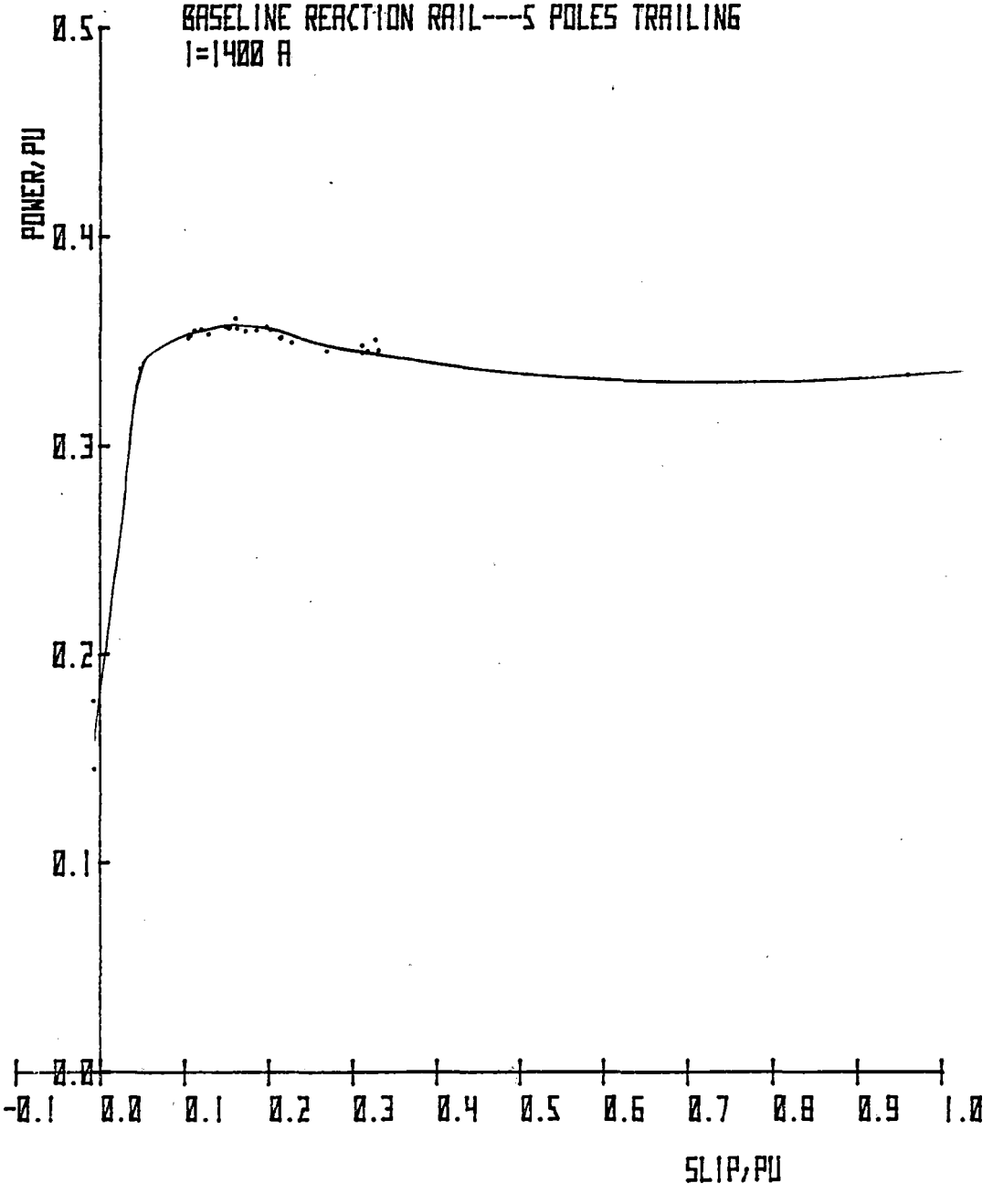
THRUST VS SLIP

Figure 3-10



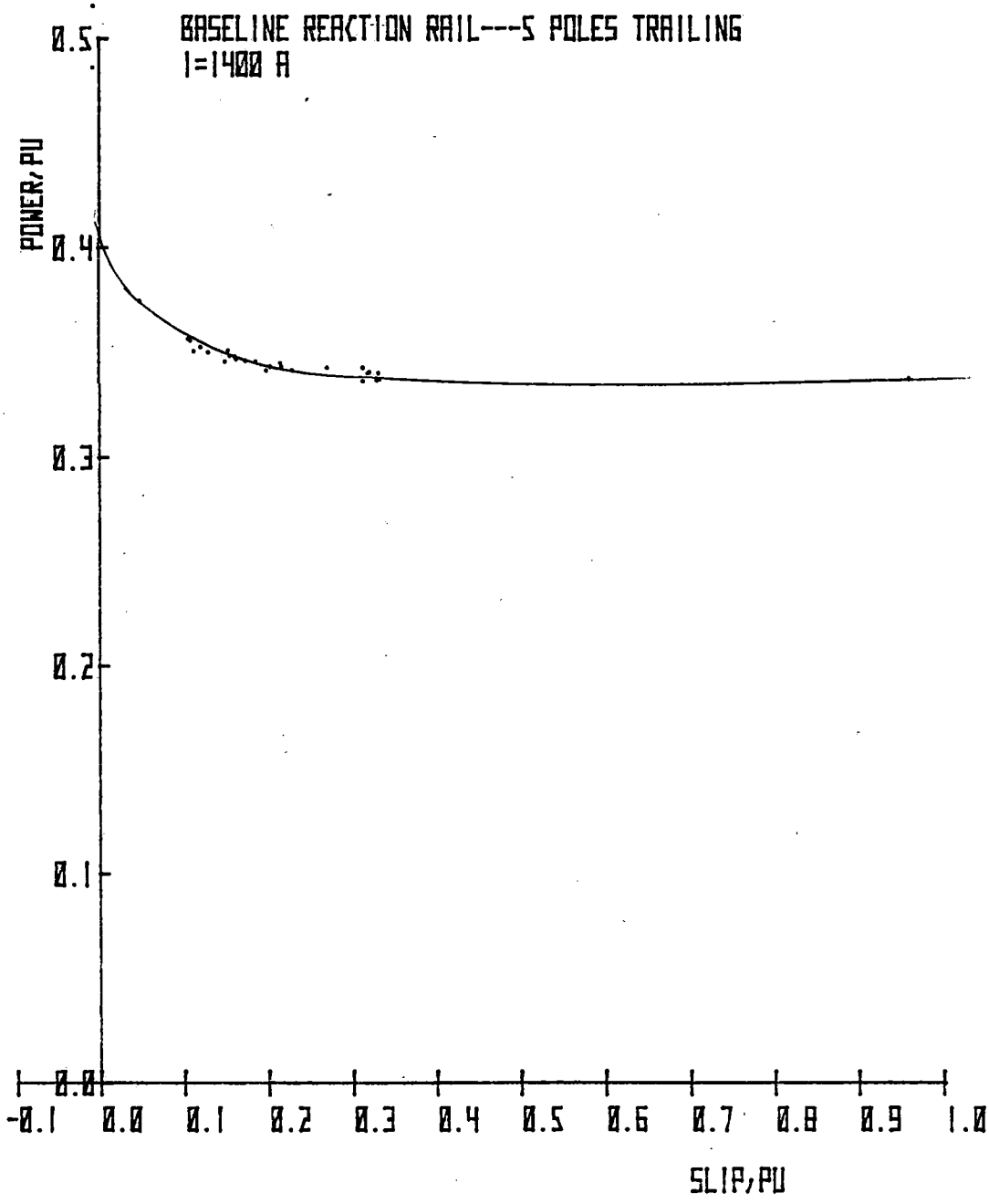
IDEAL & MEASURED POWER LOSS VS SLIP

Figure 3-11



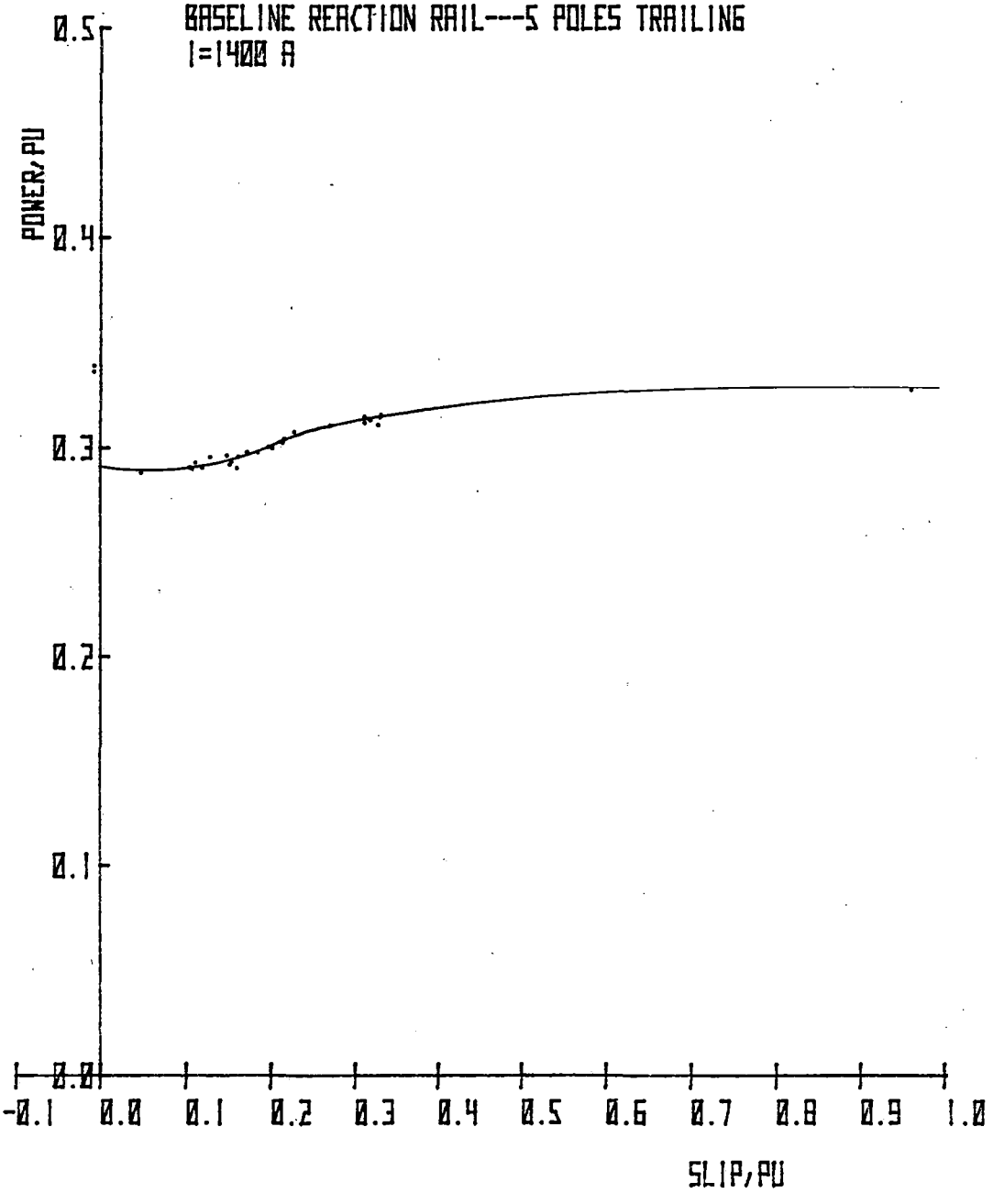
A PHASE POWER VS SLIP

Figure 3-12



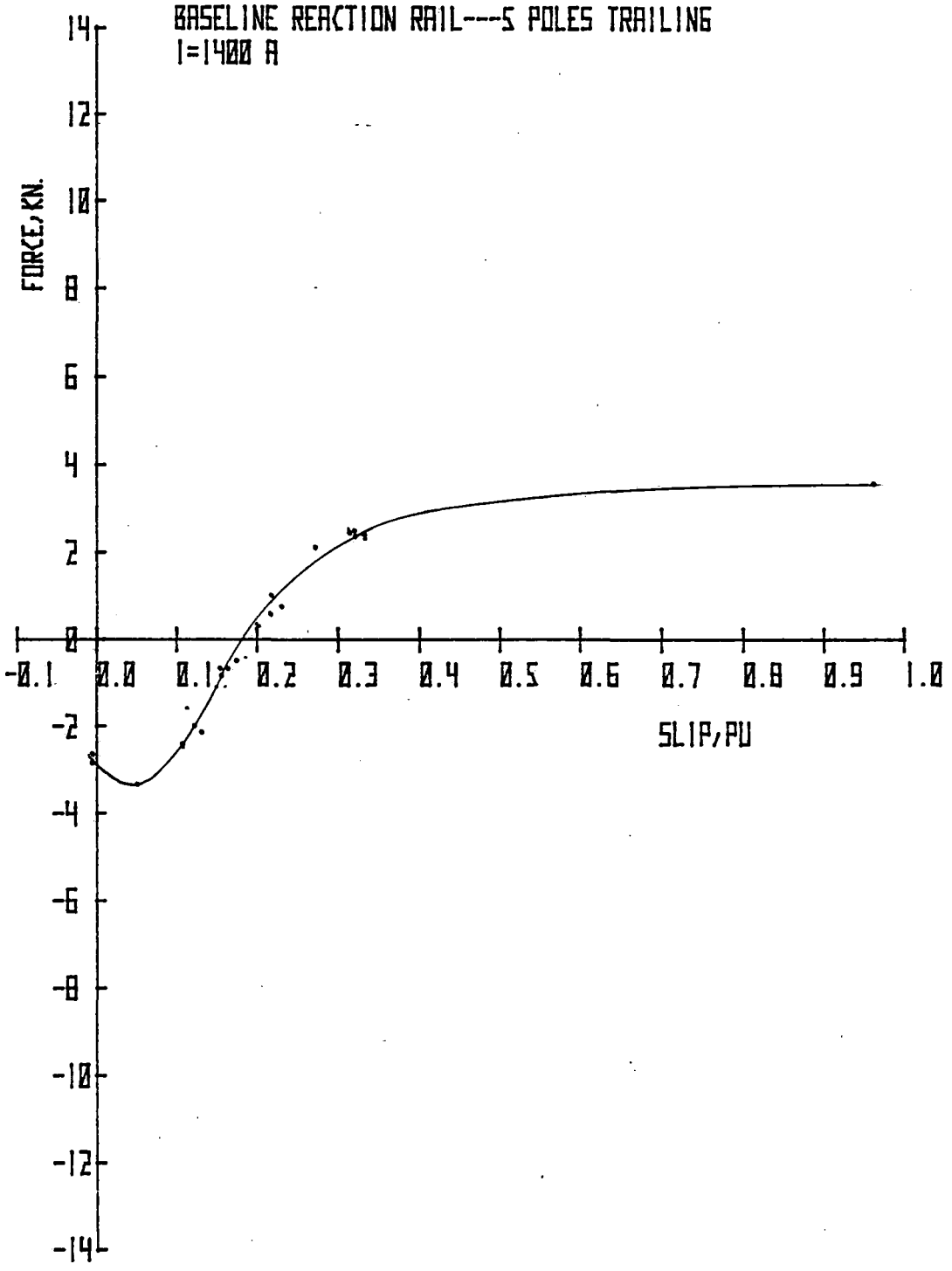
B PHASE POWER VS SLIP

Figure 3-13



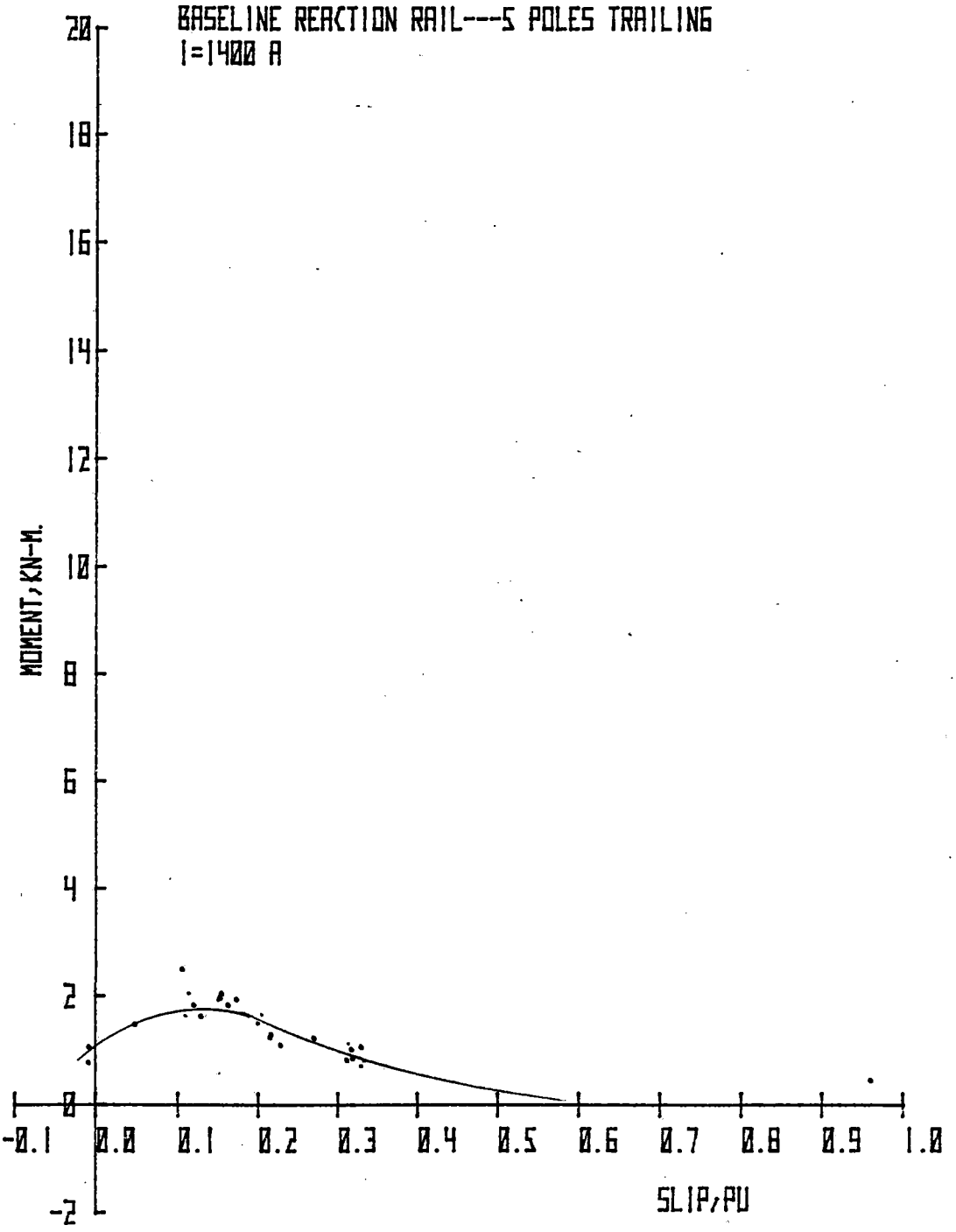
C PHASE POWER VS SLIP

Figure 3-14



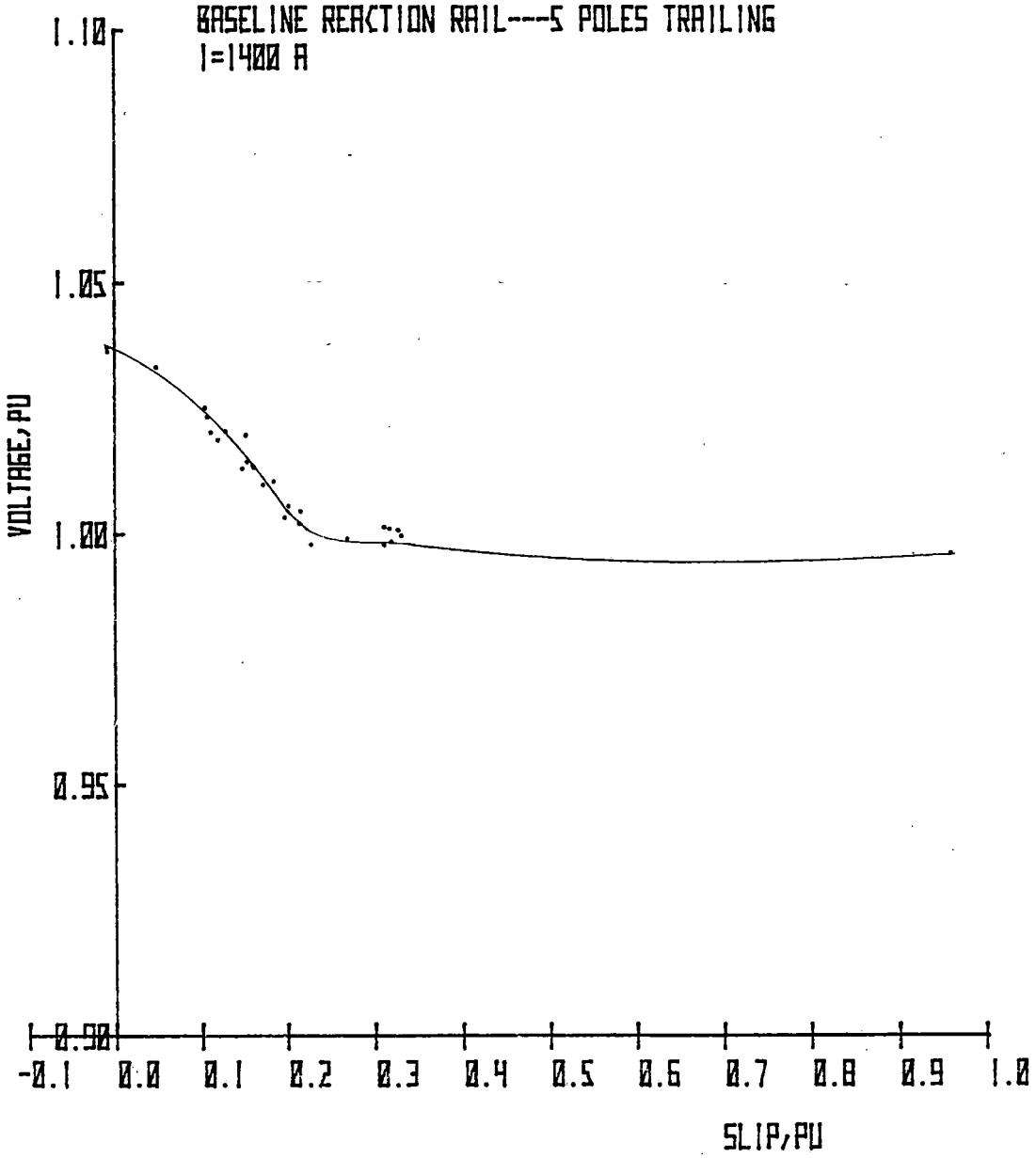
TOTAL VERTICAL FORCE VS SLIP

Figure 3-15



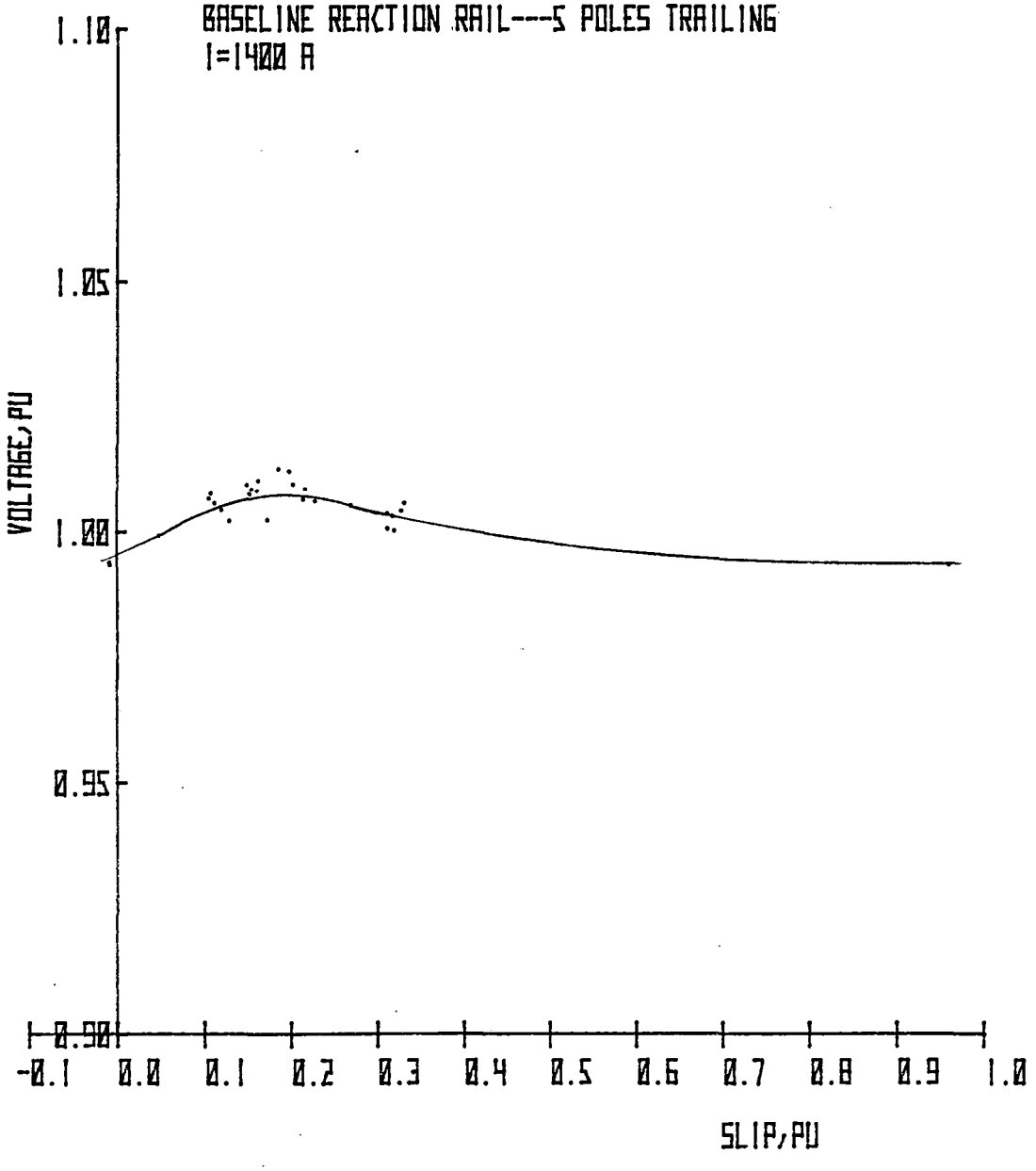
PITCHING MOMENT VS SLIP

Figure 3-16



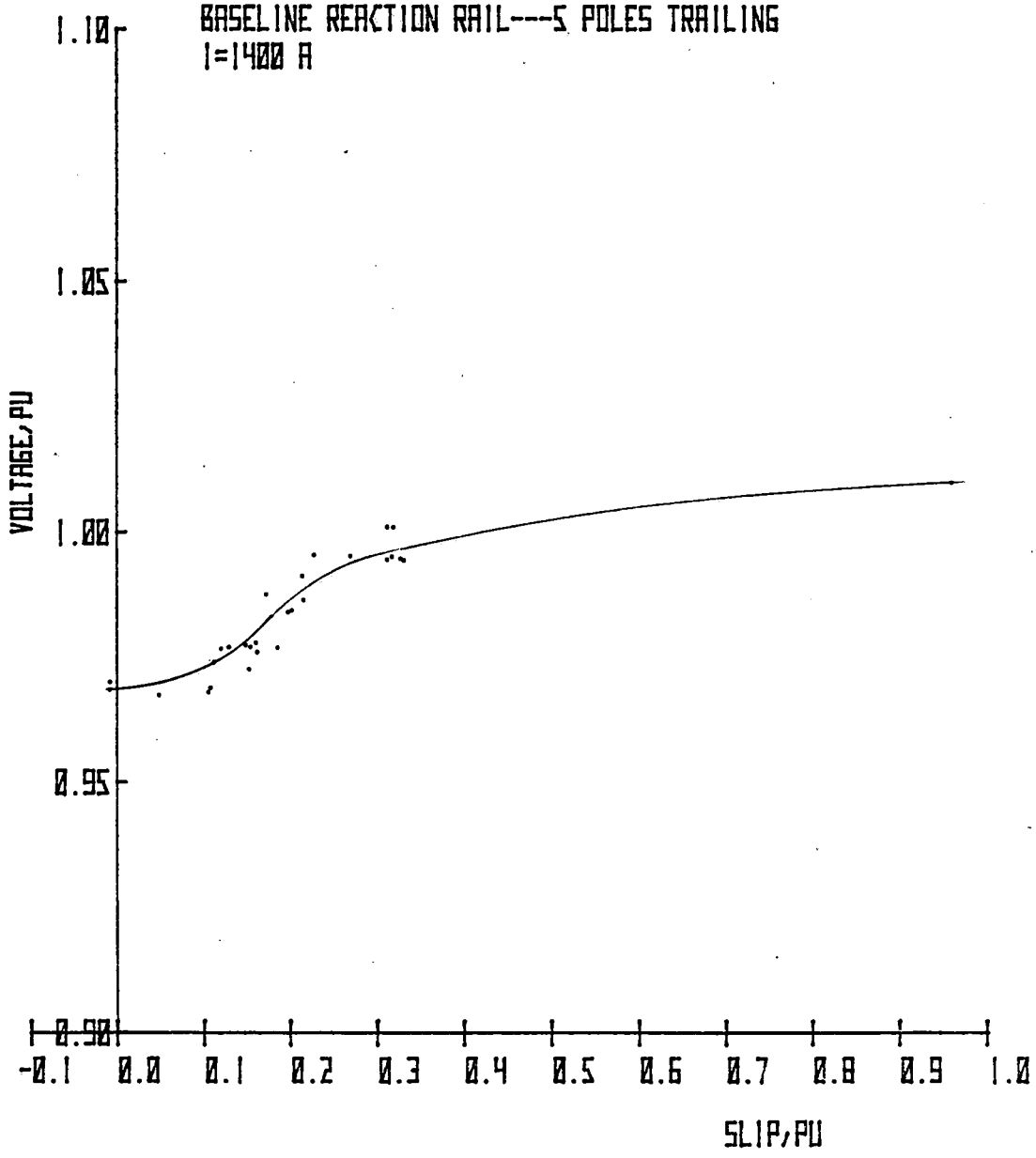
A PHASE VOLTAGE VS SLIP

Figure 3-17



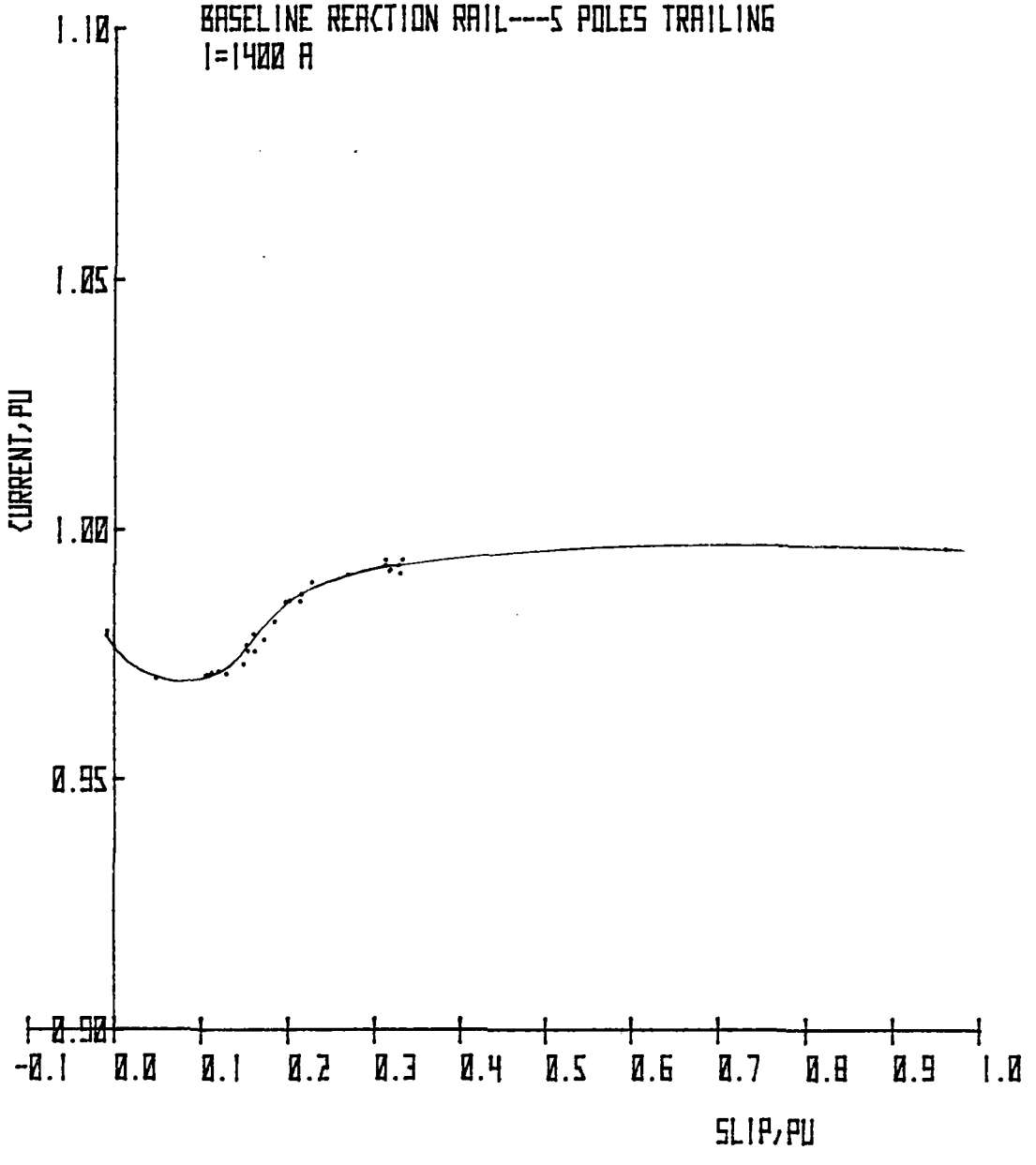
B PHASE VOLTAGE VS SLIP

Figure 3-18



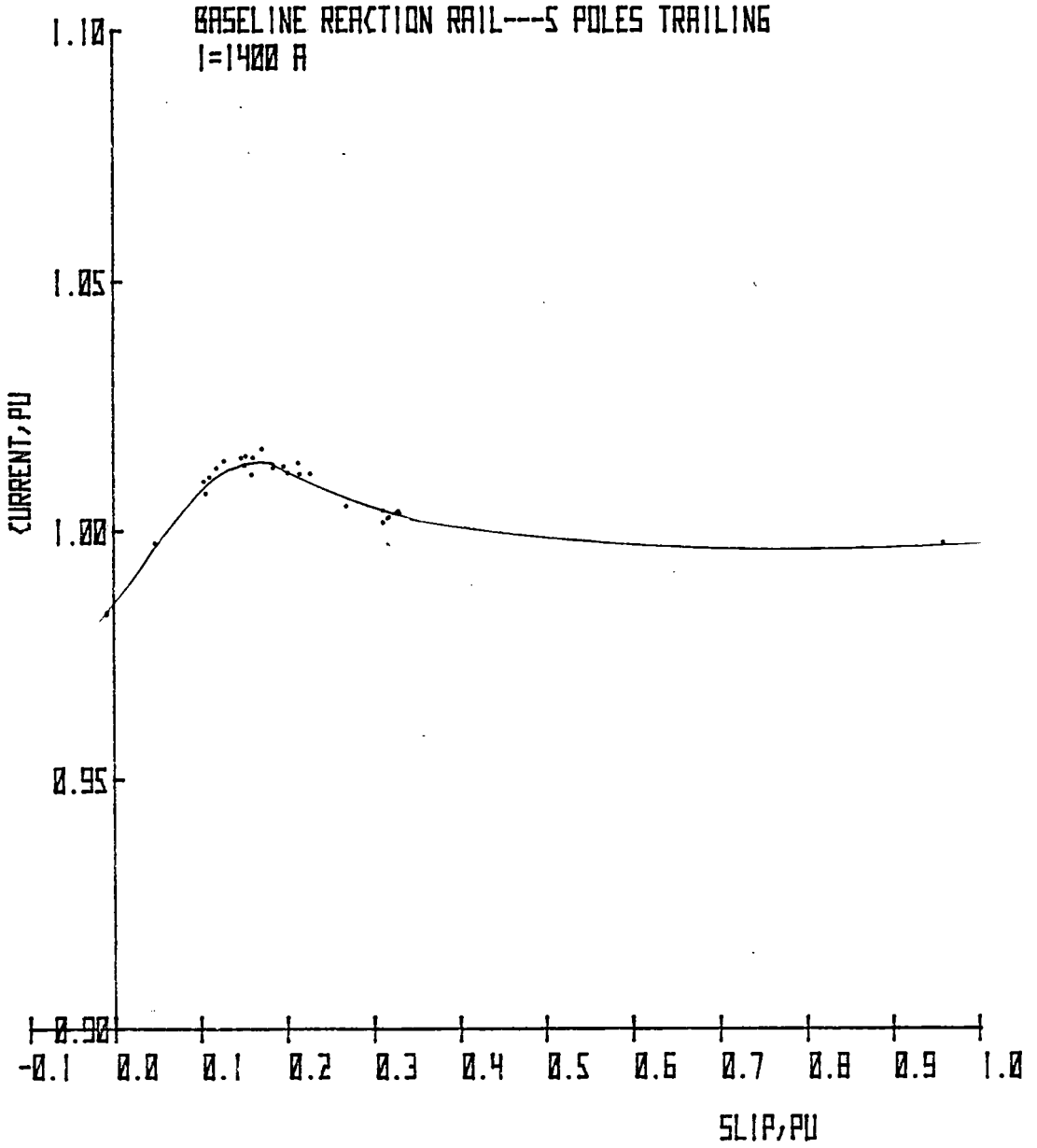
C PHASE VOLTAGE VS SLIP

Figure 3-19



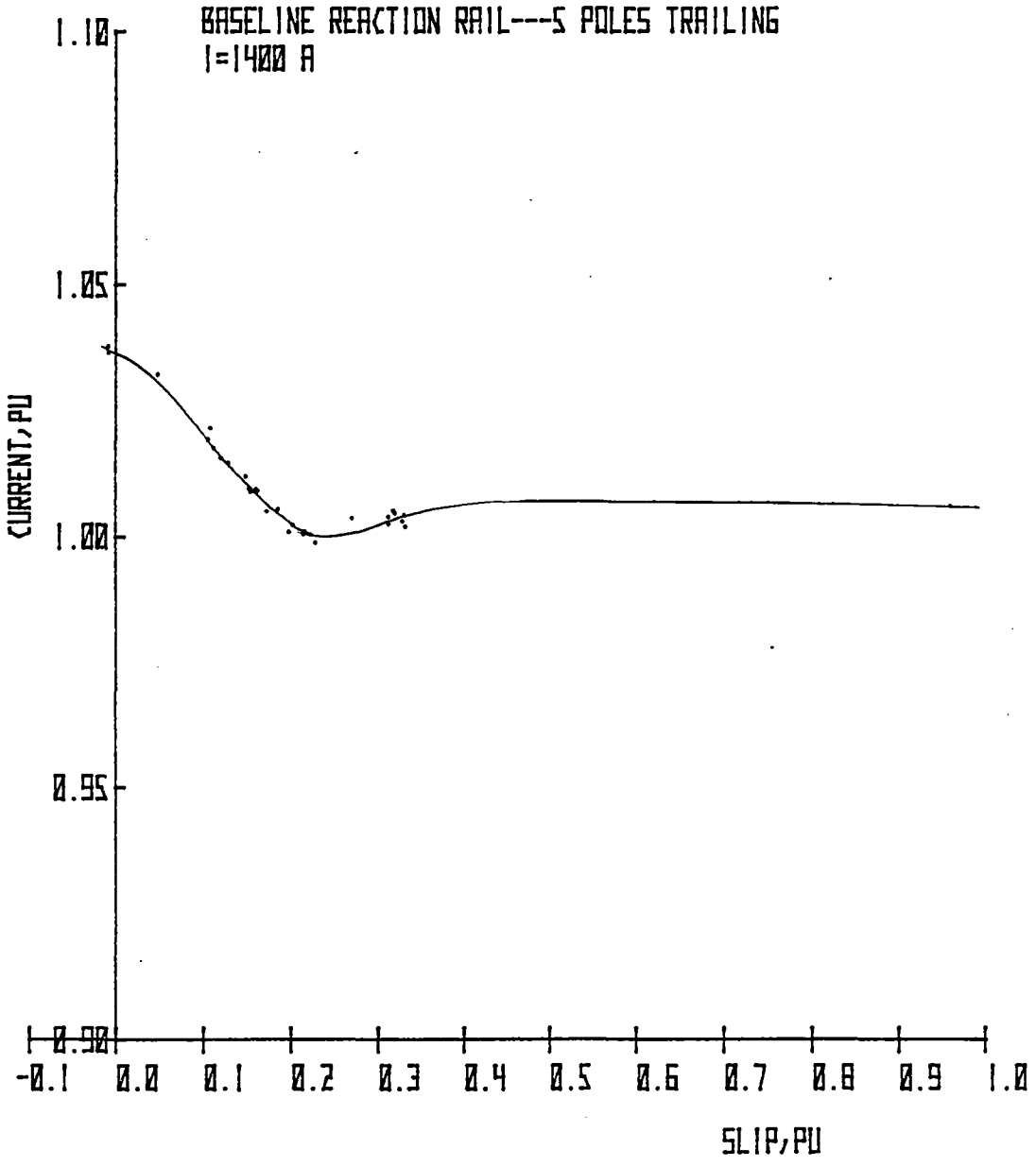
A PHASE CURRENT VS SLIP

Figure 3-20



B PHASE CURRENT VS SLIP

Figure 3-21



C PHASE CURRENT VS SLIP

Figure 3-22

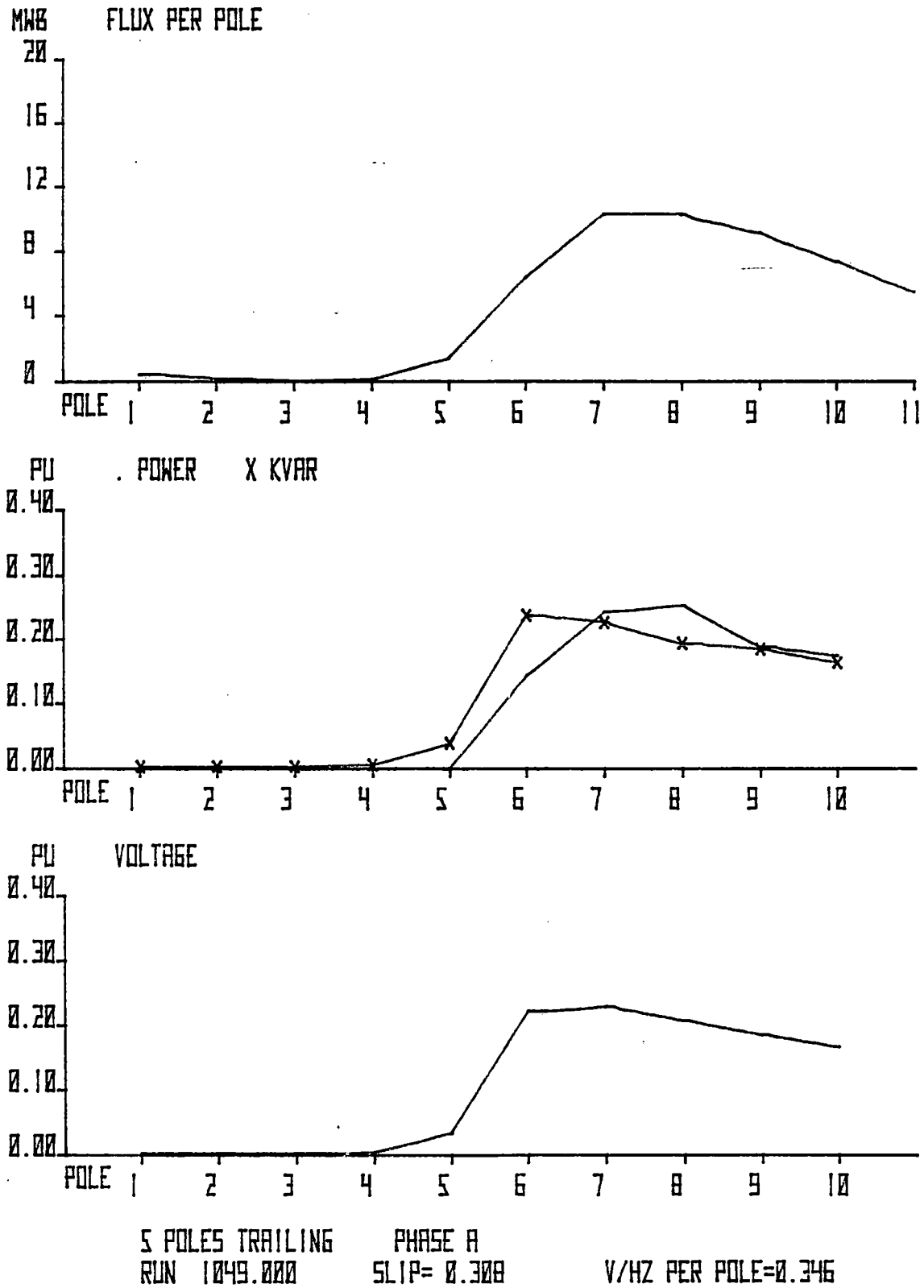

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE A
RUN 1049.000 SLIP= 0.308 V/HZ PER POLE=0.346

Figure 3-23

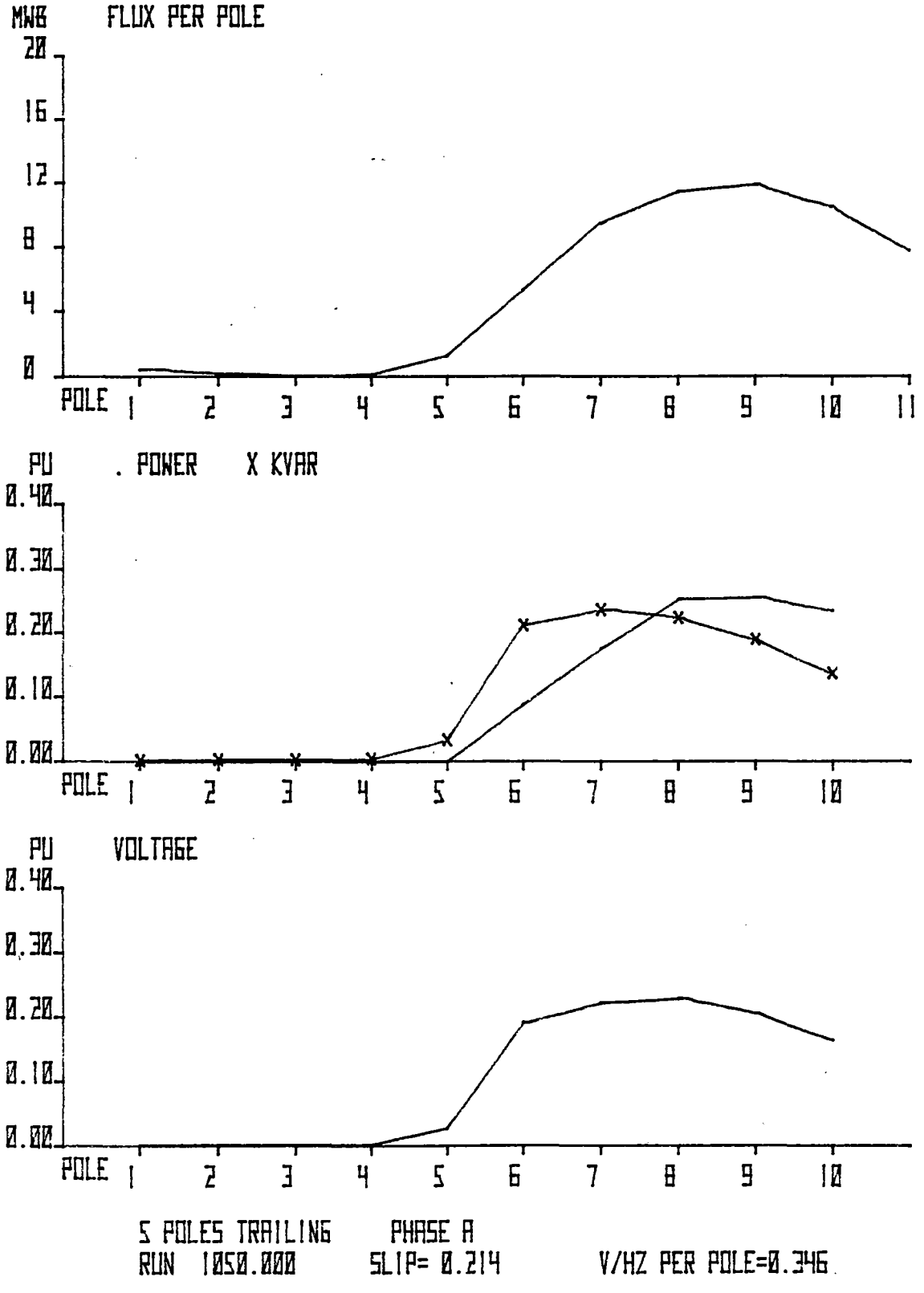

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE A
RUN 1050.000 SLIP= 0.214 V/HZ PER POLE=0.346

Figure 3-24

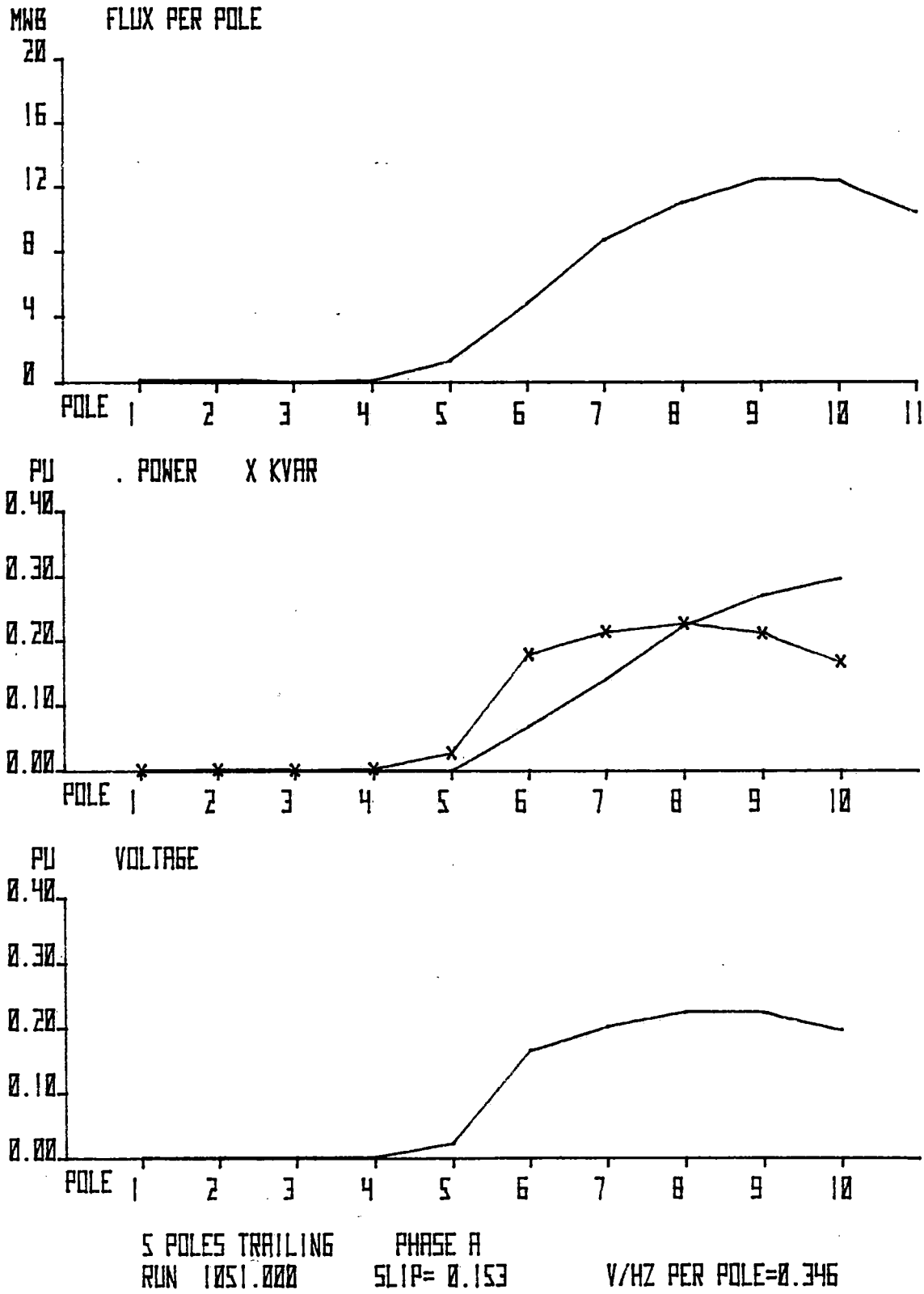

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE A
RUN 1051.000 SLIP= 0.153 V/HZ PER POLE=0.346

Figure 3-25

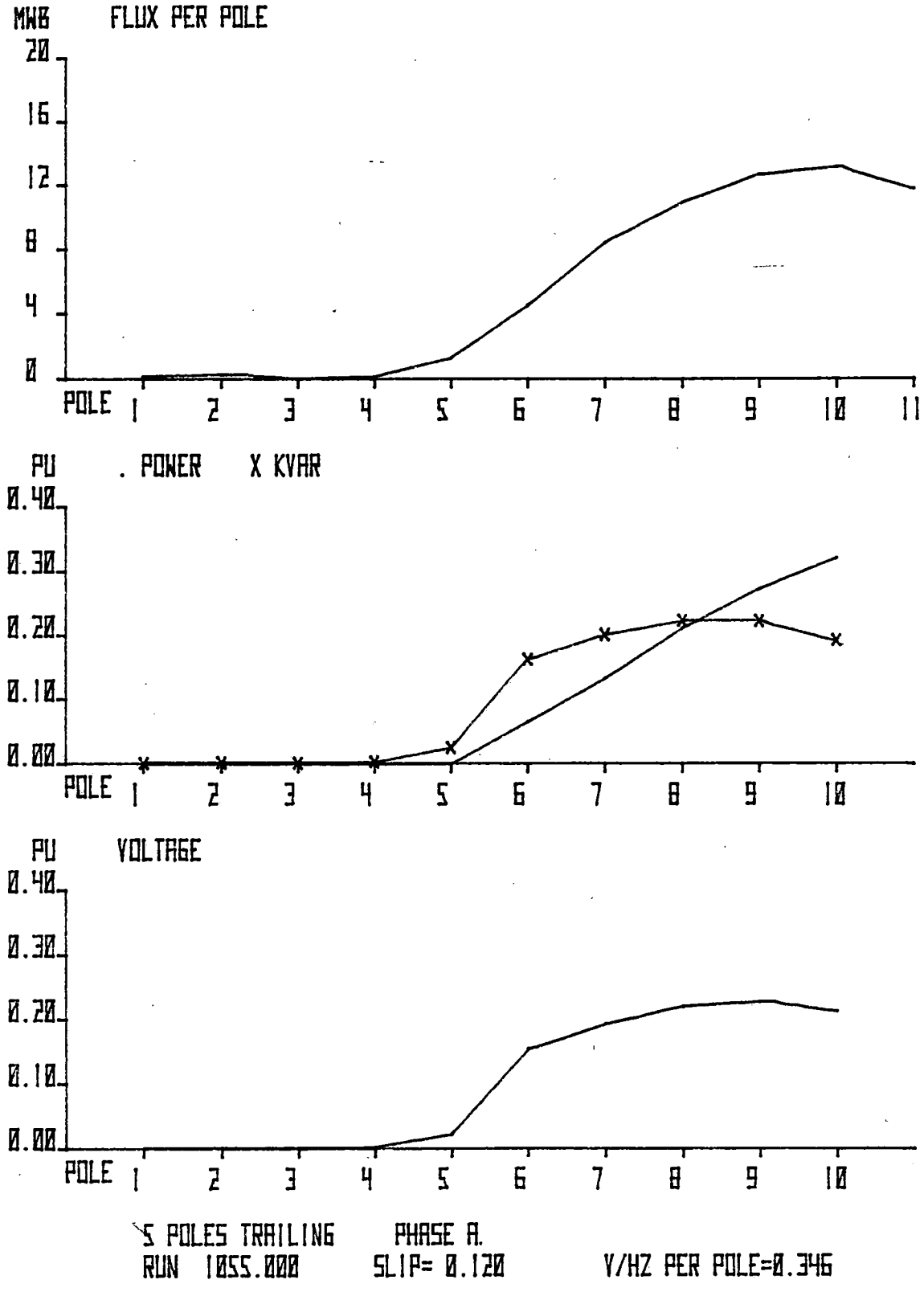

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE A.
RUN 1055.000 SLIP= 0.120 V/HZ PER POLE=0.346

Figure 3-26

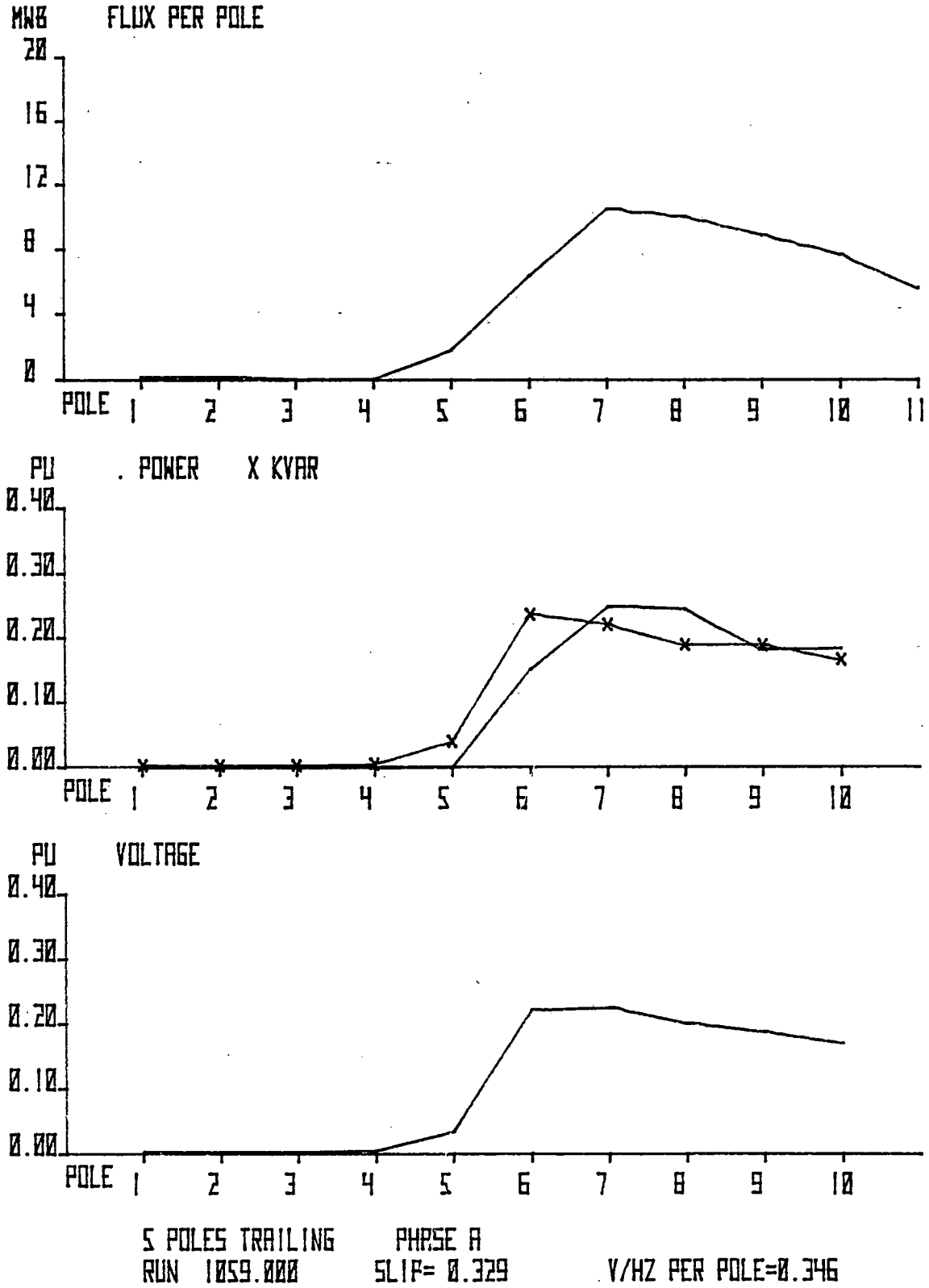

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE A
RUN 1059.000 SLIP= 0.329 V/HZ PER POLE=0.346

Figure 3-27

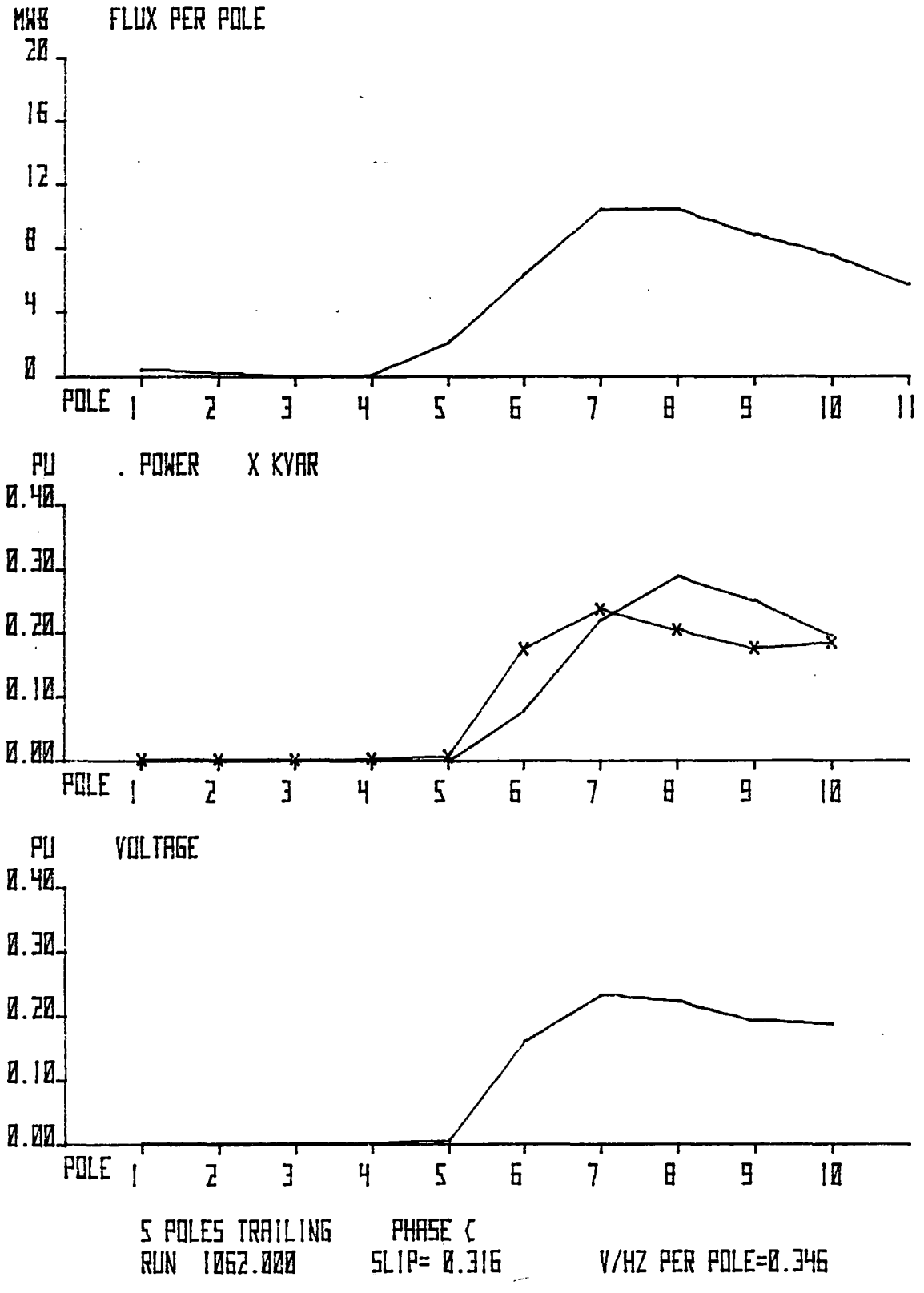

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE C
RUN 1062.000 SLIP= 0.316 V/HZ PER POLE=0.346

Figure 3-28

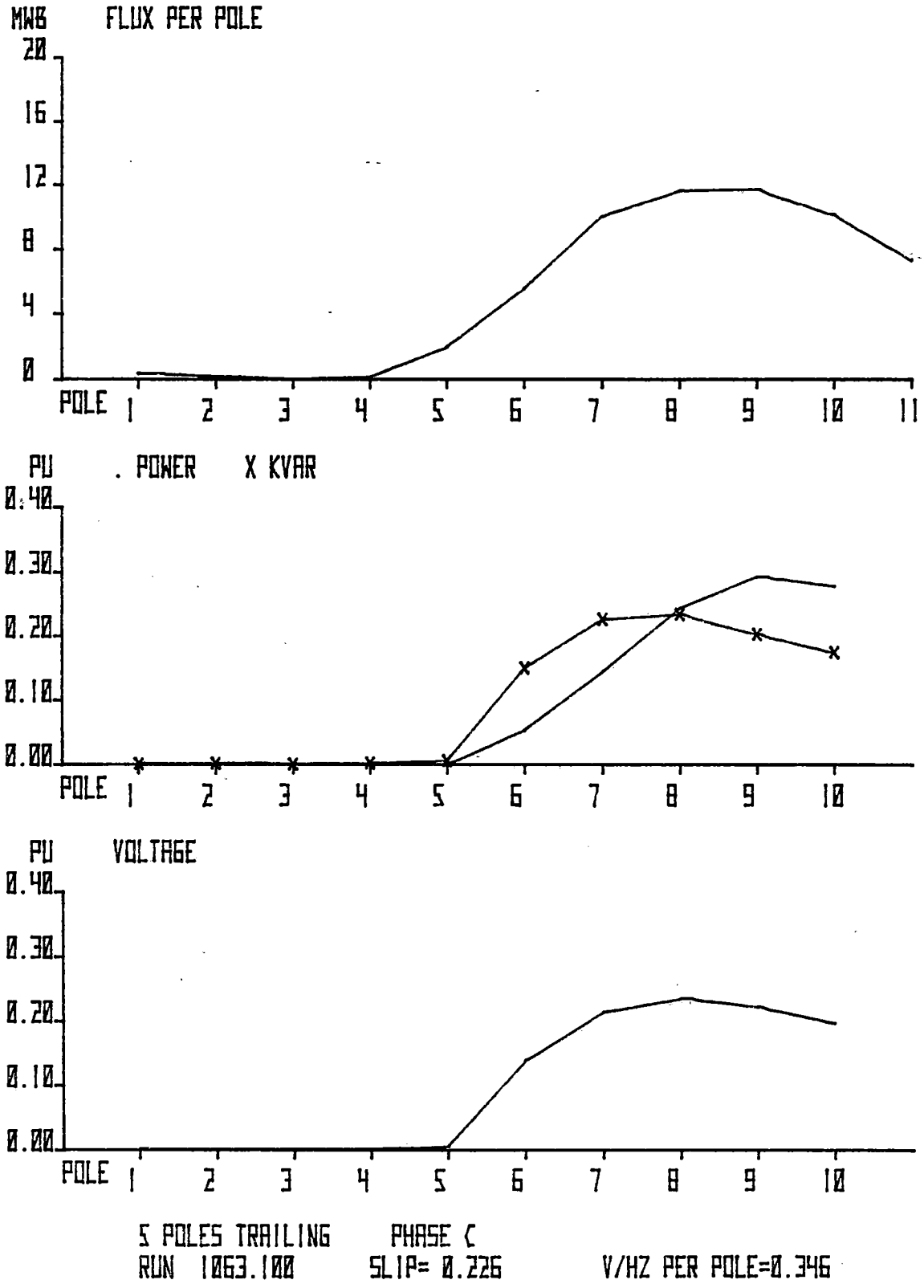

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE C
RUN 1063.100 SLIP= 0.226 V/HZ PER POLE=0.346

Figure 3-29

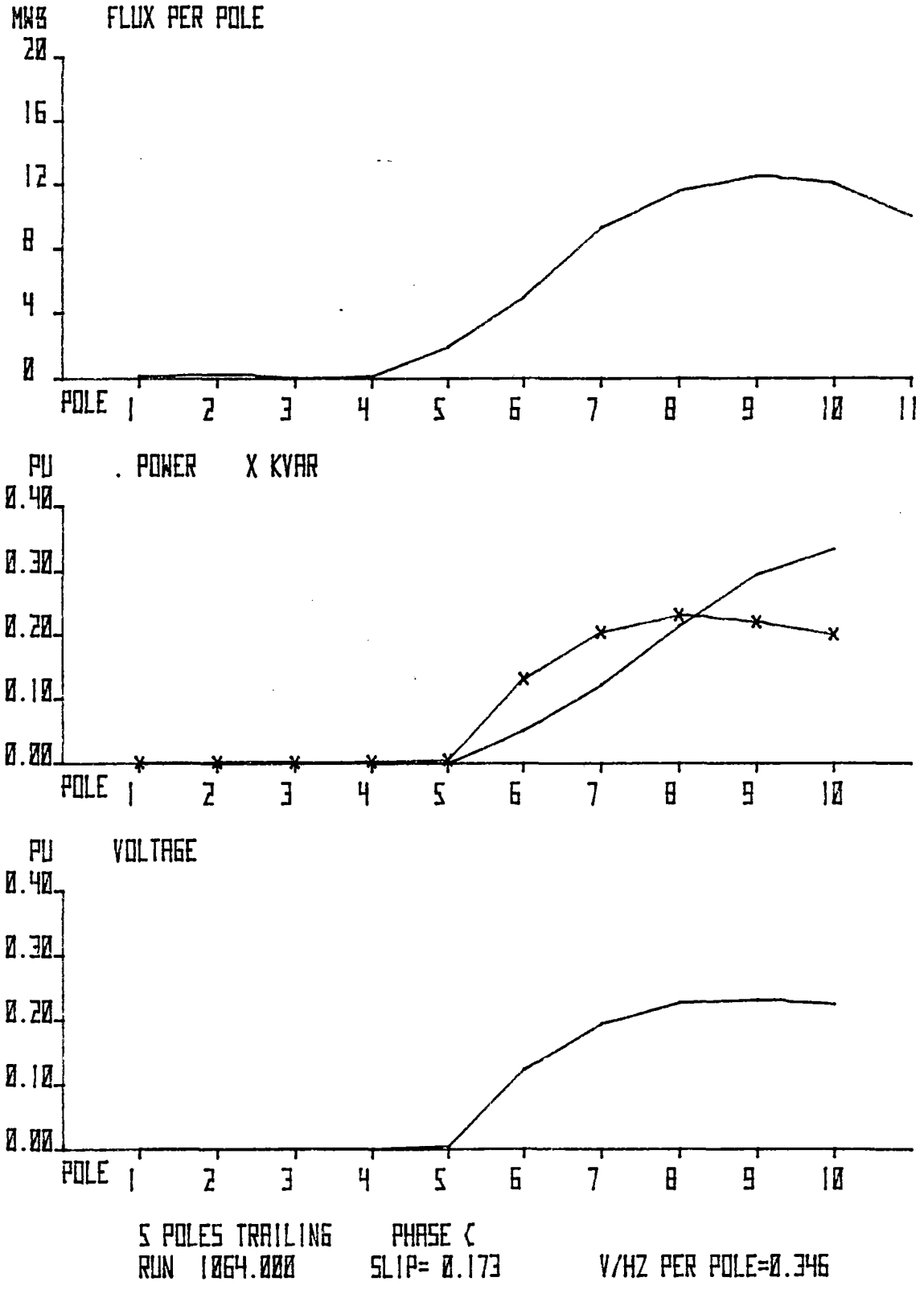

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE (
RUN 1064.000 SLIP= 0.173 V/HZ PER POLE=0.346

Figure 3-30

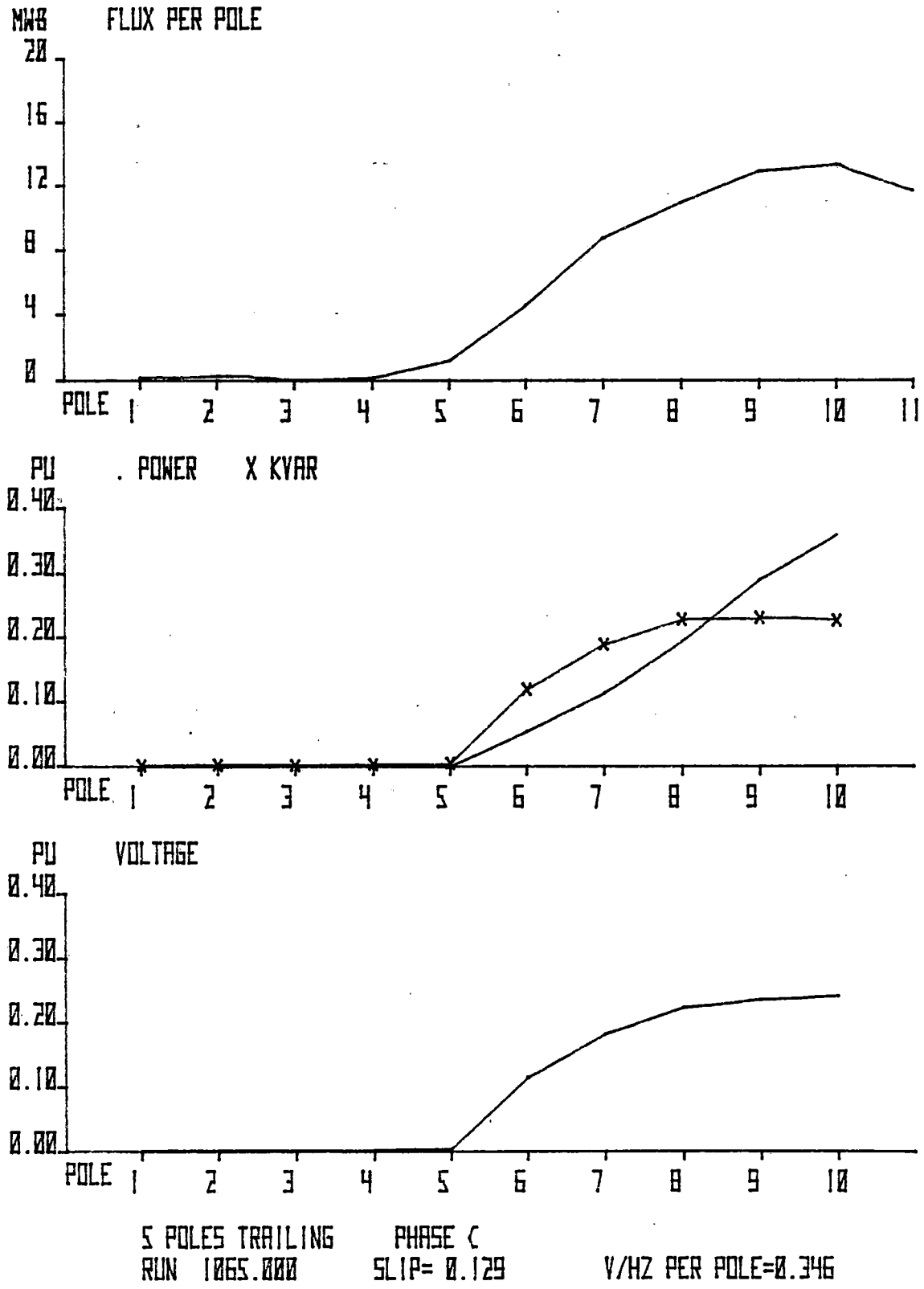

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE C
RUN 1065.000 SLIP= 0.129 V/HZ PER POLE=0.346

Figure 3-31

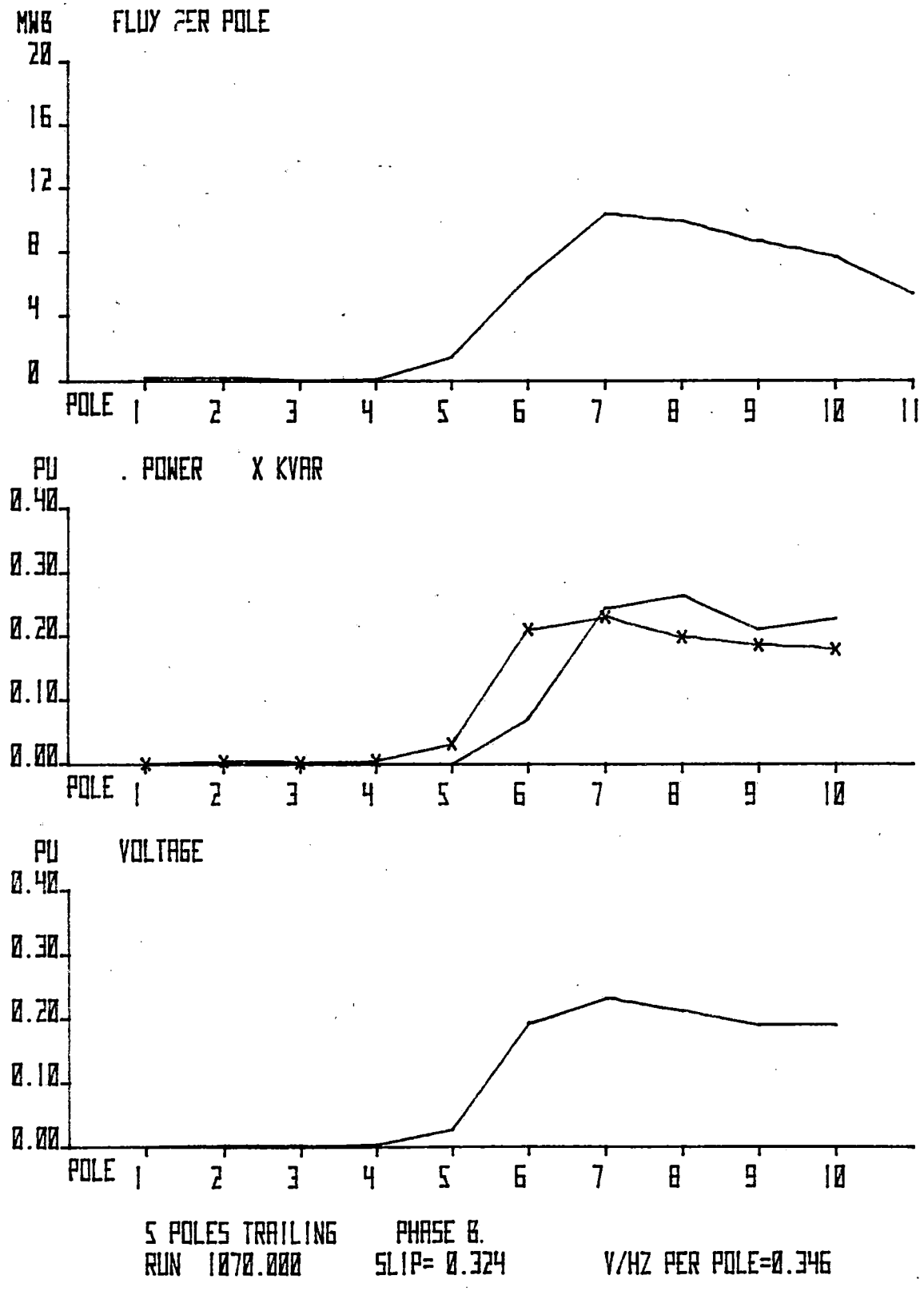

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B.
RUN 1070.000 SLIP= 0.324 V/HZ PER POLE=0.346

Figure 3-32

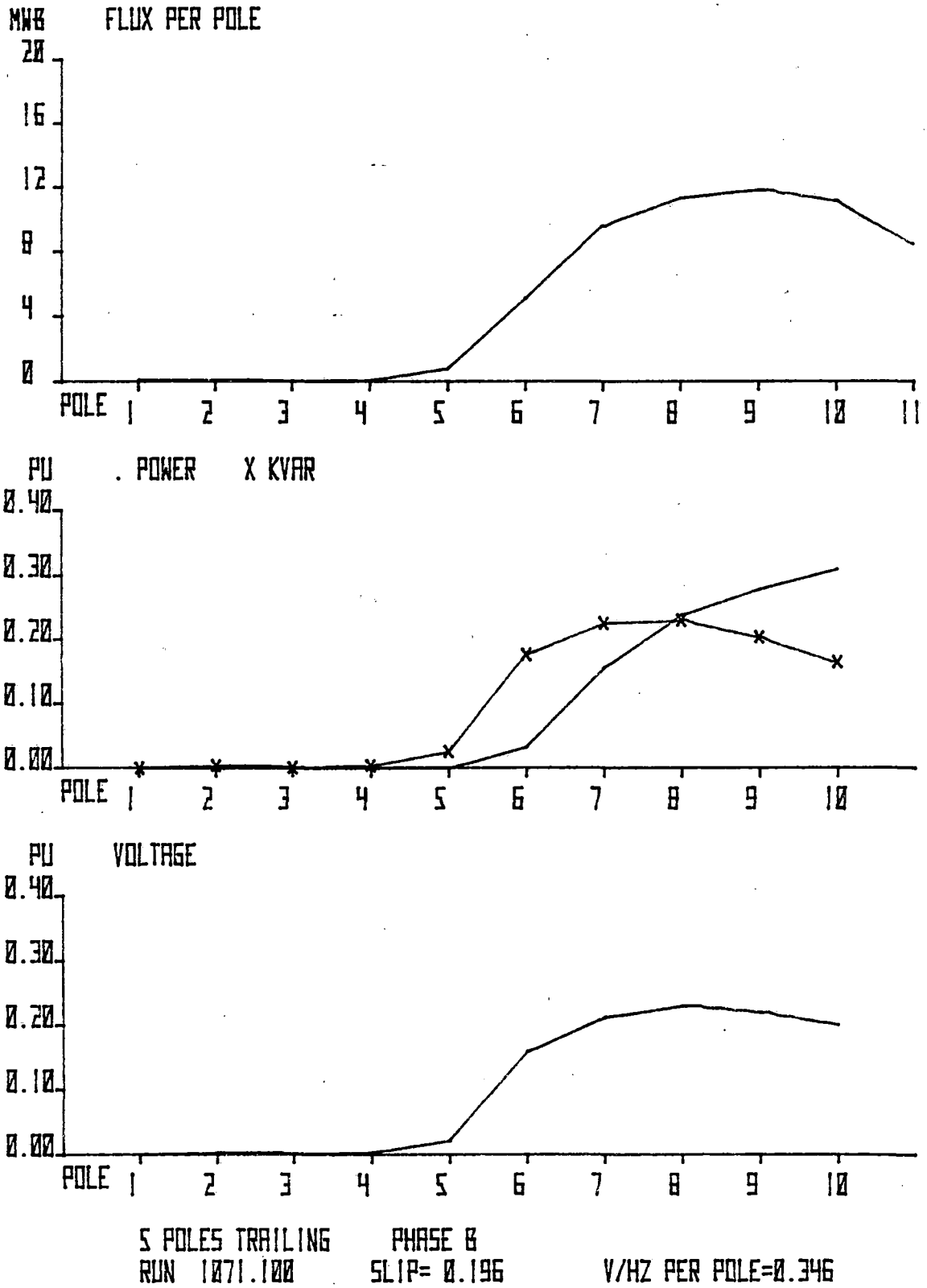

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1071.100 SLIP= 0.196 V/HZ PER POLE=0.346

Figure 3-33

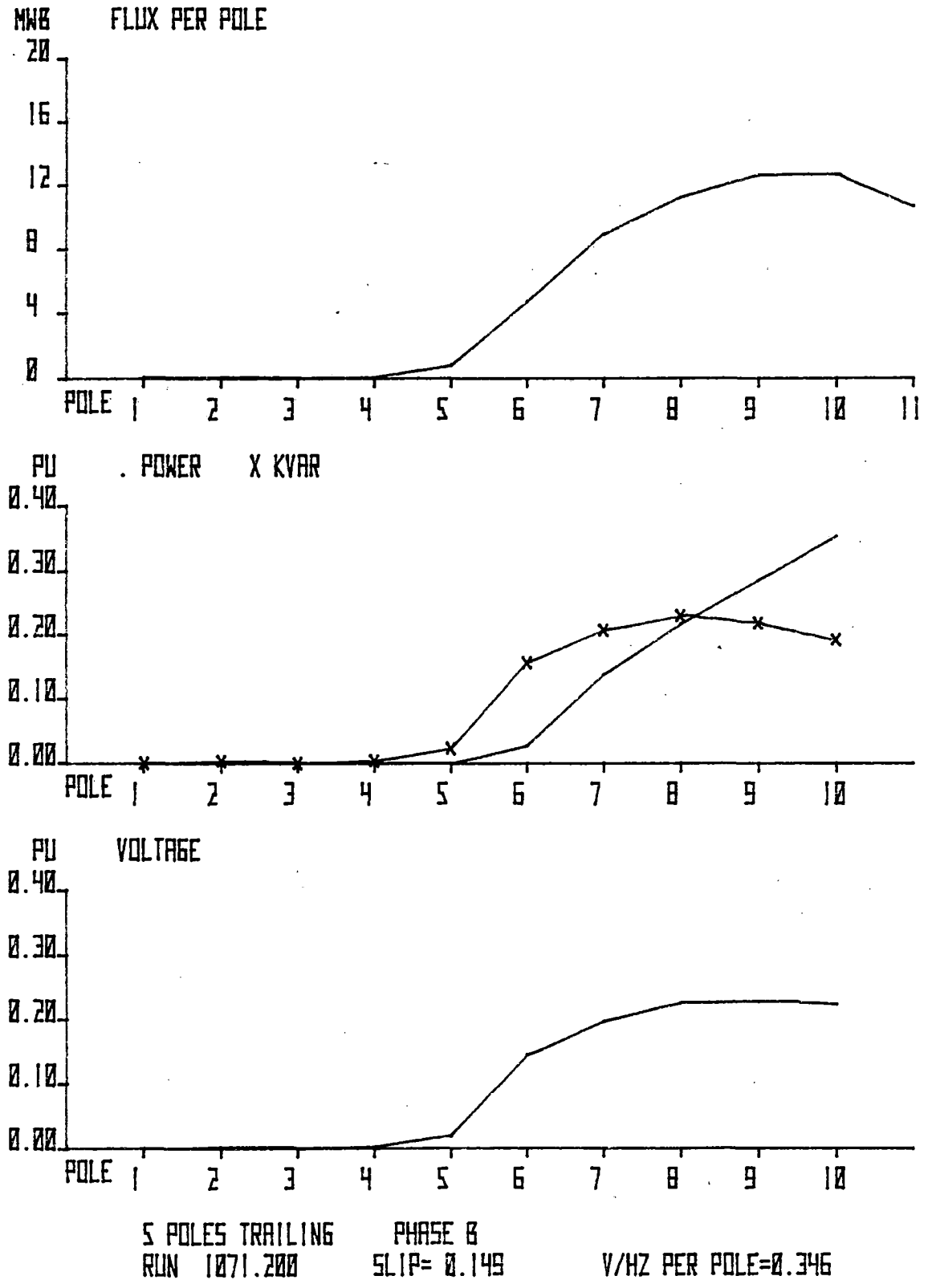

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1071.200 SLIP= 0.149 V/HZ PER POLE=0.346

Figure 3-34

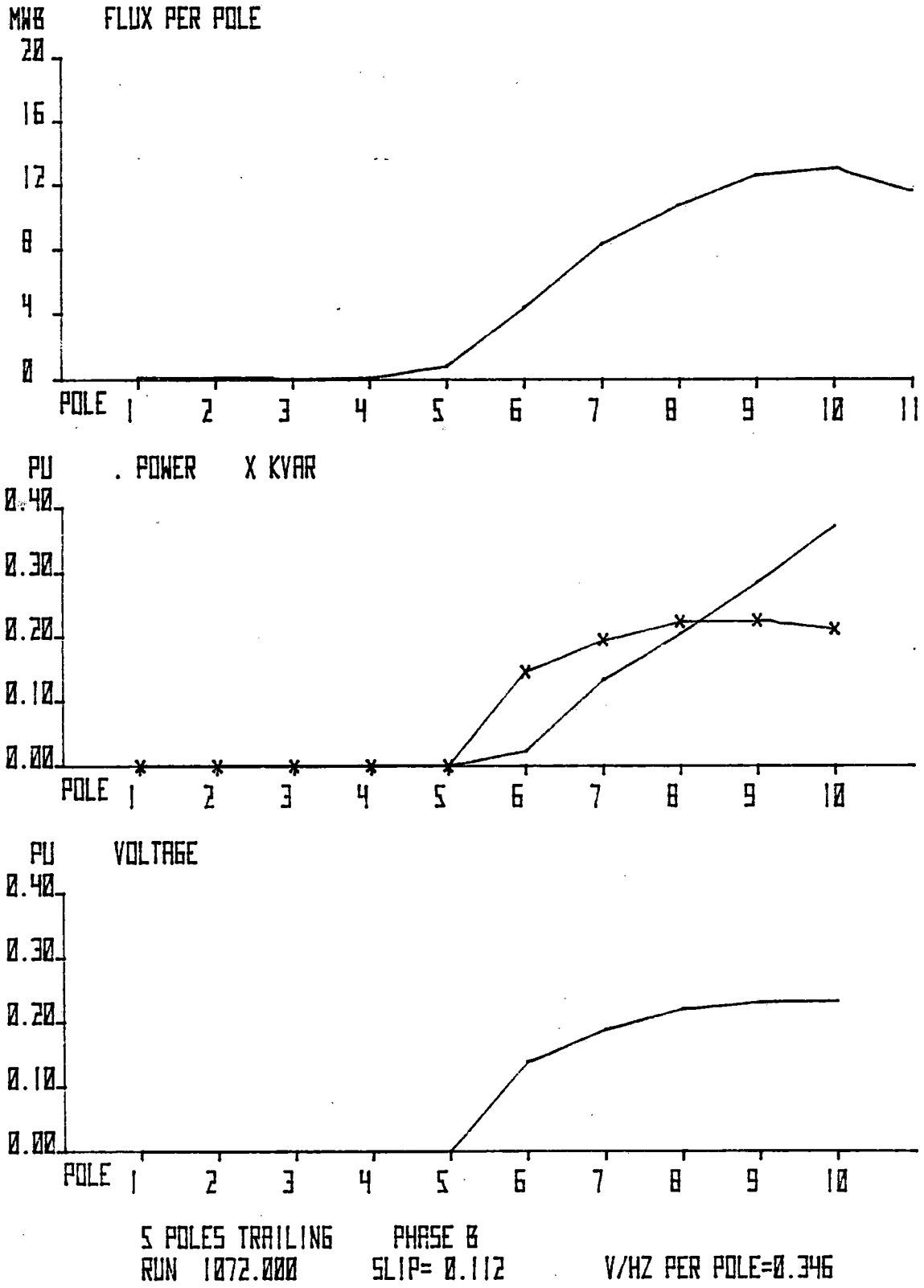

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1072.000 SLIP= 0.112 V/HZ PER POLE=0.346

Figure 3-35

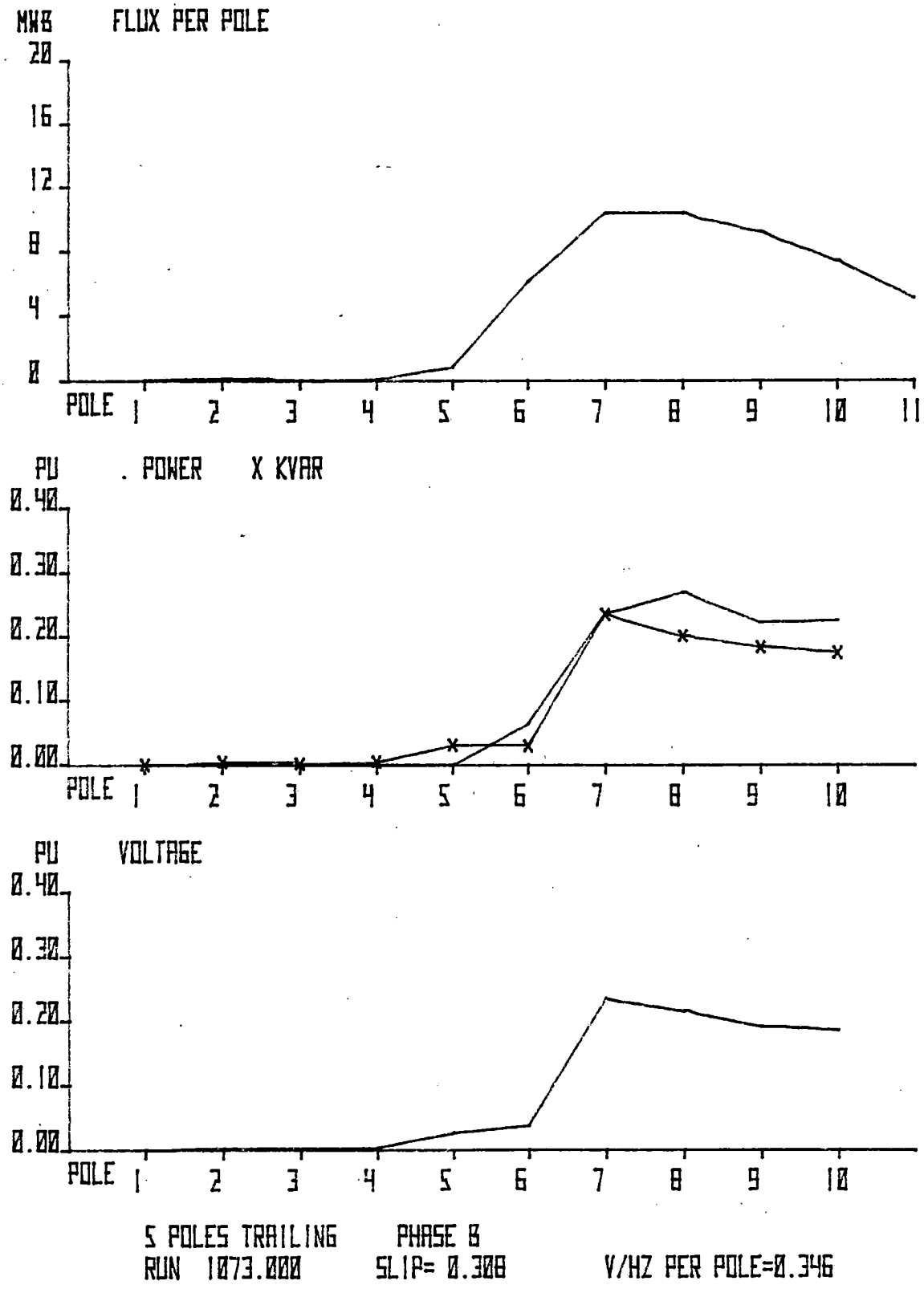

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1073.000 SLIP= 0.308 V/HZ PER POLE=0.346

Figure 3-36

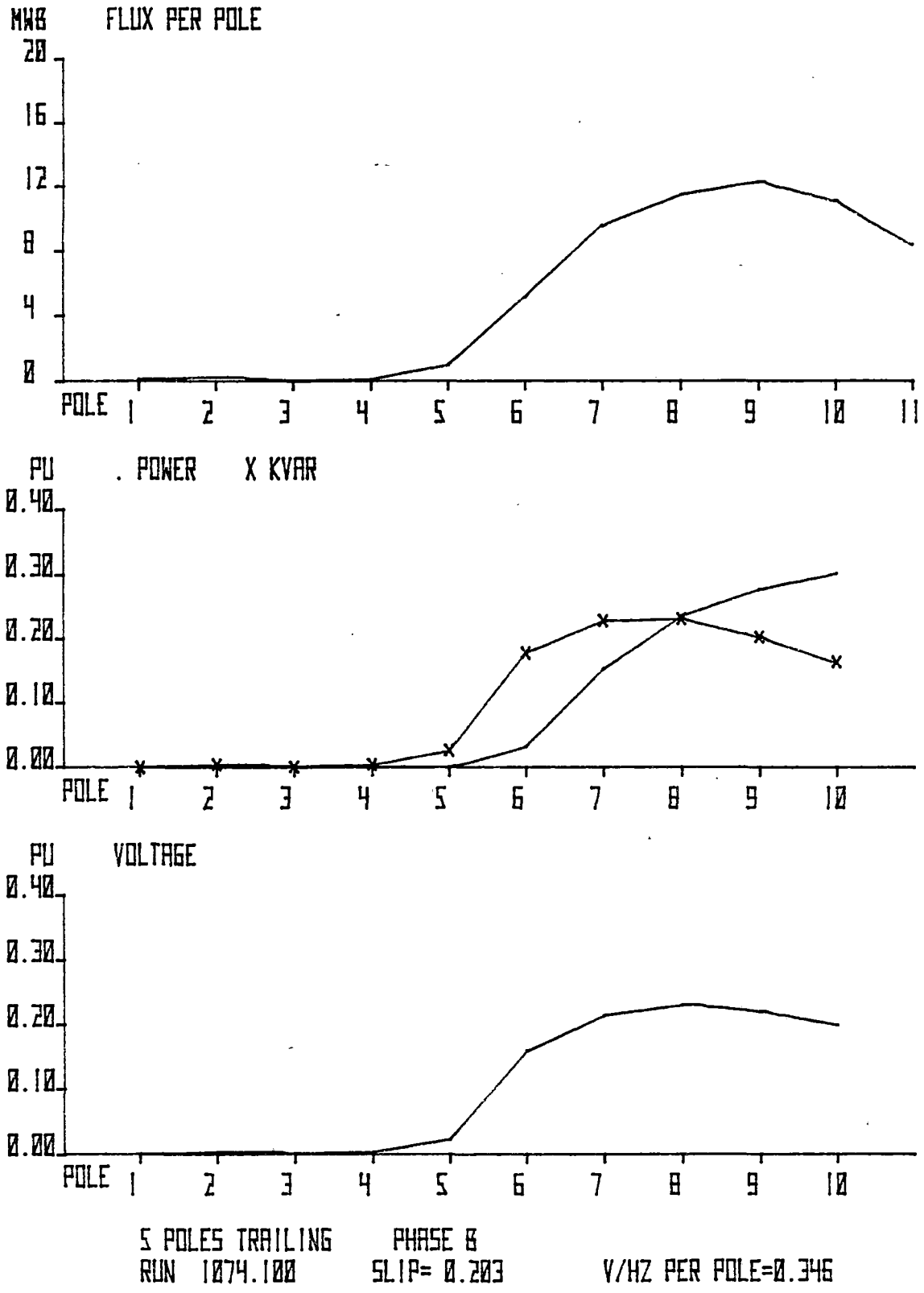

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1074.100 SLIP= 0.203 V/HZ PER POLE=0.346

Figure 3-37

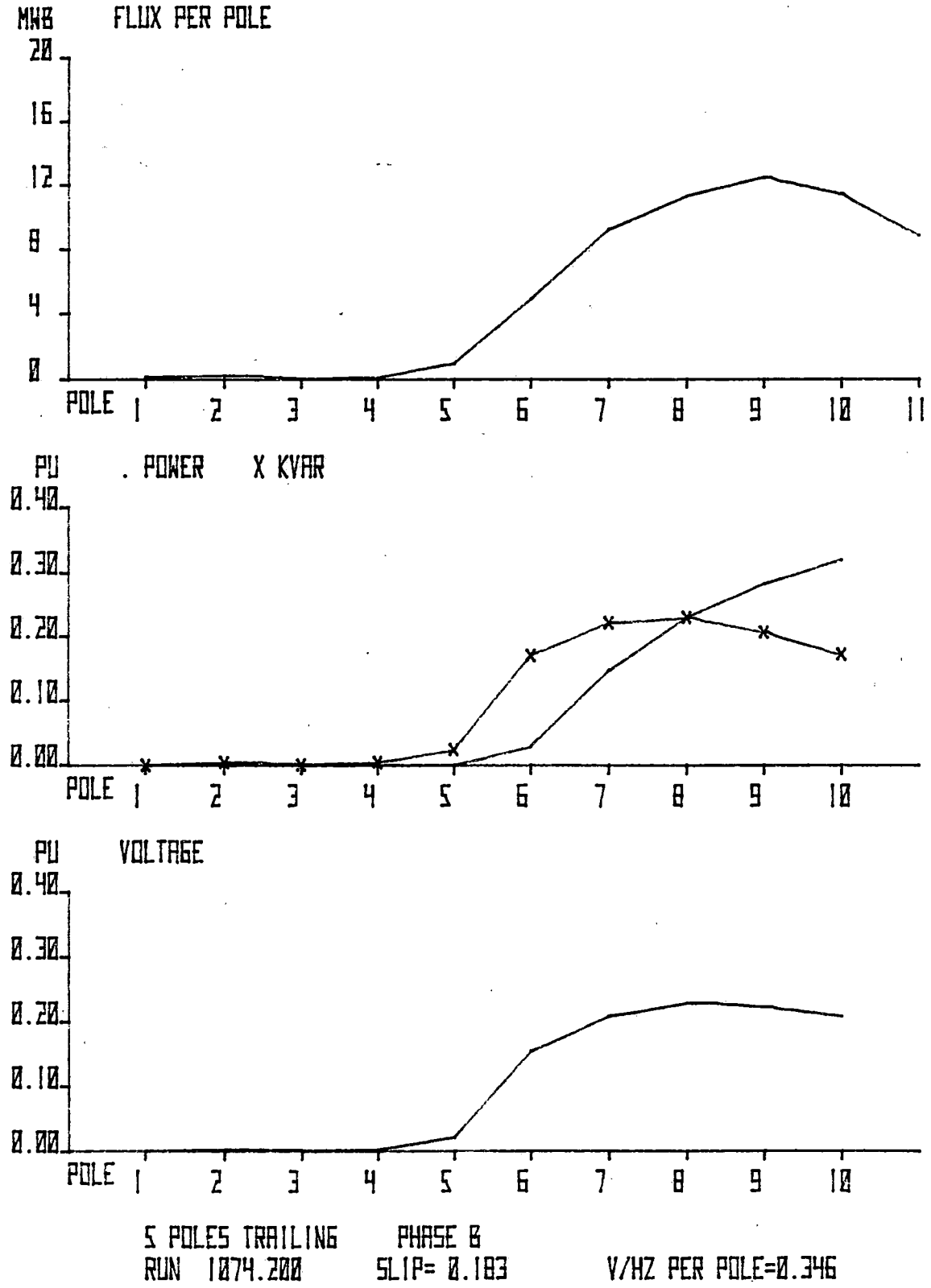

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1074.200 SLIP= 0.183 V/HZ PER POLE=0.346

Figure 3-38

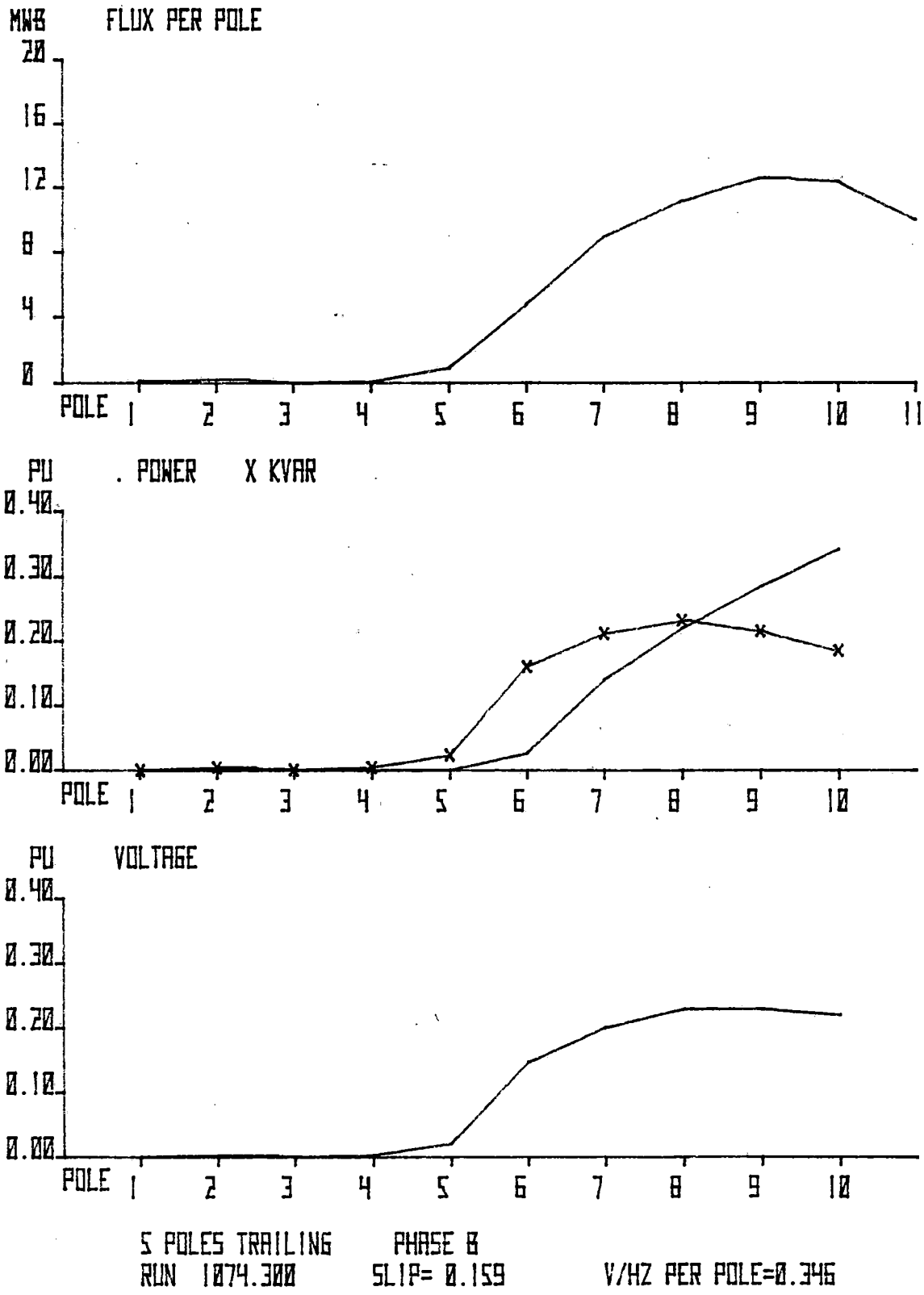

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1074.300 SLIP= 0.159 V/HZ PER POLE=0.346

Figure 3-39

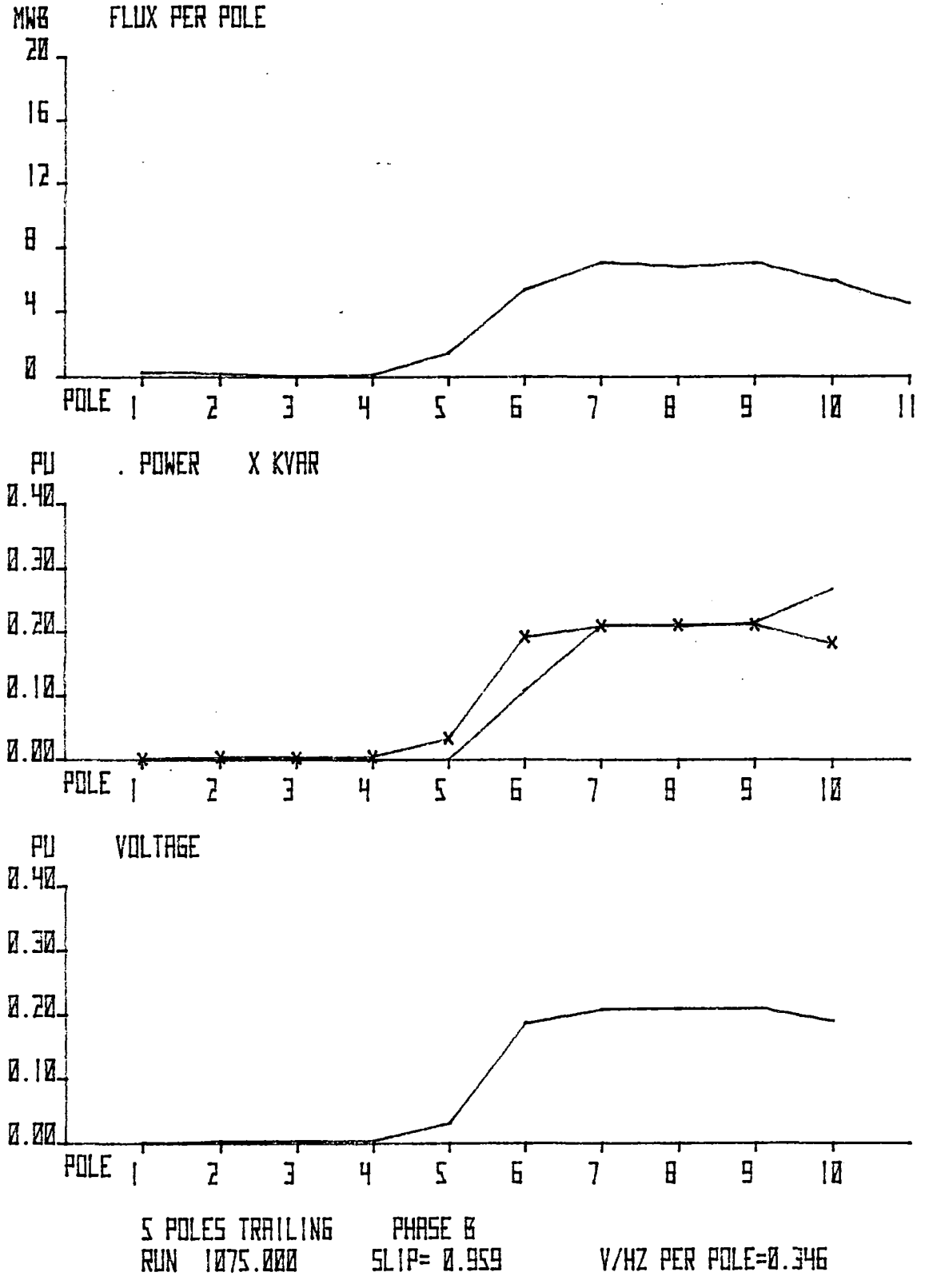

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1075.000 SLIP= 0.959 V/HZ PER POLE=0.346

Figure 3-40

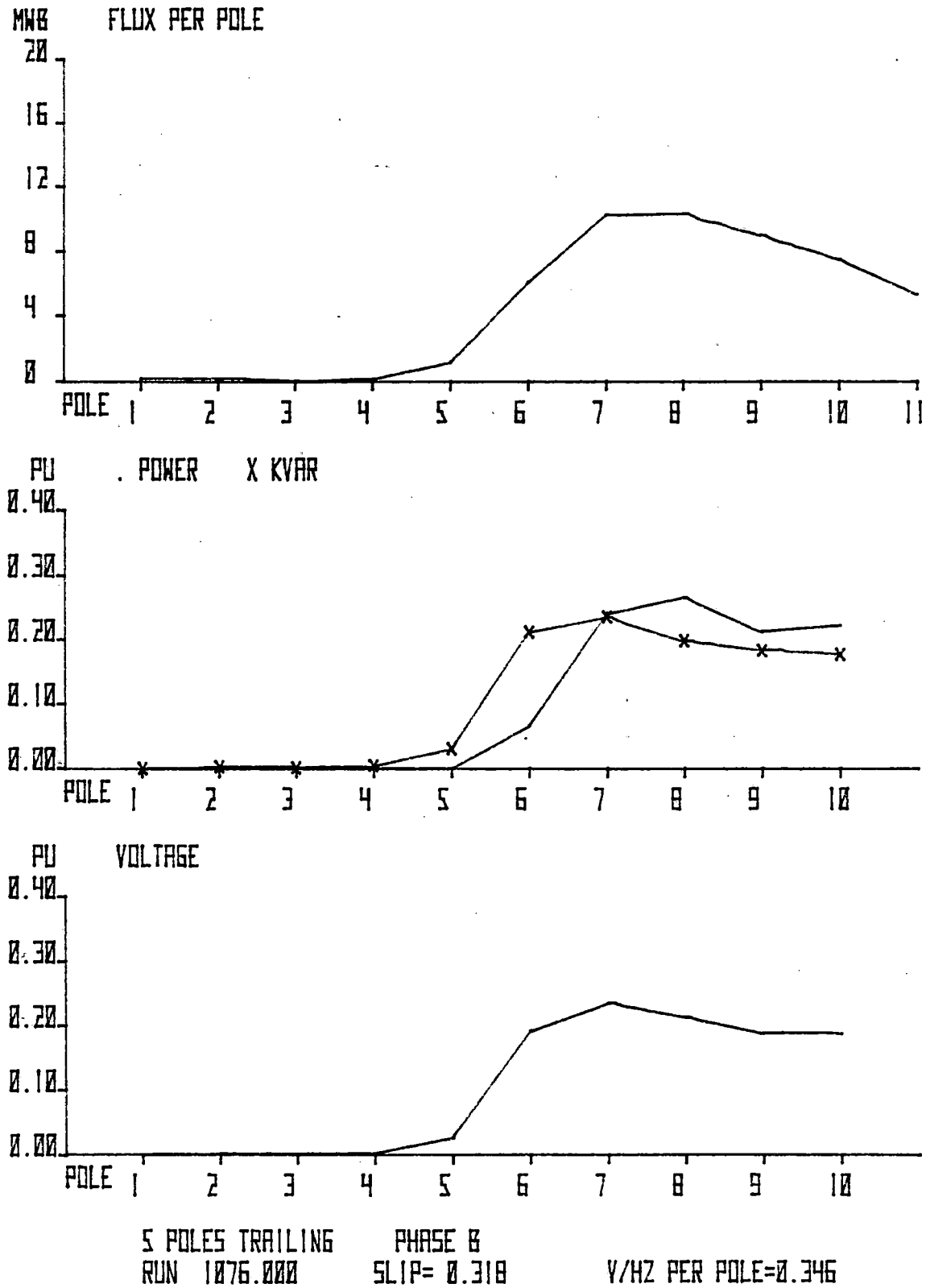

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1076.000 SLIP= 0.318 V/HZ PER POLE=0.346

Figure 3-41

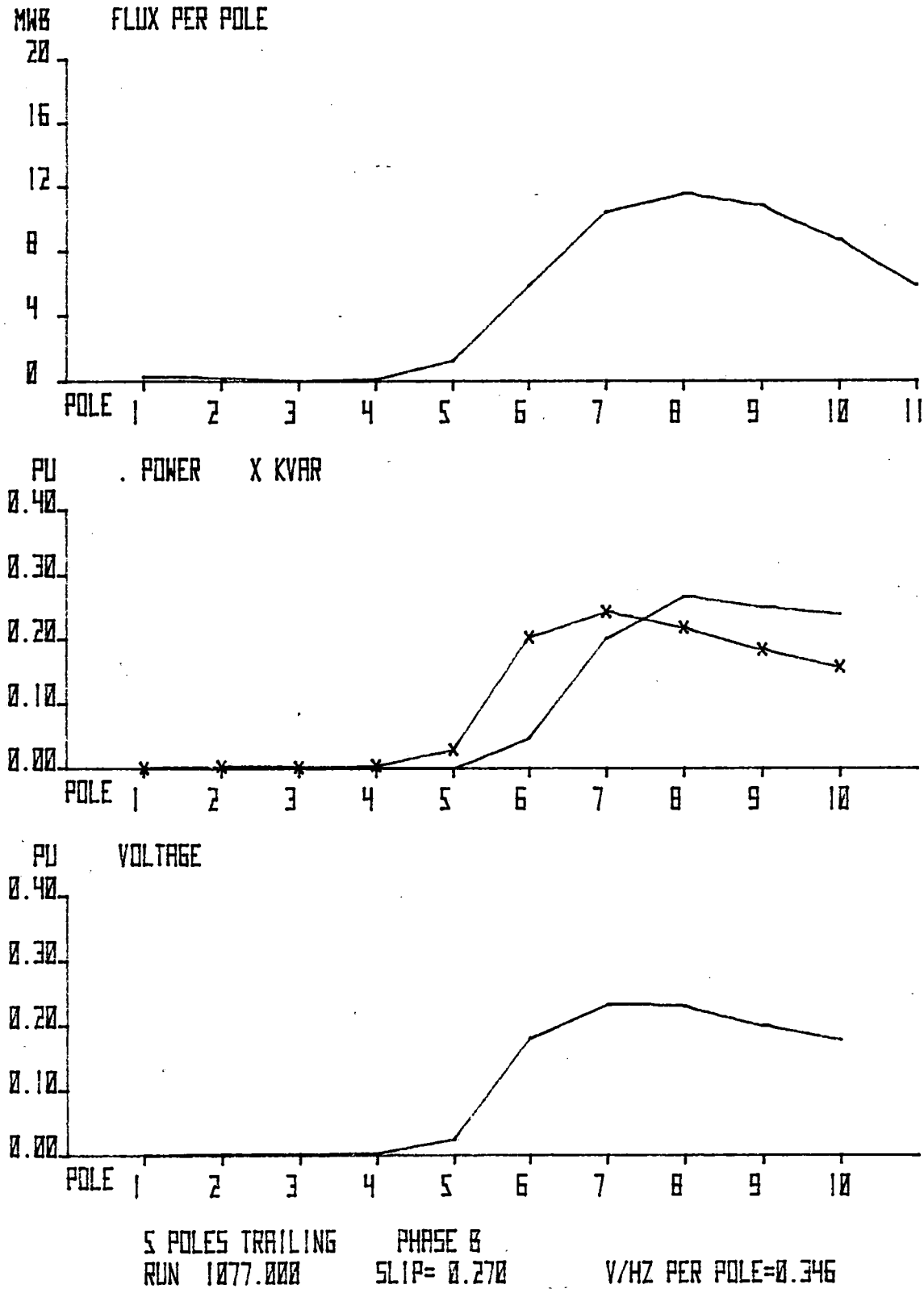

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1077.000 SLIP= 0.270 V/HZ PER POLE=0.346

Figure 3-42

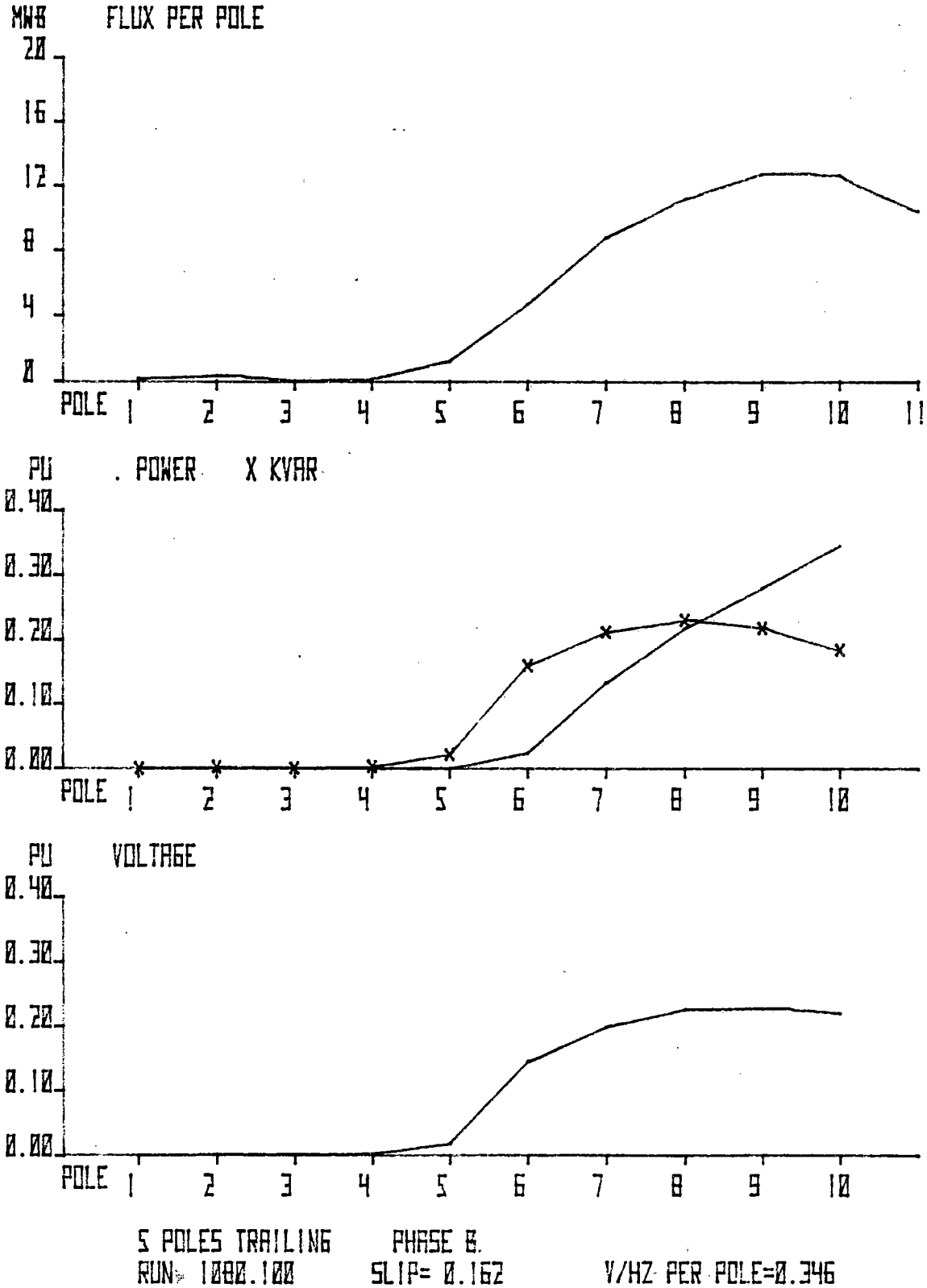

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B.
RUN= 1080.100 SLIP= 0.162 V/HZ PER POLE=0.346

Figure 3-43

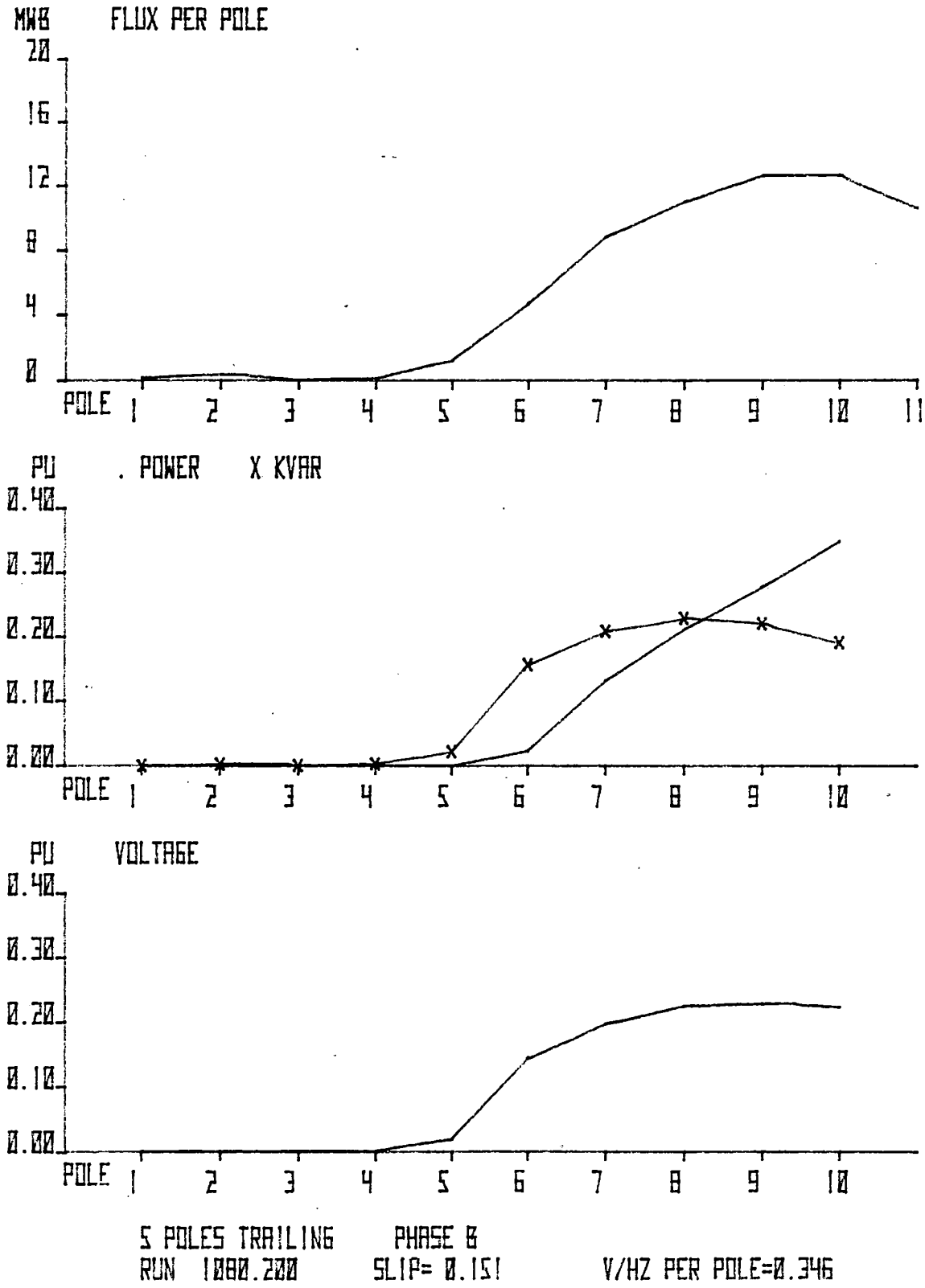

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1000.200 SLIP= 0.151 V/HZ PER POLE=0.346

Figure 3-44

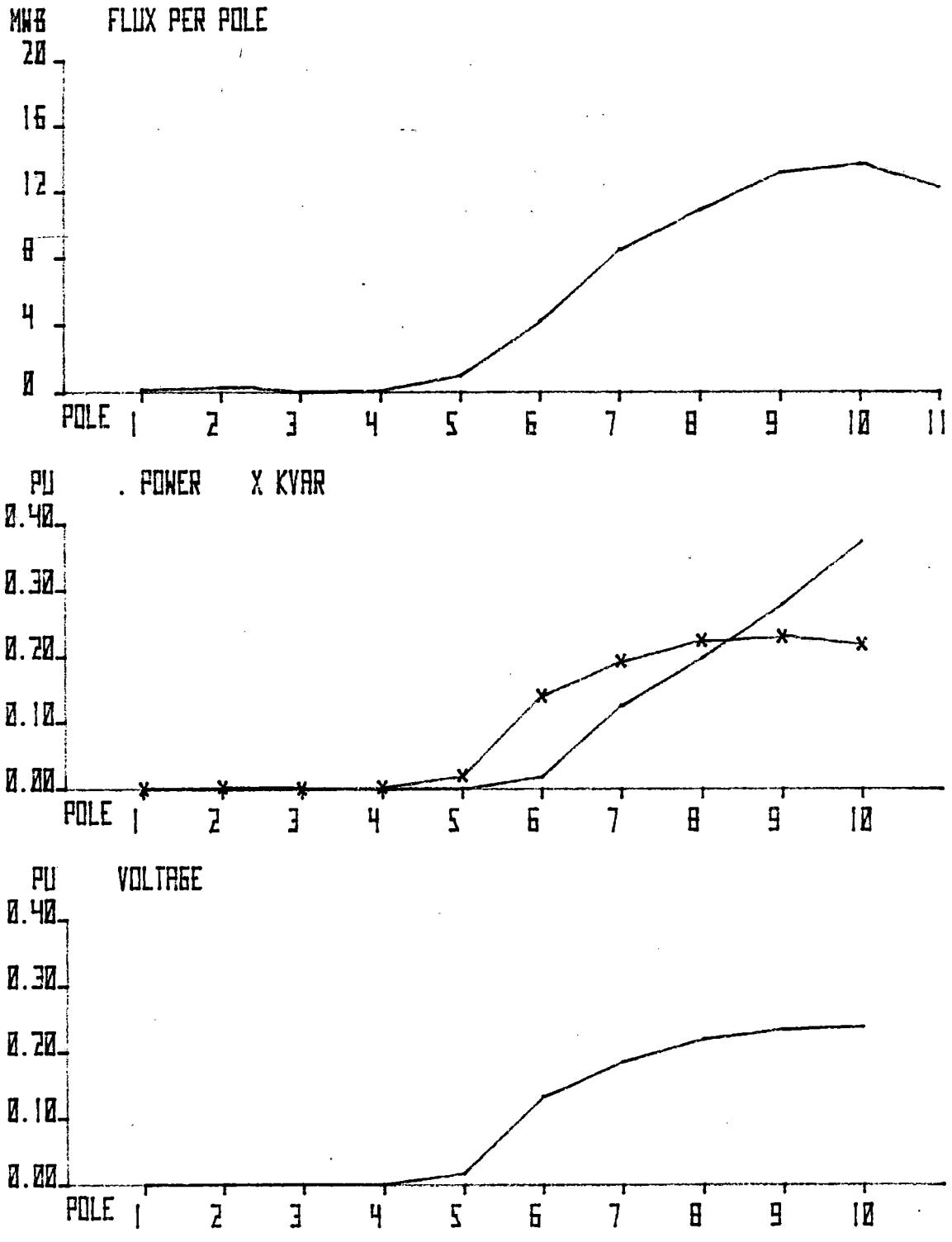

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1001.000 SLIP= 0.105 V/HZ PER POLE=0.346

Figure 3-45

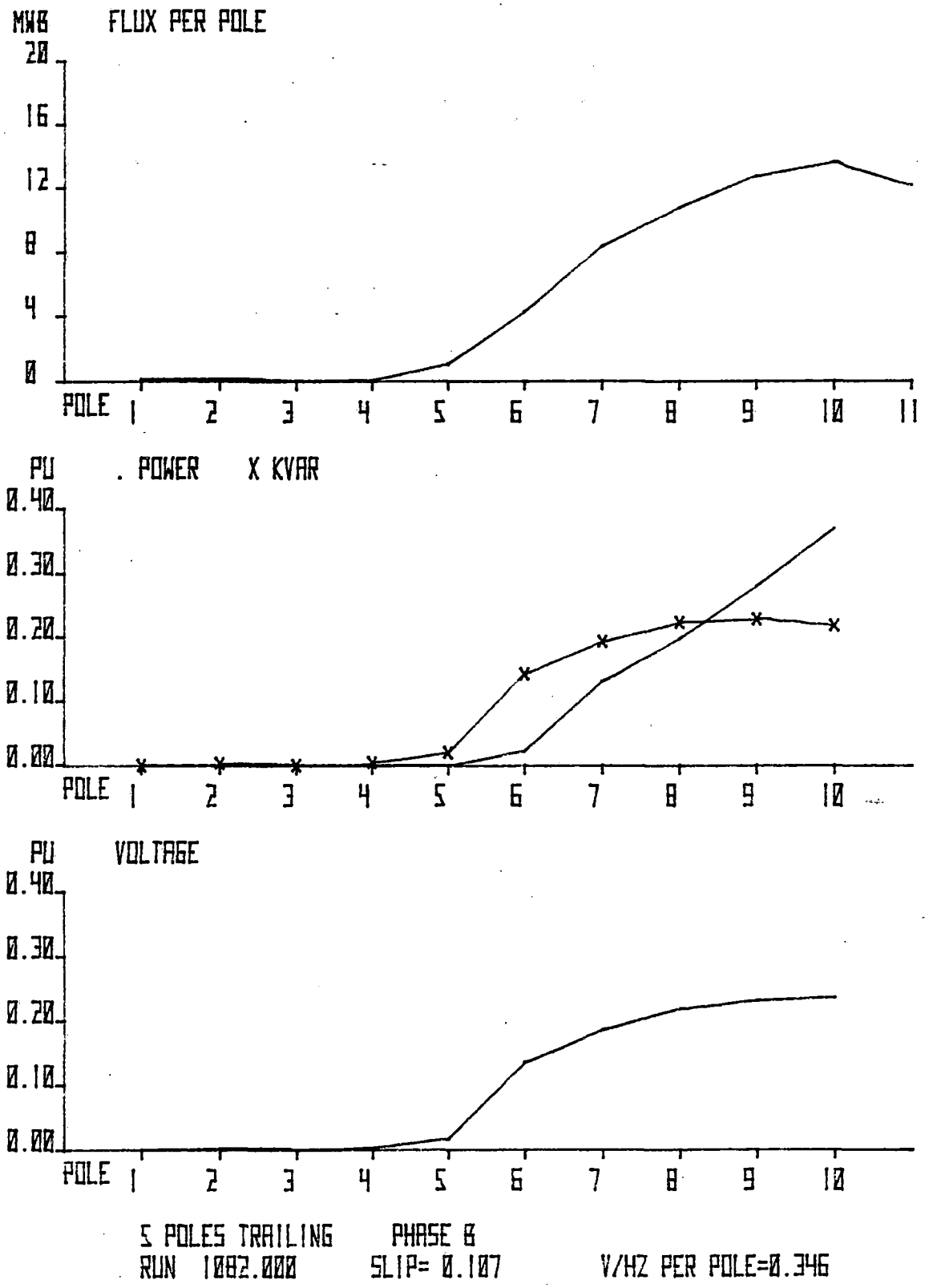

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1082.000 SLIP= 0.107 V/HZ PER POLE=0.346

Figure 3-46

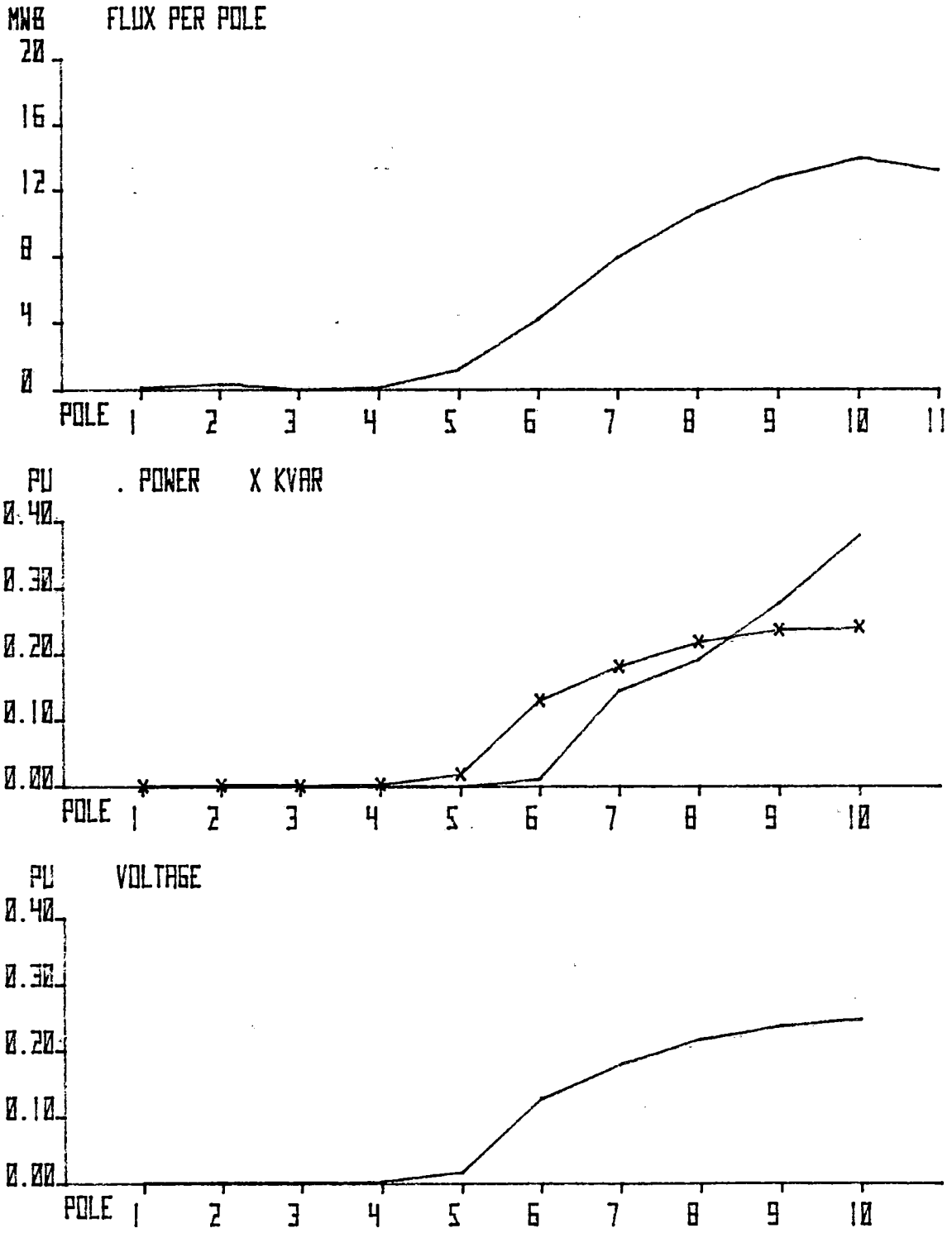

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1083.000 SLIP= 0.048 V/HZ PER POLE=0.346

Figure 3-47

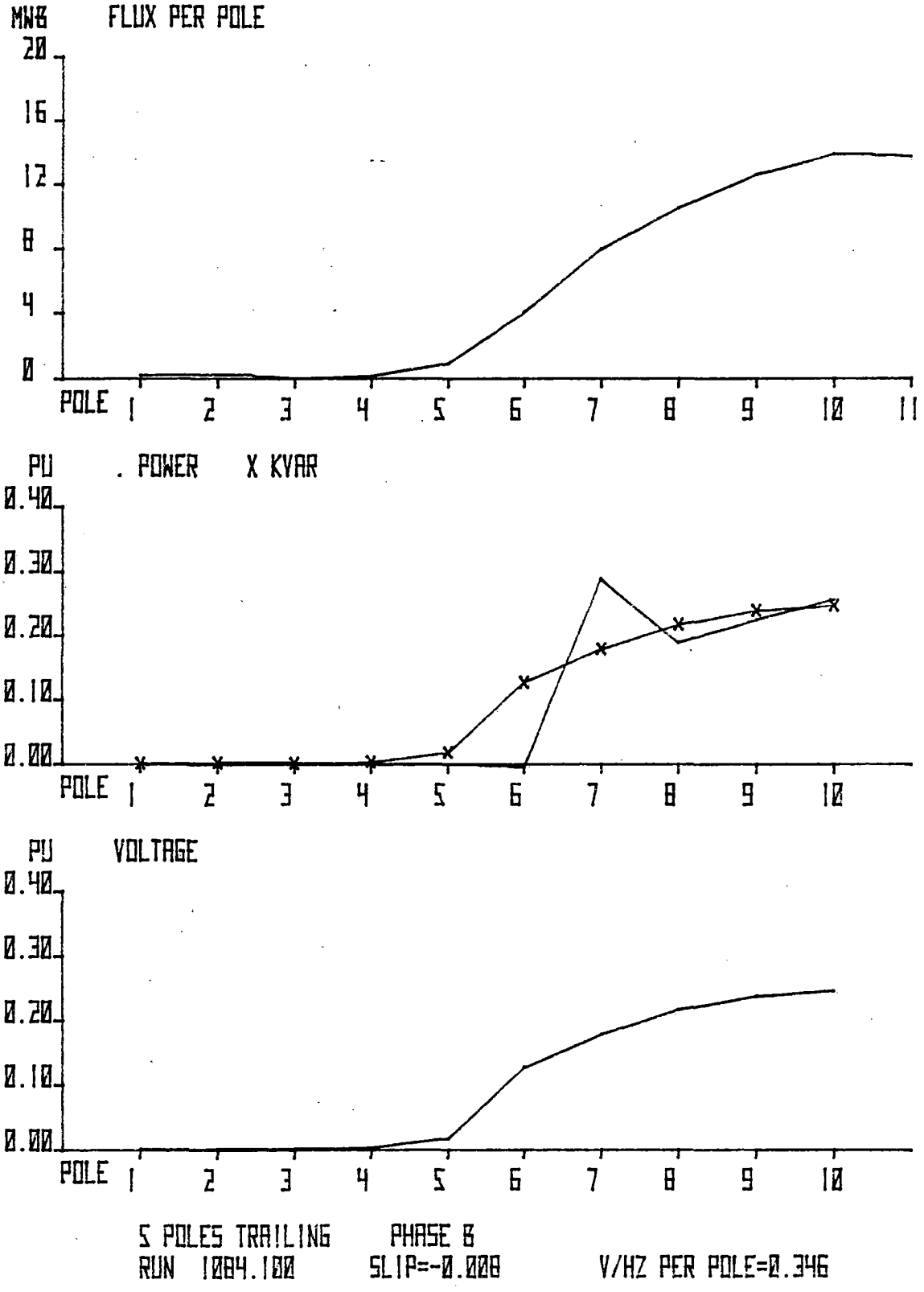

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1084.100 SLIP=-0.008 V/HZ PER POLE=0.346

Figure 3-48

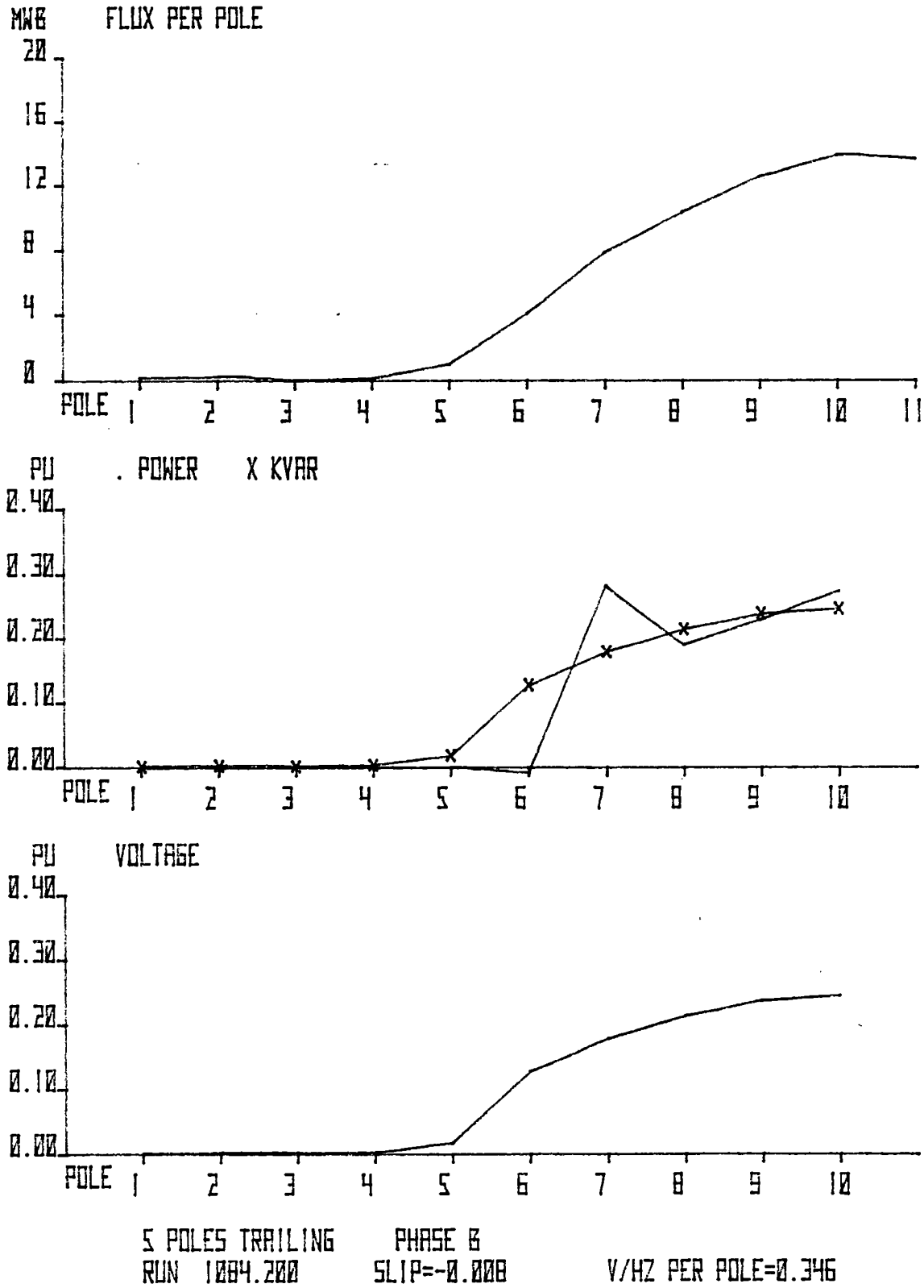
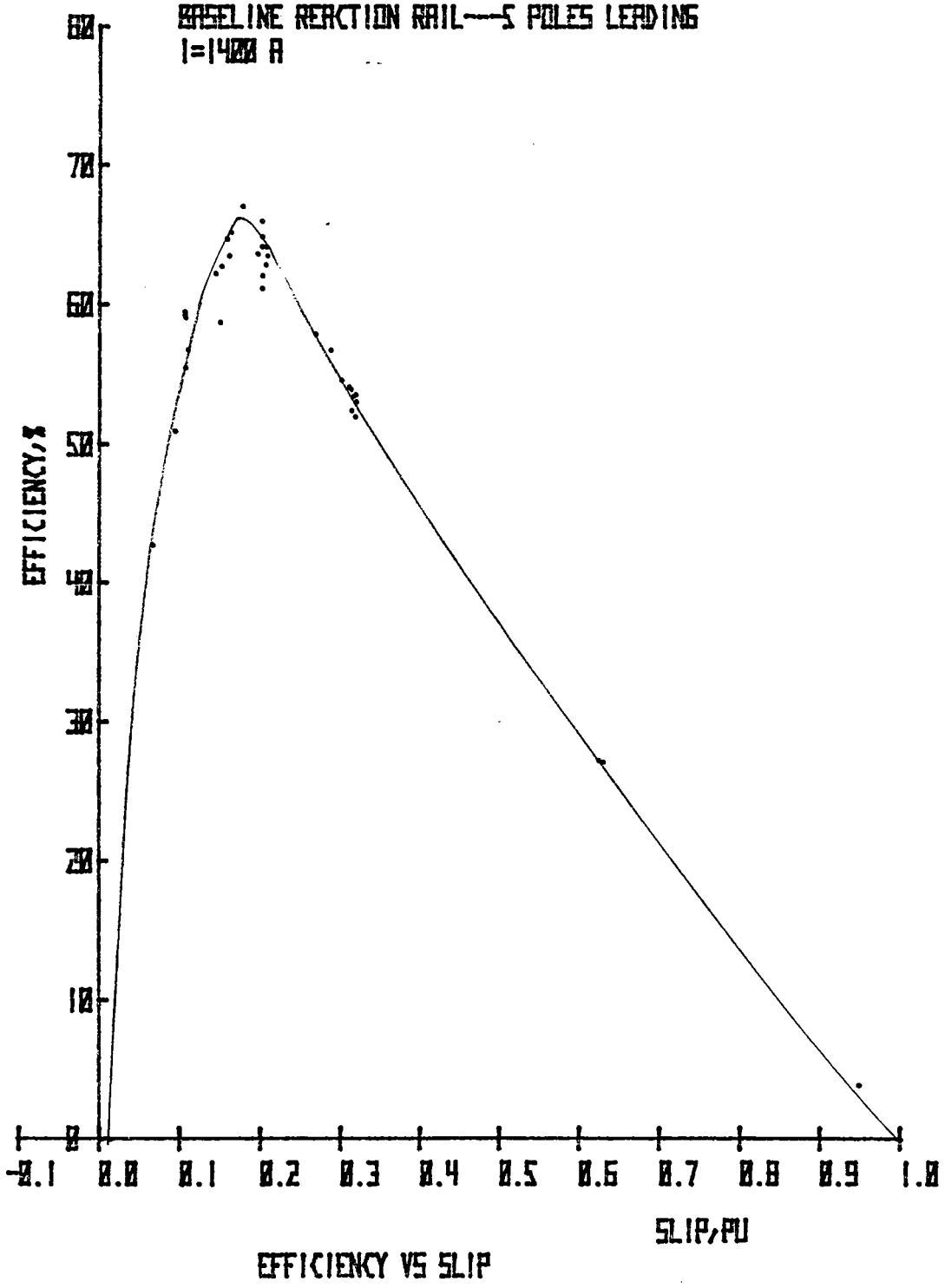
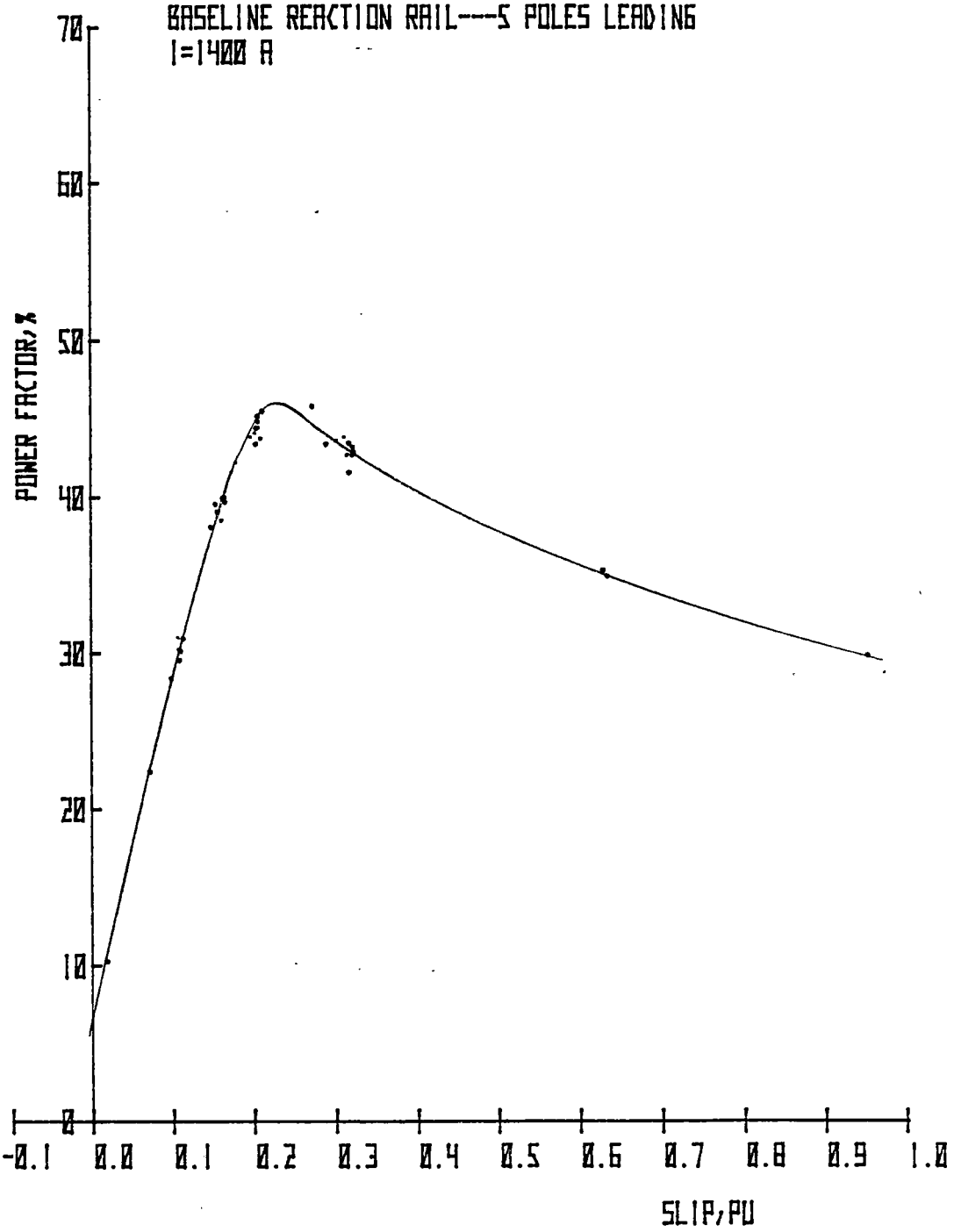

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES TRAILING PHASE B
RUN 1084.200 SLIP=-0.008 V/HZ PER POLE=0.346

Figure 3-49



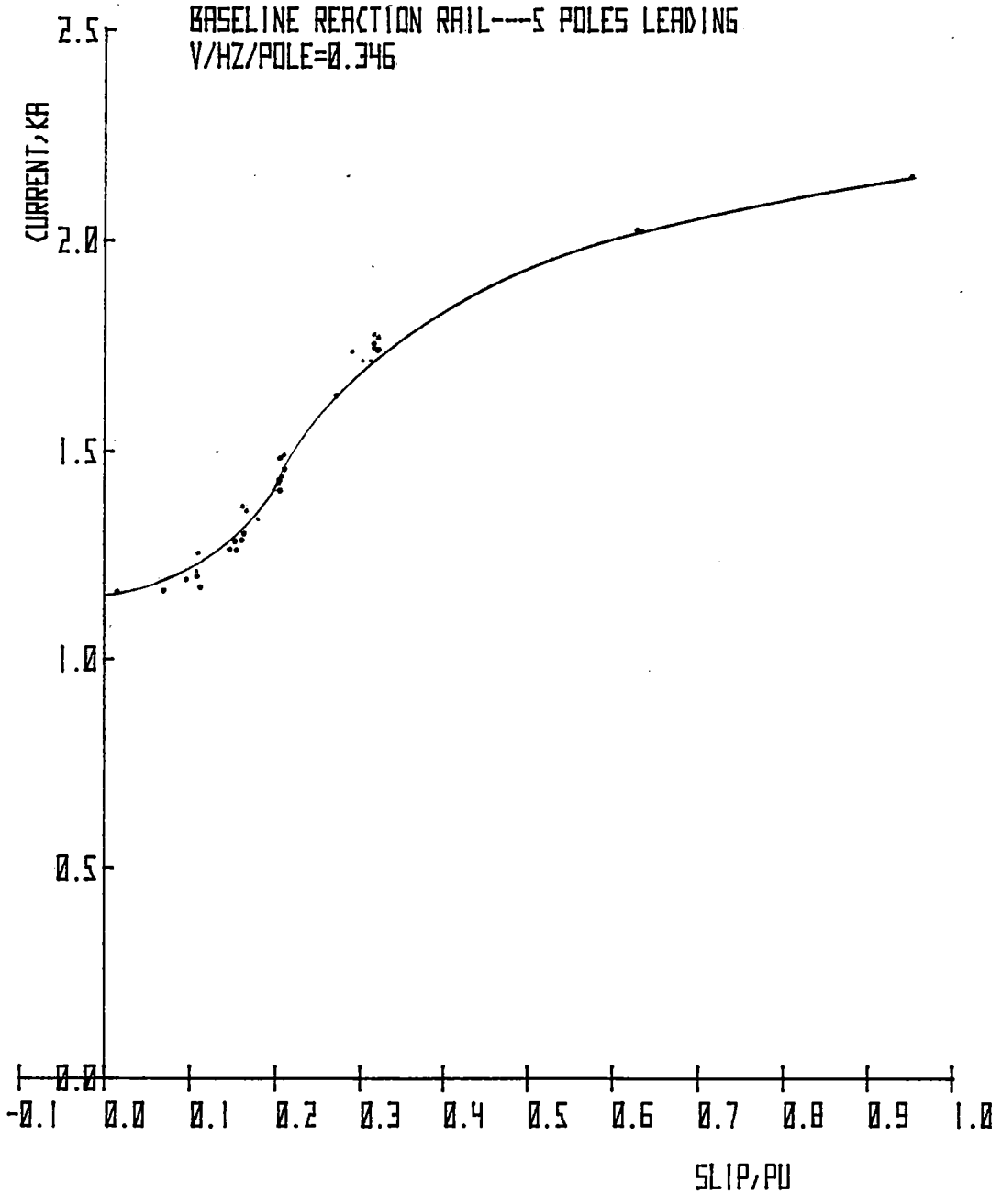
EFFICIENCY VS SLIP

Figure 3-50



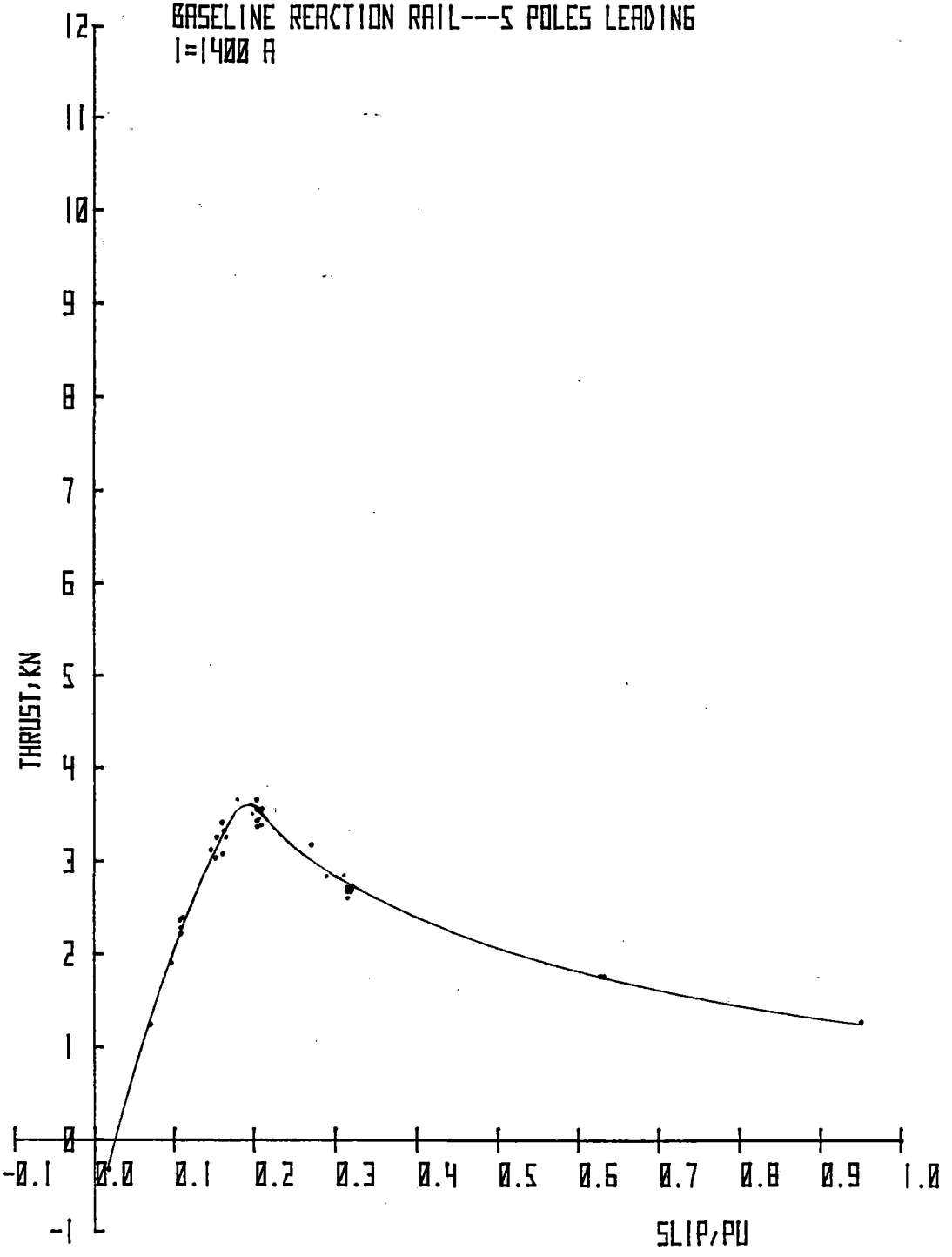
POWER FACTOR VS SLIP

Figure 3-51



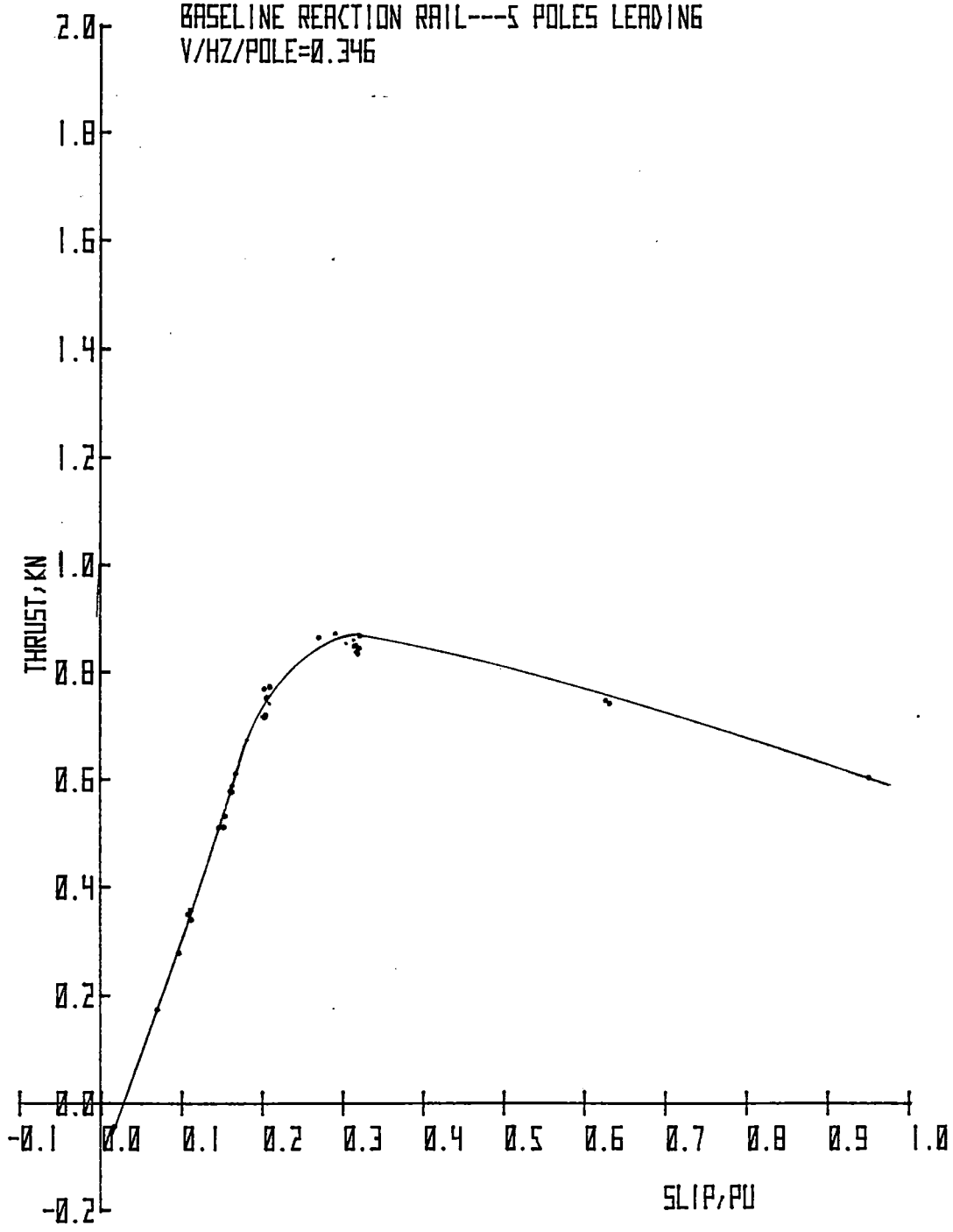
MEAN LINE CURRENT VS SLIP

Figure 3-52



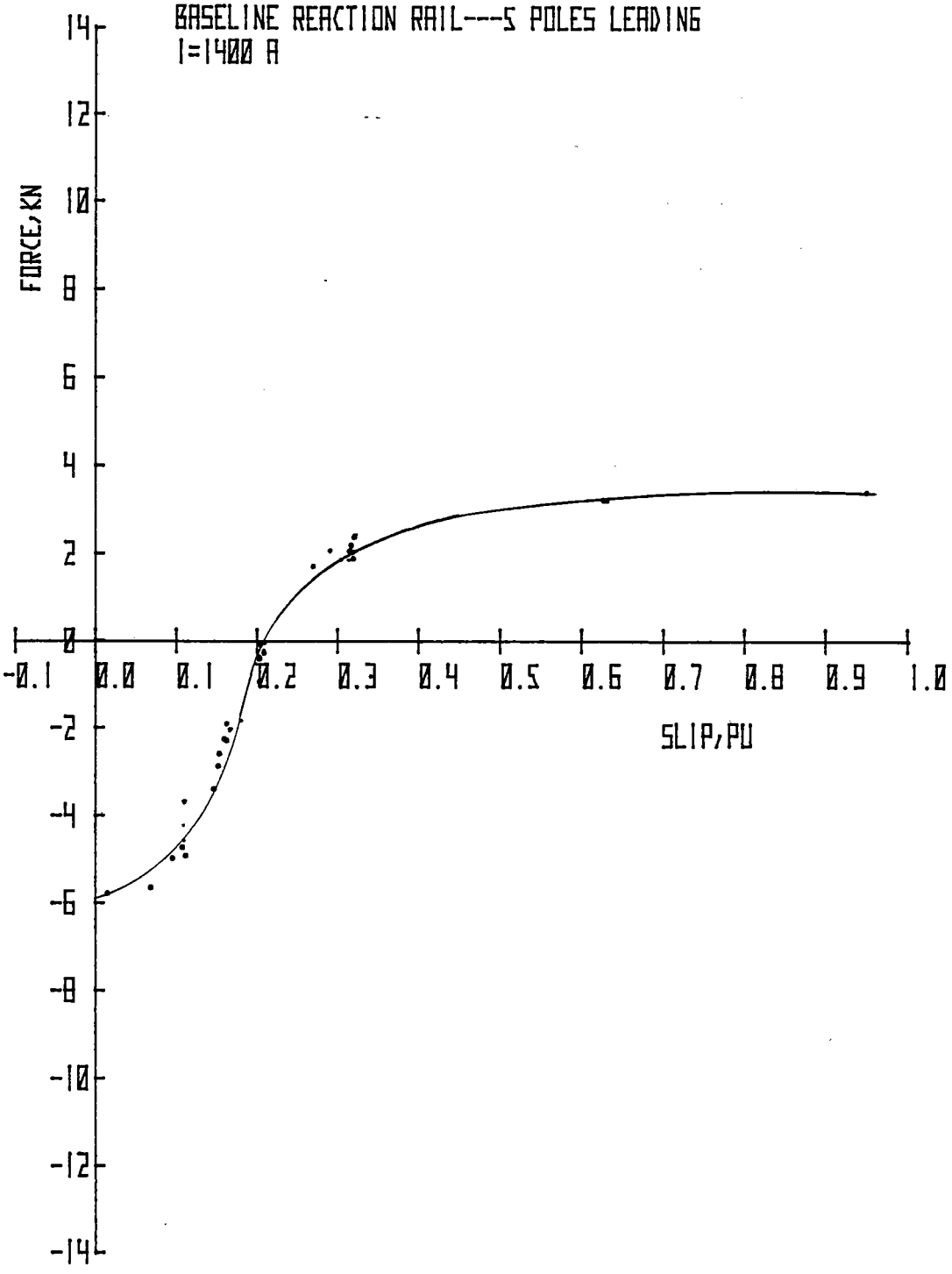
THRUST VS SLIP

Figure 3-53



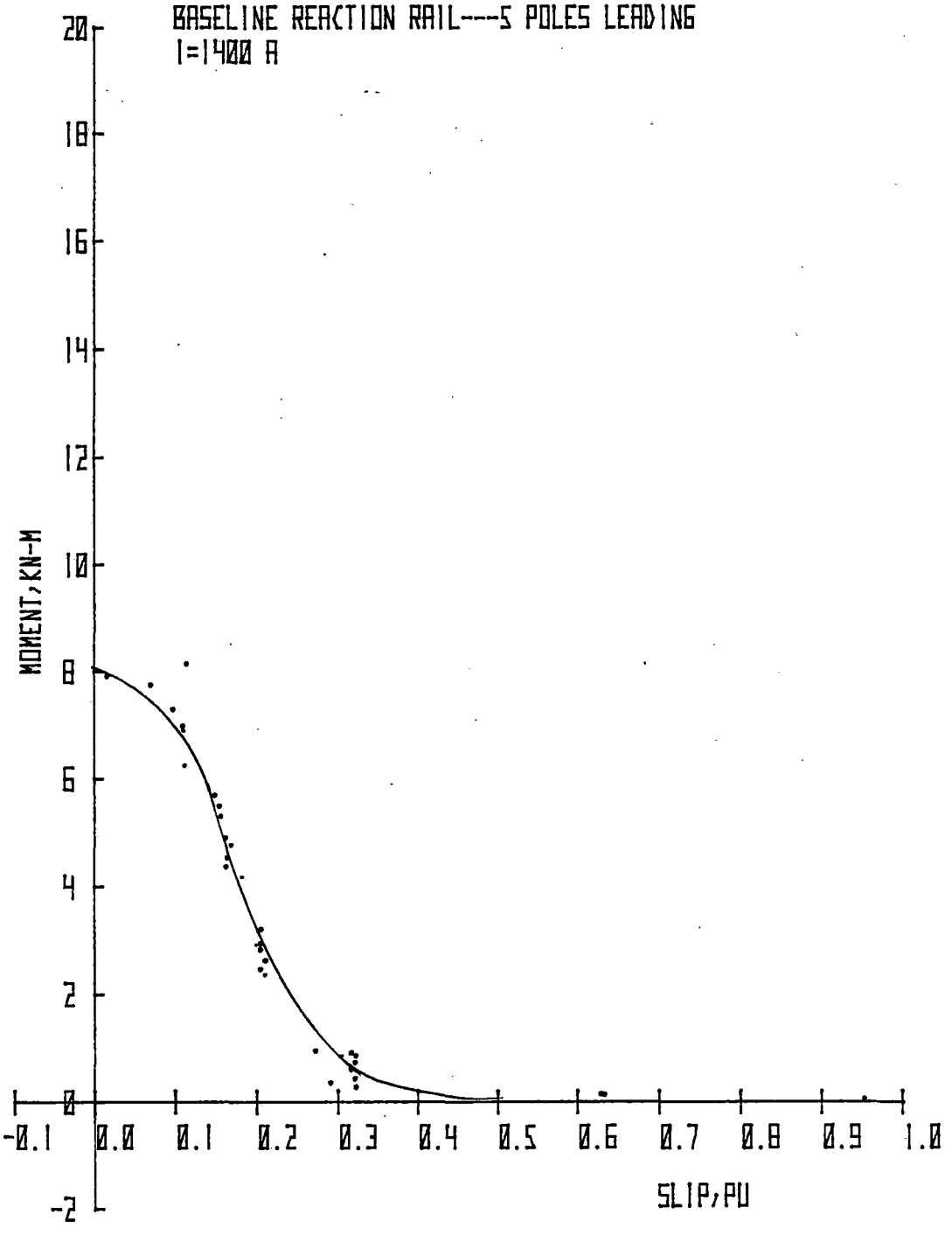
THRUST PER POLE VS SLIP

Figure 3-54



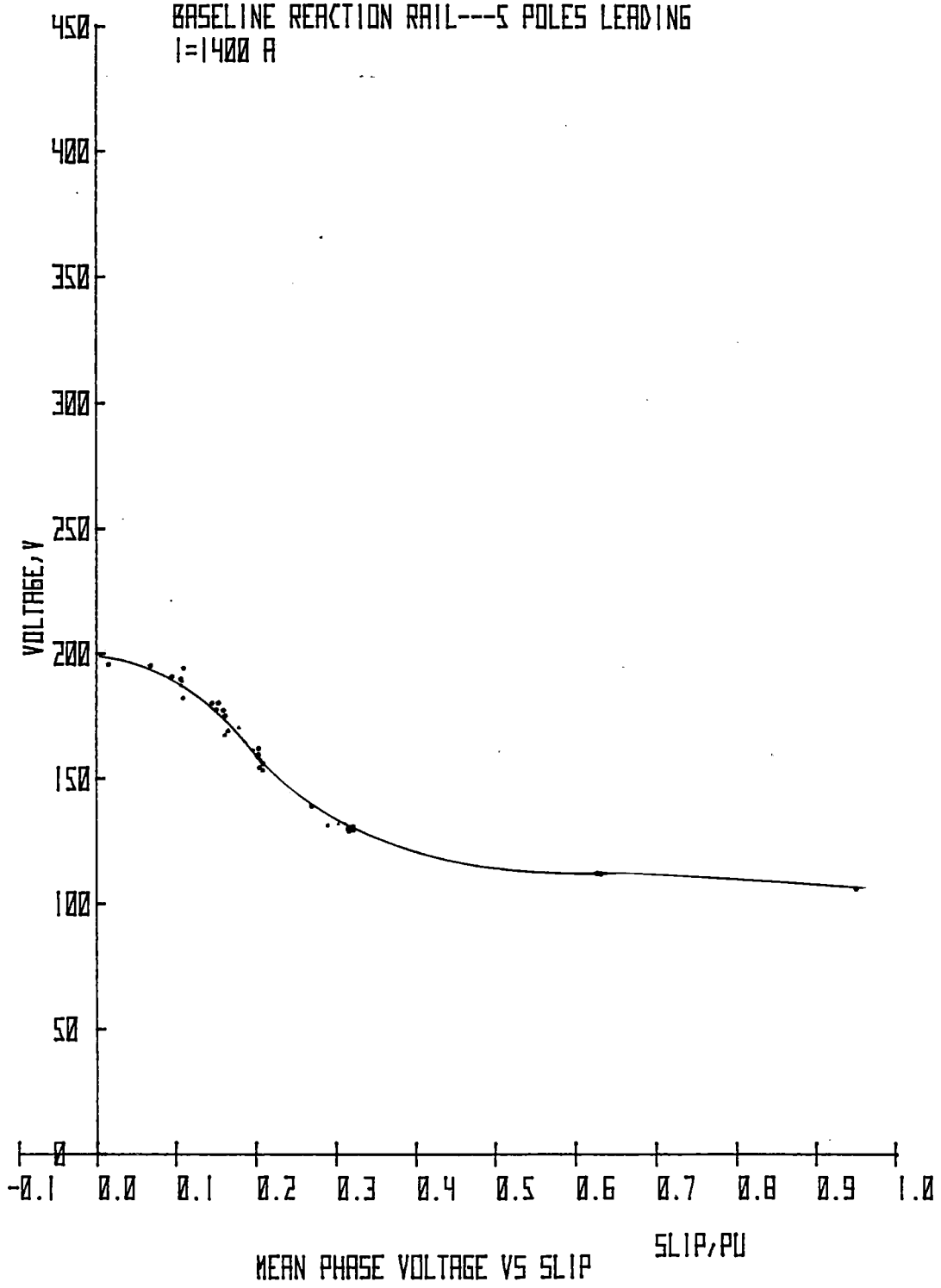
TOTAL VERTICAL FORCE VS SLIP

Figure 3-55



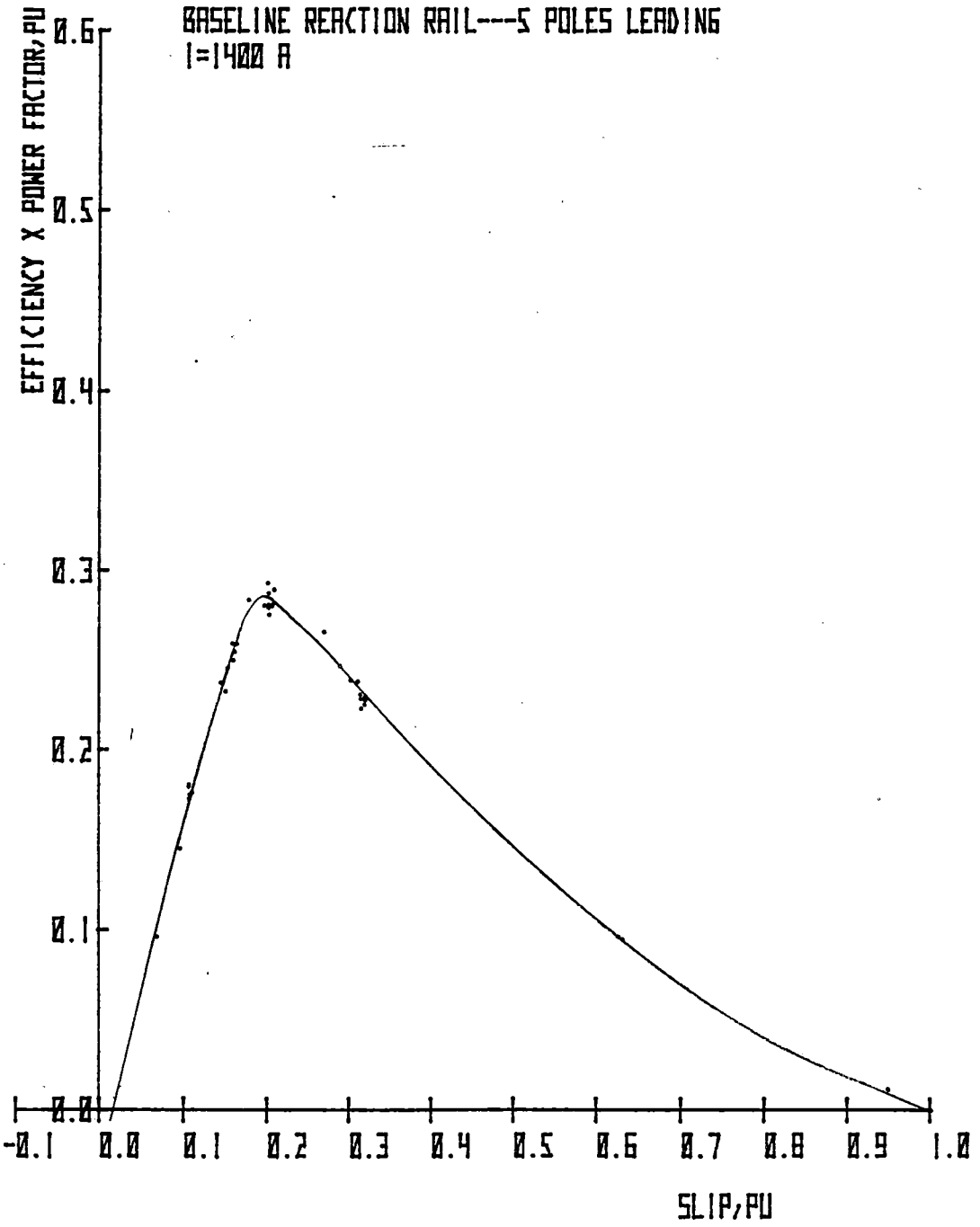
PITCHING MOMENT VS SLIP

Figure 3-56



MEAN PHASE VOLTAGE VS SLIP

Figure 3-57



EFFICIENCY X POWER FACTOR VS SLIP

Figure 3-58

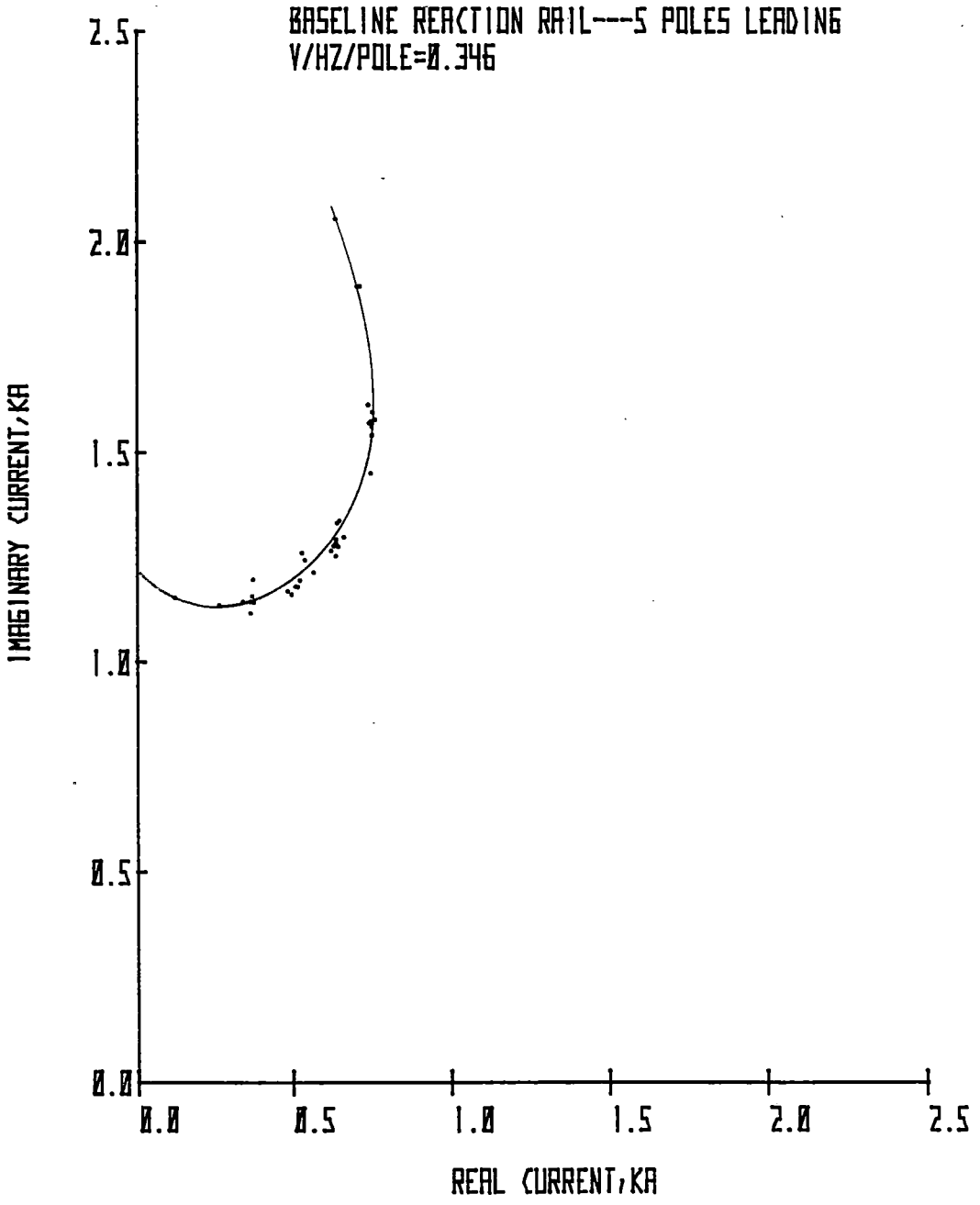
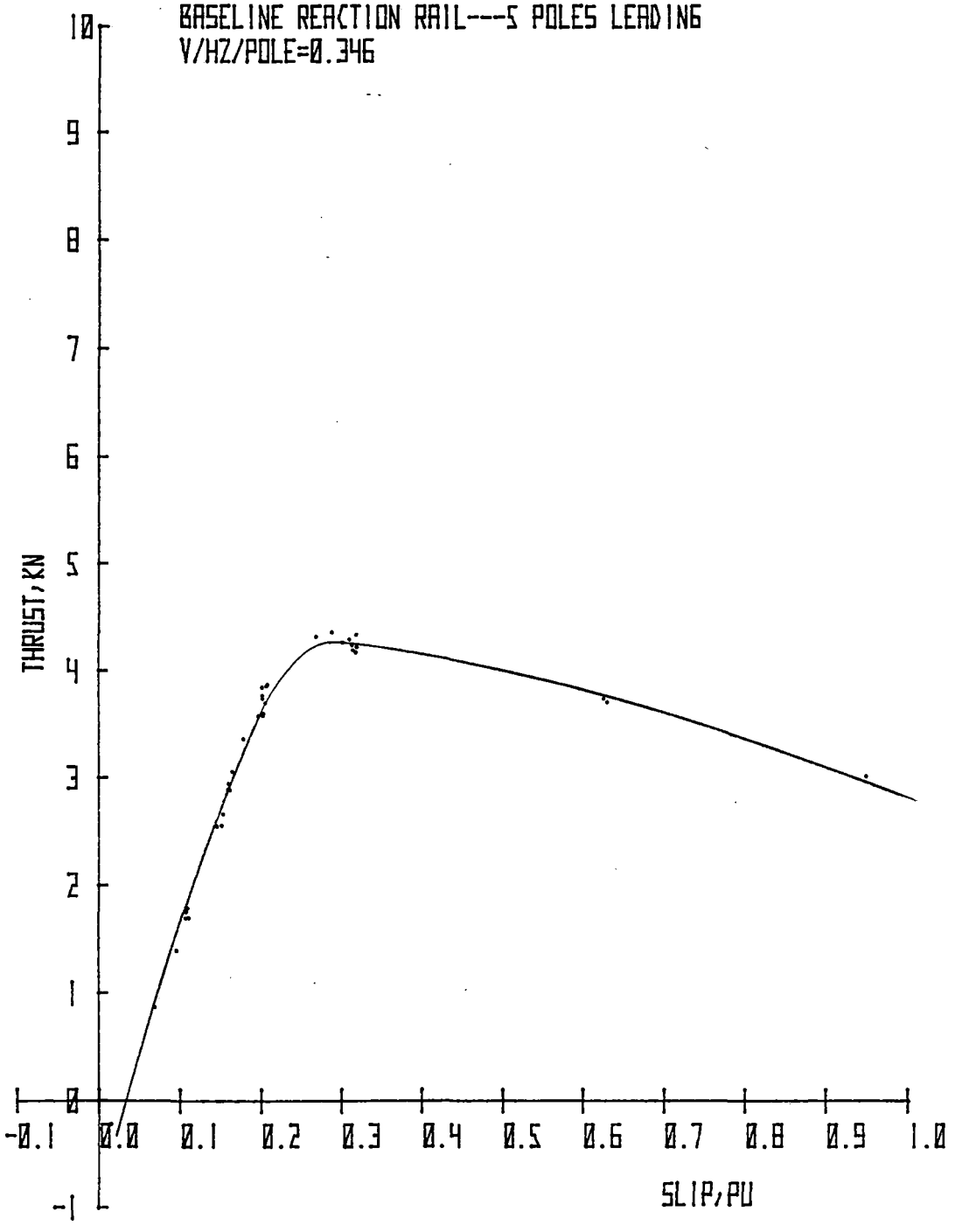
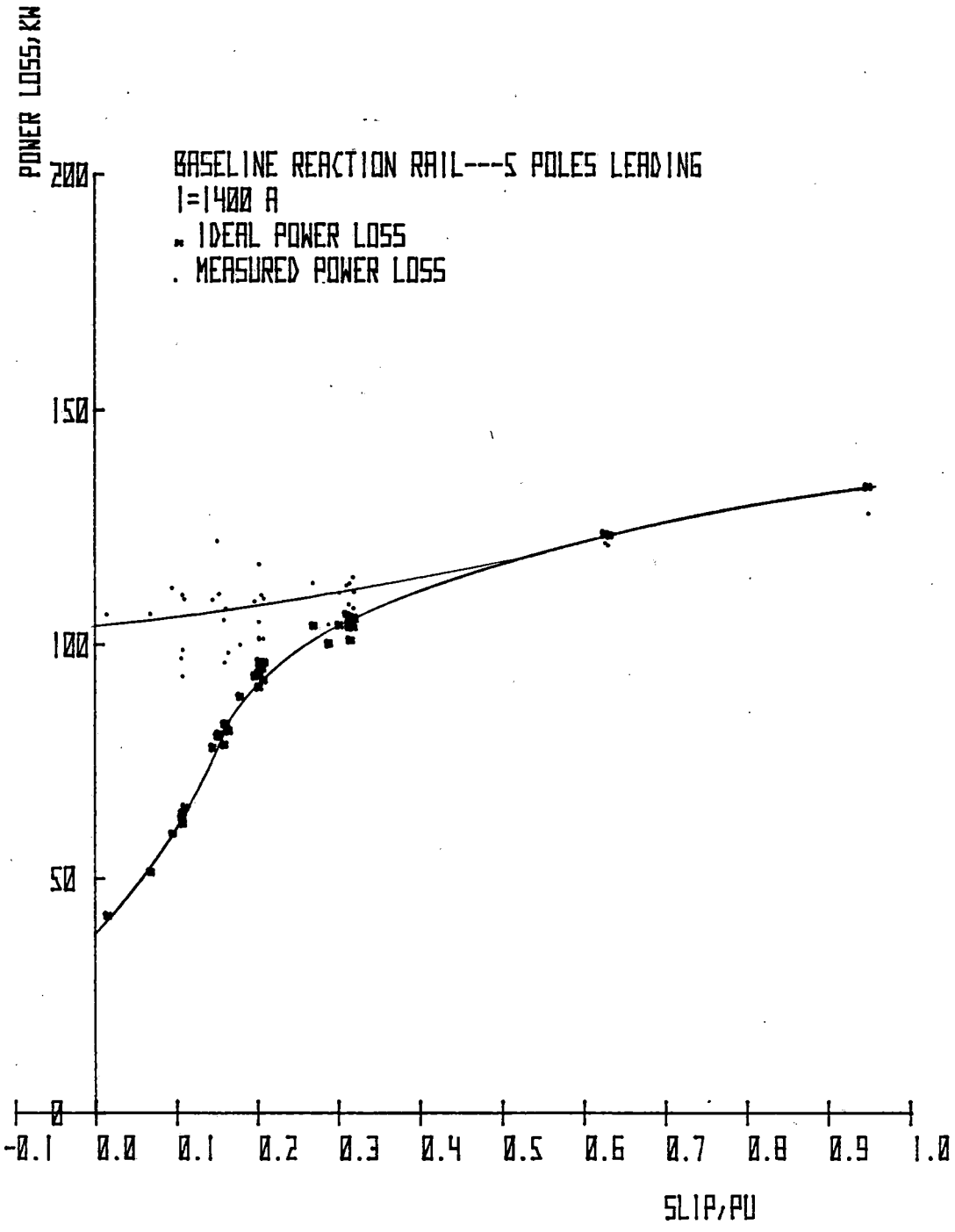

BASELINE REACTION RAIL---5 POLES LEADING
V/HZ/POLE=0.346
2.5
2.0
1.5
1.0
0.5
0.0
IMAGINARY CURRENT,KA
0.0
0.5
1.0
1.5
2.0
2.5
REAL CURRENT,KA
LIM CURRENT LOCUS

Figure 3-59



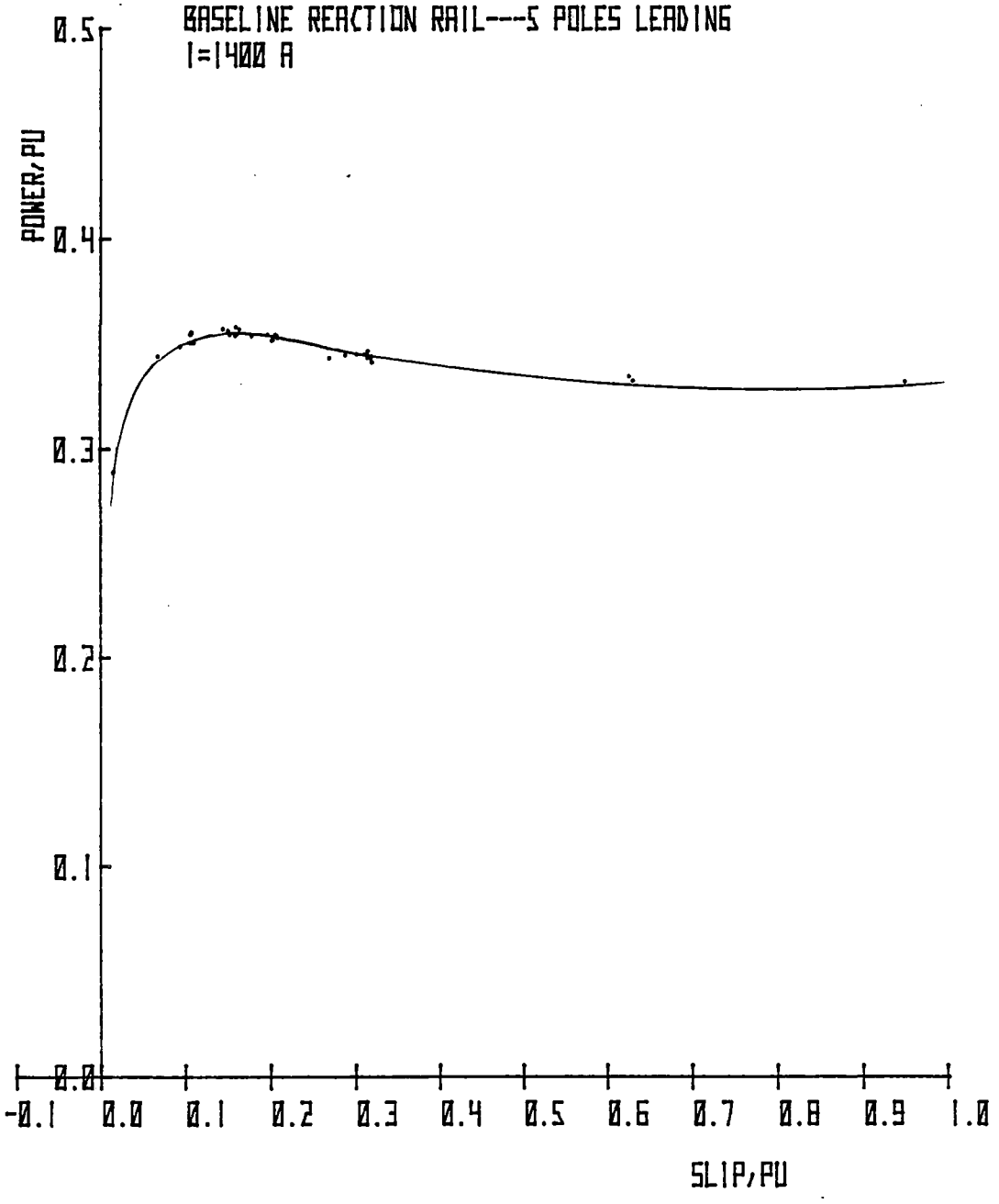
THRUST VS SLIP

Figure 3-60



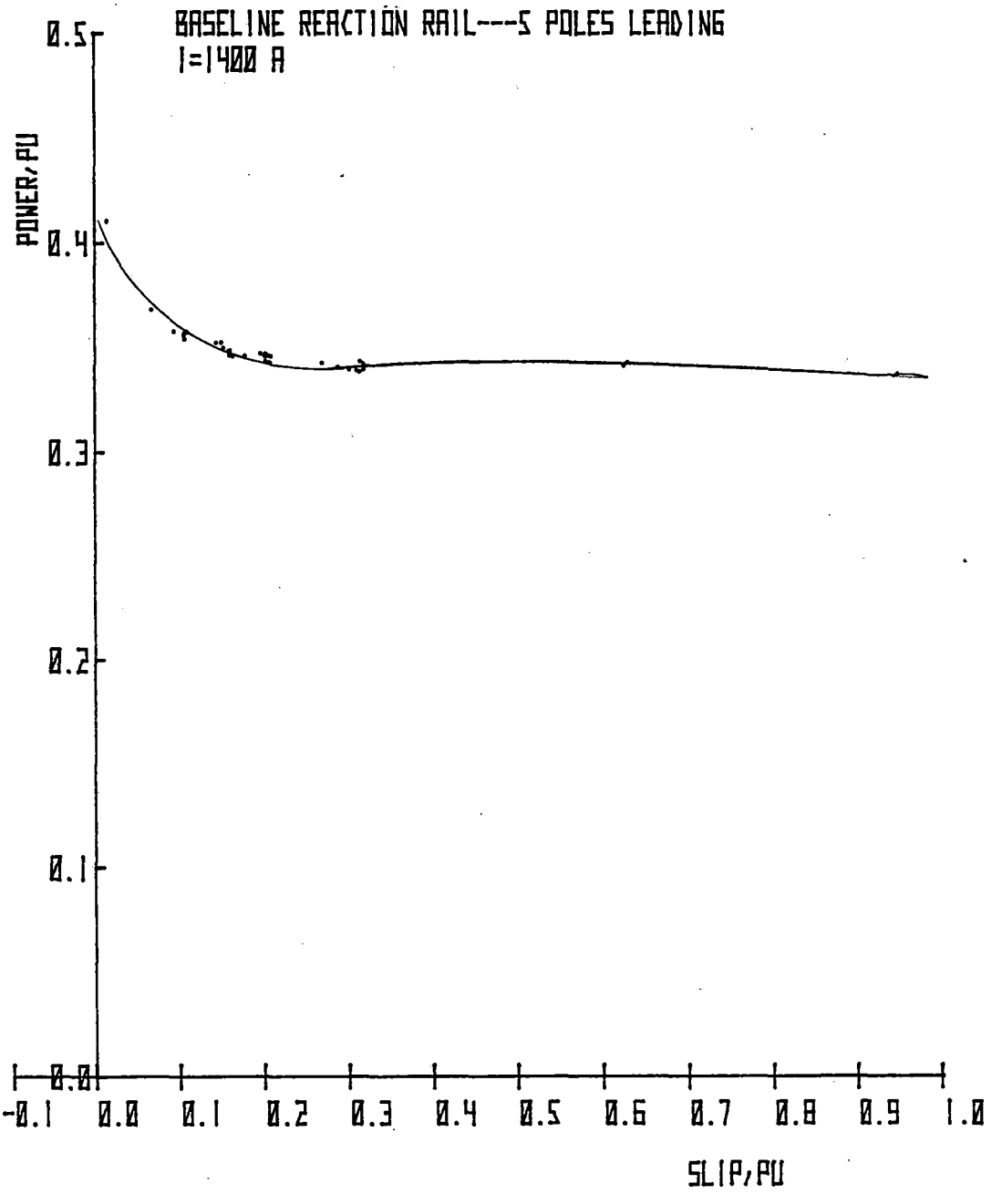
IDEAL & MEASURED POWER LOSS VS SLIP

Figure 3-61



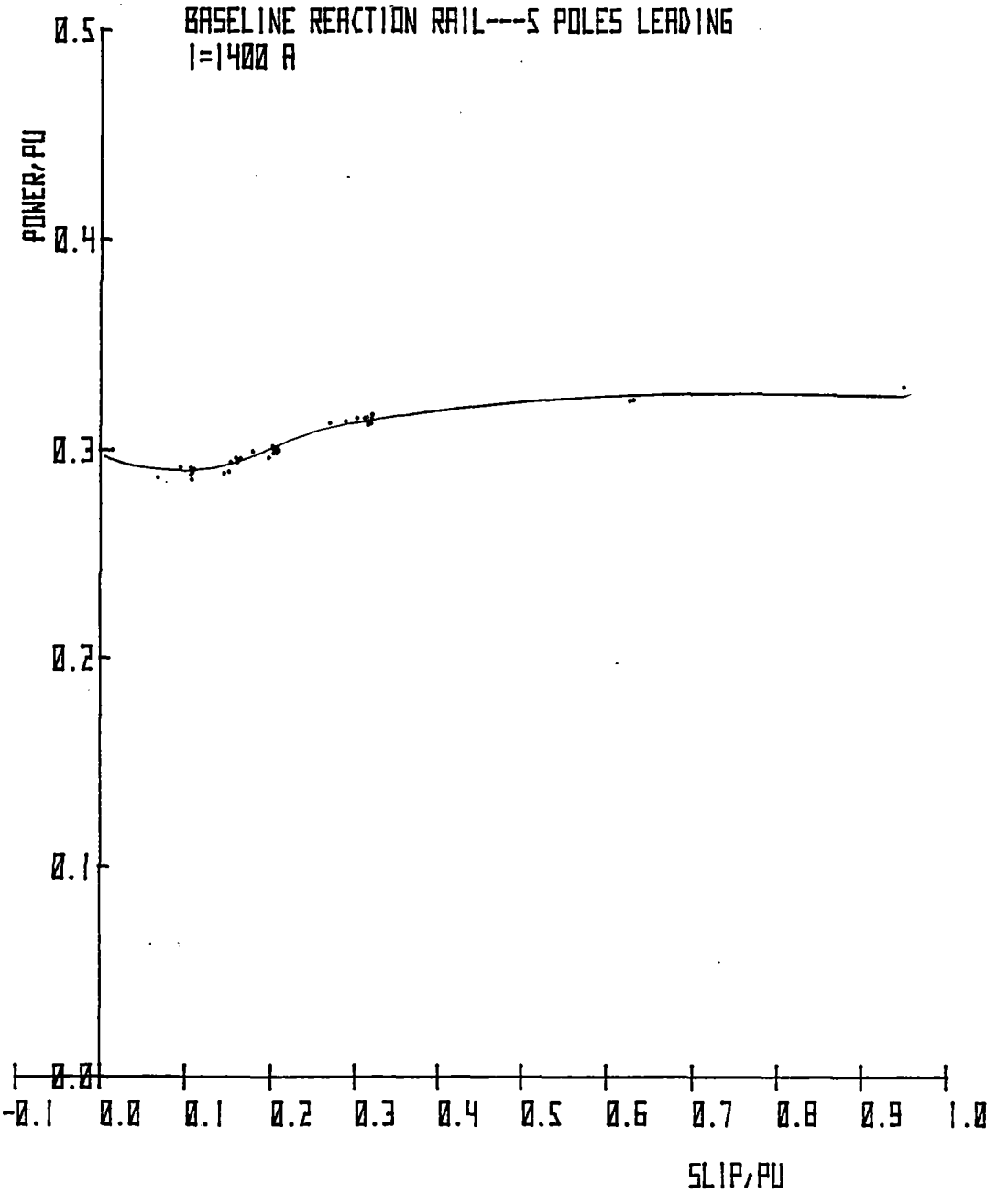
A PHASE POWER VS SLIP

Figure 3-62



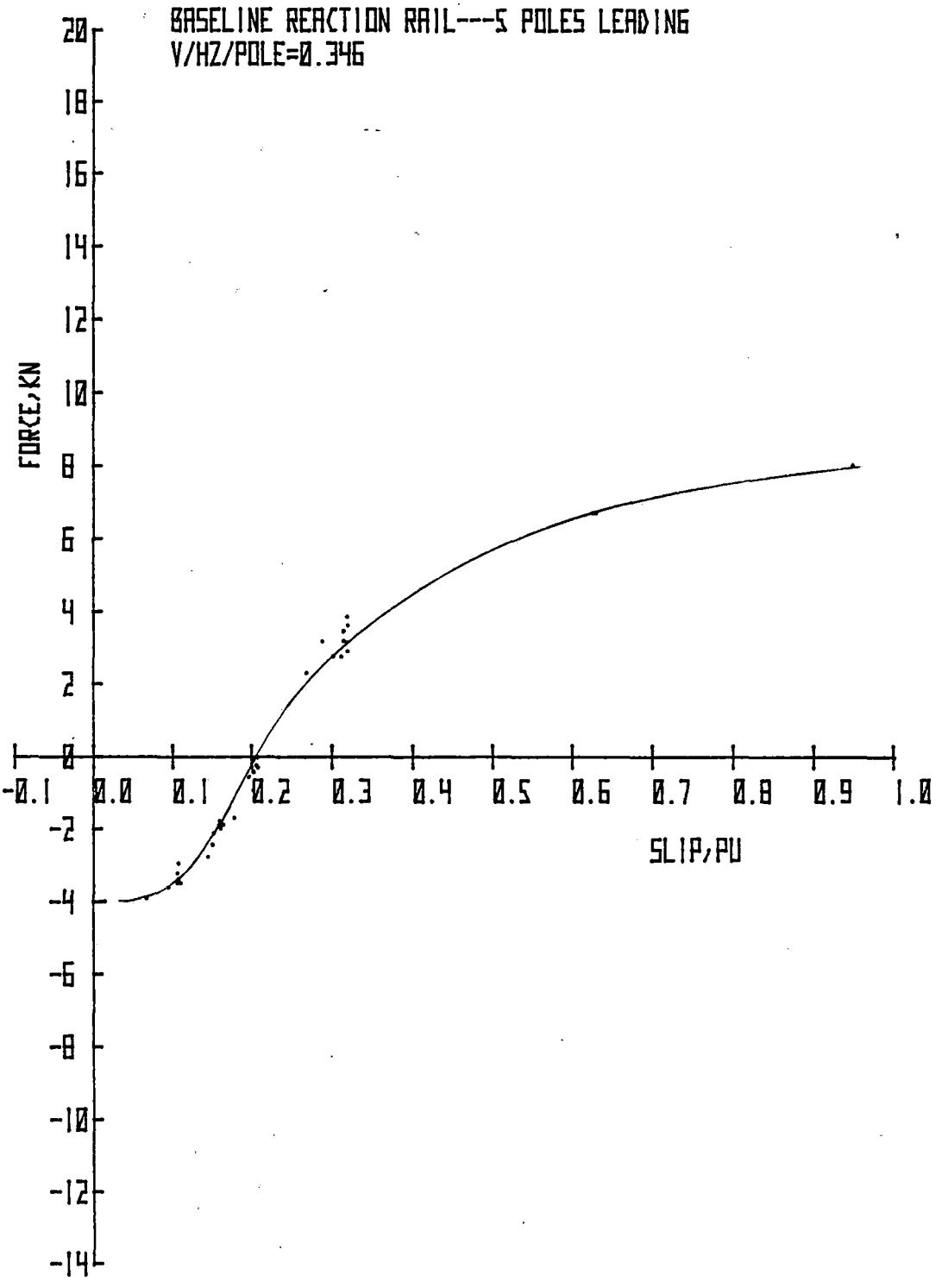
B PHASE POWER VS SLIP

Figure 3-63



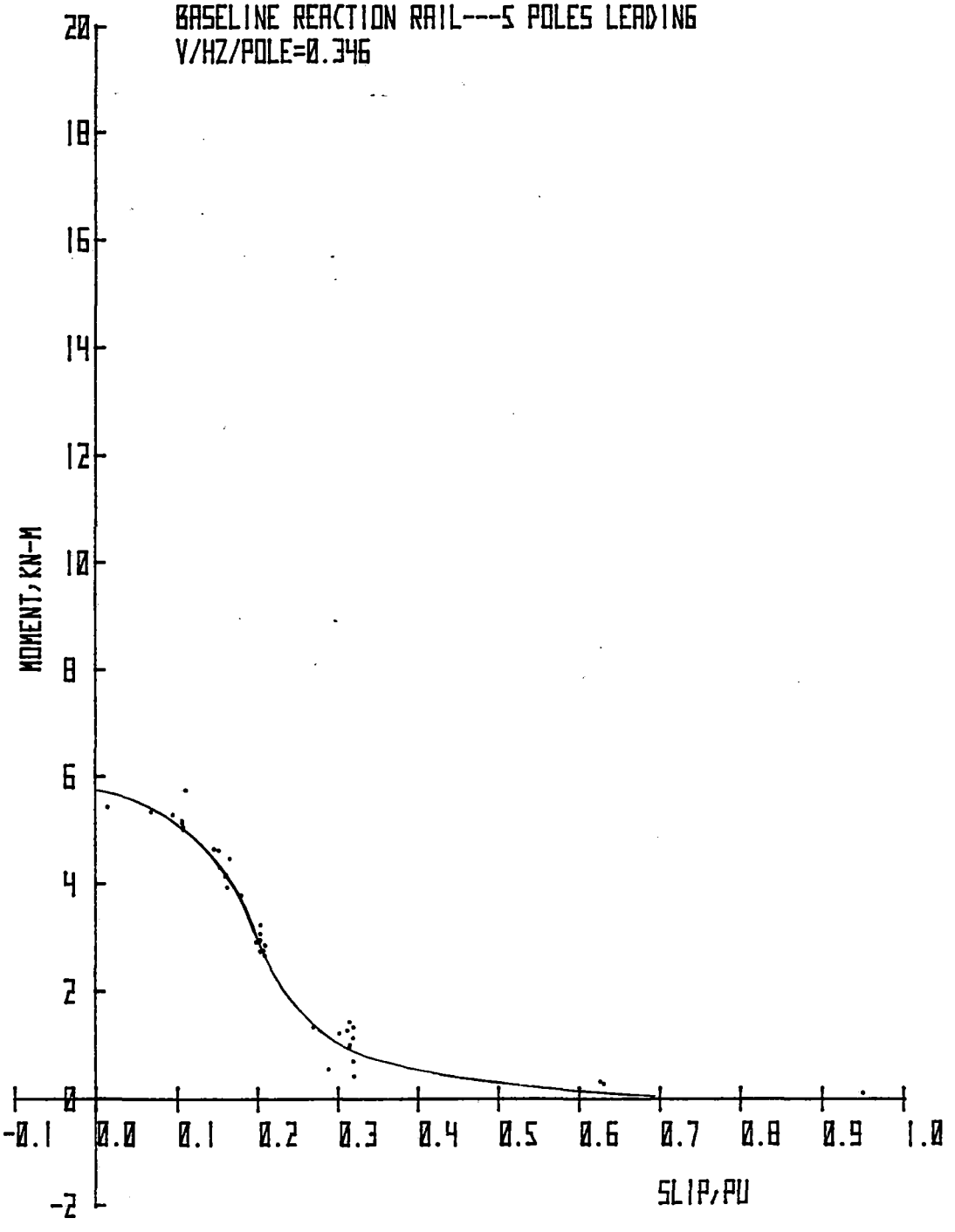
C PHASE POWER VS SLIP

Figure 3-64



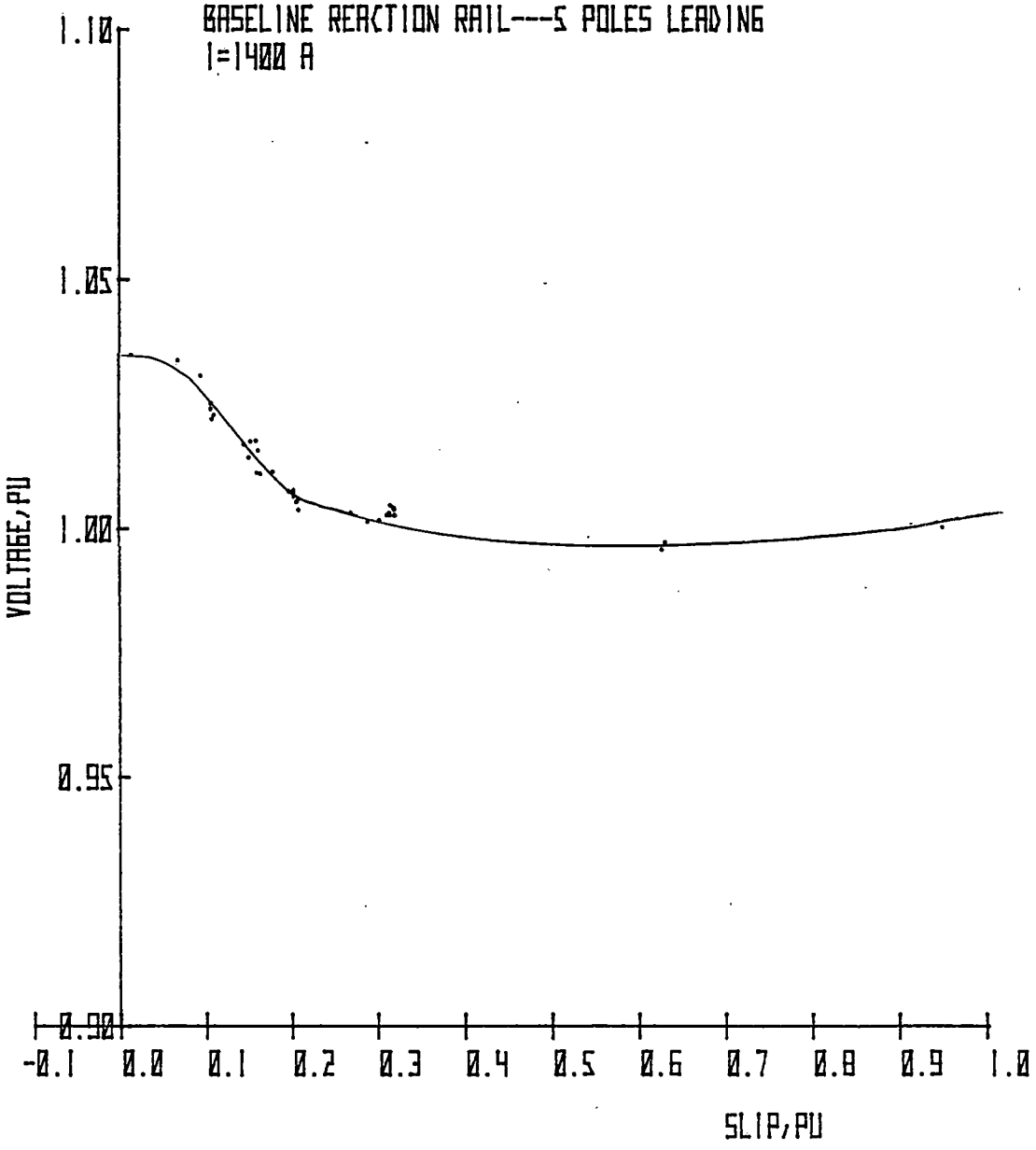
TOTAL VERTICAL FORCE VS SLIP

Figure 3-65



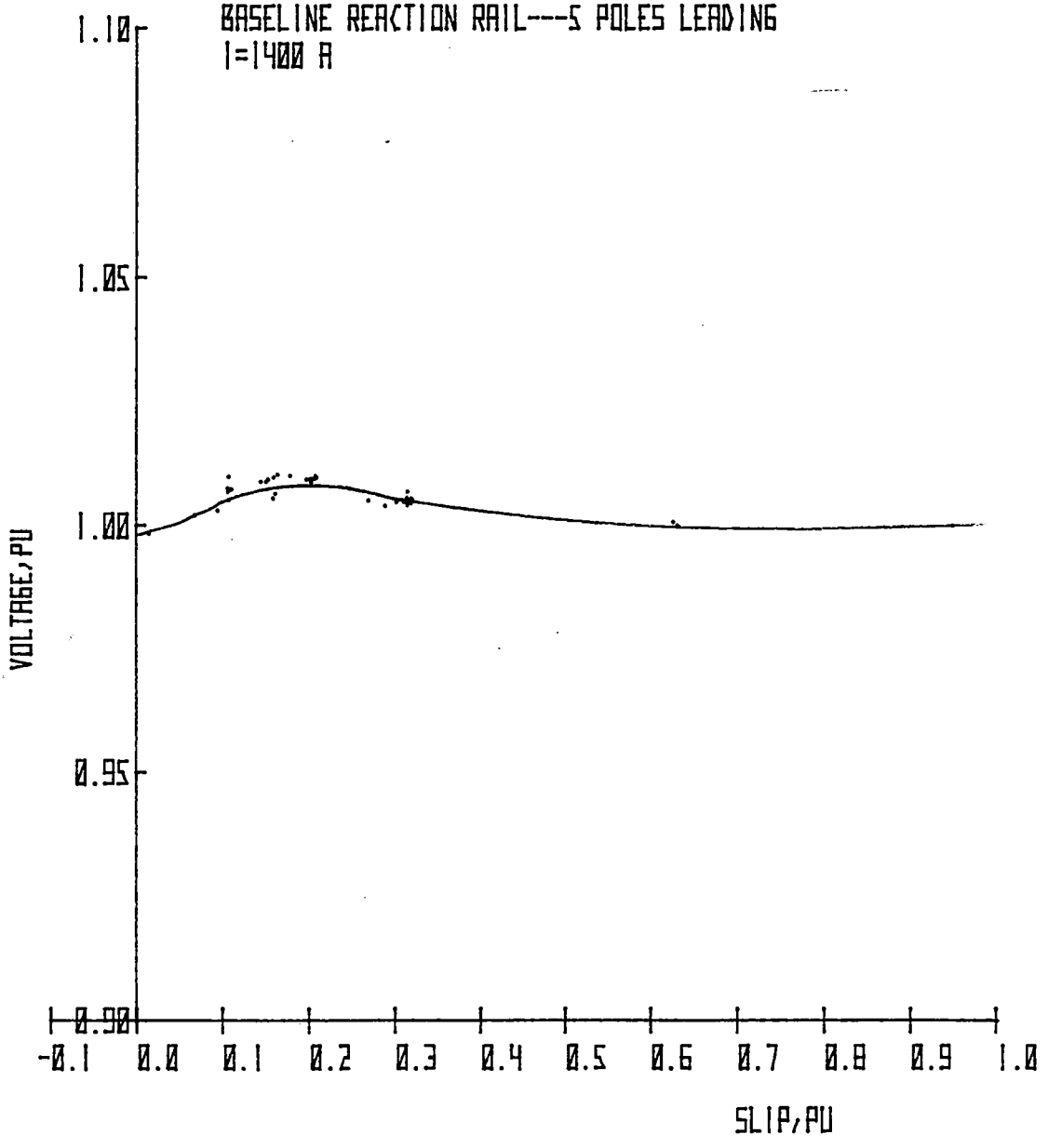
PITCHING MOMENT VS SLIP

Figure 3-66



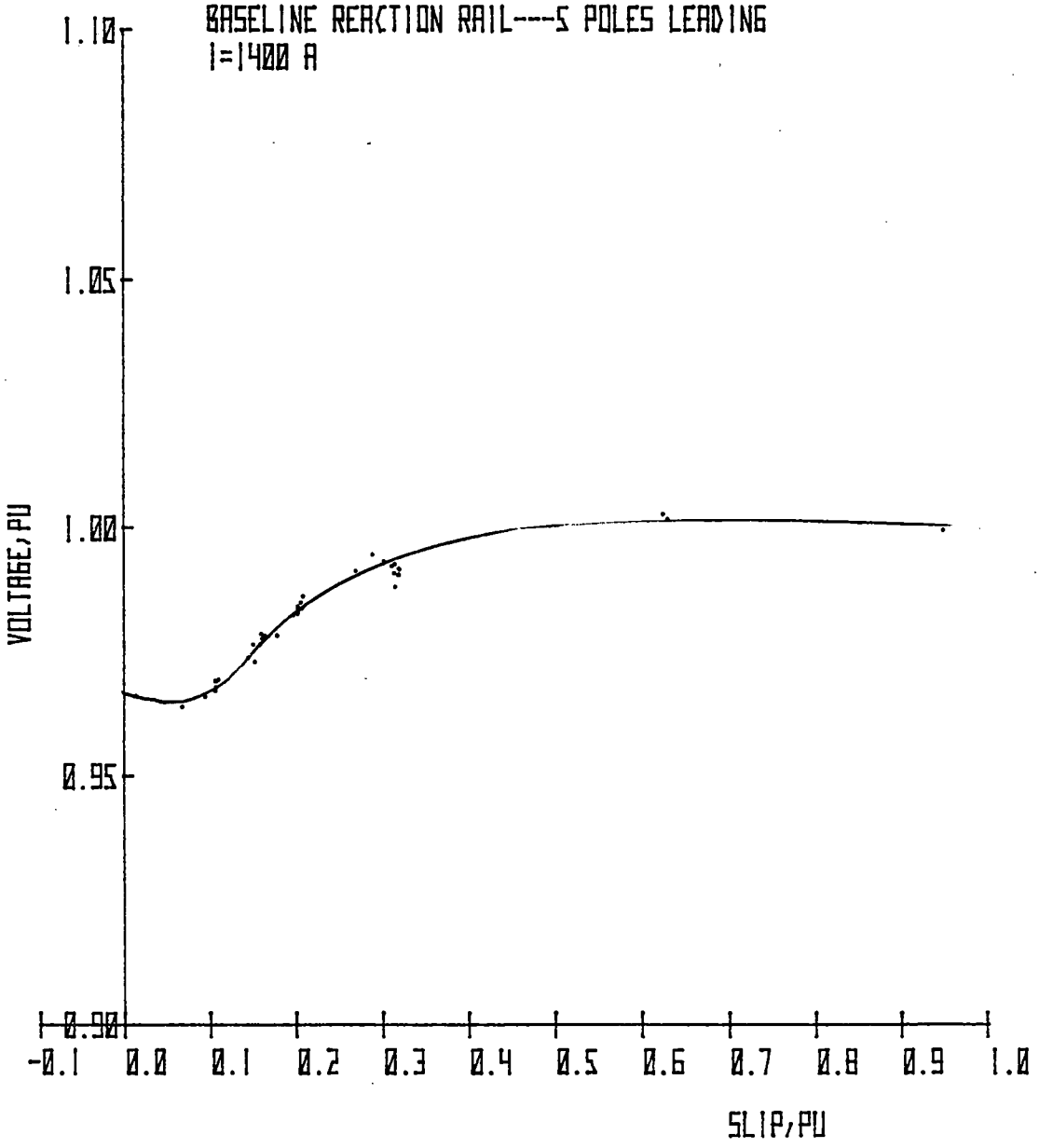
A PHASE VOLTAGE VS SLIP

Figure 3-67



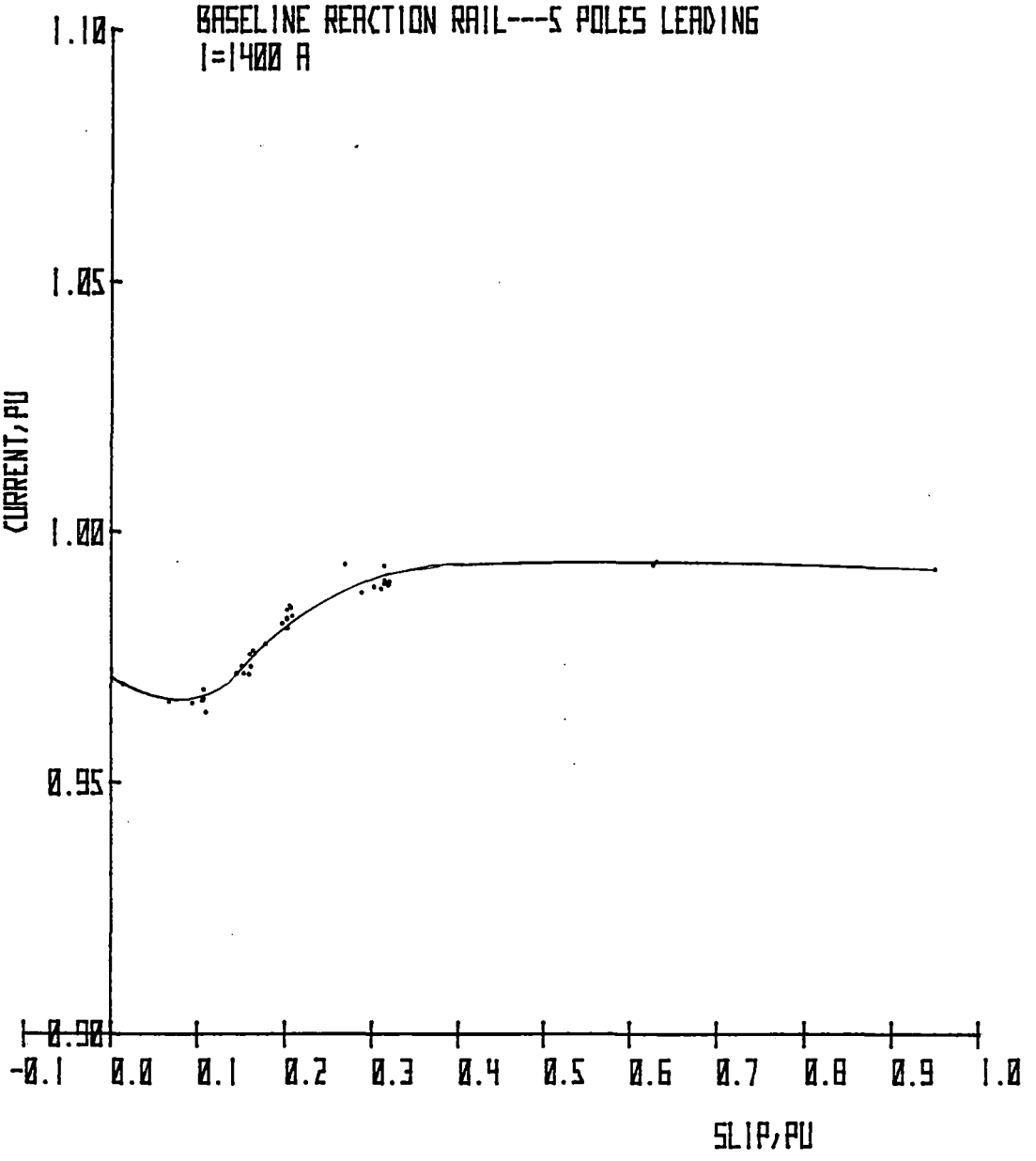
B PHASE VOLTAGE VS SLIP

Figure 3-68



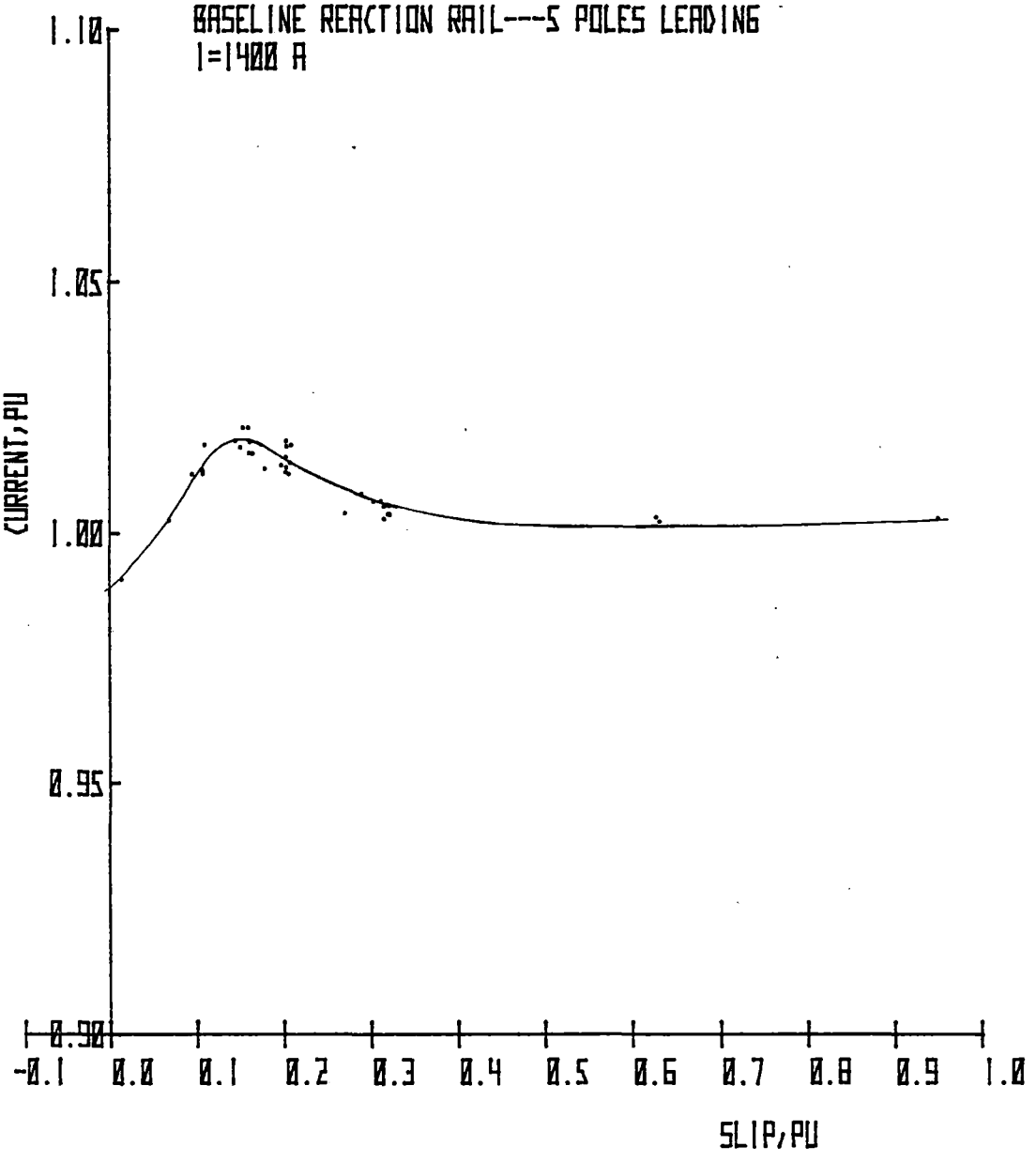
C PHASE VOLTAGE VS SLIP

Figure 3-69



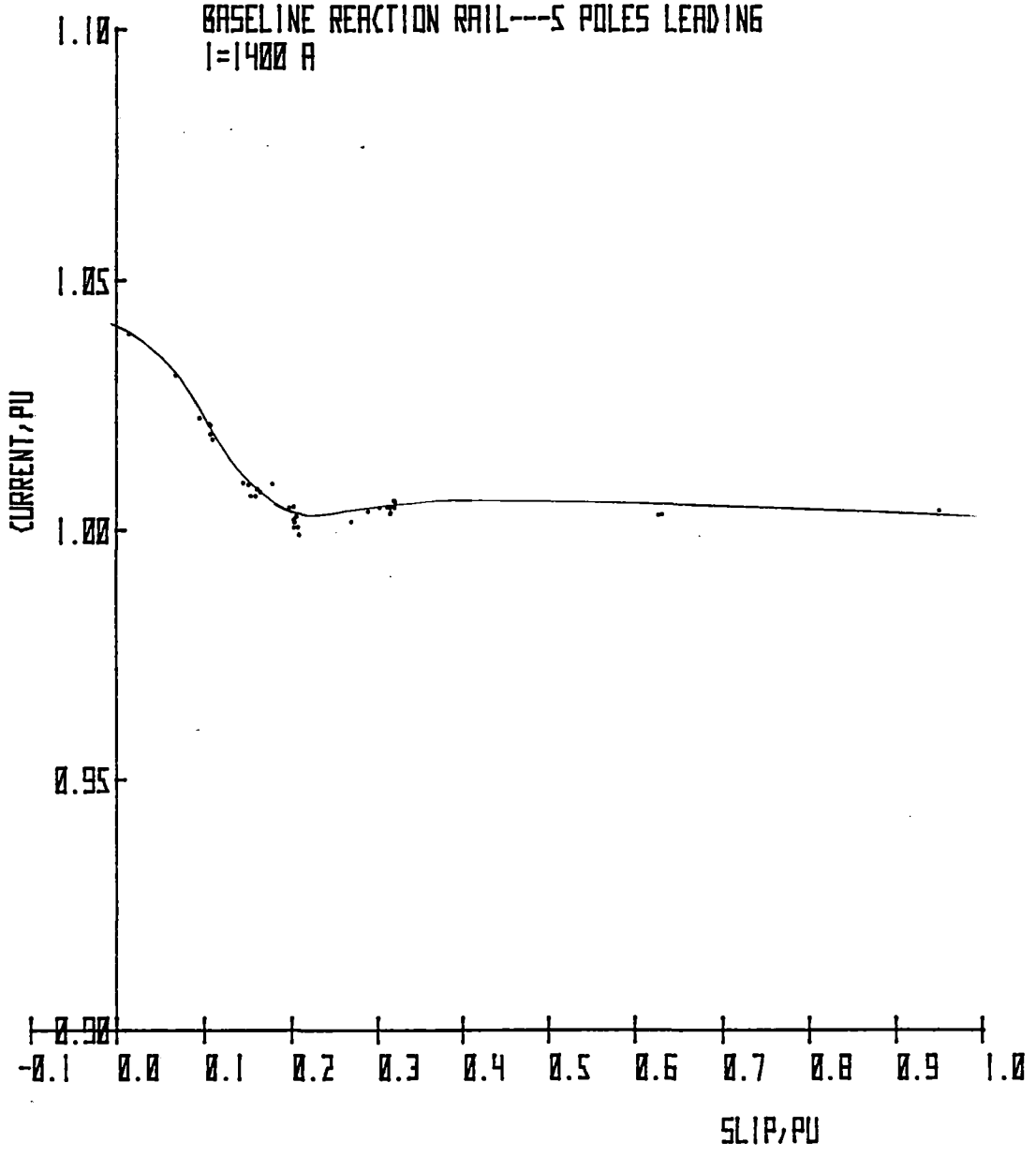
A PHASE CURRENT VS SLIP

Figure 3-70



B PHASE CURRENT VS SLIP

Figure 3-71



C PHASE CURRENT VS SLIP

Figure 3-72

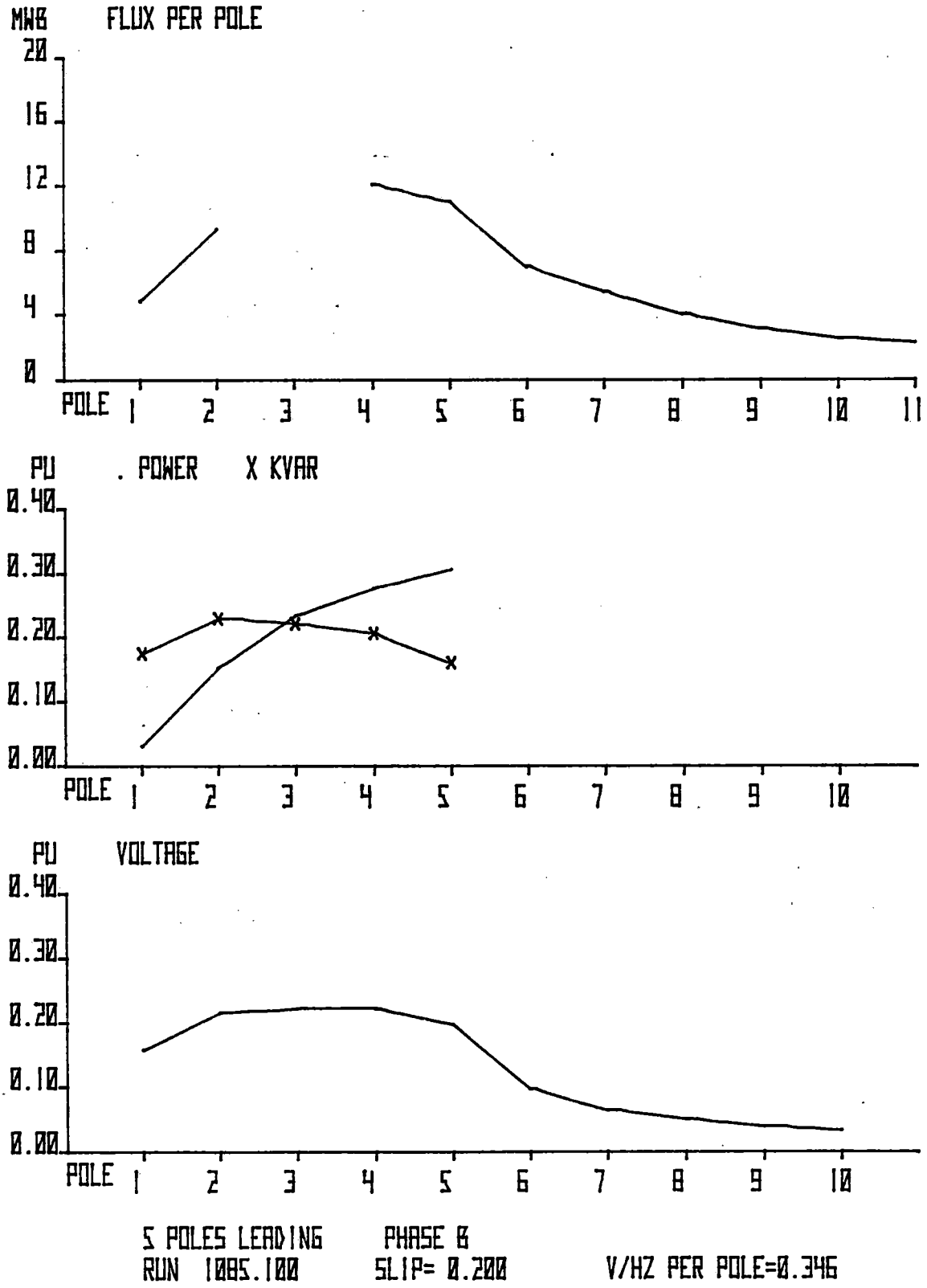

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1085.100 SLIP= 0.200 V/HZ PER POLE=0.346

Figure 3-73

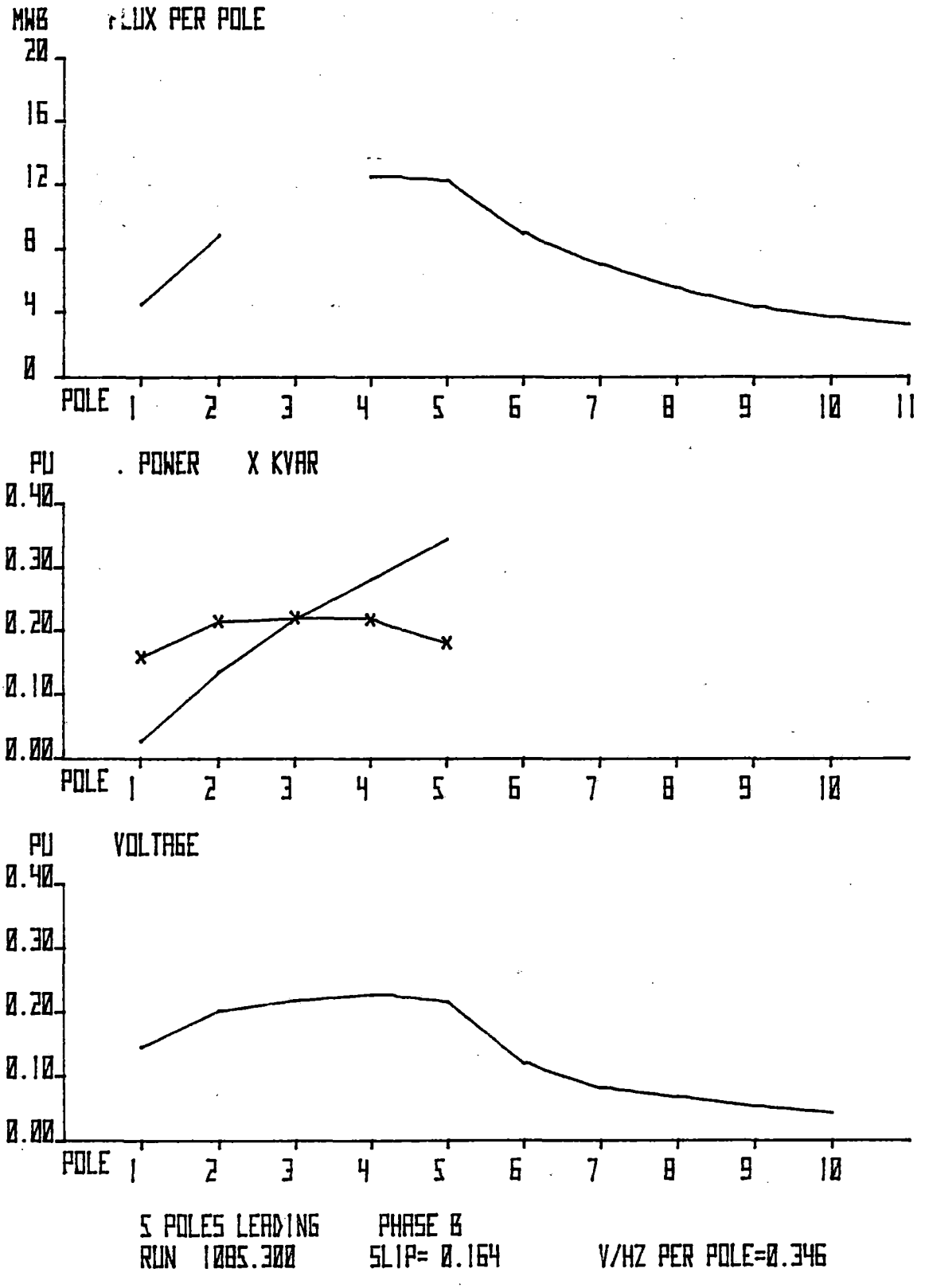

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1085.300 SLIP= 0.164 V/HZ PER POLE=0.346

Figure 3-74

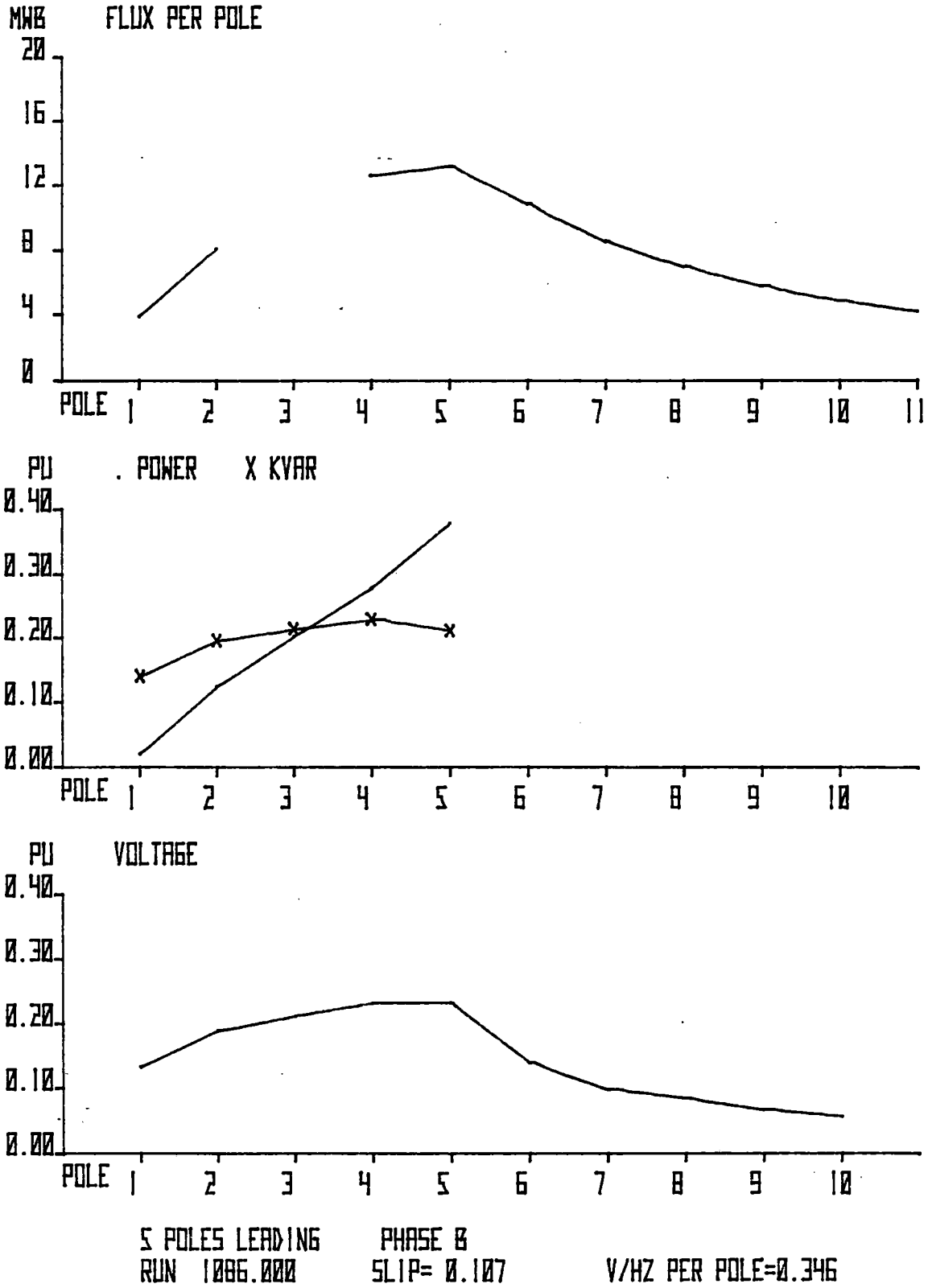

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1086.000 SLIP= 0.107 V/HZ PER POLE=0.346

Figure 3-75

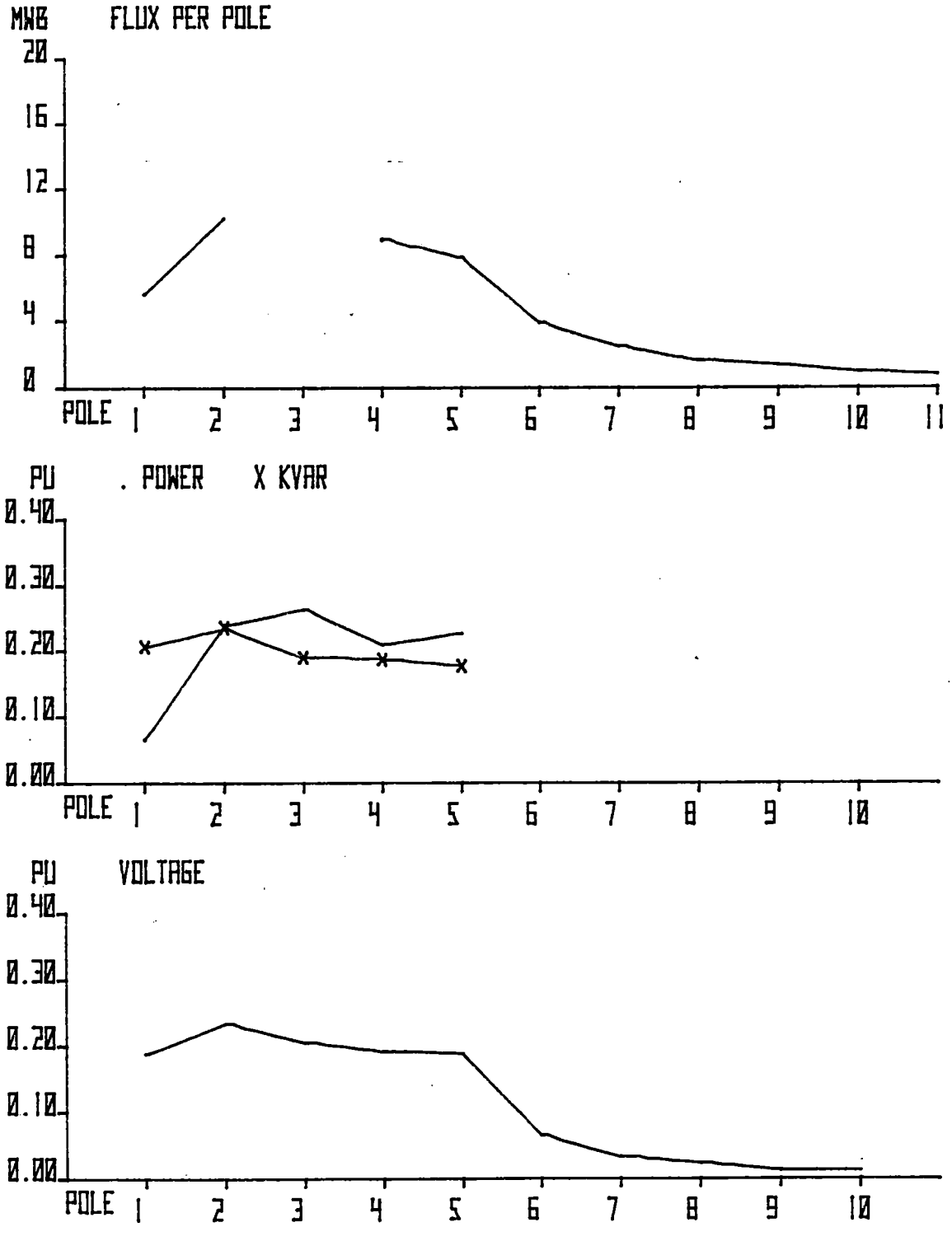

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1087.100 SLIP= 0.318 V/HZ PER POLE=0.346

Figure 3-76

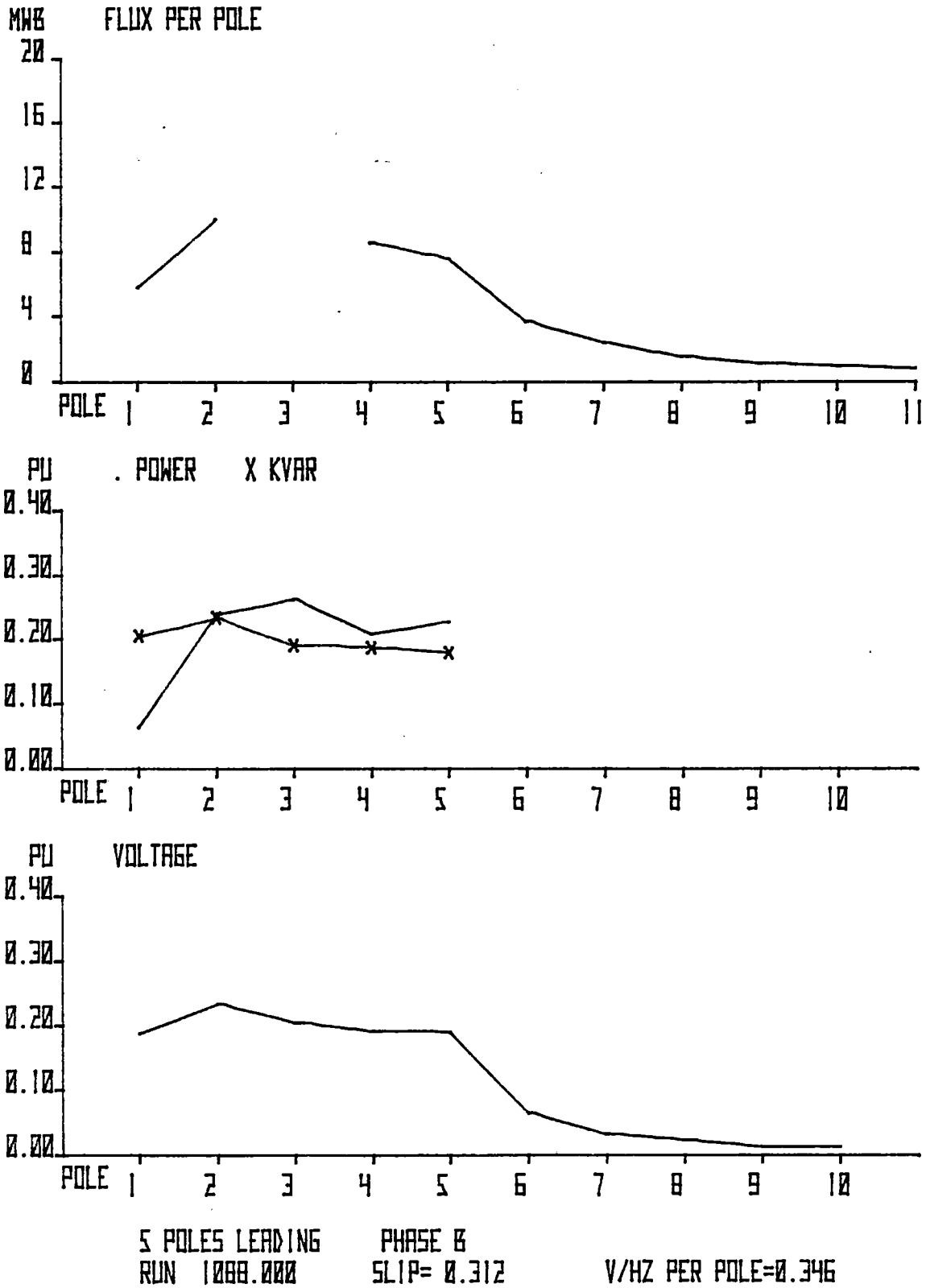

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1088.000 SLIP= 0.312 V/HZ PER POLE=0.346

Figure 3-77

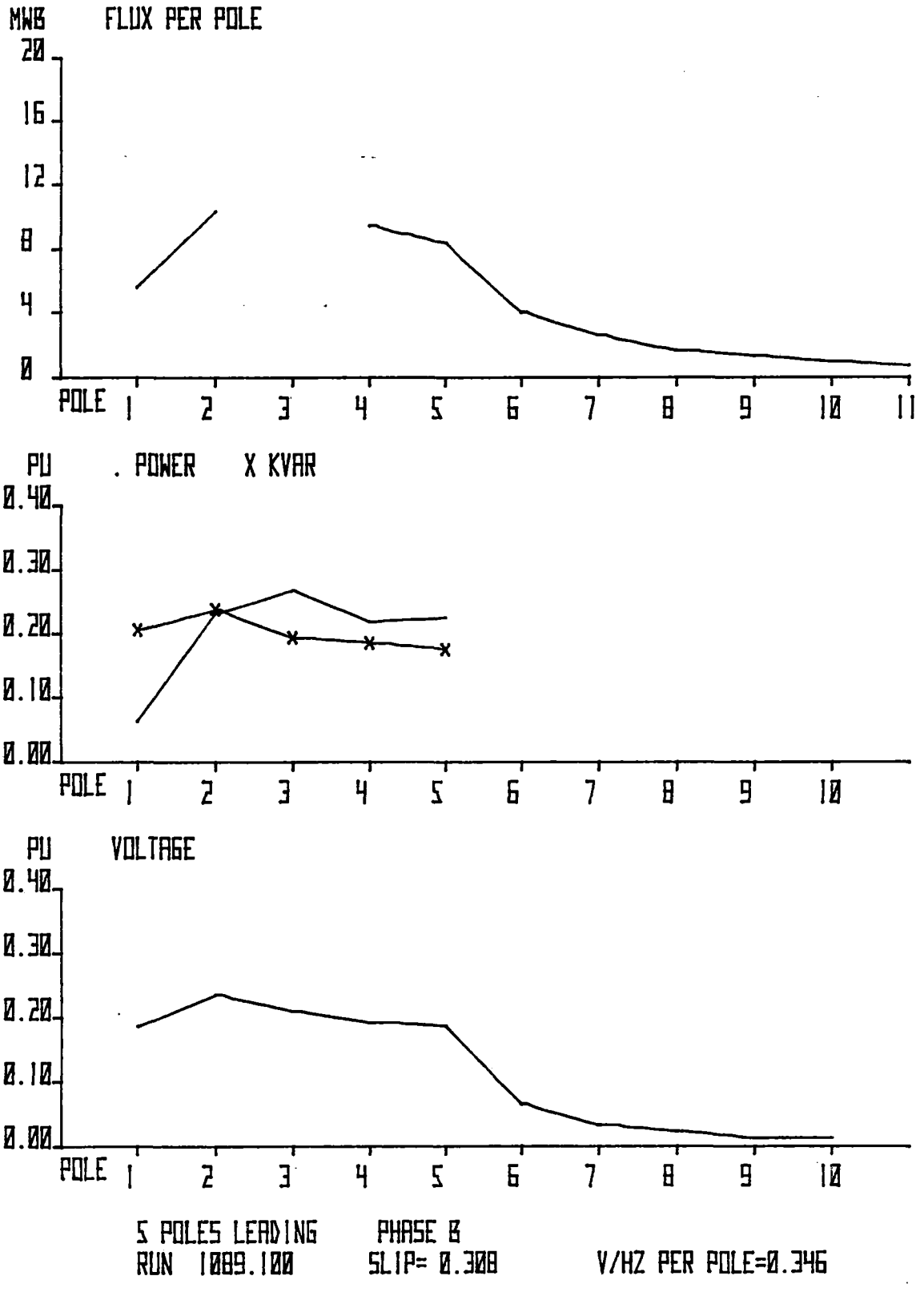

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1089.100 SLIP= 0.308 V/HZ PER POLE=0.346

Figure 3-78

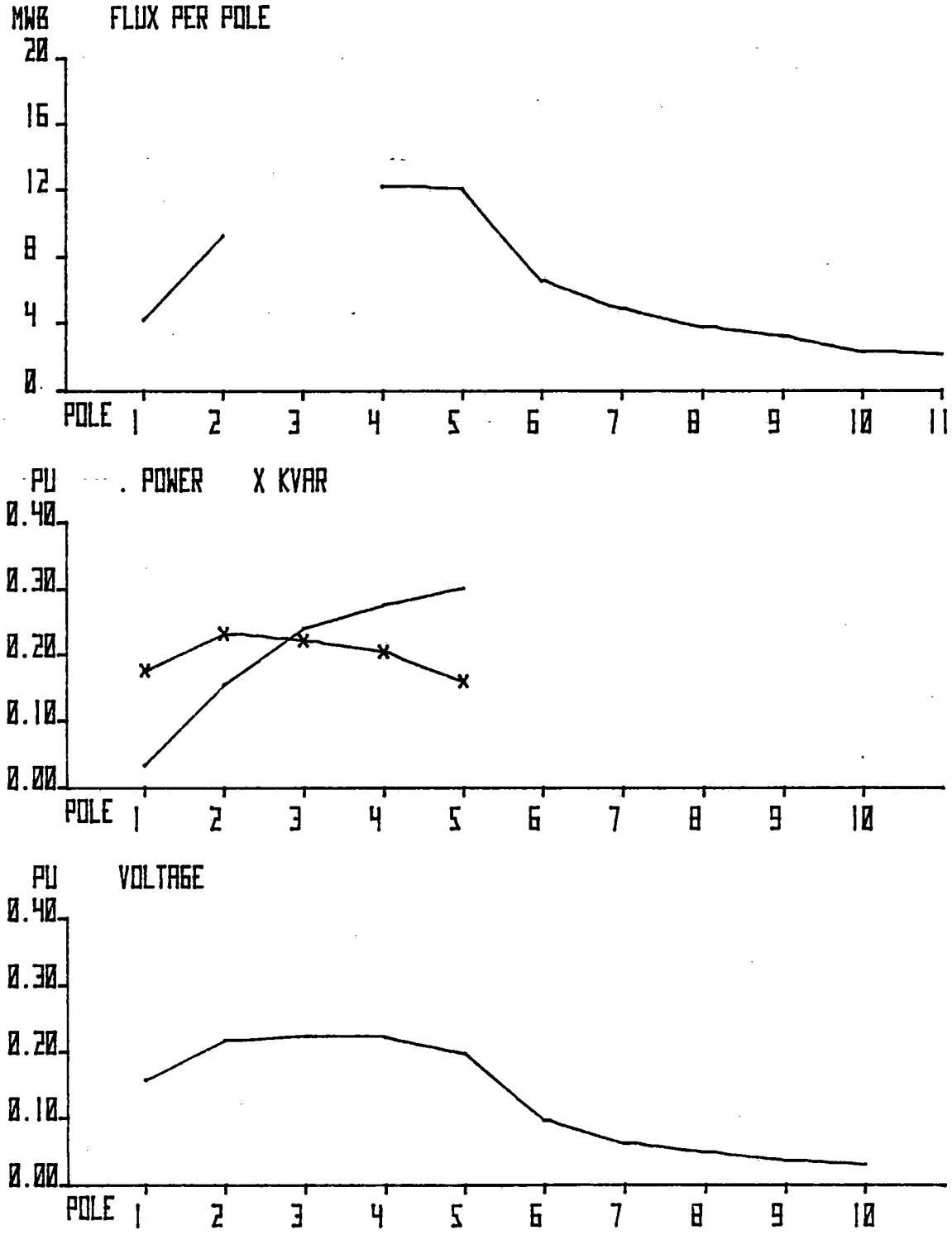

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1090.300 SLIP= 0.204 V/HZ PER POLE=0.346

Figure 3-79

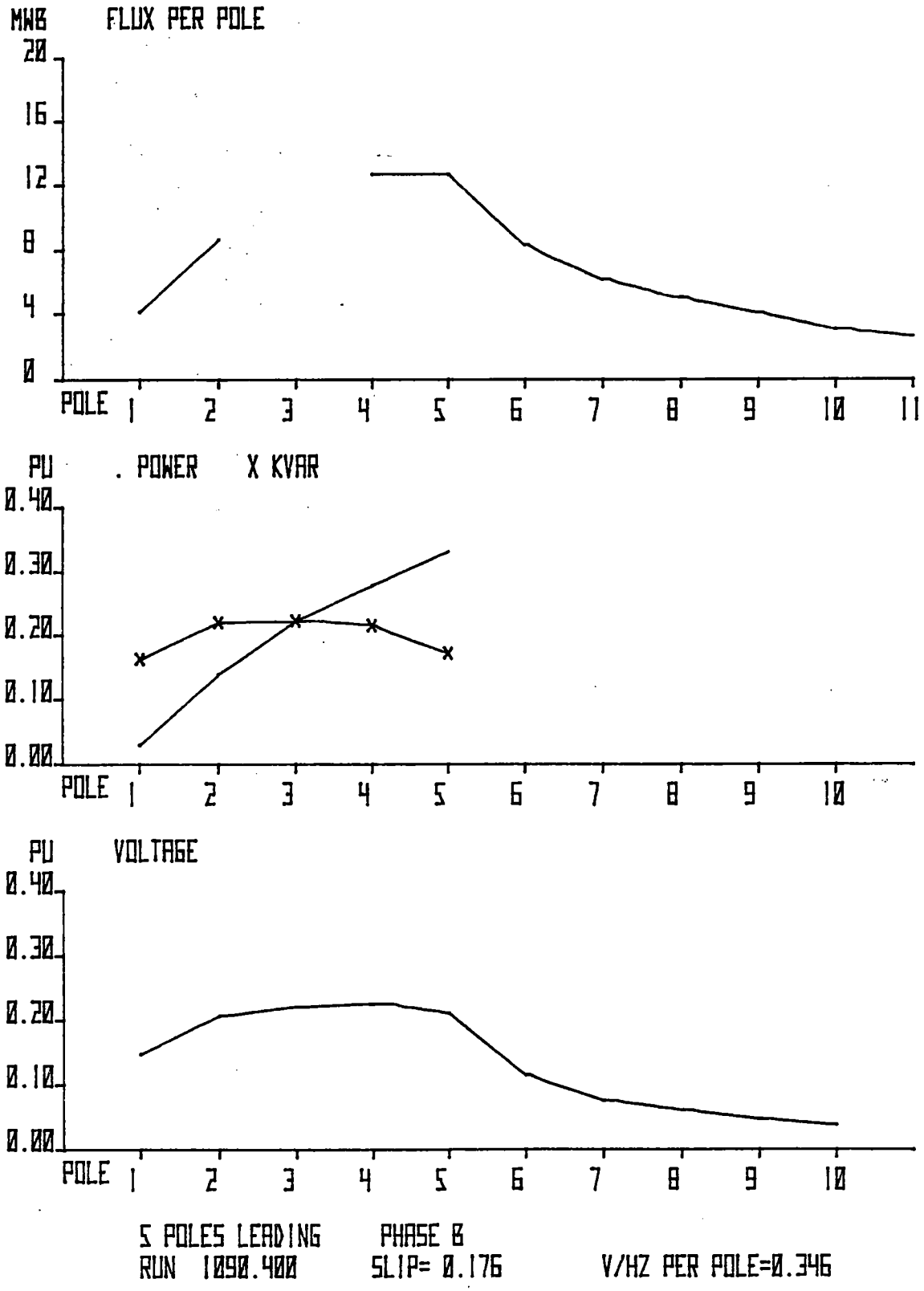

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1090.400 SLIP= 0.176 V/HZ PER POLE=0.346

Figure 3-80

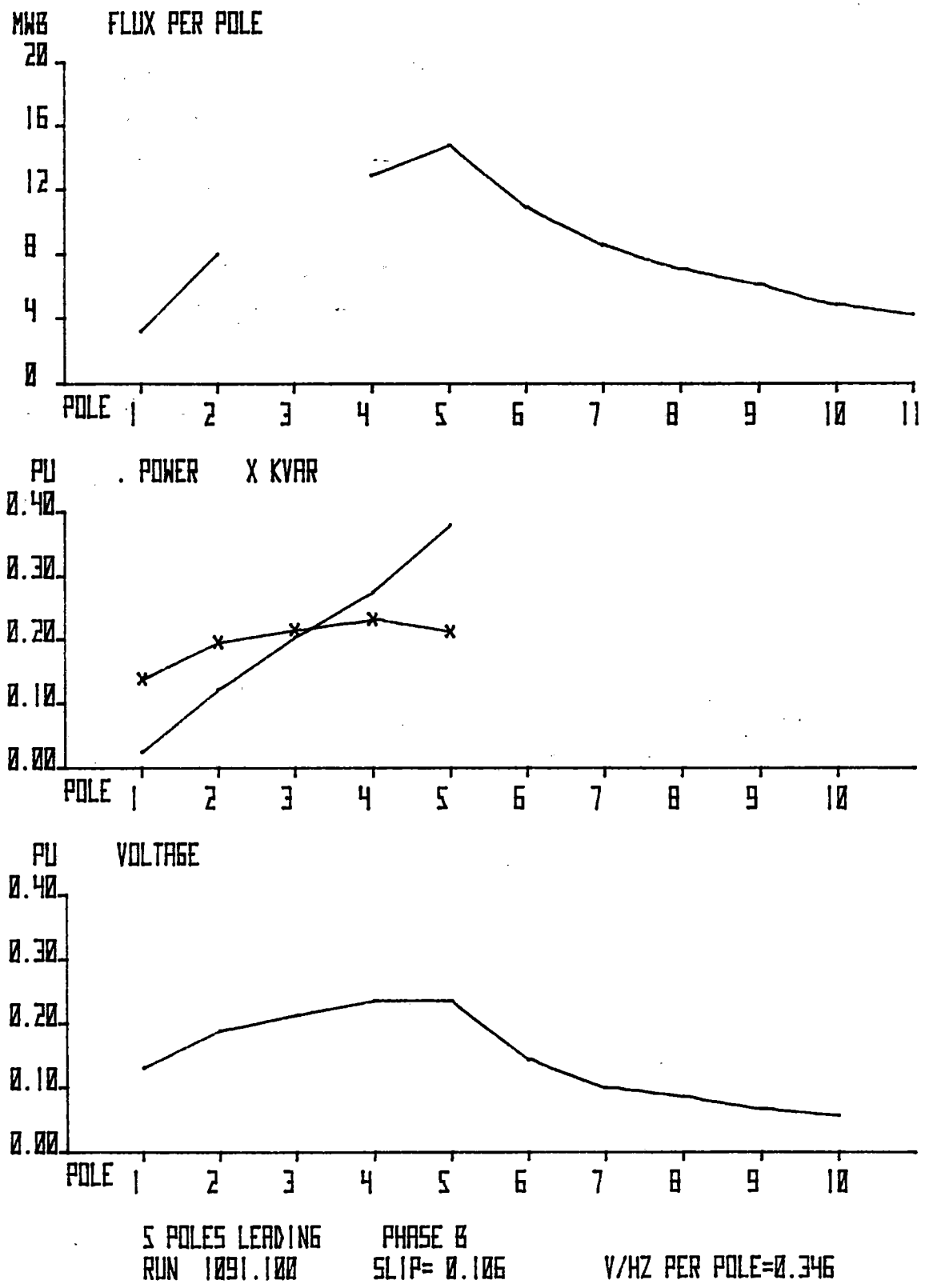

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1091.100 SLIP= 0.106 V/HZ PER POLE=0.346

Figure 3-81

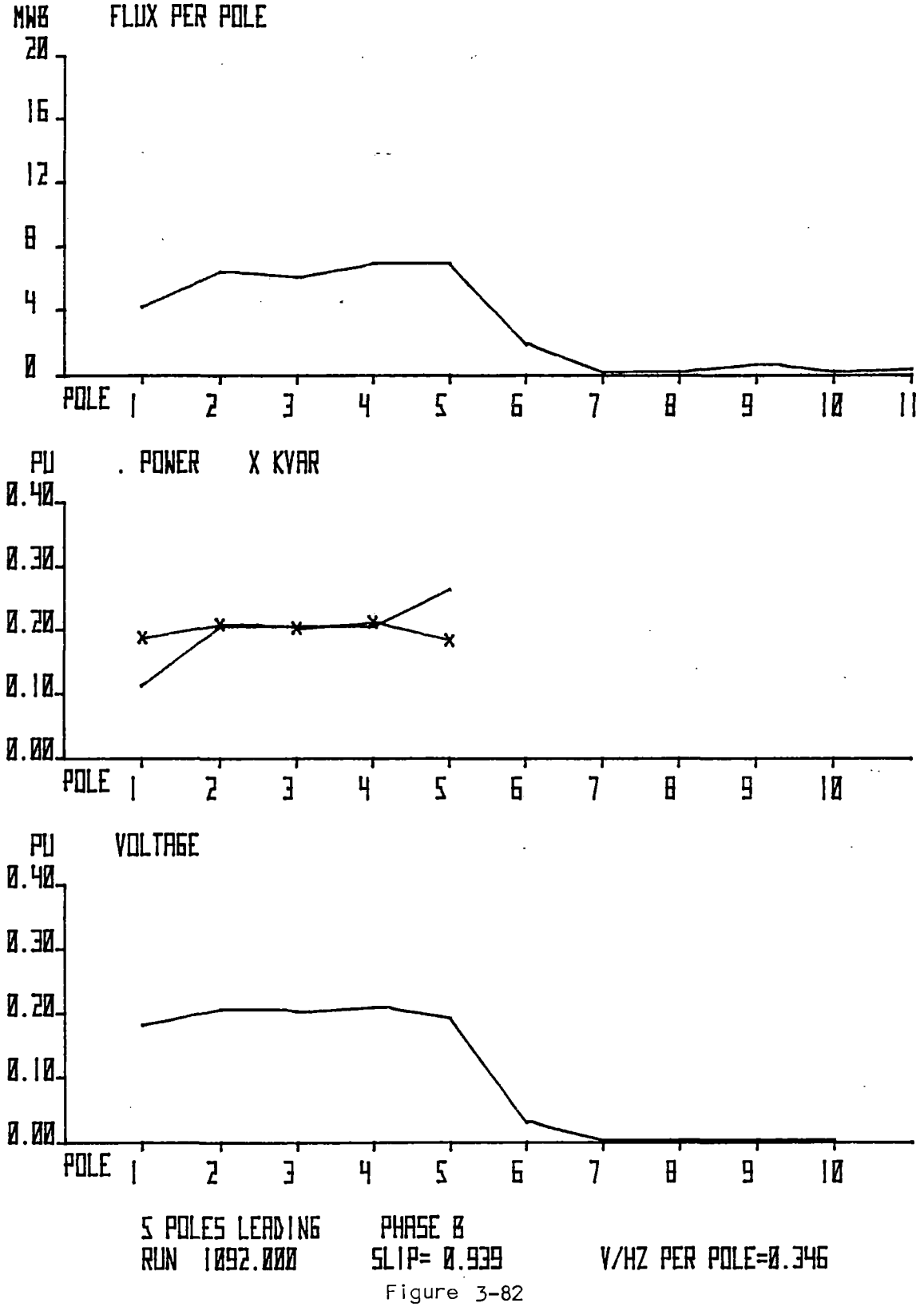

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1092.000 SLIP= 0.939 V/HZ PER POLE=0.346

Figure 3-82

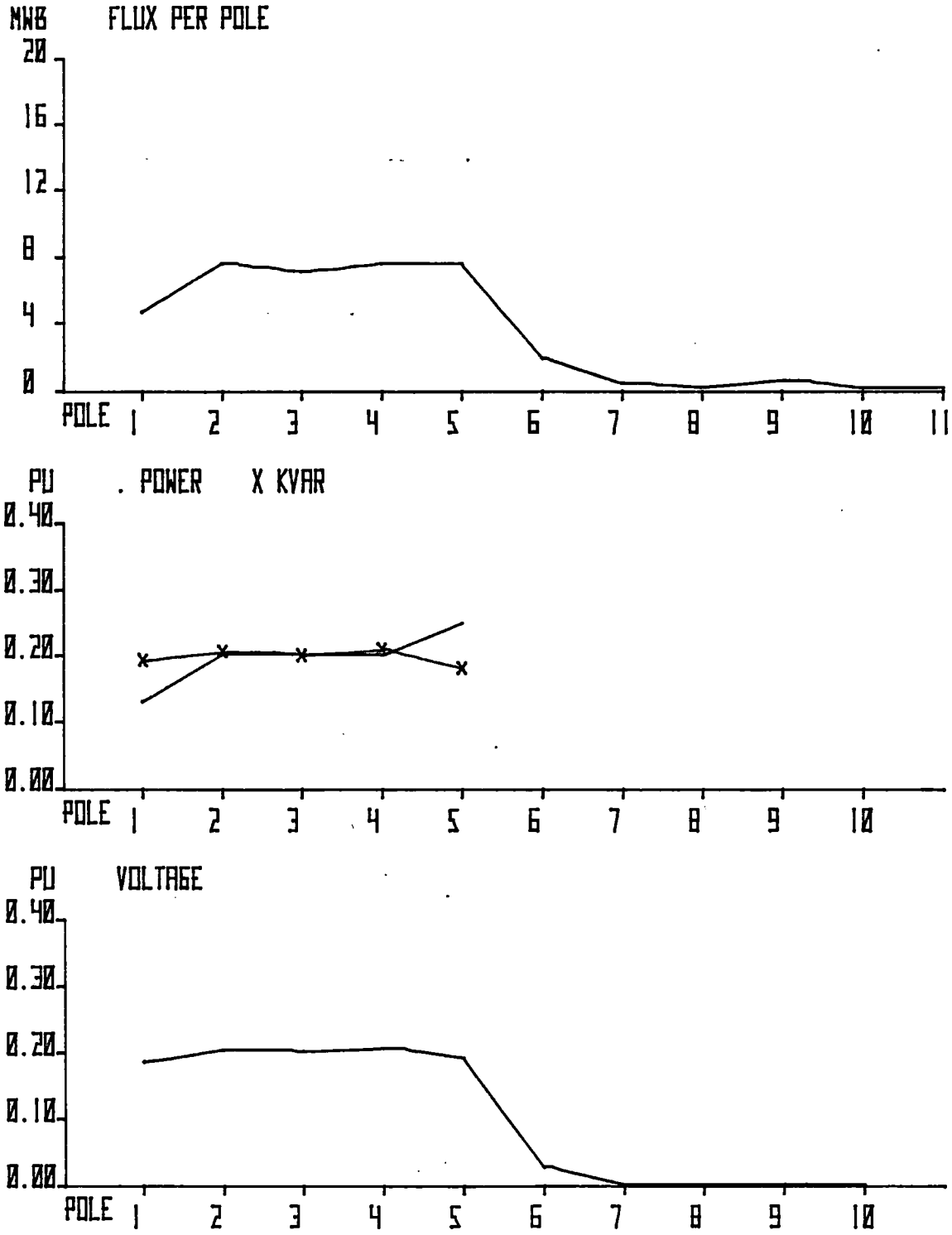

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1093.100 SLIP= 0.625 V/HZ PER POLE=0.346

Figure 3-83

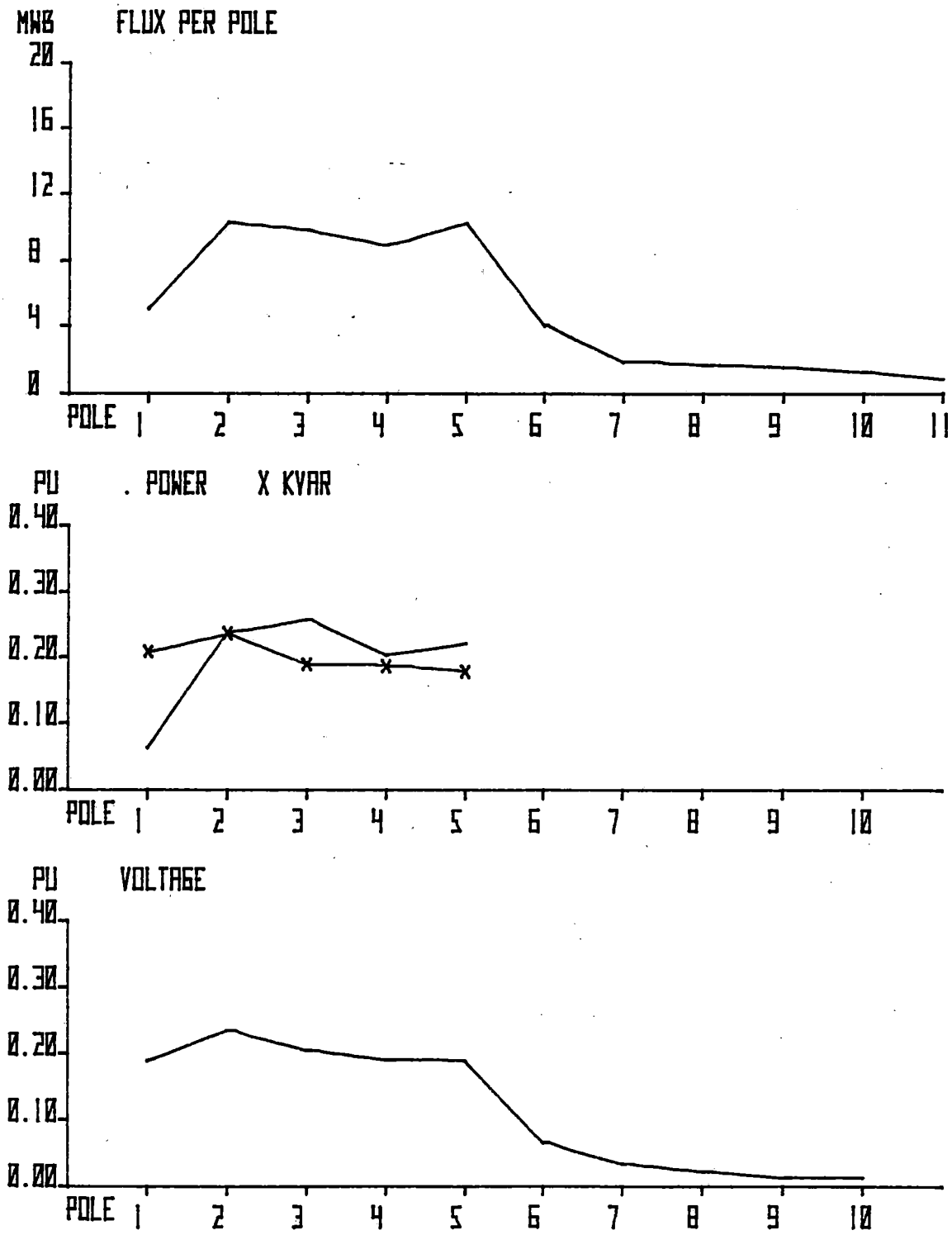

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1094.100 SLIP= 0.316 V/HZ PER POLE=0.346

Figure 3-84

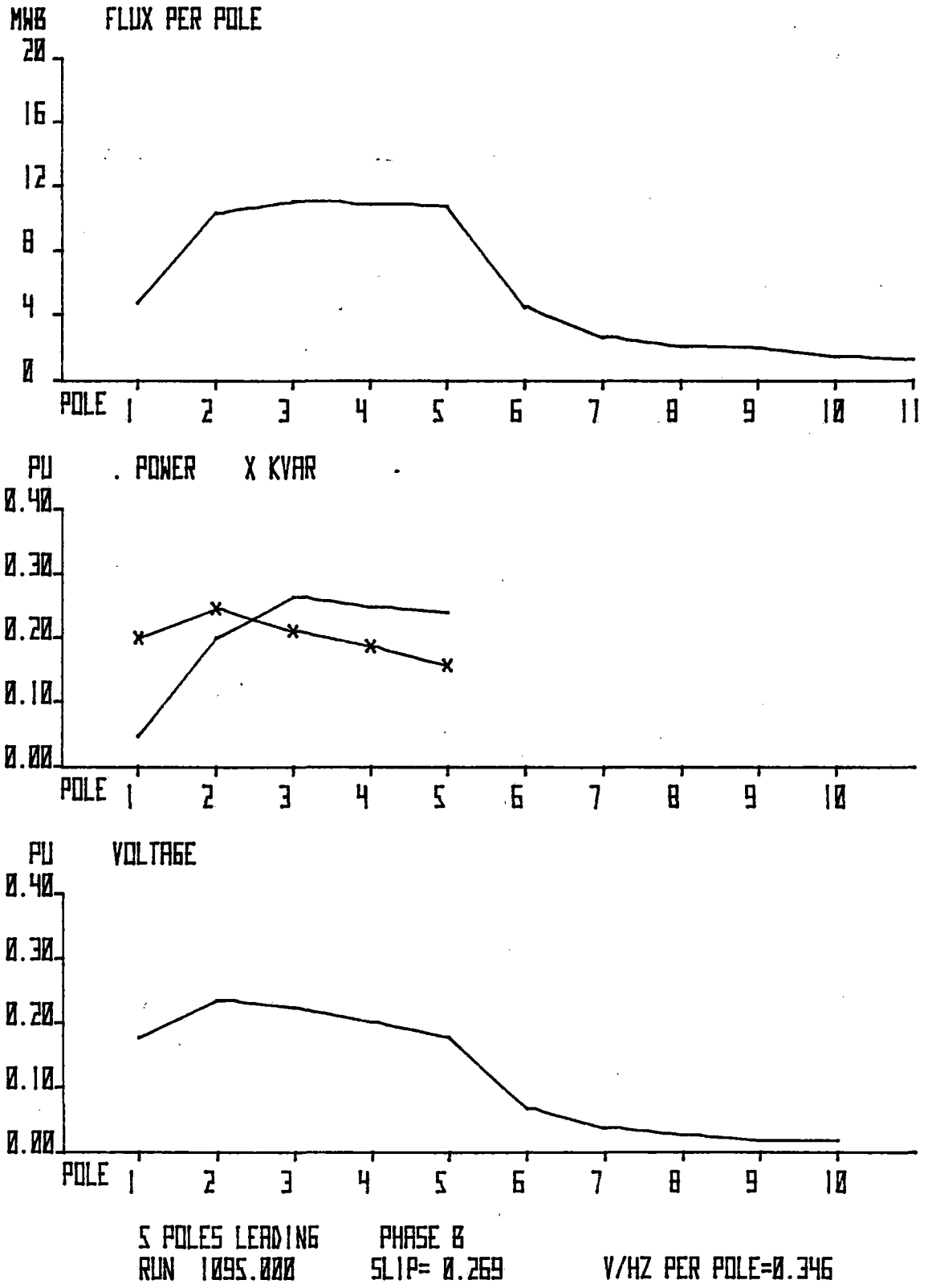

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1095.000 SLIP= 0.269 V/HZ PER POLE=0.346

Figure 3-85

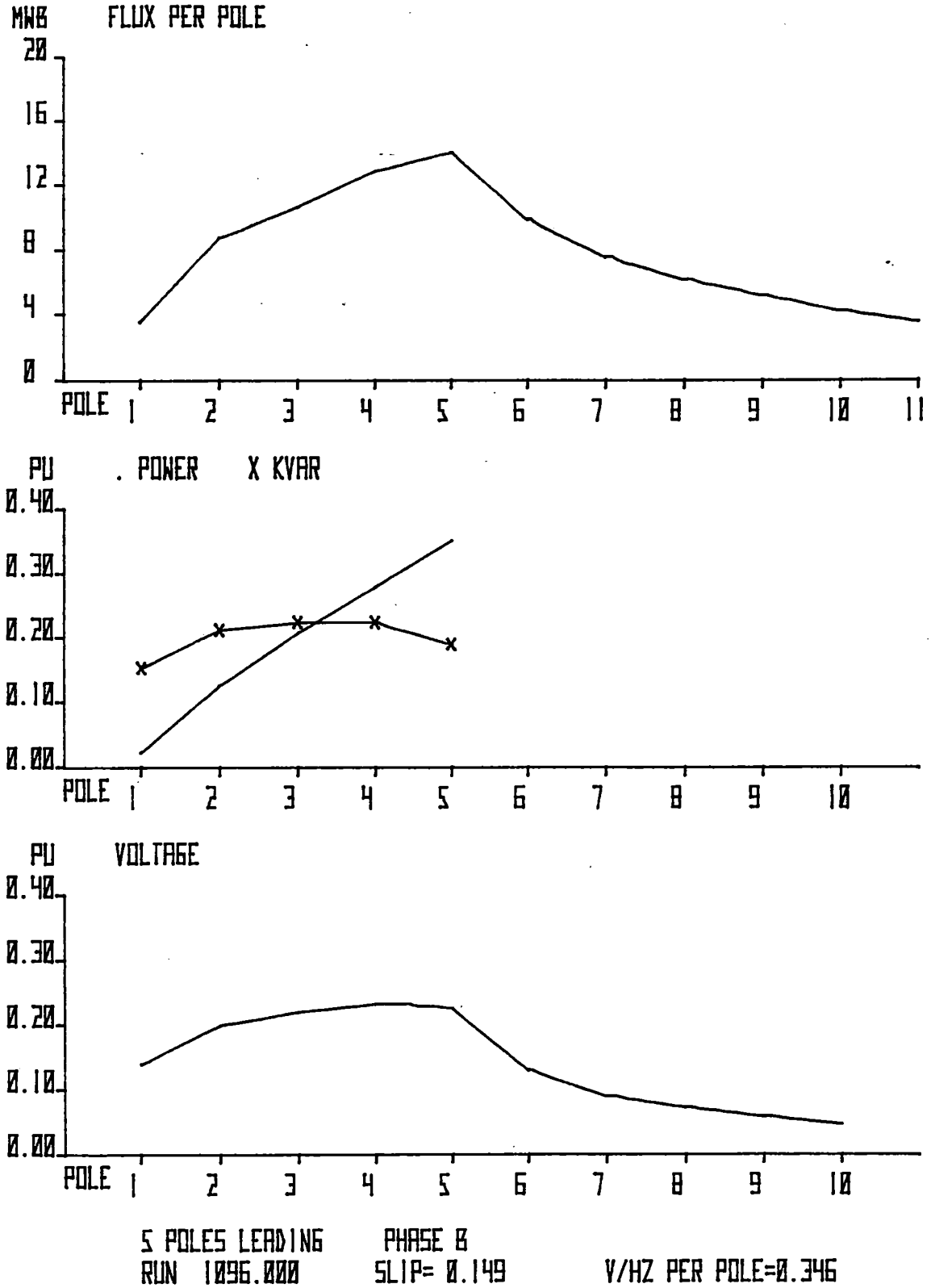

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1096.000 SLIP= 0.149 V/HZ PER POLE=0.346

Figure 3-86

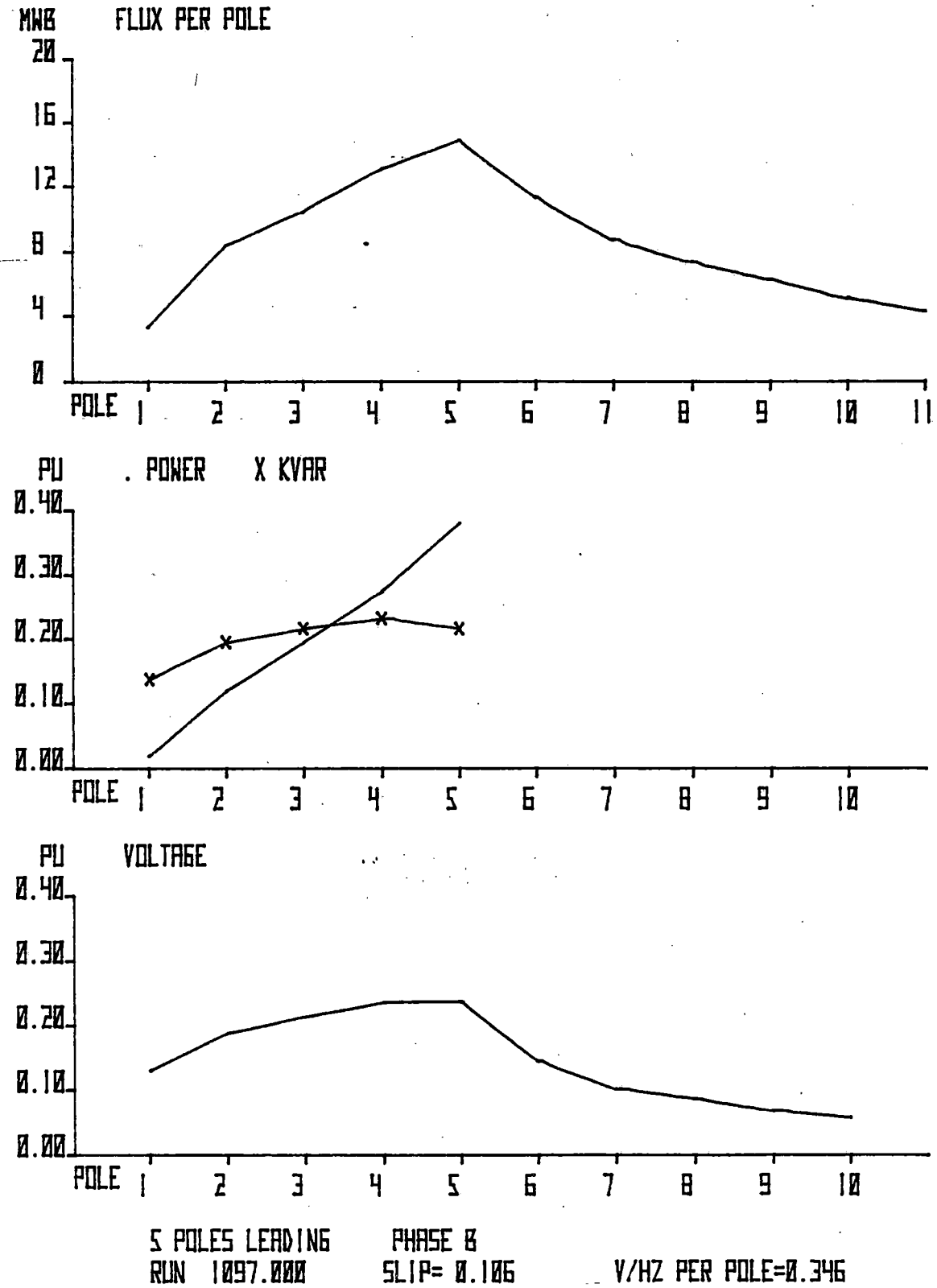

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1097.000 SLIP= 0.106 V/HZ PER POLE=0.346

Figure 3-87

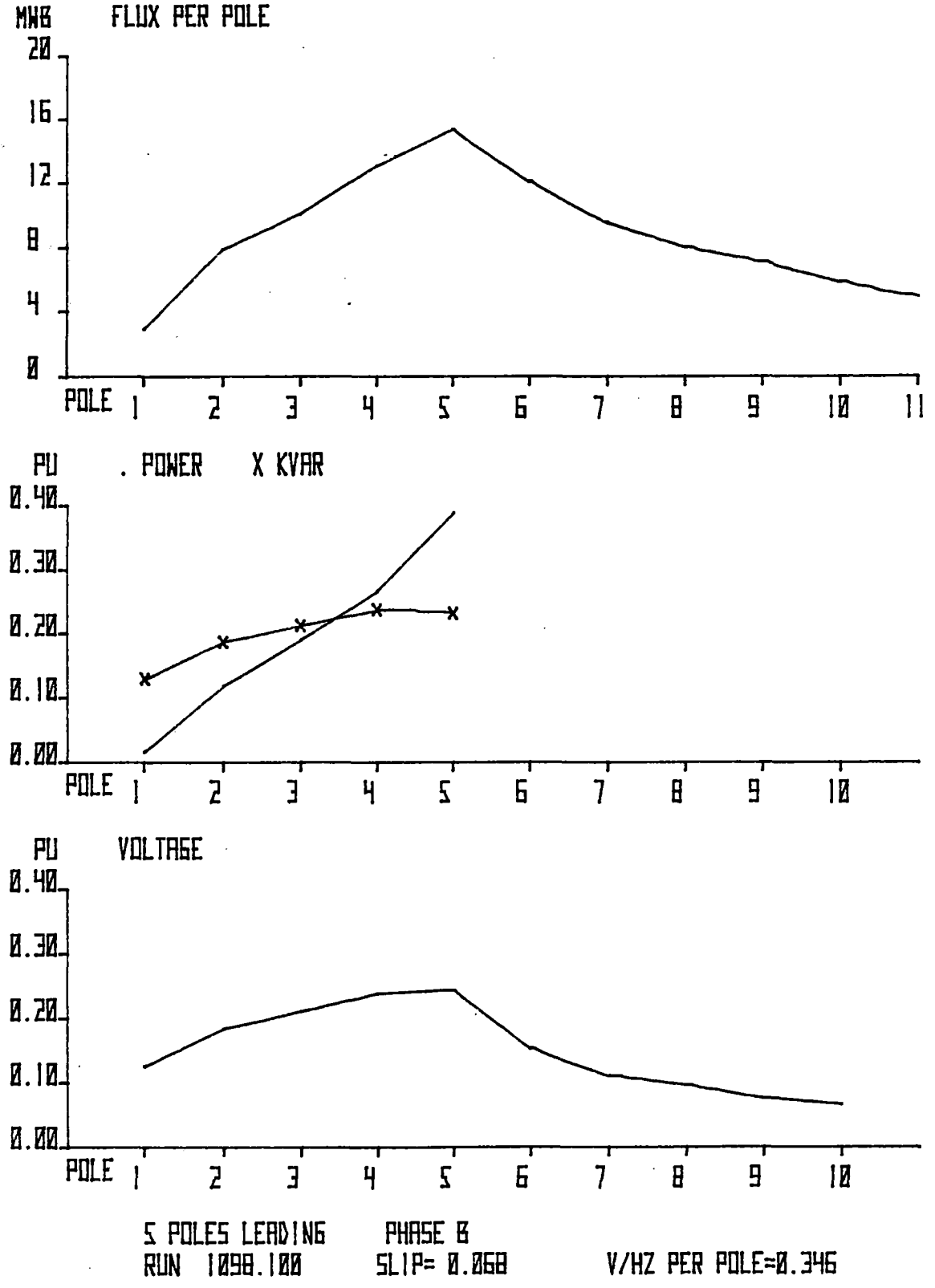

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1098.100 SLIP= 0.068 V/HZ PER POLE=0.346

Figure 3-88

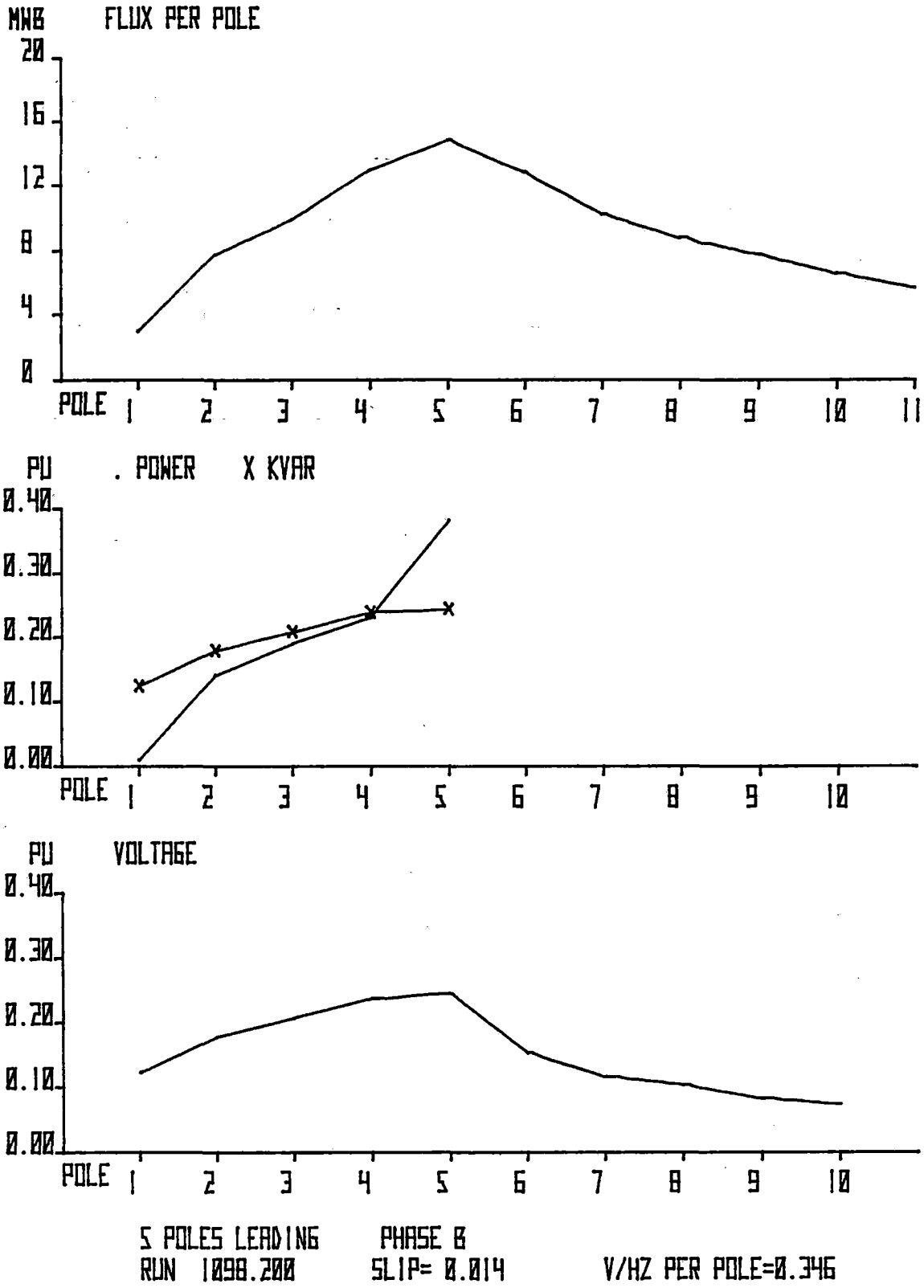

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1098.200 SLIP= 0.014 V/HZ PER POLE=0.346

Figure 3-89

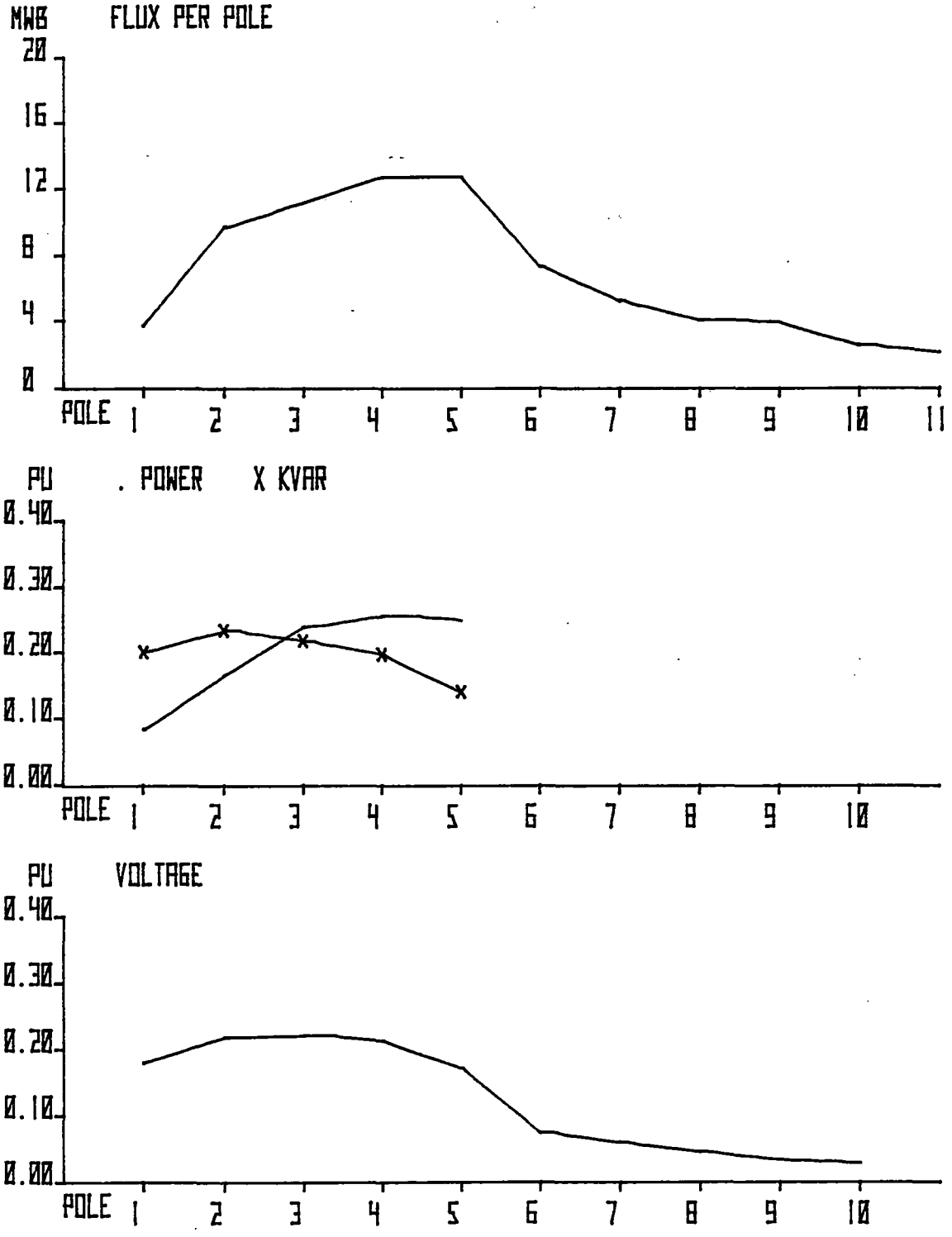

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE A.
RUN 1101.000 SLIP= 0.200 V/HZ PER POLE=0.346

Figure 3-90

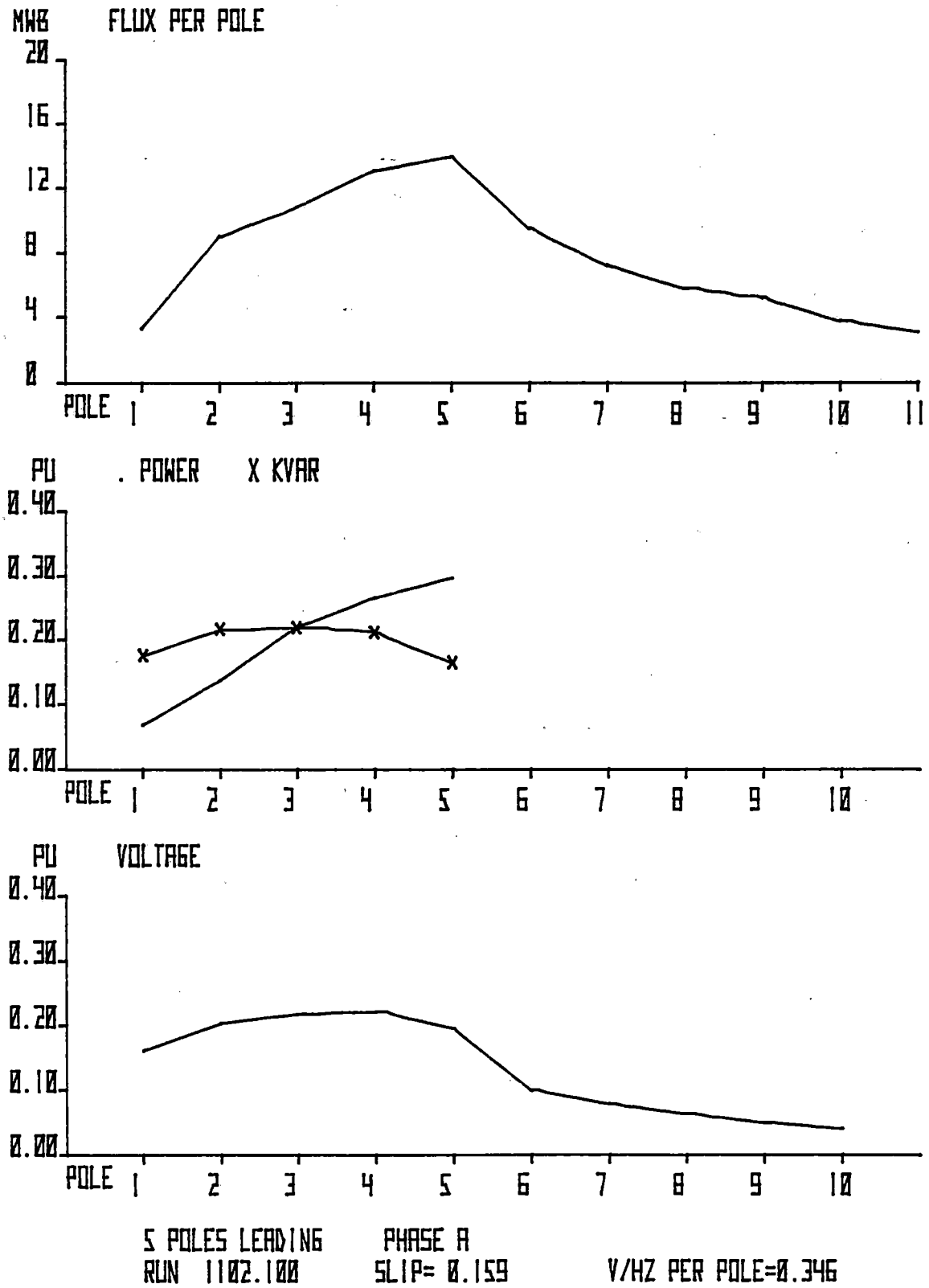

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE A
RUN 1102.100 SLIP= 0.159 V/HZ PER POLE=0.346

Figure 3-91

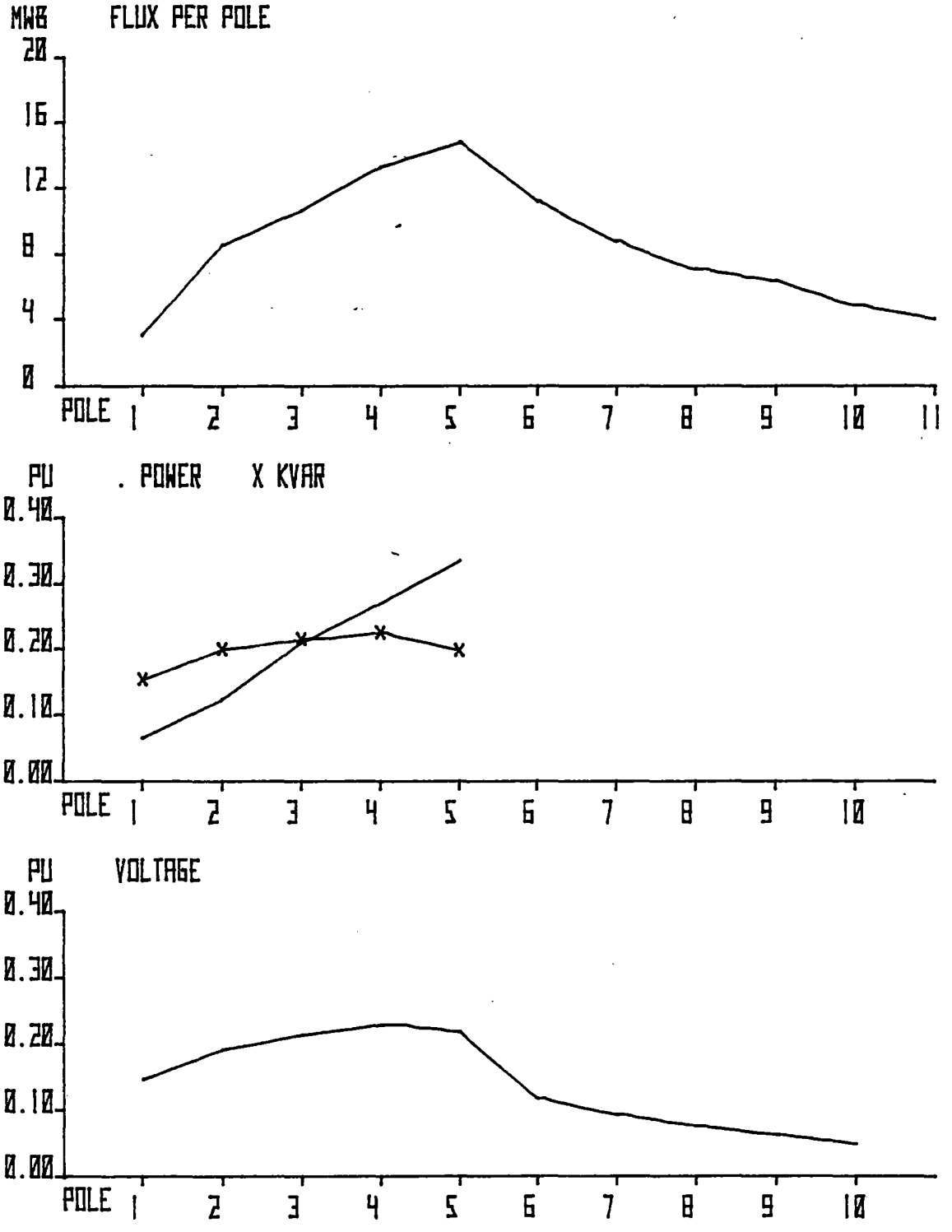

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE A
RUN 1103.000 SLIP= 0.110 V/HZ PER POLE=0.346

Figure 3-92

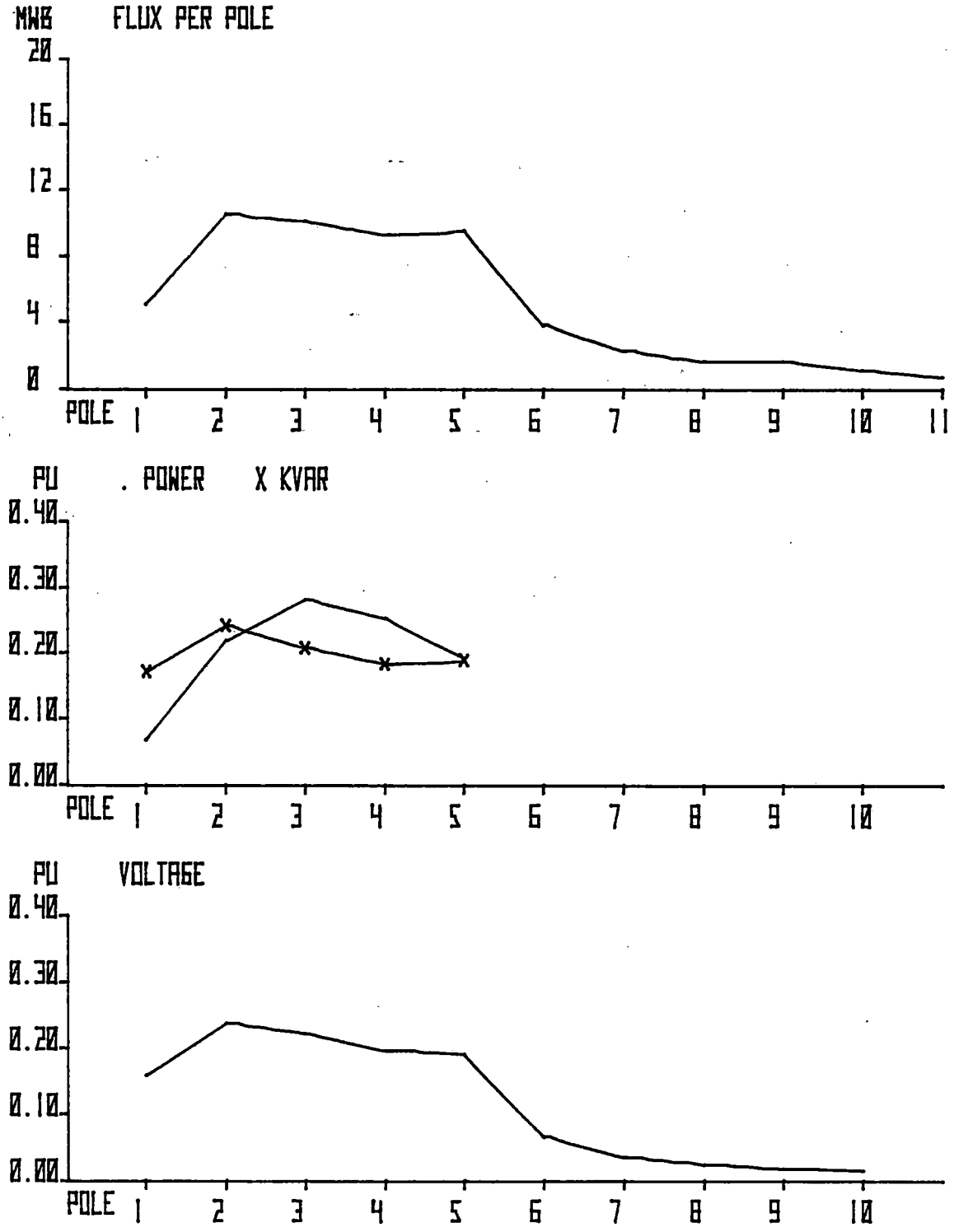

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE C
RUN 1104.000 SLIP= 0.310 V/HZ PER POLE=0.346

Figure 3-93

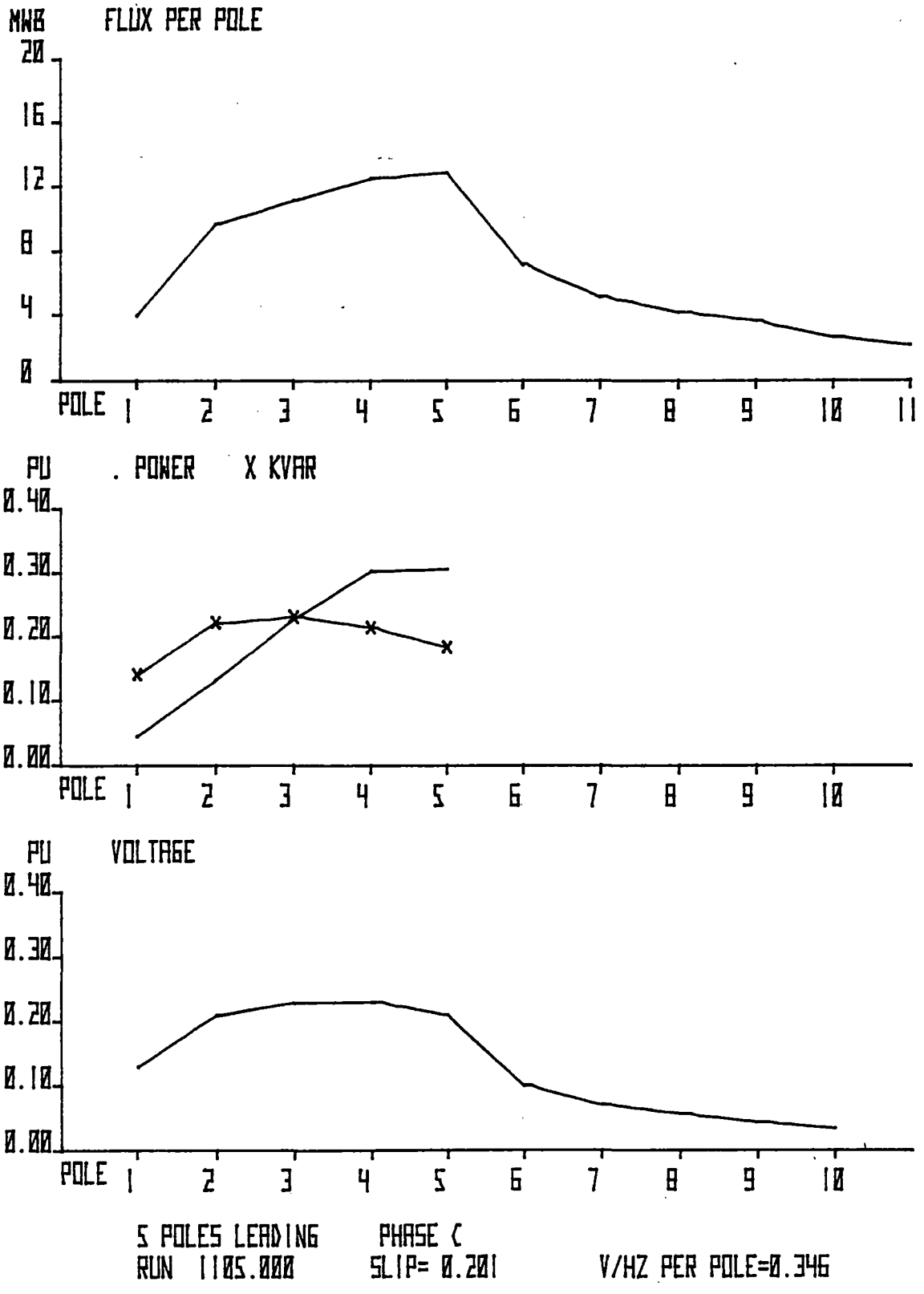

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE C
RUN 1105.000 SLIP= 0.201 V/HZ PER POLE=0.346

Figure 3-94

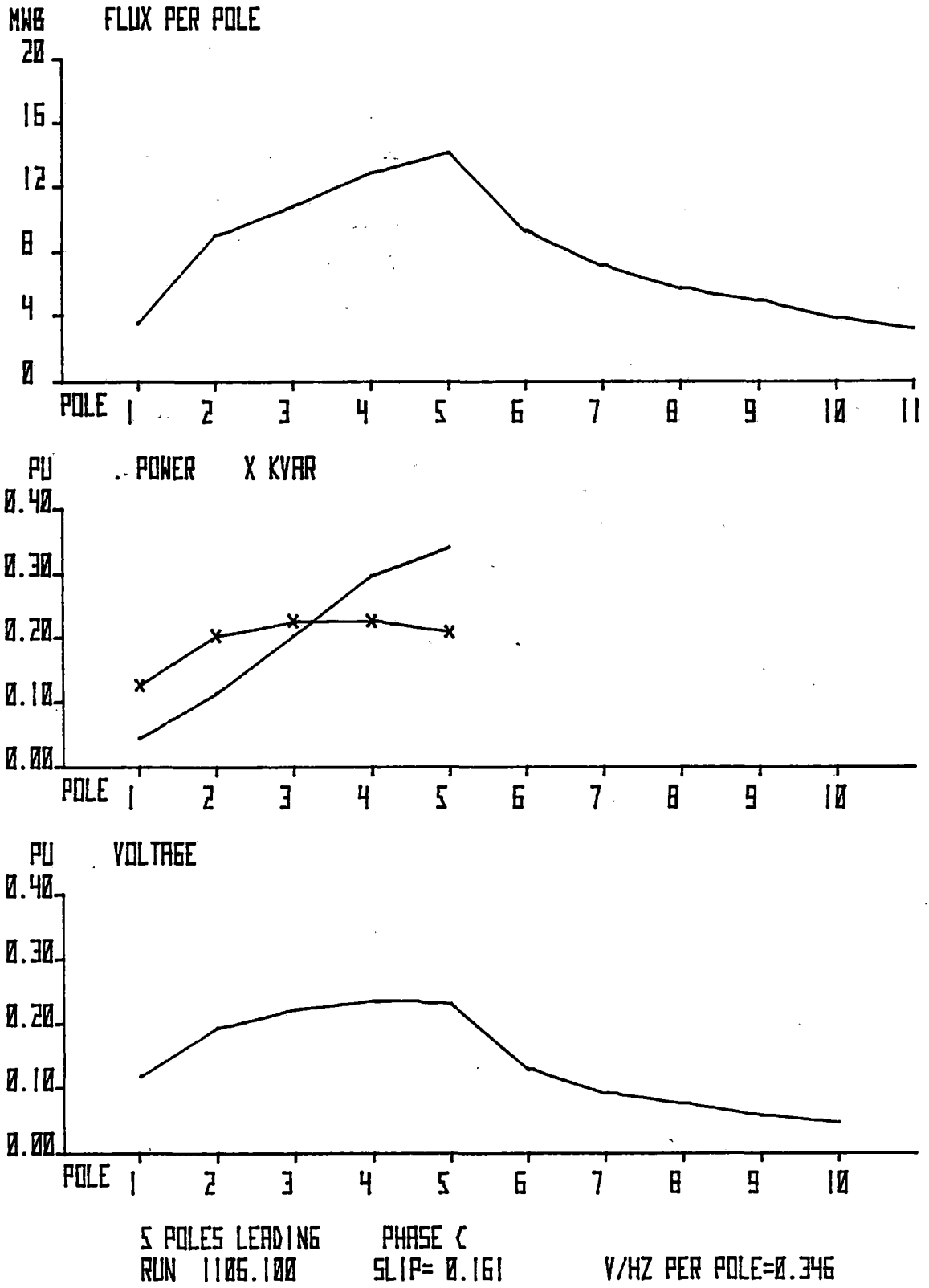

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE (
RUN 1106.100 SLIP= 0.161 V/HZ PER POLE=0.346

Figure 3-95

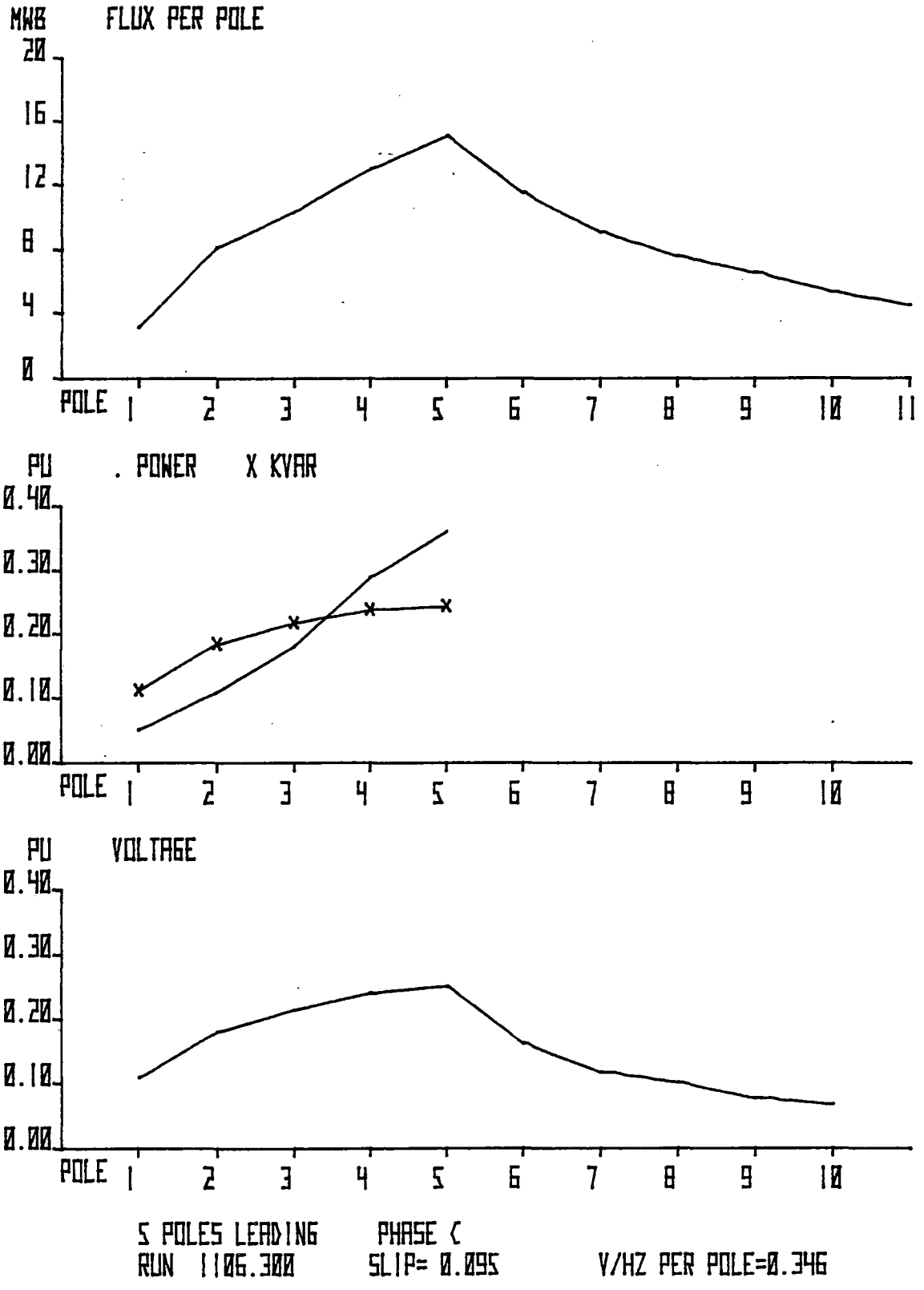

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE (
RUN 1106.300 SLIP= 0.095 V/HZ PER POLE=0.346

Figure 3-96

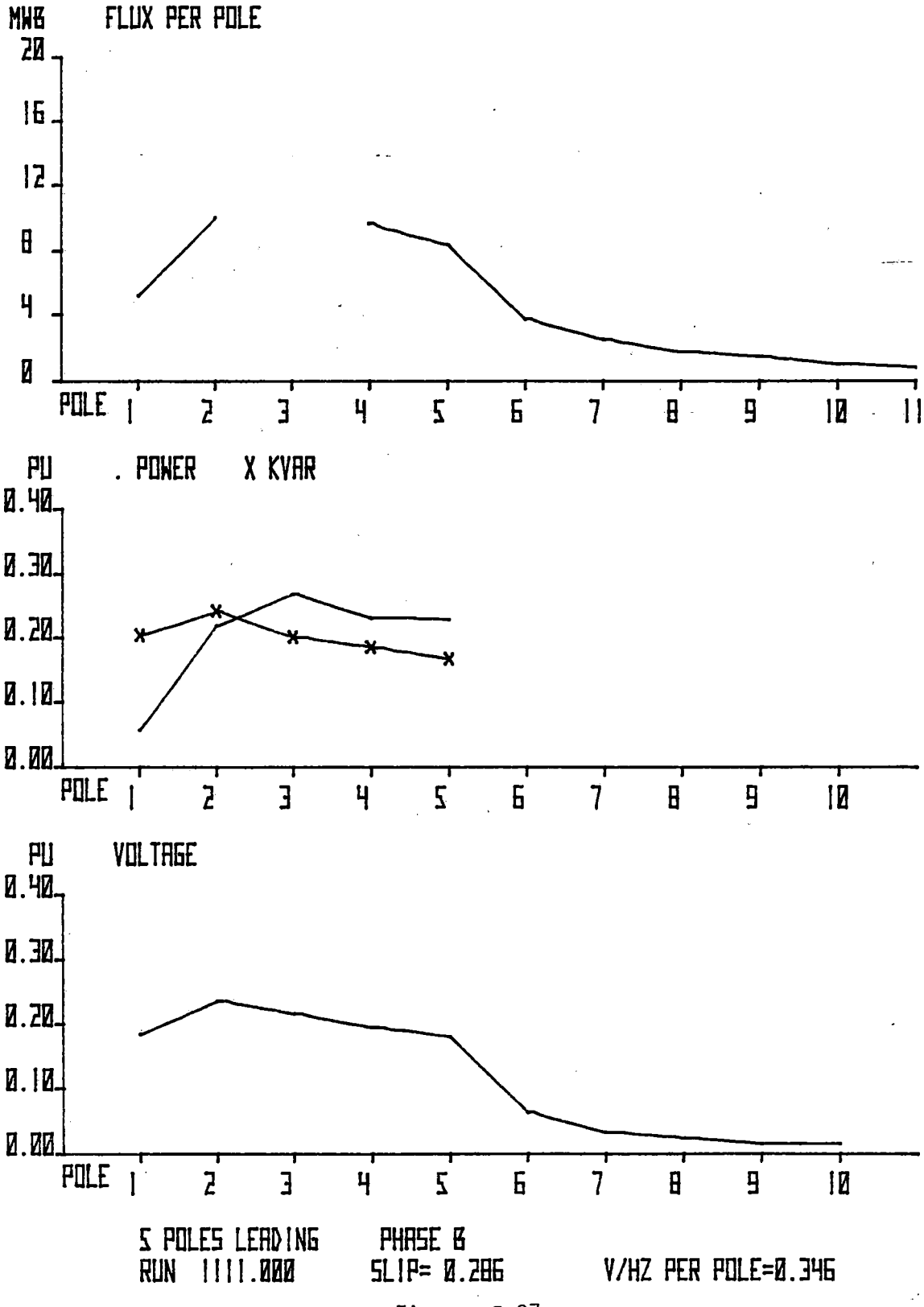

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1111.000 SLIP= 0.286 V/HZ PER POLE=0.346

Figure 3-97

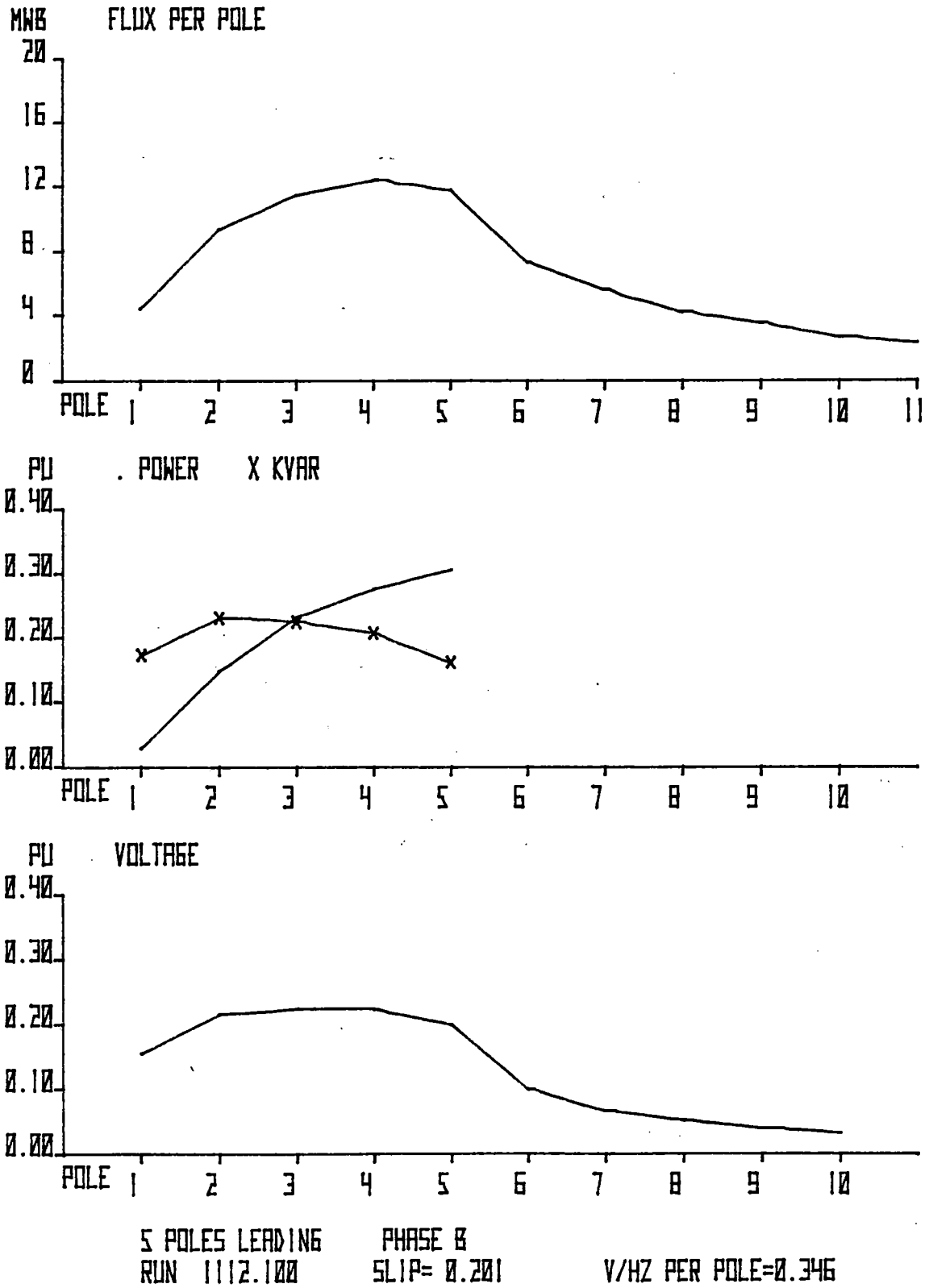

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1112.100 SLIP= 0.201 V/HZ PER POLE=0.346

Figure 3-98

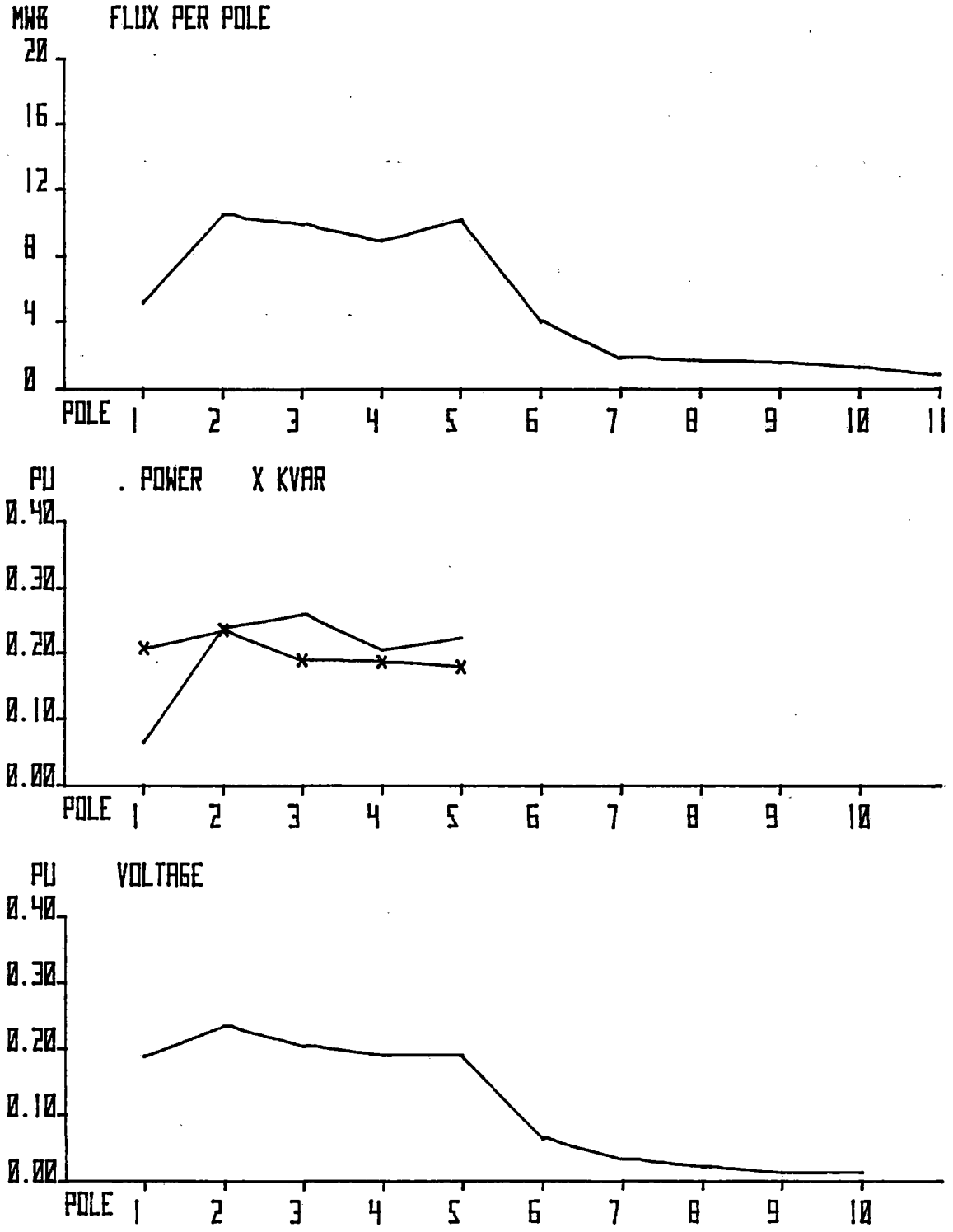
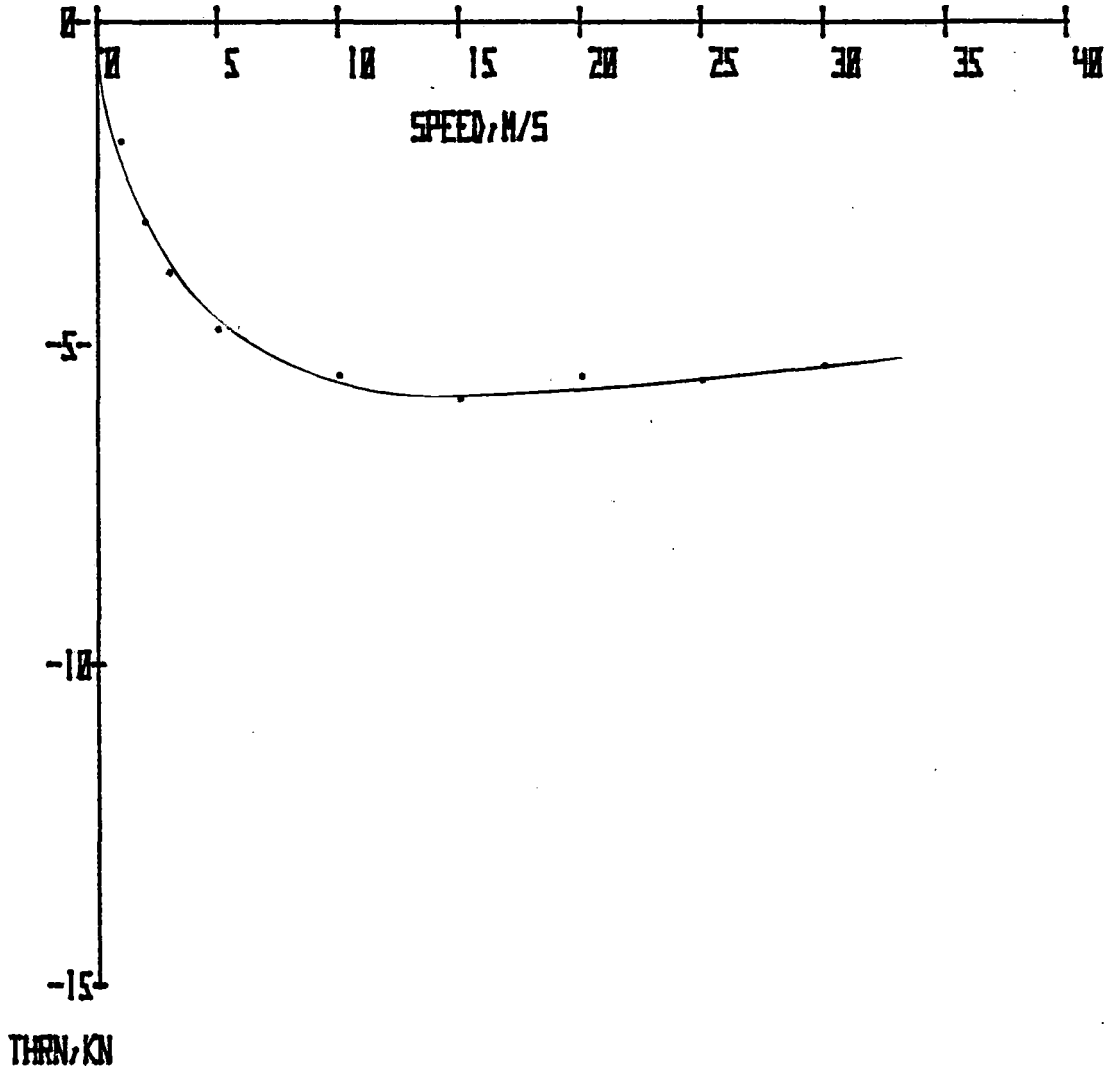

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
5 POLES LEADING PHASE B
RUN 1112.300 SLIP= 0.316 V/HZ PER POLE=0.346

Figure 3-99

SECTION 4

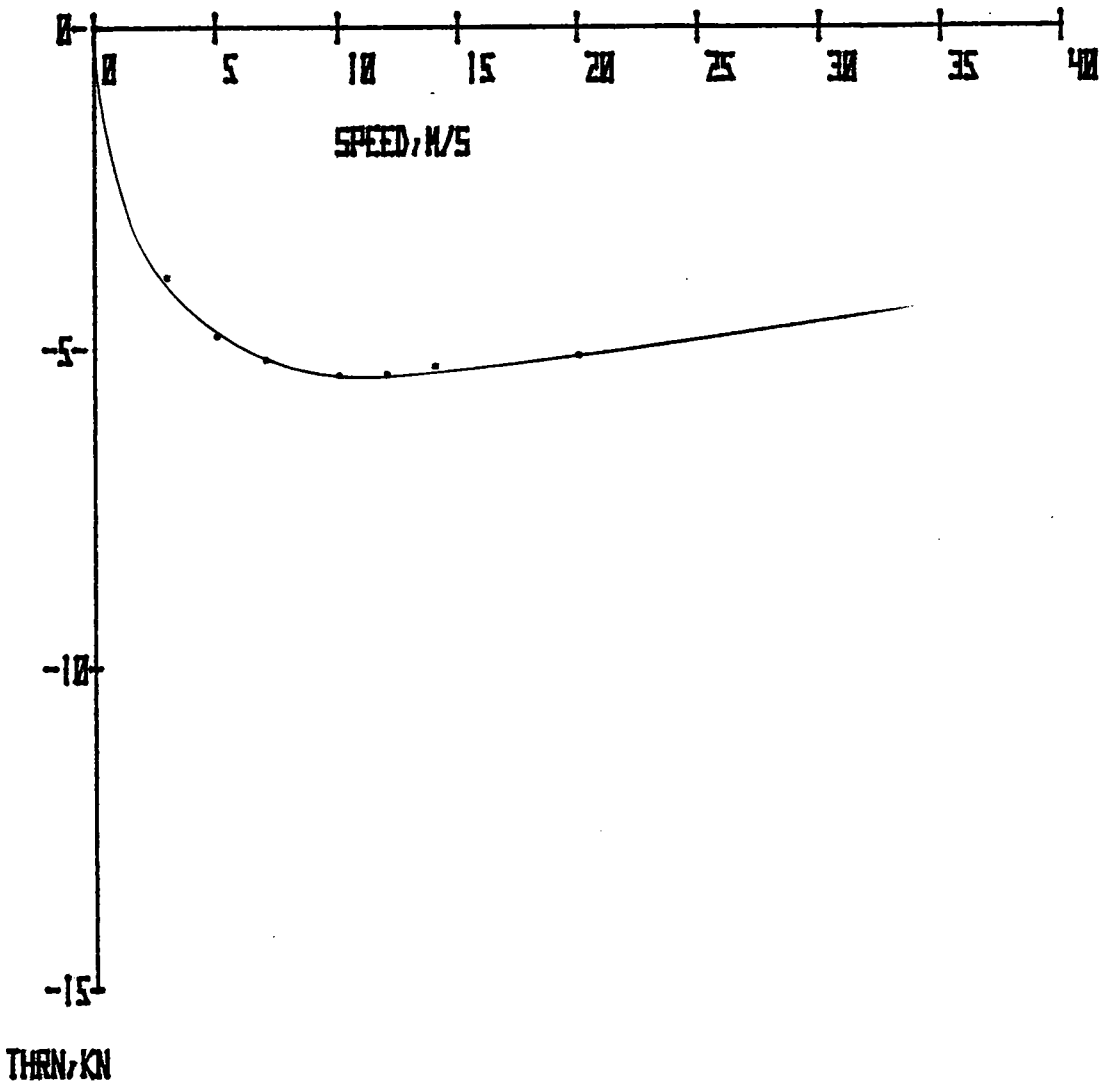
SOLID IRON REACTION RAIL TEST DATA, 10-POLE SLIM, 26-MM AIRGAP

Figures 4-1 through 4-6 reflect test data acquired with dc excitation, while the ac excitation mode is applicable to data in Figures 4-7 through 4-45.



DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
BRAKING FORCE VS SPEED
10 POLES I=1.36 KA RUN 1119
26 MM AIR GAP

Figure 4-1.



DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
BRAKING FORCE VS SPEED
10 POLES I=1.36 KA RUN 1120
25 MM AIR GAP

Figure 4-2

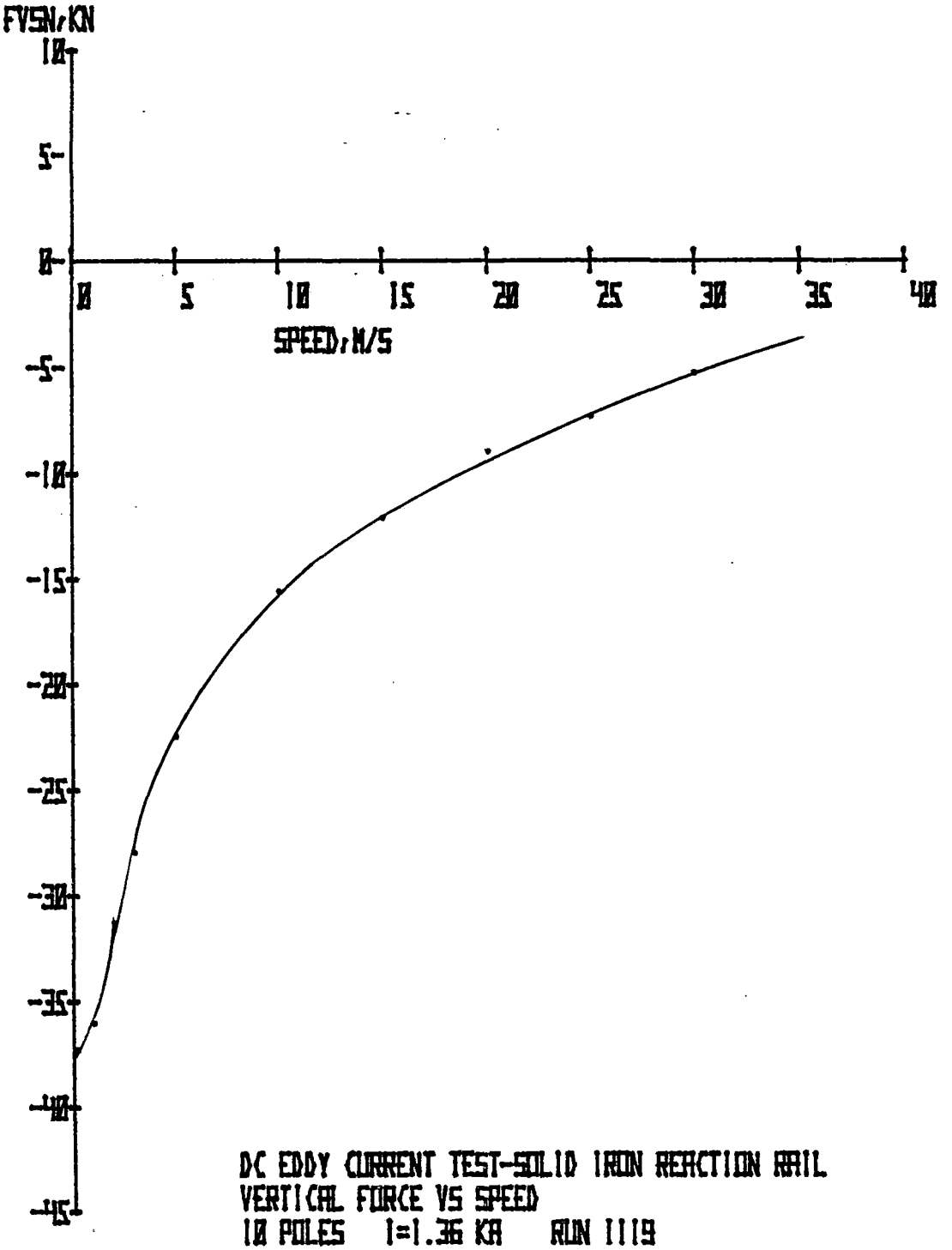

FVSN,KN
10
5
0
0
5
10
15
20
25
30
35
40
SPEED,M/S
-5
-10
-15
-20
-25
-30
-35
-40
-45
DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
VERTICAL FORCE VS SPEED
10 POLES I=1.36 KA RUN 1119
25 MM AIR GAP

Figure 4-3

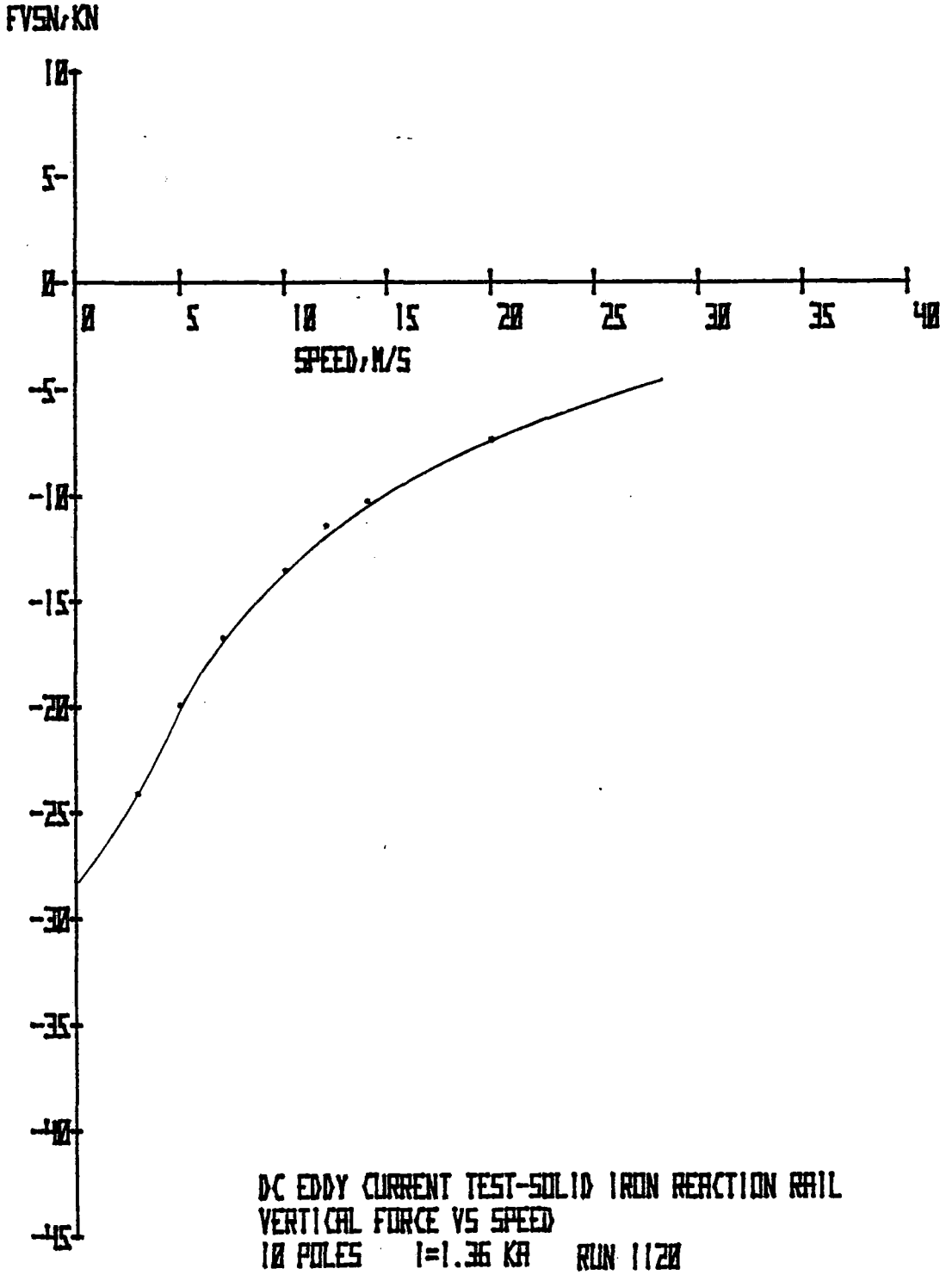

FVSN,KN
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0
5
10
15
20
25
30
35
40
SPEED,M/S
DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
VERTICAL FORCE VS SPEED
10 POLES I=1.36 KA RUN 1120
26 MM AIR GAP

Figure 4-4

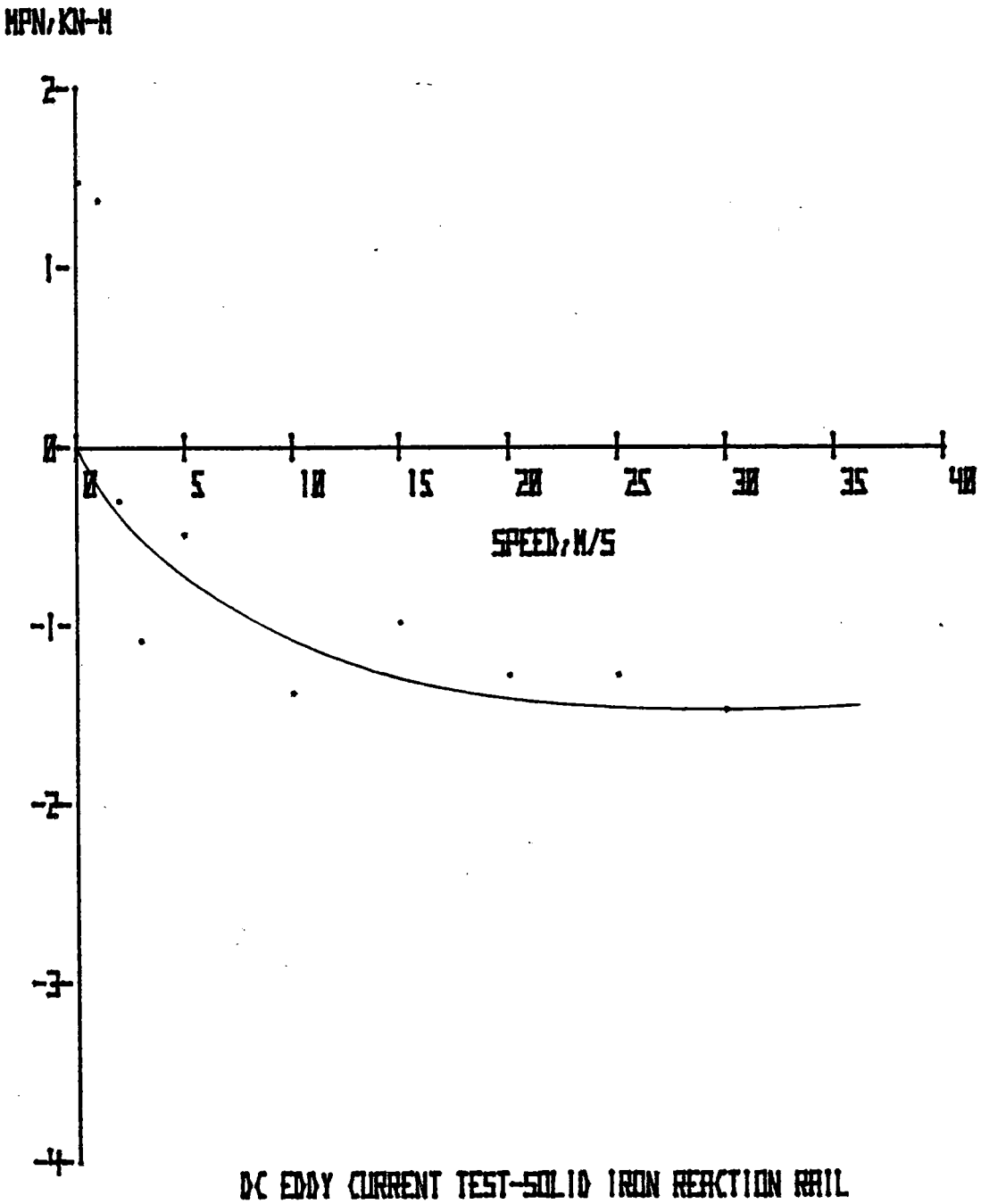

MPN/KN-M
2
1
0
-1
-2
-3
-4
0
5
10
15
20
25
30
35
40
SPEED, M/S
DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
PITCHING MOMENT VS SPEED
10 POLES I=1.36 KA RUN 1119
26 MM AIR GAP

Figure 4-5

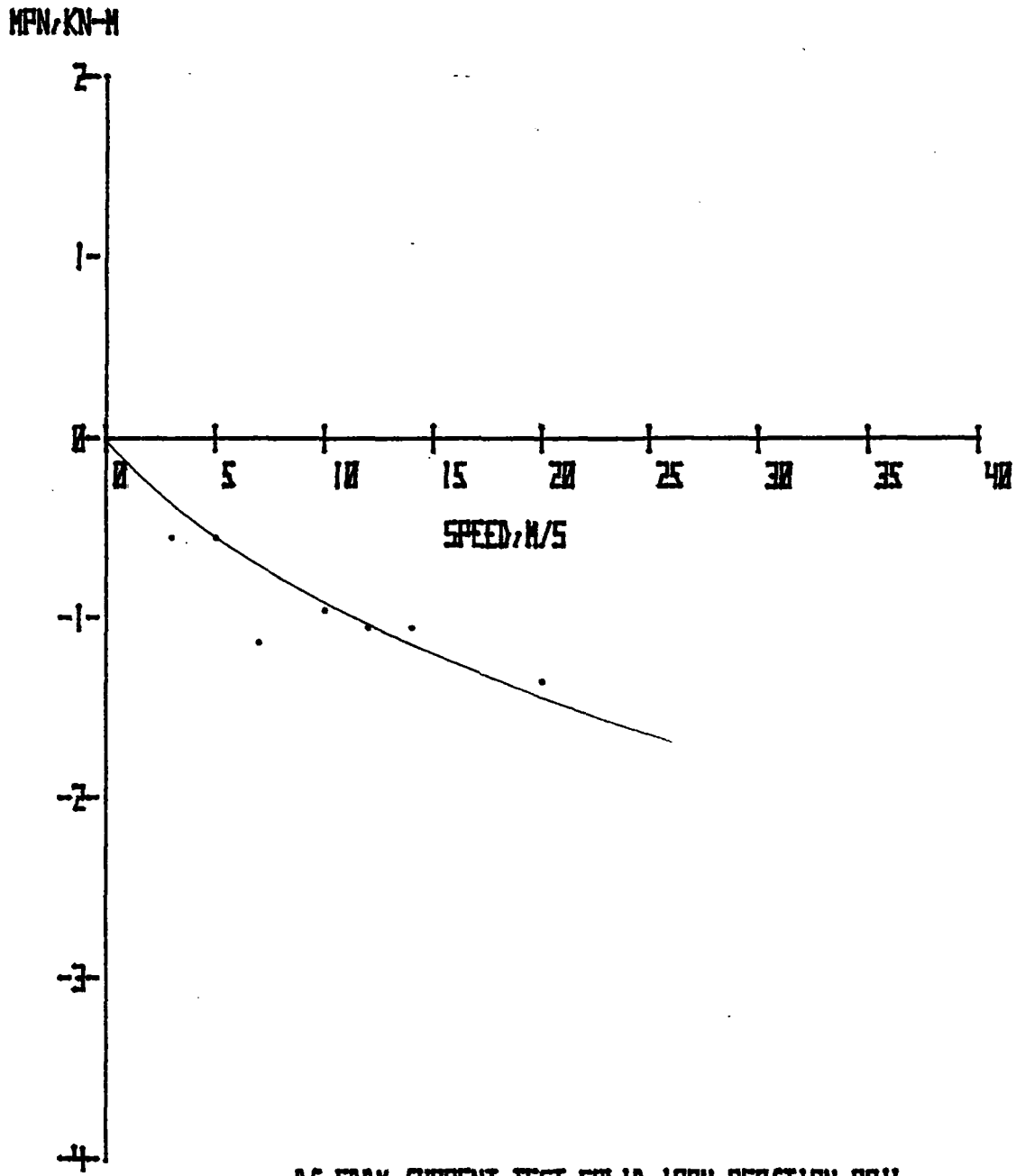
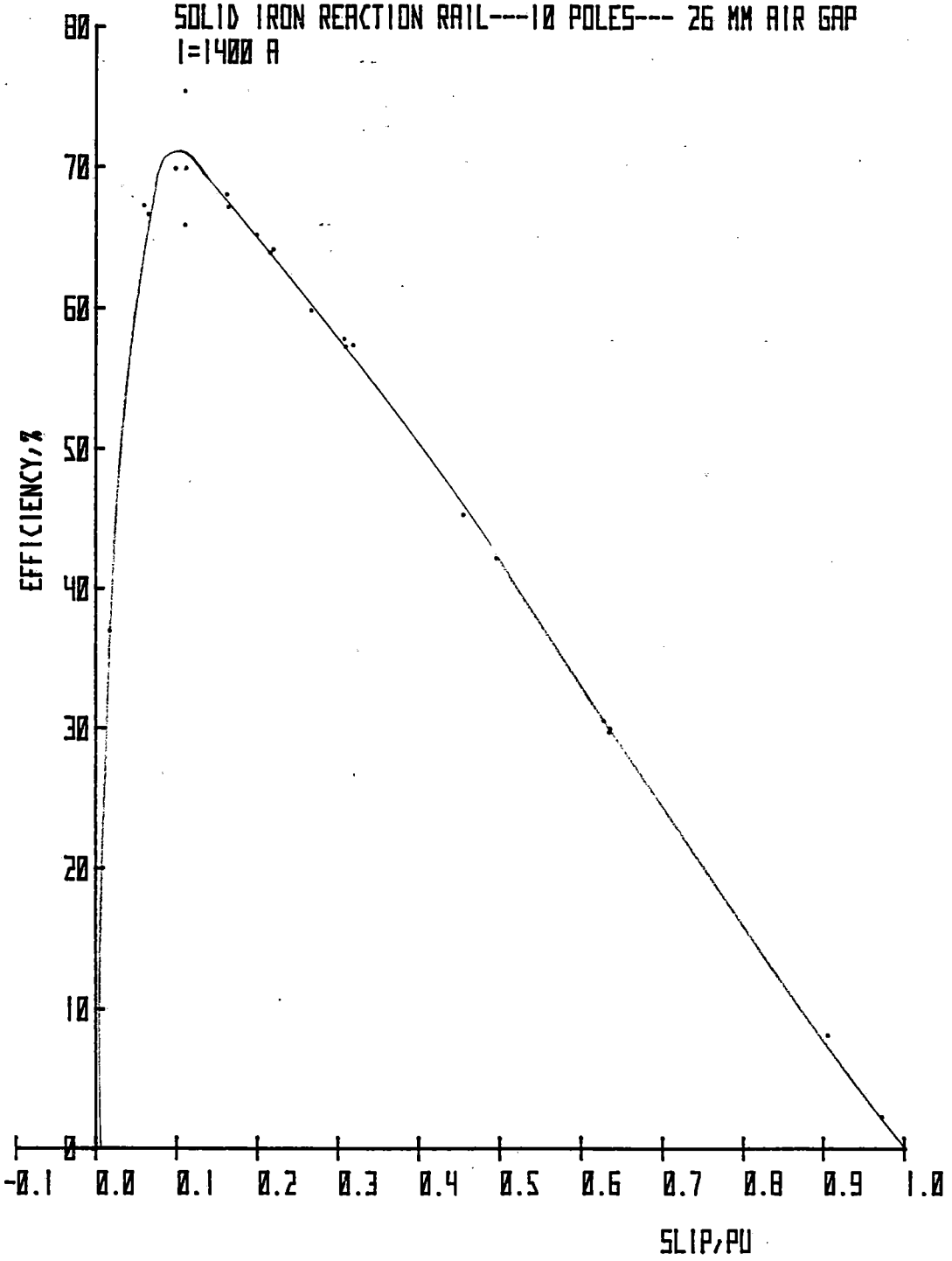
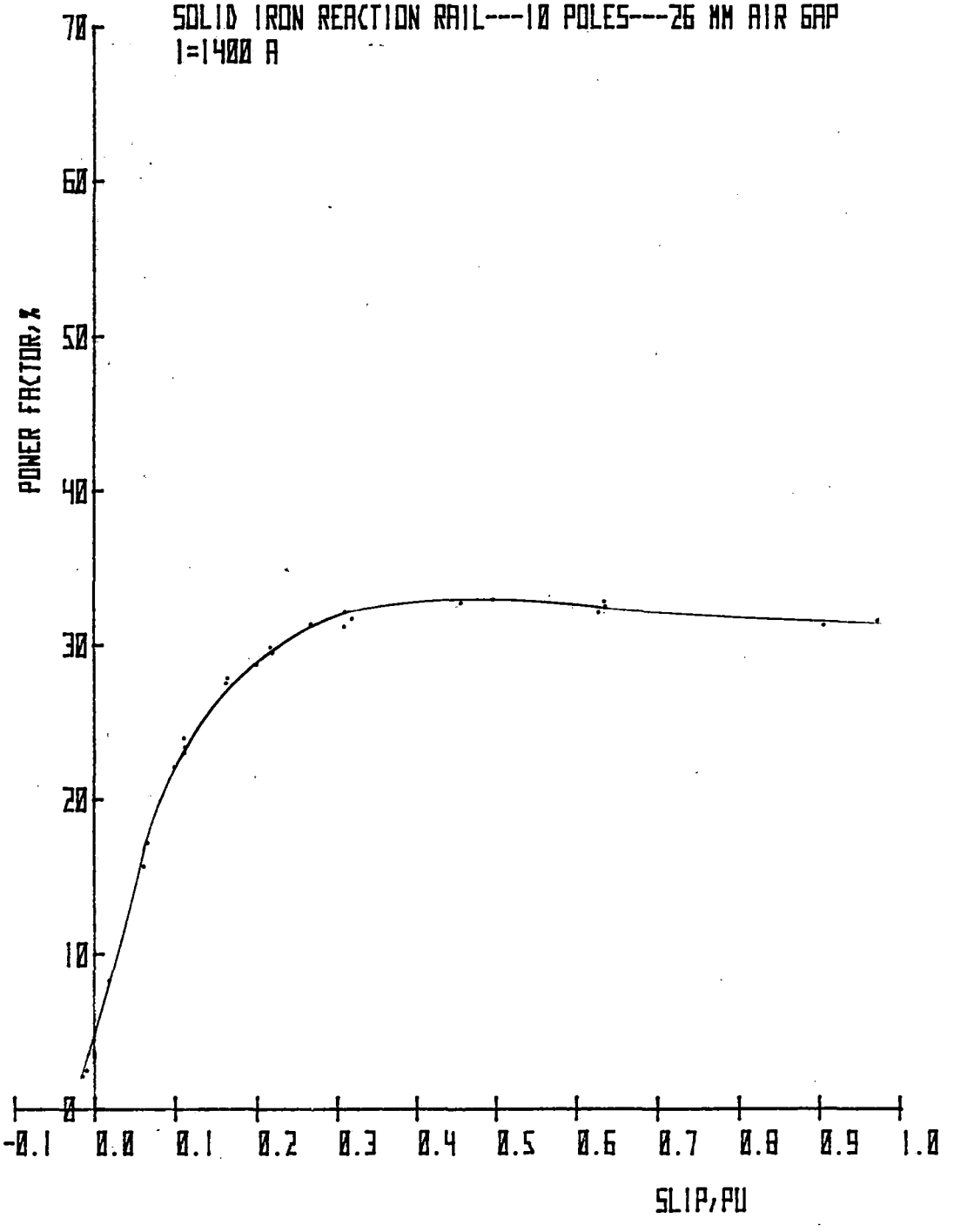

MFN,KN-M
2
1
0
-1
-2
-3
-4
0
5
10
15
20
25
30
35
40
SPEED,M/S
DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
PITCHING MOMENT VS SPEED
10 POLES I=1.36 KA RUN 1120
26 MM AIR GAP

Figure 4-6



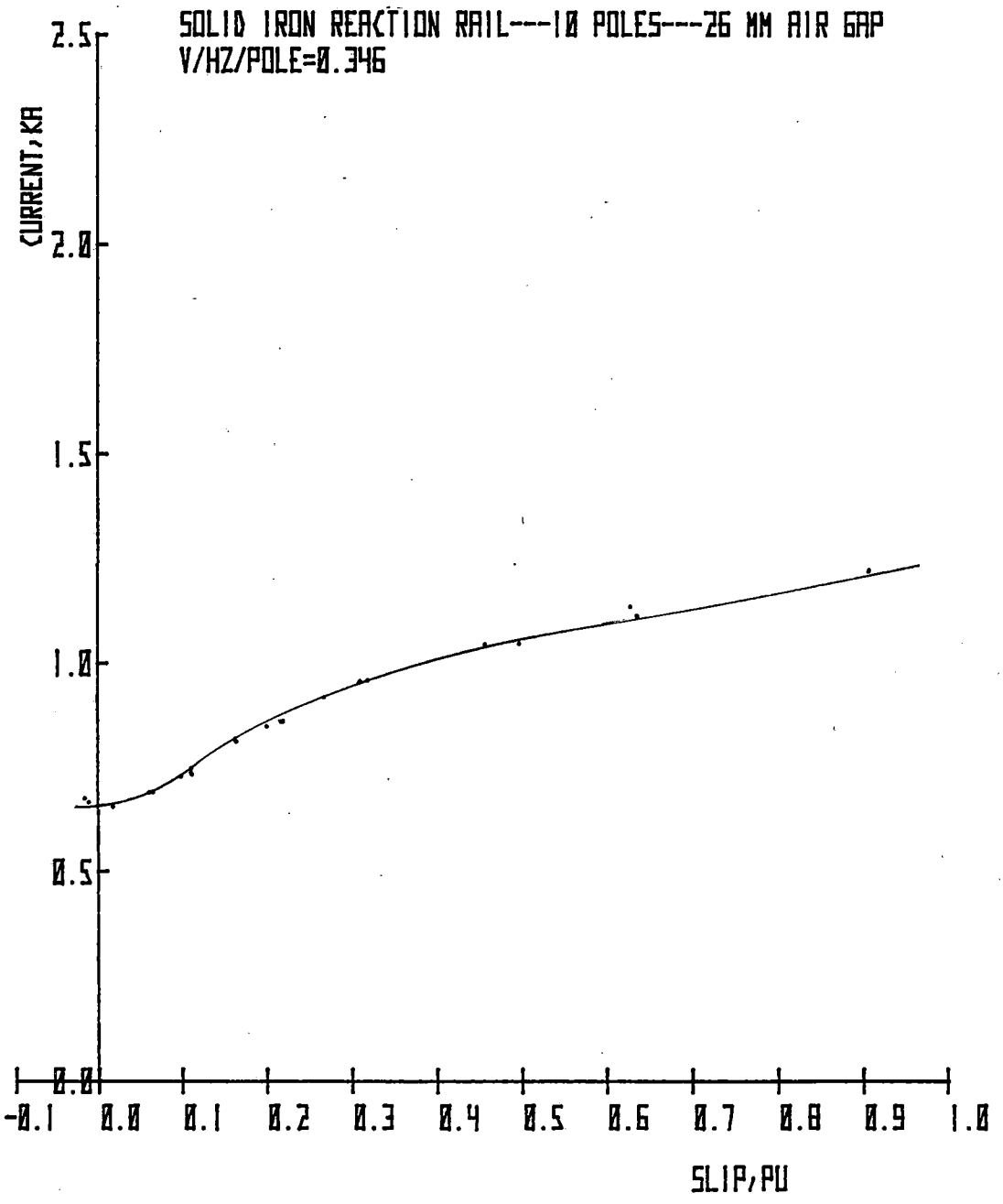
EFFICIENCY VS SLIP

Figure 4-7



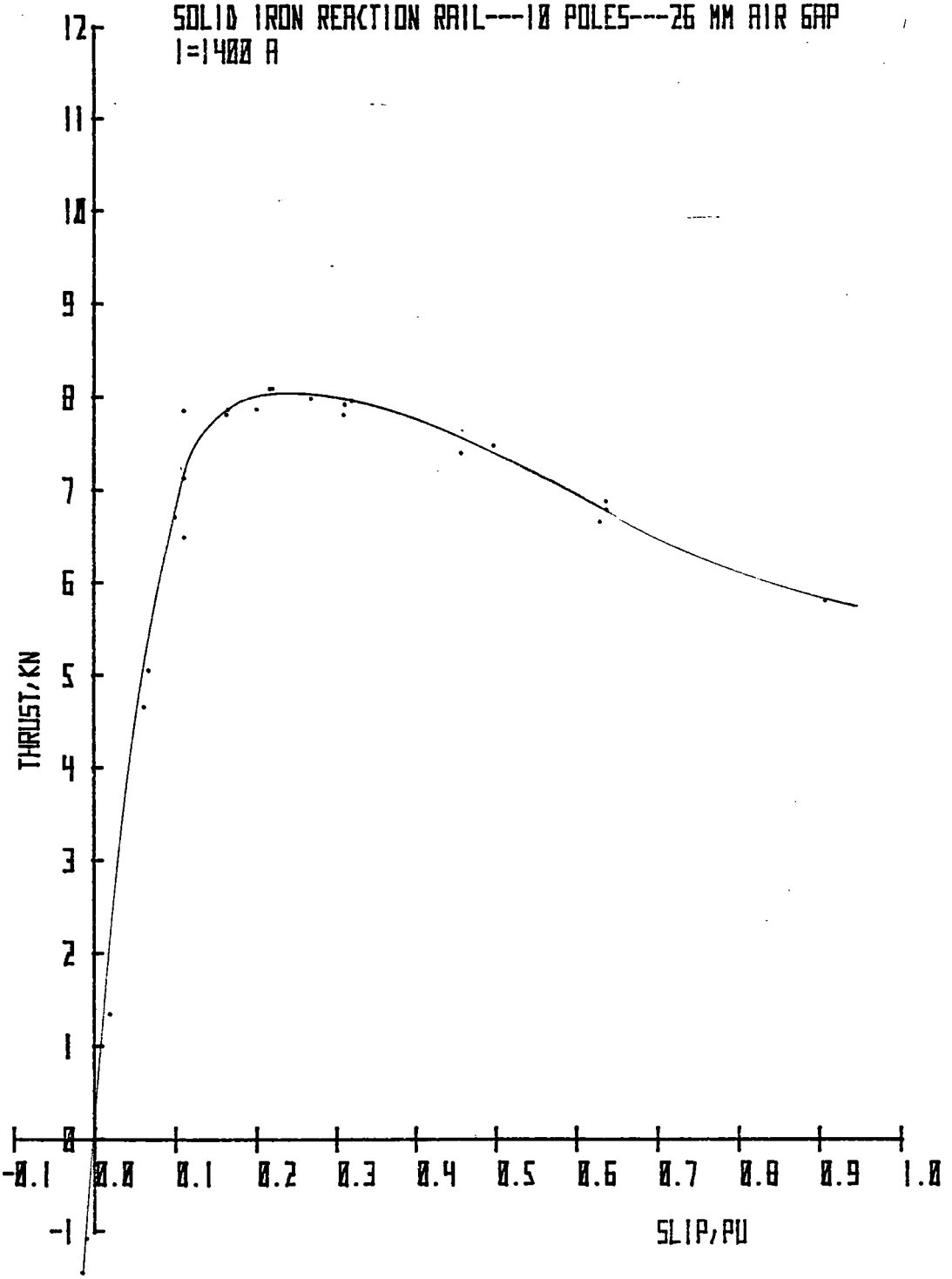
POWER FACTOR VS SLIP

Figure 4-8



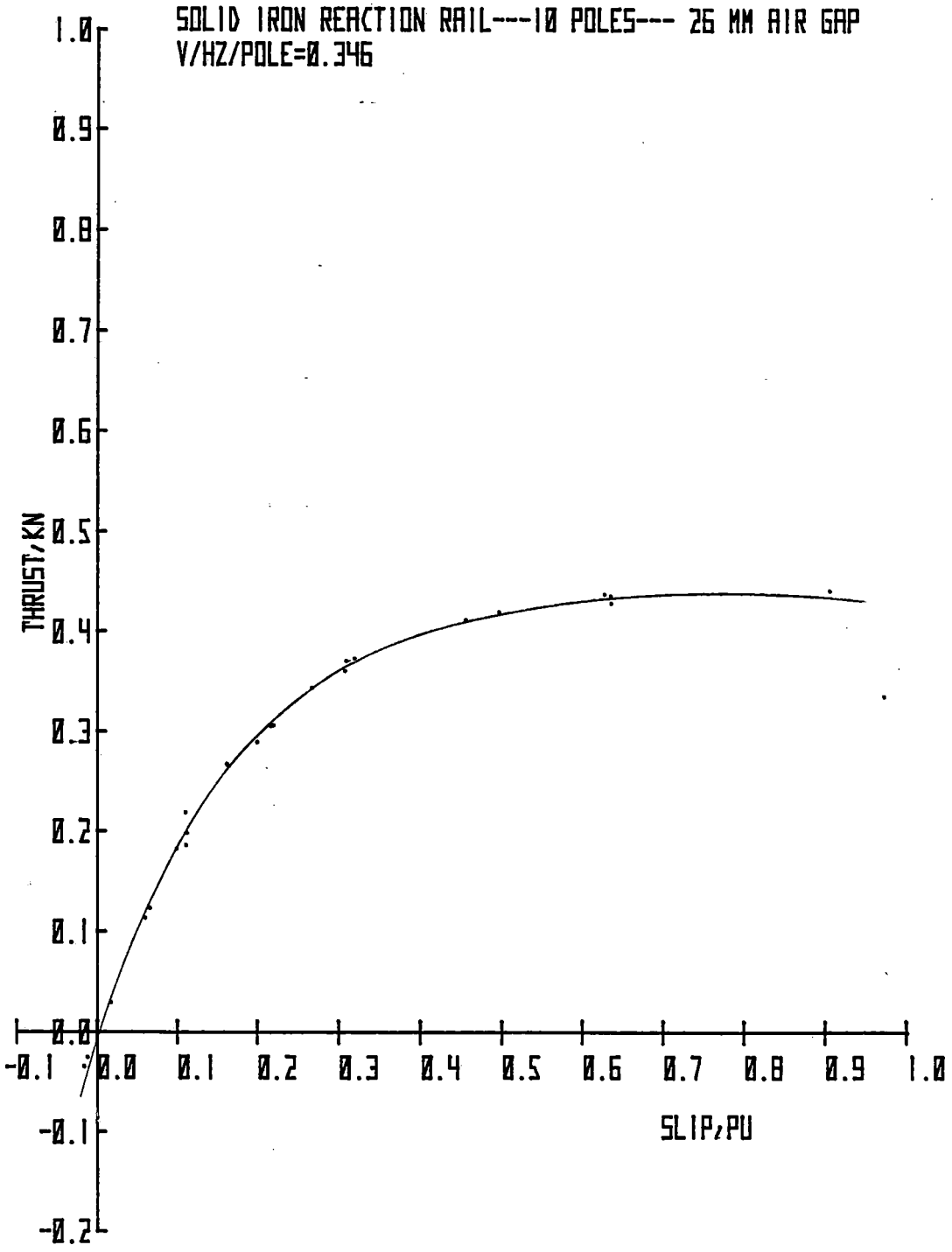
MEAN LINE CURRENT VS SLIP

Figure 4-9



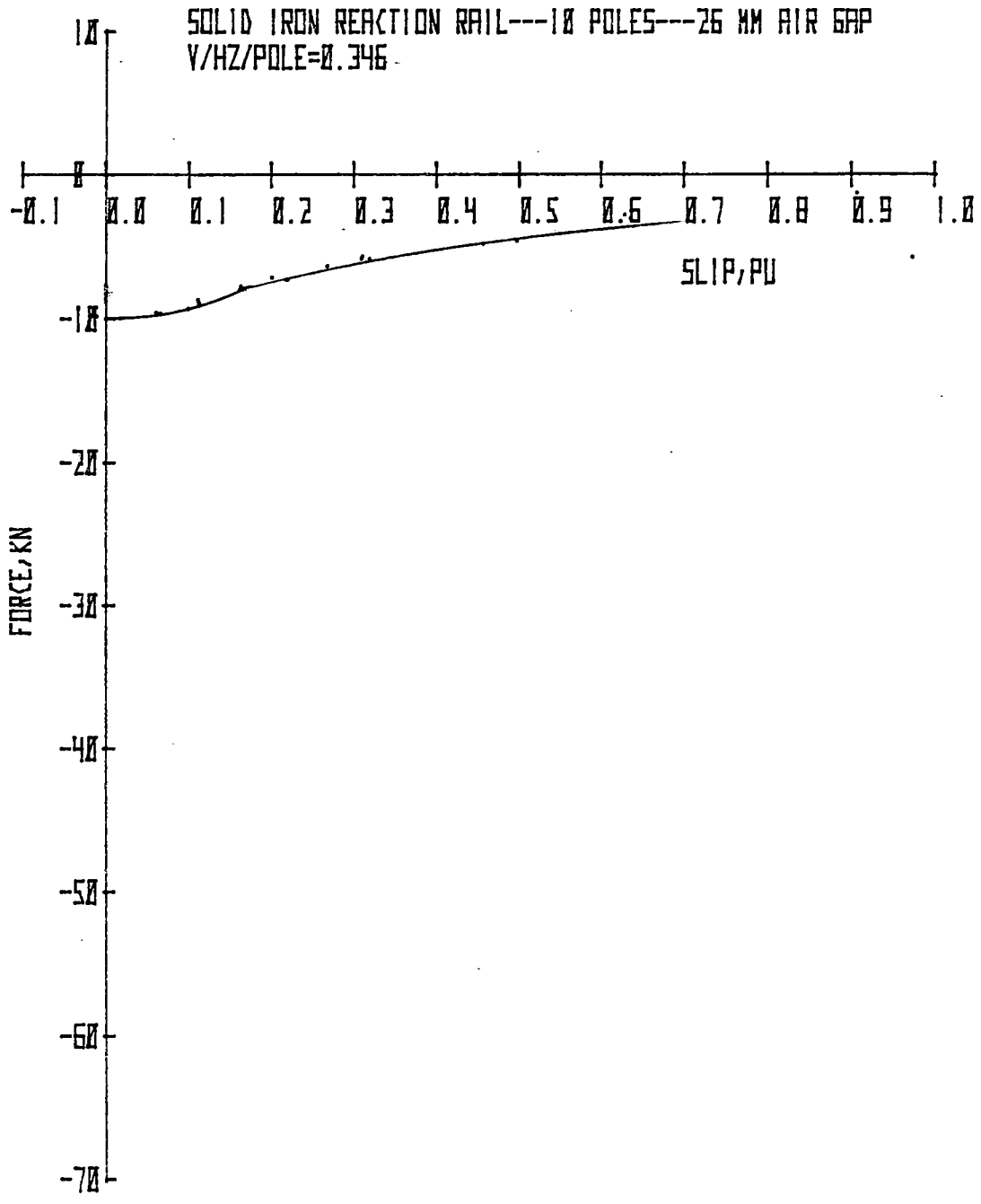
THRUST VS SLIP

Figure 4-10



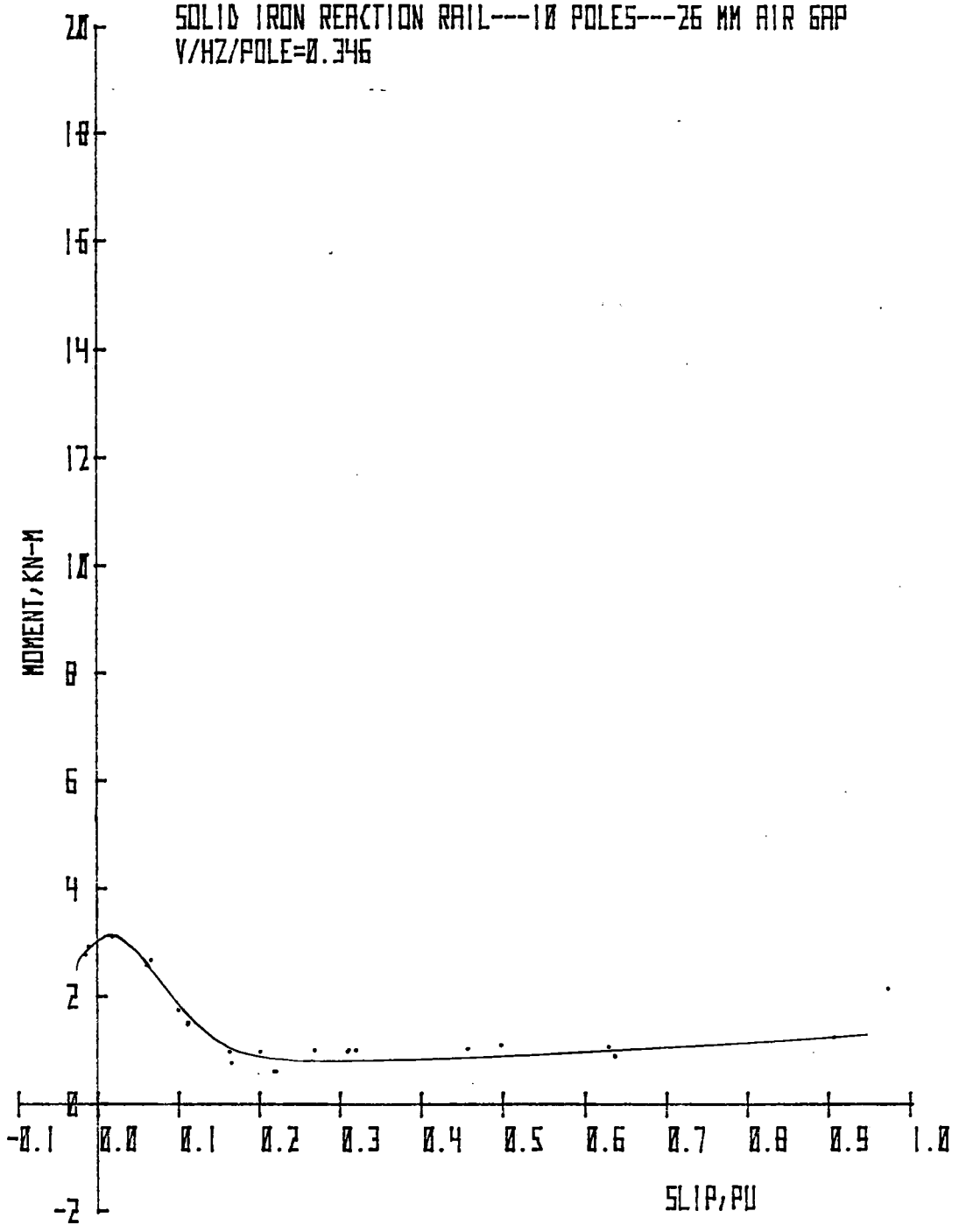
THRUST PER POLE VS SLIP

Figure 4-11



TOTAL VERTICAL FORCE VS SLIP

Figure 4-12



PITCHING MOMENT VS SLIP

Figure 4-13

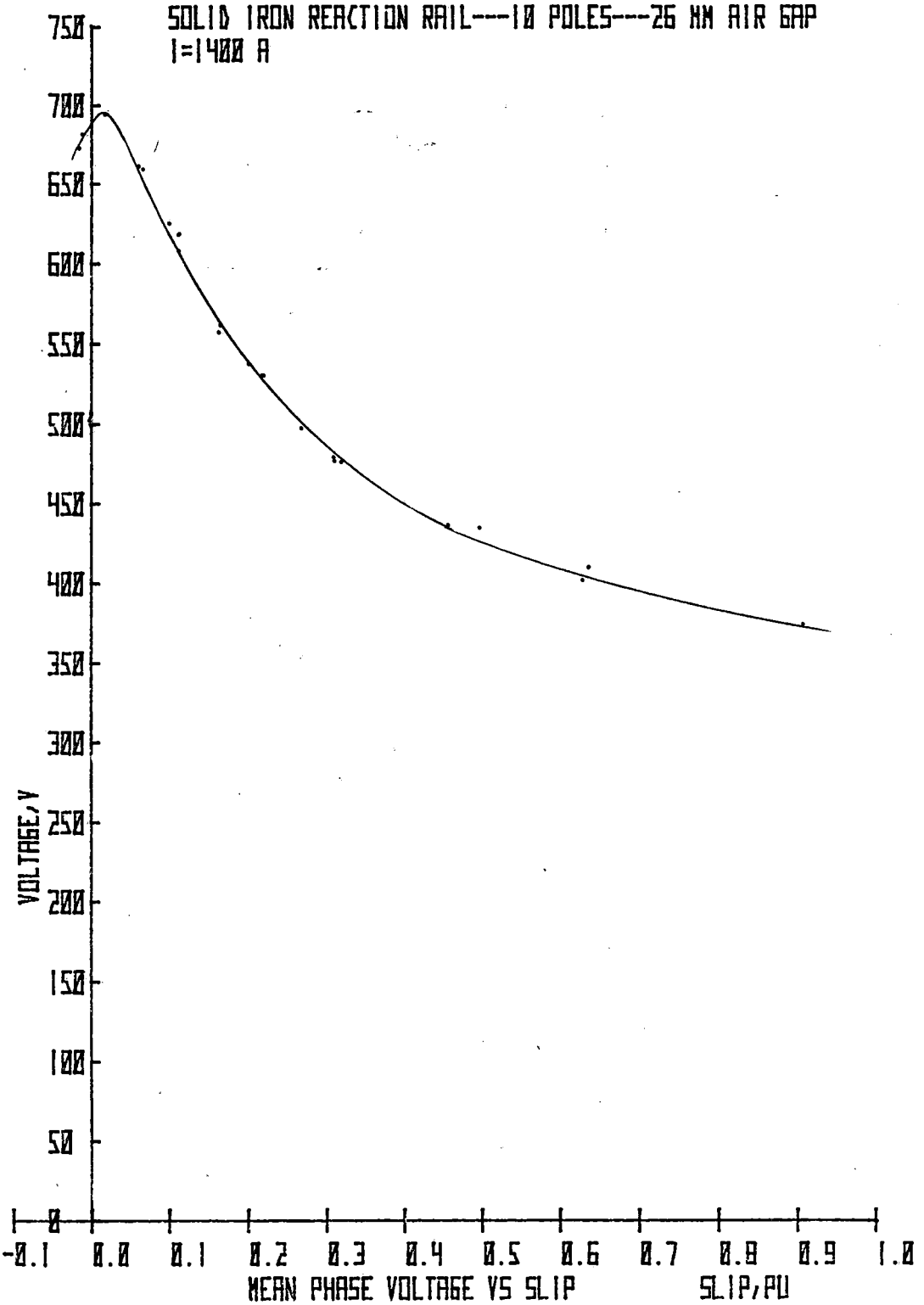
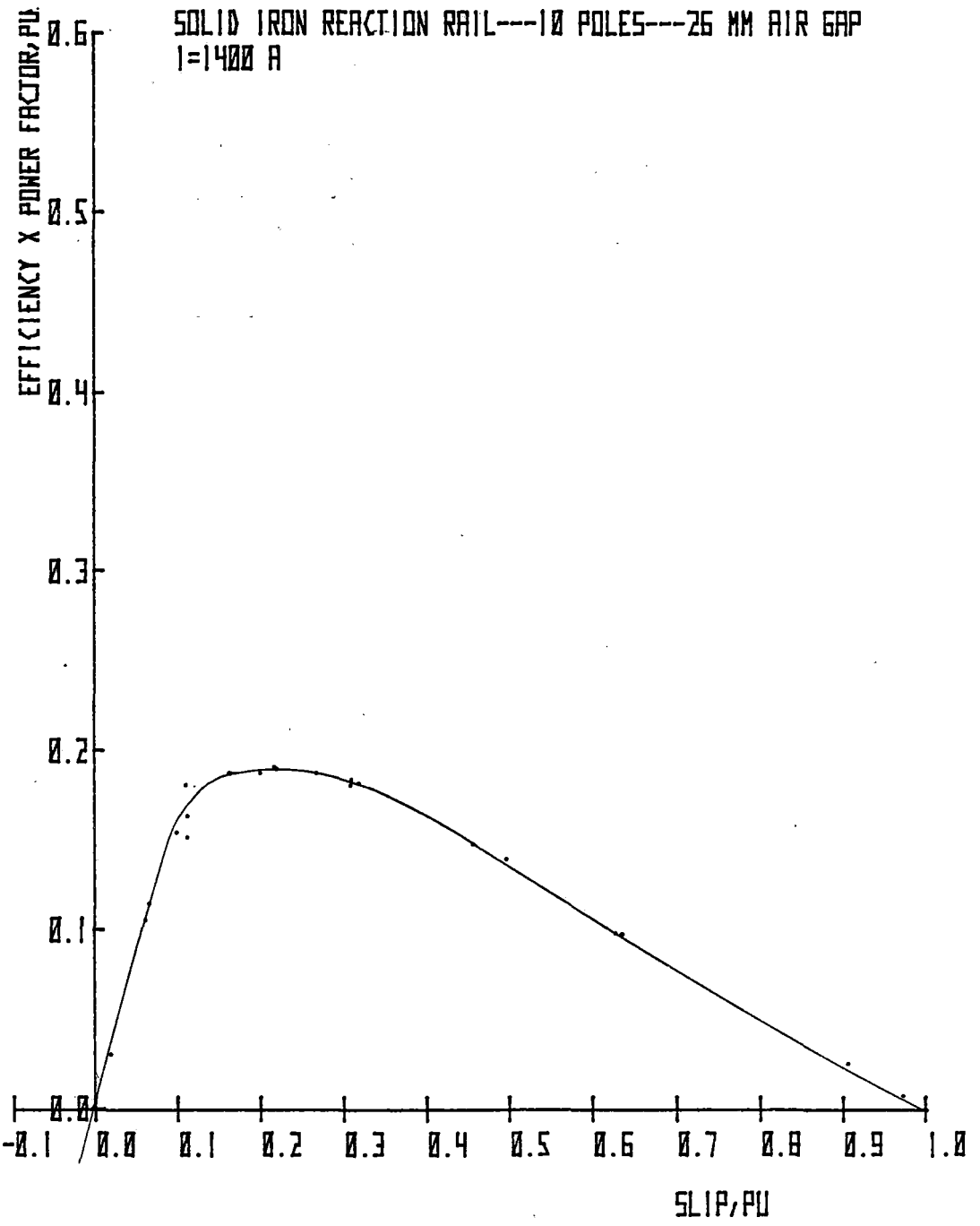

SOLID IRON REACTION RAIL---10 POLES---26 MM AIR GAP
I=1400 A
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
VOLTAGE,V
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
MEAN PHASE VOLTAGE VS SLIP
SLIP,PU

Figure 4-14



EFFICIENCY X POWER FACTOR VS SLIP

Figure 4-15

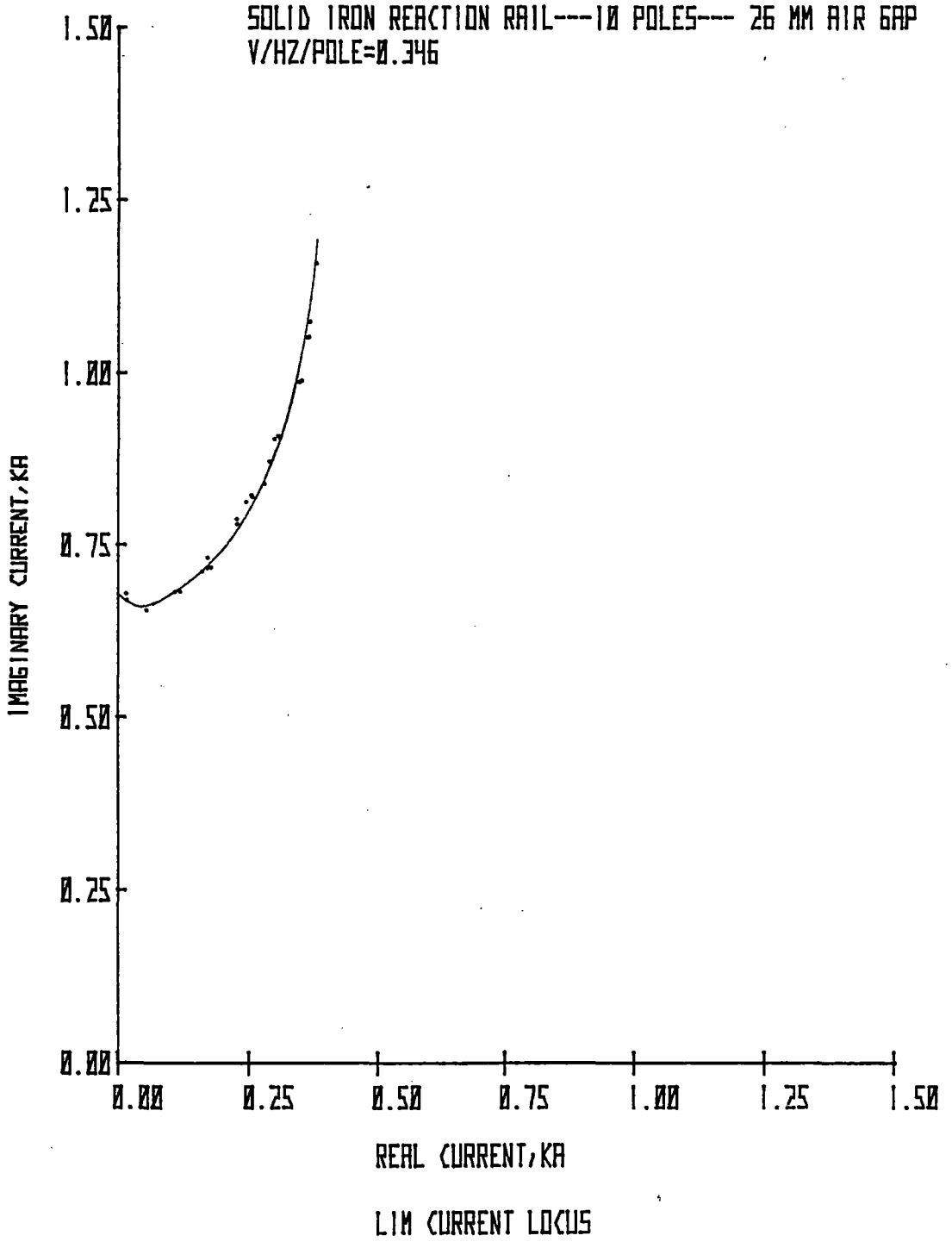
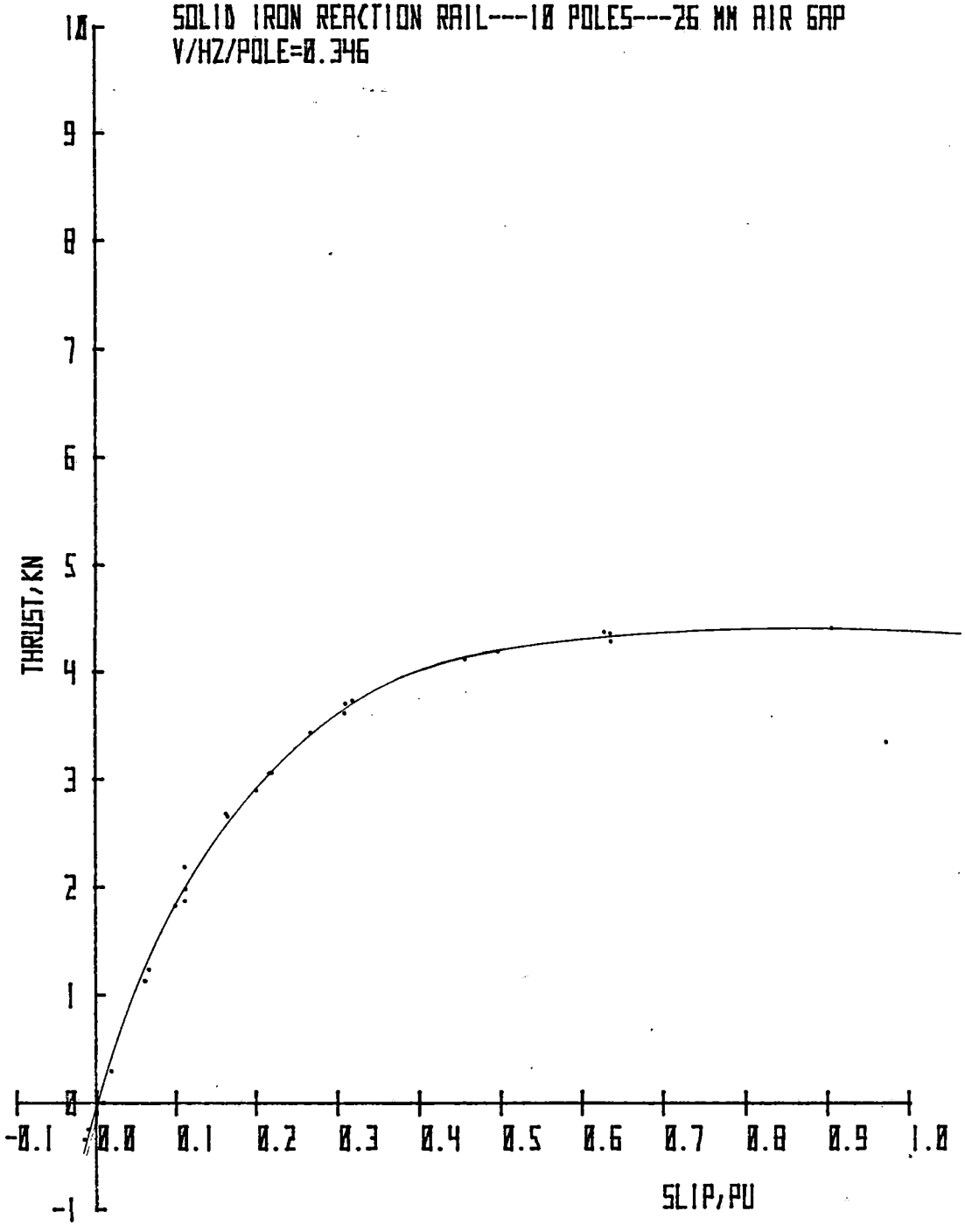

SOLID IRON REACTION RAIL---10 POLES--- 26 MM AIR GAP
V/HZ/POLE=0.346
1.50
1.25
1.00
0.75
0.50
0.25
0.00
IMAGINARY CURRENT,KA
0.00
0.25
0.50
0.75
1.00
1.25
1.50
REAL CURRENT,KA
LIM CURRENT LOCUS

Figure 4-16



THRUST VS SLIP

Figure 4-17

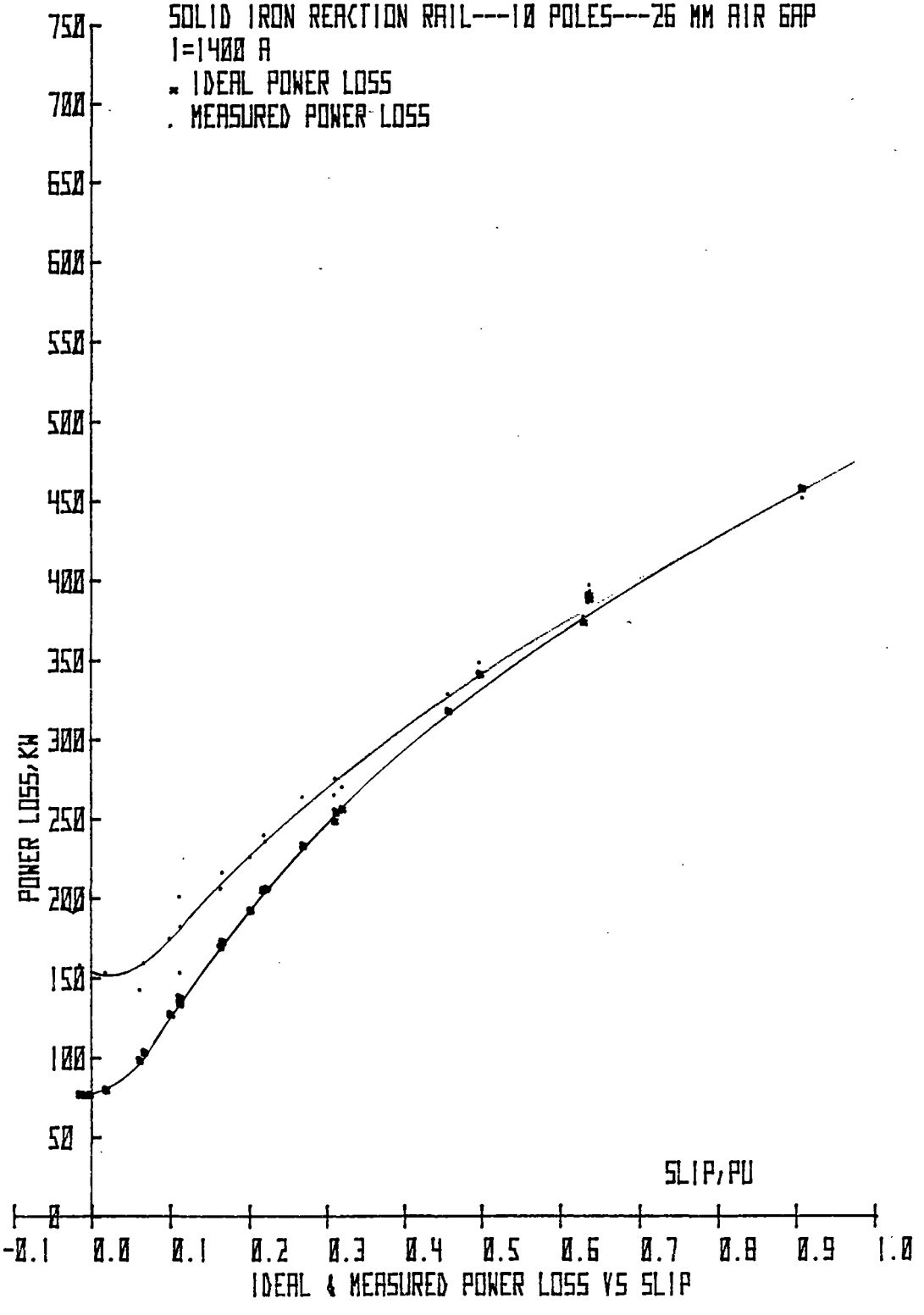
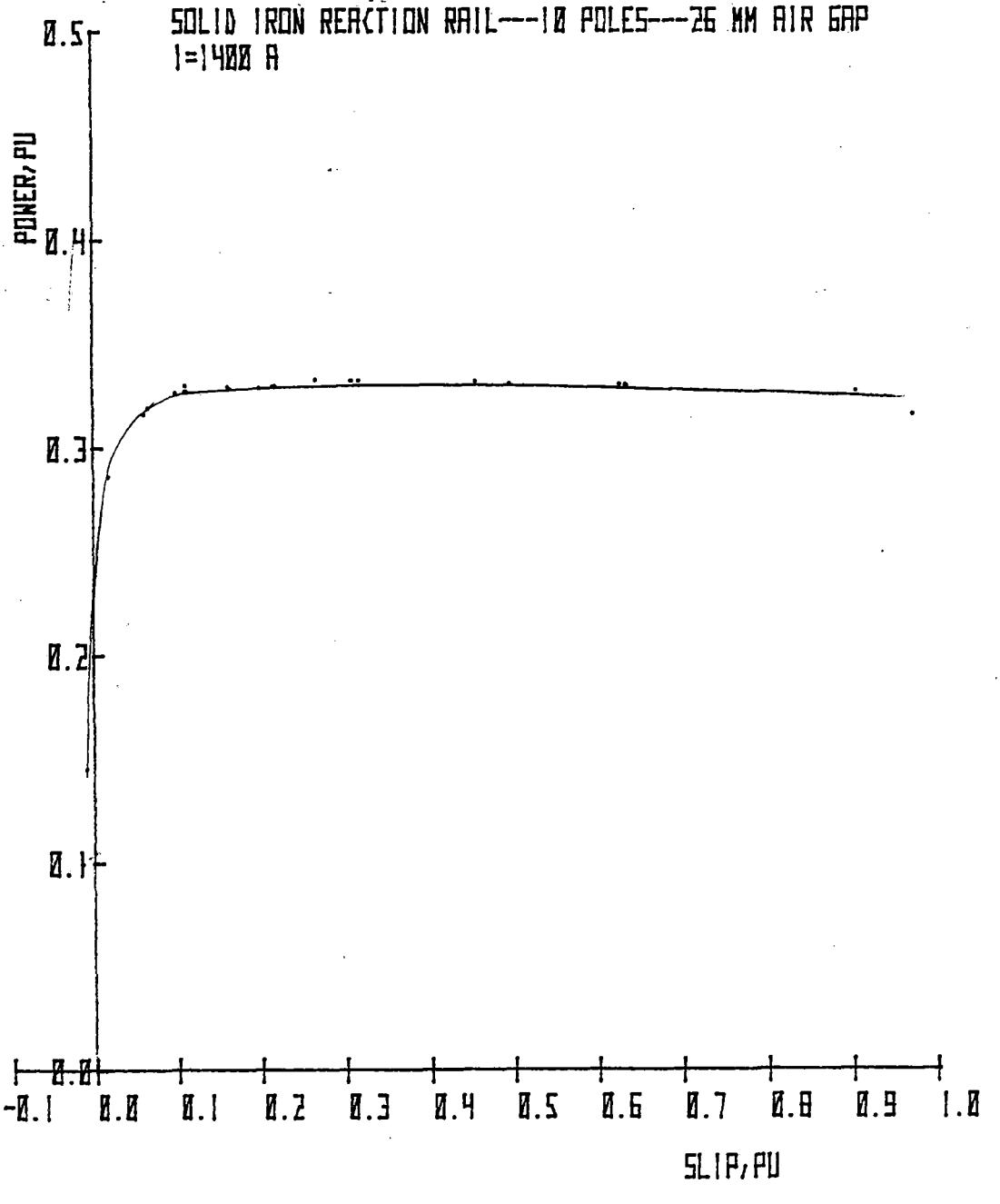
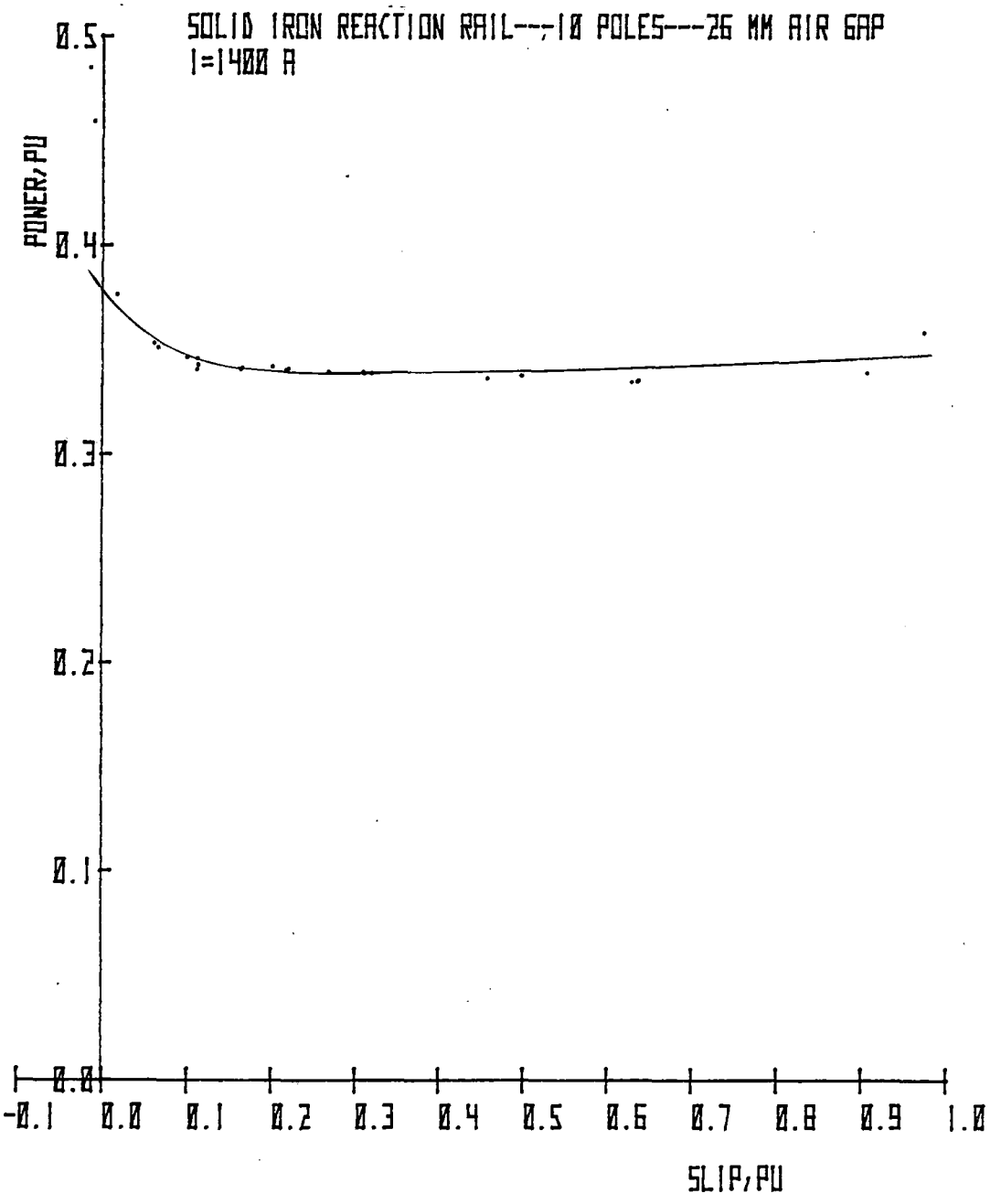

SOLID IRON REACTION RAIL---10 POLES---26 MM AIR GAP
I=1400 A
* IDEAL POWER LOSS
. MEASURED POWER LOSS
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
POWER LOSS, KW
SLIP, PU
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
IDEAL & MEASURED POWER LOSS VS SLIP

Figure 4-18



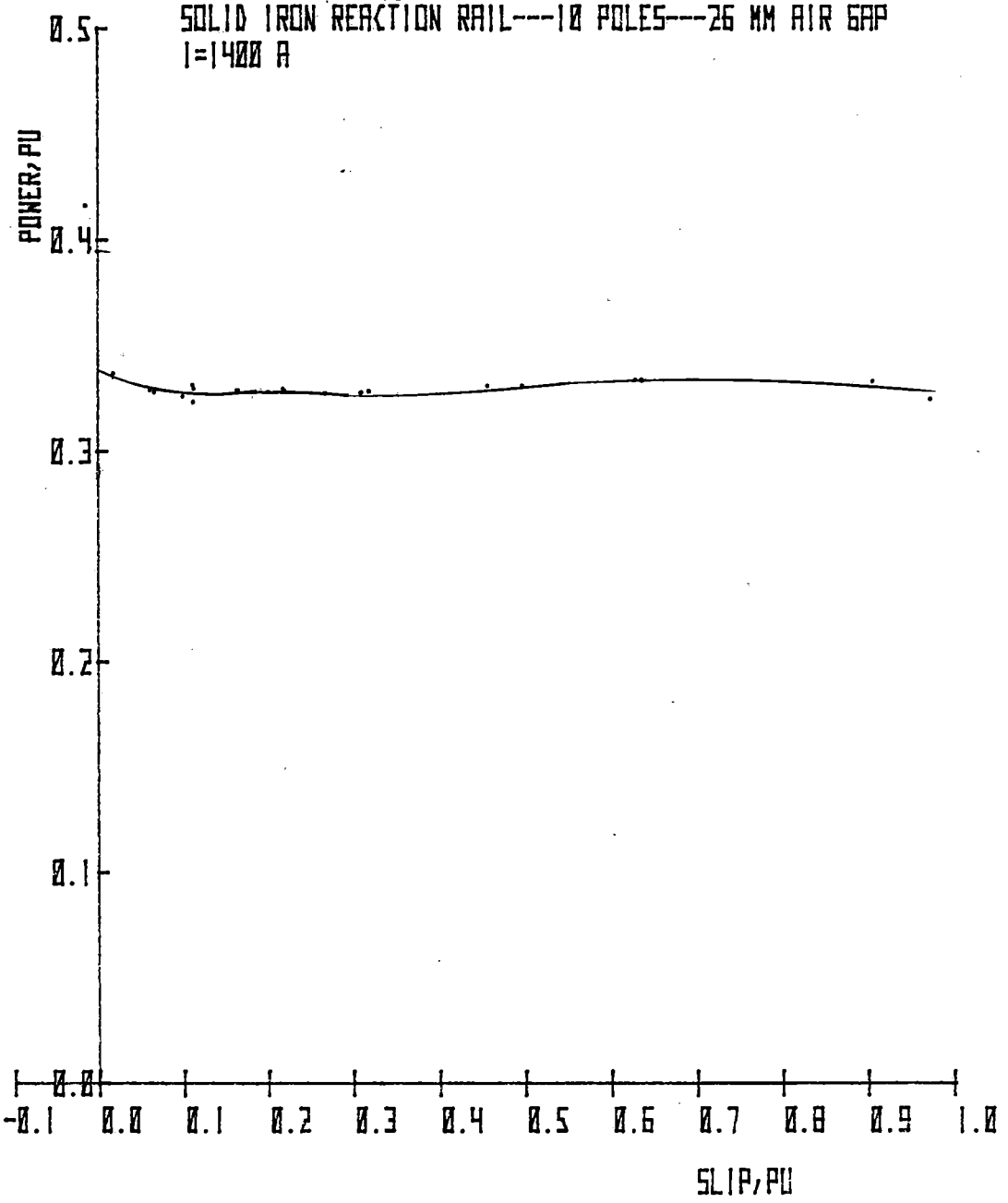
A PHASE POWER VS SLIP

Figure 4-19



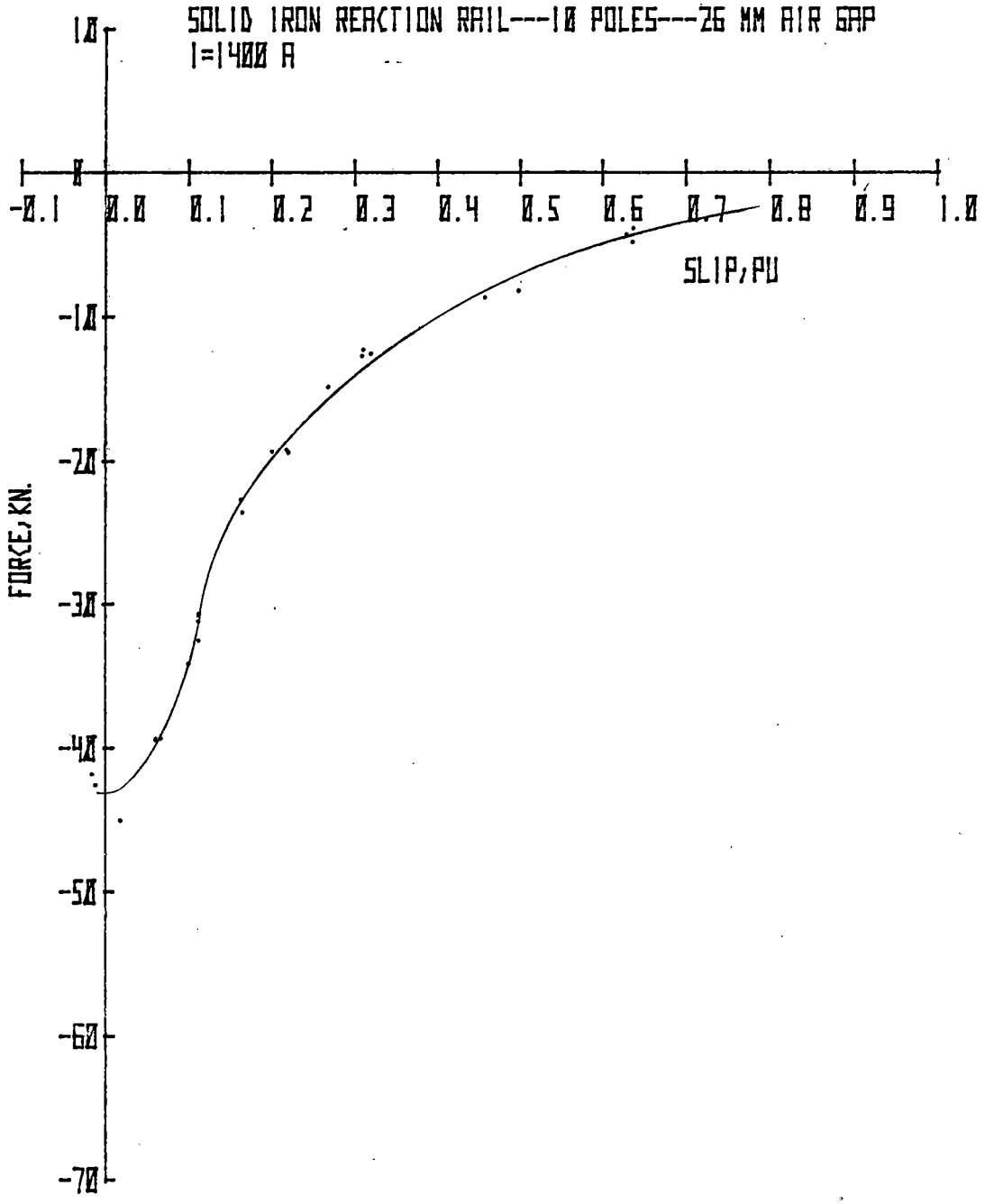
B PHASE POWER VS SLIP

Figure 4-20



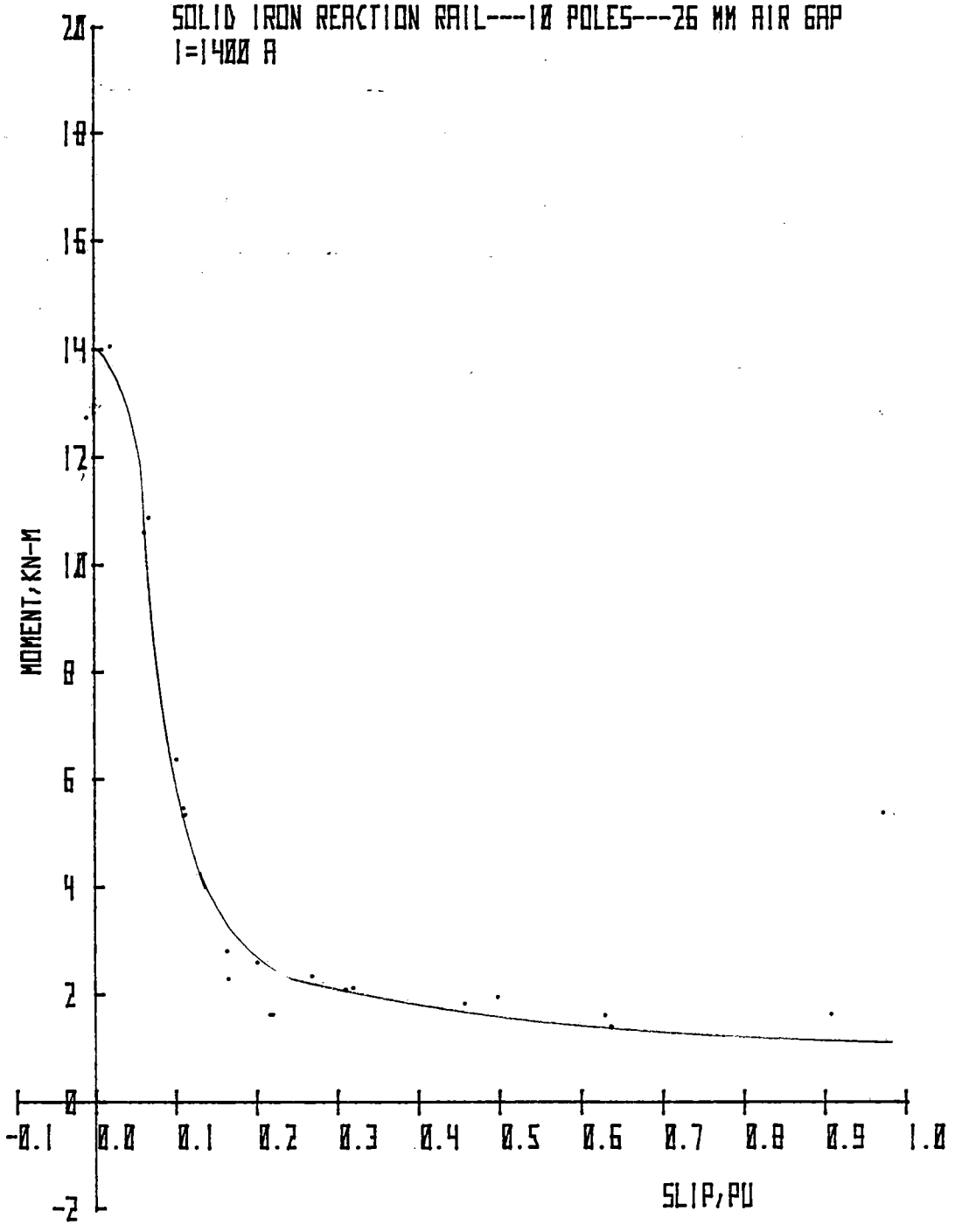
C PHASE POWER VS SLIP

Figure 4-21



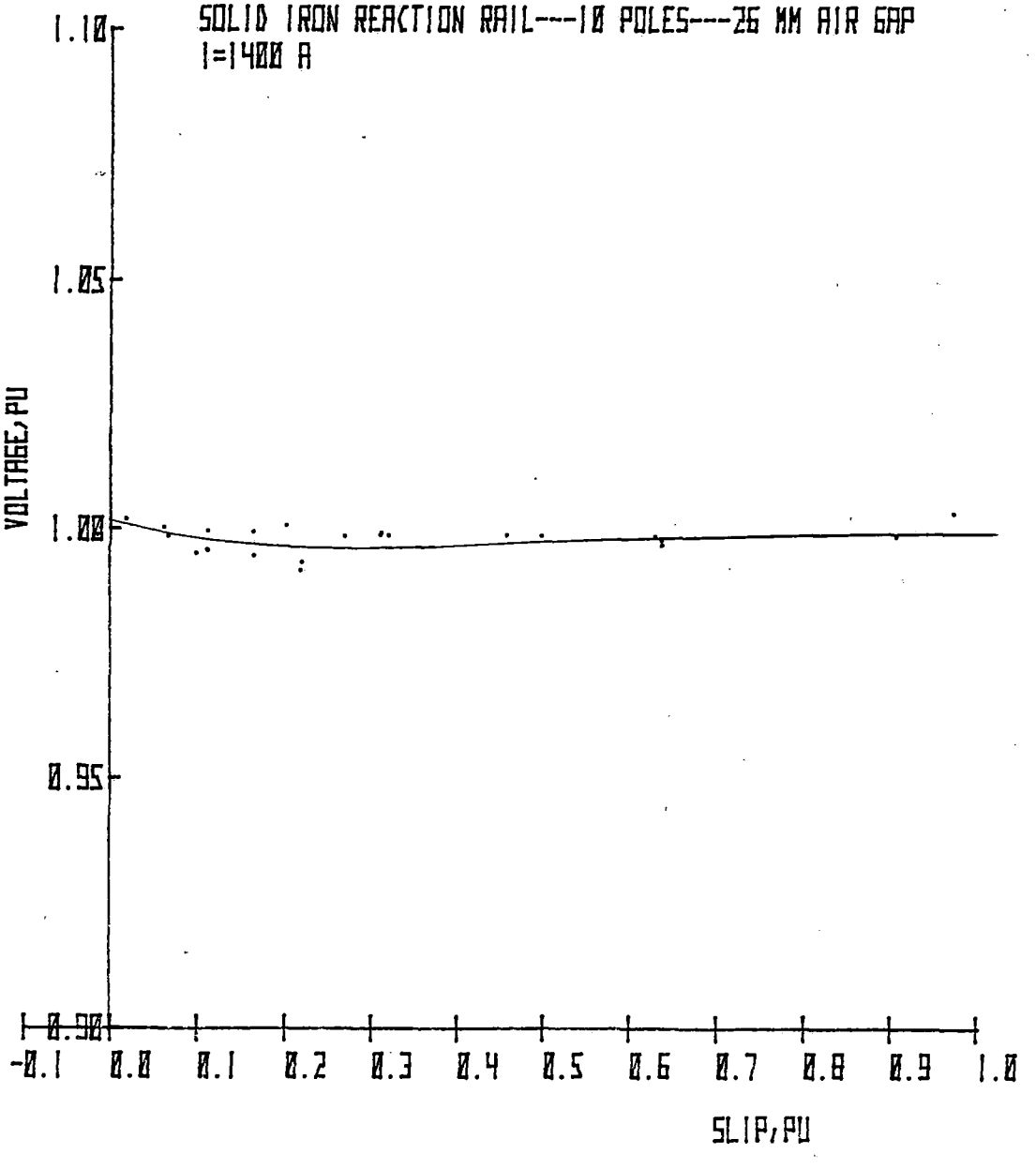
TOTAL VERTICAL FORCE VS SLIP

Figure 4-22



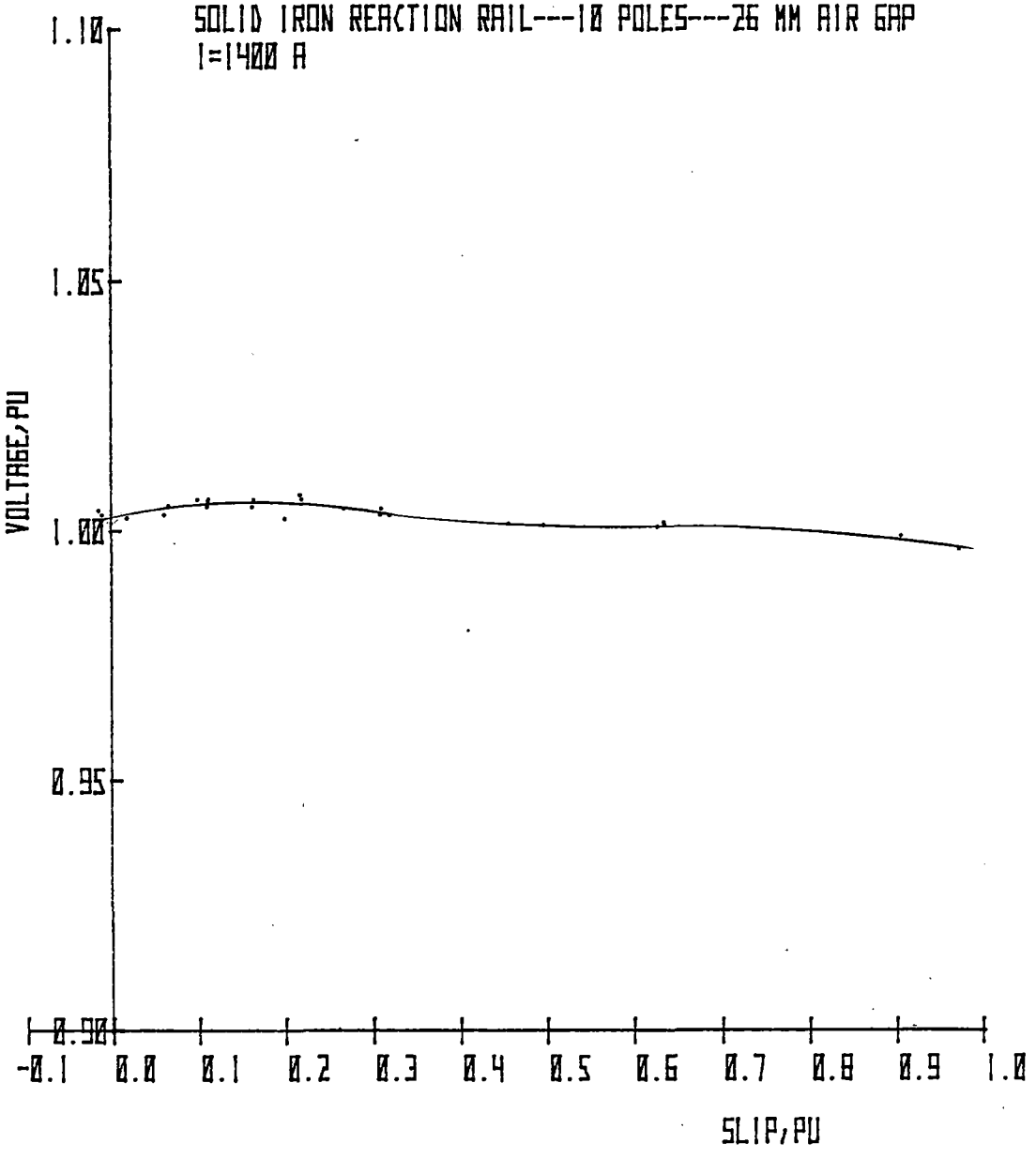
PITCHING MOMENT VS SLIP

Figure 4-23



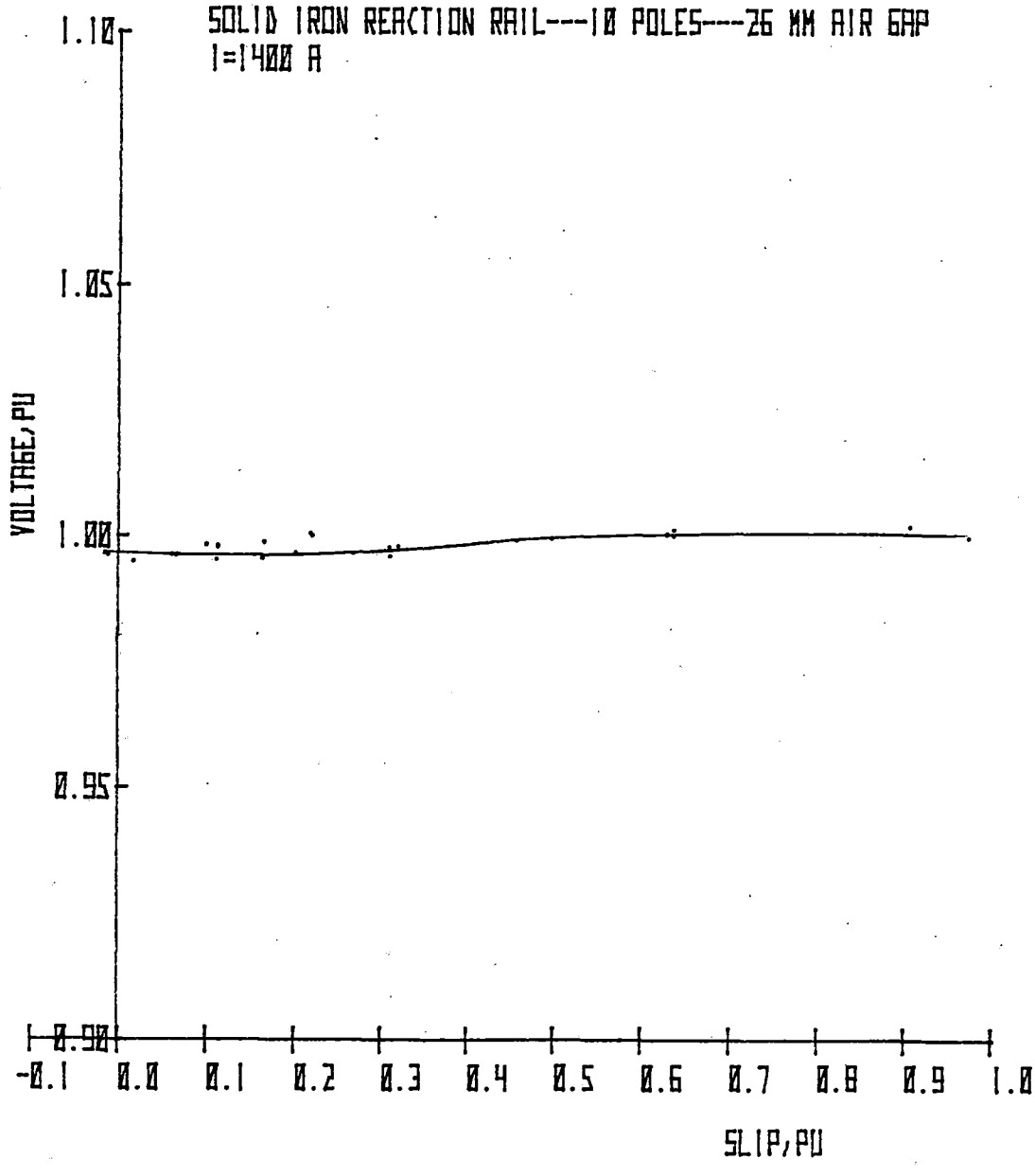
A PHASE VOLTAGE VS SLIP

Figure 4-24



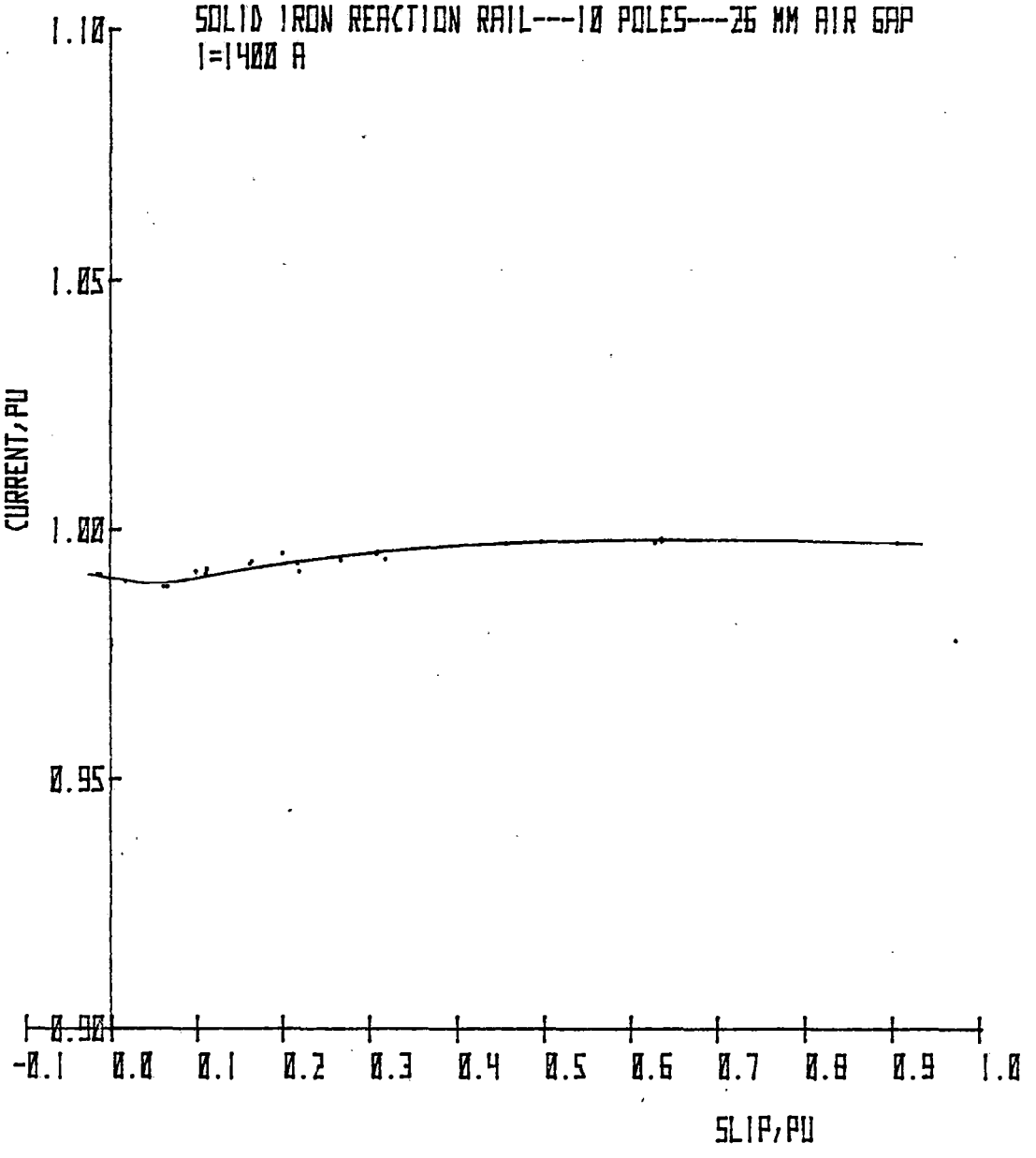
B PHASE VOLTAGE VS SLIP

Figure 4-25



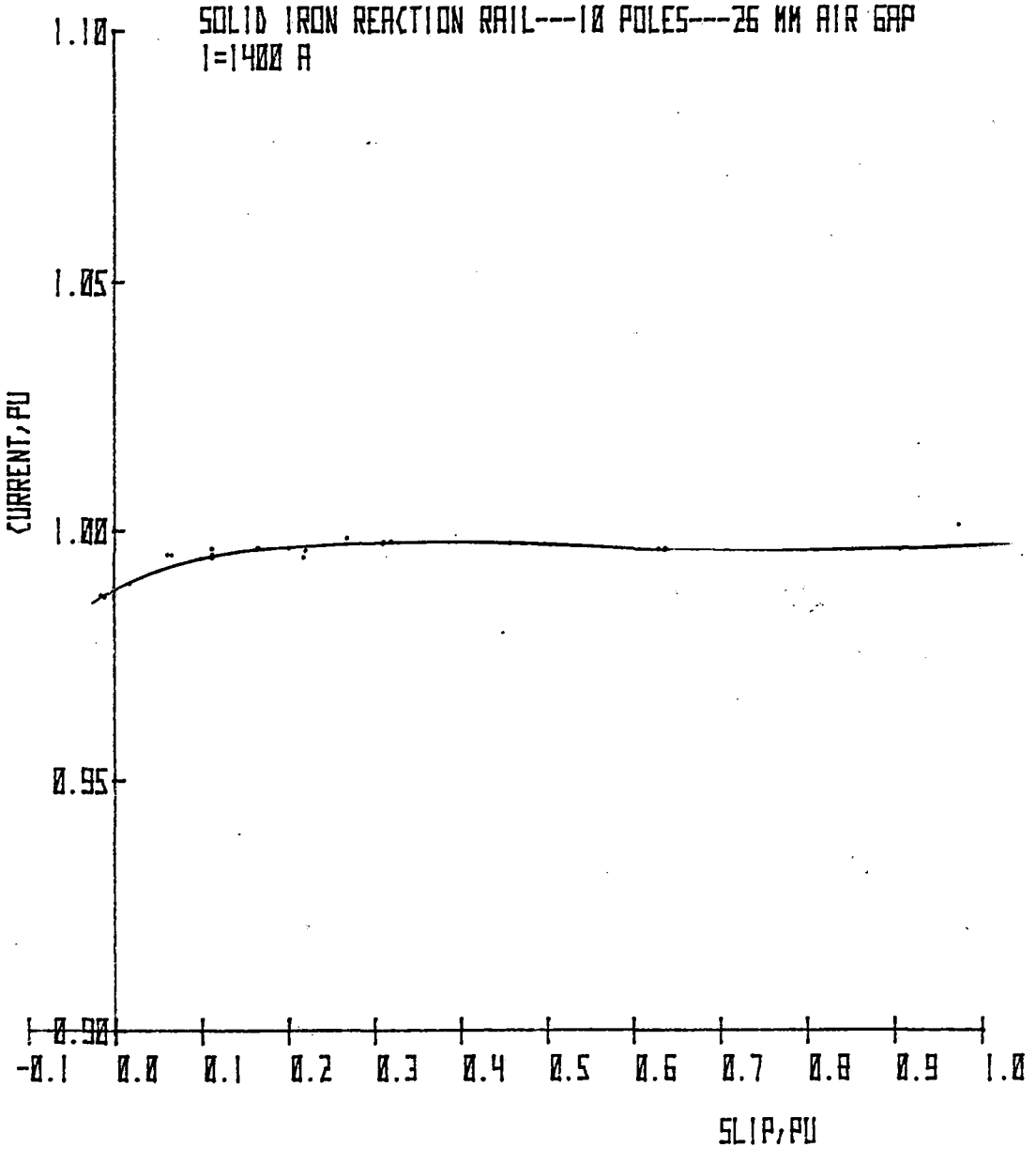
C PHASE VOLTAGE VS SLIP

Figure 4-26



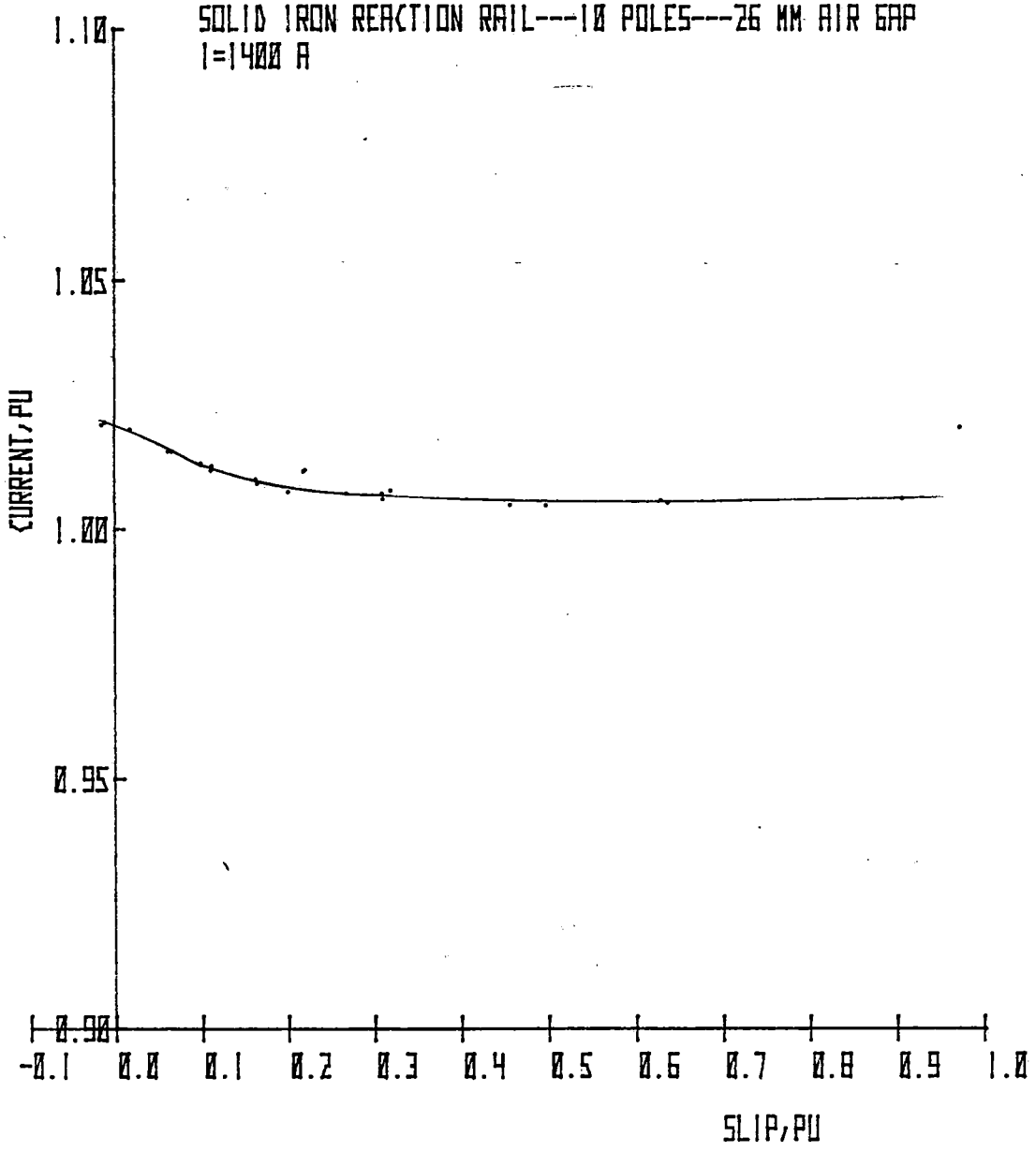
A PHASE CURRENT VS SLIP

Figure 4-27



B PHASE CURRENT VS SLIP

Figure 4-28



C PHASE CURRENT VS SLIP

Figure 4-29

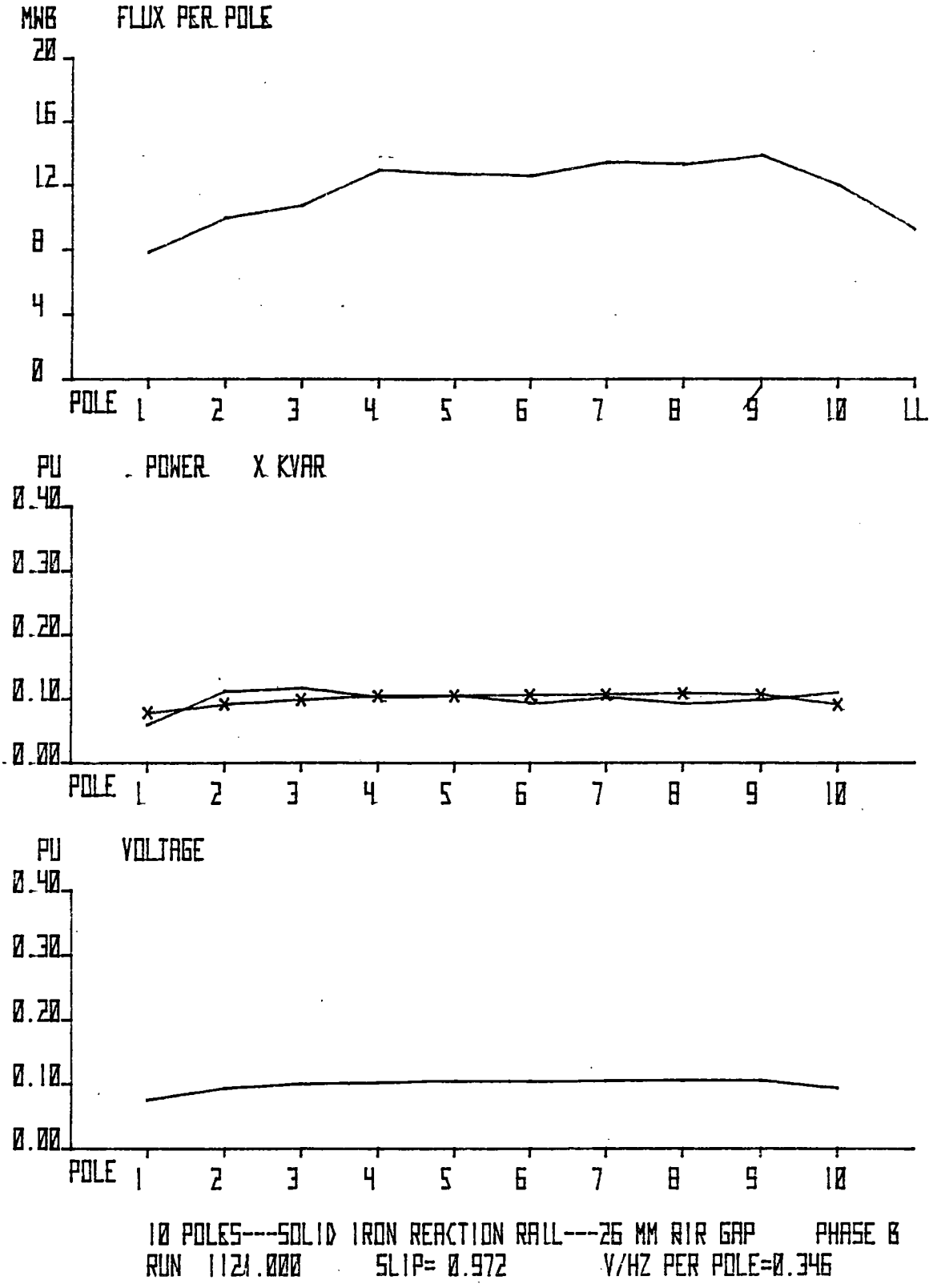

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1121.000 SLIP= 0.972 V/HZ PER POLE=0.346

Figure 4-30

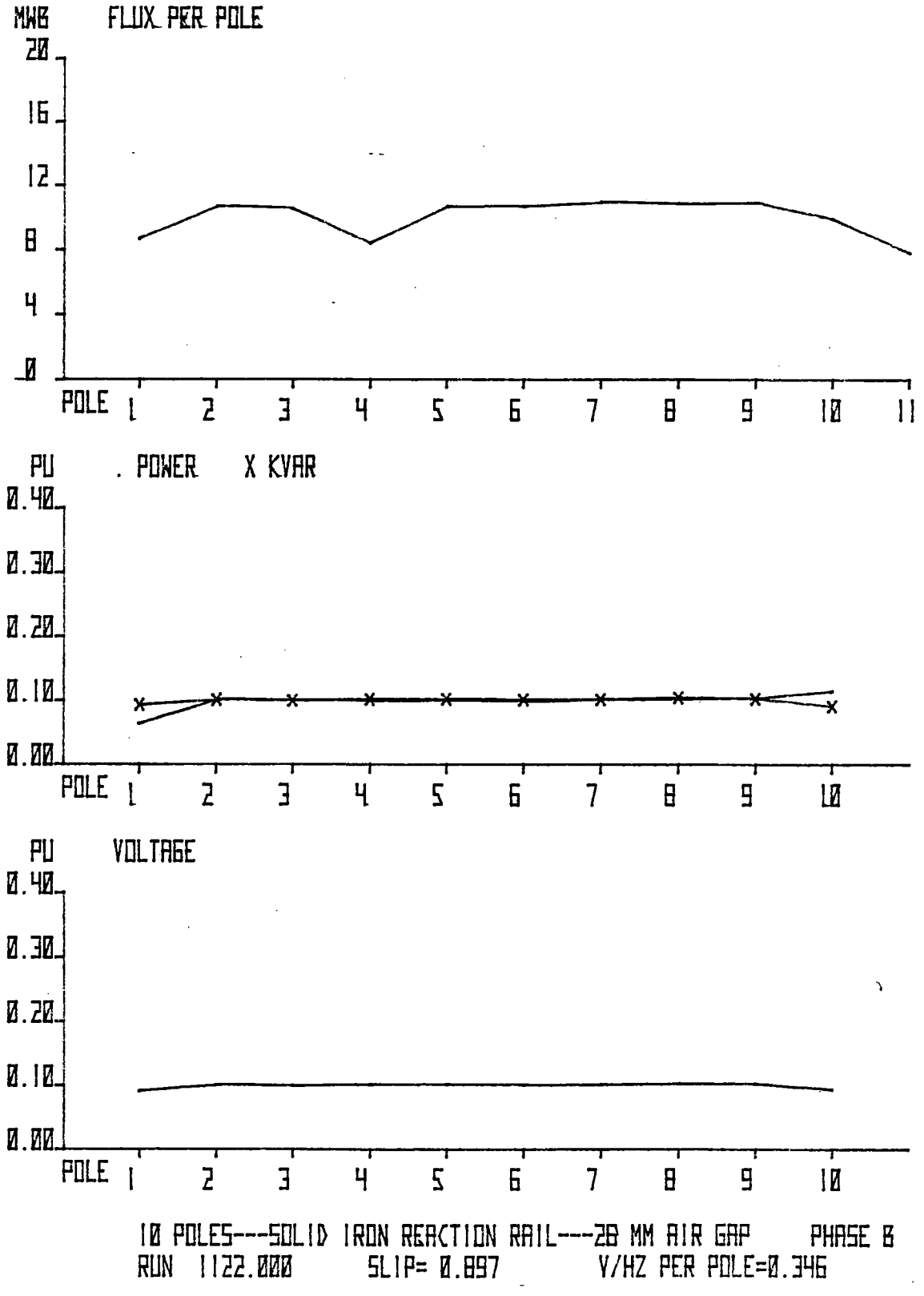

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---28 MM AIR GAP PHASE B
RUN 1122.000 SLIP= 0.897 V/HZ PER POLE=0.346

Figure 4-31

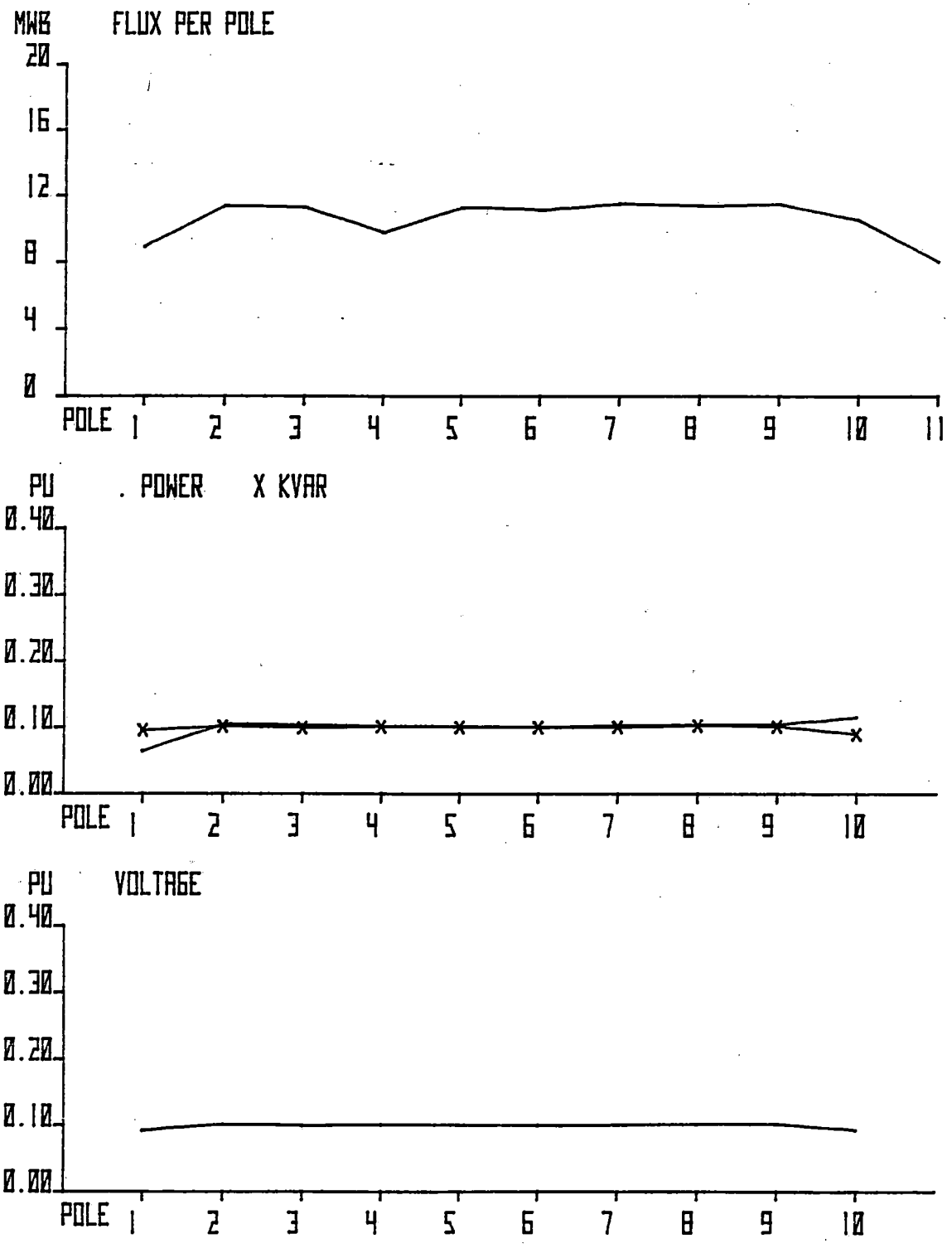

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1123.100 SLIP= 0.628 V/HZ PER POLE=0.346

Figure 4-32

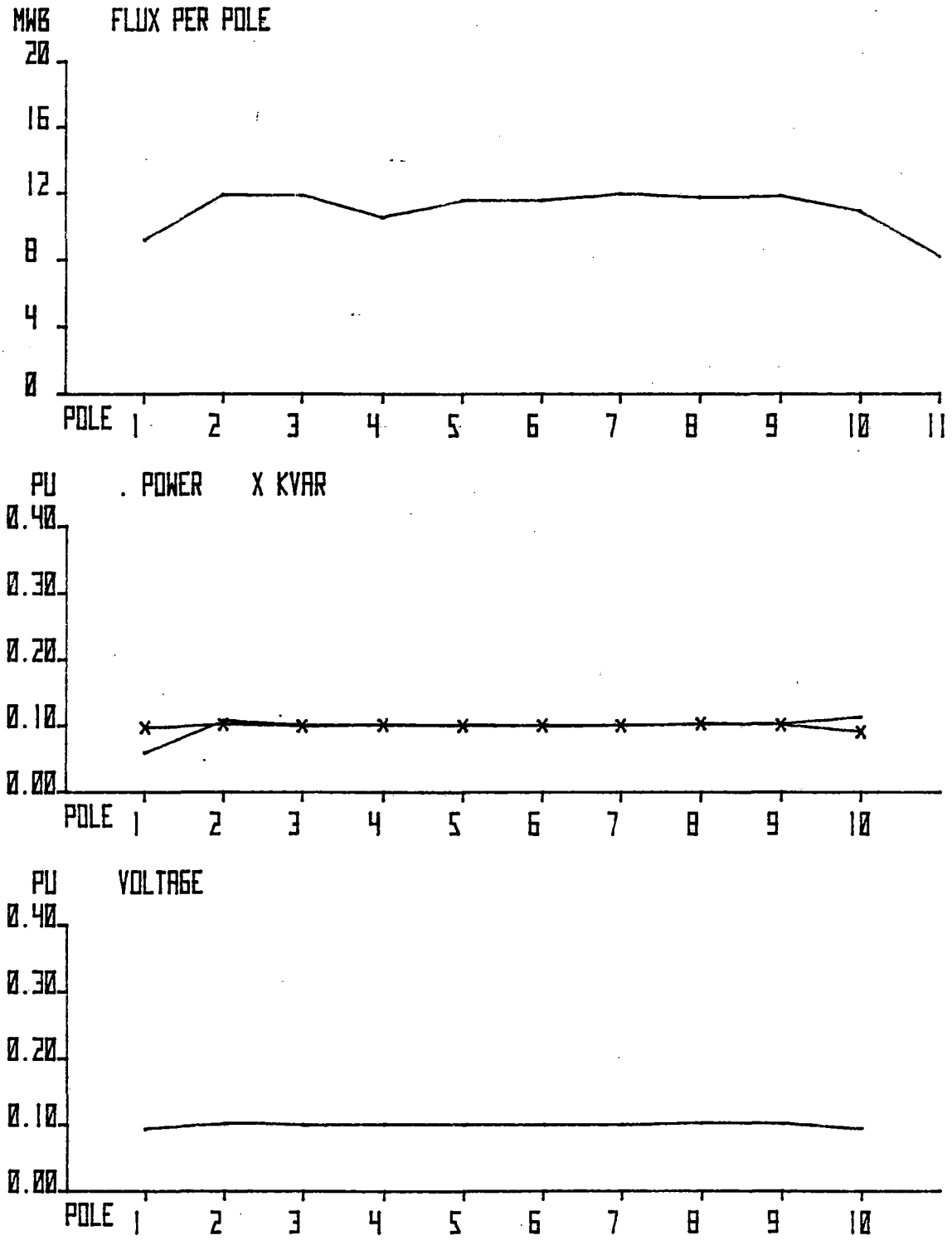

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1123.200 SLIP= 0.492 V/HZ PER POLE=0.346

Figure 4-33

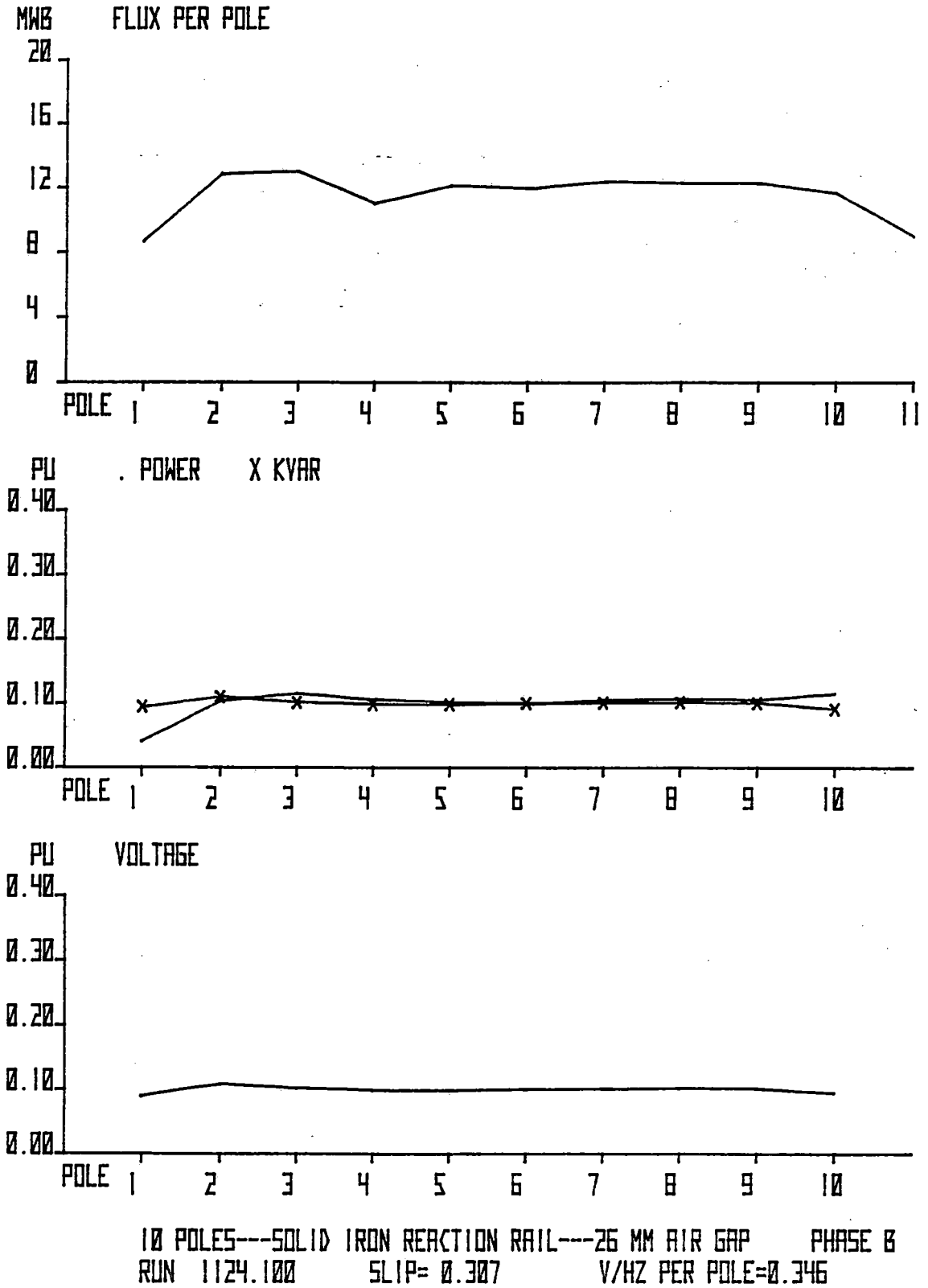

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1124.100 SLIP= 0.307 V/HZ PER POLE=0.346

Figure 4-34

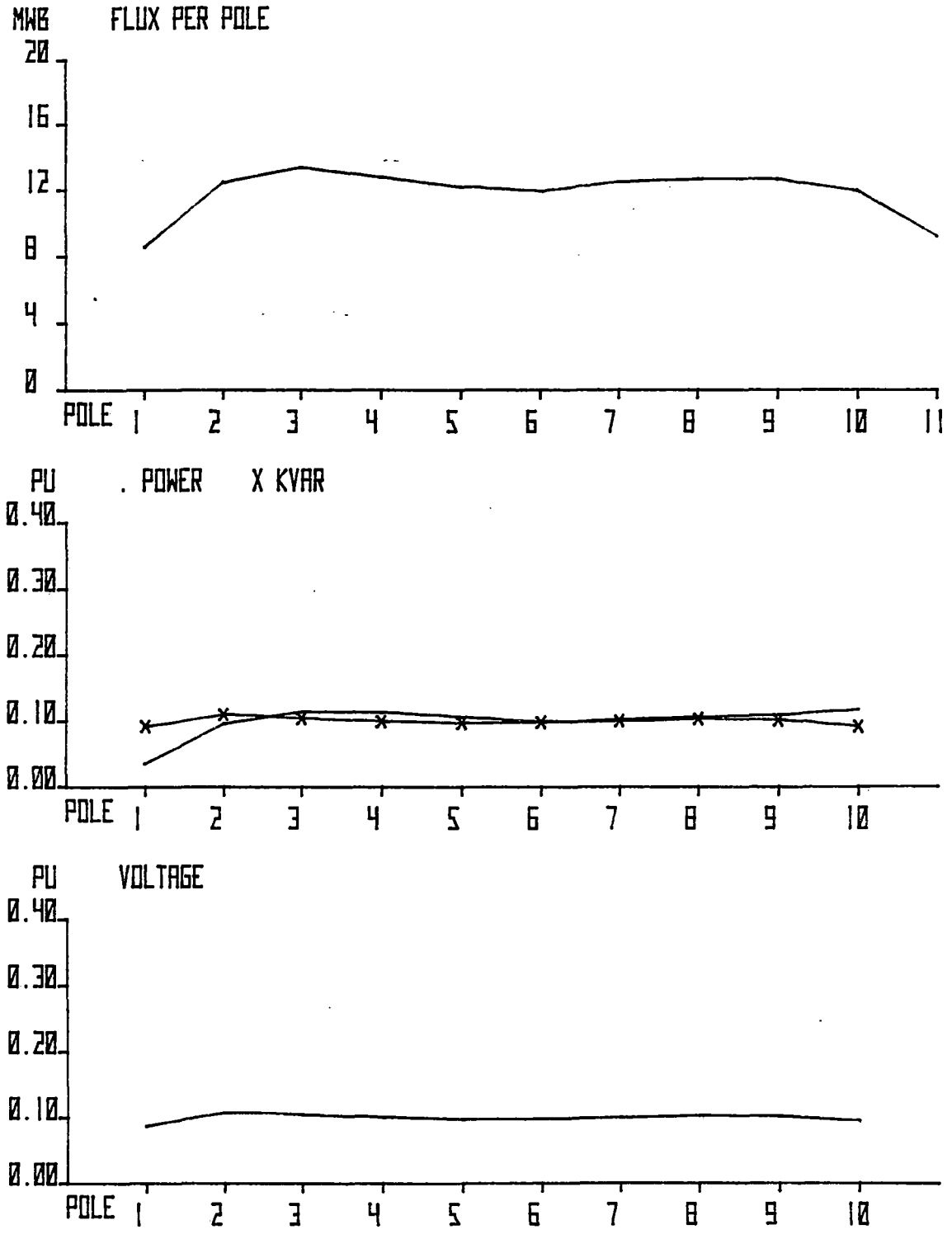

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1125.000 SLIP= 0.268 V/HZ PER POLE=0.346

Figure 4-35

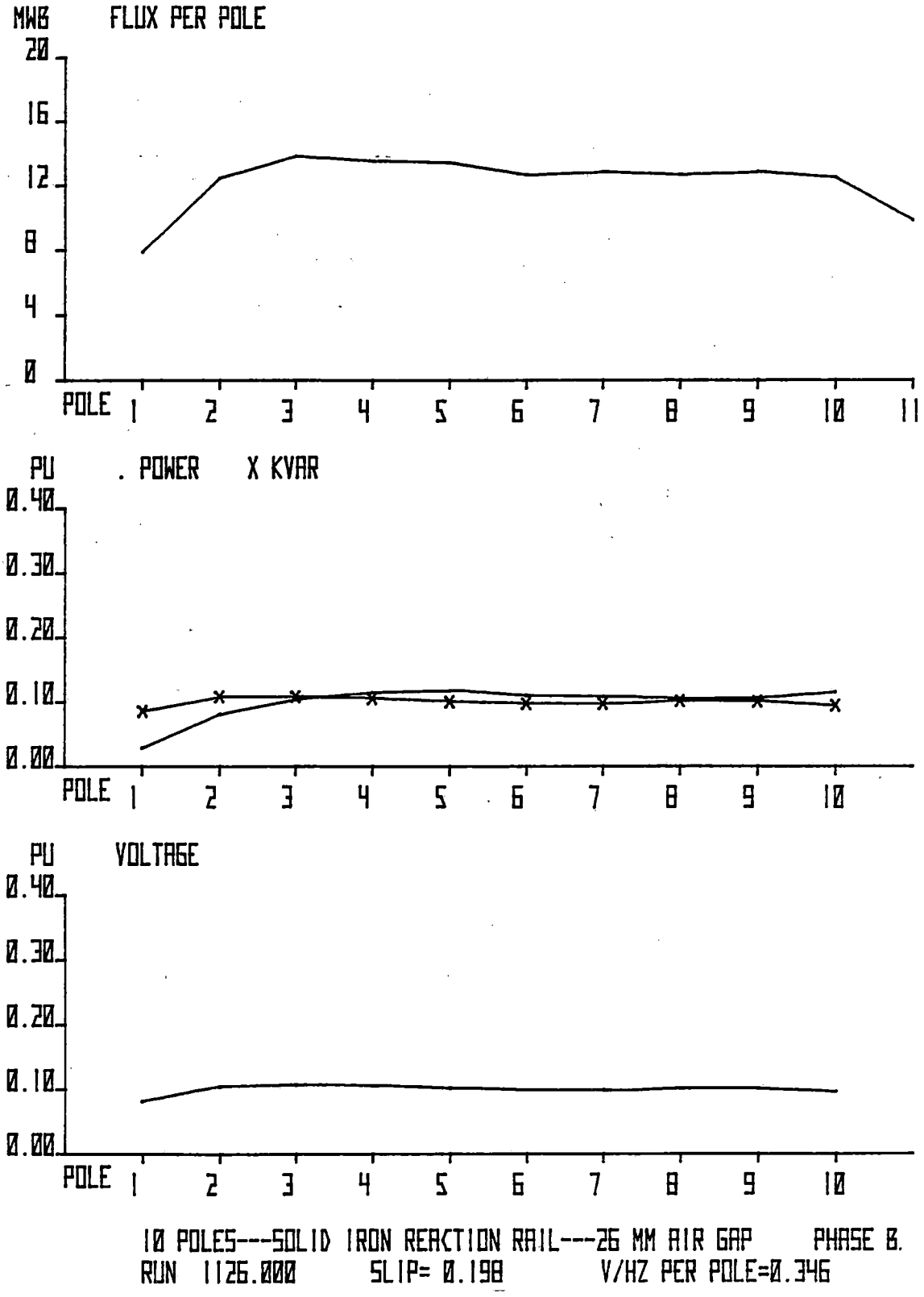
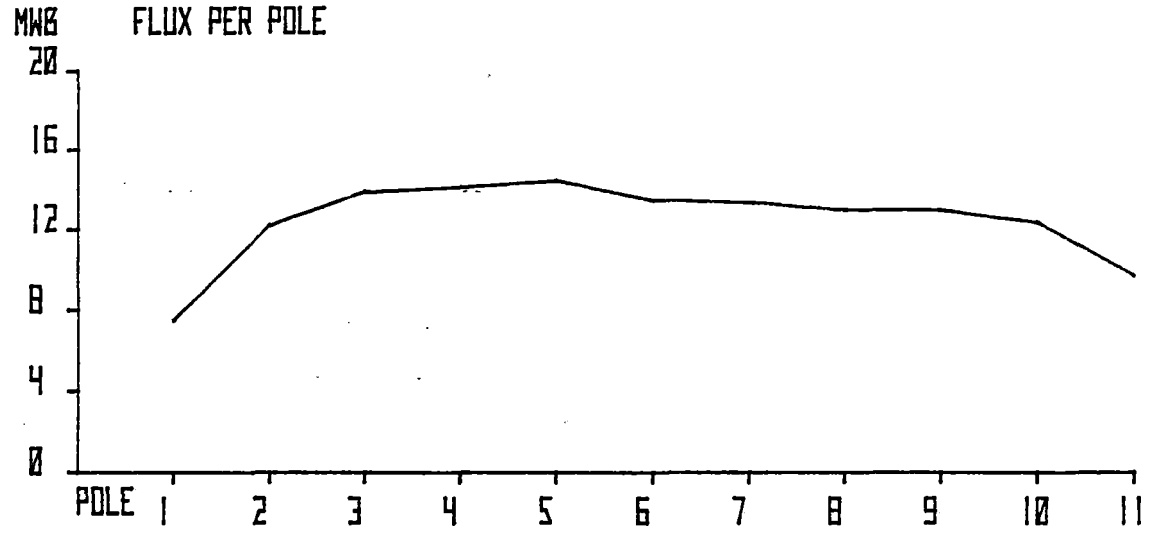
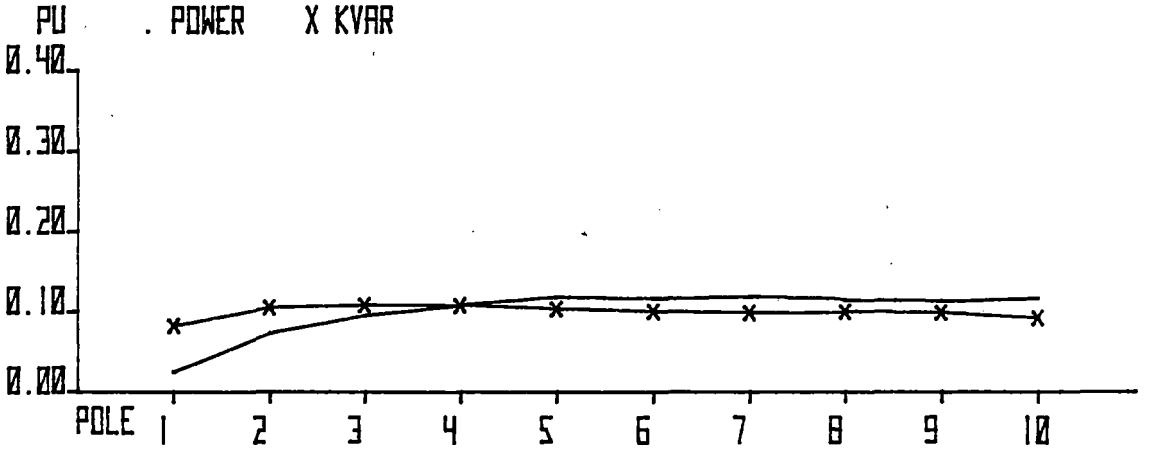
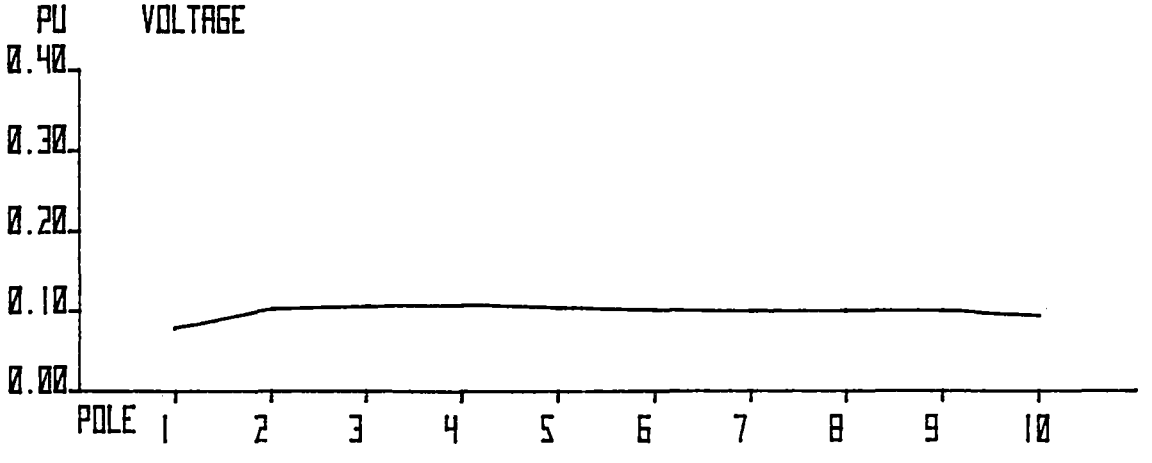

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B.
RUN 1126.000 SLIP= 0.198 V/HZ PER POLE=0.346

Figure 4-36







10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1127.000 SLIP= 0.162 V/HZ PER POLE=0.346

Figure 4-37

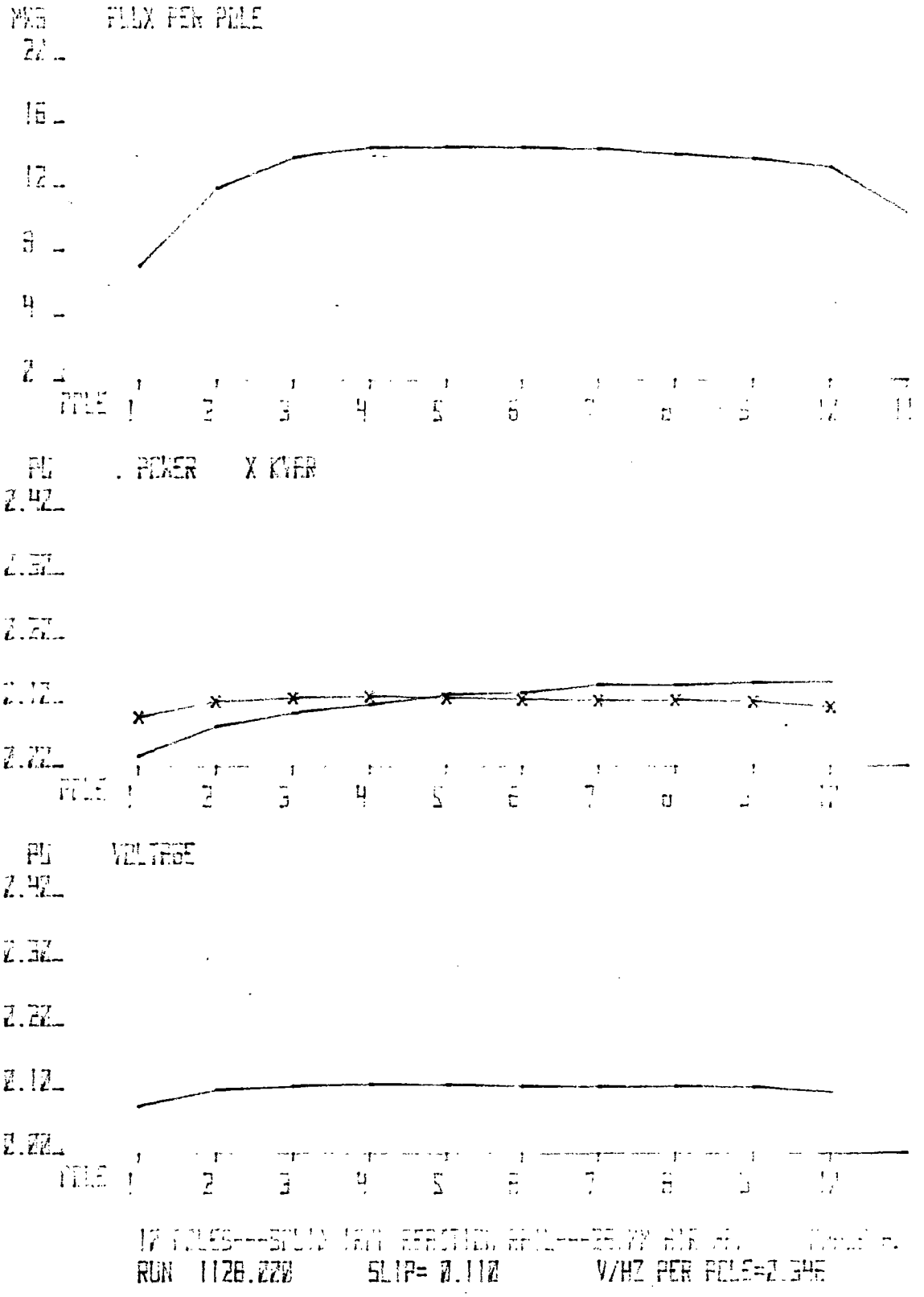

FLUX PER POLE
POLE
PU POWER X KVER
PU VOLTAGE
RUN 1128.220 SLIP= 0.110 V/HZ PER POLE=2.346

Figure 4-38

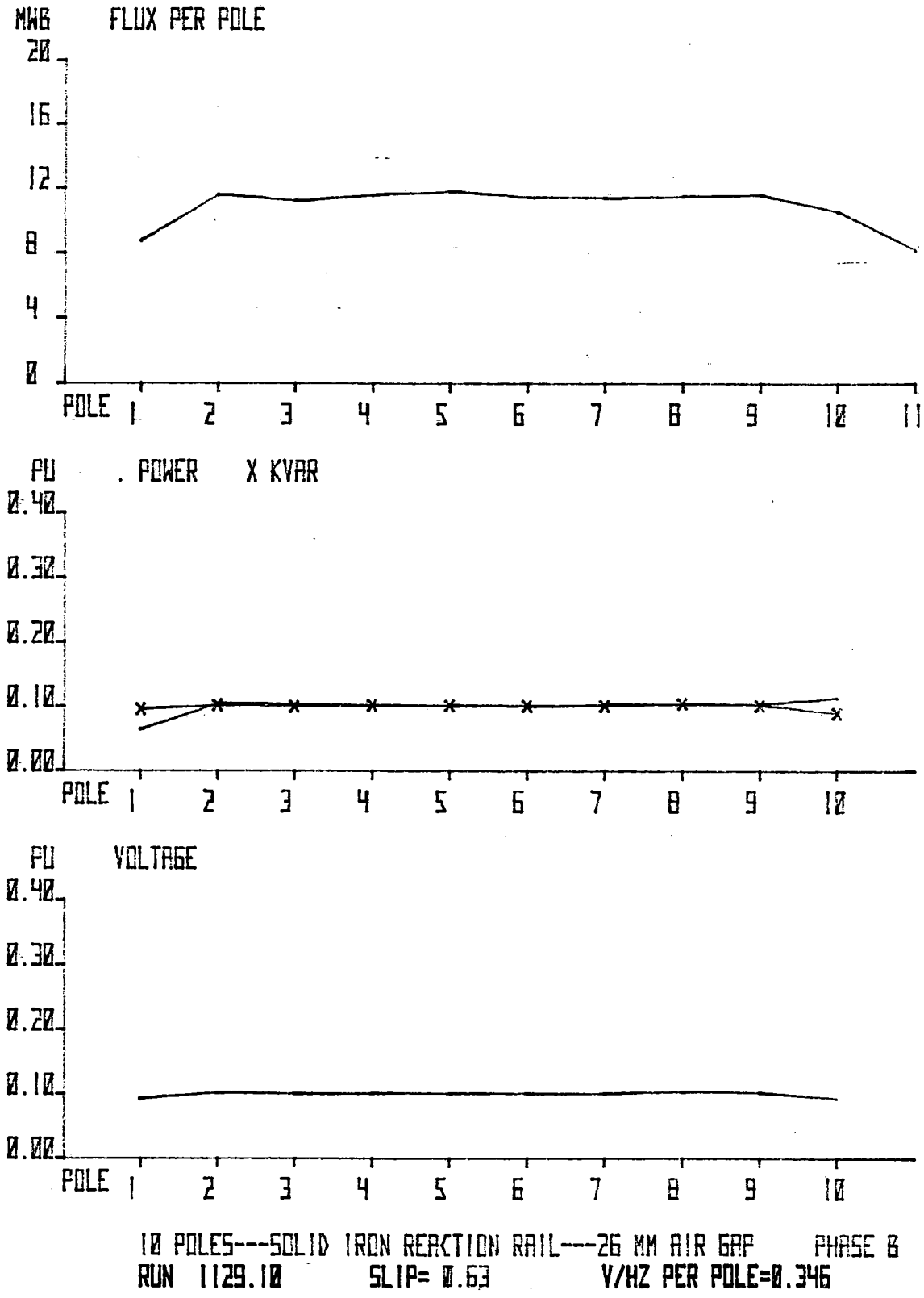

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1129.10 SLIP= 0.63 V/HZ PER POLE=0.346

Figure 4-39

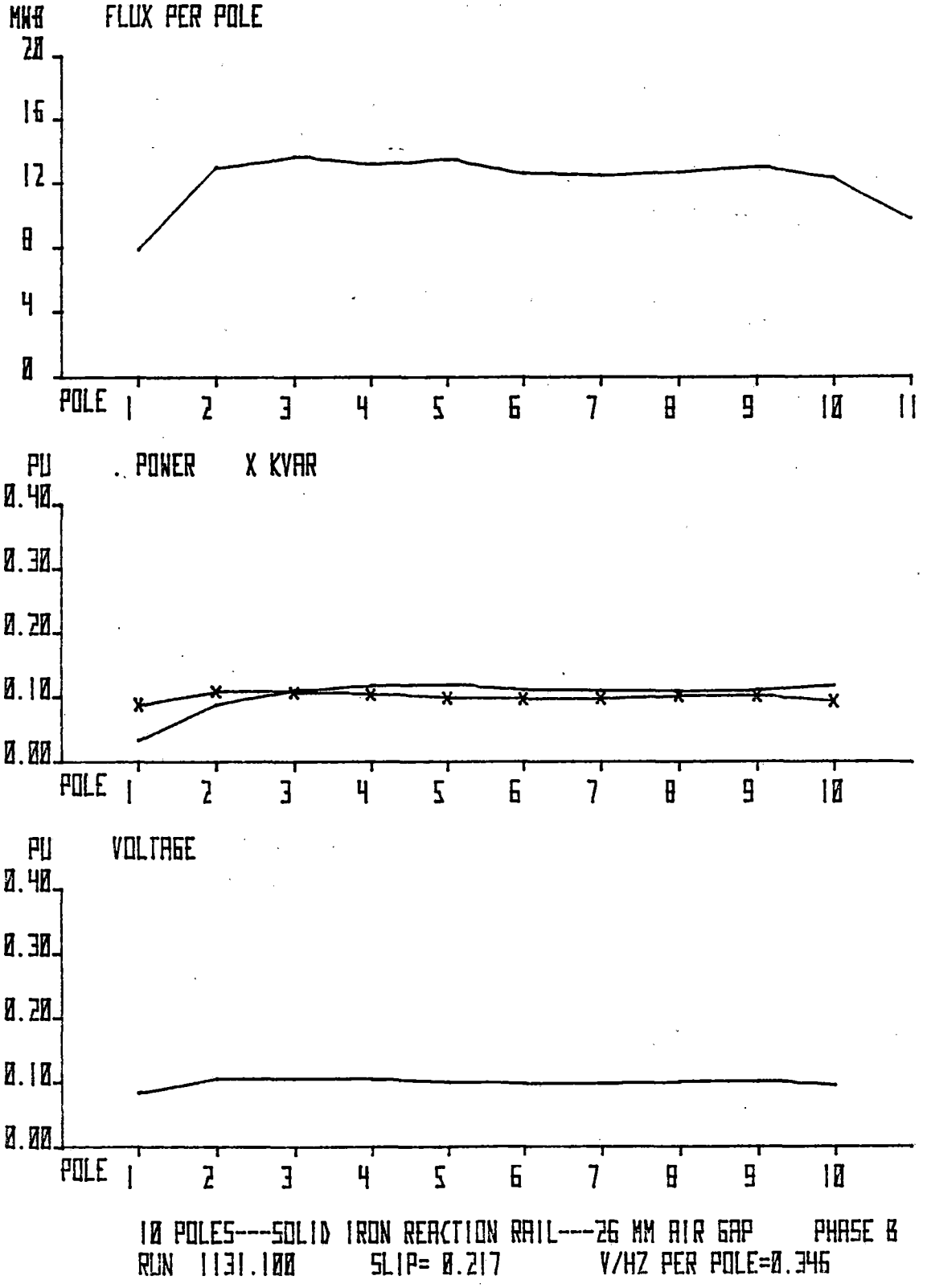

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1131.100 SLIP= 0.217 V/HZ PER POLE=0.346

Figure 4-40

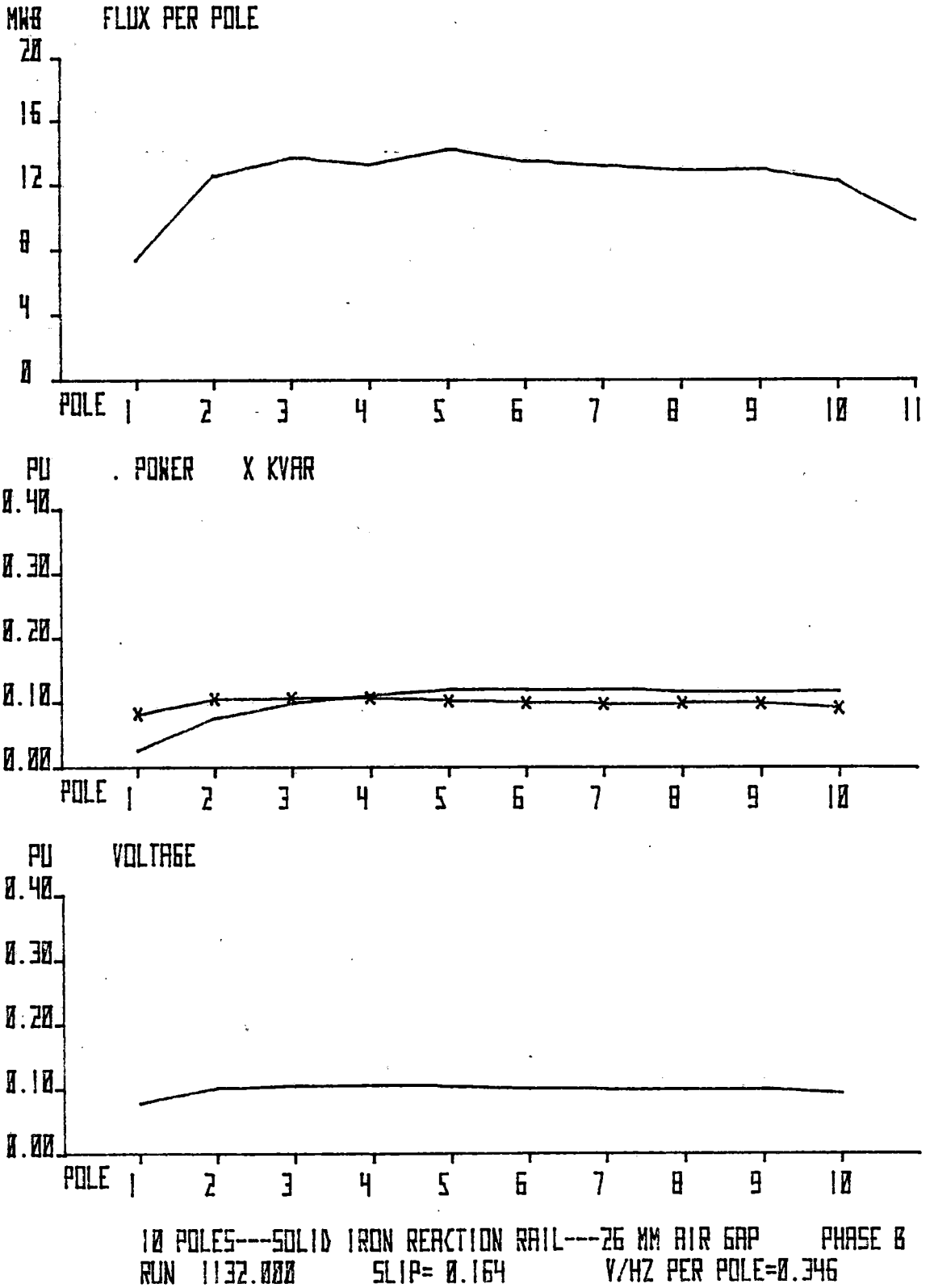

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1132.000 SLIP= 0.164 V/HZ PER POLE=0.346

Figure 4-41

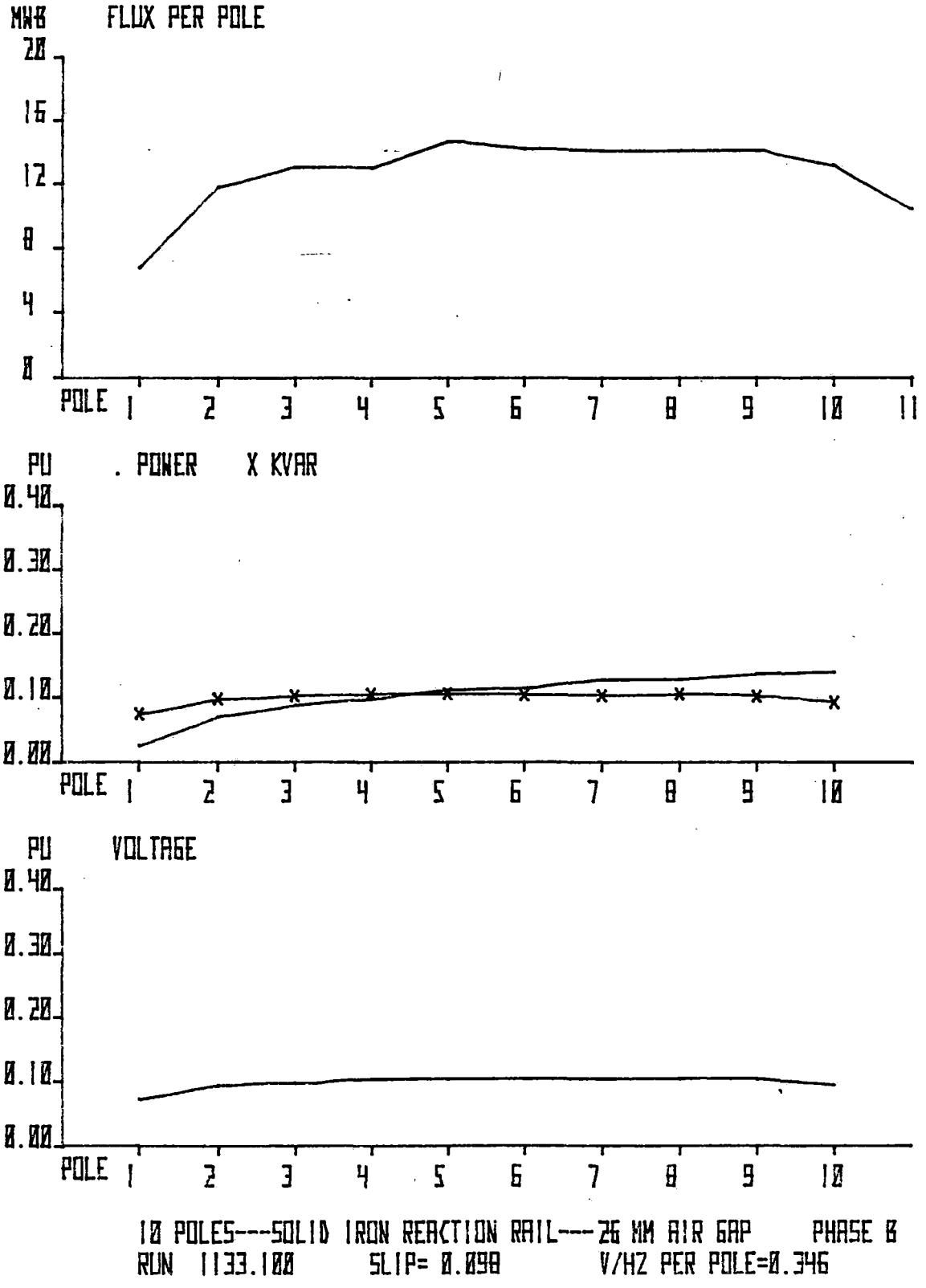

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1133.100 SLIP= 0.098 V/HZ PER POLE=0.346

Figure 4-42

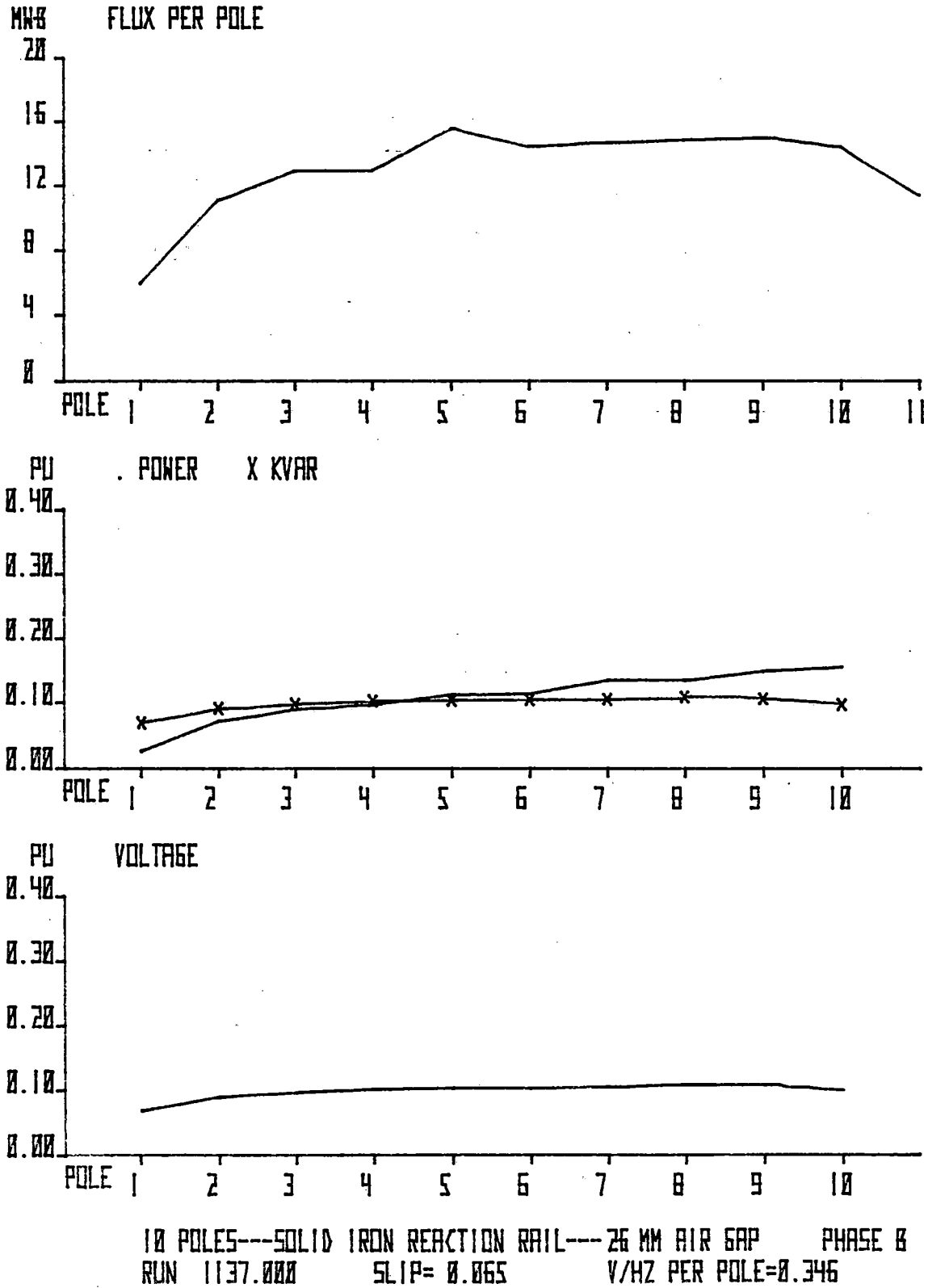
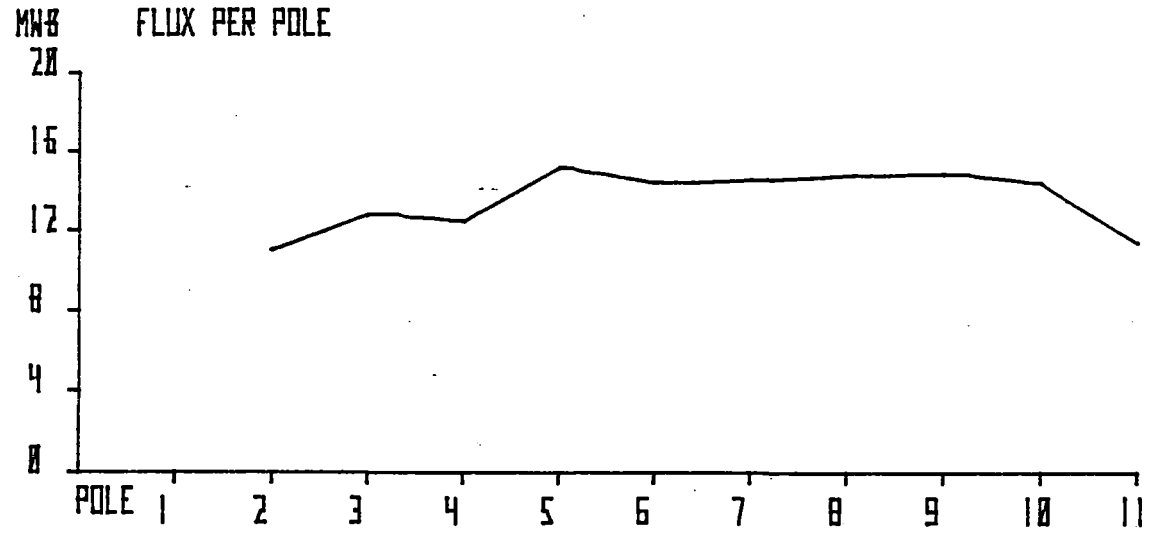
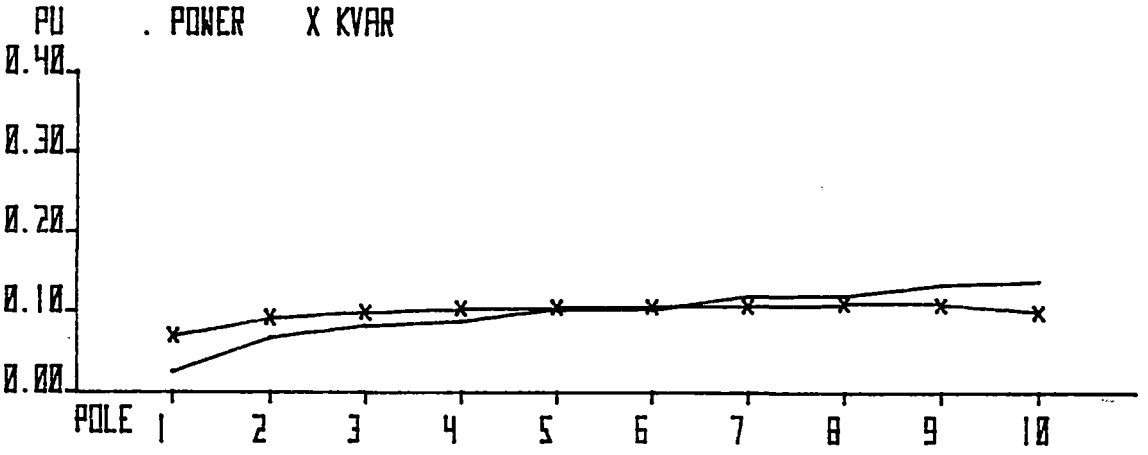
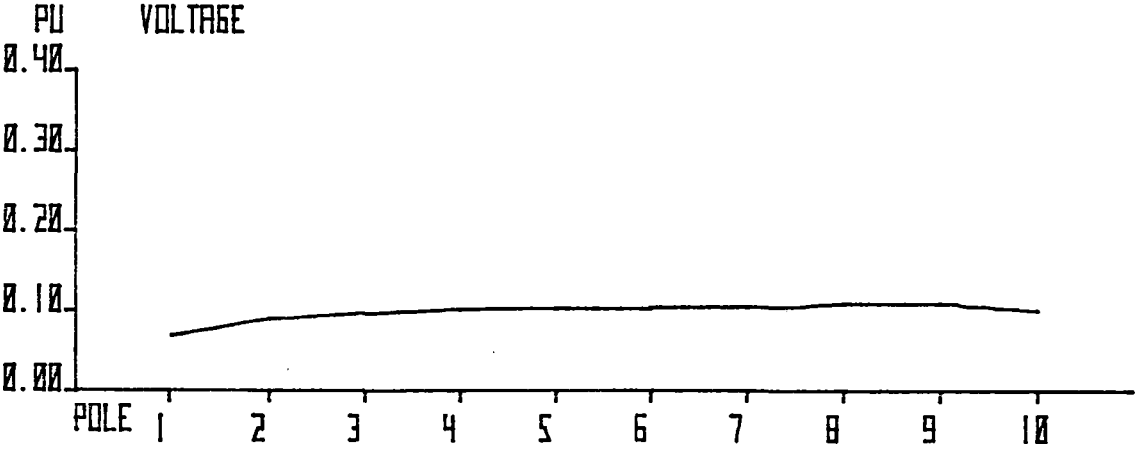

MW-B FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1137.000 SLIP= 0.065 V/HZ PER POLE=0.346

Figure 4-43







10 POLES---SOLID IRON REACTION RAIL---25 MM AIR GAP PHASE B.
RUN 1138.000 SLIP= 0.059 V/HZ PER POLE=0.346

Figure 4-44

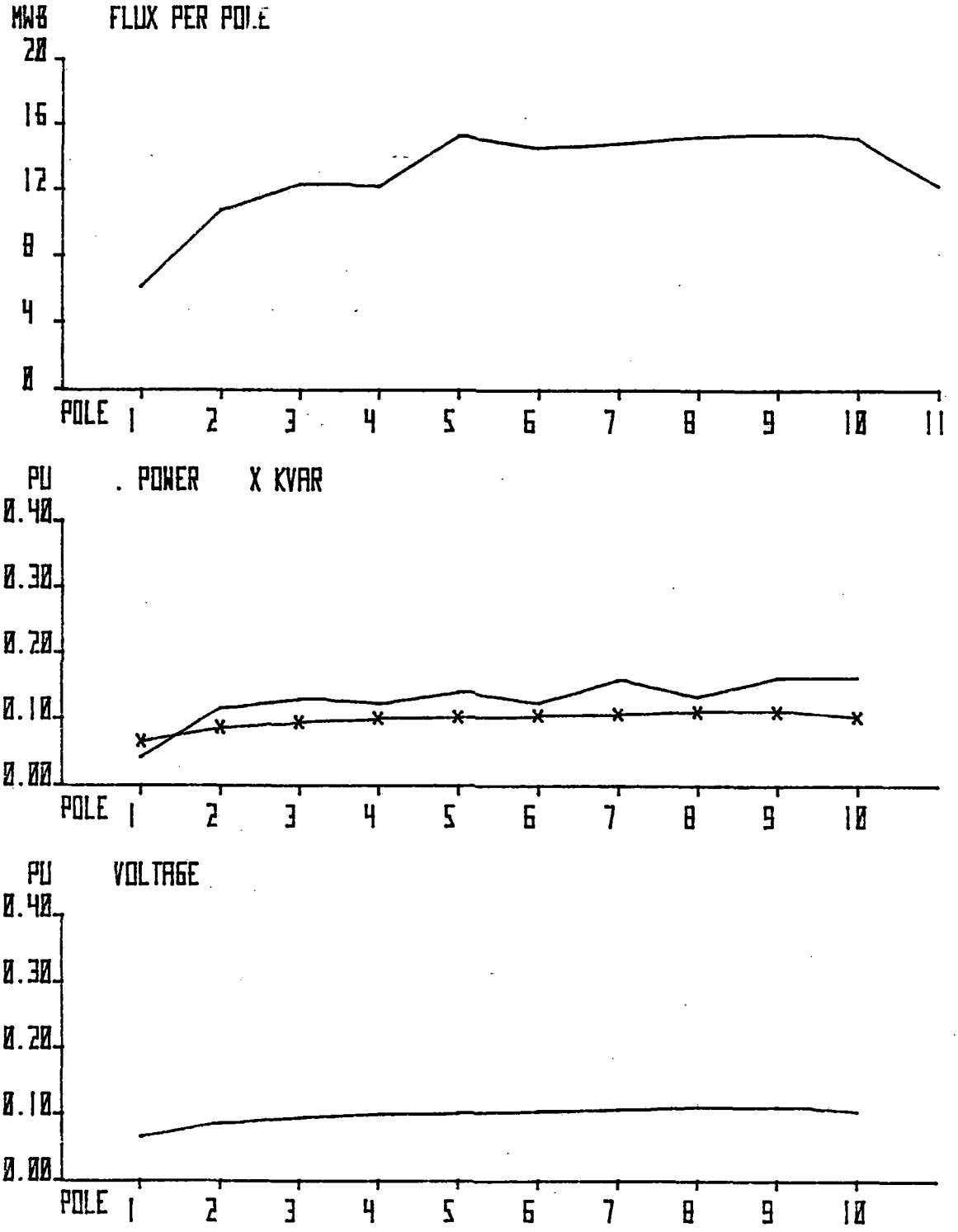
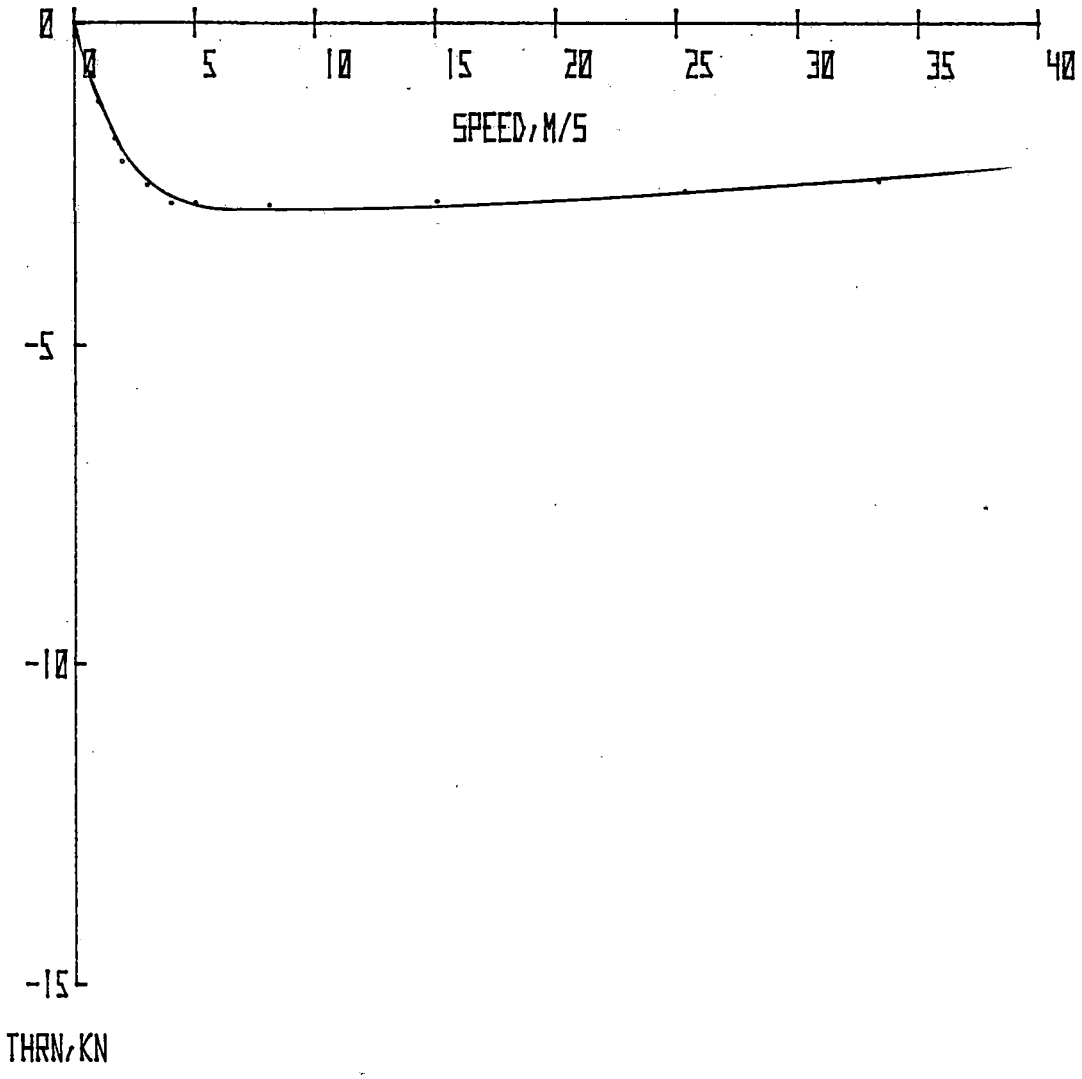

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---26 MM AIR GAP PHASE B
RUN 1139.000 SLIP= 0.017 V/HZ PER POLE=0.346

Figure 4-45

SECTION 5

SOLID IRON REACTION RAIL TEST DATA, 10-POLE SLIM, 18-MM AIRGAP

Figures 5-1 through 5-4 reflect test data acquired with dc excitation, while the ac excitation mode is applicable to data in Figures 5-5 through 5-40.



DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
BRAKING FORCE VS SPEED VS SPEED
10 POLES I=.83 KA RUN 1081
18 MM AIR GAP

Figure 5-1

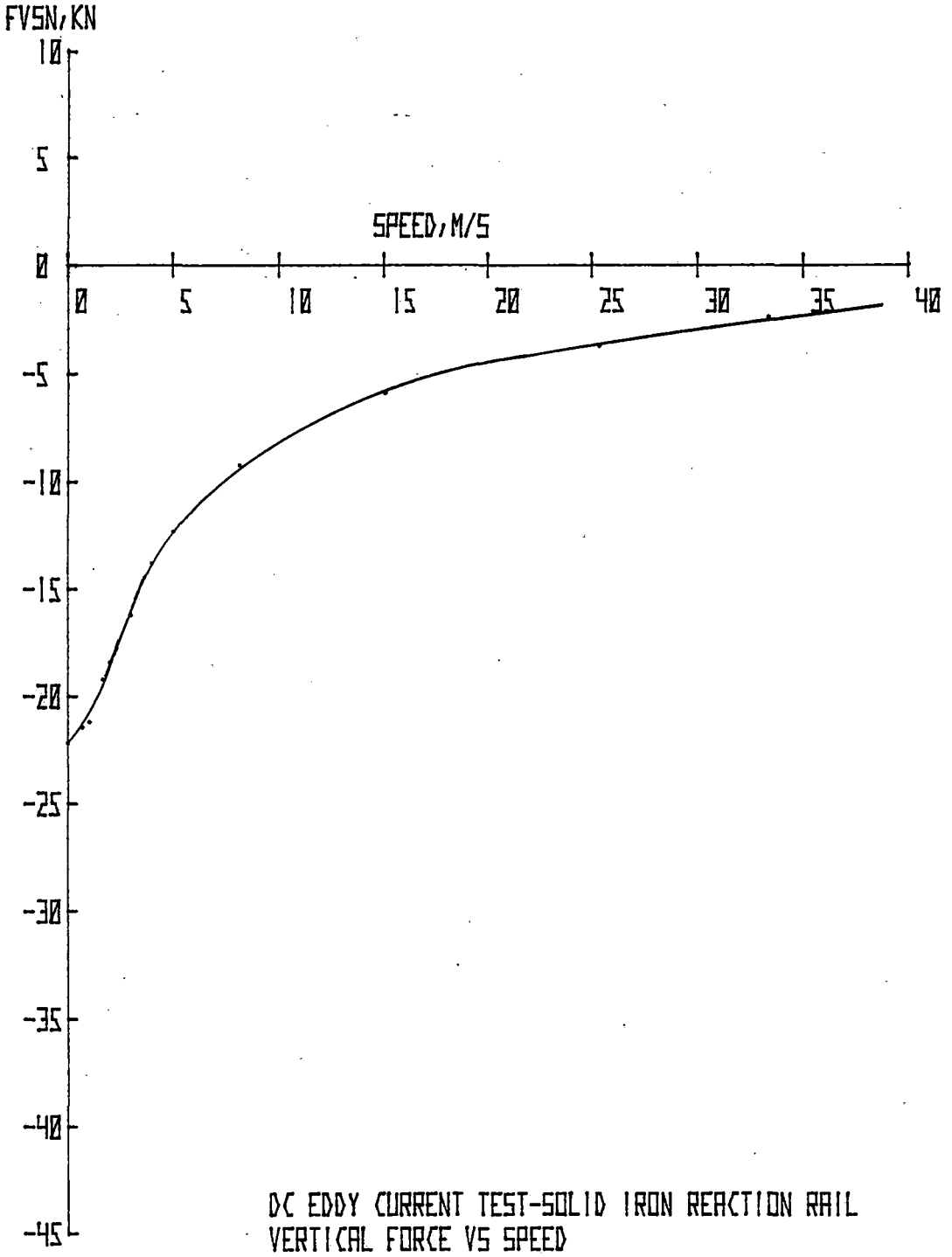
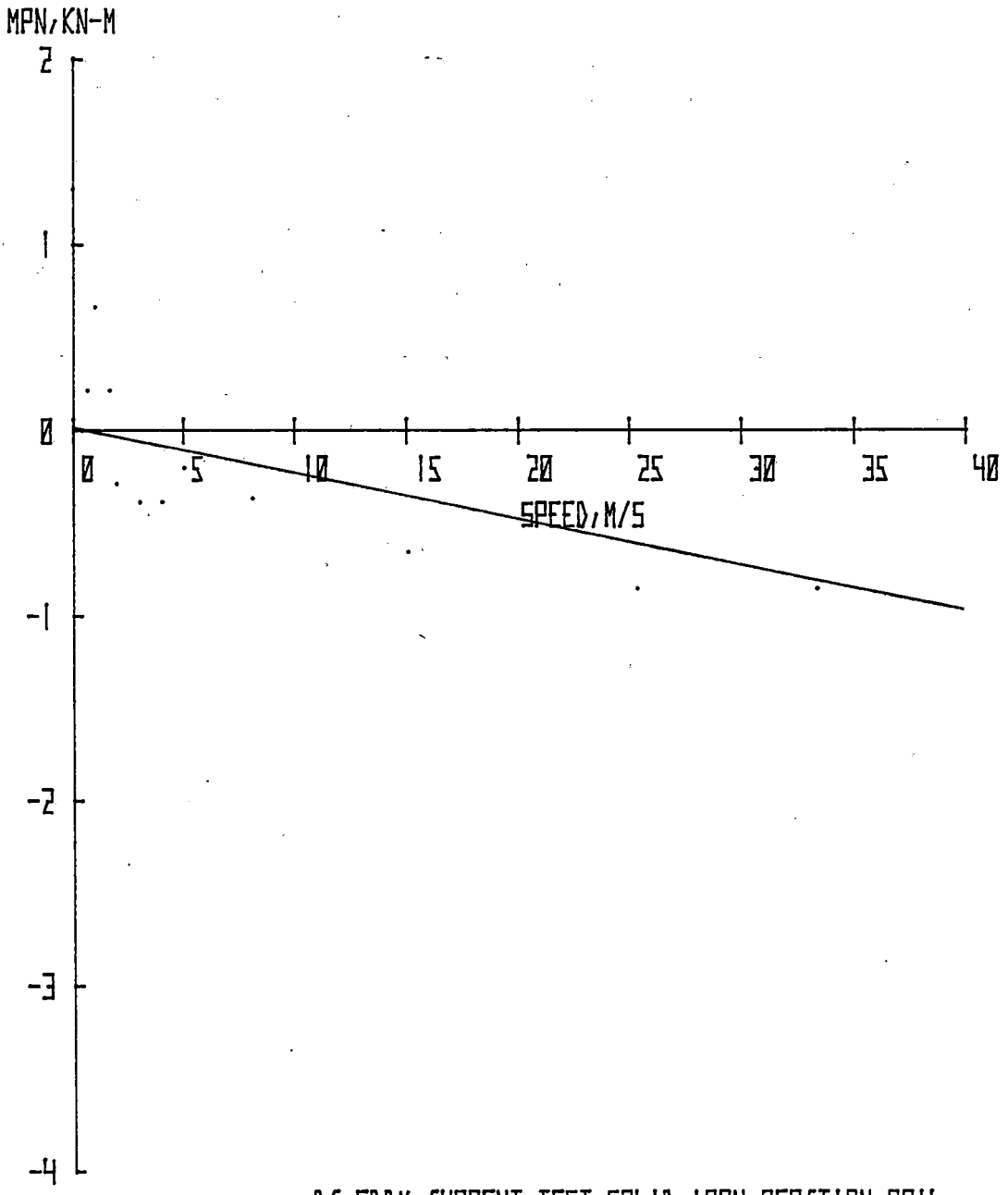

FVSN/KN
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
SPEED/M/S
0
5
10
15
20
25
30
35
40
DC EDDY CURRENT TEST-SOLID IRON REACTION RAIL
VERTICAL FORCE VS SPEED
10 POLES I=.83 KA RUN 1081
18 MM AIR GAP

Figure 5-2



DC EDDY CURRENT TEST SOLID-IRON REACTION RAIL
PITCHING MOMENT VS SPEED
10 POLES I=.83KA RUN 1081
18 MM AIR GAP

Figure 5-3

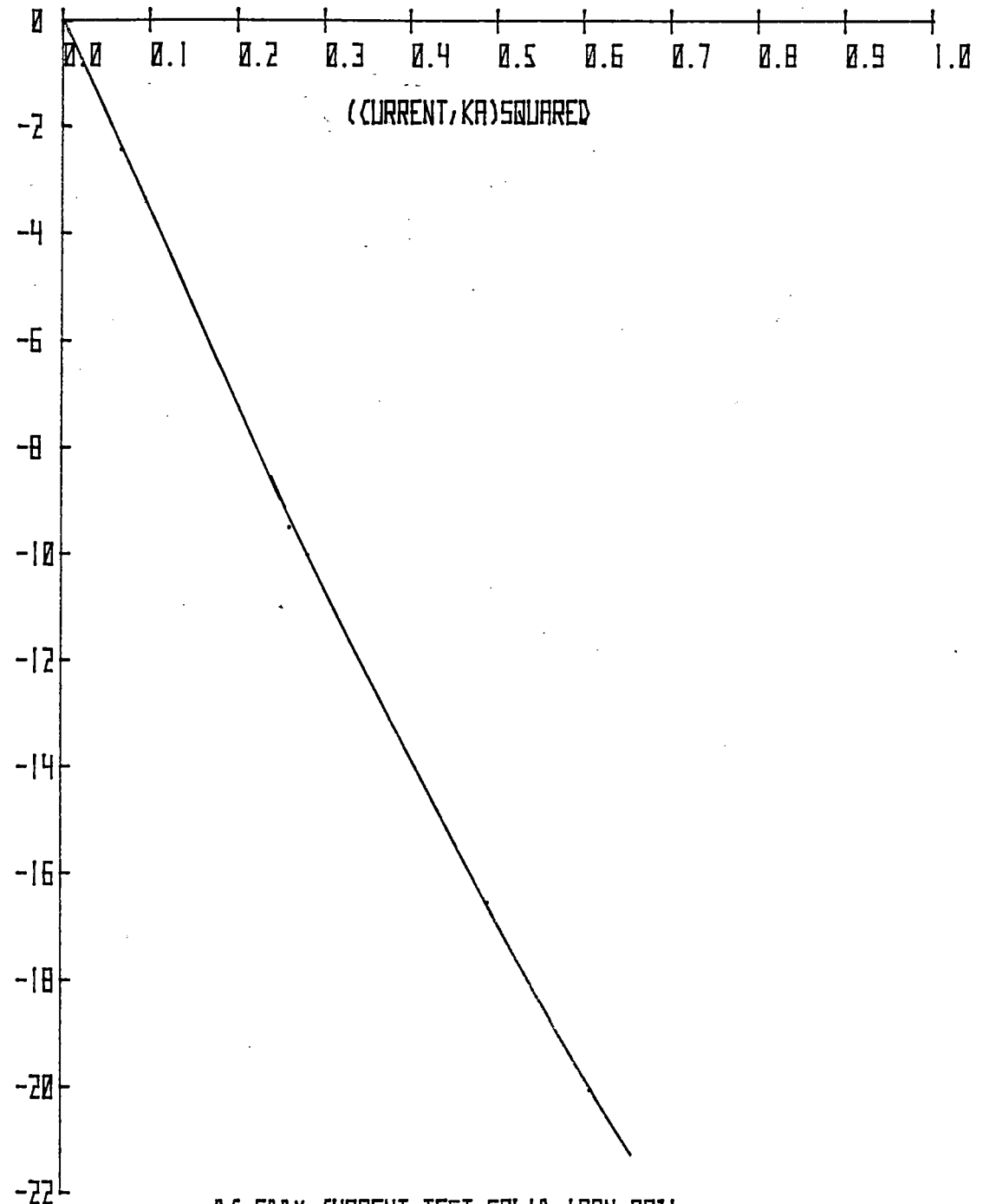
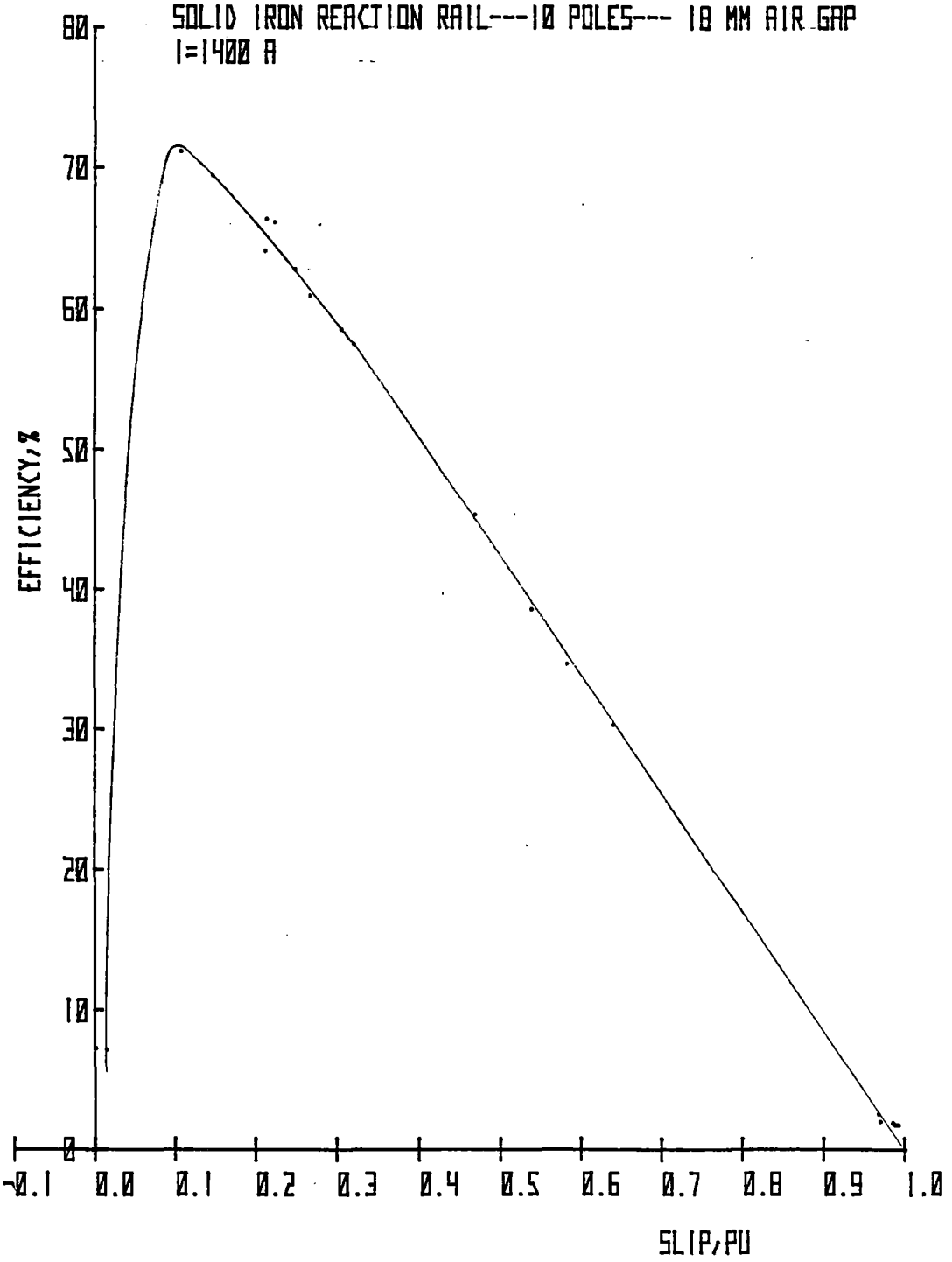
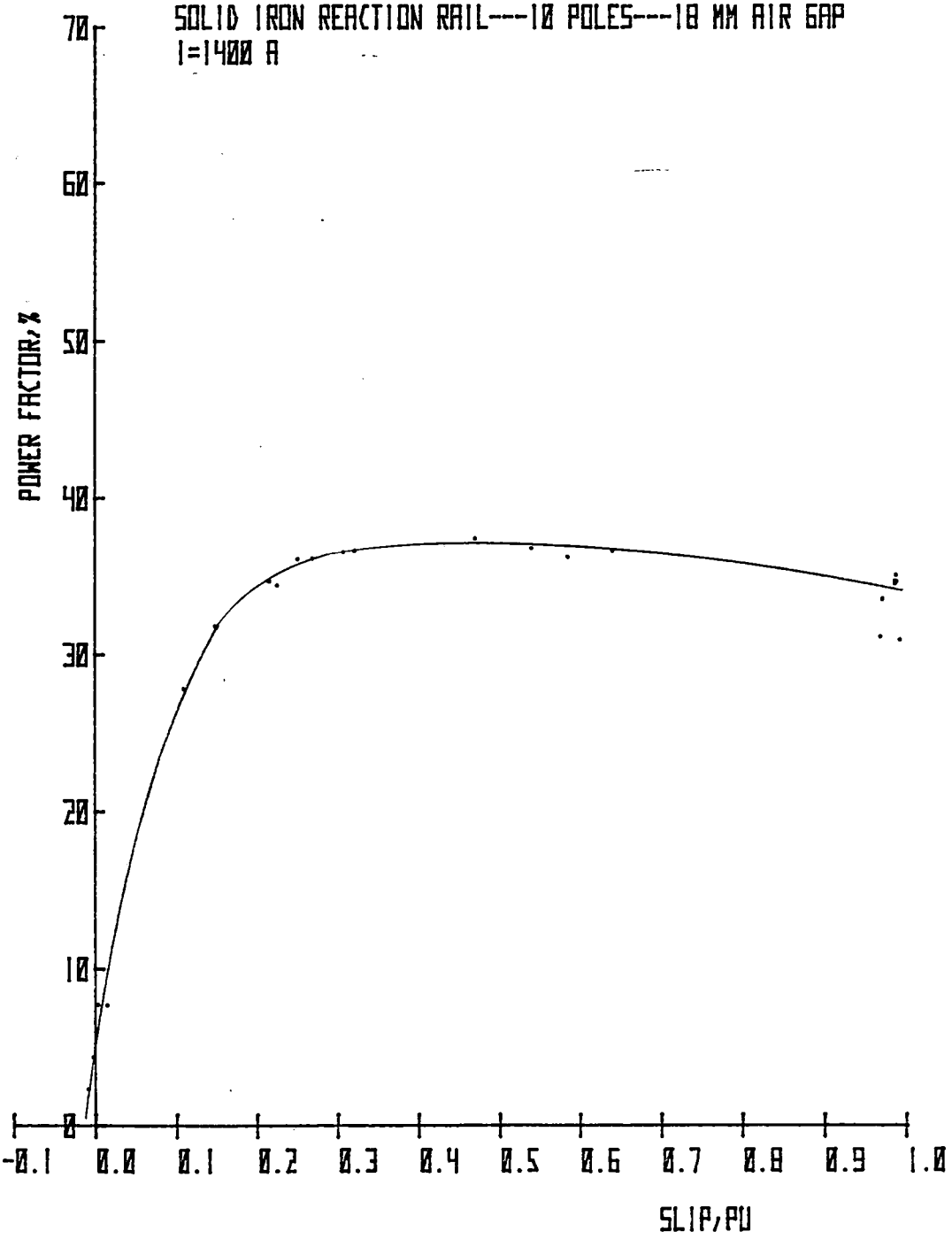

0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
((CURRENT/KA)SQUARED)
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
FVS/KN
DC EDDY CURRENT TEST-SOLID IRON RAIL
VERTICAL FORCE VS CURRENT SQUARED
10 POLES 18 MM AIR GAP RUN 1181

Figure 5-4



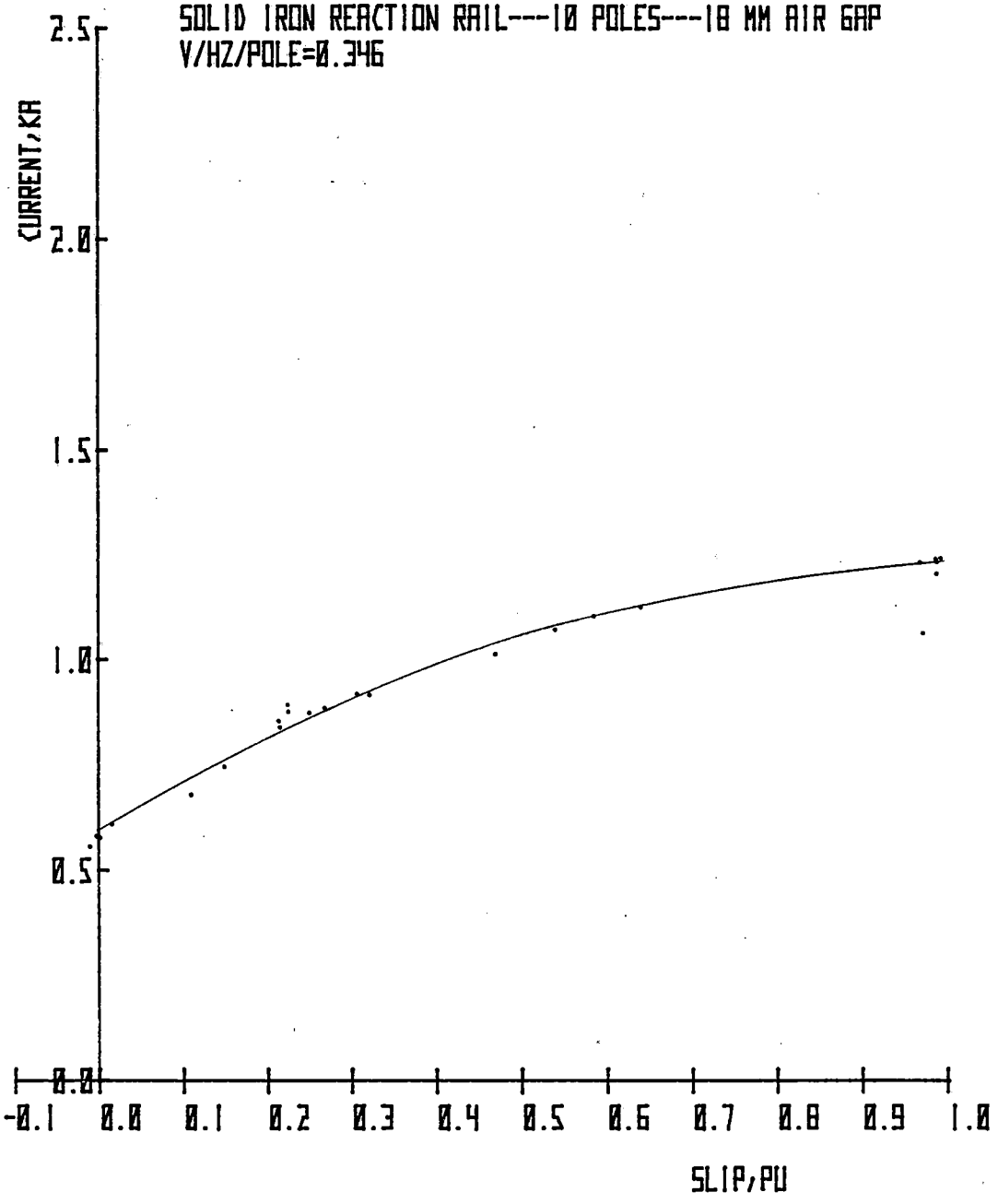
EFFICIENCY VS SLIP

Figure 5-5



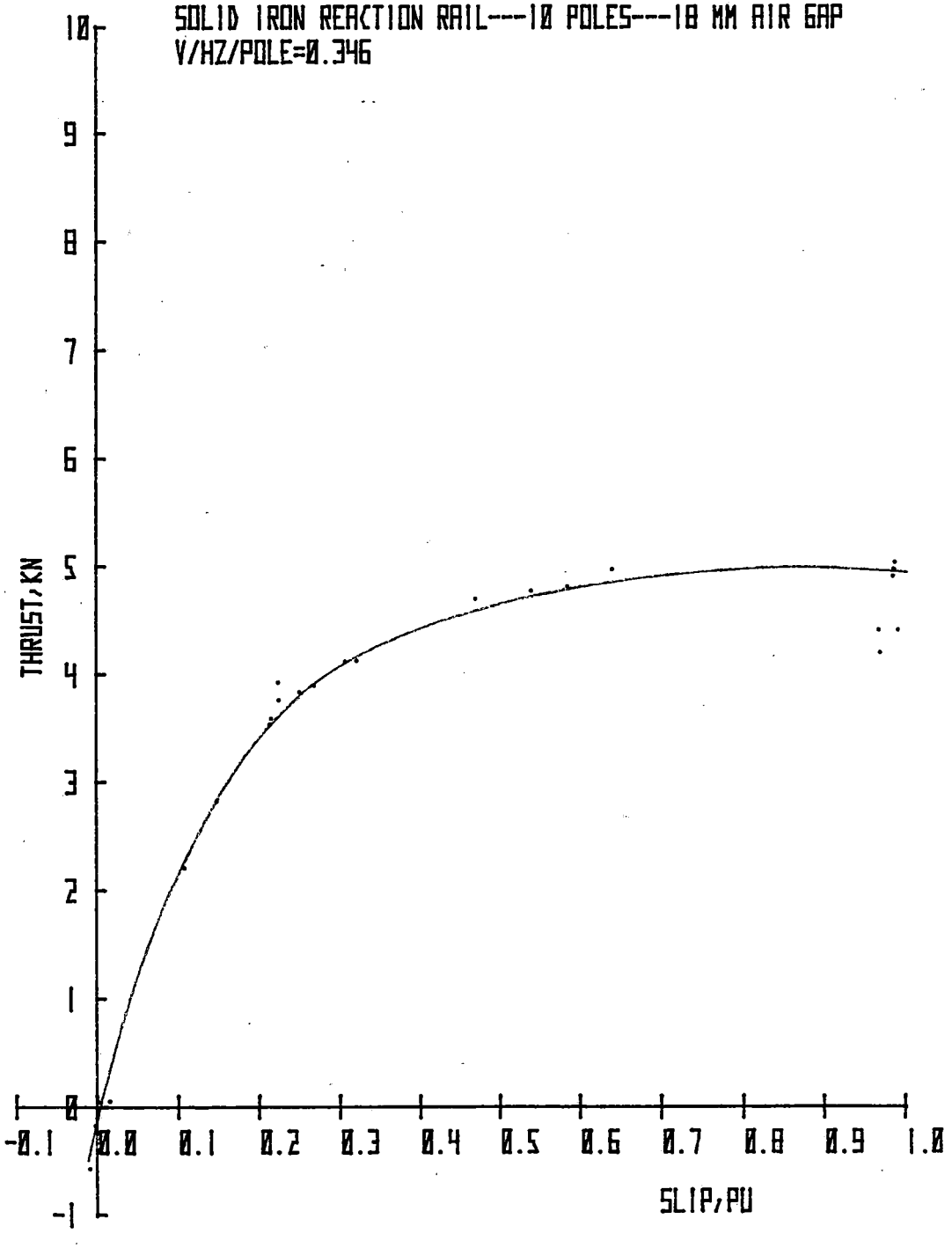
POWER FACTOR VS SLIP

Figure 5-6



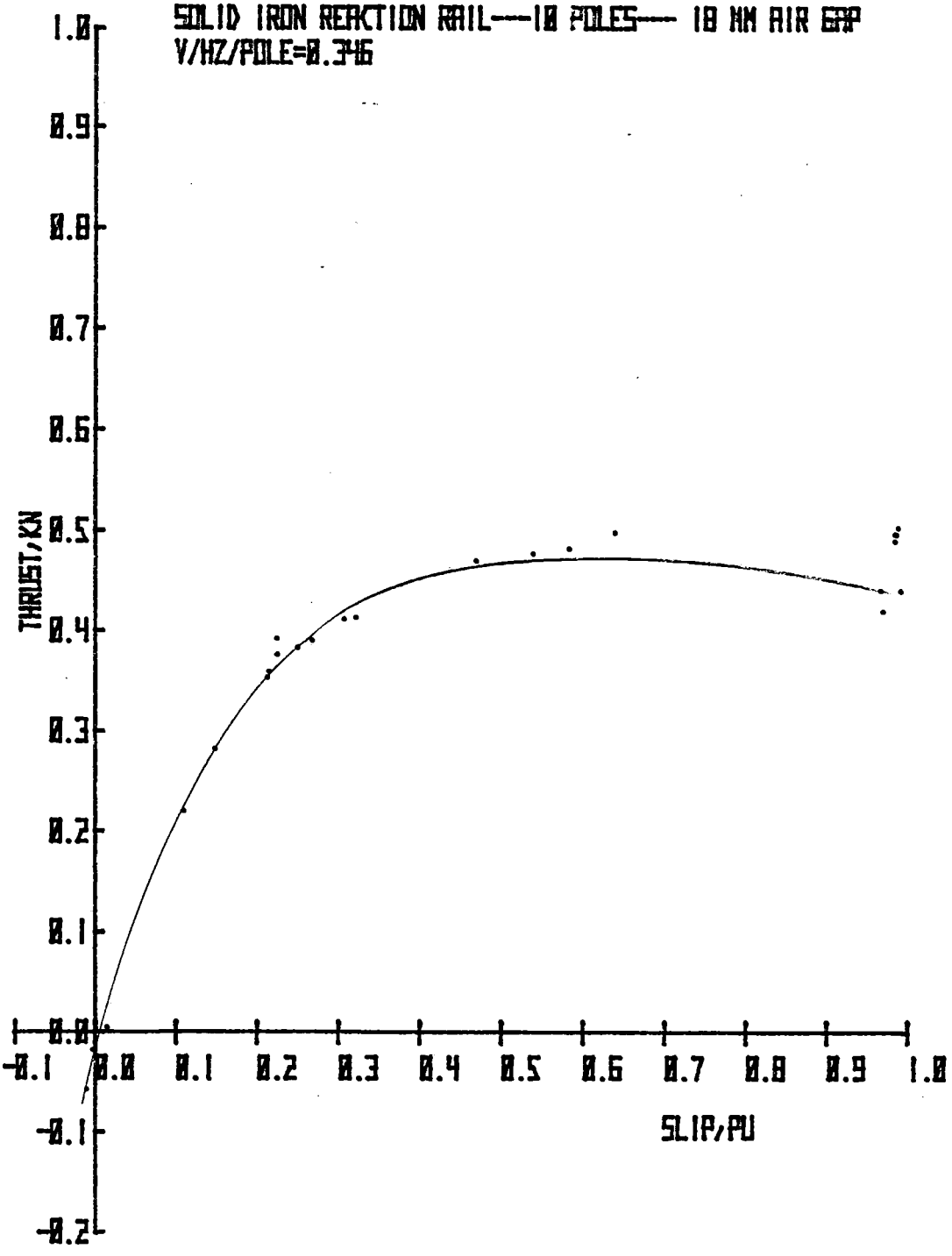
MEAN LINE CURRENT VS SLIP

Figure 5-7



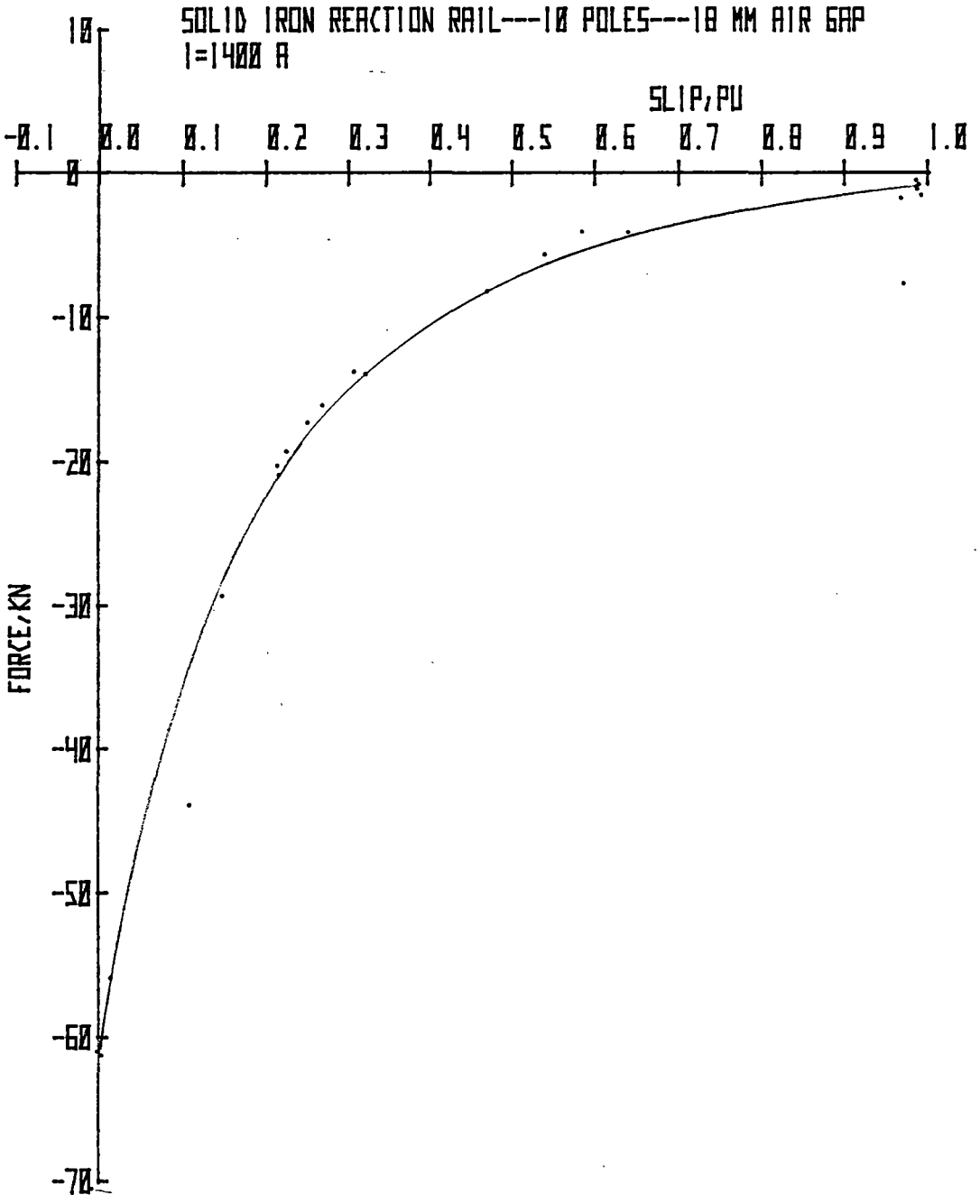
THRUST VS SLIP

Figure 5-8



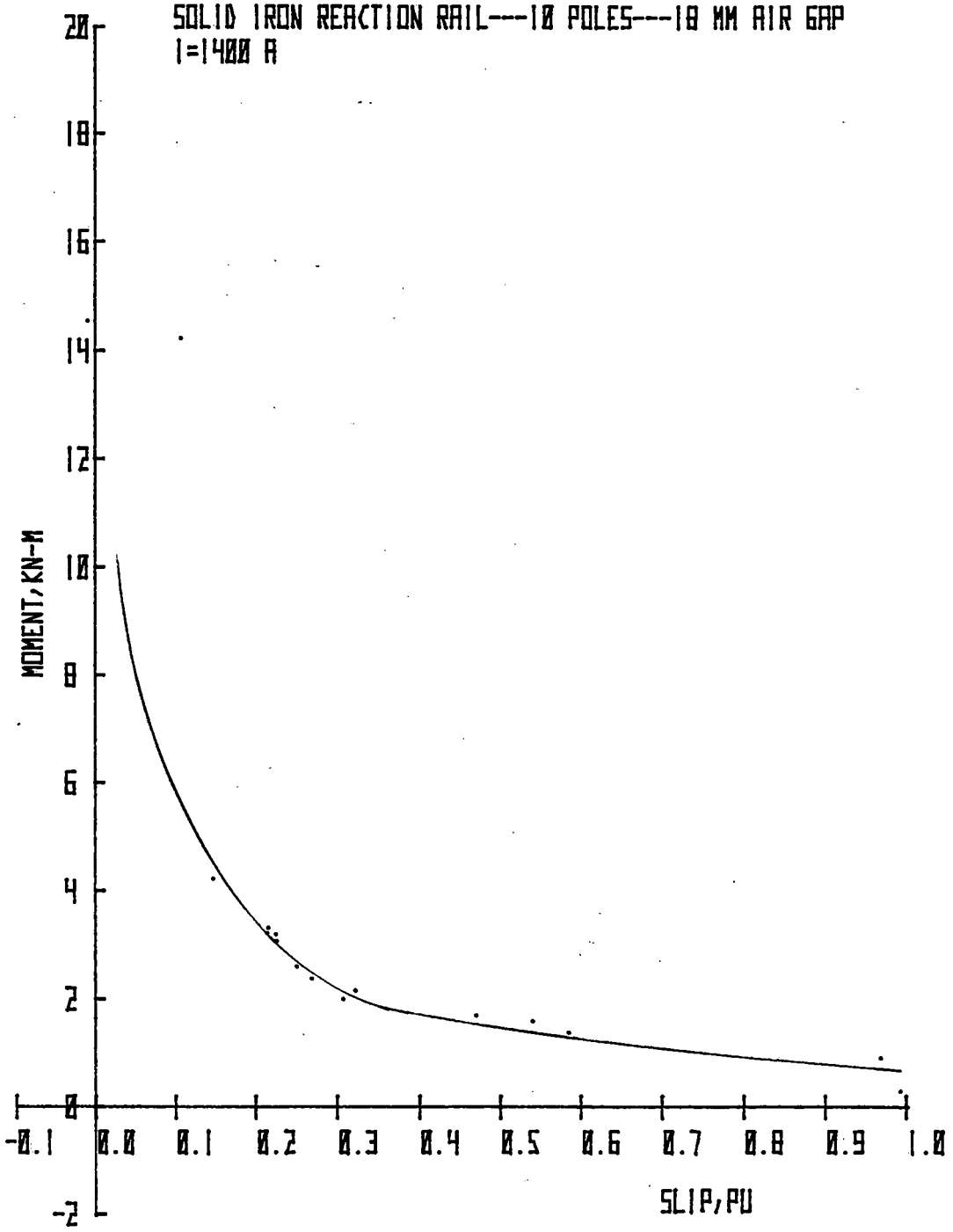
THRUST PER POLE VS SLIP

Figure 5-9



TOTAL VERTICAL FORCE VS SLIP

Figure 5-10



PITCHING MOMENT VS SLIP

Figure 5-11

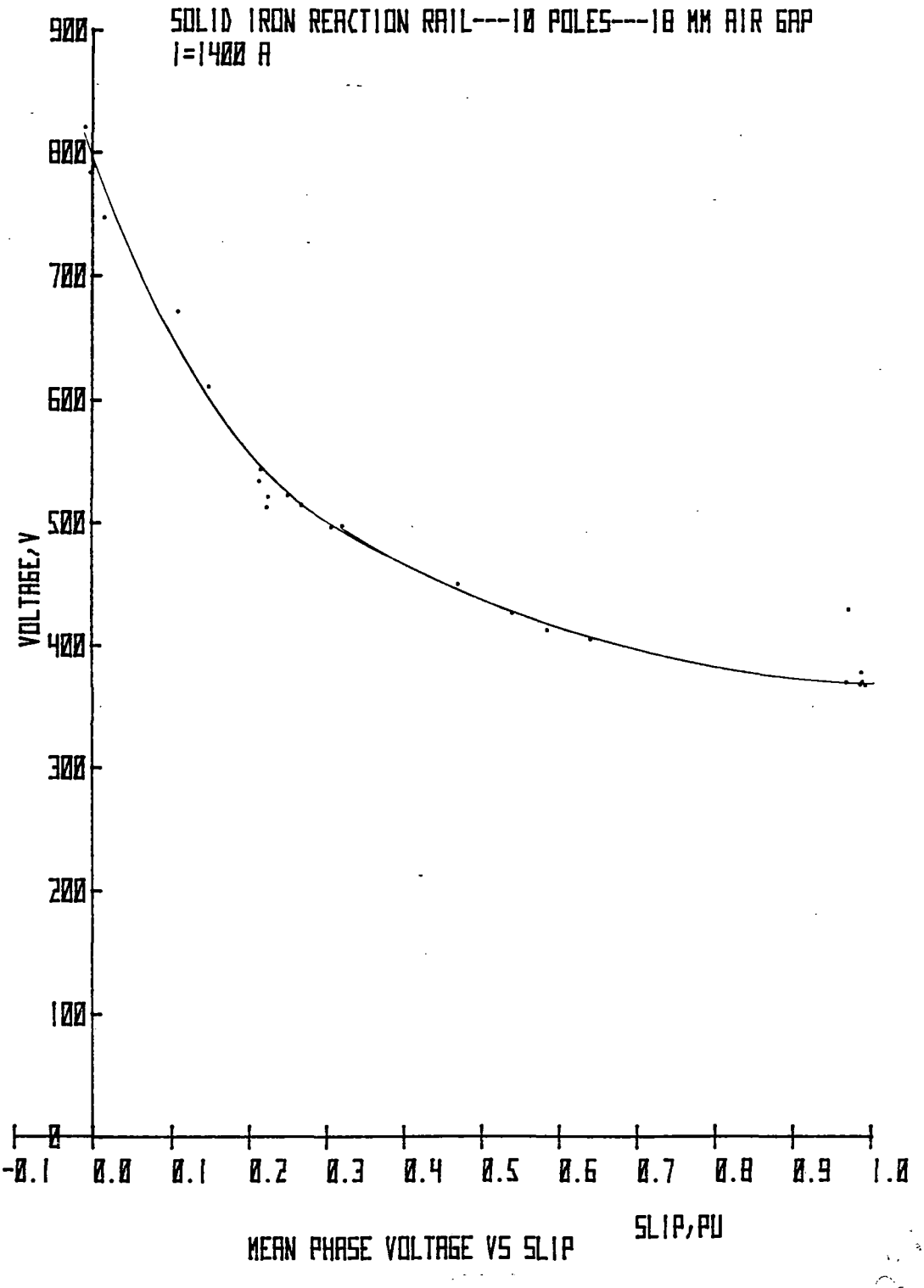
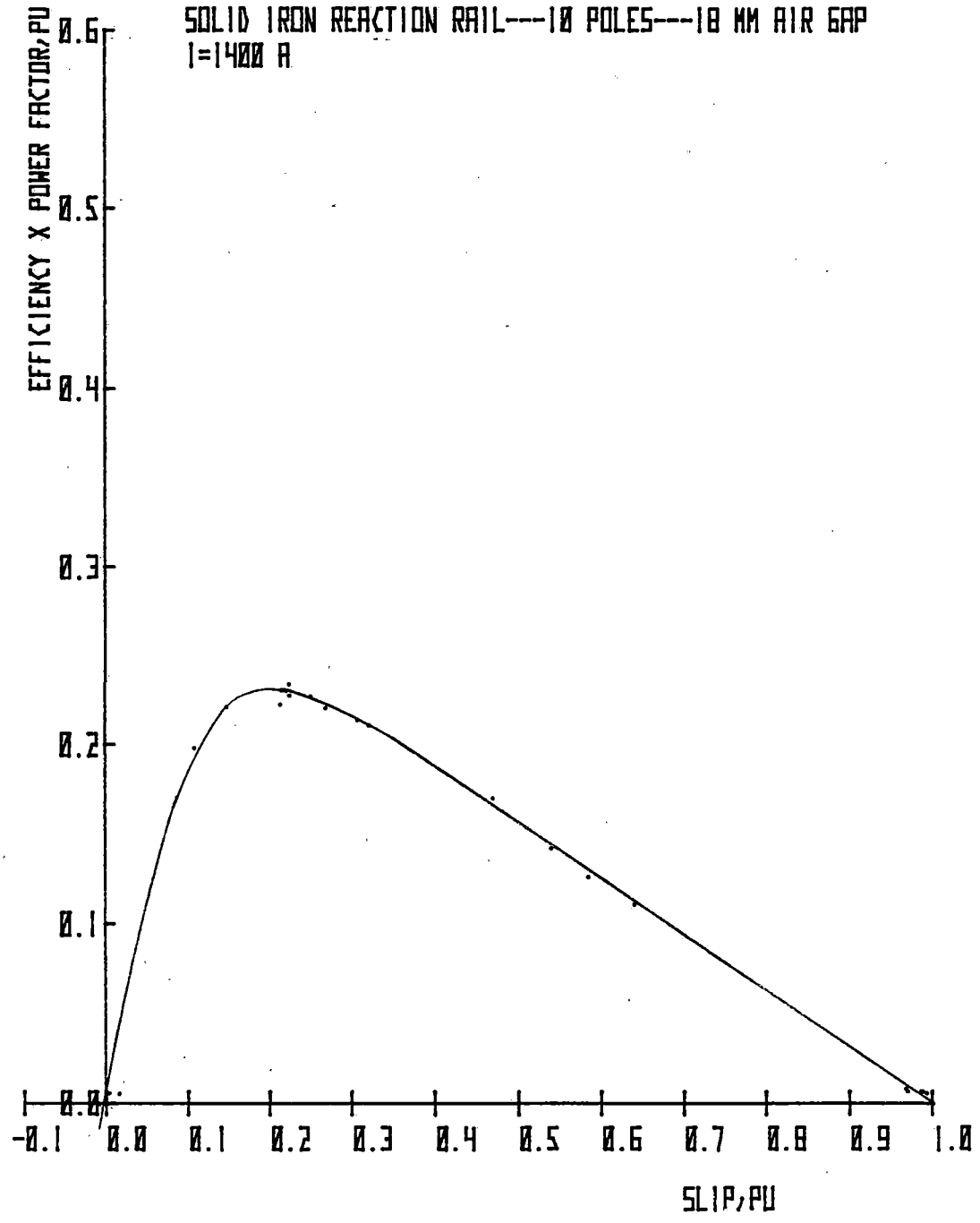

SOLID IRON REACTION RAIL---10 POLES---18 MM AIR GAP
I=1400 A
900
800
700
600
500
400
300
200
100
0
VOLTAGE,V
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
SLIP,PU
MEAN PHASE VOLTAGE VS SLIP

Figure 5-12



EFFICIENCY X POWER FACTOR VS SLIP

Figure 5-13

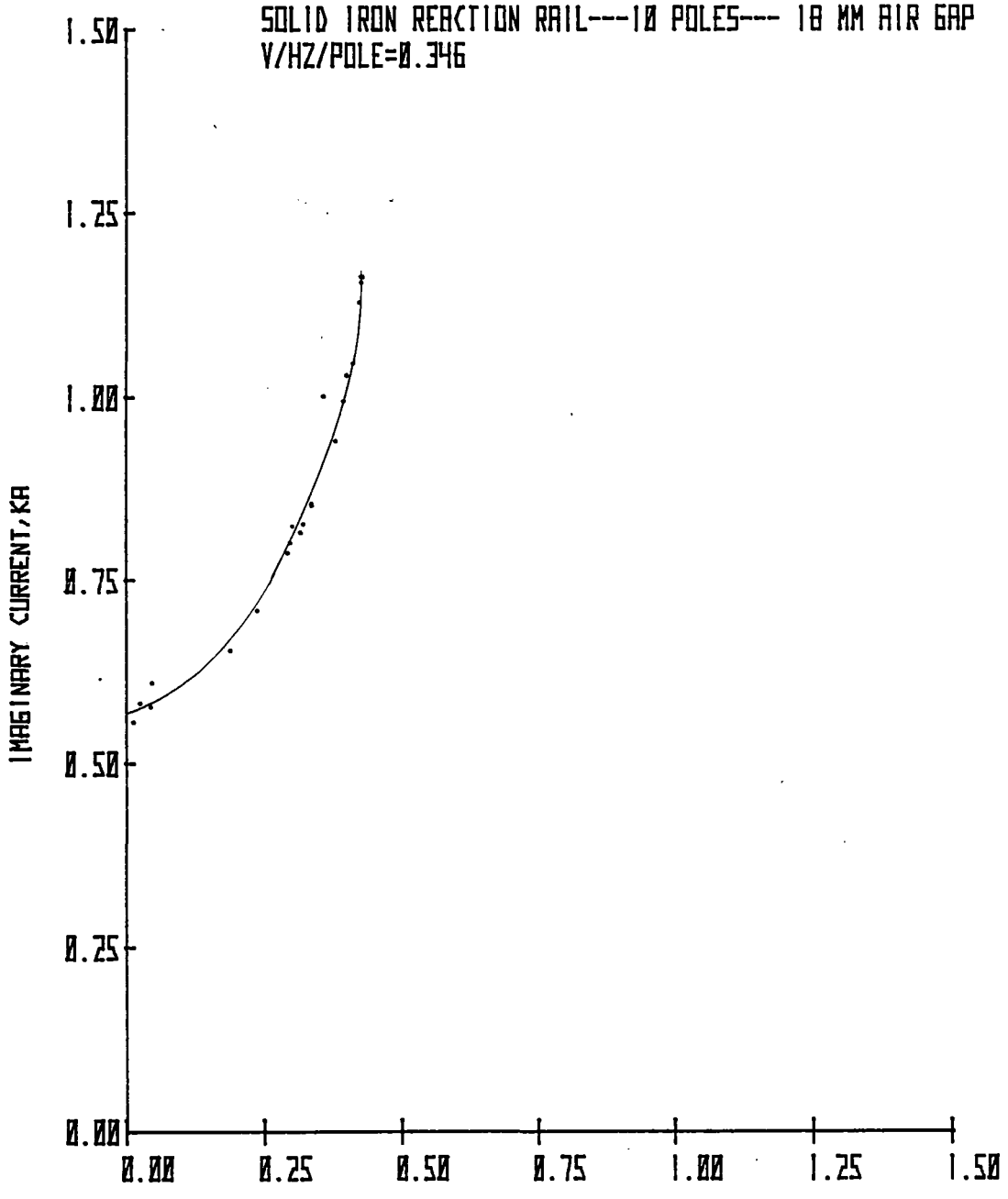
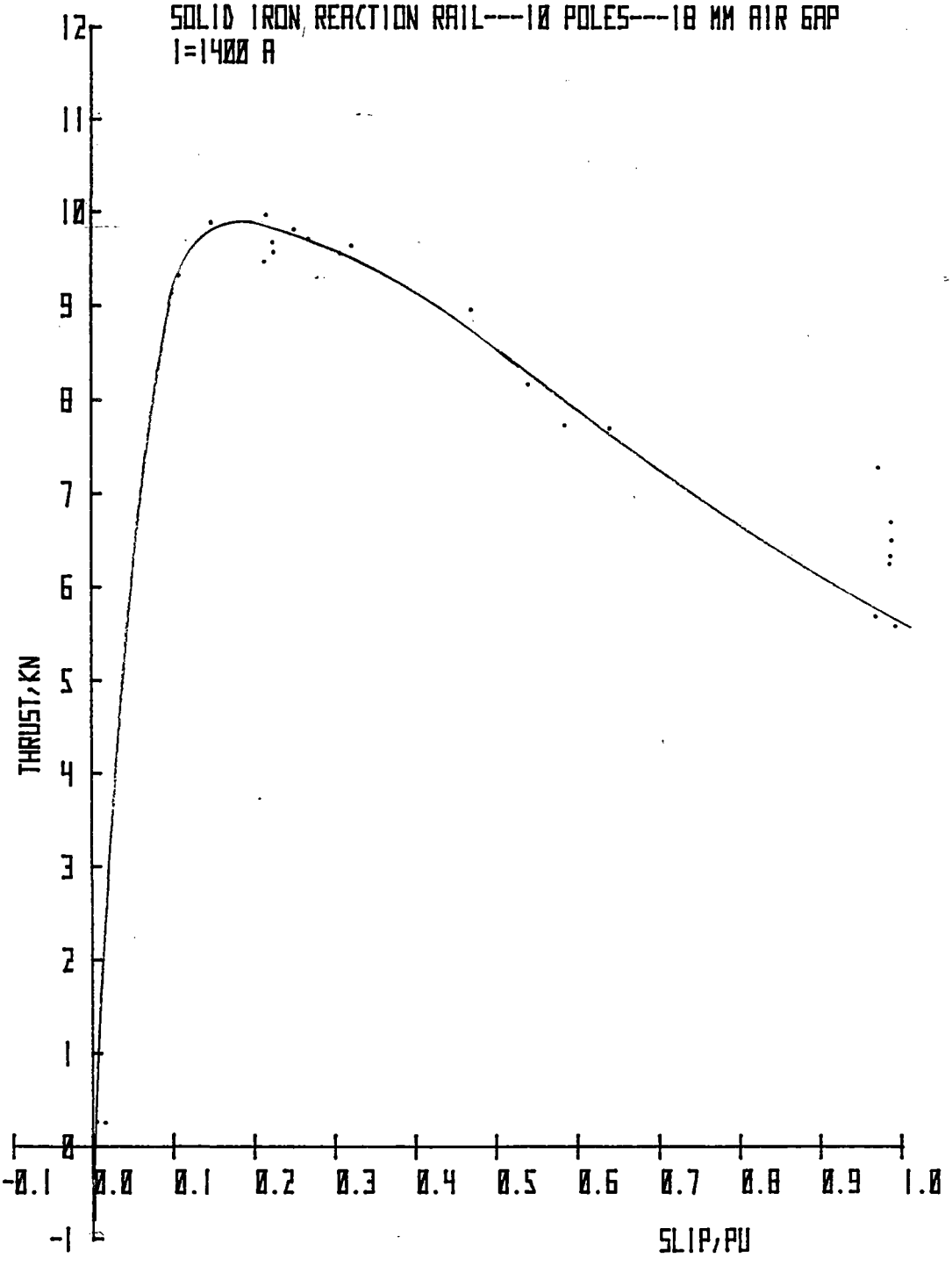
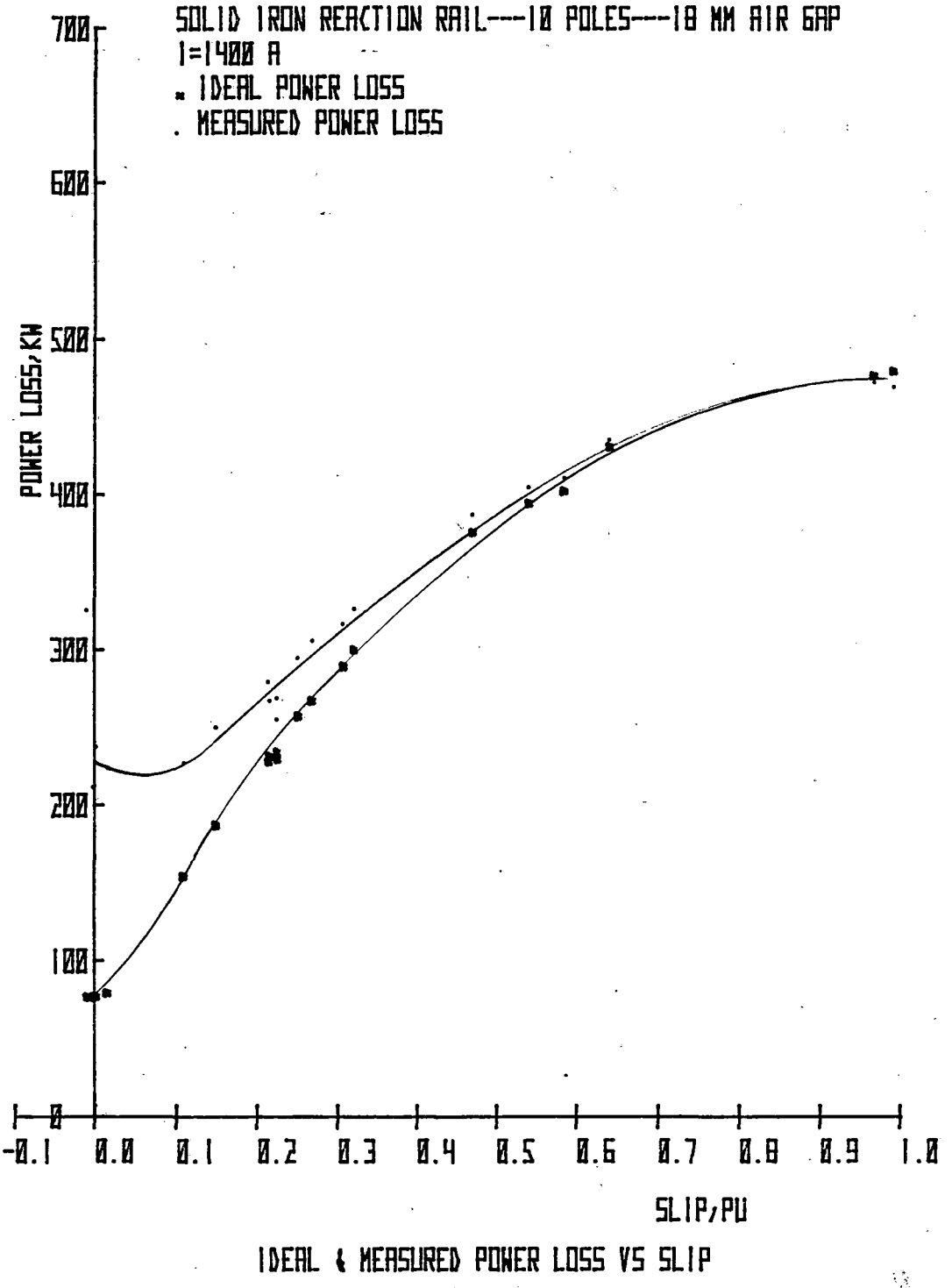

SOLID IRON REACTION RAIL---10 POLES--- 18 MM AIR GAP
V/HZ/POLE=0.346
1.50
1.25
1.00
0.75
0.50
0.25
0.00
IMAGINARY CURRENT,KA
0.00
0.25
0.50
0.75
1.00
1.25
1.50
REAL CURRENT,KA
LIM CURRENT LOCUS

Figure 5-14



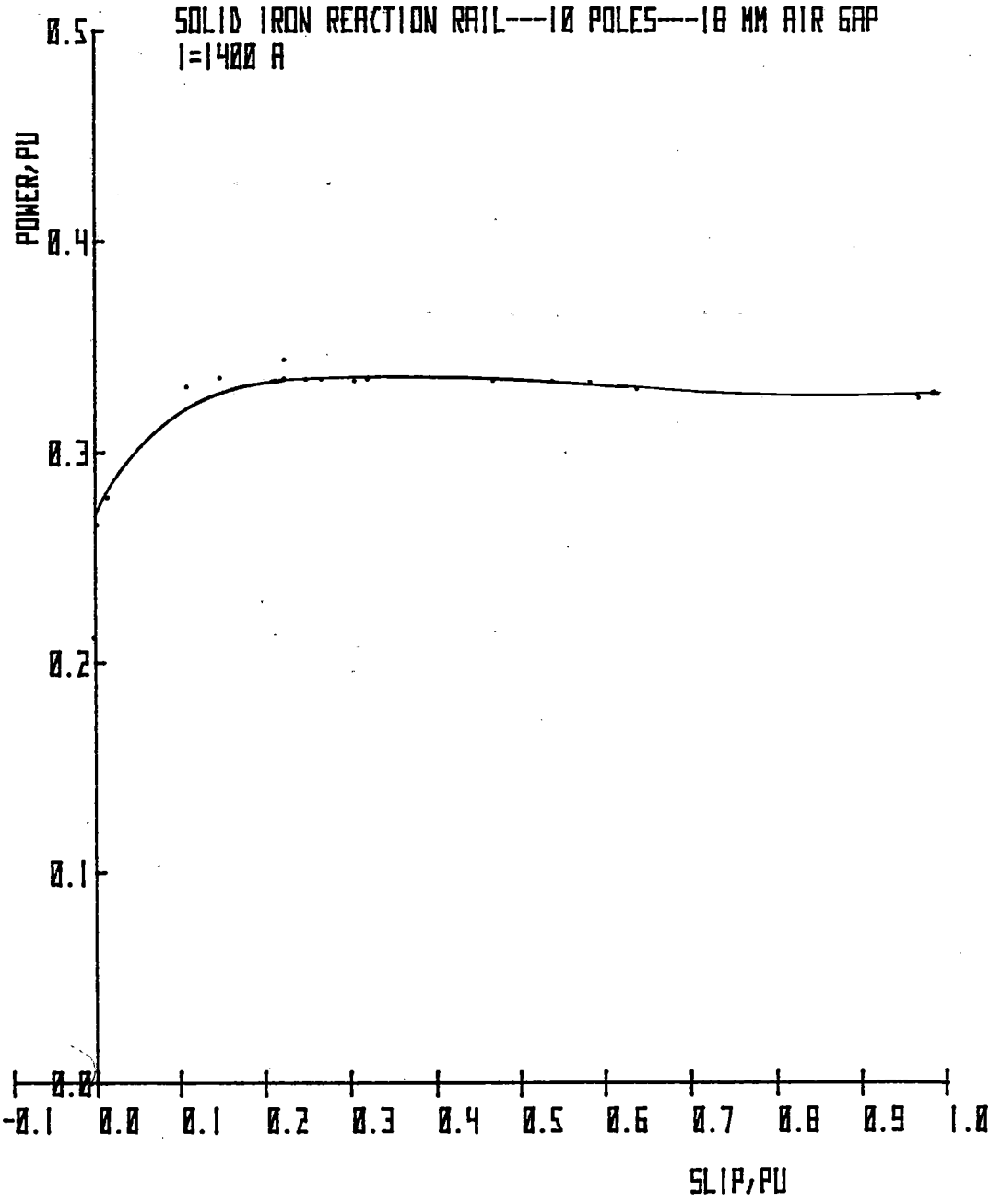
THRUST VS SLIP

Figure 5-15



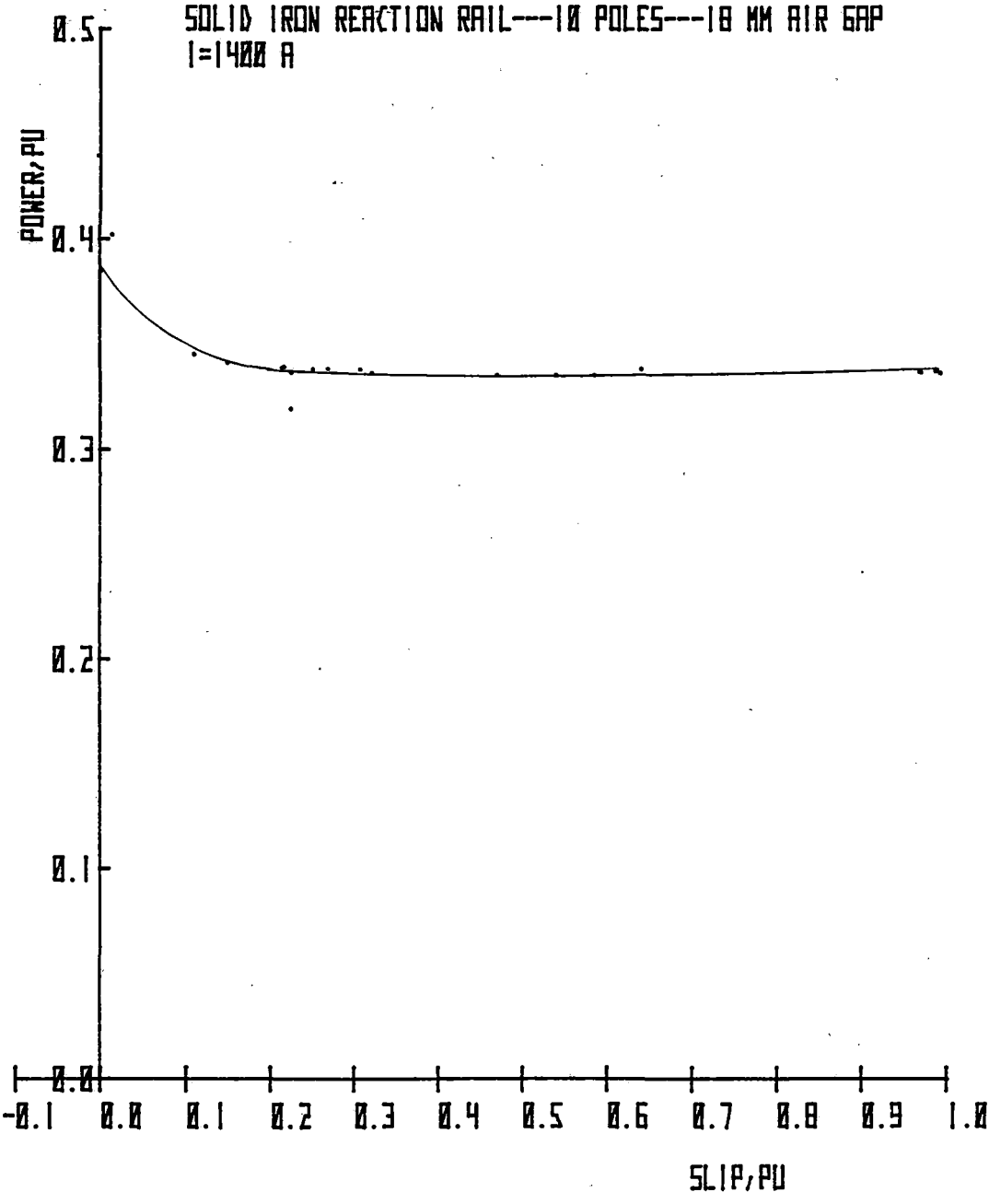
IDEAL & MEASURED POWER LOSS VS SLIP

Figure 5-16



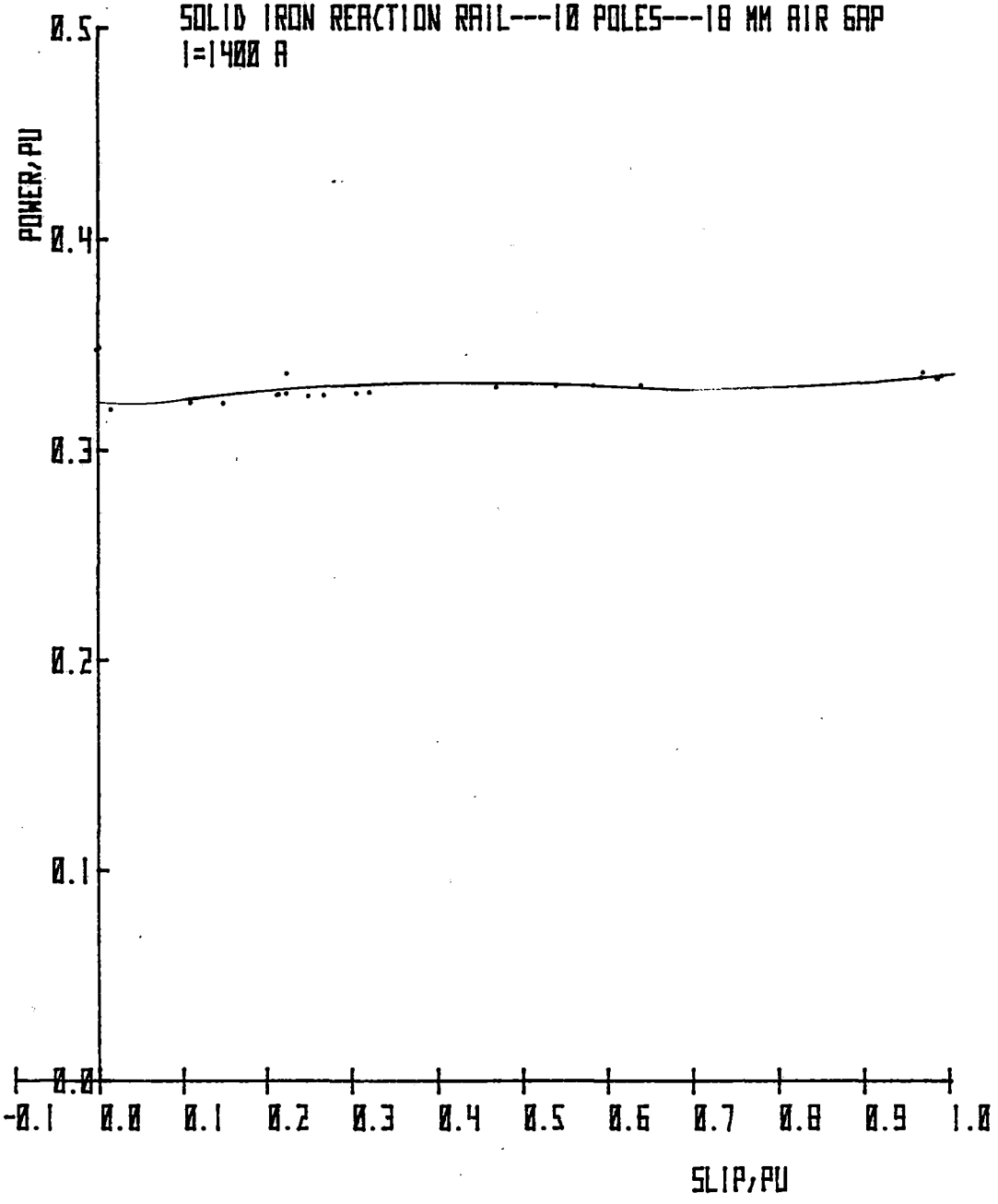
A PHASE POWER VS SLIP

Figure 5-17



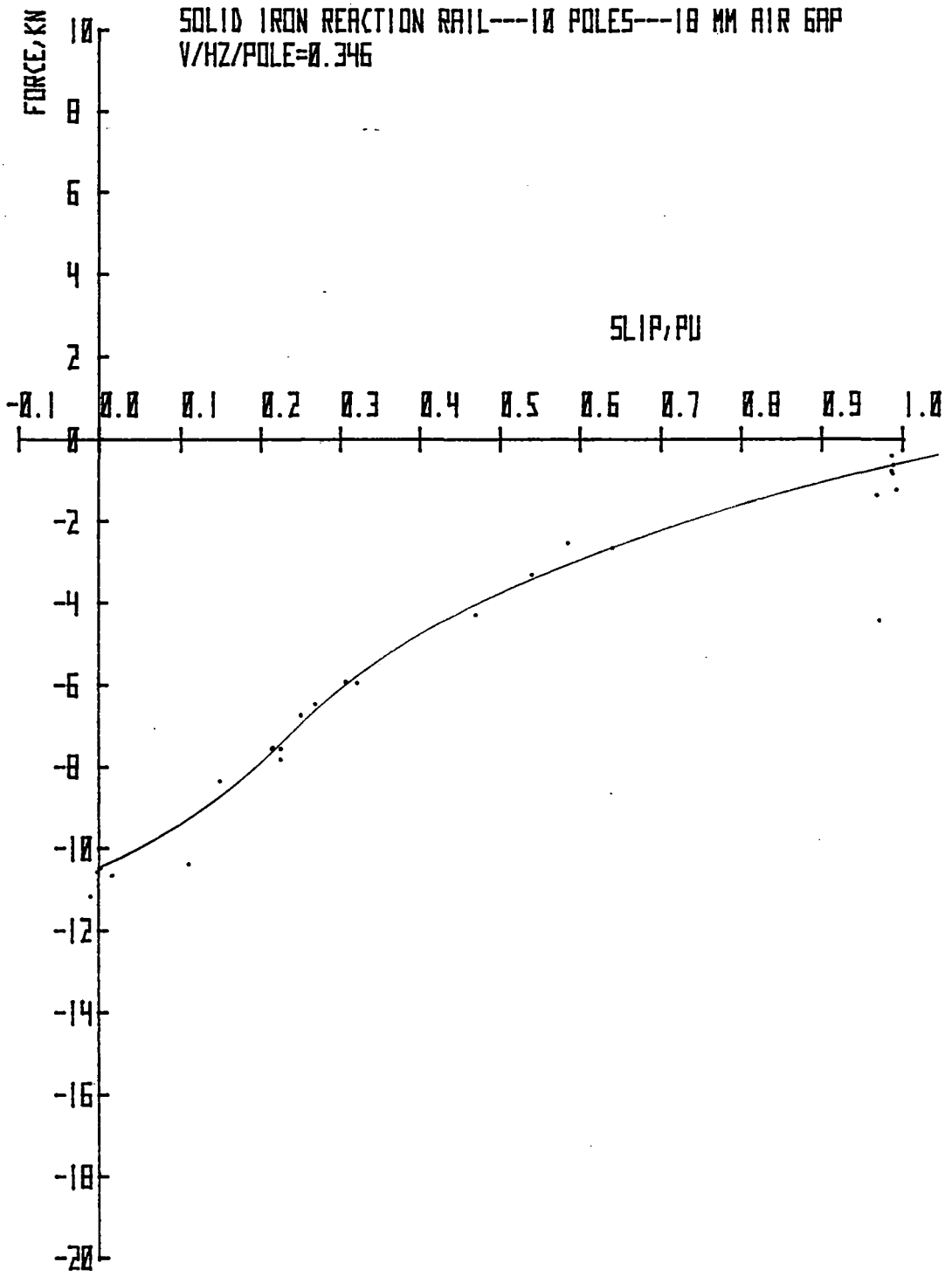
B PHASE POWER VS SLIP

Figure 5-18



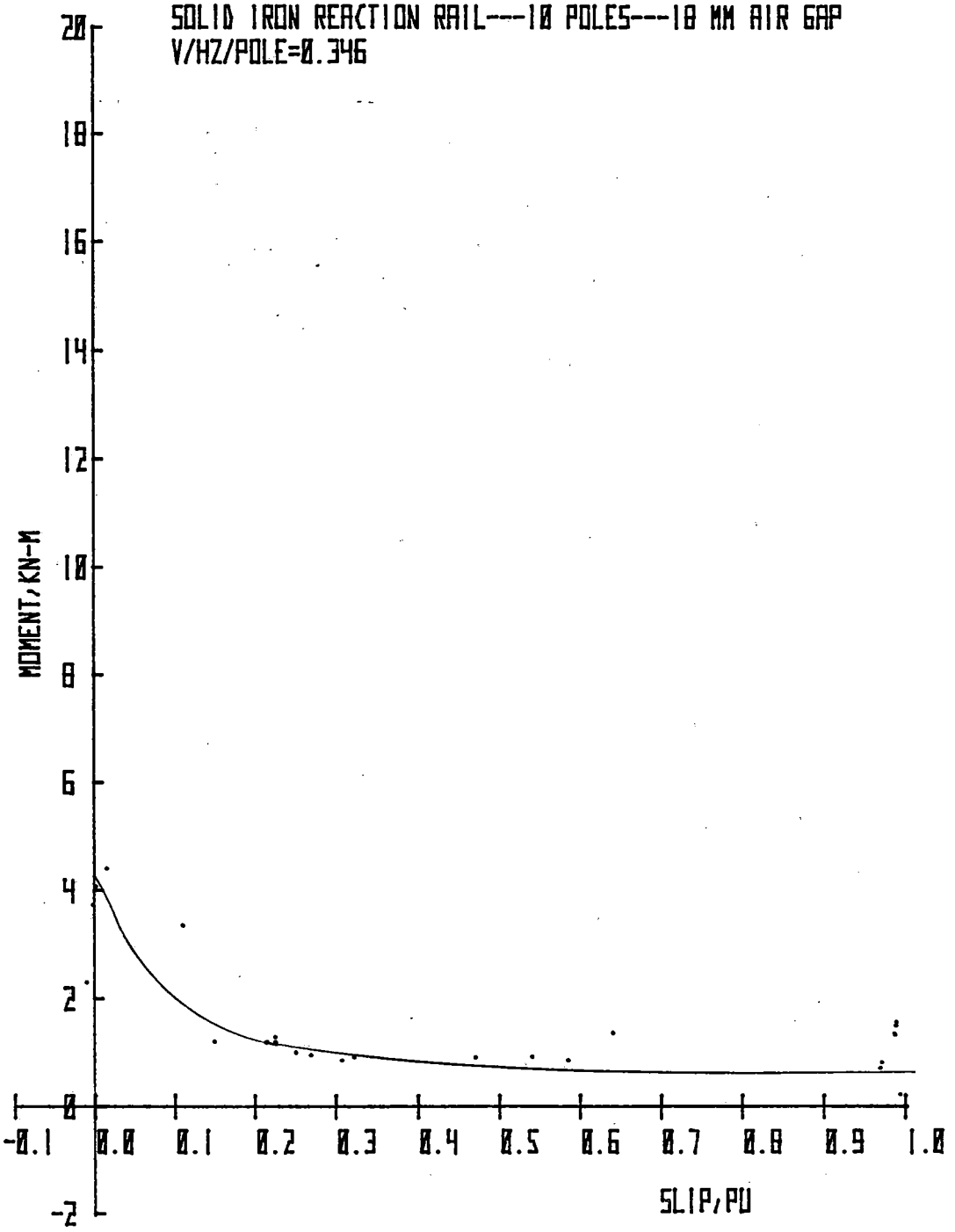
C PHASE POWER VS SLIP

Figure 5-19



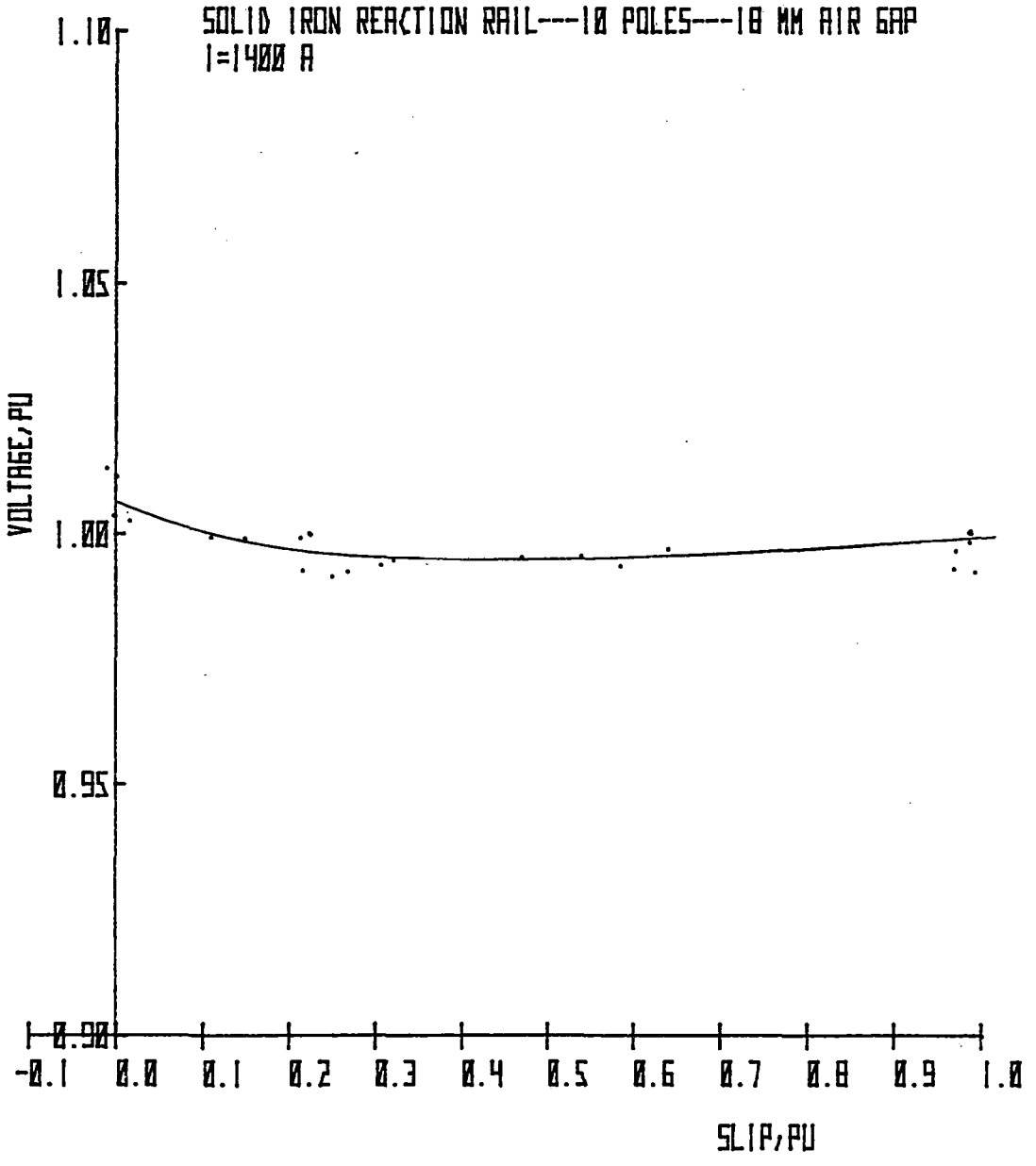
TOTAL VERTICAL FORCE VS SLIP

Figure 5-20



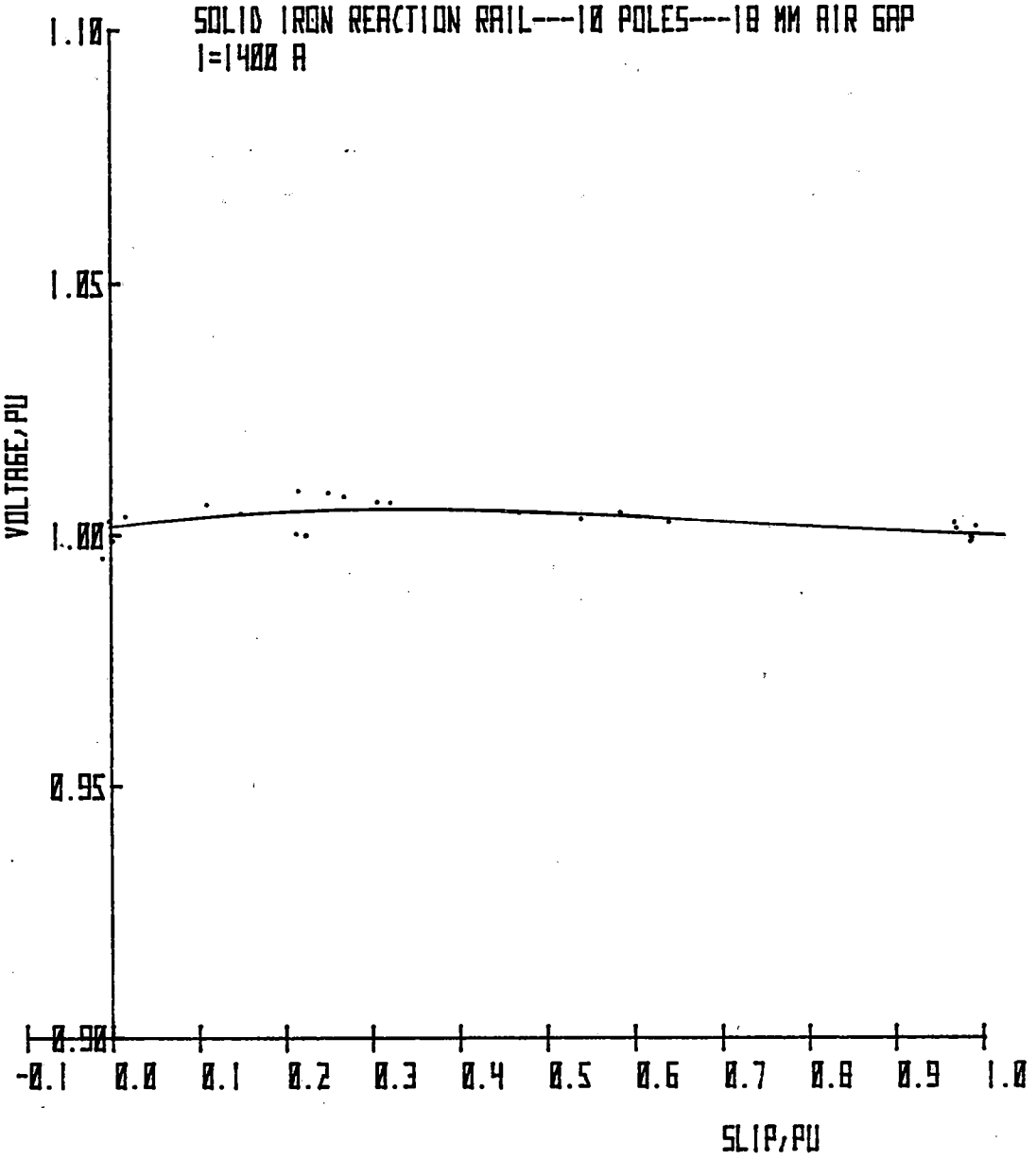
PITCHING MOMENT VS SLIP

Figure 5-21



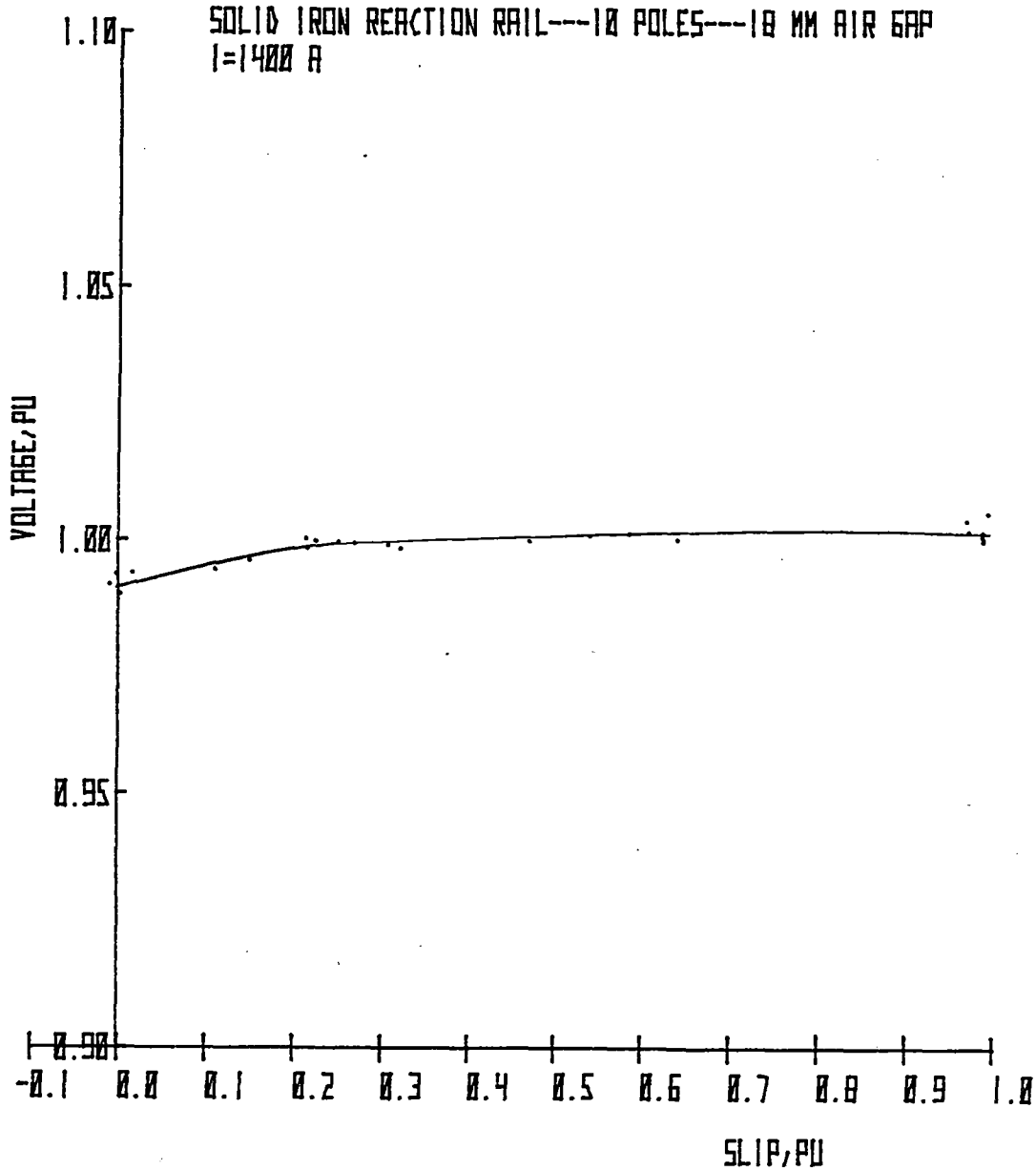
A PHASE VOLTAGE VS SLIP

Figure 5-22



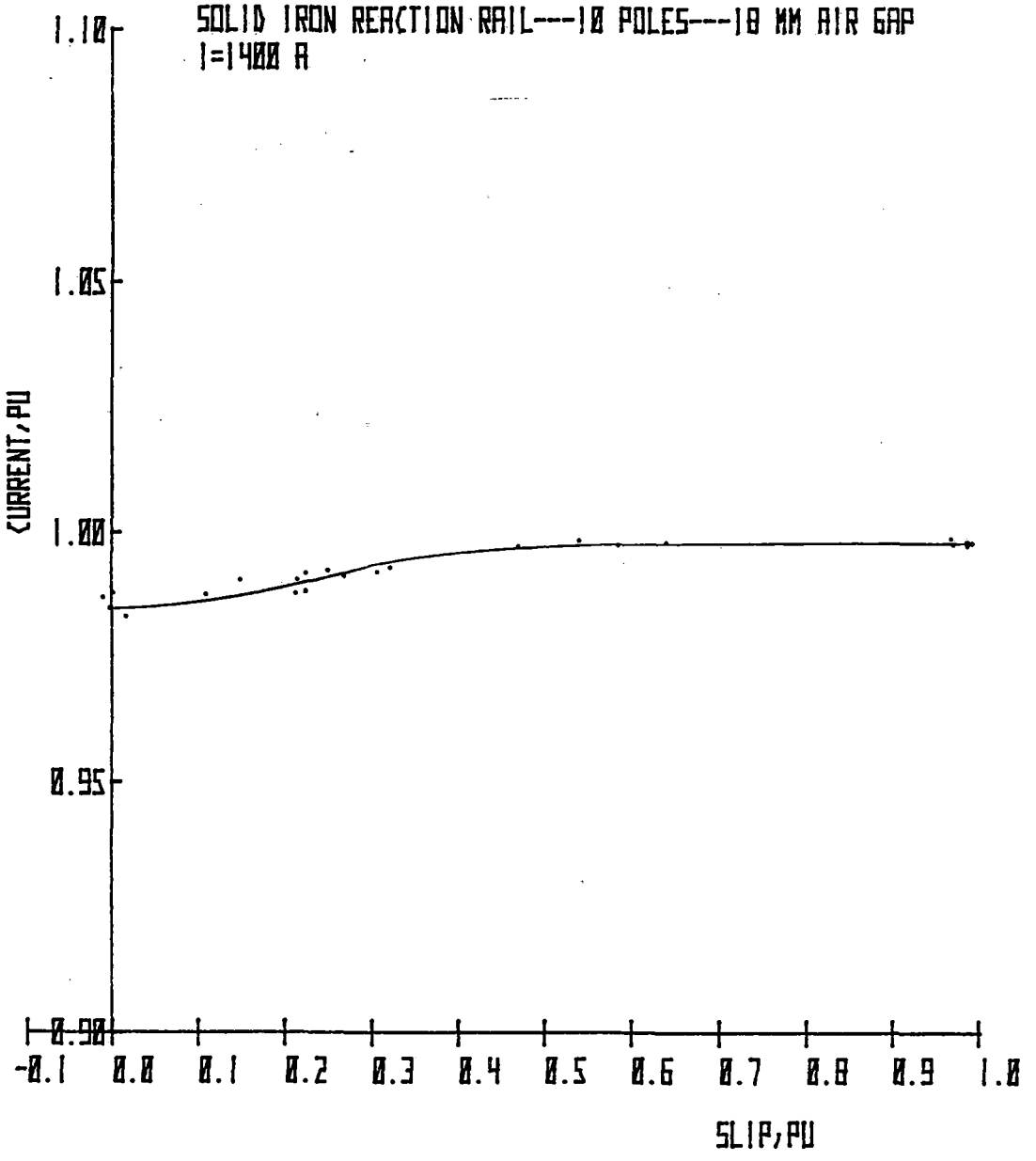
B PHASE VOLTAGE VS SLIP

Figure 5-23



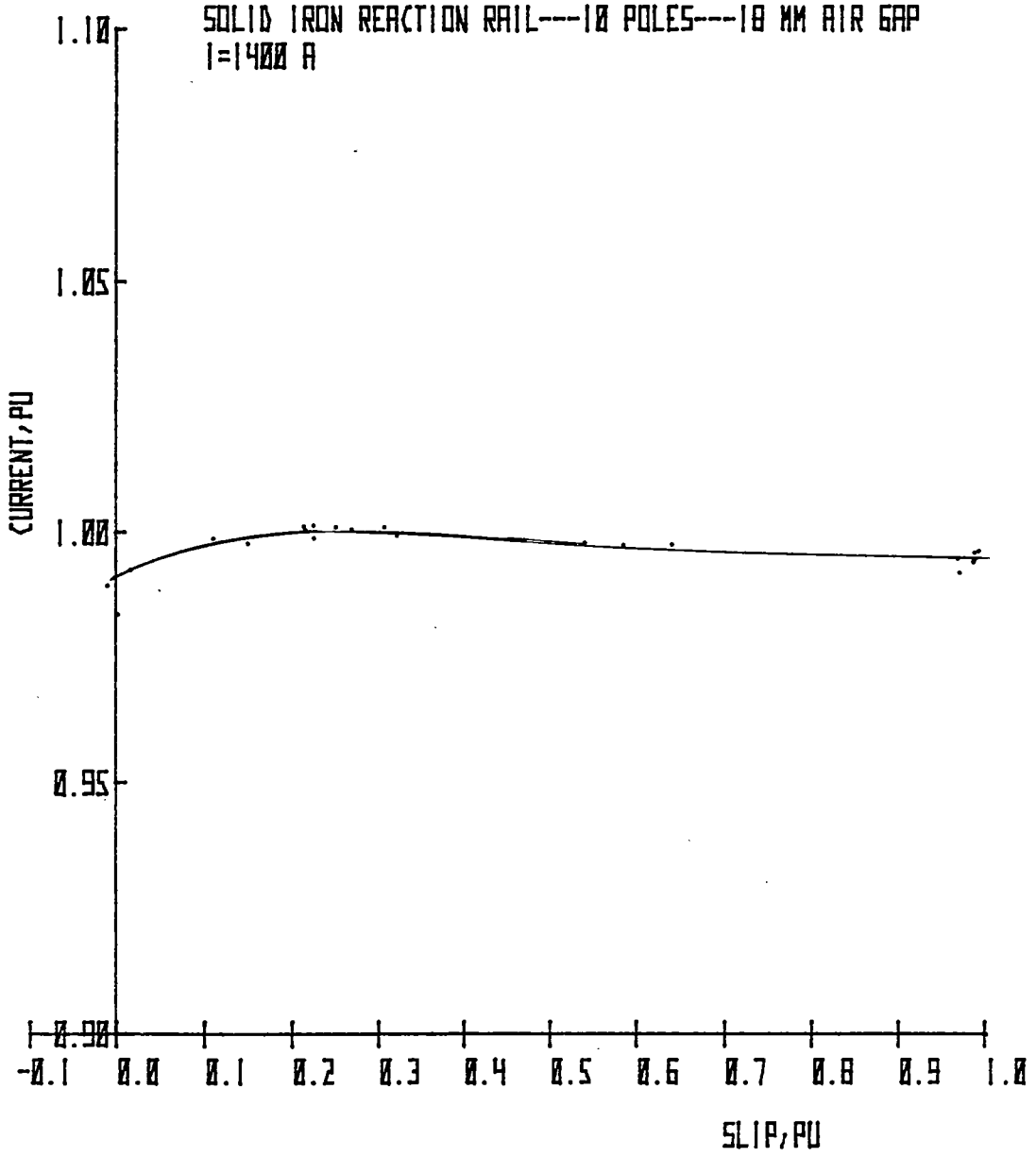
C PHASE VOLTAGE VS SLIP

Figure 5-24



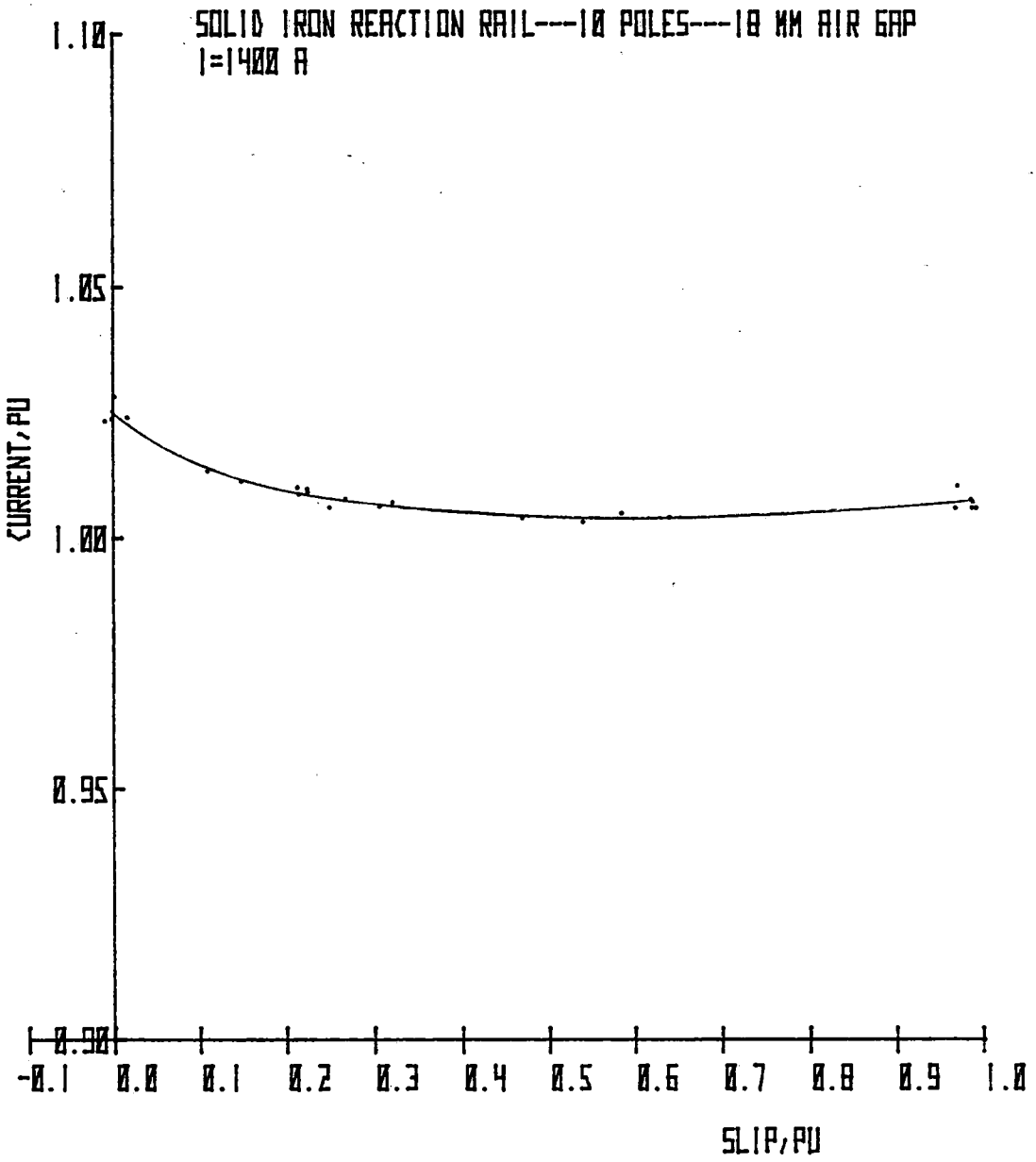
A PHASE CURRENT VS SLIP

Figure 5-25



B PHASE CURRENT VS SLIP

Figure 5-26



C PHASE CURRENT VS SLIP

Figure 5-27

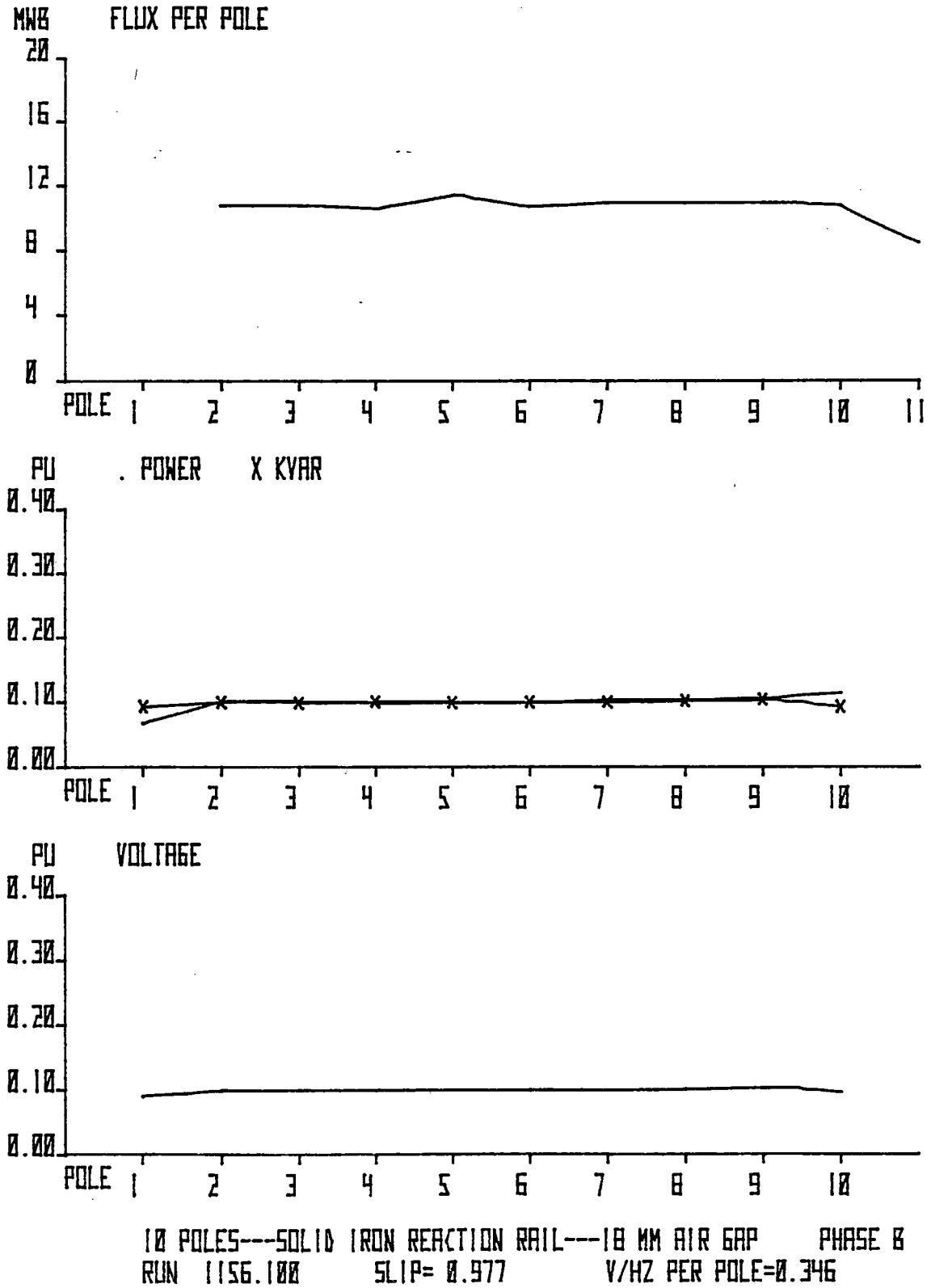

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---18 MM AIR GAP PHASE B
RUN 1156.100 SLIP= 0.977 V/HZ PER POLE=0.346

Figure 5-28

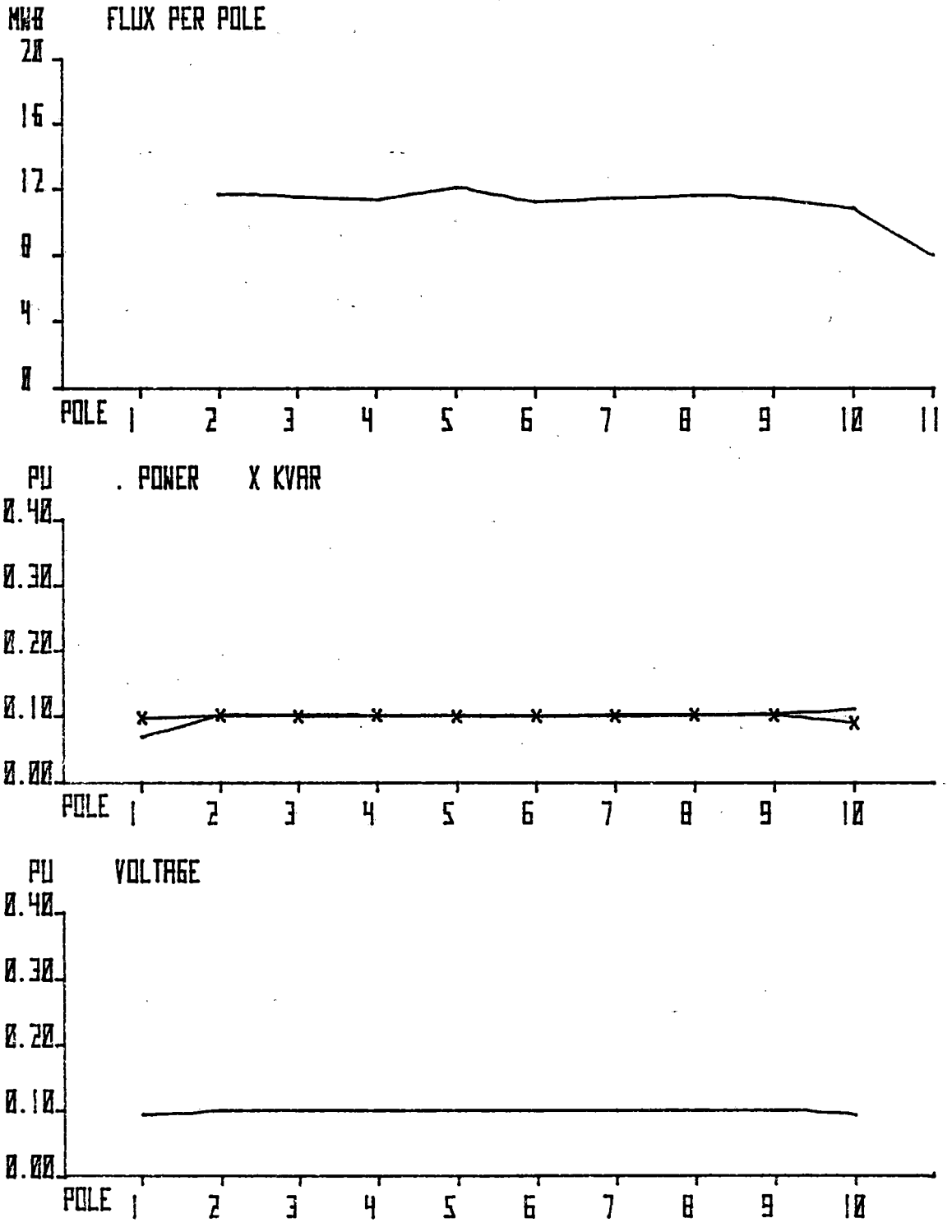

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---18 MM AIR GAP PHASE B
RUN 1157.000 SLIP= 0.634 V/HZ PER POLE=0.346

Figure 5-29

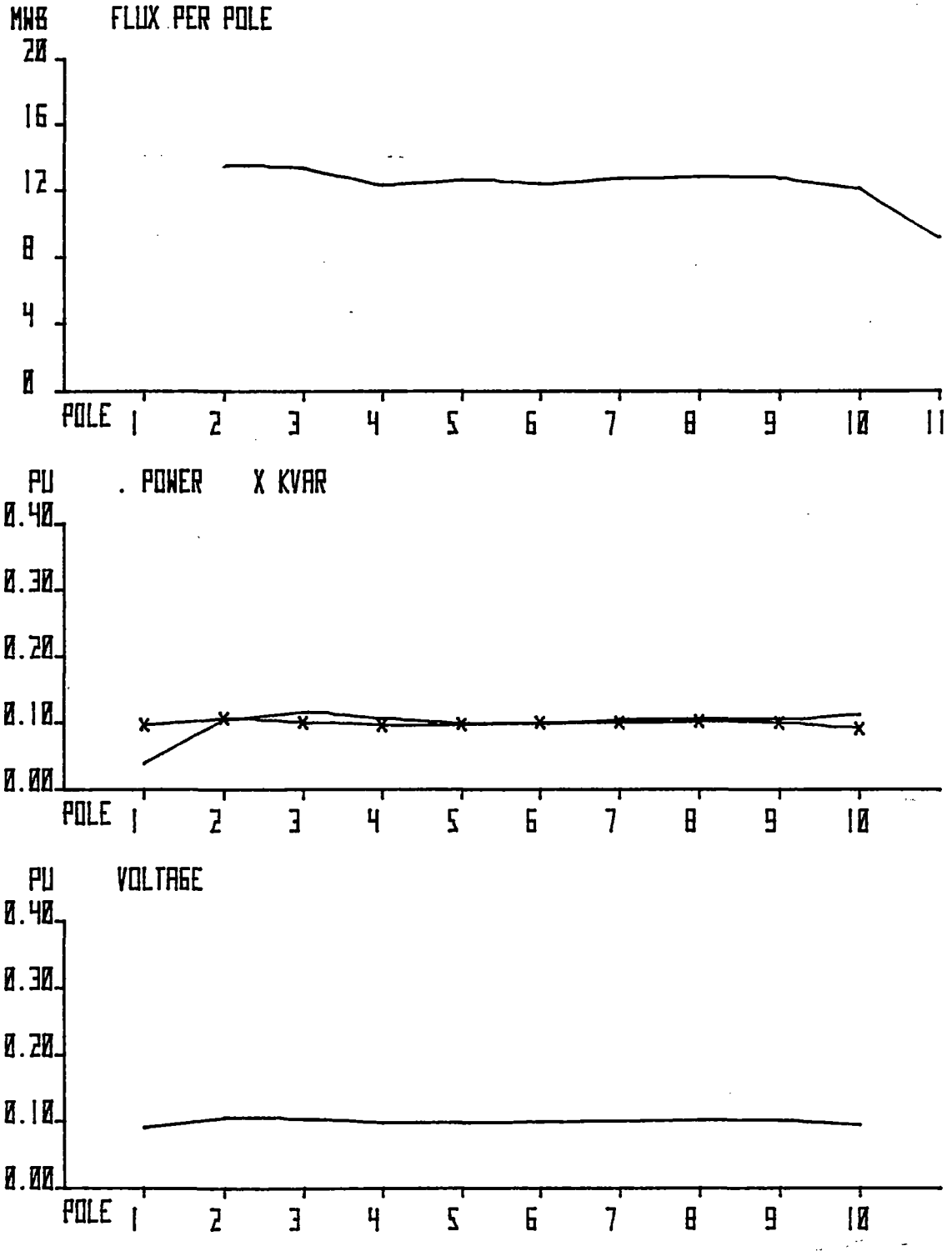

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1162.100 SLIP= 0.304 V/HZ PER POLE=0.346

Figure 5-30

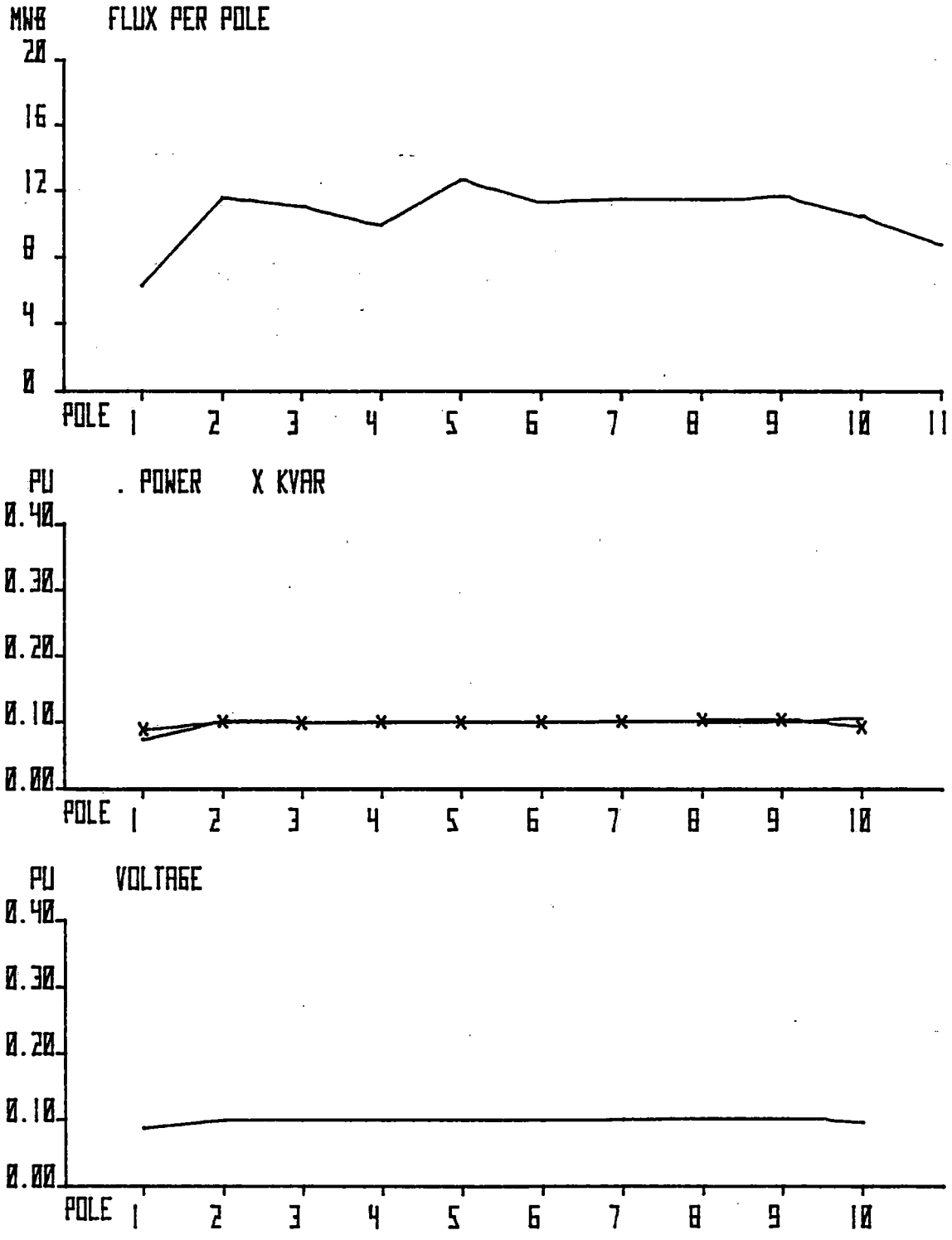

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1162.500 SLIP= 0.970 V/HZ PER POLE=0.346

Figure 5-31

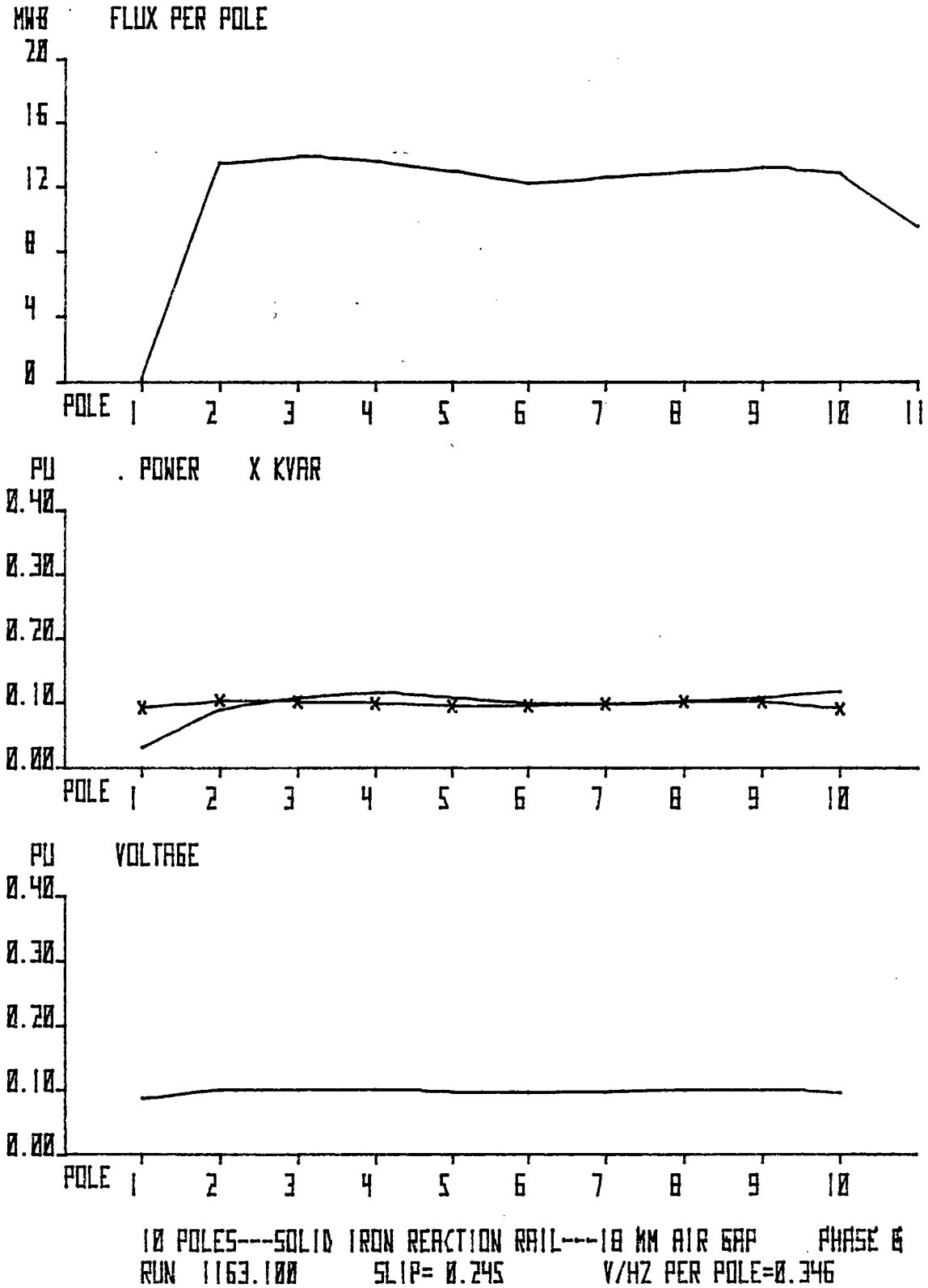

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---18 MM AIR GAP PHASE B
RUN 1163.100 SLIP= 0.245 V/HZ PER POLE=0.346

Figure 5-32

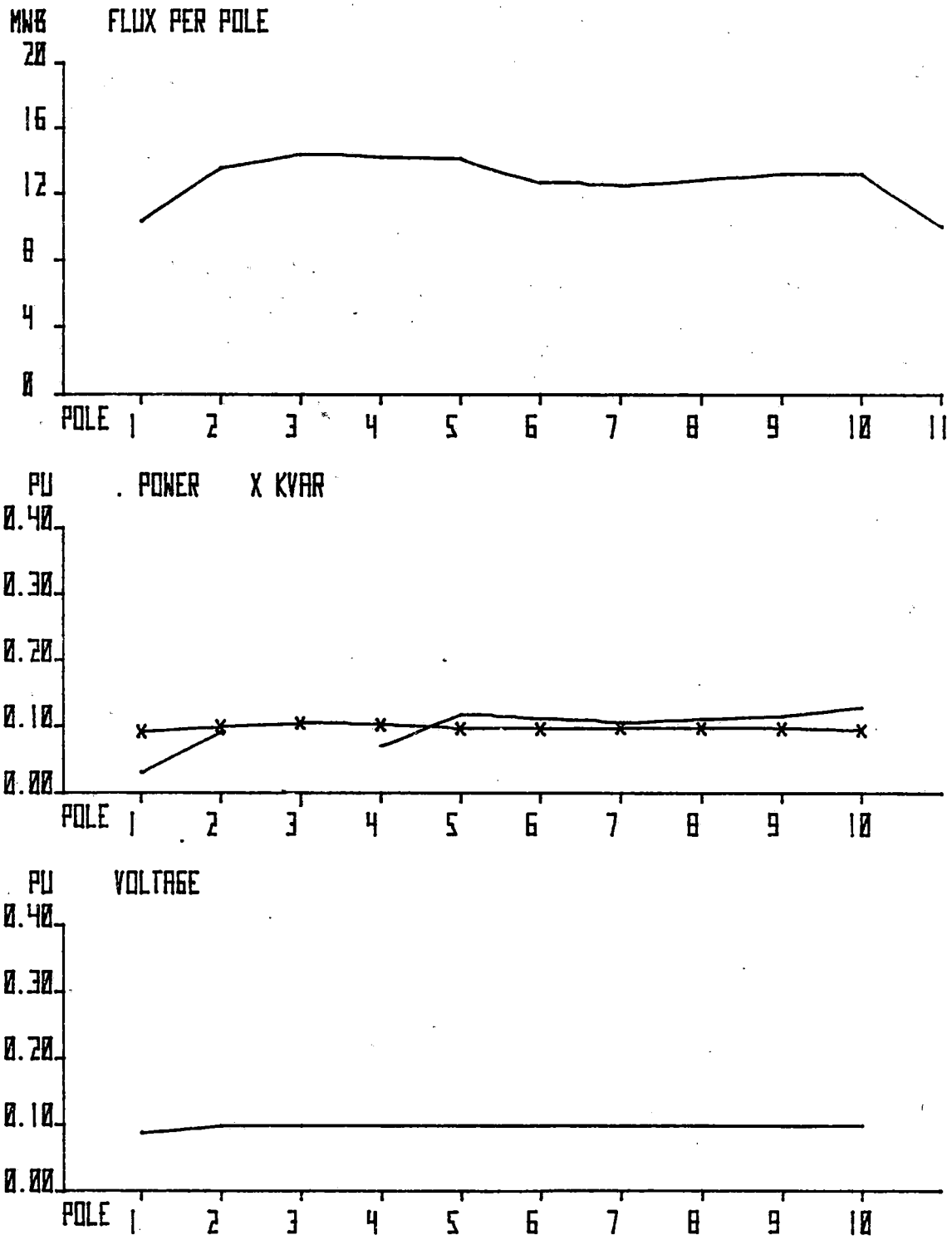

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---18 MM AIR GAP PHASE B
RUN 1164.200 SLIP= 0.224 V/HZ PER POLE=0.346

Figure 5-33

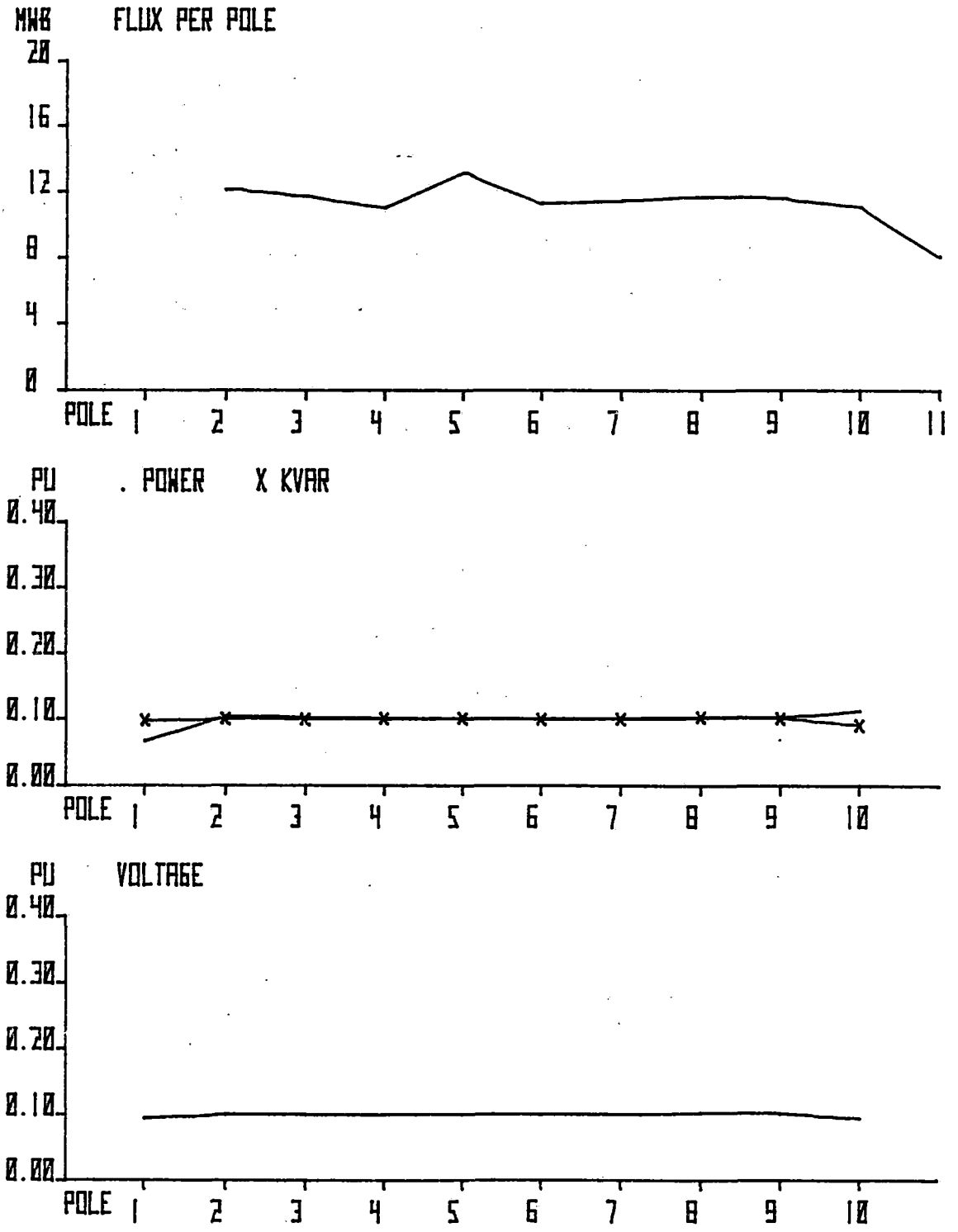

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1165.100 SLIP= 0.578 V/HZ PER POLE=0.346

Figure 5-34

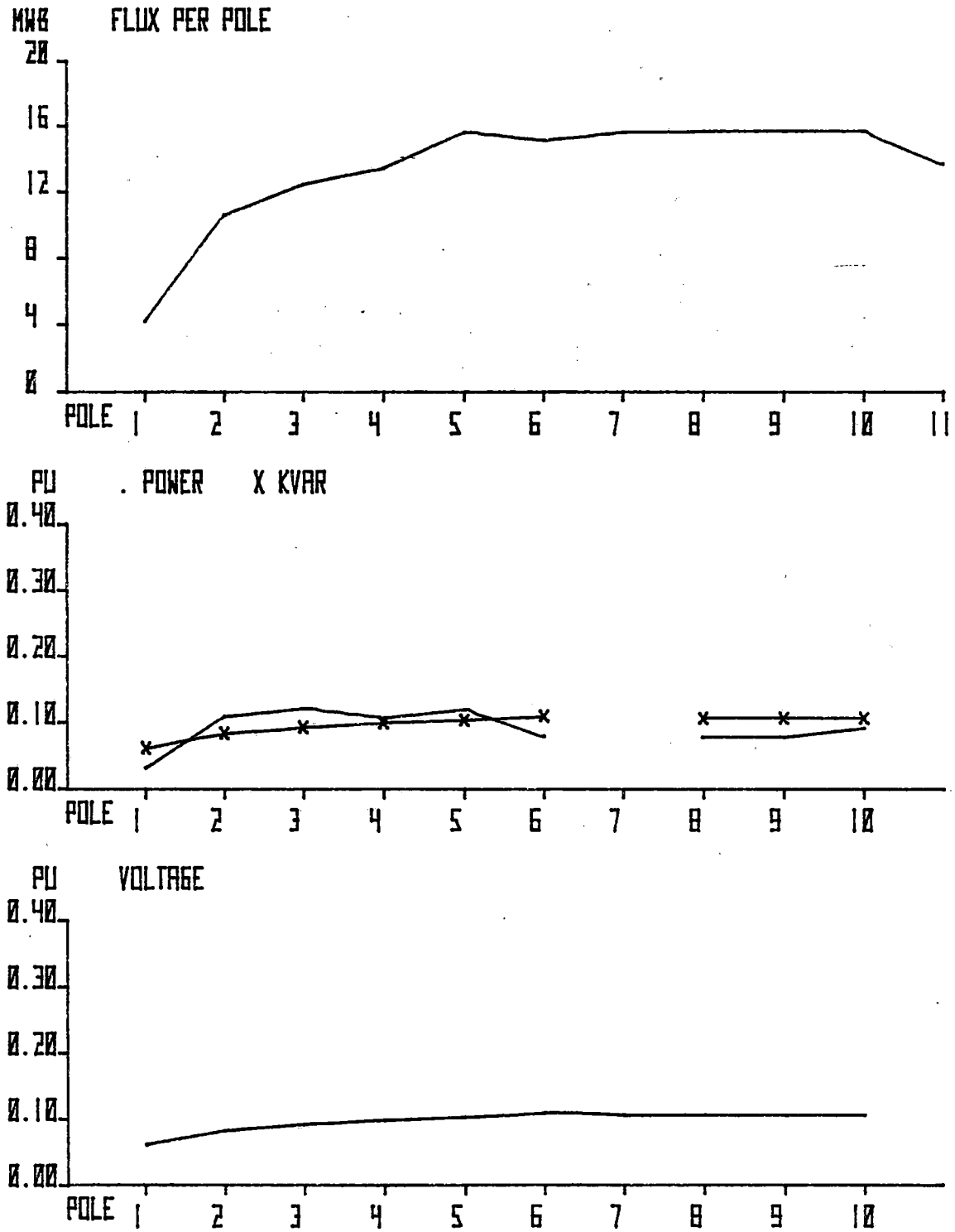

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1167.000 SLIP=-0.003 V/HZ PER POLE=0.346

Figure 5-35

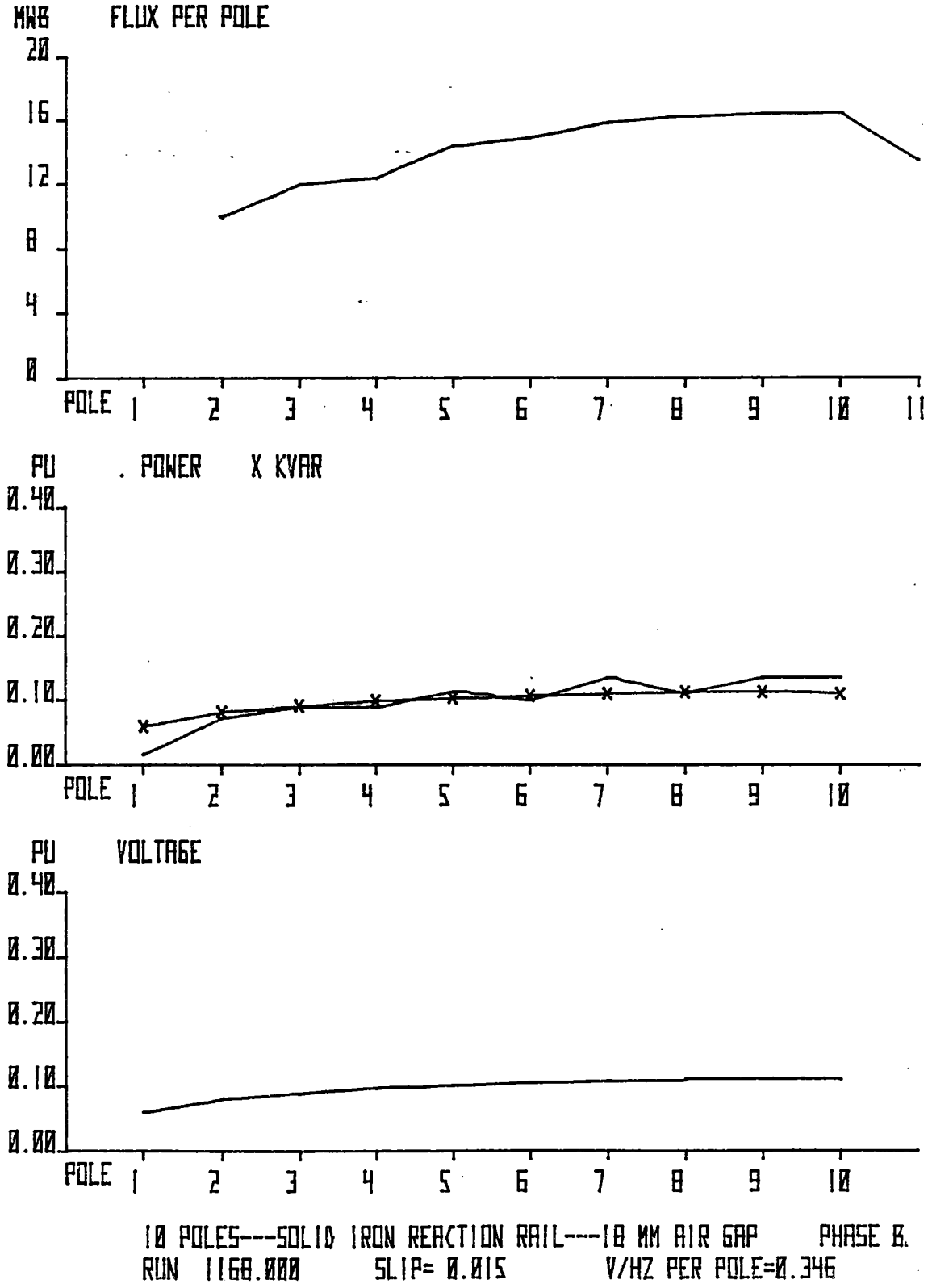

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B.
RUN 1168.000 SLIP= 0.015 V/HZ PER POLE=0.346

Figure 5-36

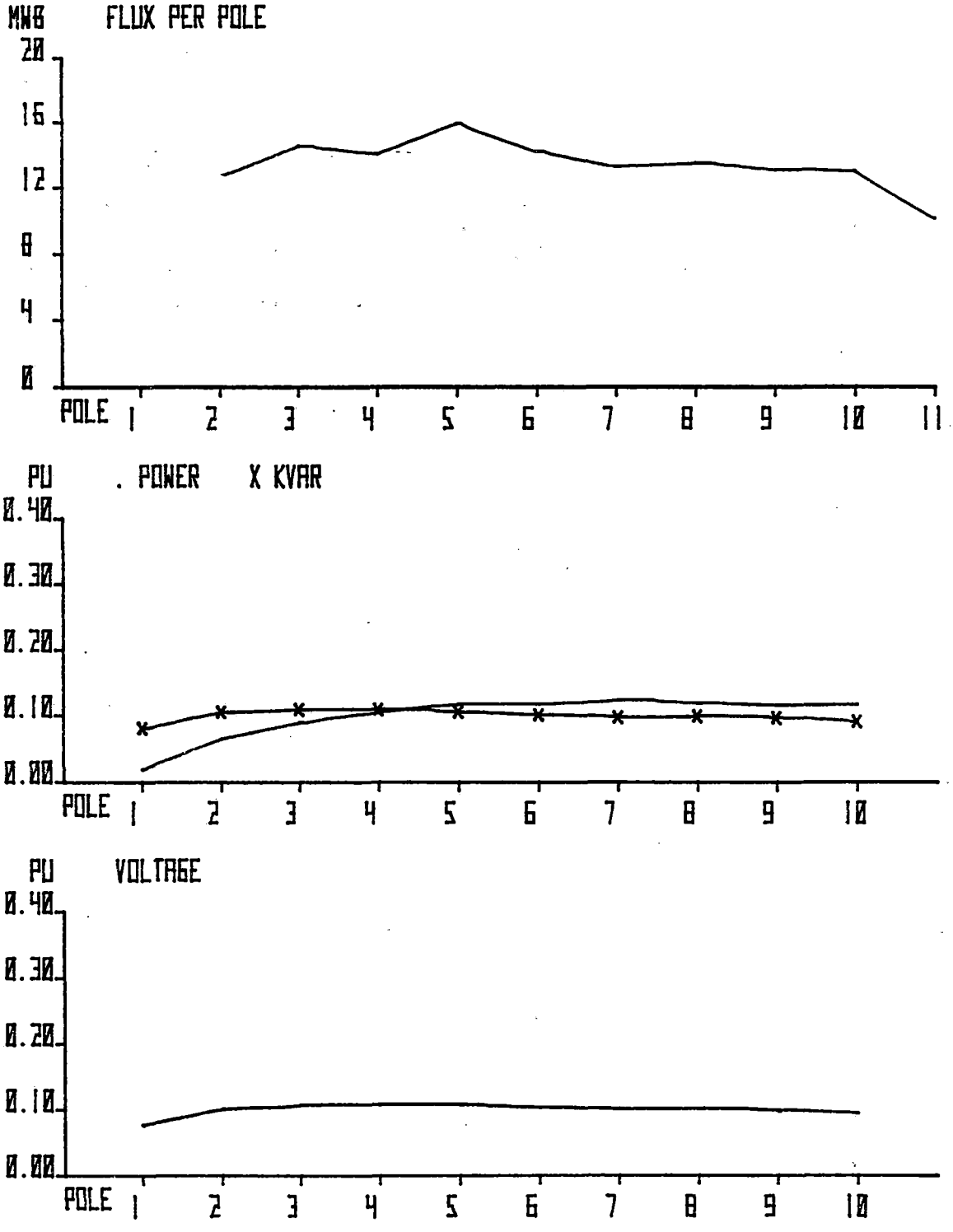

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B.
RUN 1170.000 SLIP= 0.146 V/HZ PER POLE=0.346

Figure 5-37

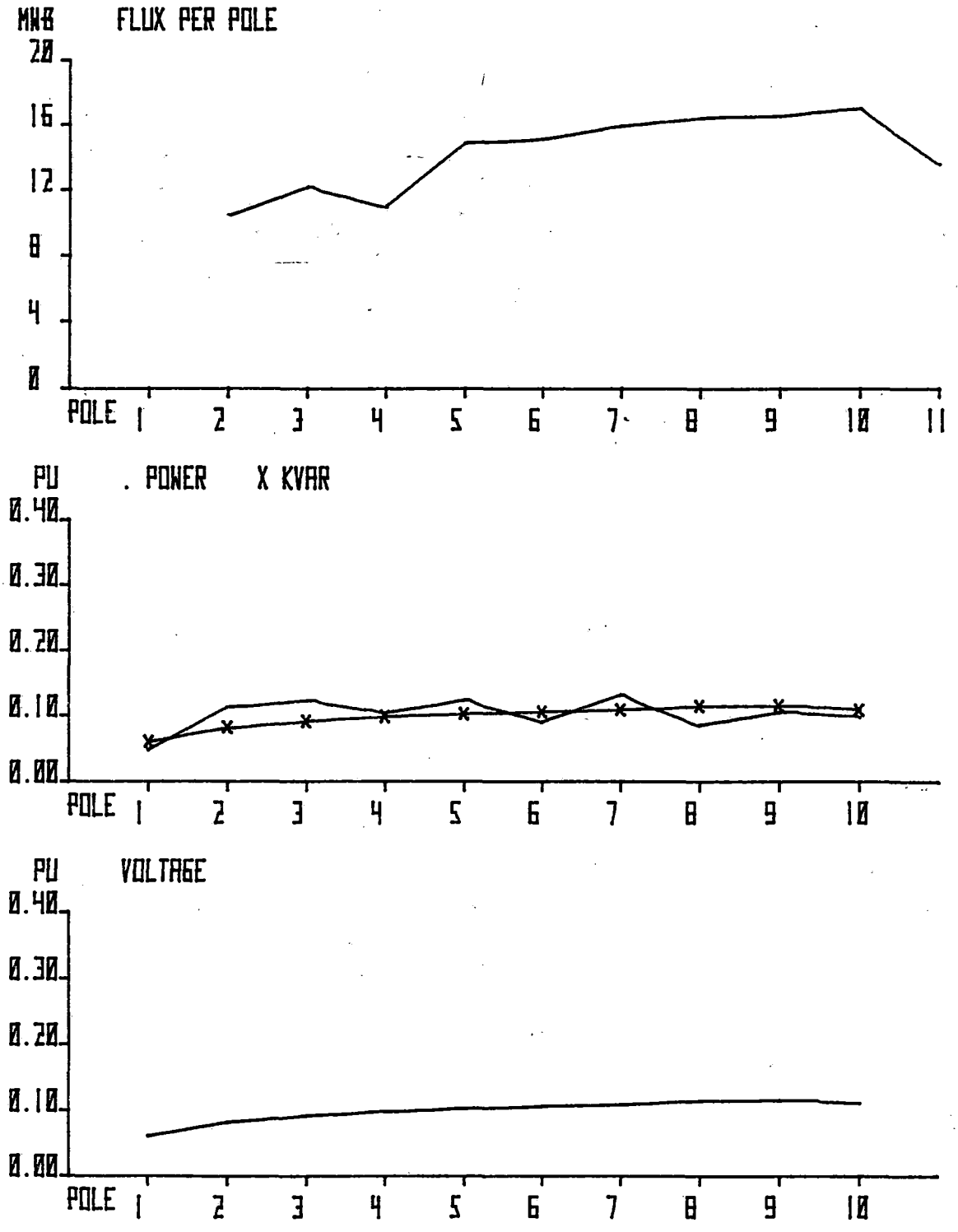

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1172.000 SLIP= 0.001 V/HZ PER POLE=0.346

Figure 5-38

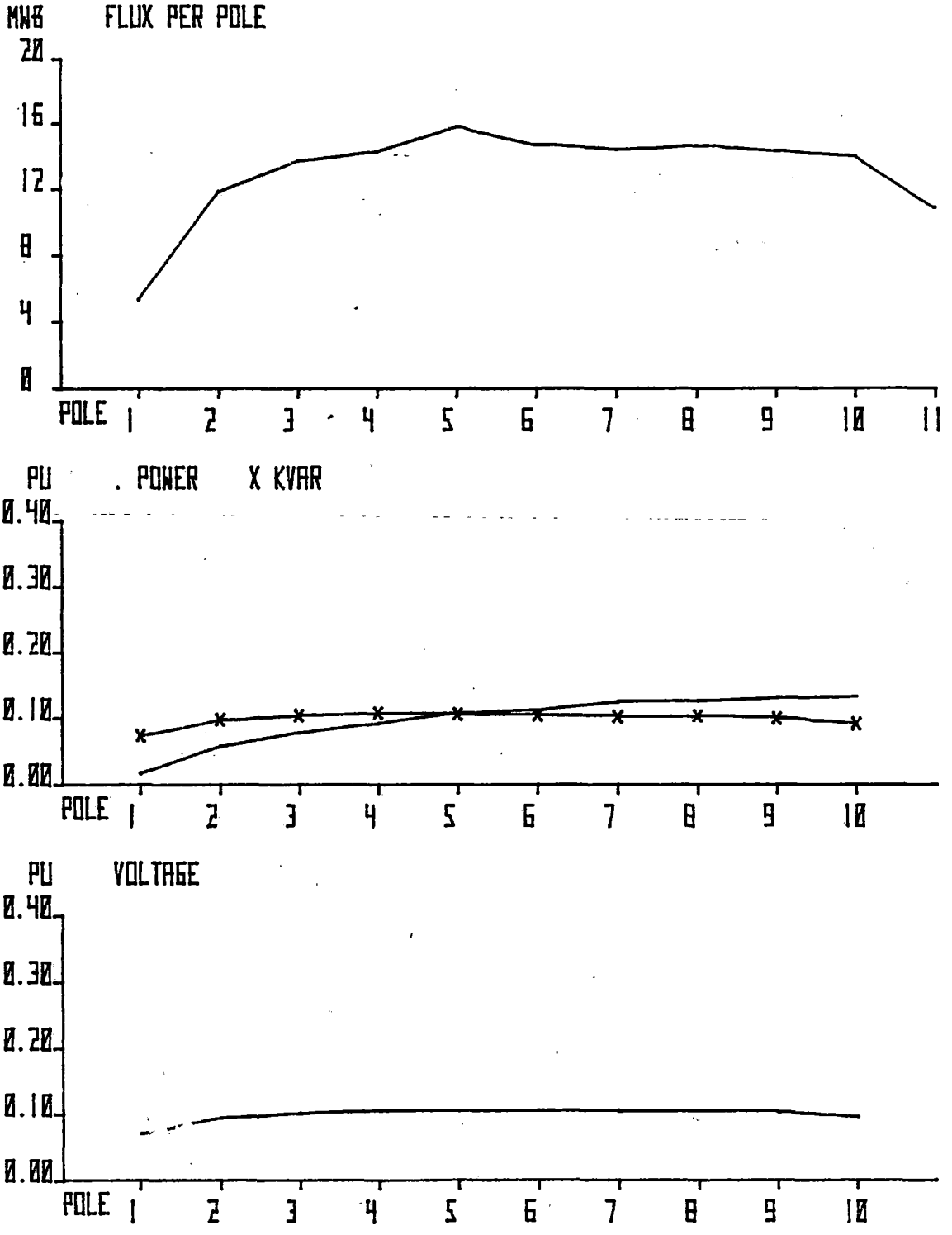

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1176.000 SLIP= 0.100 V/HZ PER POLE=0.346

Figure 5-39

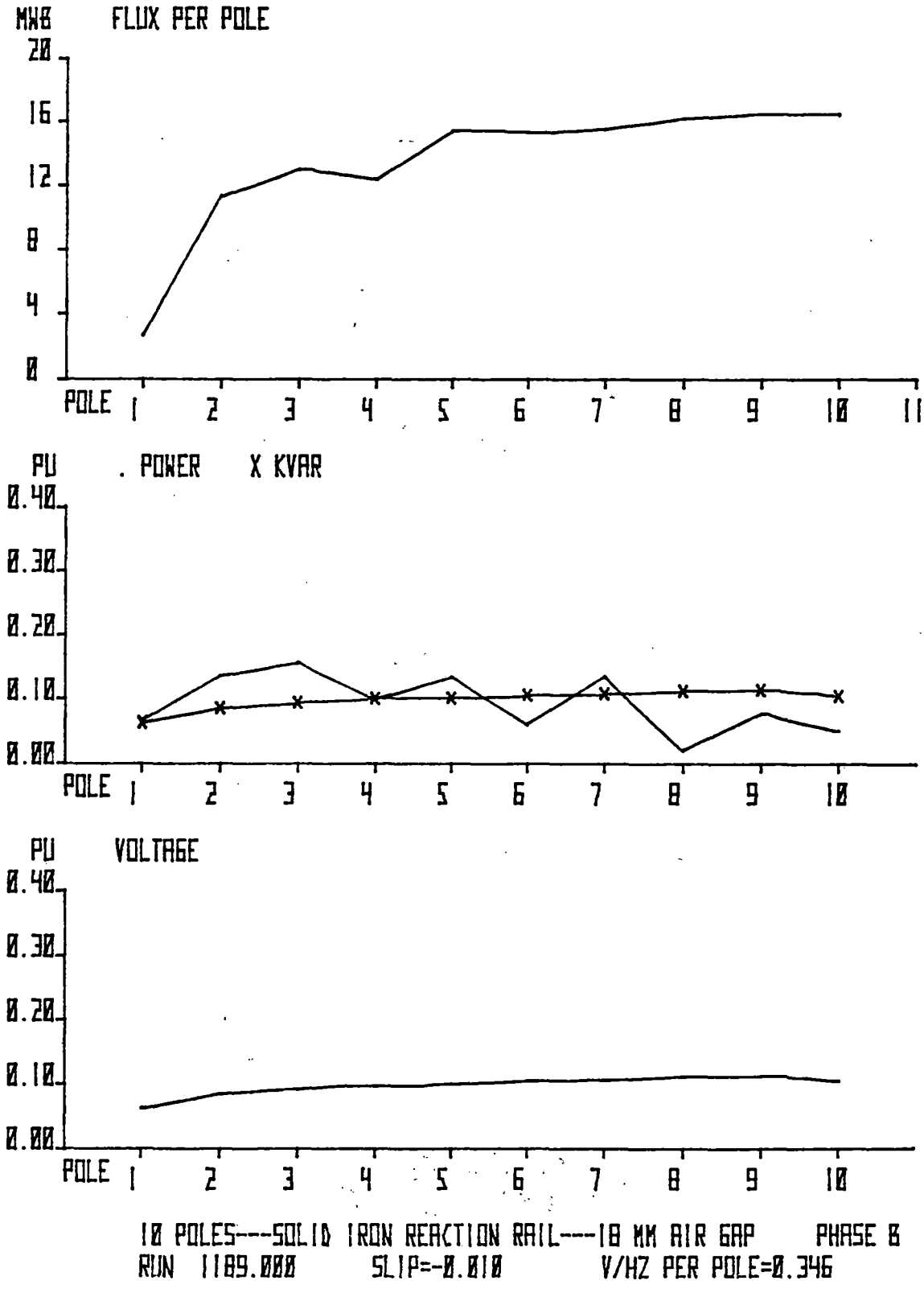

MWB FLUX PER POLE
20
16
12
8
4
0
POLE 1 2 3 4 5 6 7 8 9 10 11
PU . POWER X KVAR
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
PU VOLTAGE
0.40
0.30
0.20
0.10
0.00
POLE 1 2 3 4 5 6 7 8 9 10
10 POLES---SOLID IRON REACTION RAIL---10 MM AIR GAP PHASE B
RUN 1189.000 SLIP=-0.010 V/HZ PER POLE=0.346

Figure 5-40