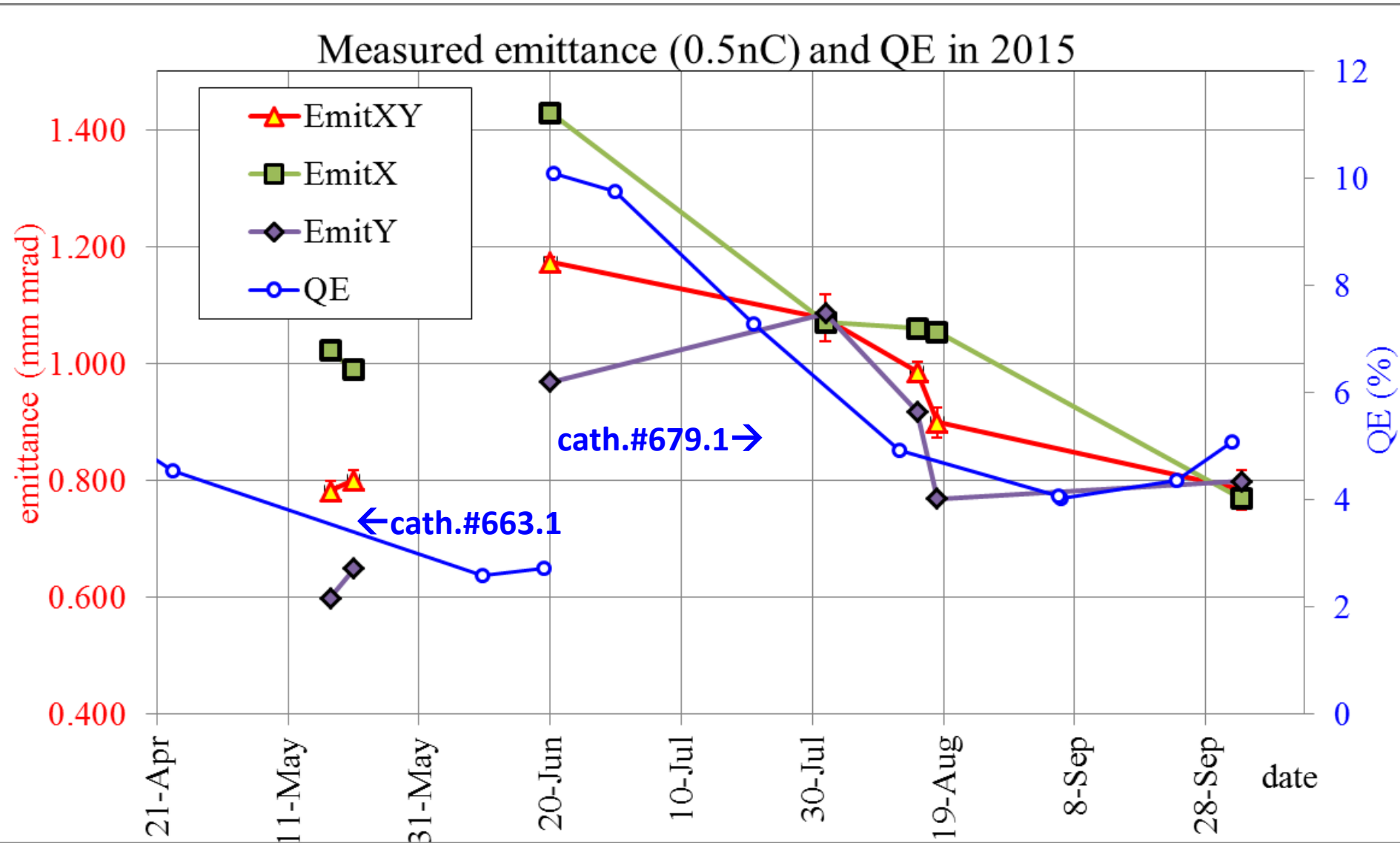


Emittance and QE in 2015: a bit more detailed analysis

M.Krasilnikov

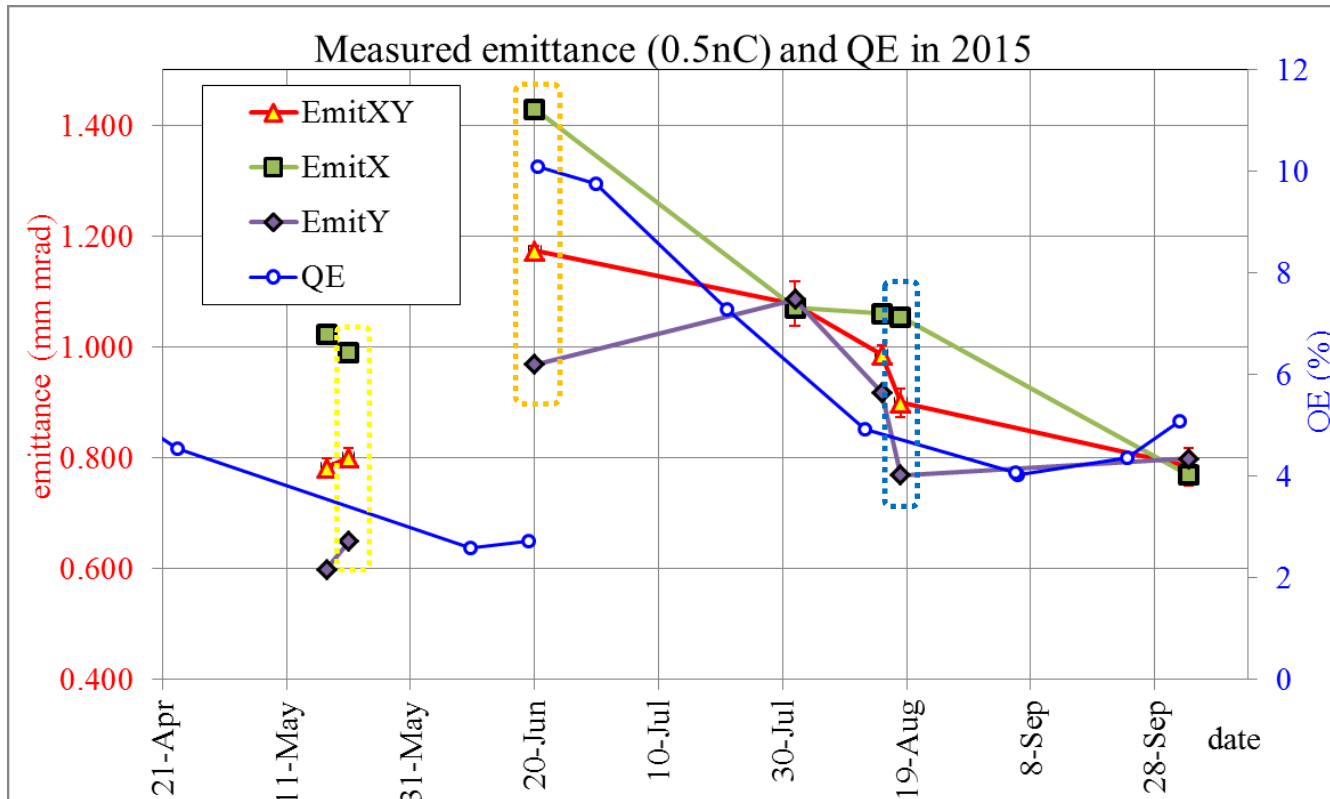
April, 2016

2015: Measured emittance (0.5nC) and QE



2015: Measured emittance (0.5nC) and QE

Date	Time	BSA	Gun phase	Laser rms, mm			EmitX	EmitXerr	EmitY	EmitYerr	EmitXY	EmitXYerr	Imain	#	<Pz>, MeV/c		PzRMS, keV/c		E-beam at EMSY1, mm			Remark	
				Xrms	Yrms	XYrms									gun	final	gun	final	Xrms	Yrms	Xyrms		
17.05.2015	M(11:55)	1.2	0	0.302	0.313	0.307	1.022	0.032	0.599	0.017	0.782	0.017	354										
5/21/2015	M(14:56)	1.2	0	0.299	0.306	0.302	0.990	0.030	0.649	0.017	0.801	0.016	354	1	6.06	21.4	25.2	168	0.474	0.276	0.362		
cathode exchange																							
6/20/2015	A(22:14)	1.2	0	0.298	0.327	0.312	1.429	0.013	0.968	0.016	1.174	0.008	357	2	6.08	21.29	24.3	60.4	0.727	0.344	0.5	Interrupted by IL	
8/1/2015	A	1.3?	0				1.071	0.027	1.087	0.065	1.078	0.041	355										
8/15/2015		1.2	0				1.061	0.020	0.918	0.024	0.987	0.016											
8/18/2015	M(08:53)	1.2	0	0.3	0.326	0.313	1.054	0.025	0.769	0.041	0.900	0.026	356	3	6.06	21.41	17*	39.3	0.512	0.349	0.422	Gun power fluctuation	
10/3/2015		1.4	0	0.349	0.361	0.355	0.769	0.043	0.799	0.055	0.784	0.035	358										

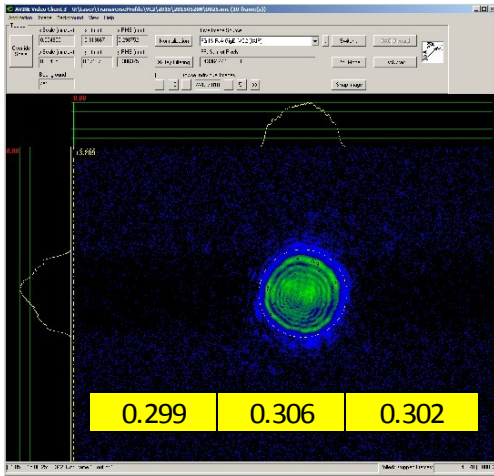


NB: Cathode laser temporal: Gaussian ~11.5ps (FWHM) - expected

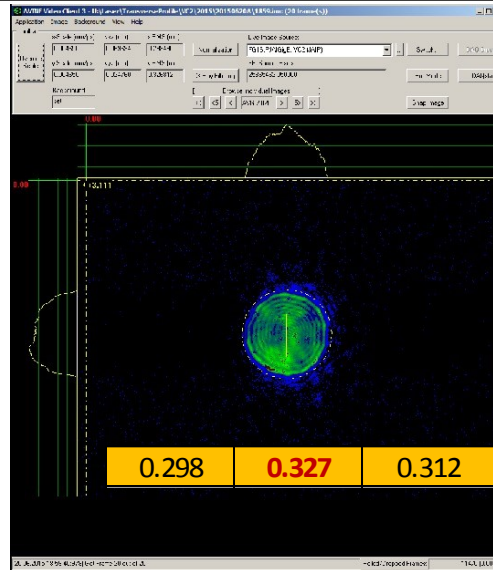
Measurements #1(21.05), #2(20.06) and #3(18.08)

VC2 and e-beam at EMSY

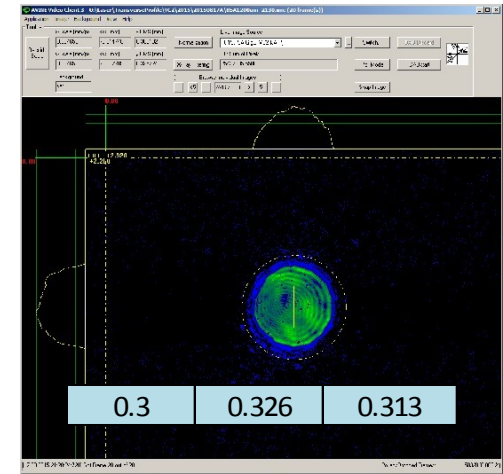
#1(21.05.2015M)



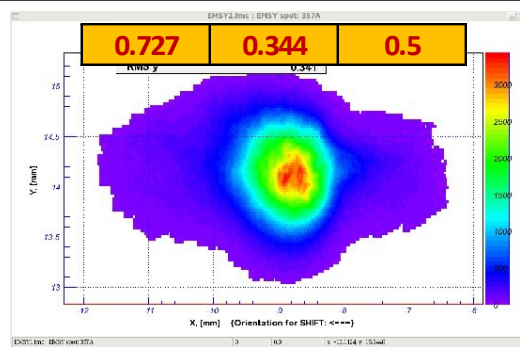
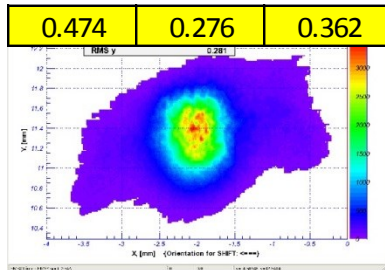
#2(20.06.2016A)



#3(18.08.2016M*)

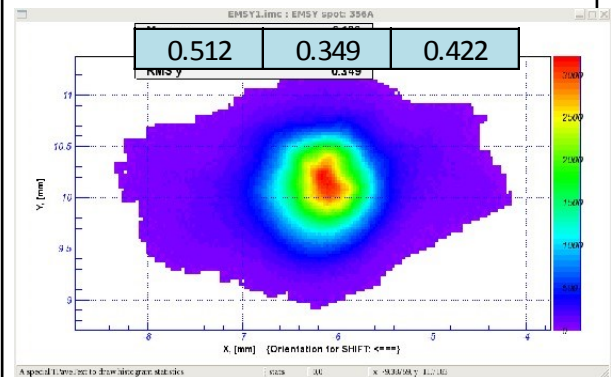


I_{main}=354A



- I_{main}=357A!
- Different <XY>
- Higher position → steering?

I_{main}=356A!

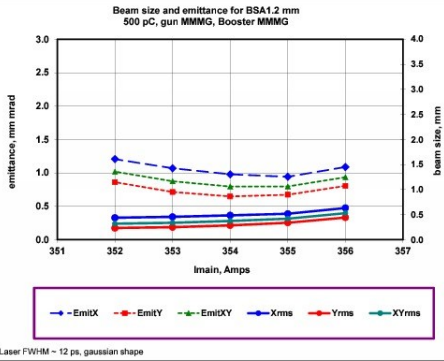


Measurements #1(21.05), #2(20.06) and #3(18.08)

Solenoid scans and statistics

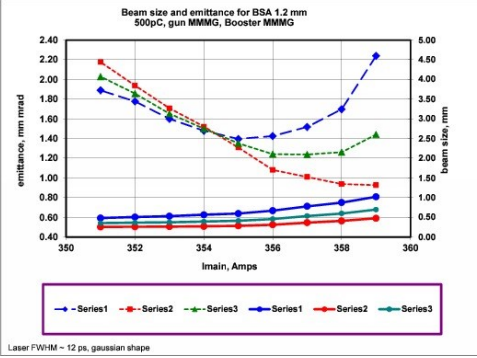
#1(21.05.2015M)

	Emitt (A)	Xrms, mm	Yrms, mm	XRms, mm	YRms, mm	EMSY1 NoP	EMSY1 Gain	MOI NoP	MOI Gain	BSA 1.2 mm	Gun phase MIMMG	Boo phase MIMMG	YBL NoP	YBL Gain	EMITX, JD, nonscaled	EMITY, JD, nonscaled	EMITXY, JD, nonscaled	StatX	AlphaX	AlphaY
356	0.634	0.443	0.53	1.22	2.19	1.088	0.670	9	22	0.806	0.673	12	22	0.936	0.671					
355	0.519	0.340	0.42	1.19	1.22	0.943	0.533	6	21	0.674	0.580	10	21	0.791	0.556					
354	0.488	0.288	0.373	1.18	1.18	0.839	0.428	8	21	0.649	0.469	8	21	0.798	0.436					
353	0.466	0.249	0.337	1.12	1.17	0.700	0.391	3	21	0.715	0.486	8	20	0.675	0.436					
352	0.437	0.233	0.319	1.9	1.16	1.207	0.377	3	21	0.861	0.505	8	20	0.619	0.436					



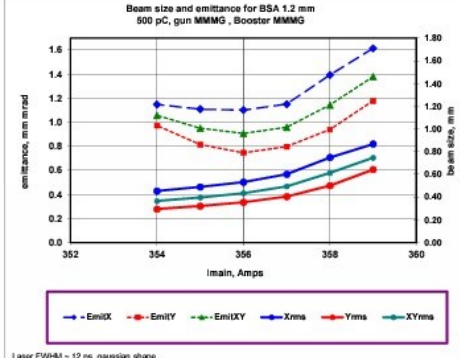
#2(20.06.2016A)

	Emitt (A)	Xrms, mm	Yrms, mm	XRms, mm	YRms, mm	EMSY1 NoP	EMSY1 Gain	MOI NoP	MOI Gain	BSA 1.2 mm	Gun phase MIMMG	Boo phase MIMMG	YBL NoP	YBL Gain	EMITX, JD, nonscaled	EMITY, JD, nonscaled	EMITXY, JD, nonscaled	StatX	AlphaX	AlphaY
359	1.003	0.478	0.697	1.15	2.22	2.240	1.206	15	22	0.827	0.791	17	22	1.441	0.977					
358	0.975	0.409	0.598	1.12	2.18	1.698	0.831	10	22	0.838	0.734	15	22	1.263	0.781					
357	0.780	0.366	0.524	1.1	2.0	2.818	0.568	14	21	0.910	0.724	13	22	1.238	0.662					
356	0.699	0.312	0.457	1.4	1.6	1.426	0.563	4	22	1.082	0.709	11	22	1.243	0.632					
355	0.697	0.284	0.412	1.2	1.18	1.396	0.579	4	22	1.309	0.711	10	22	1.352	0.641					
354	0.568	0.272	0.392	1.2	1.11	1.419	0.624	5	22	1.522	0.741	10	22	1.503	0.663					
353	0.530	0.264	0.374	1.1	1.1	1.600	0.712	7	22	1.708	0.767	11	22	1.653	0.739					
352	0.507	0.261	0.364	1.1	1.1	1.776	0.851	10	22	1.939	0.865	11	22	1.887	0.853					
351	0.462	0.258	0.351	1.0	1.20	1.860	0.936	11	22	2.177	0.989	12	22	2.028	0.962					



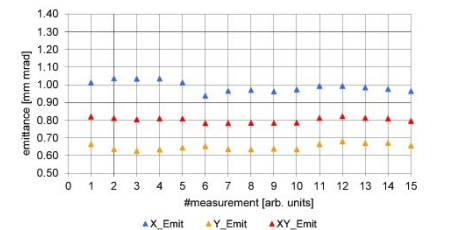
#3(18.08.2016M*)

	Emitt (A)	Xrms, mm	Yrms, mm	XRms, mm	YRms, mm	EMSY1 NoP	EMSY1 Gain	MOI NoP	MOI Gain	BSA 1.2 mm	Gun phase MIMMG	Boo phase MIMMG	YBL NoP	YBL Gain	EMITX, JD, nonscaled	EMITY, JD, nonscaled	EMITXY, JD, nonscaled	StatX	AlphaX	AlphaY
359	0.988	0.443	0.747	1.17	3.22	1.876	1.111	20	22	1.170	0.986	20	22	1.380	1.036					
358	0.749	0.361	0.613	1.13	3.22	1.384	0.802	13	22	0.940	0.705	14	22	1.146	0.816					
357	0.602	0.426	0.484	1.0	2.10	1.152	0.643	7	22	0.798	0.657	10	22	0.959	0.655					
356	0.532	0.368	0.434	1.0	2.10	1.059	0.601	4	22	0.747	0.637	7	22	0.987	0.639					
355	0.460	0.321	0.397	1.3	1.10	1.110	0.481	3	22	0.815	0.511	6	22	0.851	0.474					
354	0.464	0.264	0.385	1.0	1.18	1.140	0.377	2	22	0.974	0.545	6	22	0.958	0.483					



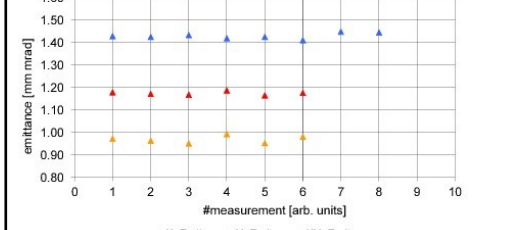
	Emitt (A)	Xrms, mm	Yrms, mm	XRms, mm	YRms, mm	EMSY1 NoP	EMSY1 Gain	MOI NoP	MOI Gain	BSA 1.2 mm	Gun phase MIMMG	Boo phase MIMMG	YBL NoP	YBL Gain	EMITX, JD, nonscaled	EMITY, JD, nonscaled	EMITXY, JD, nonscaled	StatX	AlphaX	AlphaY
354	0.481	0.271	0.353	0.938	0.438	0.653	0.518	0.783												

meas	beam size @ EMSY	X-emittance	Y-emittance	XYemitt, scaled
1	0.487	0.277	0.367	0.912
2	1.036	0.421	0.630	0.495
3	1.034	0.410	0.625	0.497
4	1.035	0.406	0.633	0.500
5	0.913	0.412	0.644	0.504
6	0.481	0.271	0.353	0.938
7	0.985	0.434	0.635	0.506
8	0.970	0.413	0.634	0.512
9	0.962	0.430	0.638	0.522
10	0.973	0.423	0.640	0.496
11	0.475	0.281	0.365	0.963
12	0.963	0.442	0.630	0.519
13	0.984	0.423	0.670	0.506
14	0.970	0.425	0.671	0.511
15	0.964	0.428	0.656	0.499



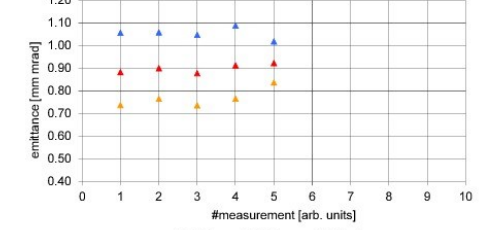
	Emitt (A)	Xrms, mm	Yrms, mm	XRms, mm	YRms, mm	EMSY1 NoP	EMSY1 Gain	MOI NoP	MOI Gain	BSA 1.2 mm	Gun phase MIMMG	Boo phase MIMMG	YBL NoP	YBL Gain	EMITX, JD, nonscaled	EMITY, JD, nonscaled	EMITXY, JD, nonscaled	StatX	AlphaX	AlphaY
357	0.727	0.344	0.509	1.428	0.528	0.972	0.719	1.178												

meas	beam size @ EMSY	X-emittance	Y-emittance	XYemitt, scaled
1	0.747	0.351	0.513	1.428
2	1.428	0.624	0.963	0.728
3	1.433	0.628	0.951	0.702
4	0.712	0.340	0.492	1.419
5	1.428	0.611	0.952	0.715
6	1.410	0.664	0.980	0.723
7	0.722	0.341	0.498	1.448
8	1.444	0.668		



	Emitt (A)	Xrms, mm	Yrms, mm	XRms, mm	YRms, mm	EMSY1 NoP	EMSY1 Gain	MOI NoP	MOI Gain	BSA 1.2 mm	Gun phase MIMMG	Boo phase MIMMG	YBL NoP	YBL Gain	EMITX, JD, nonscaled	EMITY, JD, nonscaled	EMITXY, JD, nonscaled	StatX	AlphaX	AlphaY
356	0.512	0.349	0.422	1.096	0.466	0.766	0.561	0.901												

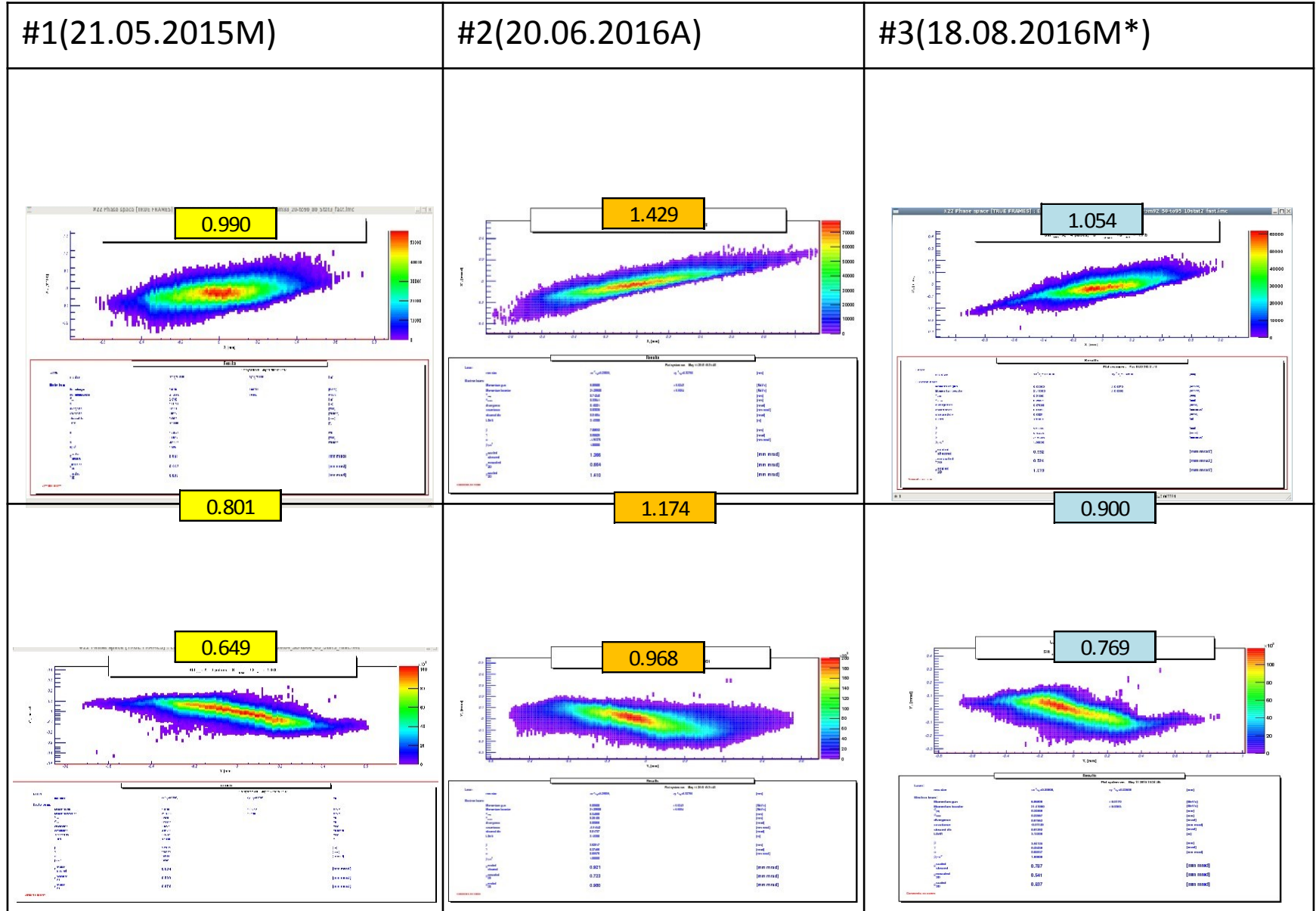
meas	beam size @ EMSY	X-emittance	Y-emittance	XYemitt, scaled
1	0.510	0.348	0.421	1.057
2	1.096	0.466	0.766	0.539
3	1.048	0.468	0.737	0.546
4	0.514	0.349	0.424	1.089
5	1.018	0.524	0.837	0.541



comment
H1.54 F160, Bin2x2
y-axis label
1.5 1.2
1.8 1.2
1.8 1.2
2.2 1.4
2.6 1.8
3.0 1.8

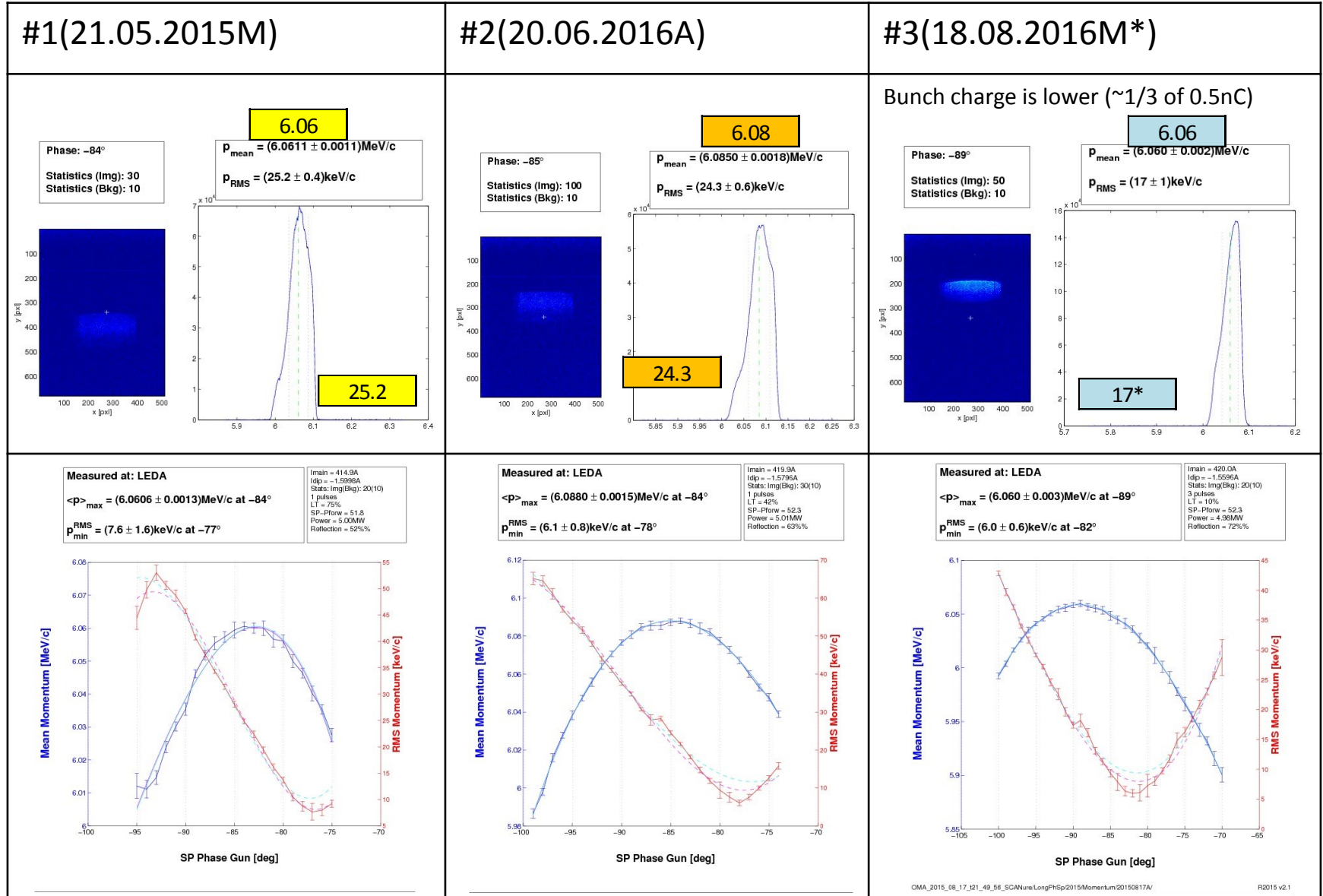
Measurements #1(21.05), #2(20.06) and #3(18.08)

XPX (upper) and YPY (bottom)



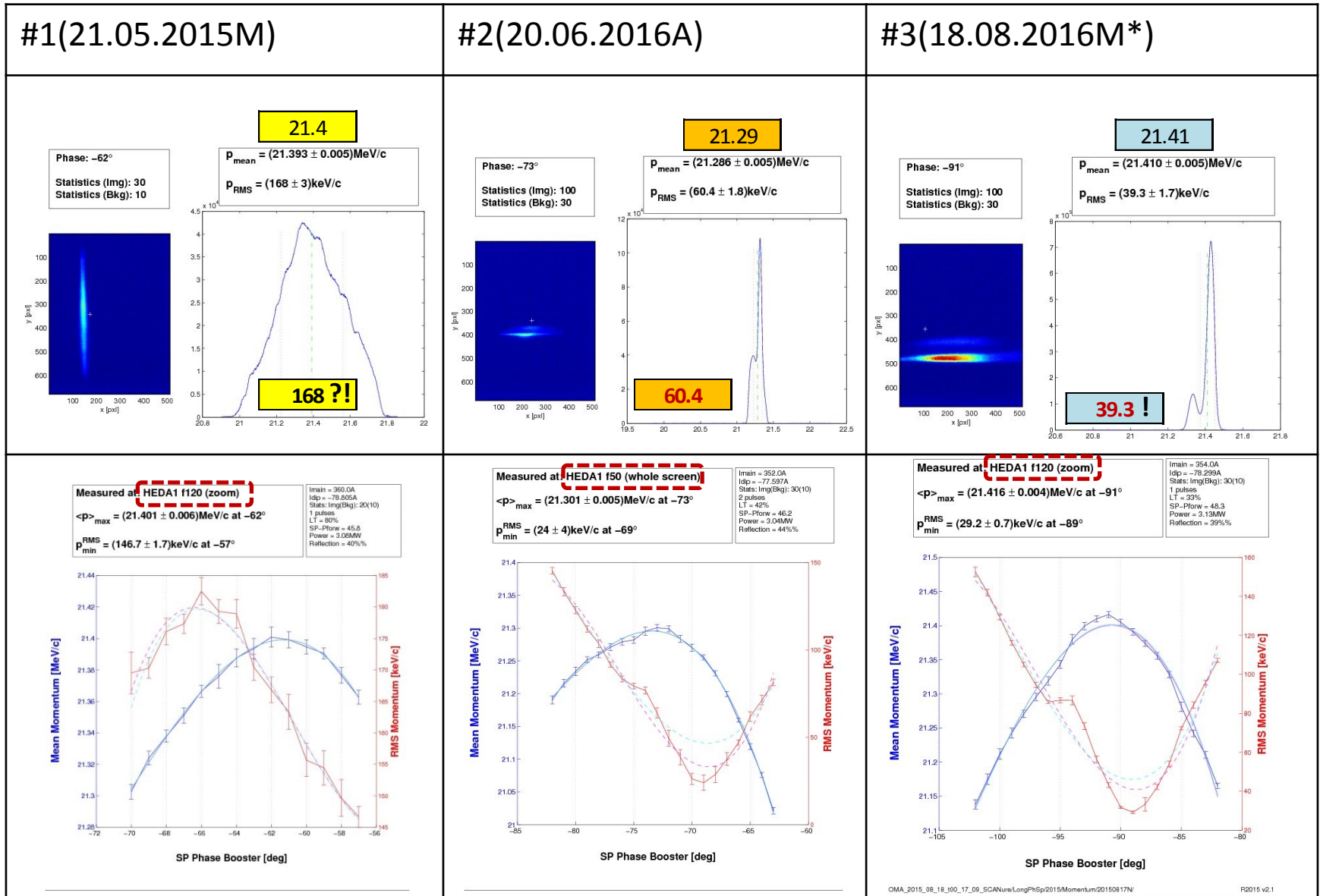
Measurements #1(21.05), #2(20.06) and #3(18.08)

Beam momentum Pz after the gun



Measurements #1(21.05), #2(20.06) and #3(18.08)

Beam momentum Pz after the booster

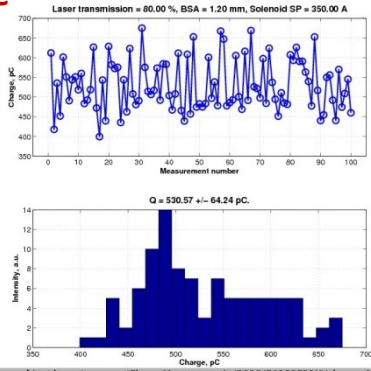


Measurements #1(21.05), #2(20.06) and #3(18.08)

Bunch charge and steering

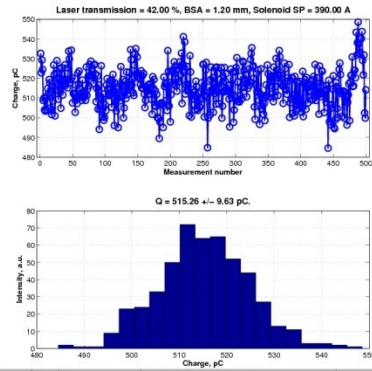
#1(21.05.2015M)

(531+/-64)pC



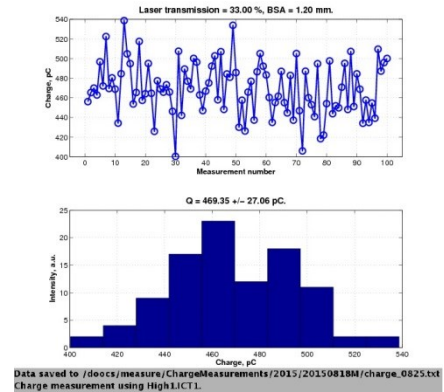
#2(20.06.2016A)

(515+/-9)pC



#3(18.08.2016M*)

(469+/-27)pC



magnets_steerer.xml PITZ_CA/MAGNETS//

PITZ steerer magnets

rotating steerers

Motor power is on.

3	LOWST1	F.TZF32-6	steerer	0.72	-4.2885 A	0.97	0.49659 A
6	LOWST3	F.TZF35-5	steerer	0.00	-4.0000 A	0.67	0.67038 A
7	LOWST4	F.TZF35-6	steerer	-0.20	-4.20001 A	1.50	1.50027 A
39	HIGHZST1	F.TZF32-4	steerer	0.00	0.00000 A	0.00	0.00050 A

status: 1 the magnets power supply.

manage all magnets via EPICS

magnets_steerer.xml PITZ_CA/MAGNETS/HIGH1.ST1

PITZ steerer magnets

rotating steerers

Motor power is on.

3	LOWST1	F.TZF32-6	steerer	0.72	-4.2885 A	0.97	0.49659 A
6	LOWST3	F.TZF35-5	steerer	0.00	-4.00000 A	0.59	0.59033 A
7	LOWST4	F.TZF35-6	steerer	0.00	-4.00000 A	0.50	0.50033 A
39	HIGHZST1	F.TZF32-4	steerer	0.00	0.00000 A	0.00	0.00050 A

status: 1 the magnets power supply.

manage all magnets via EPICS

magnets_steerer.xml PITZ_CA/MAGNETS/HIGH1.ST1

PITZ steerer magnets

rotating steerers

Motor power is on.

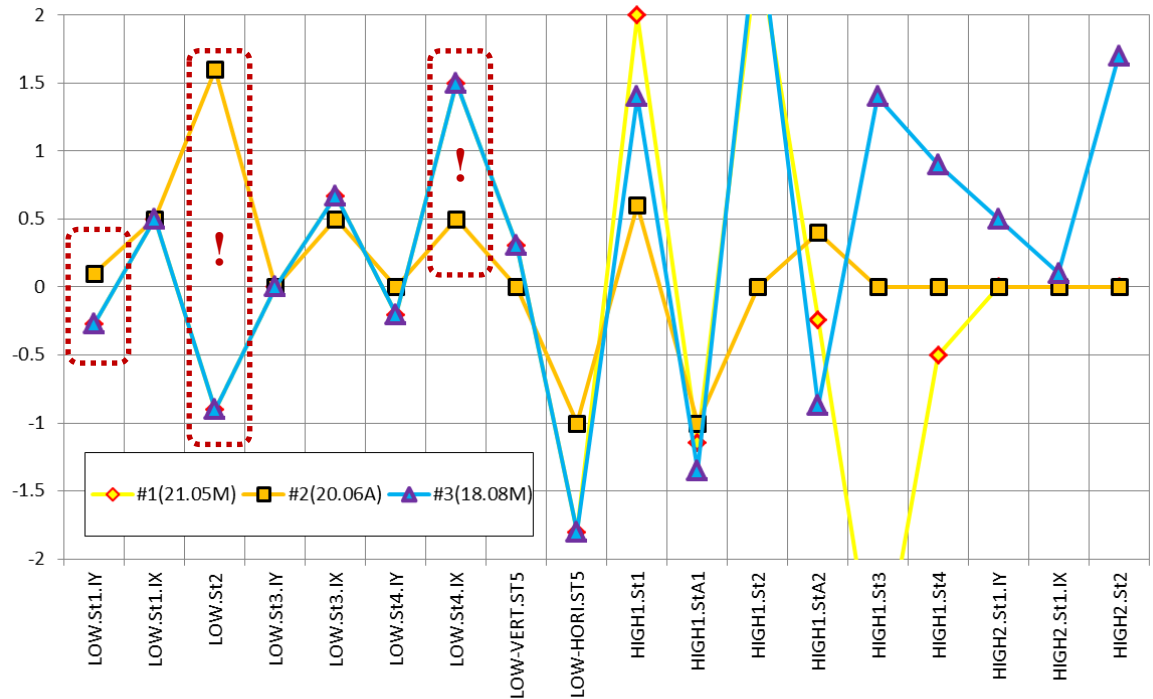
3	LOWST1	F.TZF32-6	steerer	0.72	-4.2885 A	0.97	0.49659 A
6	LOWST3	F.TZF35-5	steerer	0.00	-4.00000 A	0.67	0.67038 A
7	LOWST4	F.TZF35-6	steerer	-0.20	-4.20001 A	1.50	1.50027 A
39	HIGHZST1	F.TZF32-4	steerer	0.50	0.50011 A	0.10	0.10017 A

status: 1 the magnets power supply.

manage all magnets via EPICS

Steering!

	#1(21.05M)	#2(20.06A)	#3(18.08M)
LOW.St1.IY	-0.27	0.1	-0.27
LOW.St1.IX	0.5	0.5	0.5
LOW.St2	-0.9	1.6	-0.9
LOW.St3.IY	0	0	0
LOW.St3.IX	0.67	0.5	0.67
LOW.St4.IY	-0.2	0	-0.2
LOW.St4.IX	1.5	0.5	1.5
LOW-VERT.ST5	0.31	0	0.31
LOW-HORI.ST5	-1.8	-1	-1.8
HIGH1.St1	2	0.6	1.4
HIGH1.StA1	-1.14	-1	-1.35
HIGH1.St2	2.5	0	2.7
HIGH1.StA2	-0.24	0.4	-0.87
HIGH1.St3	-3	0	1.4
HIGH1.St4	-0.5	0	0.9
HIGH2.St1.IY	0	0	0.5
HIGH2.St1.IX	0	0	0.1
HIGH2.St2	0	0	1.7



It seems the steering (esp. in the LOW section) is the major reason for the difference!!!

Outlook → ? Other points to be compared (but different BSAs) ?