

# The Latest From Beam Operations

---



Emil Zitvogel  
Beam Operations Group Leader  
NSLS-II Town Meeting  
February 27, 2018



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# Topics

---

- Operations Schedule
- FY18 Statistics
- News From Accelerator Physics
- Need for RF Cryo Pump & Purge
- Re-Cap of Winter Shutdown Activities
- Planned Spring Shutdown Activities
- Ask for Help From the Floor Coordinators



# Operations Schedule

January-18							February-18							March-18							April-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	S	S	S	O	O	O	1	C	C	C	C	C	C
2	D	D	D	D	D	D	2	O	O	O	O	O	O	2	O	O	O	O	O	O	2	C	C	S	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	I	I	S	S	5	O	O	O	O	O	O	5	O	O	O	O	O	O
6	D	D	D	D	D	D	6	S	S/M	M	M	M	M	6	O	O	O	O	O	O	6	O	O	O	O	O	O
7	D	D	D	D	D	D	7	M	M	M	M	M/S	S	7	O	O	O	O	O	O	7	O	O	O	O	O	O
8	D	D	D	D	D	D	8	S	S	S	O	O	O	8	O	O	O	O	O	O	8	O	O	O	O	O	O
9	D	D	D	D	D	D	9	O	O	O	O	O	O	9	O	O	O	O	O	O	9	O	O	I	I	S	S
10	D	D	D	D	D	D	10	O	O	O	O	O	O	10	O	O	O	O	O	O	10	S	S/M	M	M	M	M
11	D	D	S	S	S	S	11	O	O	O	O	O	O	11	O	O	C	C	C	C	11	M	M	M	M	M/S	S
12	S	S	S	S	S	S	12	O	O	O	O	O	O	12	C	C	C	C	C	C	12	S	S	S	O	O	O
13	S	S	S	S	S	S	13	O	O	O	O	O	O	13	C	C	S	O	O	O	13	O	O	O	O	O	O
14	S	S	S	S	S	S	14	O	O	O	O	O	O	14	O	O	O	O	O	O	14	O	O	O	O	O	O
15	S	S	S	S	S	S	15	O	O	O	O	O	O	15	O	O	O	O	O	O	15	O	O	O	O	O	O
16	S	S	S	O	O	O	16	O	O	O	O	O	O	16	O	O	O	O	O	O	16	O	O	O	O	O	O
17	O	O	O	O	O	O	17	O	O	C	C	C	C	17	O	O	O	O	O	O	17	O	O	O	O	O	O
18	O	O	O	O	O	O	18	C	C	C	C	C	C	18	O	O	O	O	O	O	18	O	O	O	O	O	O
19	O	O	O	O	O	O	19	C	C	S	O	O	O	19	O	O	I	I	S	S	19	O	O	O	O	O	O
20	O	O	O	O	O	O	20	O	O	O	O	O	O	20	S	S/M	M	M	M	M	20	O/S	S	S	S	S	S
21	O	O	O	O	O	O	21	O	O	O	O	O	O	21	M	M	M	M	M/S	S	21	S	S	S	S	S	S
22	O	O	O	O	O	O	22	O	O	O	O	O	O	22	S	S	S	O	O	O	22	S	S	S	S	S	S
23	O	O	O	O	O	O	23	O	O	O	O	O	O	23	O	O	O	O	O	O	23	S	S	D	D	D	D
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
25	O	O	O	O	O	O	25	O	O	O	O	O	O	25	O	O	O	O	O	O	25	D	D	D	D	D	D
26	O	O	O	O	O	O	26	O	O	I	I	S	S	26	O	O	O	O	O	O	26	D	D	D	D	D	D
27	O	O	O	O	O	O	27	S	S/M	M	M	M	M	27	O	O	O	O	O	O	27	D	D	D	D	D	D
28	O	O	C	C	C	C	28	M	M	M	M	M/S	S	28	O	O	O	O	O	O	28	D	D	D	D	D	D
29	C	C	C	C	C	C								29	O	O	O	O	O	O	29	D	D	D	D	D	D
30	C	C	S	O	O	O								30	O	O	O	O	O	O	30	D	D	D	D	D	D
31	O	O	O	O	O	O								31	O	O	C	C	C	C							
Total Hours - January						744	Total Hours - February						672	Total Hours - March						743	Total Hours - April						720
Total Days - January						31	Total Days - February						28	Total Days - March						30.96	Total Days - April						30
January-18							February-18							March-18							April-18						

Beam Current Increase to 375 mA



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# 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	I	I	S	S
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	M	M	M	10	O	O	O	O	O	O
11	D	D	D	D	D	D	11	C	C	O	O	O	O	11	M	M	M	M	M/S	S	11	O	O	O	O	O	O
12	D	D	D	D	D	D	12	O	O	O	O	O	O	12	S	S	O	O	O	O	12	O	O	O	O	O	O
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	M	M	M	M/S	S	20	O	O	O	O	O	O	20	O	O	S	S	S	S
21	D	D	D	D	D	D	21	S	S	O	O	O	O	21	O	O	O	O	O	O	21	S	S	D	D	D	D
22	D	D	D	D	D	D	22	O	O	O	O	O	O	22	O	O	O	O	O	O	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	O	O	O	31	D	D	D	D	D	D
Total Hours - May						744	Total Hours - June						720	Total Hours - July						744	Total Hours - August						744
Total Days - May						31	Total Days - June						30	Total Days - July						31	Total Days - August						31
May-18							June-18							July-18							August-18						



---

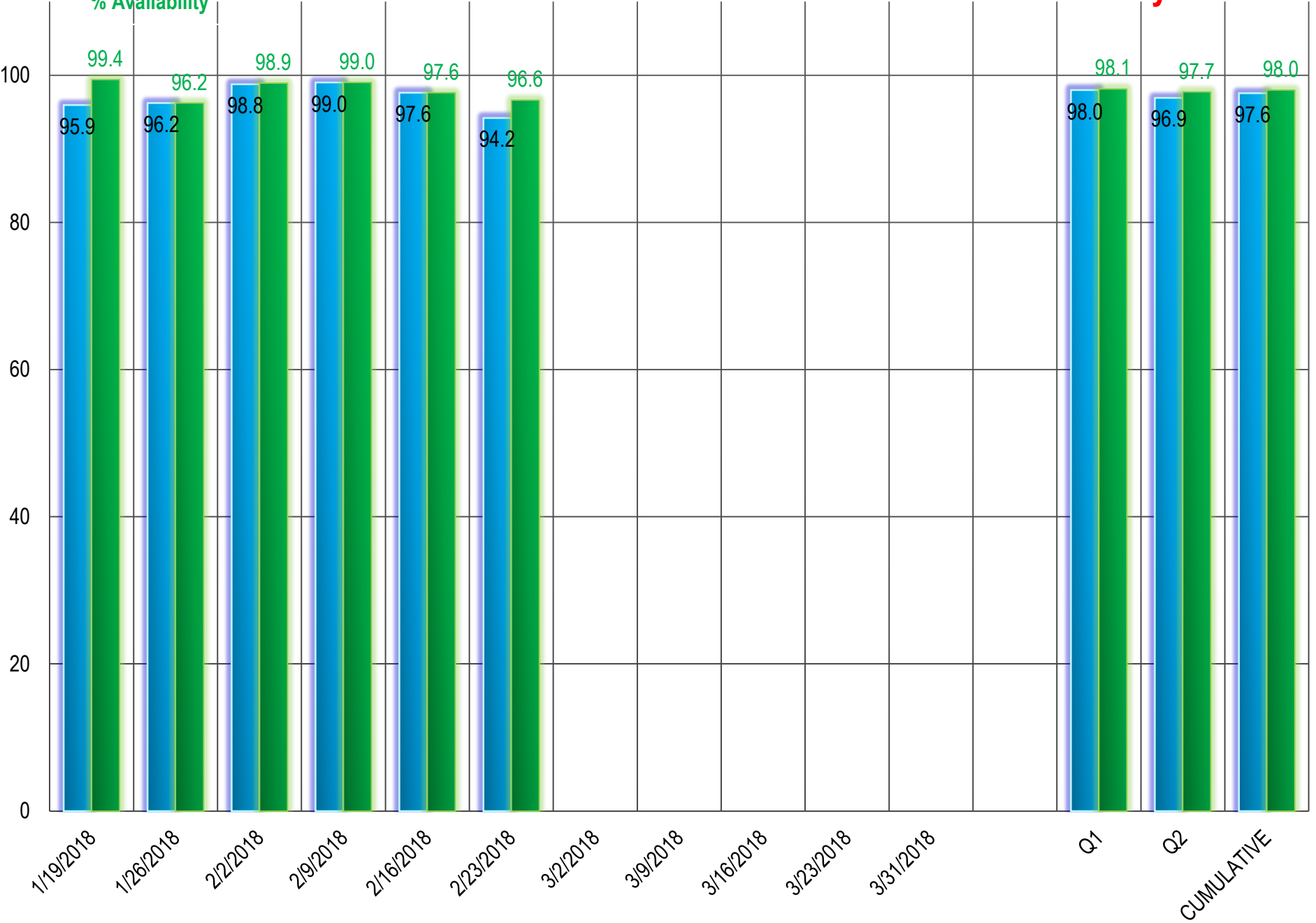
# FY 18 STATISTICS

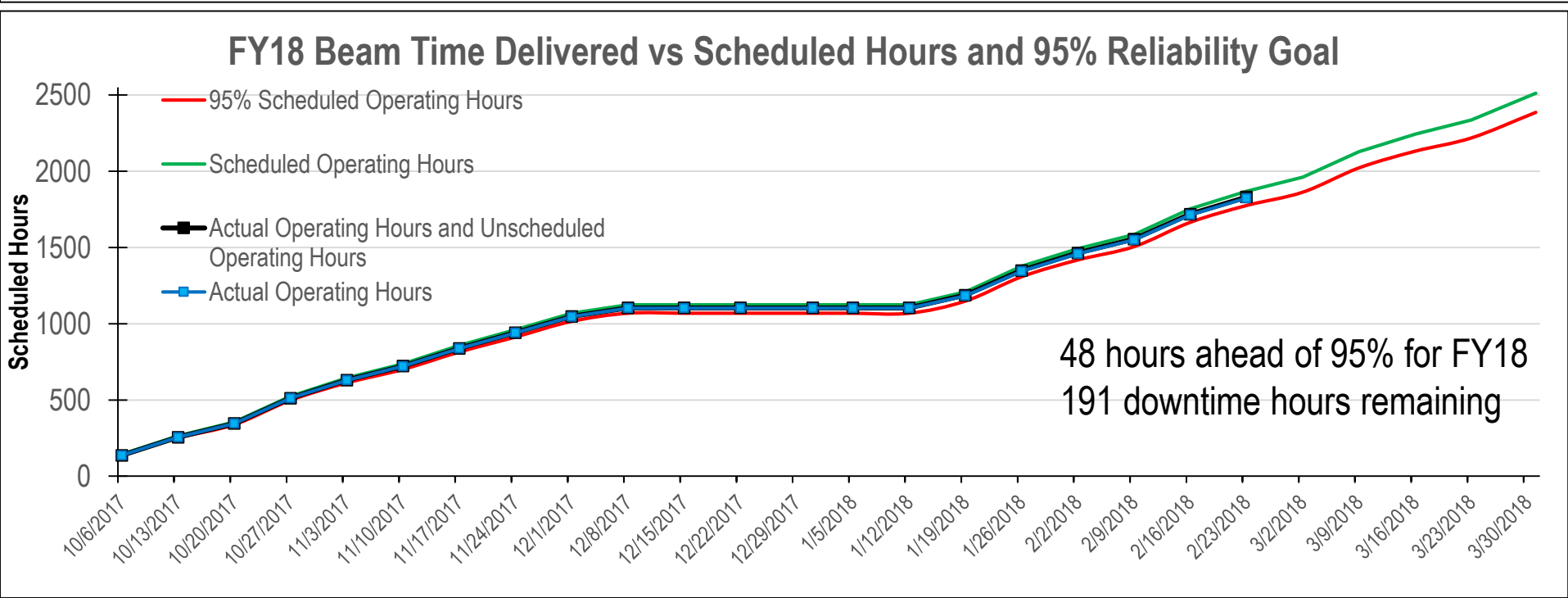
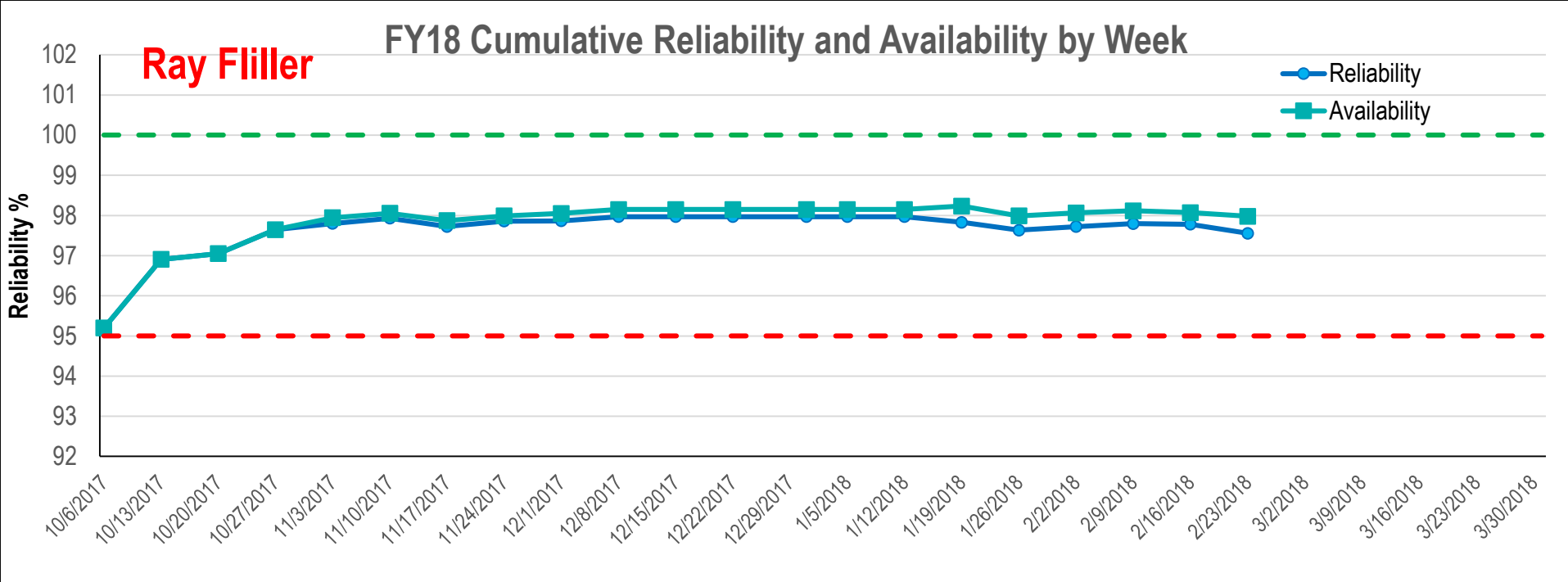


# FY18 Operations

Ray Filler

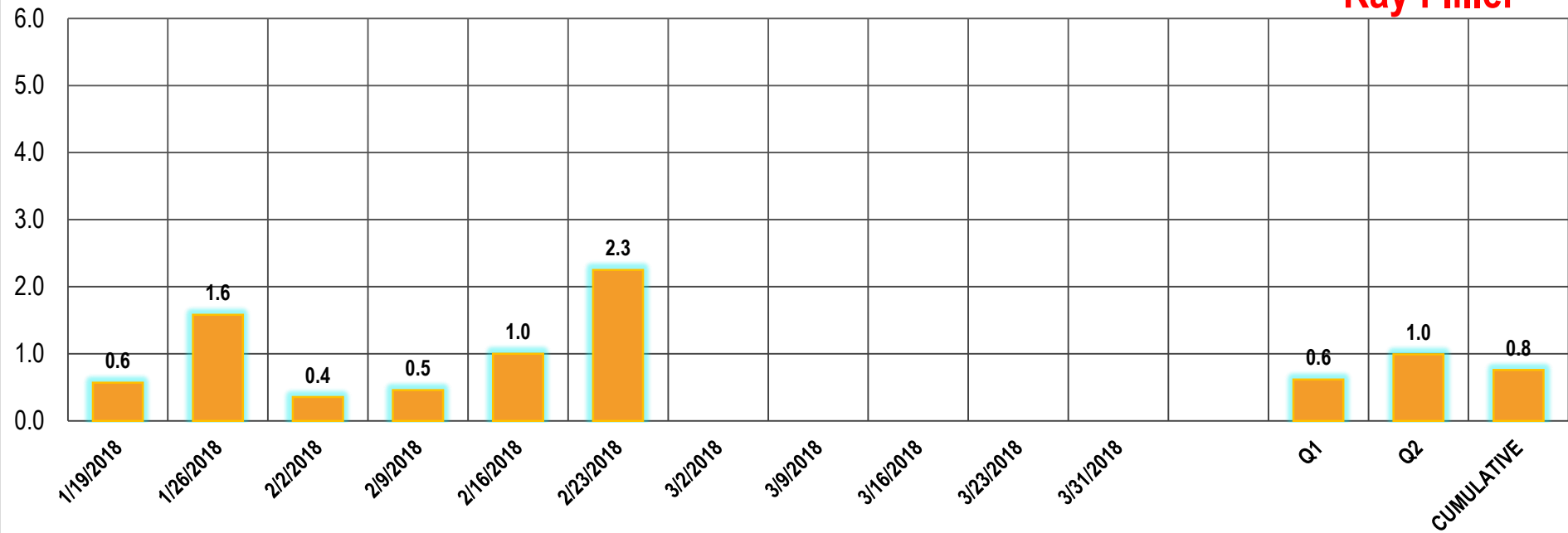
% Reliability  
% Availability



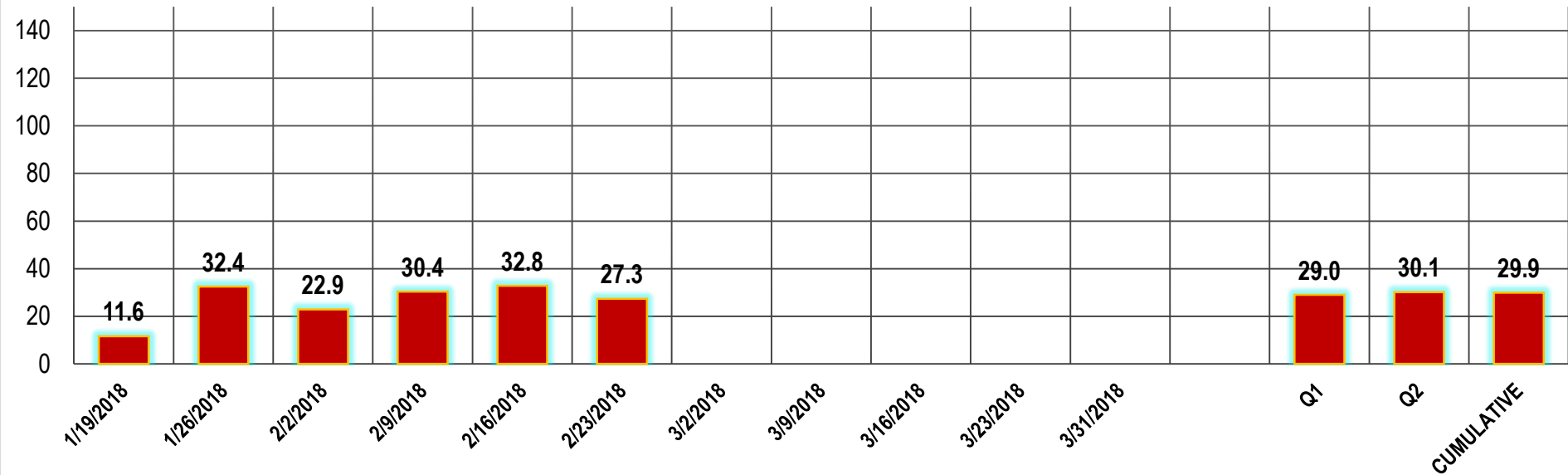


2018 Q2 Mean Time to Recovery (hours)

Ray Filler



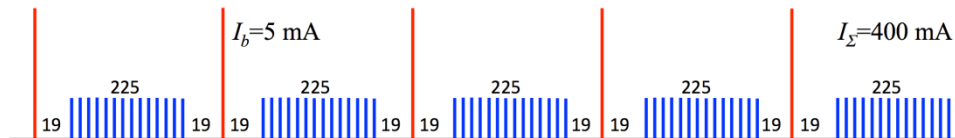
2018 Q2 Mean Time Between Failures (hours)



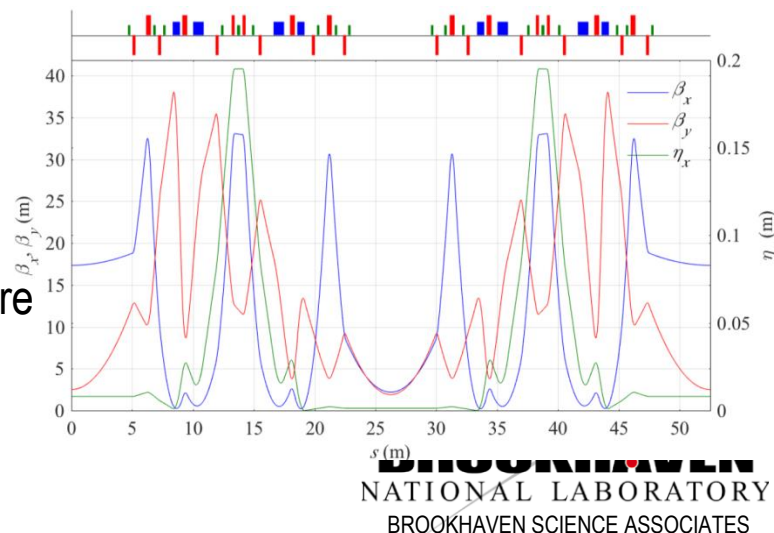


# News From Accelerator Physics

- **HLA common tools development:** measurement and correction of orbit and linear optics (beta function, coupling, dispersion); local bumps; beam-based alignment; measurement/correction/adjustment of betatron tunes and linear chromaticity + measurement of 2nd-order chromaticity; energy knob for Injector; measurement of beam transport efficiency RF Gun-Linac-LTB-Booster-BTS-SR;
- **New hybrid fill pattern for time-resolved experiments:** 5 trains and 5 high-intensity (>5mA) single bunches between the trains (driven by interest from the User Community in timing opportunities at NSLS-II).



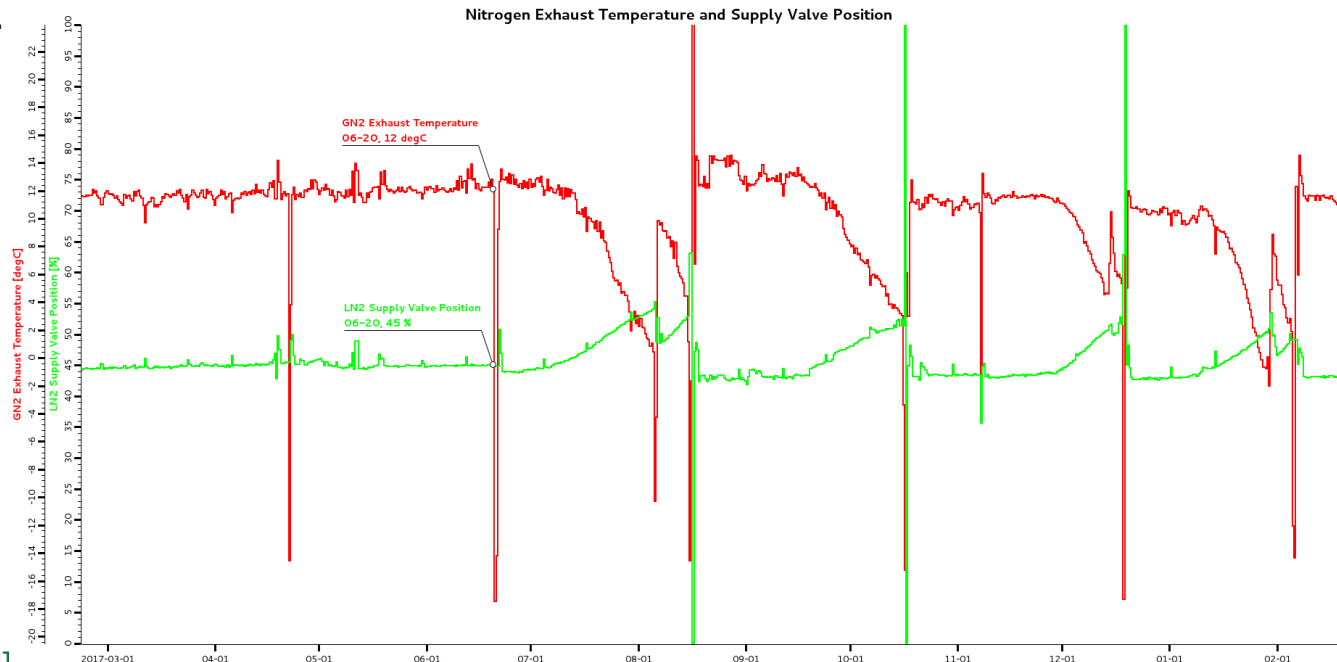
- **Beam dynamics with a 3<sup>rd</sup>-harmonic cavity** - beam lifetime improvement, bunch lengthening, feedback performance, and transverse beam instabilities.
- **Low-emittance upgrade option for NSLS-II: “split-bend” approach.**  
Linear optics with  $e_x = 333 \text{ pm-rad}$  has been developed with modification of girders 3,4,5.  
Work in progress: chromaticity correction, dynamic aperture injection options, collective effects, magnet design.



**Victor Smalyuk**

# Need for RF Cryo System Pump & Purge

- Following the burst disk incident in June, the RF cryo system has displayed a periodic degradation in performance.
- The plot below clearly shows this periodicity in the GN2 exhaust temperature and LN2 supply valve position.
- This performance forces the Cryo group to execute a regular pump & purge of the system in order to remove contaminants that entered when the helium system was exposed to atmosphere in June.
- Analysis of the extracted gas proves that the contamination is due to atmospheric elements.
- This is a stop gap measure until the system can be thoroughly cleaned when the 3<sup>rd</sup> RF cavity is installed.



Bill Gash



# Highlights of Winter Shutdown Activities

- Substation shutdown for trip module test, substations 1, 2, 3, 4, 5 and LB
- Core switch upgrade
- Install/test new Klystron tube in modulator 1
- Booster kicker hot cathode pulser installation
- Main Magnet Cooling Water Tasks
  - Flow test all magnets
  - Replace all P5 sextupole magnet water flow restrictors with full flow tubing
  - Clean quadrupole magnet water manifolds in BTS and other locations as required
  - Replace Dipole water manifolds
  - Cell 19, Flush girder C19G2 with Citrinix
  - Cell 29: C29G2 clean and flush girder
- Cells 2, 11, 21, 23, 28 Front End maintenance
- Cell 17BM: bleed up and install gate valve at mirror, repair water leak
- Cell 18 Front End: Replace bellows downstream of photon shutter and bake.
- Cell 22 Front End: FIS-MET installation, remove plug in wall, install vacuum pipe and shielding, modify pentant fence
- Cell 22 straight: install waveguide, capillary tubing and shielding for new RF cavity
- Cell 24 straight: Maintenance, leak check and partial warm up of RF cavity D, Full warm up of cavity C



**Lewis Doom**

**BROOKHAVEN**  
NATIONAL LABORATORY  
BROOKHAVEN SCIENCE ASSOCIATES



# Planned Spring Shutdown Activities

## ▪ Prior to Shutdown:

- Cryo cold box warm-up & pump/purge
- 22-BM – Cable pulling, mechanical utilities, grout M1 floor plate
- Cell 19 - Remove NYX IVU & rack electronics on 3/20; install spool piece in SR
- Install new cooling circuit in NYX IVU in bldg. 832

## ▪ During Shutdown:

- Cell 19 – Reinstall NYX IVU, bake
- 22-BM – New dipole chamber, optics, cable term, EPS work
- 3<sup>rd</sup> RF cavity prep – core drill SR mezz, install doghouses, install penetration cable tray
- Cell 22 Str – Remove day 1 chamber, reinstall & bake for above core drilling
- Cryo system warm-up & pump/purge; including RF cavities??

- 17-BM FE – Repair mirror, bake?? (new bathtub may not be ready)
- Cells 16/17 – Install thermocouples above vehicle tunnel
- PPS tie-in of new P1/P5 PPS gate
- FIS-MET – install laser interlock, ODH
- PPS certification of FIS-MET laser interlock??
- PPS recertification of linac
- PPS recertification of 5-ID, 8-ID, 16-ID, 17-BM, & 17-ID
- Power shut-down for maintenance of 13.8 kV sub-stations 2, RF, & Injector
- Preventative maintenance on FE shutters 5-ID, 8-ID, 16-ID, 17-BM, & 17-ID
- Continuing work on booster hot cathode
- Cooling tower valve repair (3 valves; requires draining of CT)



# Ask for Help From the Floor Coordinators

Floor Coordinators (Flocos) are skilled technical staff members that have many years of experience prior their current roles.

Operations staff are being trained to execute some routine accelerator system repairs such as main magnet Klixon panel replacement.

We encourage beamline staff to call on them to help with issues such as monitoring processes and filling LN2 Dewars.

We can also help with some mechanical fabrication.

Our extension is 5046 which rings simultaneously to a mobile Cisco phone.





# Closing Remarks

---

FY18 storage ring performance continues on a strong track

The Accelerator Division staff members are working to complete several new installations as well as improving and maintaining equipment and systems to ensure high reliability

The Accelerator Physics Group is looking at ways to ensure that the accelerators operate at their peak levels and are developing future upgrades

Take advantage of the 24/7 presence of the Floco and Operations staff to assist you.

-Thank you-

-Questions-

