

News From Beam Operations



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NSLS-II Town Meeting
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U.S. DEPARTMENT OF
ENERGY

Office of
Science

Topics

- Operations Schedule
- FY18 Statistics (With Apologies to Dickens)
- HXN IVU Failure
- Booster BD1 Power Supply Issue
- News From Accelerator Physics
- Planned Summer Shutdown Activities
- Closing Remarks



Operations Schedule

May-18							June-18							July-18							August-18						
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	C	C	C	C	C	C	1	O	O	O	O	O	O
2	D	D	D	D	D	D	2	O	O	O	O	O	O	2	C	C	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	O	O	O	O	4	O	O	O	O	O	O	4	O	O	O	O	O	O
5	D	D	D	D	D	D	5	O	O	O	O	O	O	5	O	O	O	O	O	O	5	O	O	O	O	O	O
6	D	D	D	D	D	D	6	O	O	O	O	O	O	6	O	O	O	O	O	O	6	O	O	O	O	O	O
7	D	D	D	D	D	D	7	O	O	O	O	O	O	7	O	O	O	O	O	O	7	S	S/M	M	M	M	M
8	D	D	D	D	D	D	8	O	O	O	O	O	O	8	O	O	O	O	O	O	8	M	M	M	M	M/S	S
9	D	D	D	D	D	D	9	O	O	O	C	C	C	9	O	O	I	I	S	S	9	S	S	O	O	O	O
10	D	D	D	D	D	D	10	C	C	C	C	C	C	10	S	S/M	M				10						
11	D	D	D	D	D	D	11	C	C	O	O	O	O	11	M	M	M				11						
12	D	D	D	D	D	D	12	O	O	O	O	O	O	12	S	S	O				12						
13	D	D	D	D	D	D	13	O	O	O	O	O	O	13	O	O	O	O	O	O	13	O	O	O	O	O	O
14	D	D	D	D	D	D	14	O	O	O	O	O	O	14	O	O	O	O	O	O	14	O	O	O	O	O	O
15	D	D	D	D	D	D	15	O	O	O	O	O	O	15	O	O	O	O	O	O	15	O	O	O	O	O	O
16	D	D	D	D	D	D	16	O	O	O	O	O	O	16	O	O	O	O	O	O	16	O	O	O	O	O	O
17	D	D	D	D	D	D	17	O	O	O	O	O	O	17	O	O	O	O	O	O	17	O	O	O	O	O	O
18	D	D	D	D	D	D	18	O	O	I	I	S	S	18	O	O	C	C	C	C	18	O	O	O	O	O	O
19	D	D	D	D	D	D	19	S	S/M	M	M	M	M	19	C	C	O	O	O	O	19	O	O	O	O	O	O
20	D	D	D	D	D	D	20	M						20							20	O	O	S	S	S	S
21	D	D	D	D	D	D	21	S						21	S	S					21	S	S	D	D	D	D
22	D	D	D	D	D	D	22	O						22							22	D	D	D	D	D	D
23	D	D	D	D	D	D	23	O	O	O	O	O	O	23	O	O	O	O	O	O	23	D	D	D	D	D	D
24	D	D	S	S	S	S	24	O	O	O	O	O	O	24	O	O	O	O	O	O	24	D	D	D	D	D	D
25	S	S	S	S	S	S	25	O	O	O	O	O	O	25	O	O	O	O	O	O	25	D	D	D	D	D	D
26	S	S	S	S	S	S	26	O	O	O	O	O	O	26	O	O	O	O	O	O	26	D	D	D	D	D	D
27	S	S	S	S	S	S	27	O	O	O	O	O	O	27	O	O	O	O	O	O	27	D	D	D	D	D	D
28	S	S	S	S	S	S	28	O	O	O	O	O	O	28	O	O	O	O	O	O	28	D	D	D	D	D	D
29	S	S	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
30	O	O	O	O	O	O	30	O	O	O	C	C	C	30	C	C	O	O	O	O	30	D	D	D	D	D	D
31	O	O	O	O	O	O	31	O	O	O				31	O	O	O	O	O	O	31	D	D	D	D	D	D

Beam Current Increase to 400 mA

Begin Low Emittance Operation Through 8/6



Operations Schedule

September-18						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	D	D	D	D	D	D
2	D	D	D	D	D	D
3	D	D	D	D	D	D
4	D	D	D	D	D	D
5	D	D	D	D	D	D
6	D	D	D	D	D	D
7	D	D	D	D	D	D
8	D	D	D	D	D	D
9	D	D	D	D	D	D
10	D	D	D	D	D	D
11	D	D	D	D	D	D
12	D	D	D	D	D	D
13	D	D	D	D	D	D
14	D	D	S	S	S	S
15	S	S	S	S	S	S
16	S	S	S	S	S	S
17	S	S	S	O	O	O
18	O	O	O	O	O	O
19	O	O	O	O	O	O
20	O	O	O	O	O	O
21	O	O	O	O	O	O
22	O	O	O	O	O	O
23	O	O	O	O	O	O
24	O	O	I	I	S	S
25	S	S/M	M	M	M	M
26	M	M	M	M	M/S	S
27	S	S	O	O	O	O
28	O	O	O	O	O	O
29	O	O	O	O	O	O
30	O	O	O	O	O	O

October-18						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	O	O	O	O	O	O
2	O	O	O	O	O	O
3	O	O	O	O	O	O
4	O	O	O	O	O	O
5	O	O	O	O	O	O
6	O	O	O	O	O	O
7	O	O	S	S	S	S
8	S	S	S	S	S	S
9	S	S	O	O	O	O
10	O	O	O	O	O	O
11	O	O	O	O	O	O
12	O	O	O	O	O	O
13	O	O	O	O	O	O
14	O	O	O	O	O	O
15	O	O/M	M	M	M	M
16	M	M	M	M	M/S	S
17	S	S	O	O	O	O
18	O	O	O	O	O	O
19	O	O	O	O	O	O
20	O	O	O	O	O	O
21	O	O	O	O	O	O
22	O	O	O	O	O	O
23	O	O	O	O	O	O
24	O	O	O	O	O	O
25	O	O	O	O	O	O
26	O	O	I	I	S	S
27	S	S	S	S	S	S
28	S	S	S	S	S	S
29	S	S	O	O	O	O
30	O	O	O	O	O	O
31	O	O	O	O	O	O

November-18						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	O	O	O	O	O	O
2	O	O	O	O	O	O
3	O	O	S	S	S	S
4	S	S	S	S	S	S
5	S	S	O	O	O	O
6	O	O	O	O	O	O
7	O	O	O	O	O	O
8	O	O	O	O	O	O
9	O	O	O	O	O	O
10	O	O	O	O	O	O
11	O	O	O	O	O	O
12	O	O	O	O	O	O
13	O	O/M	M	M	M	M
14	M	M	M	M	M/S	S
15	S	S	O	O	O	O
16	O	O	O	O	O	O
17	O	O	O	O	O	O
18	O	O	O	O	O	O
19	O	O	O	O	O	O
20	O	O	O	O	O	O
21	O	O	I	I	S	S
22	S	S	S	S	S	S
23	S	S	S	S	S	S
24	S	S	S	S	S	S
25	S	S	S	S	S	S
26	S	S	O	O	O	O
27	O	O	O	O	O	O
28	O	O	O	O	O	O
29	O	O	O	O	O	O
30	O	O	O	O	O	O

December-18						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	O	O	O	O	O	O
2	O	O	O	O	O	O
3	O	O/M	M	M	M	M
4	M	M	M	M	M/S	S
5	S	S	O	O	O	O
6	O	O	O	O	O	O
7	O	O	O	O	O	O
8	O	O	O	O	O	O
9	O	O	O	O	O	O
10	O	O	O	O	O	O
11	O	O	O	O	O	O
12	O	O	O	O	O	O
13	O	O	O	O	O	O
14	O	O	O	O	O	O
15	O	O	S	S	S	S
16	S	S	S	S	S	S
17	S	S	D	D	D	D
18	D	D	D	D	D	D
19	D	D	D	D	D	D
20	D	D	D	D	D	D
21	D	D	D	D	D	D
22	D	D	D	D	D	D
23	D	D	D	D	D	D
24	D	D	D	D	D	D
25	D	D	D	D	D	D
26	D	D	D	D	D	D
27	D	D	D	D	D	D
28	D	D	D	D	D	D
29	D	D	D	D	D	D
30	D	D	D	D	D	D
31	D	D	D	D	D	D

Begin 5000 hrs Operations

Begin a Change in Pattern



Run Pattern Committee

- Committee was charged with developing a new run pattern for 5000 hours beginning in FY19
- Committee membership is a good cross-section of Accelerator and Beamline program staff members
- There were many issues that were brought to the table
- Lots of discussion and compromise brought us to decouple the interlock check day from maintenance moving ops start-up from Thursday to Wednesday. This puts some risk in the logistics of beamline PPS certification.
- This will be tried out in the fall and revisited prior to developing the rest of FY19
- Discussions also drove a change to the pattern of long shutdown periods...



A 10x10 grid of colored squares. The colors are: 0 (white), 1 (light green), 2 (medium green), 3 (dark green), 4 (teal), 5 (blue), 6 (dark blue), 7 (purple), 8 (dark purple), 9 (black), and 10 (red). The grid is filled with these colors in a repeating pattern. Overlaid on the grid are red numbers: '00' at the top, '1' in the middle, '>' in the lower middle, and '11' at the bottom.

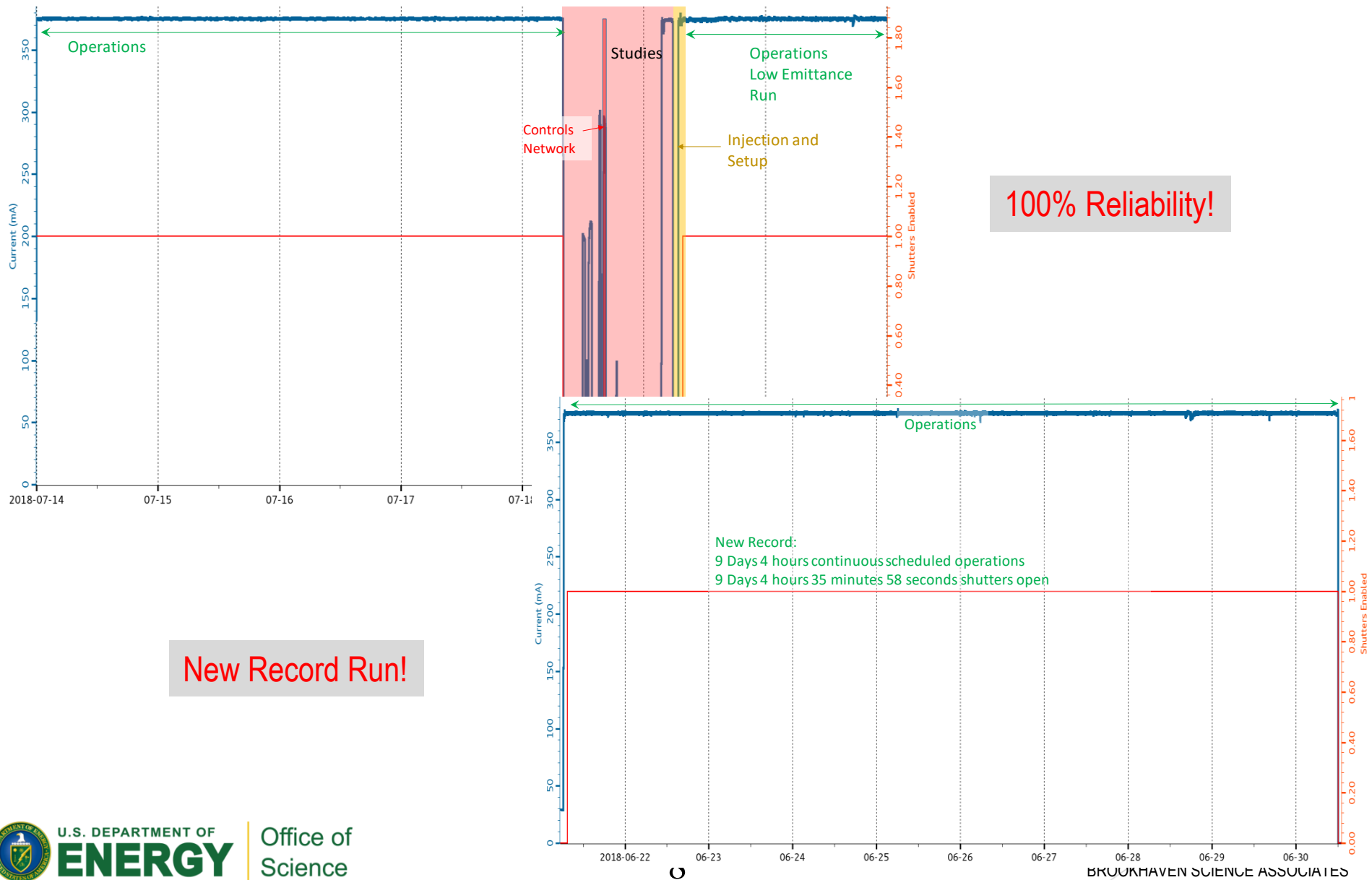

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 NATIONAL LABORATORY
 BROOKHAVEN SCIENCE ASSOCIATES

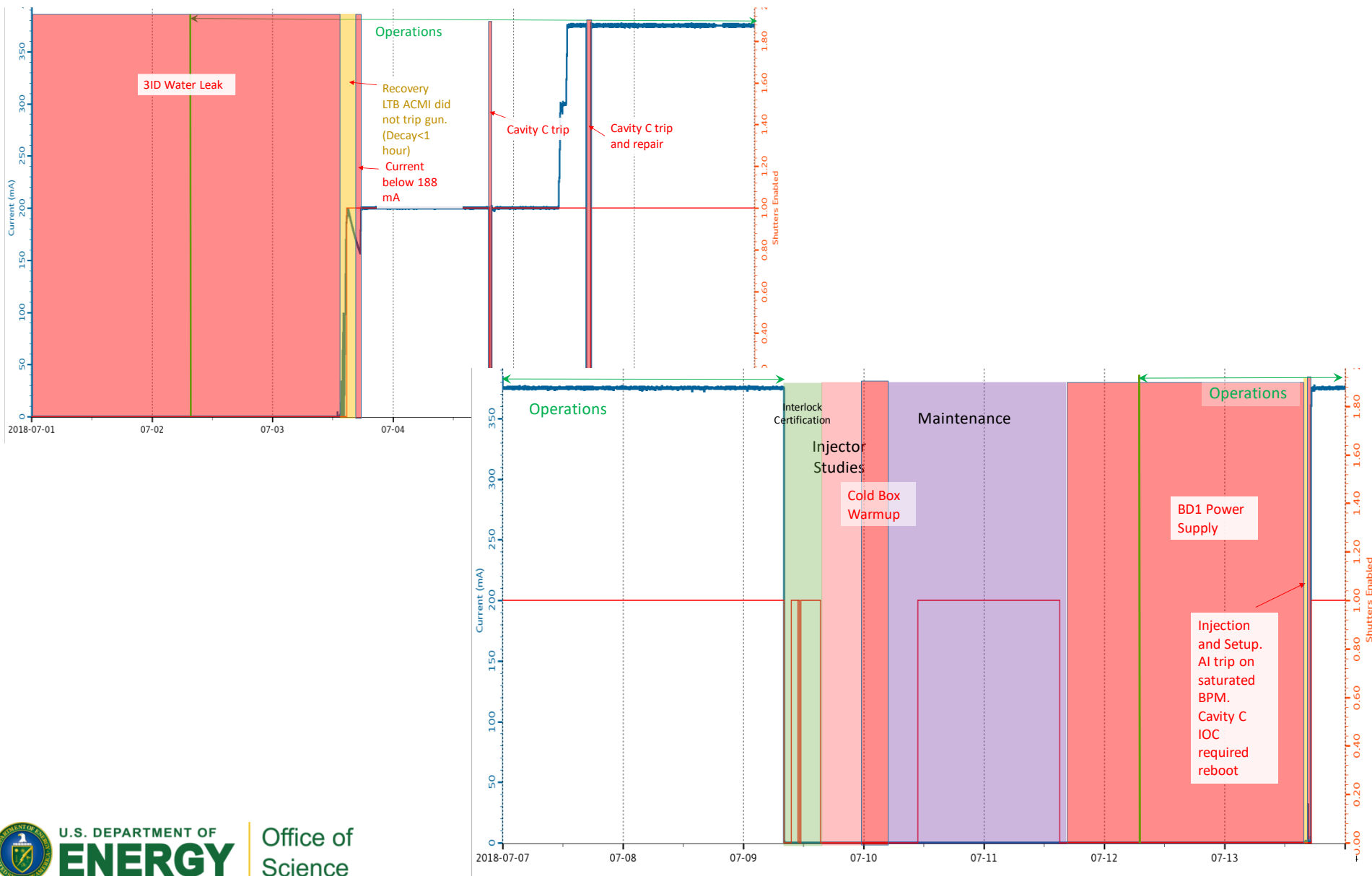
FY 18 STATISTICS



They Were the Best of Times...

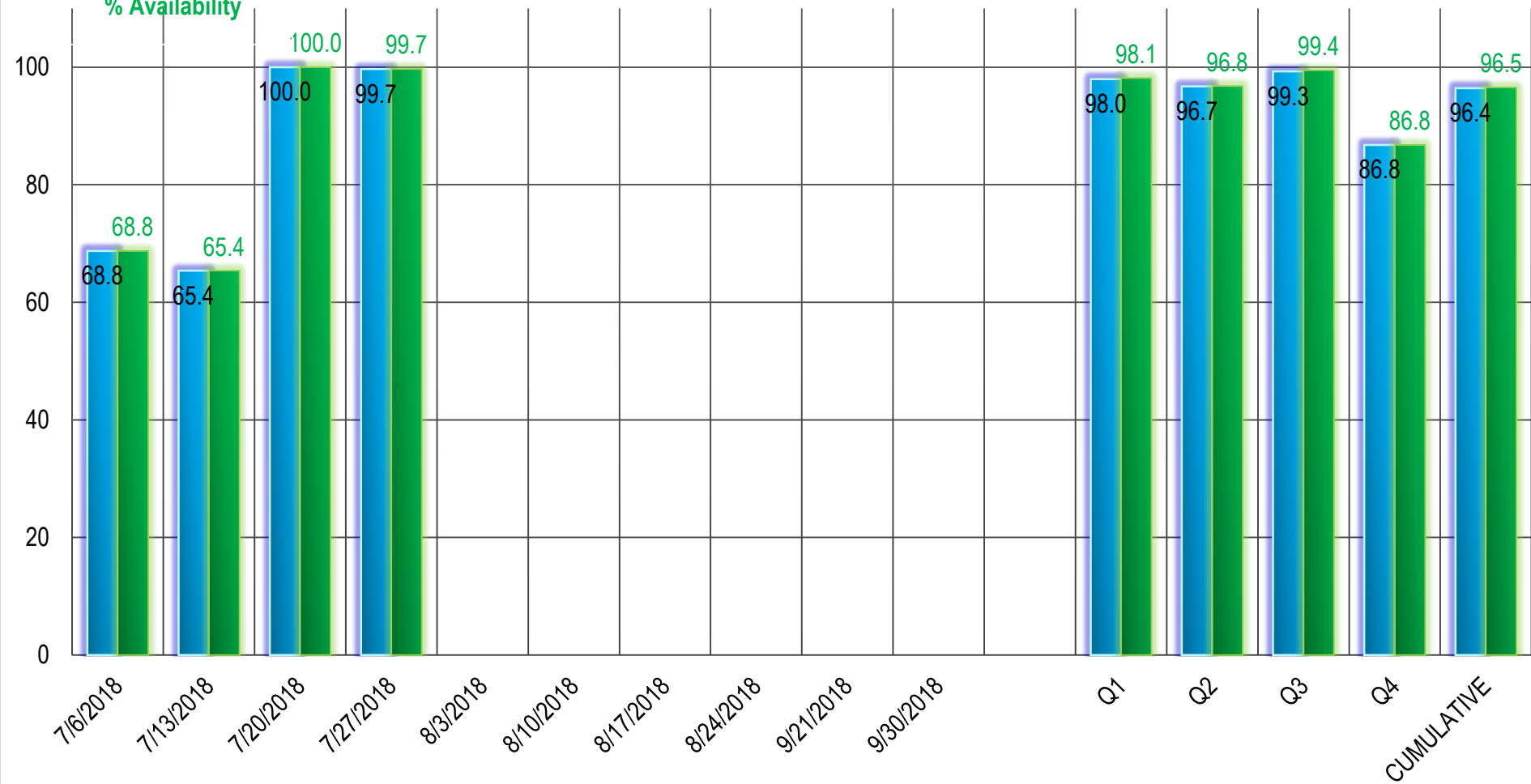


They Were the Worst of Times...



FY18 Operations

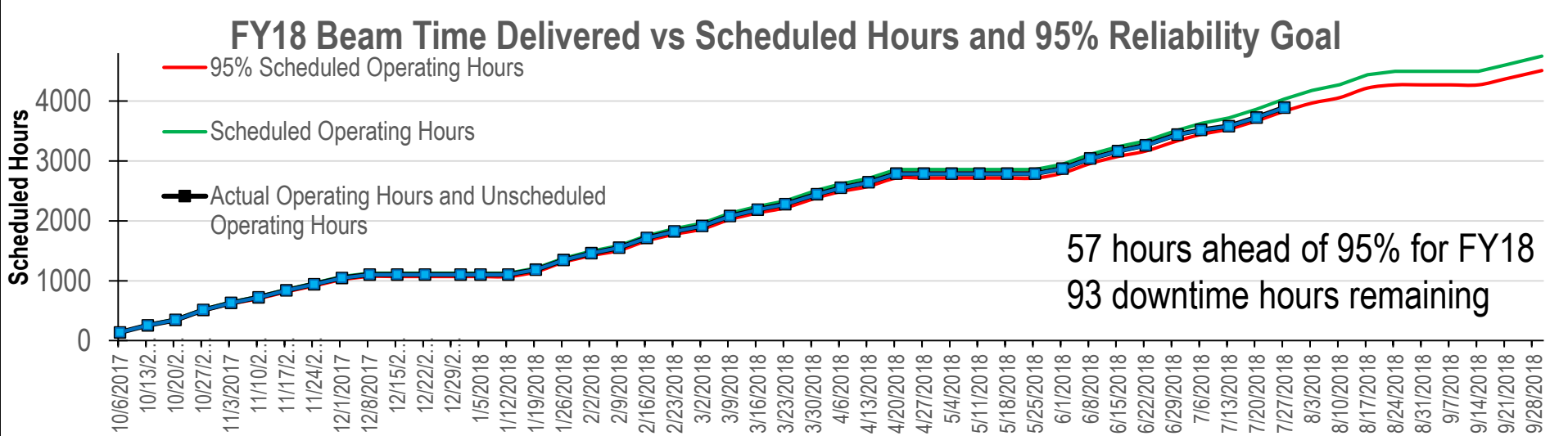
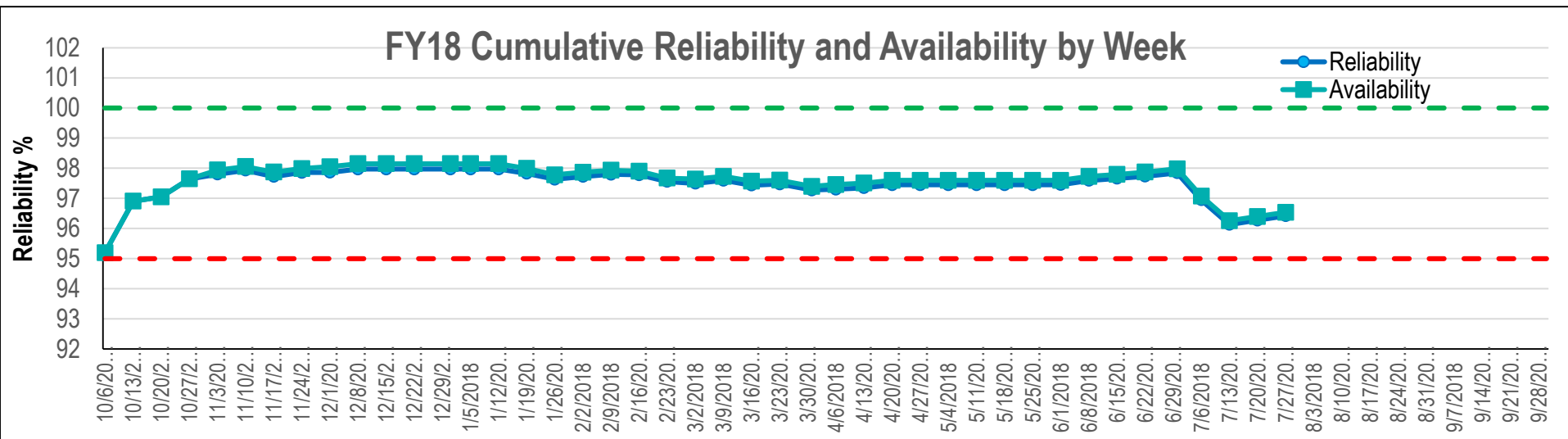
% Reliability
% Availability



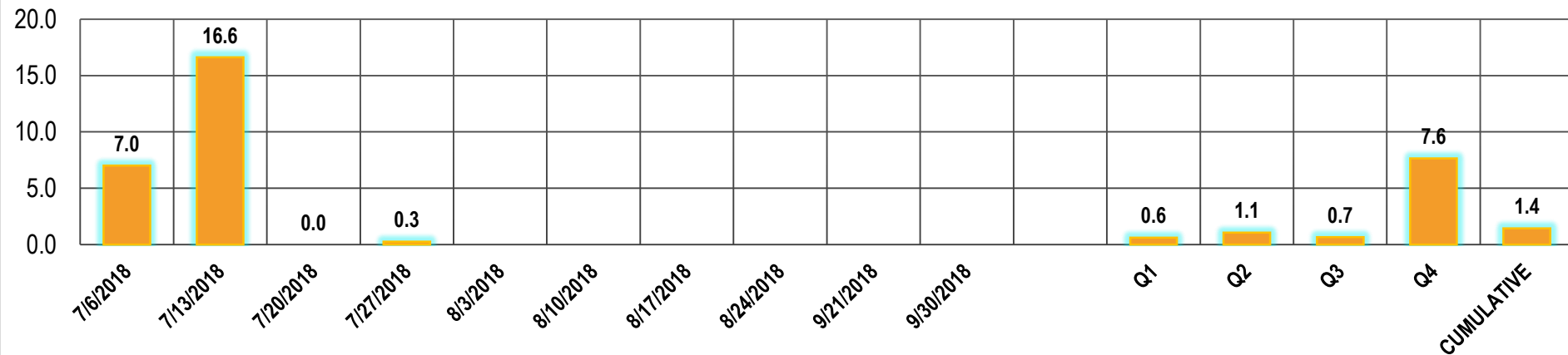
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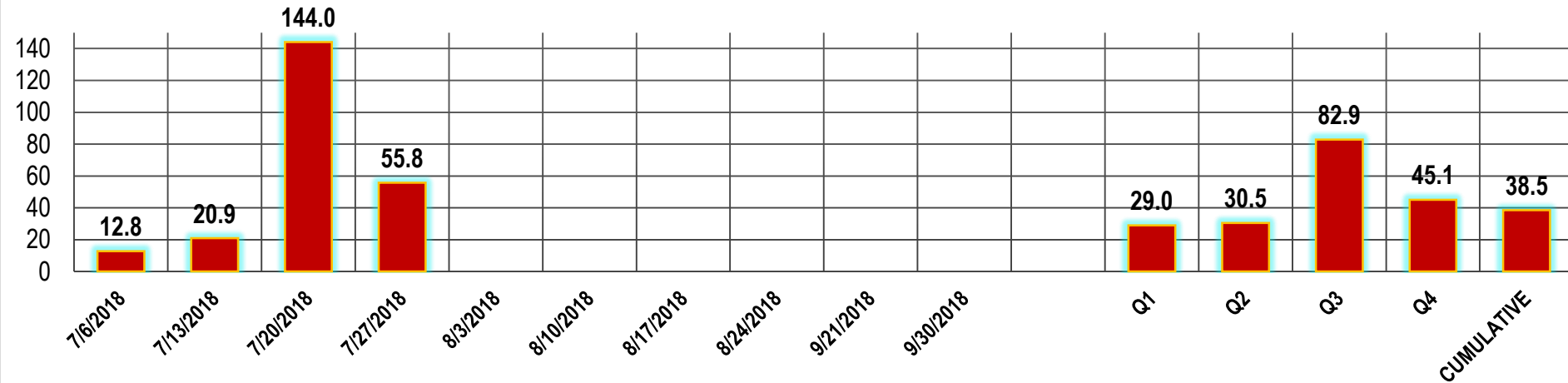
Ray Filler



2018 Q4 Mean Time to Recovery (hours)

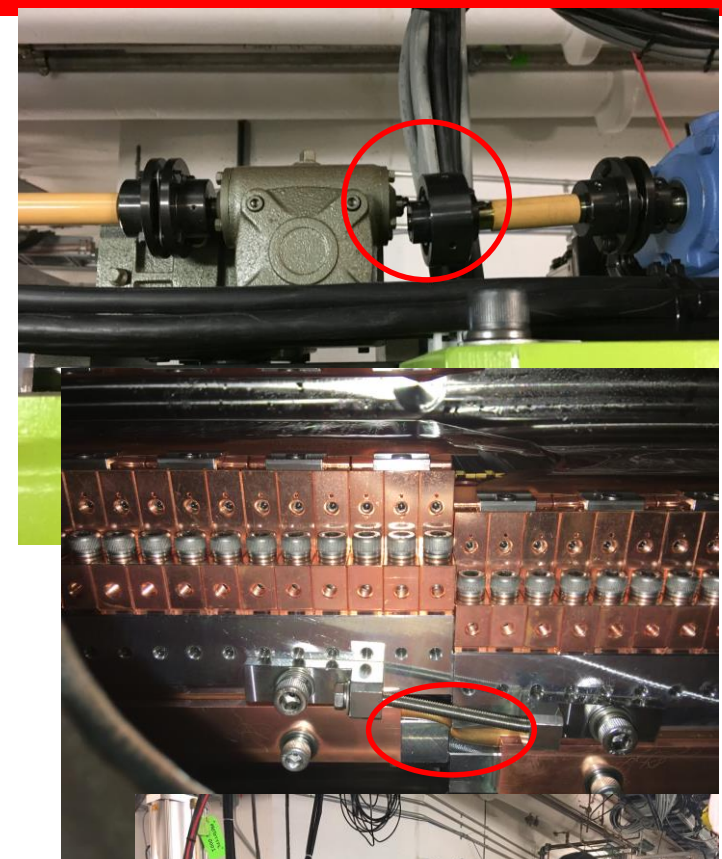


2018 Q4 Mean Time Between Failures (hours)



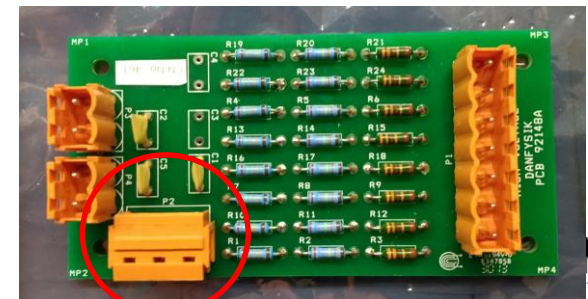
HXN IVU failure

- At midnight on Sunday 7/1/2018 a drive shaft of the 3-meter long IVU broke during motion of the ID gap, severing the water pipe inside vacuum, causing a water leak and vacuum intervention
 - Gate valves around IVU closed isolating the straight section.
 - NSLS-II AD staff arrived to the scene at 7 am on Sunday; work planning completed in a few hours,
 - ID cell-3 removed from the ring on Sunday evening,
 - Spool piece is installed on Monday, baked overnight,
 - Operations restored on Tuesday afternoon.
- AD Director called investigation committee. Report is due by Aug 10th.
- Other IDs are being inspected for signs of similar faults. Procurement and the vendor (NEOMAX) are involved in root cause analysis
- IVU Cell 3 is being disassembled in the ID lab. Planning repair / measurements. Install and recommission in December shutdown.



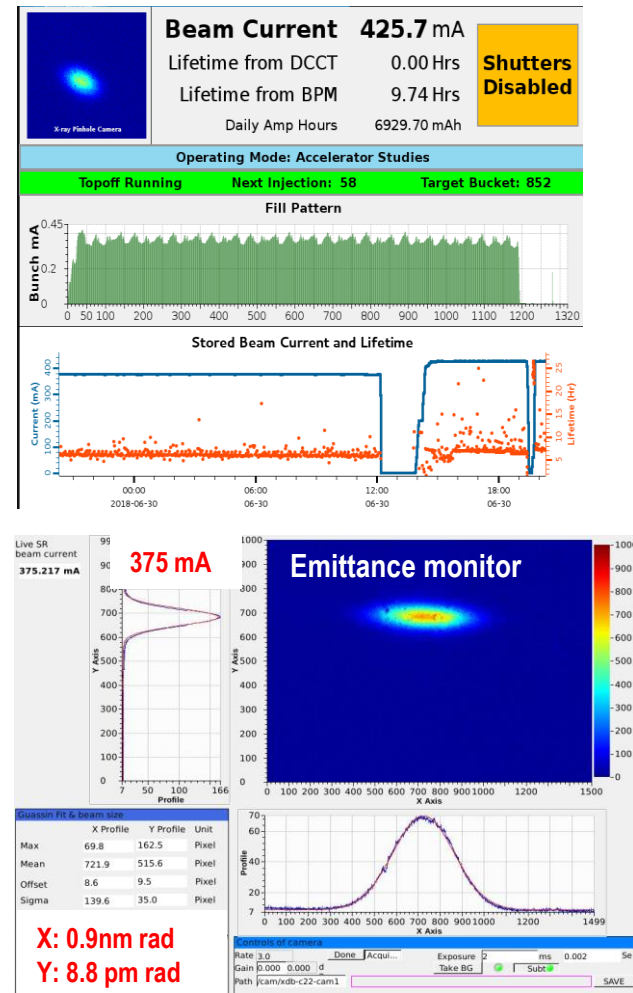
Issue with Booster Dipole Power Supply

- There are 3 high-power (900 A / 450 V) dipole PSs in the booster, procured from Danfysik.
- The failure in BD1 was identified when the power supply was being turned on after the 2-day maintenance period on 7/11/2018.
 - Manifested itself in audible noise with the output voltage oscillating 200 V at 600 Hz.
 - Work planning was completed the same evening and investigation / debugging commenced.
 - This is a high power system with electrical hazards. Careful planning, barriers, & documentation were put into place.
 - We contacted Danfysik immediately, gaining some help via daily teleconferences.
 - On 7/13/2018 we were able to localize the problem to a connector on one of the scaling cards: oxidation of contacts.
 - Reconditioned the card and restarted operations on Friday evening.
- Investigation report is available
 - Will augment maintenance procedures
 - Author of the DPSs from Danfysik is being scheduled for site visit for consultations and preparing needed documentation
 - Project on installing a separate diagnostic monitoring system is pending funding



News From Accelerator Physics

- 425 mA High current study:
 - Successfully stored beam current at 425 mA for ~10 hrs.
 - Studied the impact on beam properties with different filling patterns (80% and 90% fill).
 - Beam life time is 8.7h with 80% filling pattern and 9.7h with 90% (normal ops vertical emittance 30 pm).
 - Characterized temperature of chambers and Vacuum performance
- Low emittance study and operation
 - Corrected and maintained an operational lattice with the vertical emittance reduced to ~8 pm
 - Beam lifetime is ~ 4 hrs.
 - Lengthened top-off injection period to 90 seconds to relieve injector operation
 - Low emittance operations are in progress July 19th –Aug. 6th
- Implemented local bump auto correction tool for C11 ID BL
- Injector studies:
 - 12.5 nC in 100 bunches out of the linac
 - 9.8 nC out of Booster
 - Future development: BR stacking mode
- Will increase operational current to 400 mA on Aug. 9th



Planned Summer Shutdown Activities

▪ Prior to Shutdown:

Prep work for 22 BM installation
12 ID Annual PPS certification

12 ID FE shutter PM
3 ID GV2 PPS enhancements

▪ During Shutdown:

22 BM New dipole chamber, optics,
connections, utilities, EPS work, bake
Beamline PPS EPICS interface
GV2 PPS enhancements at ID 10, 11 16 & 17
28 ID D hutch new PPS keypad
18 ID Full PPS certification
18 ID FE shutter PM

Install new klystron tube in Linac modulator 1
Annual PPS certifications of SR, LTB & BTS
ACMIs
ARM recalibration
Magnet flushing and manifold inspection
Cooling tower maintenance
Magnet temperature monitor system
installation
Water leak detection system installation
Relocate SR magnet Klixons



Closing Remarks

Following the springtime resolution of some nagging issues affecting reliability, the NSLS-II has performed very well with record runs, 100% weeks & improving MTBF

A couple of unfortunate and difficult problems knocked our performance back a little in Q4 so far

5000 operations hours in FY19 comes with a new schedule pattern
22 BM FIS-MET installation is scheduled for the upcoming shutdown

-Thank you-

-Questions-

