Fermilab

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Software for Optics Measurements

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On behalf of PI-II test Team
12-07-2016

Outline

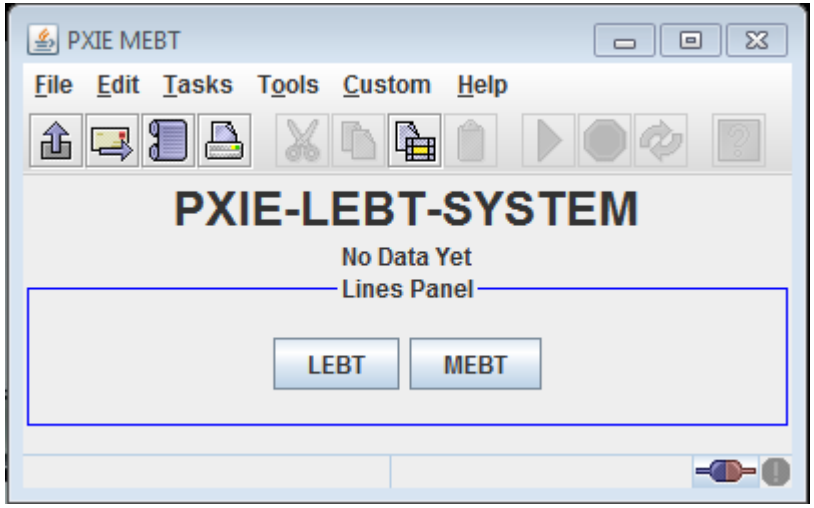
- Objectives of this software
- Present status of program
- Data Output Format
- Beam Energy Measurements
- Summary

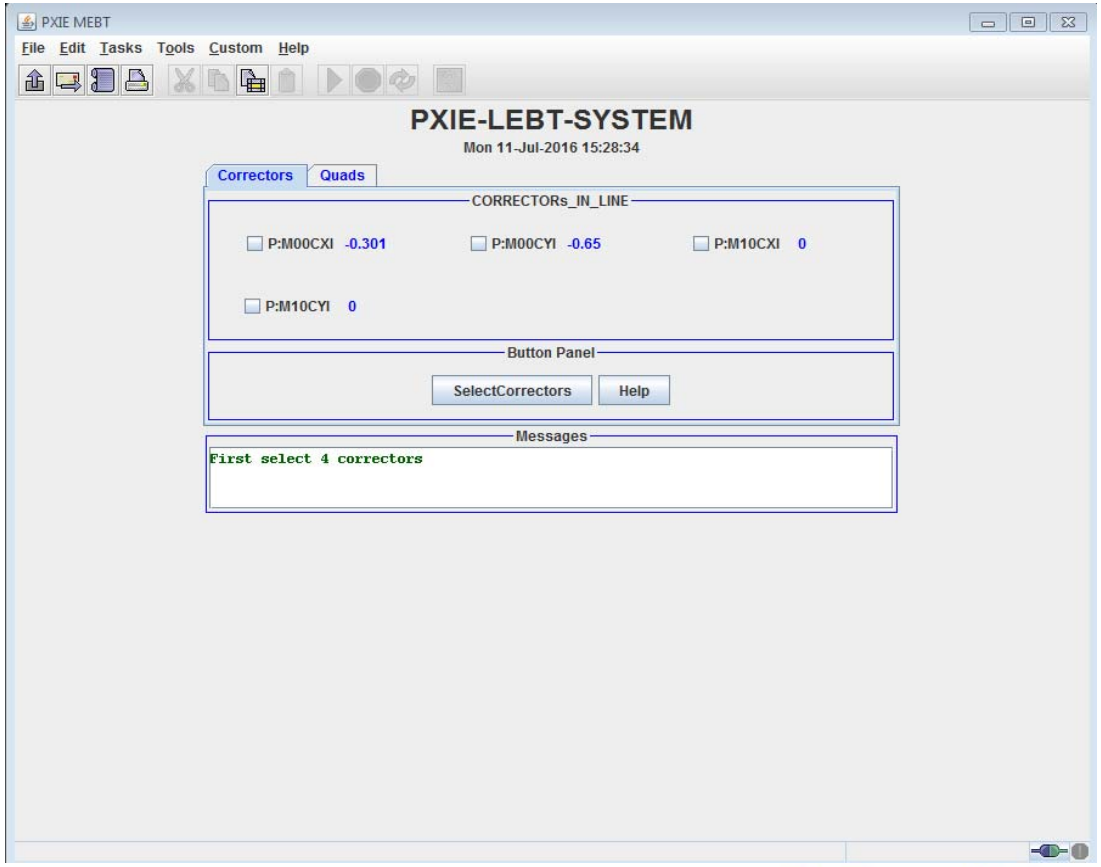
Objectives

- Obtain the Experimental data
  - Differential Corrector/Quad scan
- Data (good data) has to stored in a file
  - By using the Monitoring devices
- From this Experimental data one has to get the relevant parameters and store in a file compatible to OptiM program.

Present Status of the Program

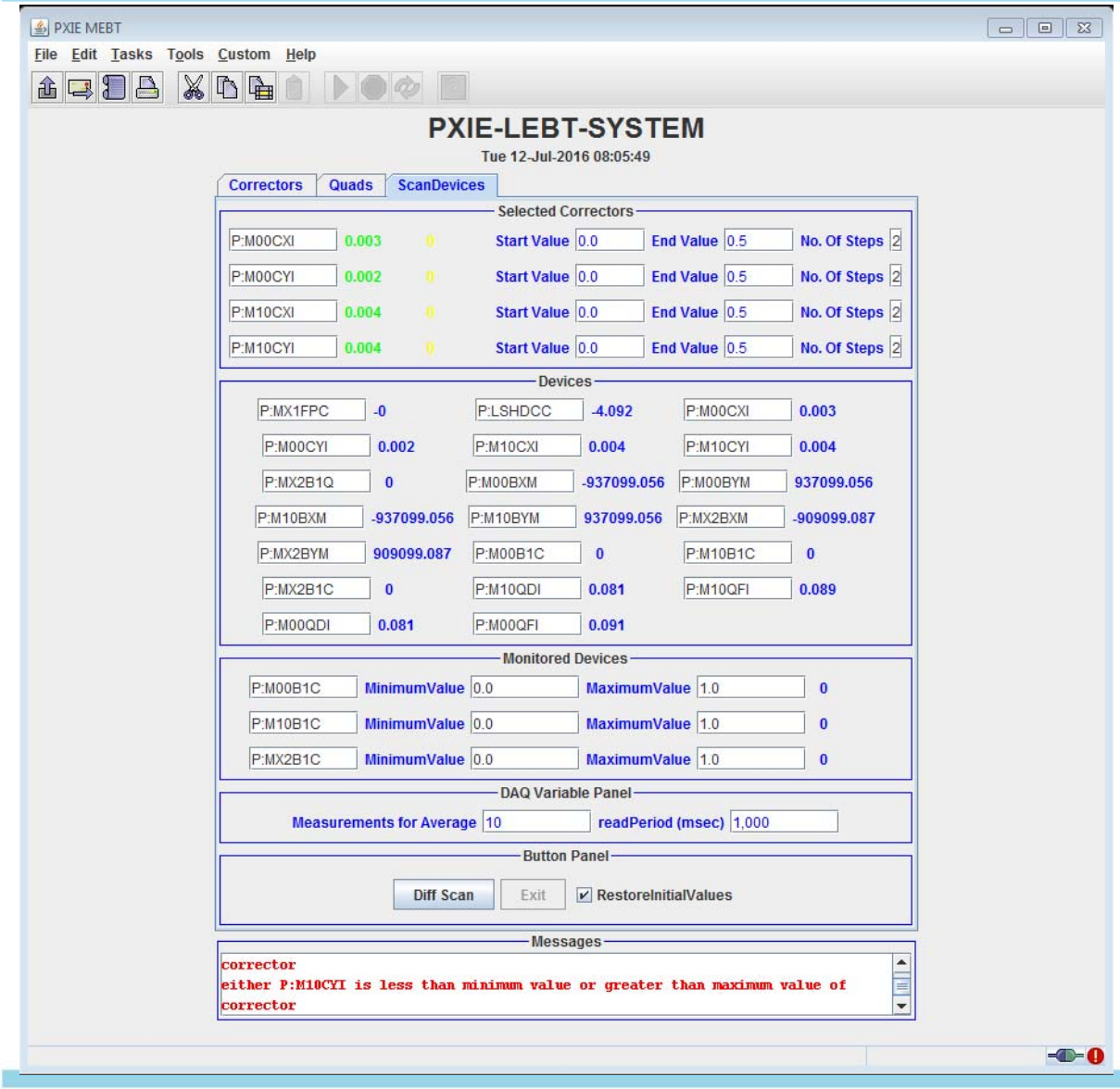
1. Basic program for DAQ is written in Java (eclipse).





- It will display all Correctors, Quads and Cavities present values (Set Values)
- One can select the corrector for differential scan

Present Status Contd



- Operator is free to change the correctors, Devices (BPMS) and Monitored Devices.
- Green color numbers are read values, yellow numbers are set values (S).
- Start and end values are by default S±0.5, operator is free to change.
- Monitor devices are used to write the desired data to file when the values of these devices are within the limits.
- readPeriod is the time between two set of readings
- MeasurementsforAverage 10 implies, 10 measurements are taken for averaging.

Data Output Format:

CorrectorScan.csv - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW Teamcenter

Lalitha sanyasirao Sista venugopal x 32151N

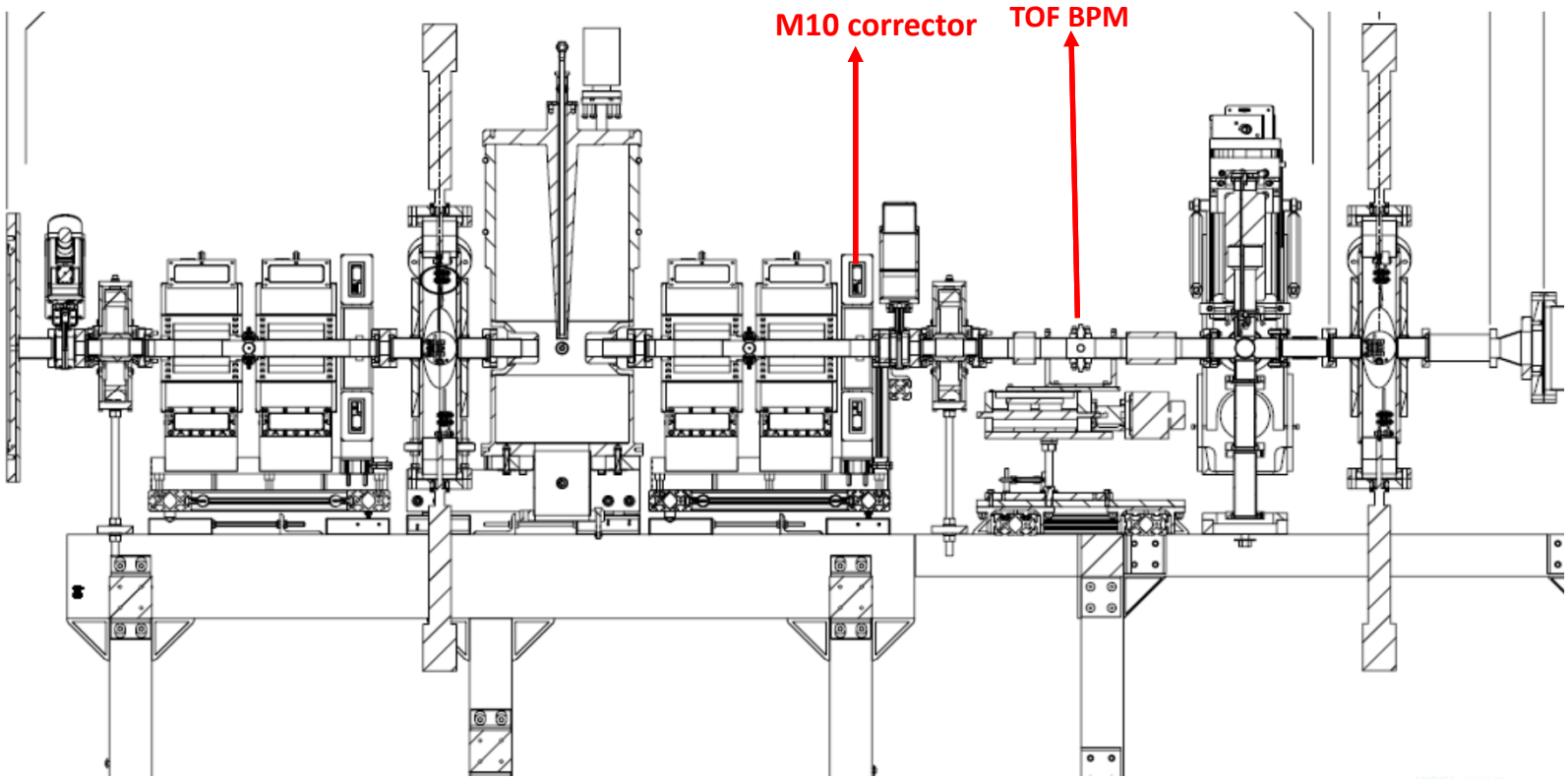
A1 setValueP:M00CXI

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	setValueP:M00CXI	ReadValueP:M00CXI	setValueP:M00CYI	ReadValueP:M00CYI	setValueP:M10CXI	ReadValueP:M10CXI	setVal	ReadValu	P:M00CYI	P:M00CXI	P:M00BXI	P:M00BYI	P:M10BXI	P:M10BYI	P:MX2BXI	P:MX2BYI	P:M00B1C	P:M10B1C	P:MX2B1C	P:M10QD	P:M10QFI	P:M00QD	P:M00QFI
2	-2	-1.99	-0.65	-0.643	0	0.004	0	0.004	-0.64331	-1.98959	-802.164	463.4707	-5209.92	4224.543	-4215.9	2008.505	27721.45	27092.84	22588.51	5.56005	4.9388	7.78365	6.41935
3	-1.75	-1.741	-0.65	-0.643	0	0.004	0	0.004	-0.64333	-1.7404	-784.221	407.8009	-4618.14	4227.263	-3783.63	2051.949	27981.12	27337.26	22733.48	5.5597	4.9385	7.7843	6.41835
4	-1.5	-1.491	-0.65	-0.643	0	0.004	0	0.004	-0.64324	-1.49133	-744.04	354.0134	-3998.08	4191.278	-3330.49	2077.437	27964.21	27347.77	22708.81	5.5599	4.9382	7.78425	6.41865
5	-1.25	-1.242	-0.65	-0.643	0	0.004	0	0.004	-0.64326	-1.24217	-691.415	281.3877	-3347.46	4131.062	-2858.74	2098.617	27862.46	27264.68	22620.38	5.5602	4.938	7.78455	6.4188
6	-1	-0.993	-0.65	-0.643	0	0.004	0	0.004	-0.64324	-0.99297	-672.051	284.6087	-2717.28	4123.79	-2385.38	2105.158	27832.76	27236.16	22587.35	5.55975	4.93835	7.7841	6.4187
7	-0.75	-0.744	-0.65	-0.643	0	0.004	0	0.004	-0.64327	-0.74376	-655.02	287.3566	-2071.22	4135.137	-1893.74	2115.478	27805.84	27200.75	22554.09	5.5604	4.9385	7.7843	6.4187
8	-0.5	-0.495	-0.65	-0.643	0	0.004	0	0.004	-0.64326	-0.49469	-658.401	281.4476	-1447.3	4117.444	-1404.22	2117.168	27749.99	27137.36	22499.08	5.5602	4.93865	7.78335	6.4186
9	-0.25	-0.246	-0.65	-0.643	0	0.003	0	0.004	-0.64323	-0.24561	-656.464	280.656	-805.459	4113.058	-903.009	2119.933	27706.97	27088.06	22466.53	5.5593	4.93895	7.78405	6.4184
10	0	0.003	-0.65	-0.643	0	0.003	0	0.004	-0.64324	0.003088	-664.633	279.0626	-174.959	4106.904	-403.746	2122.324	27688.14	27038.14	22424.61	5.55945	4.93835	7.7836	6.4186
11	0.25	0.252	-0.65	-0.643	0	0.004	0	0.004	-0.64322	0.252509	-655.24	280.4442	476.6289	4098.909	104.0856	2119.297	27681.06	27019.27	22422.42	5.55935	4.9385	7.7844	6.4193
12	0.5	0.502	-0.65	-0.643	0	0.004	0	0.004	-0.64324	0.502063	-654.839	273.7847	1115.386	4084.423	612.4467	2116.698	27657.73	26975.76	22399.71	5.5591	4.9388	7.78435	6.4186
13	0.75	0.752	-0.65	-0.643	0	0.004	0	0.004	-0.64326	0.751691	-622.646	285.8536	1772.42	4082.641	1119.742	2108.114	27737.07	27039.74	22476.01	5.5593	4.93805	7.7843	6.4188
14	1	1.001	-0.65	-0.643	0	0.004	0	0.004	-0.64323	1.001349	-639.117	278.582	2367.015	4061.572	1595.082	2099.967	27690.79	26965.67	22431.54	5.5599	4.9384	7.78405	6.4189
15	1.25	1.251	-0.65	-0.643	0	0.003	0	0.004	-0.64327	1.250946	-643.983	271.1847	2959.87	4041.55	2065.474	2091.116	27633.91	26880.08	22387.25	5.55995	4.93815	7.7843	6.41865
16	1.5	1.5	-0.65	-0.643	0	0.004	0	0.004	-0.64325	1.500366	-619.068	275.053	3562.663	4024.959	2531.536	2074.459	27673.99	26898.36	22426.46	5.56005	4.9388	7.78435	6.4184
17	1.75	1.75	-0.65	-0.643	0	0.004	0	0.004	-0.64327	1.749884	-643.879	267.4862	4081.196	3998.843	2951.993	2061.193	27598.25	26793.92	22353.61	5.55975	4.93835	7.7837	6.41855
18	2	1.999	-0.65	-0.643	0	0.004	0	0.004	-0.64326	1.999274	-636.183	274.504	4621.349	3983.566	3367.858	2042.897	27628.56	26797.39	22378.72	5.5599	4.93895	7.7842	6.4189
19	0	0.003	-2	-1.984	0	0.004	0	0.004	-1.98427	0.003015	-646.303	270.172	-565.465	2180.807	-686.128	501.1369	27655.89	26993.66	22384.71	5.56005	4.9385	7.7838	6.4186
20	0	0.003	-1.75	-1.735	0	0.004	0	0.004	-1.73556	0.003076	-635.164	276.5966	-545.131	2592.509	-677.676	824.4404	27680.64	27020.98	22412.07	5.5596	4.9388	7.7845	6.4189
21	0	0.003	-1.5	-1.487	0	0.004	0	0.004	-1.48712	0.003156	-645.598	278.0416	-540.594	3002.465	-672.277	1149.838	27682.26	27035.39	22415.74	5.56065	4.9388	7.7843	6.4188
22	0	0.003	-1.25	-1.239	0	0.003	0	0.004	-1.23864	0.003119	-641.714	284.2834	-518.471	3386.562	-660.54	1462.709	27686.04	27046.4	22426.91	5.56035	4.93835	7.78355	6.4182
23	0	0.003	-1	-0.99	0	0.004	0	0.004	-0.99034	0.003119	-655.008	280.1275	-522.622	3747.143	-658.754	1768.224	27675.96	27040.16	22420.01	5.5601	4.9385	7.78395	6.4188
24	0	0.003	-0.75	-0.742	0	0.004	0	0.004	-0.742	0.003125	-646.771	285.3813	-489.835	4106.573	-640.233	2070.394	27694.69	27061.79	22444.75	5.5595	4.9388	7.7842	6.41845
25	0	0.003	-0.5	-0.494	0	0.004	0	0.004	-0.49383	0.003082	-644.963	292.5105	-482.421	4452.536	-632.524	2360.422	27722.14	27116.89	22480.25	5.5602	4.9385	7.78455	6.41865
26	0	0.003	-0.25	-0.246	0	0.003	0	0.004	-0.24561	0.003168	-641.858	290.4983	-451.946	4779.639	-614.072	2646.86	27726.8	27133.31	22498.28	5.5597	4.939	7.78365	6.4187
27	0	0.003	0	0.003	0	0.004	0	0.004	0.002863	0.003113	-633.712	296.9581	-430.286	5099.552	-602.901	2927.072	27712.45	27142.24	22503.41	5.5592	4.9382	7.7842	6.4186
28	0	0.003	0.25	0.252	0	0.003	0	0.004	0.252167	0.003119	-651.188	293.4132	-434.852	5394.701	-599.025	3196.67	27703.16	27136.96	22507.99	5.5596	4.93835	7.78395	6.4191
29	0	0.003	0.5	0.502	0	0.004	0	0.004	0.501691	0.003101	-625.502	301.1194	-394.562	5692.436	-576.447	3457.645	27729.14	27205.88	22563.75	5.5599	4.93895	7.78445	6.4185
30	0	0.003	0.75	0.751	0	0.004	0	0.004	0.751337	0.003076	-625.576	305.6672	-377.729	5976.578	-566.654	3712.628	27754.23	27258.01	22612.49	5.55945	4.9383	7.7844	6.4187
31	0	0.003	1	1.001	0	0.003	0	0.004	1.000708	0.003119	-632.045	300.1227	-378.204	6236.628	-561.408	3956.155	27721.34	27255.49	22617.09	5.5599	4.93895	7.7839	6.4187
32	0	0.003	1.25	1.25	0	0.004	0	0.004	1.250232	0.003143	-646.767	301.2881	-372.995	6496.317	-554.784	4192.305	27716.99	27285.34	22649.12	5.56005	4.93865	7.78425	6.419
33	0	0.003	1.5	1.5	0	0.003	0	0.004	1.499585	0.003119	-647.644	299.5745	-361.823	6735.063	-545.474	4418.054	27707.91	27304.9	22683.84	5.5599	4.9391	7.7844	6.4185
34	0	0.003	1.75	1.749	0	0.004	0	0.004	1.749036	0.003113	-661.347	297.2798	-362.427	6961.808	-541.578	4633.178	27676.24	27303.5	22703.04	5.5597	4.9382	7.78405	6.419
35	0	0.003	2	1.998	0	0.004	0	0.004	1.998138	0.003119	-647.092	304.4558	-346.147	7187.377	-528.224	4841.76	27676.31	27333.71	22756.75	5.56055	4.9394	7.78425	6.41895
36	0	0.003	0	0.003	-2	-1.992	0	0.004	0.002954	0.003198	-664.554	279.081	-506.207	4827.424	-1859.19	2746.349	27665.79	27070.2	22450.32	5.56015	4.93805	7.78395	6.41865
37	0	0.003	0	0.003	-1.75	-1.743	0	0.004	0.002869	0.003186	-663.943	288.0488	-499.65	4842.415	-1687.01	2752.813	27701.69	27106.29	22477.44	5.5602	4.9391	7.7843	6.4189
38	0	0.003	0	0.003	-1.5	-1.494	0	0.004	0.002838	0.00318	-647.023	292.6044	-477.596	4840.858	-1510	2753.344	27766.33	27166.42	22531.86	5.56035	4.9385	7.78375	6.4189
39	0	0.003	0	0.003	-1.25	-1.244	0	0.004	0.00285	0.003198	-650.542	286.6368	-471.925	4834.999	-1340.26	2757.479	27717.73	27122.71	22488.01	5.55965	4.9385	7.78385	6.4191
40	0	0.003	0	0.003	-1	-0.995	0	0.004	0.002765	0.003192	-658.05	291.0745	-462.901	4839.678	-1172.89	2762.332	27723.64	27116.95	22488.09	5.56005	4.93865	7.7841	6.41845
41	0	0.003	0	0.003	-0.75	-0.745	0	0.004	0.002765	0.003192	-652.904	288.7938	-461.868	4838.492	-1010.54	2765.058	27737.46	27138.53	22514.93	5.56005	4.9391	7.78395	6.4182
42	0	0.003	0	0.003	-0.5	-0.495	0	0.004	0.002802	0.003174	-641.063	292.7862	-442.873	4844.79	-843.403	2767.726	27770.9	27191.5	22540.88	5.56035	4.9385	7.7842	6.4187
43	0	0.003	0	0.003	-0.25	-0.246	0	0.004	0.002747	0.003162	-673.345	281.8162	-451.101	4824.238	-686.263	2770.389	27683.99	27078.77	22453.91	5.5599	4.93865	7.7842	6.4188

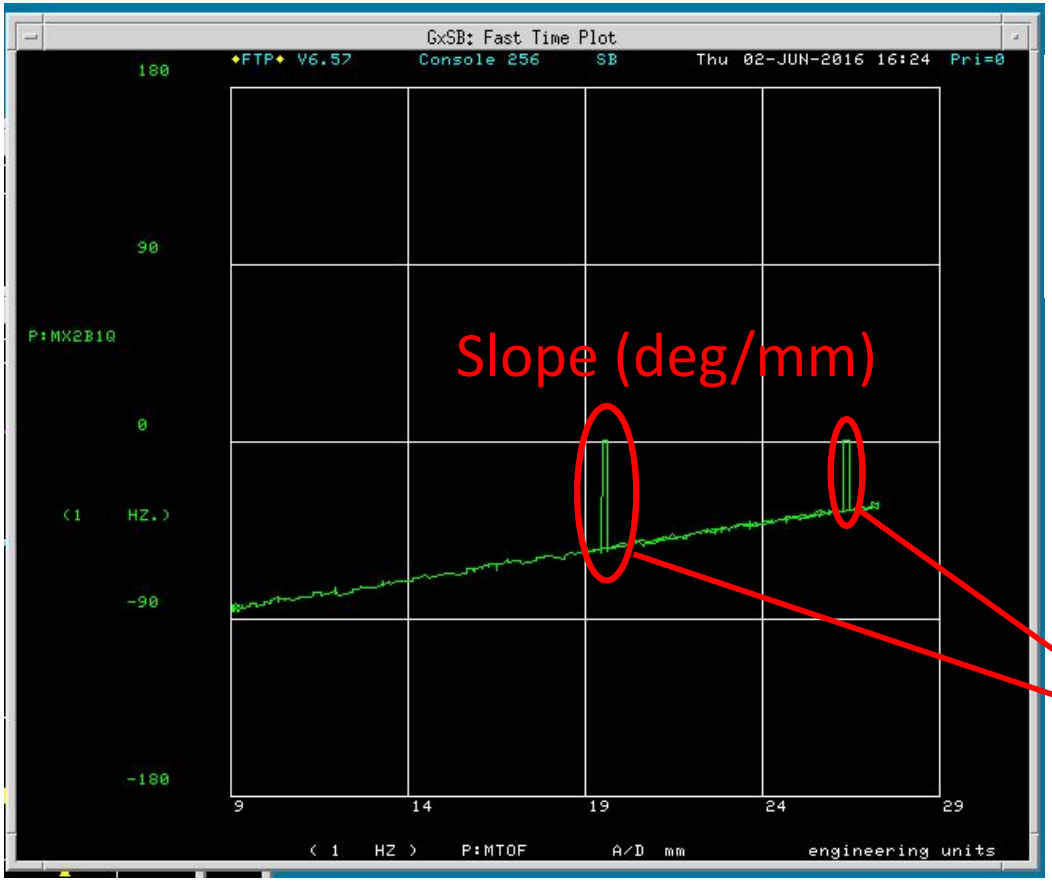
CorrectorScan

Beam Energy Measurements

- Used two methods
  - Corrector Scan (initial measurements)
  - Time of Flight (TOF)



Beam Energy Measurements Contd



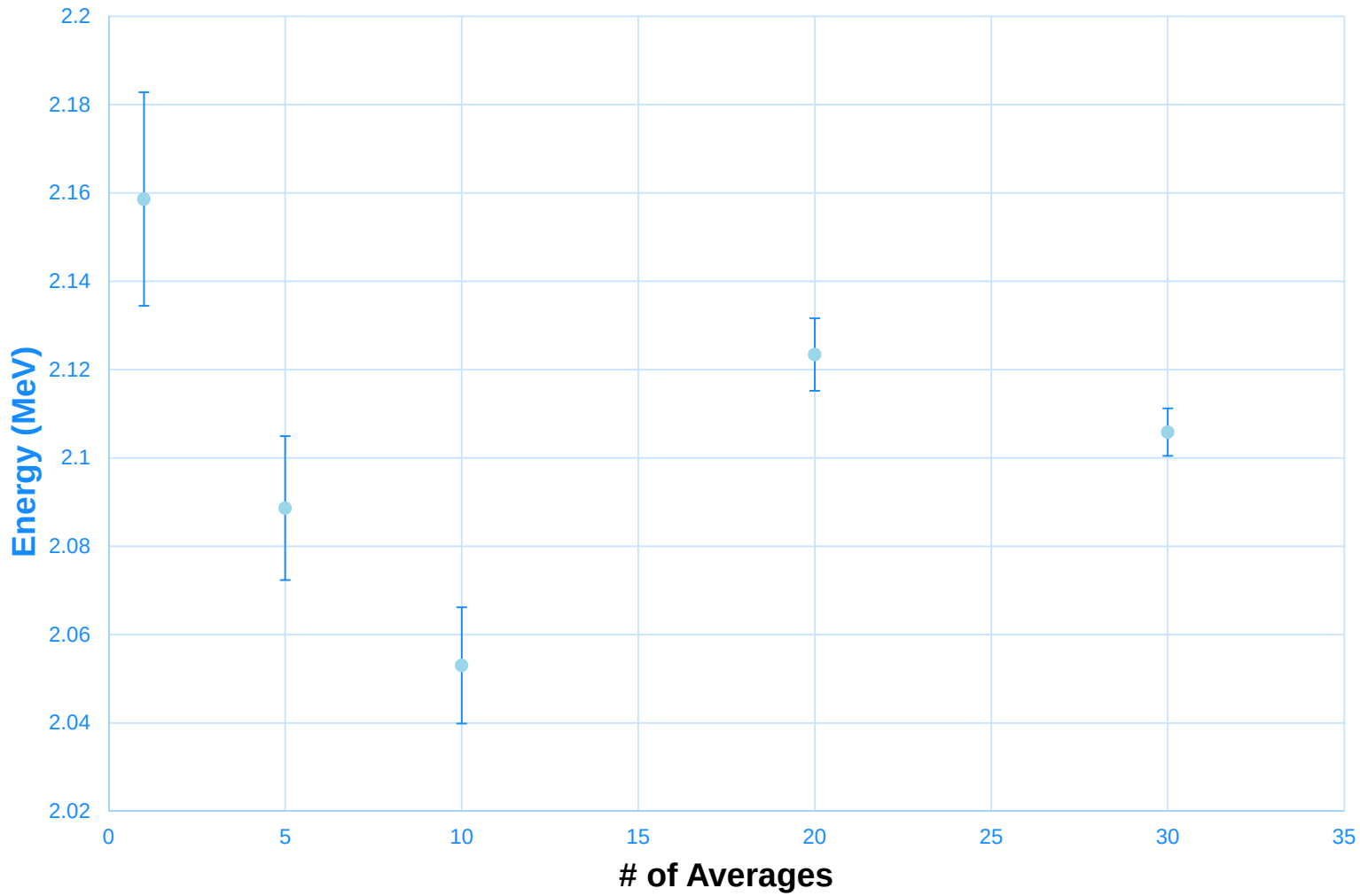
$$\beta = \frac{162.5 * 360}{1000 * slope * 300}$$

$$E(MeV) = \left[\frac{slope}{\sqrt{slope^2 - 0.195^2}} - 1\right] * m_0c^2$$

RF trips

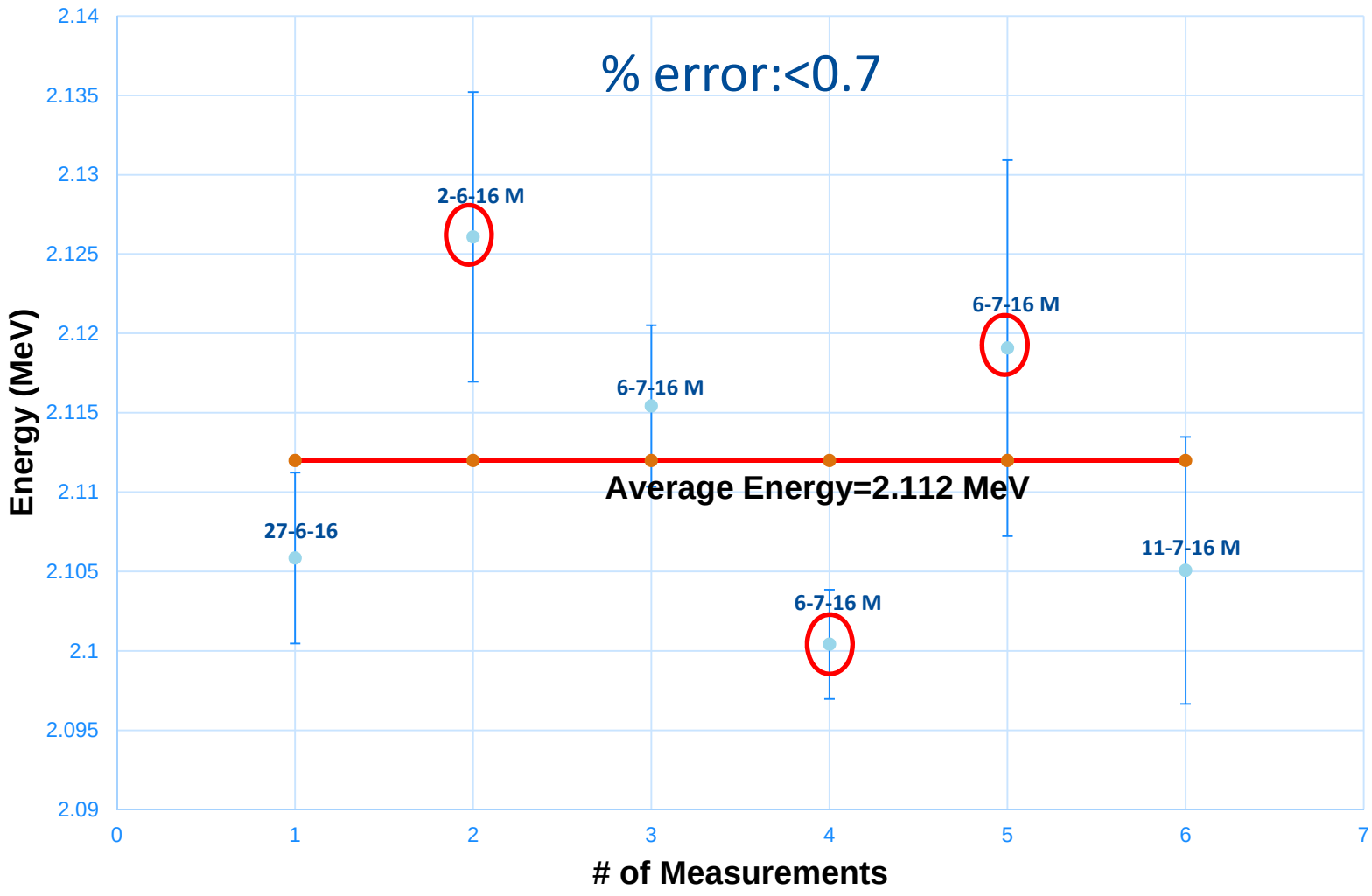
The phase of BPM is measured with reference to RF frequency 162.5 MHz.

Beam energy measurements contd (data:27th June,2016)



Data taken by using a program written by Bill Marsh

Beam energy measurement Contd:



Summary

- Written a Java based program for differential scan
- It can do the corrector and Quad scans
- Beam Energy has been measured using TOF method.
- Average Beam energy was 2.112 MeV±0.7%

Thank you

I am really thankful to Dr. Marsh for his help.