First ATS Attempt

GRD, Al, …

A few Highlights of the 1st ATS in Blue

LOptics

- A dedicated storage ramp Au14-ats
  - by Al, which made the test close to fully decoupled from operation
  - ATS for Blue only

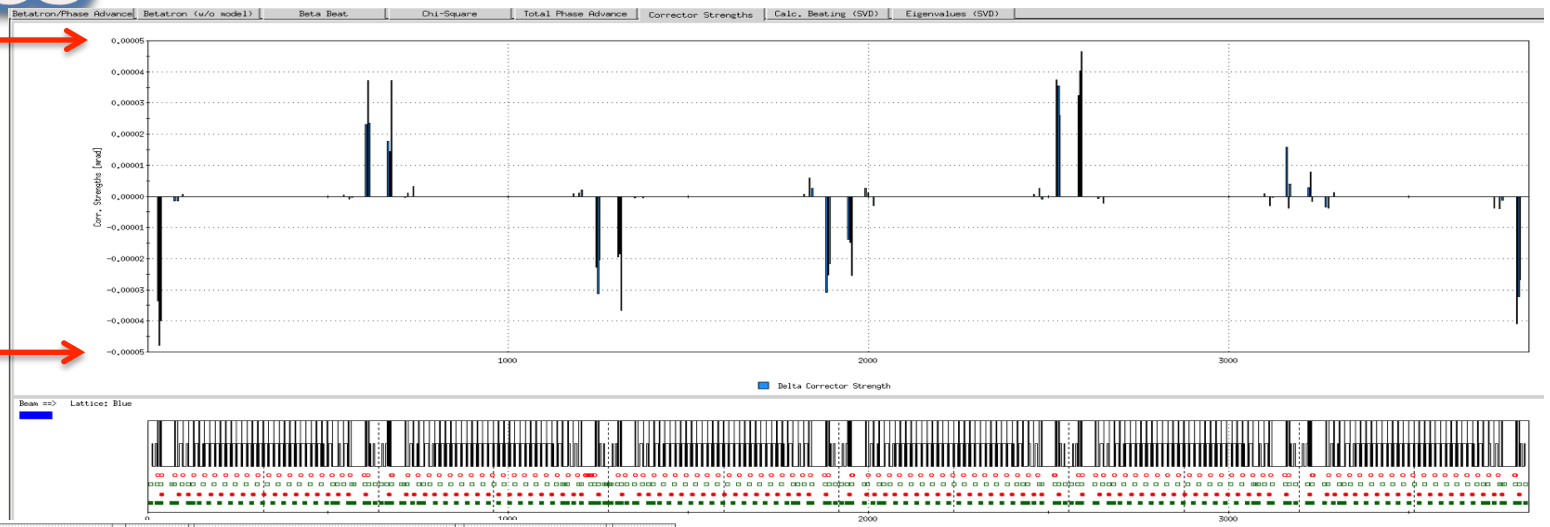
- Tested GRD's beta-beat correction calculated based on online data in Yun's momentum aperture study
  - Measured optics as well as correction are online calculated within 5-10mins. Applied 50% calculated correction.
  - Led the confidence to applied 100% correction to the first two stones of Au14-ats: flattop beta*=0.7m, beta60 beta*=0.6m
  - Measured beta-beat for 0.6m as well as 0.5m was ~+-10%

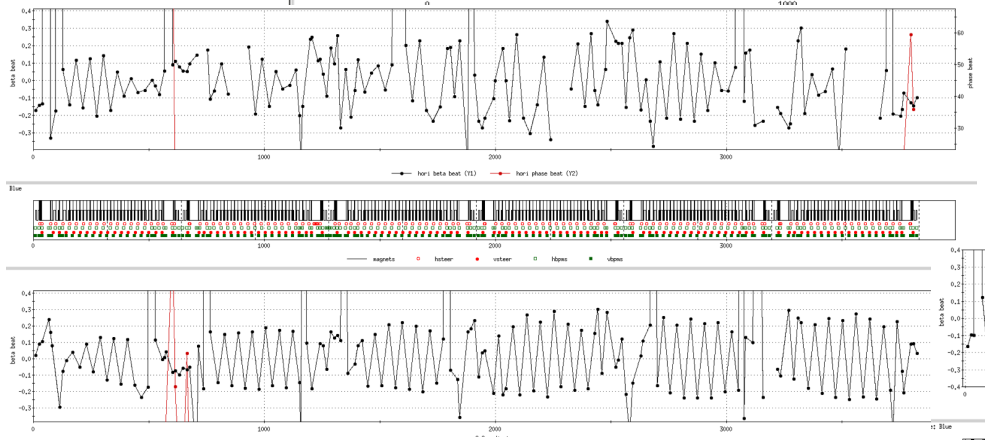
Loptics Calculated Corrections

LOptics

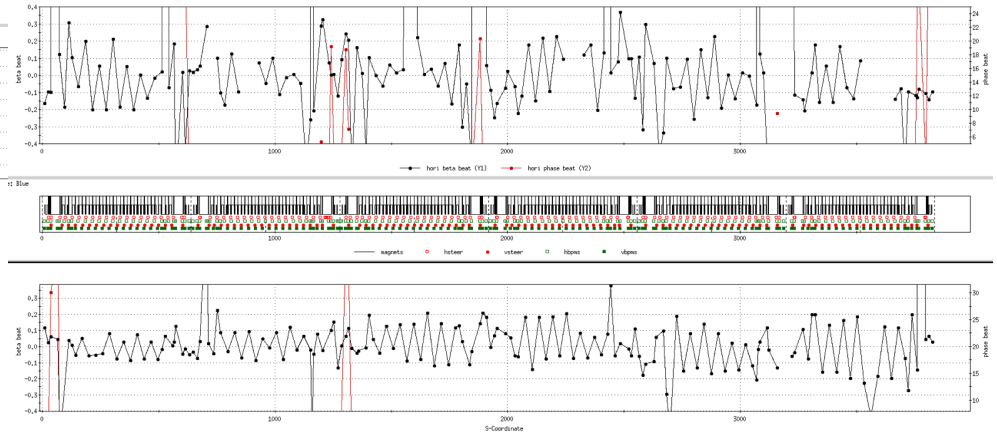
5×10^{-5} 1/m

-5×10^{-5} 1/m





50% correction, V beta-beat ~+-15%



Before correction, V beta-beat ~+-30%

A few Highlights of the 1st ATS in Blue

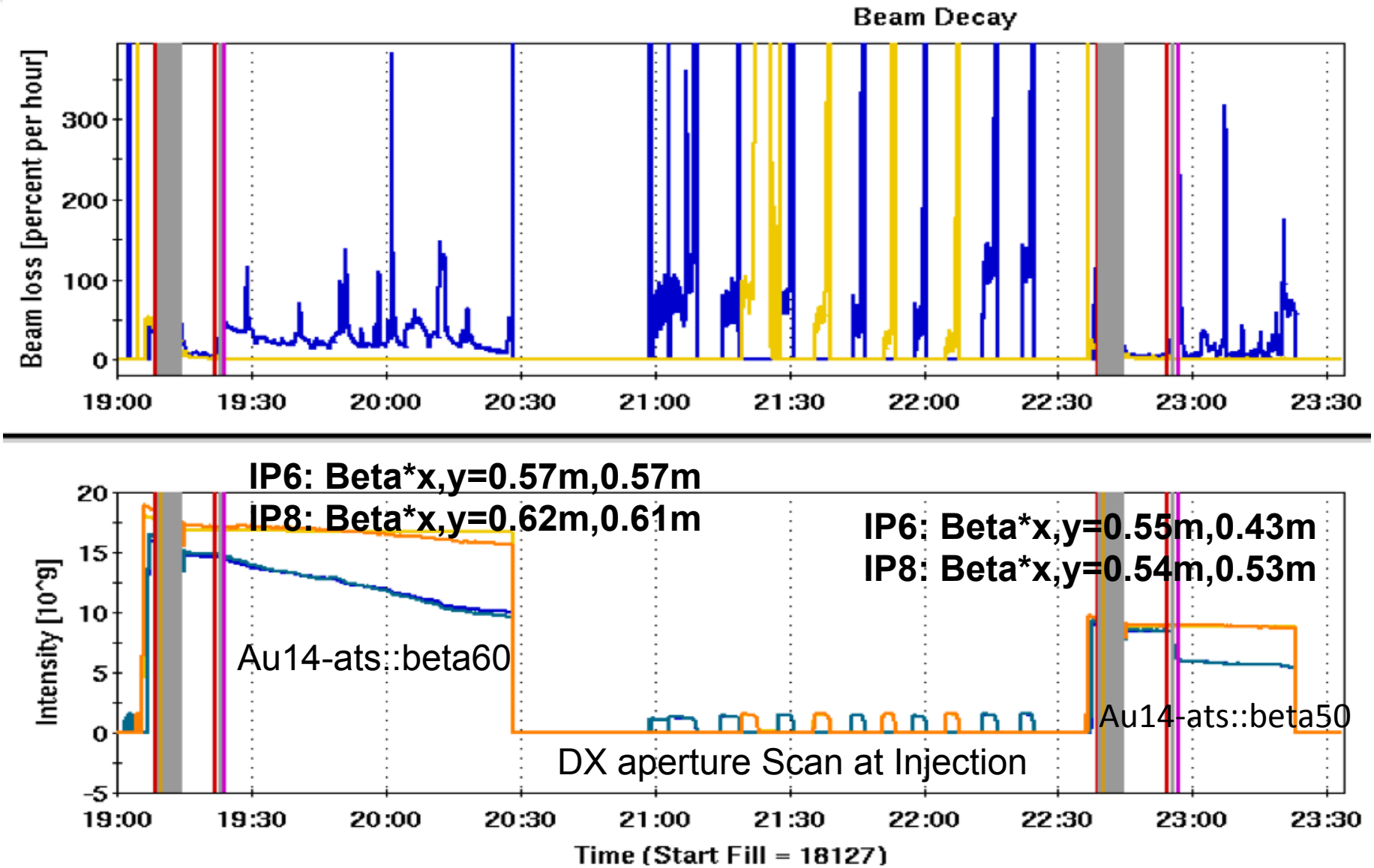
LOptics

- Chromaticity before correction was ~ 10 units below zero. Correction was necessary to significantly improve the beam lifetime
  - Beam was fully re-bucketed and no cooling
  - Chromaticities as well as dispersion functions were measured for both 0.6m and 0.5m ATS squeeze
  - Off momentum beta functions were also measured

- Record-low beta*(~0.5m) was achieved!
  - Non-linear correction including local decoupling are needed for further improving beam lifetime

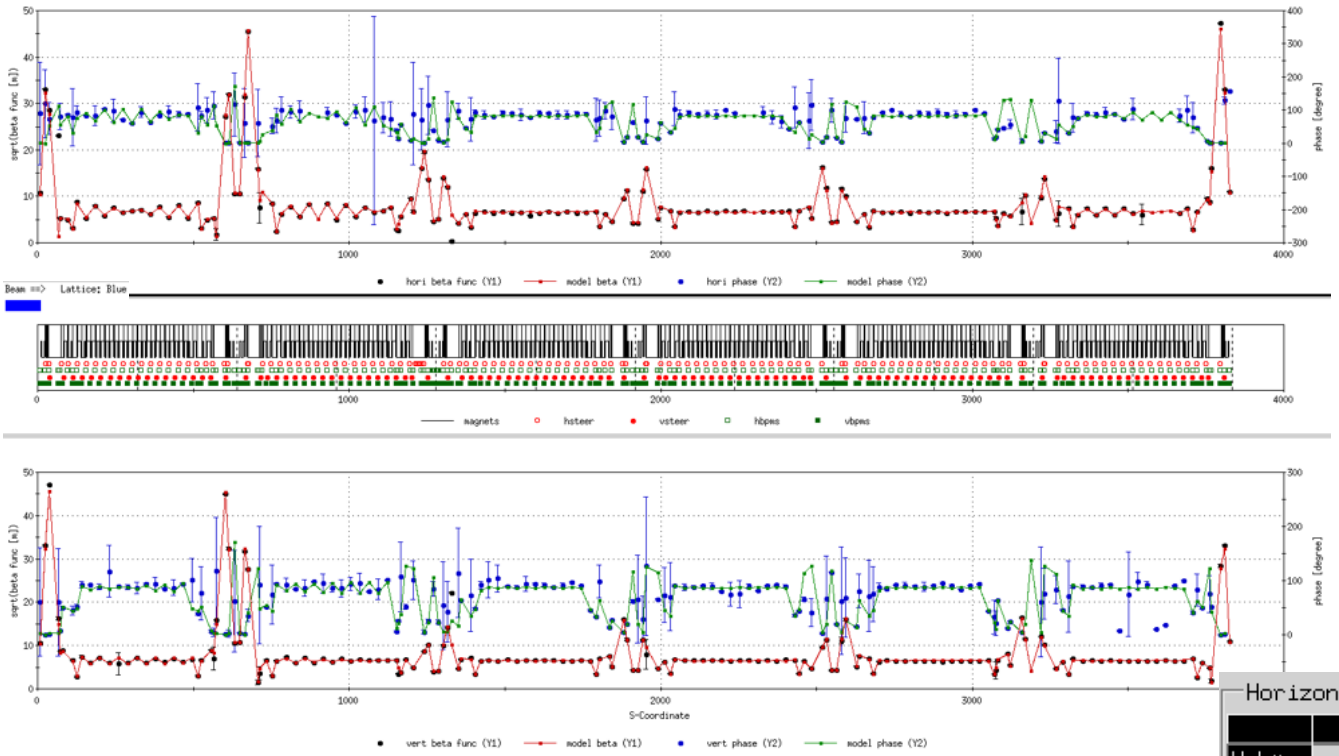
A Brief History of Beam Activities

LOptics



Au14-ats::beta60, Measured Optics

LOptics



Horizontal Beta* at IPs

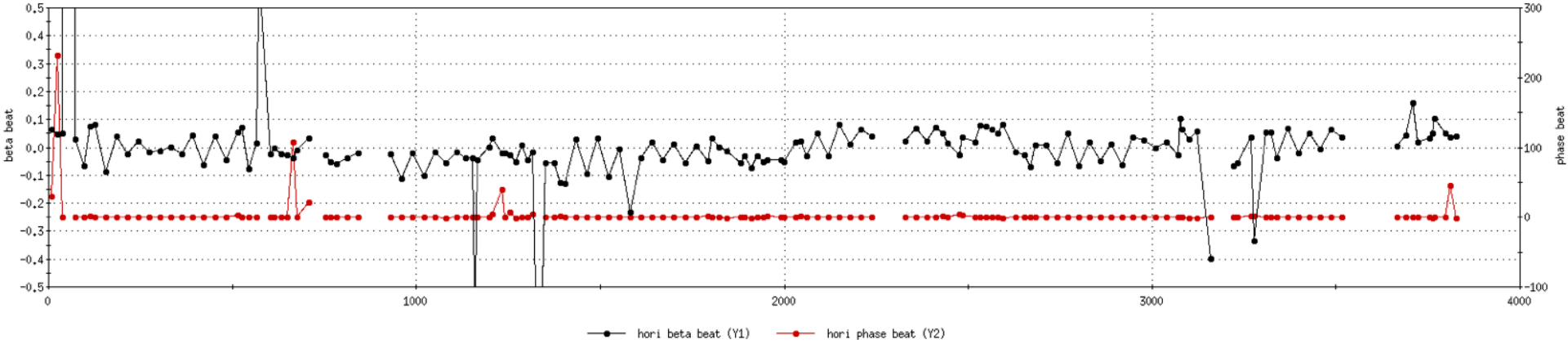
	IP2	IP4	IP6	IP8	IP10	IP12
H_b*	4.72	6.73	0.57	0.62	3.35	5.15
H_bIP	4.72	6.77	0.58	0.72	3.37	5.16
H_s*	0.08	0.56	-0.06	0.24	-0.23	0.22
H_mu	358.645	143.979	199.892	189.516	355.760	263.604

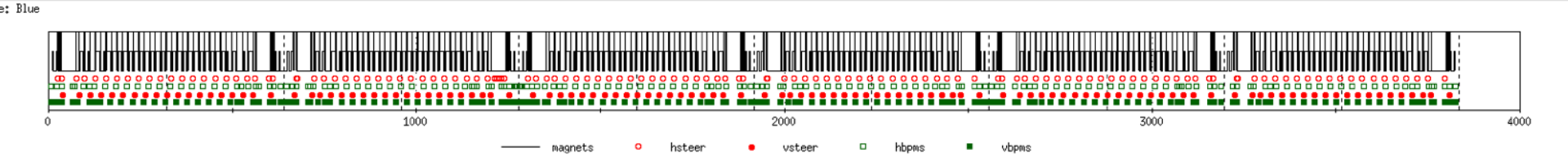
Vertical Beta* at IPs

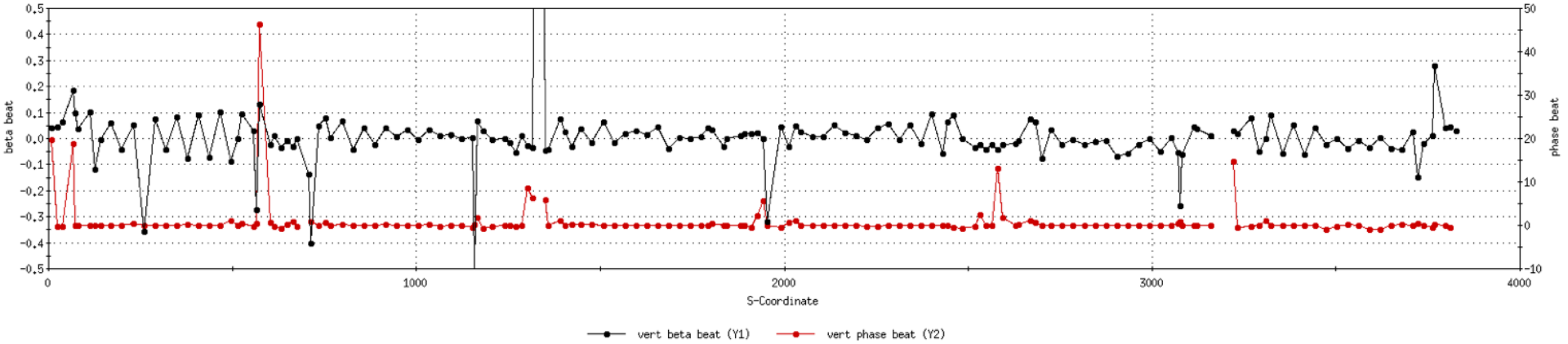
	IP2	IP4	IP6	IP8	IP10	IP12
V_b*	5.12	4.63	0.57	0.61	6.47	5.03
V_bIP	5.12	4.73	0.57	0.71	6.47	5.04
V_s*	0.14	-0.67	0.01	0.25	0.13	0.11
V_mu	165.2	105.9	212.7	162.5	178.7	135.6

Au14-ats::beta60, Measured Beta-Beat

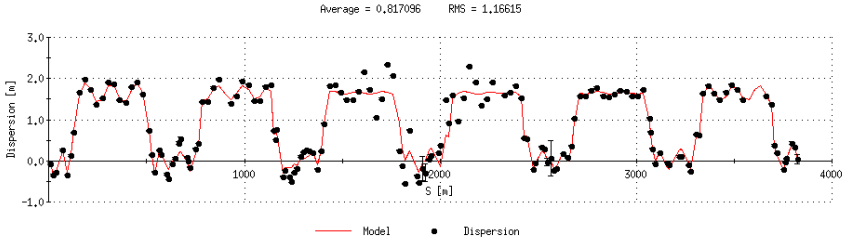
LOptics

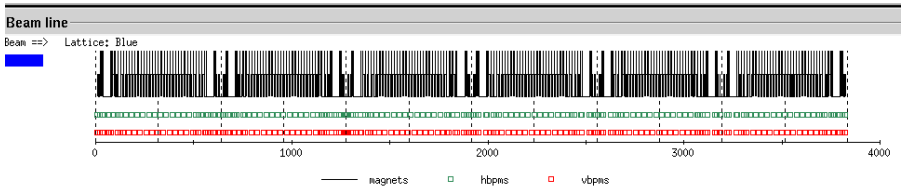


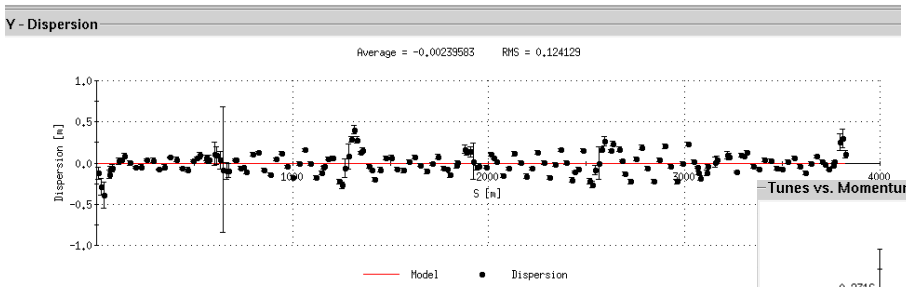


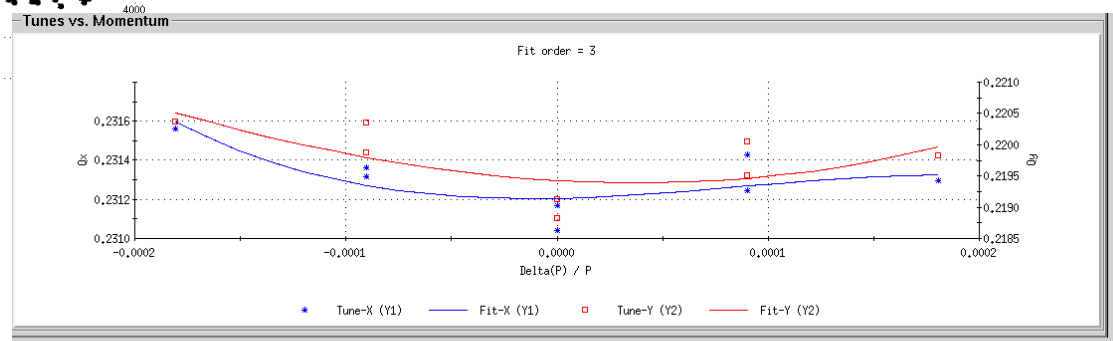


Au14-ats::beta60, Chromaticity & Dispersion









Row	Delta(p)/p	Skew q1	BBQ X	Tune X #1	Tune X #2	Select	Skew q2	BBQ Y	Tune Y #1	Tune Y #2	Select
1	-0.000180701	-0.00124104	0.231563	-999	-999	BBQ	0.00225104	0.220358	-999	-999	BBQ
2	-9.03504e-05	-0.000579619	0.23136	-999	-999	BBQ	0.00234872	0.219864	-999	-999	BBQ
3	-9.03504e-05	-0.000429136	0.231315	-999	-999	BBQ	0.00243302	0.220348	-999	-999	BBQ
4	0	-2.42417e-05	0.231043	-999	-999	BBQ	0.0023579	0.218813	-999	-999	BBQ
5	0	2.42723e-05	0.231169	-999	-999	BBQ	0.00234157	0.219113	-999	-999	BBQ
6	9.03504e-05	0.000550569	0.231427	-999	-999	BBQ	0.0018706	0.219496	-999	-999	BBQ
7	9.03504e-05	0.000634298	0.231242	0.233398	0.250977	BBQ	0.00220558	0.220043	0.220703	0.210938	BBQ
8	0.000180701	0.0007959	0.231294	-999	-999	BBQ	0.00182747	0.219814	-999	-999	BBQ
0	0	0	0	0	0	BBQ	0	0	0	0	BBQ
0	0	0	0	0	0	BBQ	0	0	0	0	BBQ
0	0	0	0	0	0	BBQ	0	0	0	0	BBQ

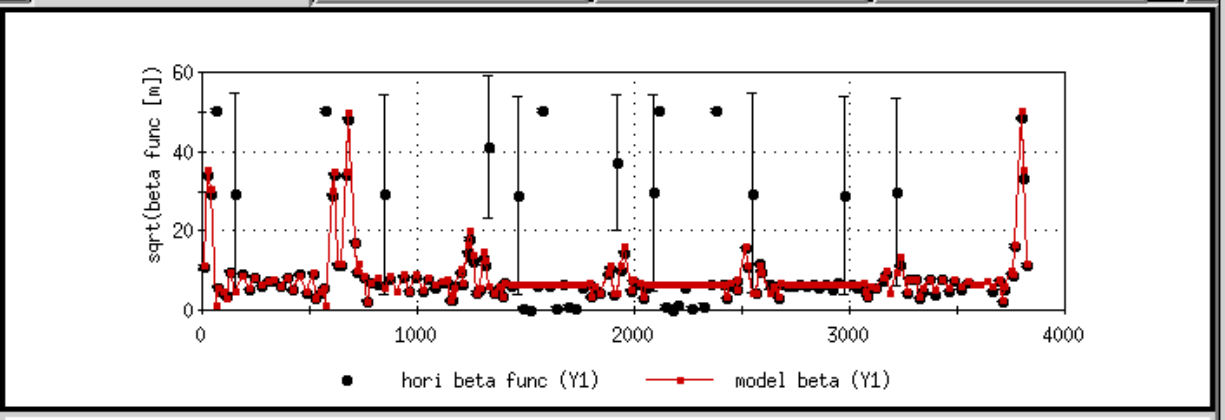
	Corr	Tune	+-Sigma	Chrom[1]	+-Sigma	Chrom[2]	+-Sigma	Chrom[3]	+-Sigma
Horizontal	0.790542	0.231206	4.53458e-05	0.23	0.41	7829	3703	-2.97421e+07	3.54966e+07
Vertical	0.680729	0.219426	0.000190977	-1.98	1.73	24954	15597	1.45711e+07	1.49496e+08
Skew-q1	0.995025	6.64547e-05	3.24333e-05	6.21	0.29	-8173	2649	-1.77031e+07	2.53887e+07
Skew-q2	0.90719	0.00231131	4.53098e-05	-2.21	0.41	-8724	3700	3.18616e+07	3.54684e+07

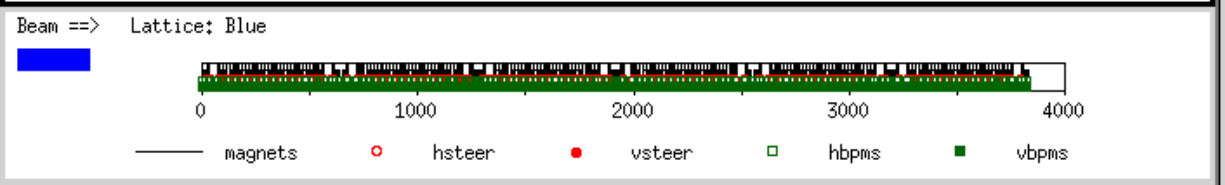
Au14-ats::beta50, Measured Optics

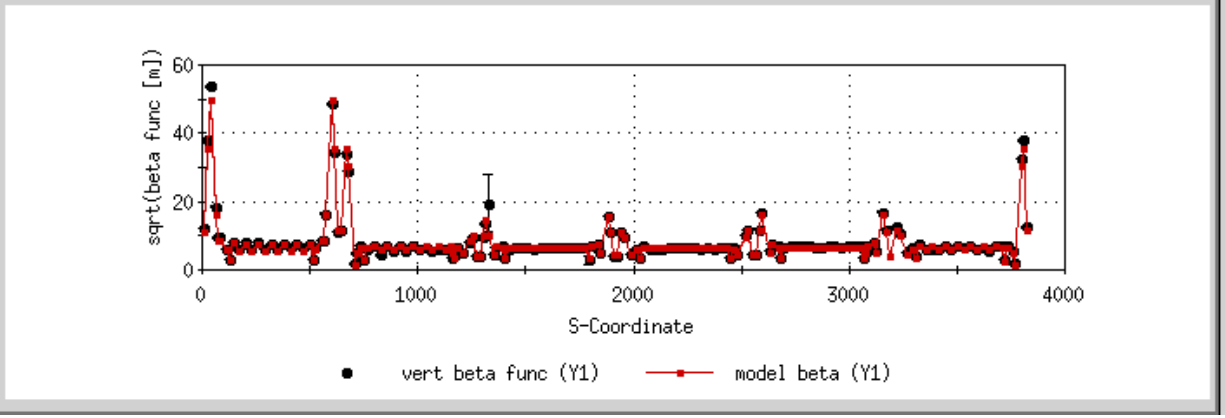
LOptics

File Lattice SetUp Corrections Help

Betatron/Phase Advance | Betatron (w/o model) | Beta Beat | Chi-Square







Setup/Betatron Tunes

	/\Qd	Amp	Up	Flat	Down	Tune	Qd
H:	-0.769	0.2285	1.0000	1.0000	1.0000	0.2314	0.0000
V:	-0.779	0.0009	0.0694	0.0694	0.0694	0.2246	0.0000

PS State

Horizontal Off On

Vertical On

Options

Trigger AC Dipole

Accumulate Avg

Horizontal Beta* at IPs

	IP2	IP4	IP6	IP8	IP10	IP12
H_b*	5.07	-1.00	0.55	0.54	3.97	6.14
H_bIP	5.16	0.00	0.66	0.55	4.08	6.22
H_s*	-0.69	10.00	-0.25	0.09	-0.67	0.71
H_mu	66.338	212.257	54.439	18.464	235.099	325.962

Vertical Beta* at IPs

	IP2	IP4	IP6	IP8	IP10	IP12
V_b*	4.67	4.36	0.43	0.53	7.27	5.08
V_bIP	4.69	4.49	0.44	0.59	7.29	5.08
V_s*	-0.33	-0.76	-0.06	0.18	-0.36	-0.10
V_mu	192.3	289.5	146.9	347.1	172.4	188.4

TBT fit parameters (0.0 = default)

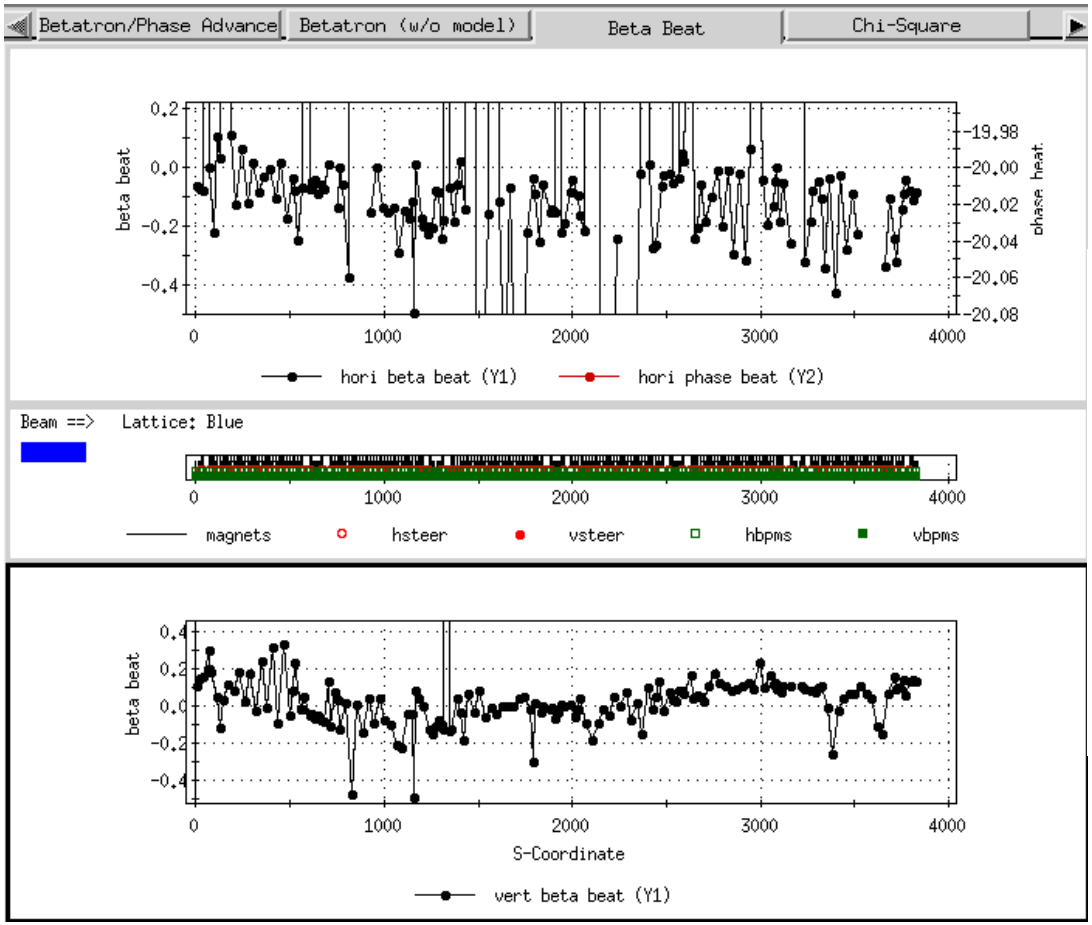
	a1	a2	a3
cosine	0.000000	0.000000	0.000000
exp*cosine	0.000000	400.0000	0.000000

Refit

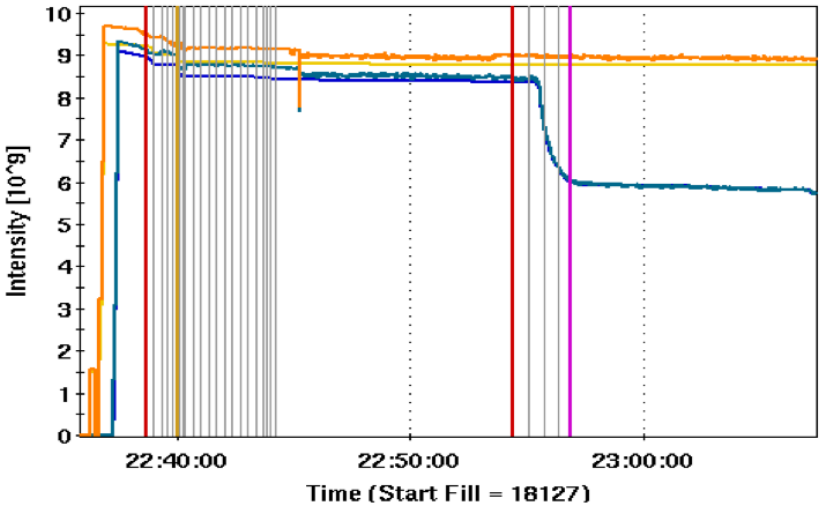
GO

Au14-ats::beta50, Measured Optics

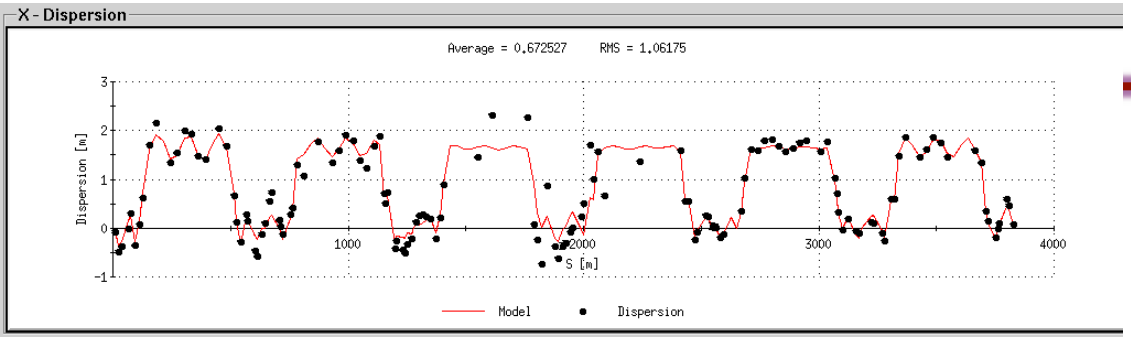
LOptics

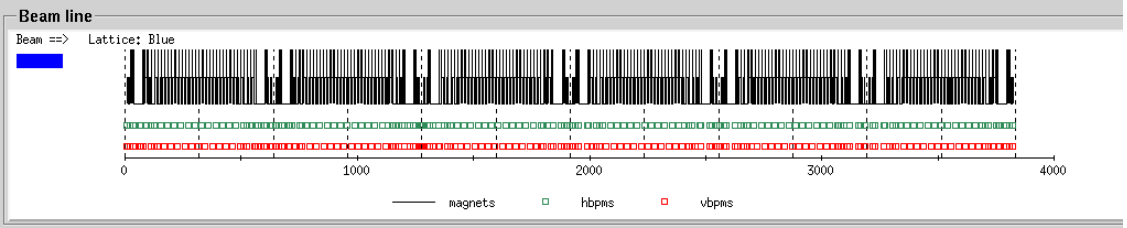


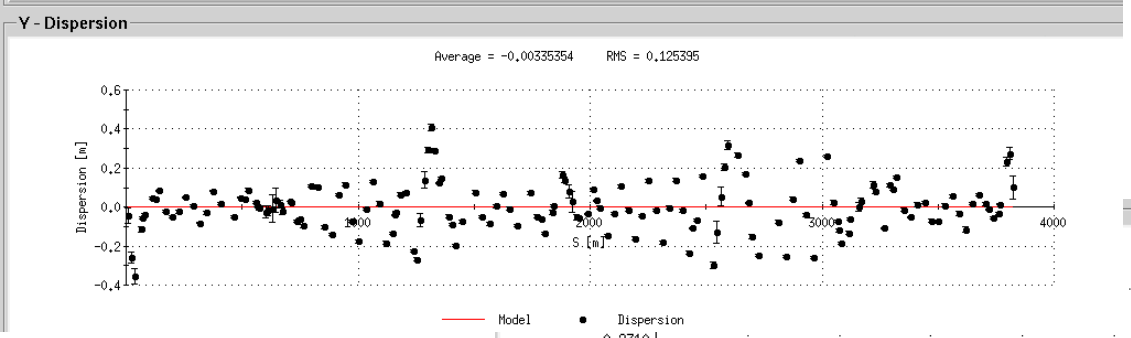
Poor data quality due to lower Bunch intensity

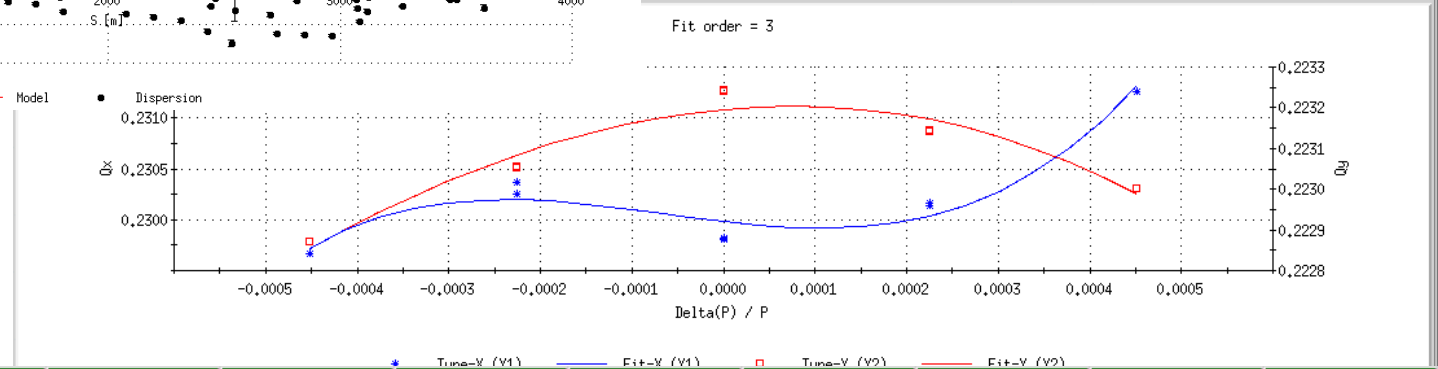


Au14-ats::beta50, Chromaticity&Dispersion









	Corr	Tune	+-Sigma	Chrom[1]	+-Sigma	Chrom[2]	+-Sigma	Chrom[3]	+-Sigma
Horizontal	0.963067	0.229982	6.30344e-05	-1.07	0.23	2639	824	1.39084e+07	3.1573e+06
Vertical	0.96225	0.223196	1.59718e-05	0.21	0.06	-1351	209	-321002	800004
Skew-q1	0.999404	-0.00145213	3.8076e-05	7.11	0.14	859	497	5.55818e+06	1.90717e+06
Skew-q2	0.918966	0.00543485	9.08535e-05	-1.90	0.33	-4670	1187	1.0919e+07	4.55072e+06

Conclusion and Plan

LOptics

- Conclusions
  - In Blue, Au14-ats::beta60 can be operational soon with store optimization including steering, as well as making sure phase advance is within the tolerance of Stochastic Cooling
  - Less than a hour work with Au14-ats::beta50 shows very encouraging sign. But, larger non-linear chromaticity needs to be addressed. In addition to routine store optimization for operation,
    - Local decoupling as well as local nonlinear compensation
- Plan for next APEX
  - Continue the optimization of Au14-ats::beta60
    - Engage SC for Au14-ats::beta60
    - Other optimizations to make it operational
  - If time permits, continue working with Au14-ats::beta50
    - Local decoupling
    - Non-linear correction