

NSLS-II Operations



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NSLS-II Town Meeting
March 1, 2017



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Topics

- Operations Schedule
- FY17 Statistics
- Tentative Plans for Increasing Current
- Machine Study Results
- Studies and Commissioning Activities
- Major Winter Shutdown Tasks Completed



Beam Operations Schedule

January-17							February-17							March-17							April-17						
Day	Half Shifts						Day	Half Shifts						Day	Half Shifts						Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24
1	D	D	D	D	D	D	1	O	O	O	O	O	O	1	O	O	O	O	O	O	1	O	O	O	O	O	O
2	D	D	D	D	D	D	2	O	O	O	O	O	O	2	O	O	O	O	O	O	2	O	O	O	O	O	O
3	D	D	D	D	D	D	3	O	O	O	O	O	O	3	O	O	O	O	O	O	3	O	O	O	O	O	O
4	D	D	D	D	D	D	4	O	O	C	C	C	C	4	O	O	O	O	O	O	4	O	O	O	C	C	C
5	D	D	S	S	S	S	5	C	C	C	C	C	C	5	O	O	O	O	O	O	5	C	C	O	O	O	O
6	S	S	S	S	S	S	6	C	C	O	O	O	O	6	O	O	I	I	S	S	6	O	O	O	O	O	O
7	S	S	S	S	S	S	7	O	O	O	O	O	O	7	S	S/M	M	M	M	M	7	O	O	O	O	O	O
8	S	S	S	S	S	S	8	O	O	O	O	O	O	8	M	M	M	M	M/S	S	8	O	O	C	C	C	C
9	S	S	S	O	O	O	9	O	O	O	O	O	O	9	S	S	O	O	O	O	9	C	C	C	C	C	C
10	O	O	O	O	O	O	10	O	O	O	O	O	O	10	O	O	O	O	O	O	10	C	C	O	O	O	O
11	O	O	O	O	O	O	11	O	O	O	O	O	O	11	O	O	O	O	O	O	11	O	O	O	O	O	O
12	O	O	O	O	O	O	12	O	O	O	O	O	O	12	O	O	O	O	O	O	12	O	O	O	O	O	O
13	O	O	O	O	O	O	13	O	O	I	I	S	S	13	O	O	O	O	O	O	13	O	O	O	O	O	O
14	O	O	O	O	O	O	14	S	S/M	M	M	M	M	14	O	O	O	C	C	C	14	O	O	O	S	S	S
15	O	O	C	C	C	C	15	M	M	M	M	M/S	S	15	C	C	O	O	O	O	15	S	S	S	S	S	S
16	C	C	O	O	O	O	16	S	S	O	O	O	O	16	O	O	O	O	O	O	16	S	S	S	S	S	S
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19	O	O	O	O	O	O	19	O	O	O	O	O	O	19	C	C	C	C	C	C	19	D	D	D	D	D	D
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28	O	O	O	O	O	O	28	O	O	O	O	O	O	28	S	S/M	M	M	M	M	28	D	D	D	D	D	D
29	O	O	O	O	O	O								29	M	M	M	M	M/S	S	29	D	D	D	D	D	D
30	O	O	O	C	C	C								30	S	S	O	O	O	O	30	D	D	D	D	D	D
31	C	C	O	O	O	O								31	O	O	O	O	O	O							
Total Hours - January						744	Total Hours - February						672	Total Hours - March						744	Total Hours - April						720
Total Days - January						31	Total Days - February						28	Total Days - March						31	Total Days - April						30
January-17							February-17							March-17							April-17						



Beam Operations Schedule

May-17							June-17							July-17							August-17							September-17						
Day	Half Shifts						Day	Half Shifts						Day	Half Shifts						Day	Half Shifts						Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24		0-4	4-8	8-12	12-16	16-20	20-24
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22	S	S	S	O	O	O	22	S	S	O	O	O	O	22	O	O	O	O	O	O	22	D	D	D	D	D	D	22	O	O	O	O	O	O
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24	O	O	O	O	O	O	24	O	O	O	O	O	O	24	O	O	O	O	O	O	24	D	D	D	D	D	D	24	O	O	O	O	O	O
25	O	O	O	O	O	O	25	O	O	O	O	O	O	25	O	O	O	C	C	C	25	D	D	D	D	D	D	25	O	O	I	I	S	S
26	O	O	O	O	O	O	26	O	O	O	O	O	O	26	C	C	O	O	O	O	26	D	D	D	D	D	D	26	S	S	M	M	M	M
27	O	O	O	O	O	O	27	O	O	O	C	C	C	27	O	O	O	O	O	O	27	D	D	D	D	D	D	27	M	M	M	M	M/S	S
28	O	O	O	O	O	O	28	C	C	O	O	O	O	28	O	O	O	O	O	O	28	D	D	D	D	D	D	28	S	S	O	O	O	O
29	O	O	O	O	O	O	29	O	O	O	O	O	O	29	O	O	C	C	C	C	29	D	D	D	D	D	D	29	O	O	O	O	O	O
30	O	O	I	I	S	S	30	O	O	O	O	S	S	30	C	C	C	C	C	C	30	D	D	D	D	D	D	30	O	O	O	O	O	O
31	S	S/M	M	M	M	M	31	C	C	O	O	O	O	31	C	C	O	O	O	O	31	D	D	D	D	D	D	31						
Total Hours - May						744	Total Hours - June						720	Total Hours - July						744	Total Hours - August						744	Total Hours - September						720
Total Days - May						31	Total Days - June						30	Total Days - July						31	Total Days - August						31	Total Days - September						30
May-17							June-17							July-17							August-17							September-17						

September has not been approved yet



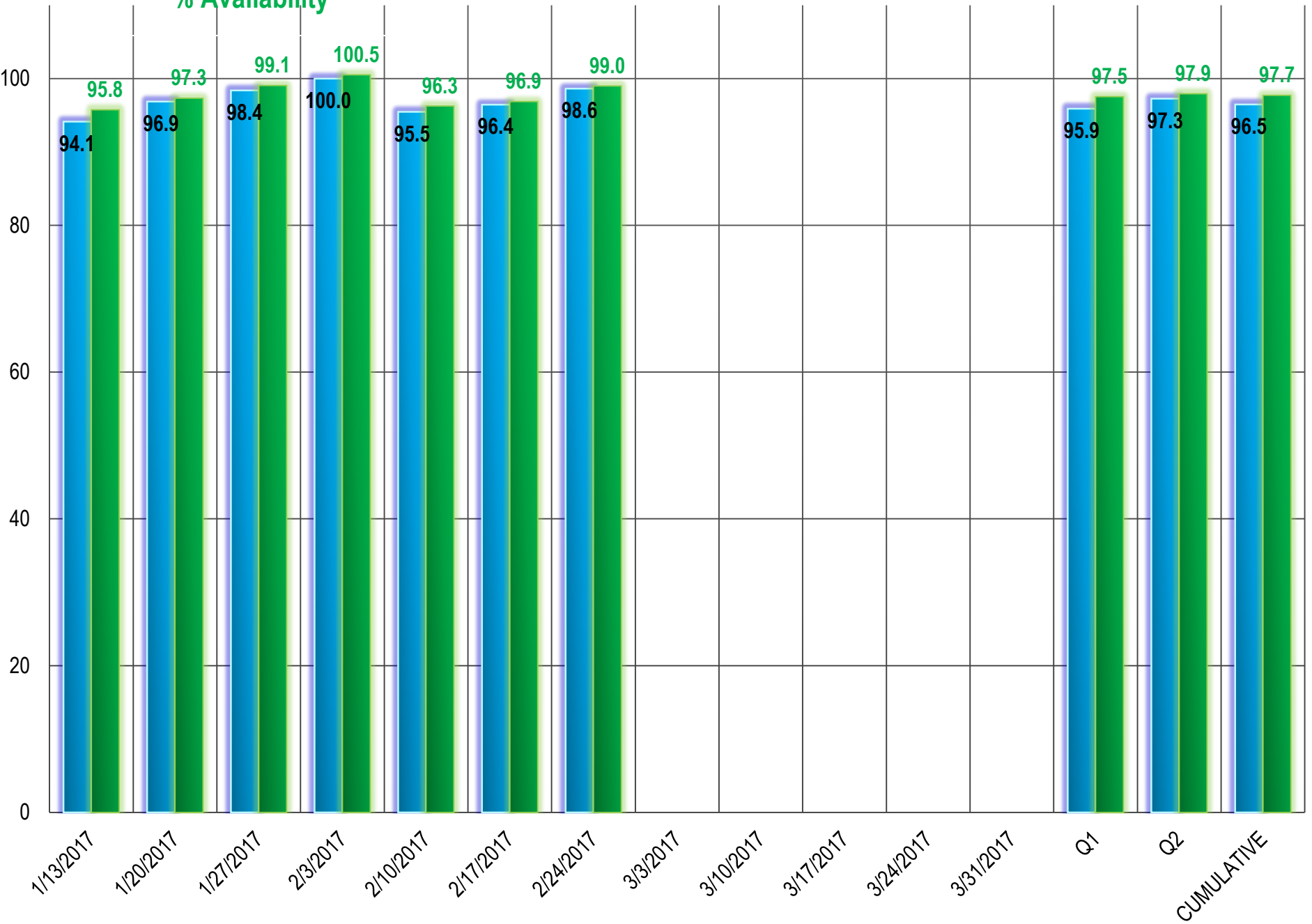
FY 17 STATISTICS



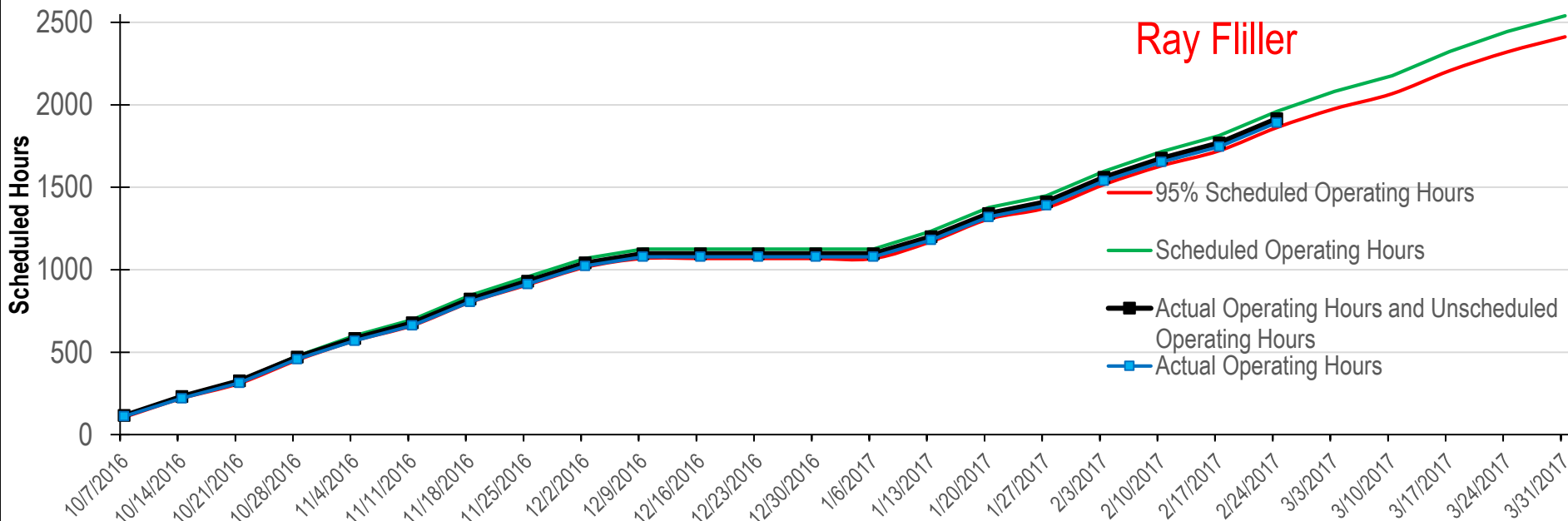
% Reliability
% Availability

FY17 Operations

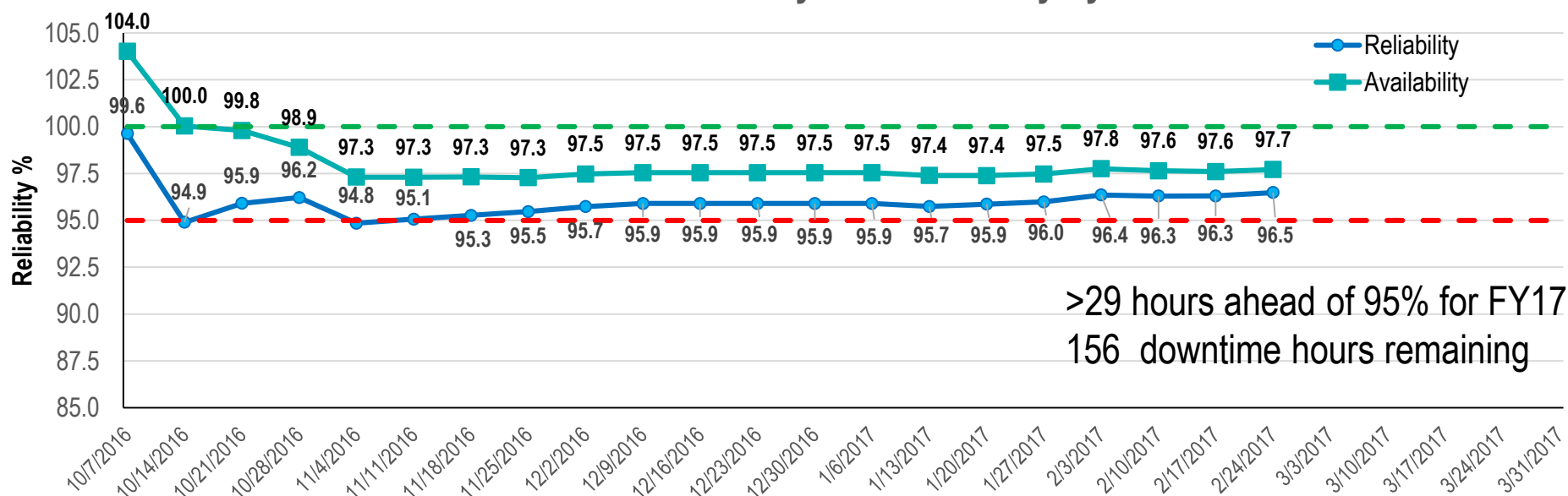
Ray Filler



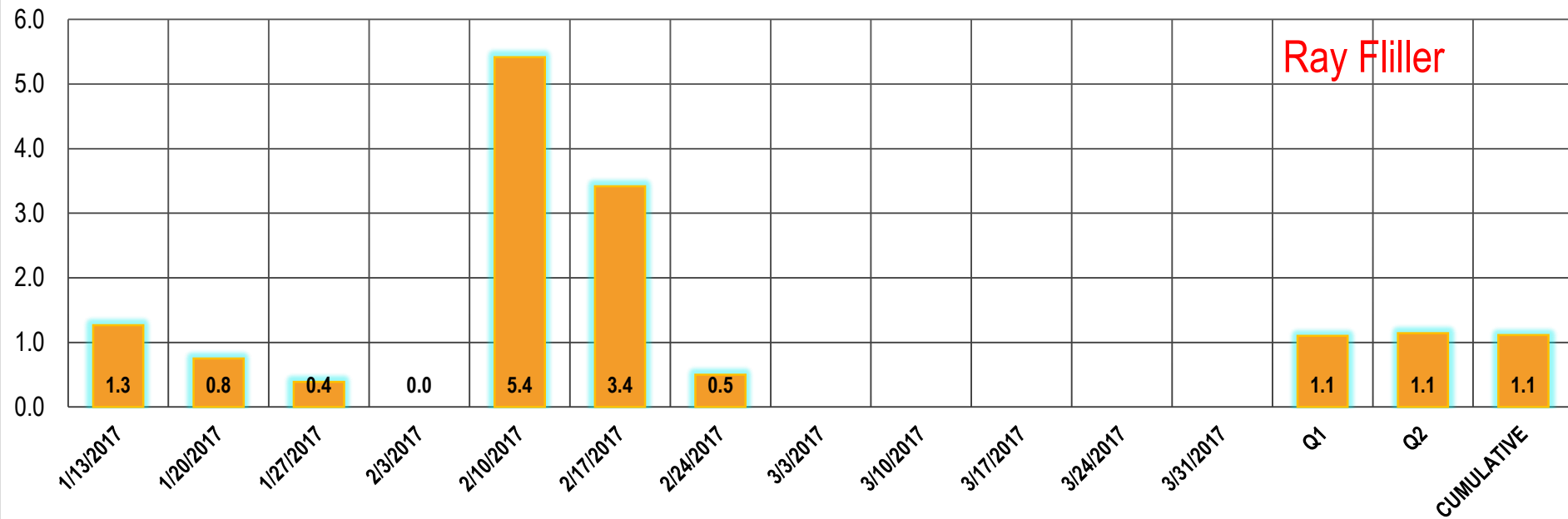
FY17 Beam Time Delivered vs Scheduled Hours and 95% Reliability Goal



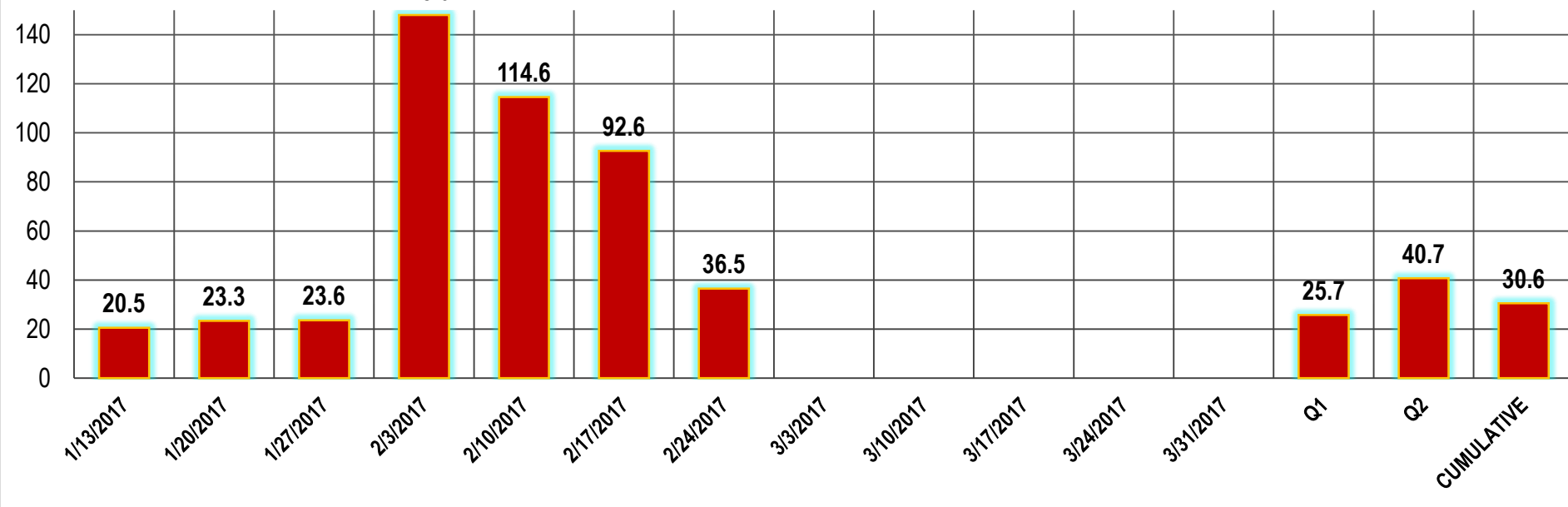
FY17 Cumulative Reliability and Availability by Week

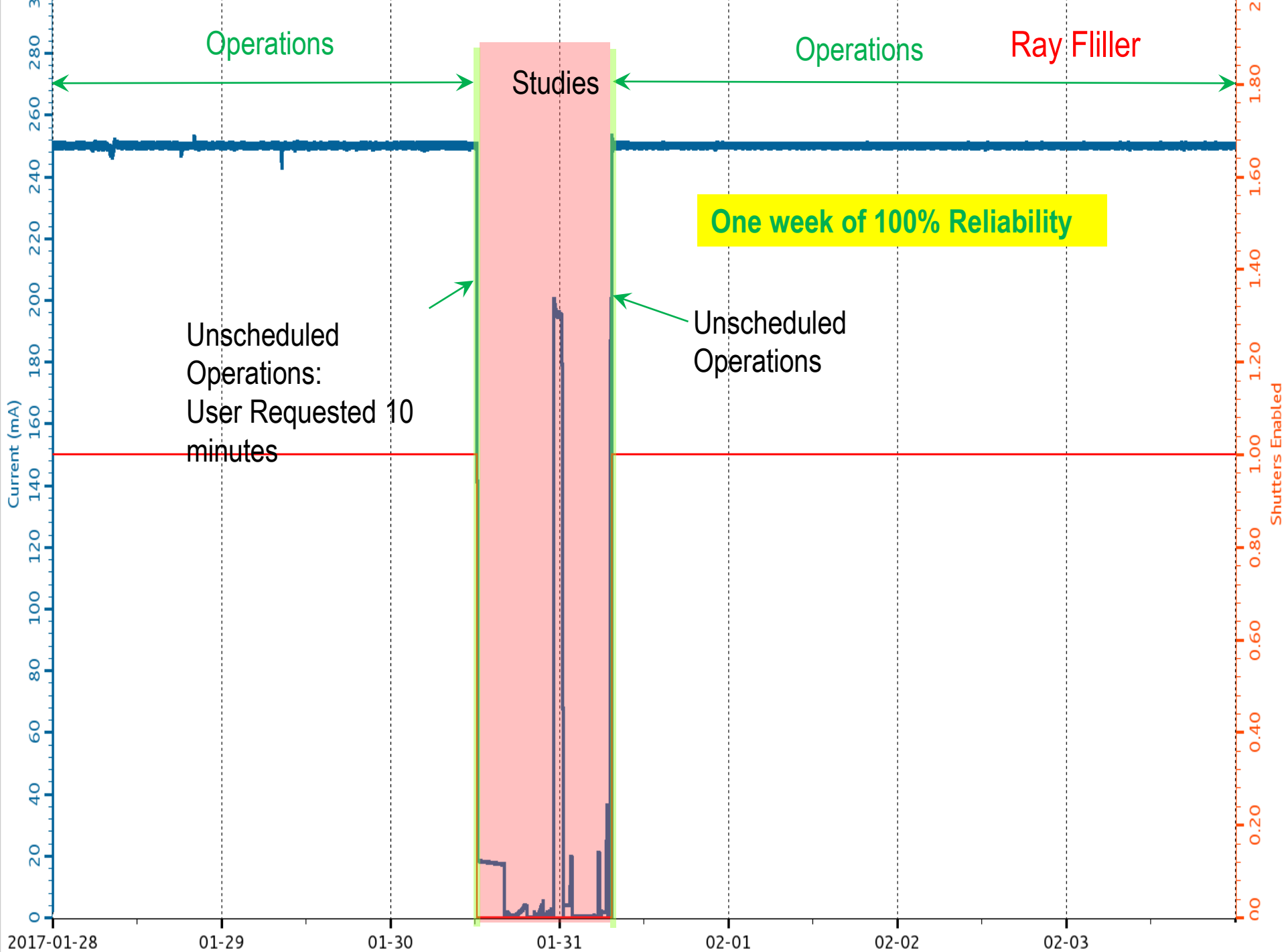


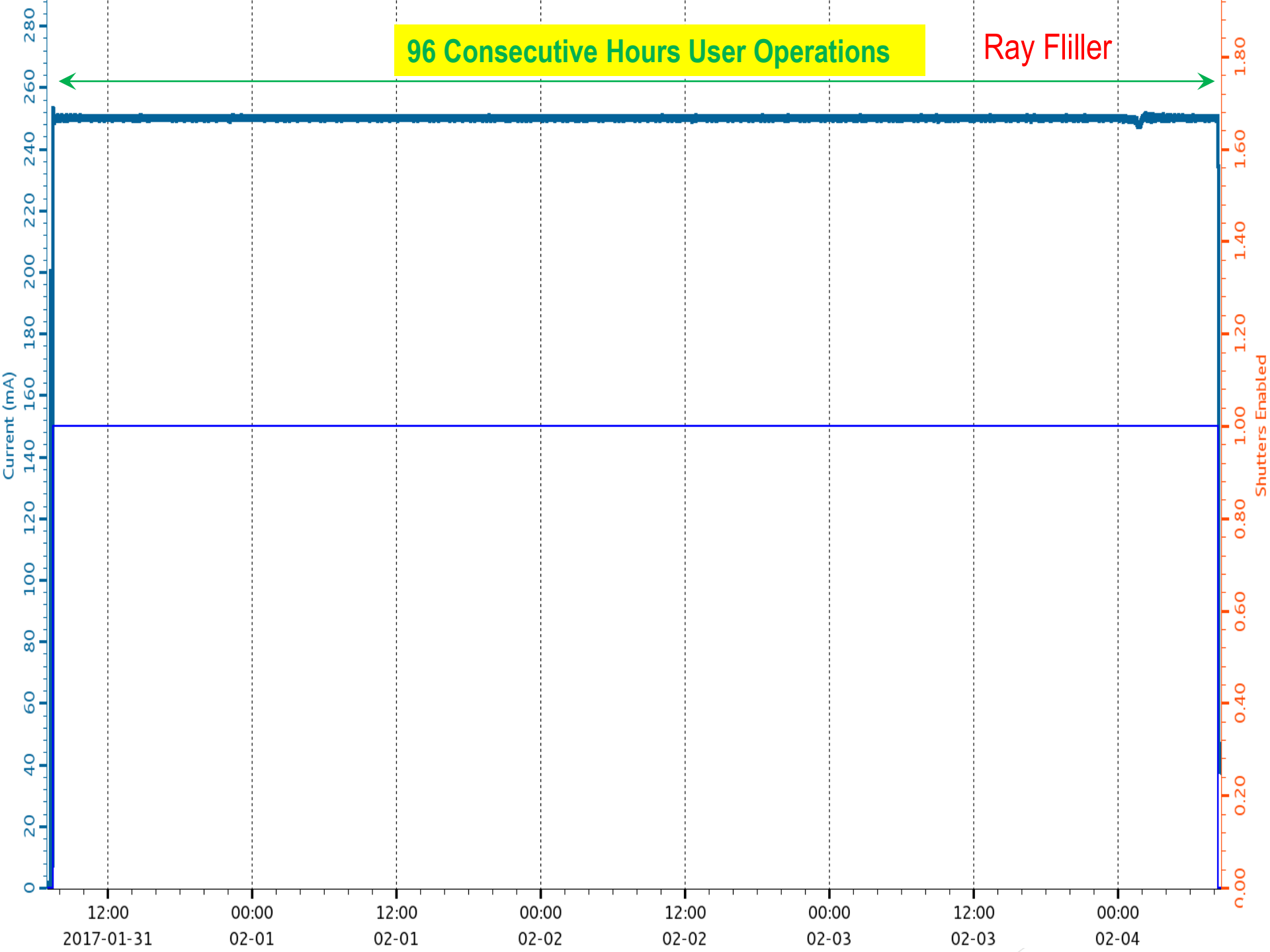
2017 Q2 Mean Time to Recovery (hours)



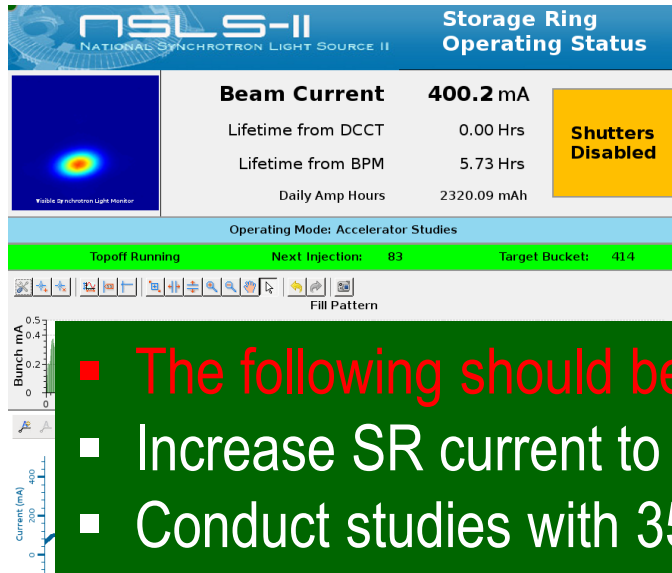
2017 Q2 Mean Time Between Failures (hours)







Tentative Plans for Increasing Current

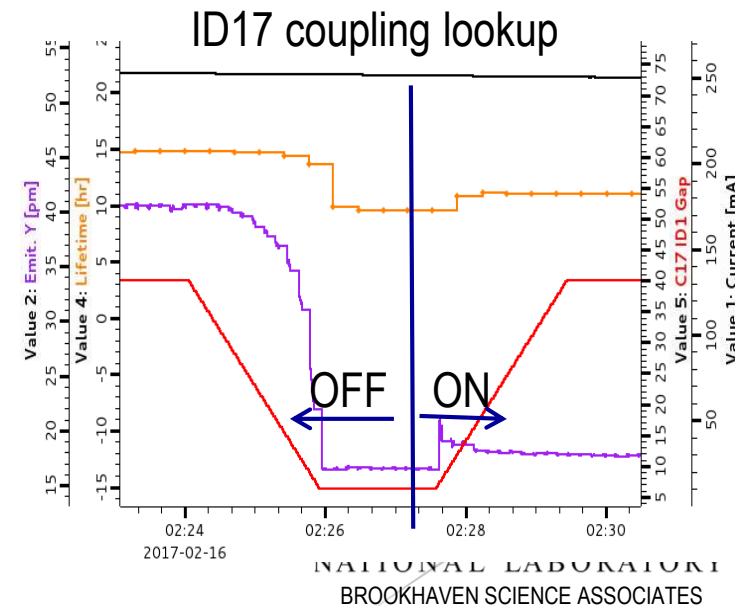
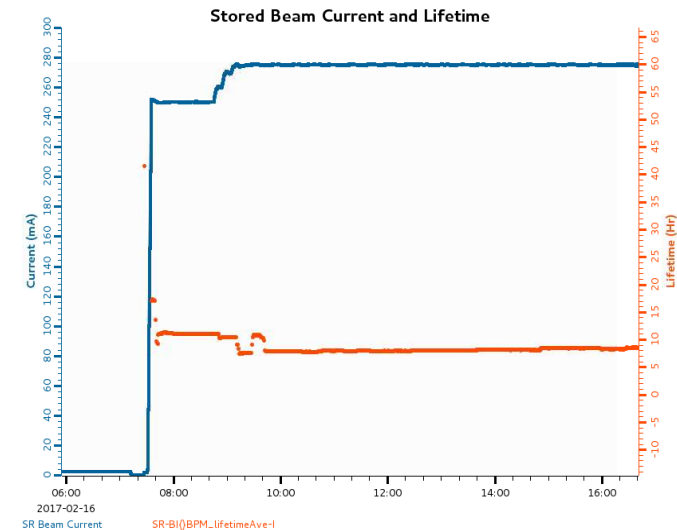


- The following should be considered tentative and subject to change:
- Increase SR current to 300 mA on April 5th.
- Conduct studies with 350 mA during the summer following kicker 3 ceramic chamber replacement in May.
- Depending on the studies outcome, 350 mA in routine operations by the end of FY17.

Machine Study Results

Guimei Wang

- Operational current was raised to 275 mA on Feb 16th
- High current beam study results:
 - At 400 mA, injection straight kicker temperature stabilized at 47°C with a fill pattern of consisting of multi-bunch trains and stronger cooling fans
 - We observed only a ~10°C temperature increase on the newly replaced C29 bellows
 - Other bellows show high temperatures and will be fixed by replacing or adding water cooling
- SIX beamline achieved first light on Feb 21st and exceeded the KPP
- C2 EPU strip coil lookup feed forward function was implemented.
- Mitigation of the V emittance change due to ID coupling
 - C17 IVU coupling feed forward function was implemented with a correction using 15 skew quads. It can maintain beam emittance at the pin-hole camera very well
 - IVU gap open hard limit will change from 40 mm to 25 mm to minimize the range of coupling

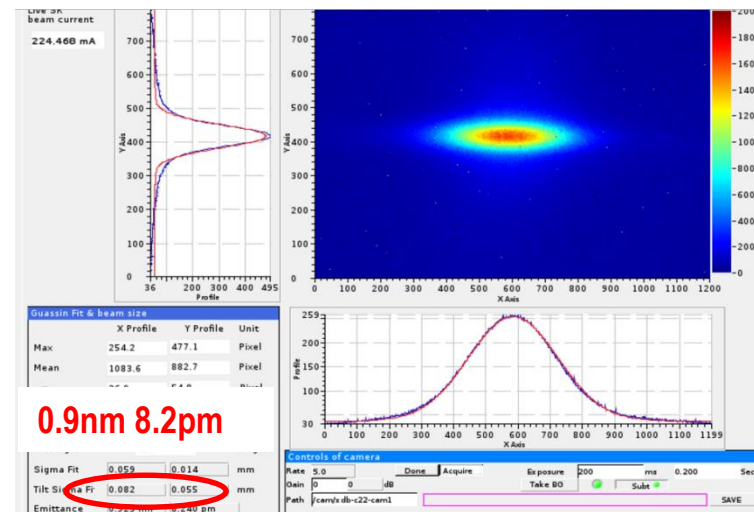


Machine Study Results

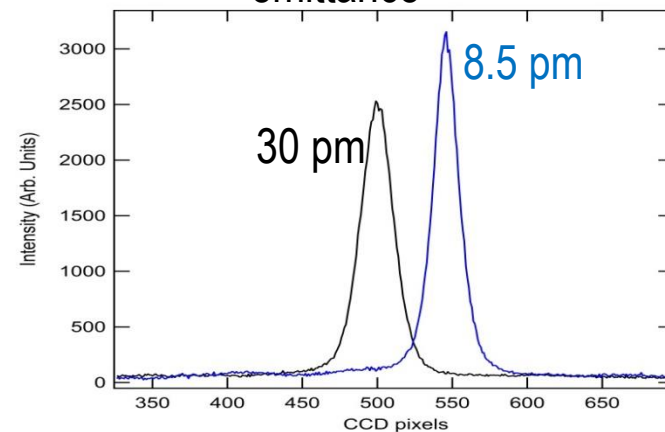
Guimei Wang

- Improvements to beam stability tools:
 - Implemented an ID local bump feed forward function.
 - Included ID BPMs in FOFB system for operation.
 - Verified fast corrector strength shift to DC correctors.
 - Tested the function of FOFB to recover the 'golden' operational orbit.
- Diffraction limit vertical emittance lattice was created and verified with pin-hole camera and other accelerator tools.
- Diffraction limit vertical emittance study with beamlines:
 - V emittance was positioned at 30 pm and 8.5 pm.
 - HXN observed 25% increase (vs model 45%) in peak intensity.
 - HXN observed 'higher' beam angle instability at 8.5 pm.
 - Low emittance operation is scheduled for a period in March.

SR emittance



HXN intensity measurement at different V emittance



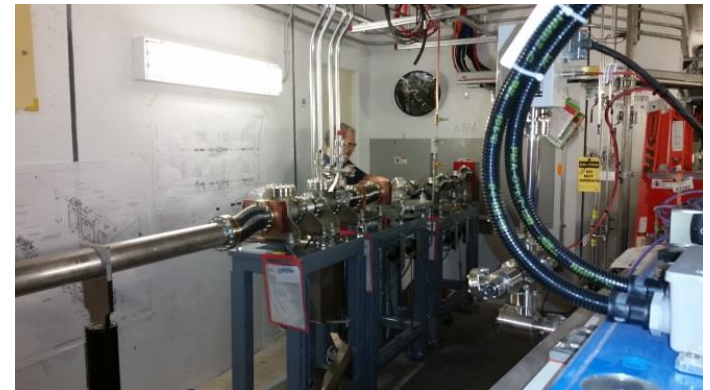
Major Winter Shutdown Tasks Completed

- Install refurbished klystron tube into modulator 2
- Cell 06 straight: Install 3PW, exit pipe, bake cell
- Cell 06 FE BM: Install Front End components including RWC
- Cell 06 FE ID: Install components
- Certifications cells 02, 04, 05, 06, 11, 21, 23, 28
- P2 substation shutdown and test
- Thermal and ground fault tests on multipole magnets
- P5: replace multipole water restrictor lines
- SR TOSS certification



C6 Straight

C6 ID Front End



C6 BM Front End

Lewis Doom



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Major Winter Shutdown Tasks Completed

- Cell 07 straight: install chamber, bake cell
- Cell 07 FE: Install Front End components including RWC
- Cell 11 FE: Install water cooling to mask
- Cell 19 straight: inspect NYX IVU leak and repair, bake
- Cell 21 straight: install EPU
- Cell 23 mezzanine: Dipole power supply maintenance
- Cell 24 straight: partial warmup of cavities C and D
- Cell 29: replace bellows, install new kicker fans
- Cell 30: replace scraper assembly



C7 Front End

C21 EPU



NYX Leak Repair

Closing Remarks

We have worked through many issues that caused beam dropouts and we are running more reliably as a result.

We will carefully push the SR current up with a tentative goal of 350 mA in routine operations by the end of FY17.

The (short) winter shutdown was very successful

We have made good progress in developing and implementing new physics tools that improve operations

-Thank you-

-Questions-

