

Machine Update

NSLS-II Town Meeting

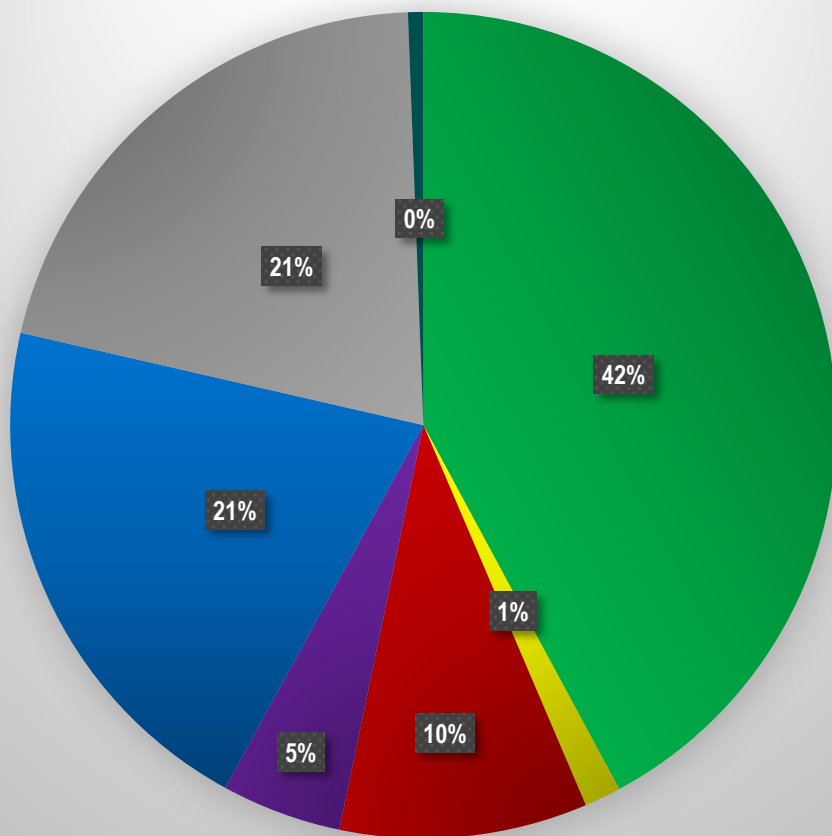
Emil Zitvogel

Wednesday August 5, 2015

Topics

- Statistics
- Schedule
- Storage Ring Performance
- Booster Dipole Power Supply Failure
- Spring Shutdown Highlights
- Aug-Sep Shutdown Plans
- Closing Remarks

Statistics Through July 31st



Operations:	1740.4 hrs
Injection/Setup:	59.1 hrs
Sched. Studies:	851.7 hrs
Sched. Maintenance:	194.2 hrs
Failure:	400.3 hrs
Shutdown:	859.6 hrs
Unscheduled Operations:	24.7 hrs

Reliability:

Of 2074.4 scheduled hrs from Feb-July 2015:

Operations:	83.9%
Injection/Setup:	2.8%
Failure:	13.3%

Availability:

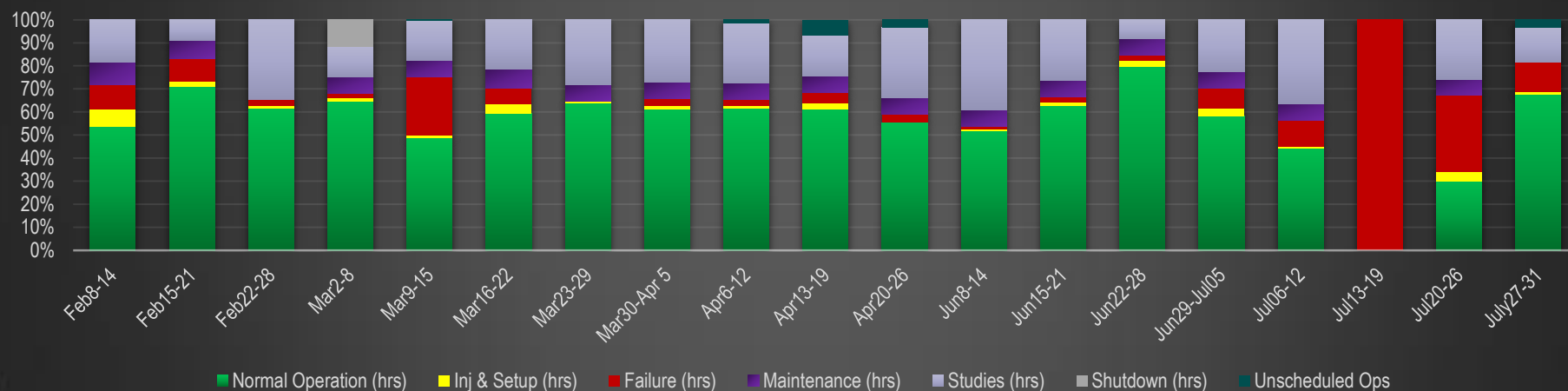
Of 2074.4 scheduled hrs from Feb-July 2015 :

Delivered Beam Time:	85.1%
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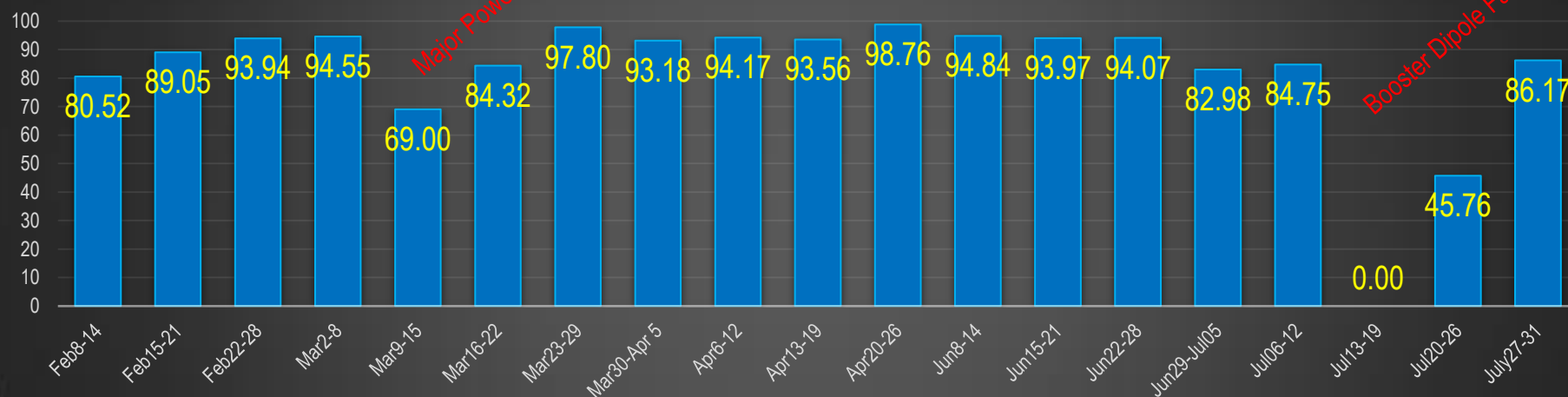
Compiled by Reid Smith

Statistics Through July 31st

Weekly Breakdown of Machine Time during Operations - 2015



Operations % Reliability



Schedule

May							June							July							August						
Half Shifts							Half Shifts							Half Shifts							Half Shifts						
Day	0-4	4-8	8-12	12-16	16-20	20-24	Day	0-4	4-8	8-12	12-16	16-20	20-24	Day	0-4	4-8	8-12	12-16	16-20	20-24	Day	0-4	4-8	8-12	12-16	16-20	20-24
1	D	D	D	D	D	D	1	D	D	S	S	S	S	1	S	S	O	O	O	O	1	O	O	O	O	O	O
2	D	D	D	D	D	D	2	S	S	S	S	S	S	2	O	O	O	O	O	O	2	O	O	O	O	O	O
3	D	D	D	D	D	D	3	S	S	S	S	S	S	3	O	O	O	O	O	O	3	O	O	O	O	O	O
4	D	D	D	D	D	D	4	S	S	S	S	S	S	4	O	O	O	O	O	O	4	O	O	O	O	O	O
5	D	D	D	D	D	D	5	S	S	S	S	S	S	5	S	S	S	S	S	S	5	S	S	S	S	S	S
6	D	D	D	D	D	D	6	S	S	S	S	S	S	6	S	S/M	M	M	M/S	S	6	S	S	S	S	S	S
7	D	D	D	D	D	D	7	S	S	S	S	S	S	7	S	S	S	S	S	S	7	S	S	S	S	S	S
8	D	D	D	D	D	D	8	S	S	S	S	S	S	8	S	S	S	S	S	S	8	S	S	S	S	S	S
9	D	D	D	D	D	D	9	S	S/M	M	M	M/S	S	9	S	S	O	O	O	O	9	S	S	S	S	S	S
10	D	D	D	D	D	D	10	S	S	S	S	O	O	10	O	O	O	O	O	O	10	S	S	S	S	S	S
11	D	D	D	D	D	D	11	O	O	O	O	O	O	11	O	O	O	O	O	O	11	S	S/M	M	M	M/S	S
12	D	D	D	D	D	D	12	O	O	O	O	O	O	12	O	O	O	O	O	O	12	S	S	S	S	S	S
13	D	D	D	D	D	D	13	O	O	O	O	O	O	13	O	O	O	O	O	O	13	S	S	S	S	S	S
14	D	D	D	D	D	D	14	O	O	O	O	S	S	14	S	S/M	M	M	M/S	S	14	S	S	S	S	S	S
15	D	D	D	D	D	D	15	S	S	S	S	S	S	15	S	S	O	O	O	O	15	S	S	S	S	S	S
16	D	D	D	D	D	D	16	S	S/M	M	M	M/S	S	16	O	O	O	O	O	O	16	S	S	S	S	S	S
17	D	D	D	D	D	D	17	S	S	O	O	O	O	17	O	O	O	O	O	O	17	S	S	D	D	D	D
18	D	D	D	D	D	D	18	O	O	O	O	O	O	18	O	O	O	O	S	S	18	D	D	D	D	D	D
19	D	D	D	D	D	D	19	O	O	O	O	O	O	19	S	S	S	S	S	S	19	D	D	D	D	D	D
20	D	D	D	D	D	D	20	O	O	O	O	O	O	20	S	S	S	S	S	S	20	D	D	D	D	D	D
21	D	D	D	D	D	D	21	O	O	O	O	O	O	21	S	S/M	M	M	M/S	S	21	D	D	D	D	D	D
22	D	D	D	D	D	D	22	O	O	O	O	O	O	22	S	S	O	O	O	O	22	D	D	D	D	D	D
23	D	D	D	D	D	D	23	O	O/M	M	M	M/S	S	23	O	O	O	O	O	O	23	D	D	D	D	D	D
24	D	D	D	D	D	D	24	S	S	O	O	O	O	24	O	O	O	O	O	O	24	D	D	D	D	D	D
25	D	D	D	D	D	D	25	O	O	O	O	O	O	25	O	O	O	O	O	O	25	D	D	D	D	D	D
26	D	D	D	D	D	D	26	O	O	O	O	O	O	26	O	O	O	O	O	O	26	D	D	D	D	D	D
27	D	D	D	D	D	D	27	O	O	O	O	O	O	27	O	O	O	O	O	O	27	D	D	D	D	D	D
28	D	D	D	D	D	D	28	O	O	O	O	O	O	28	O	O/M	M	M	M/S	S	28	D	D	D	D	D	D
29	D	D	D	D	D	D	29	O	O	O	O	O	O	29	S	S	O	O	O	O	29	D	D	D	D	D	D
30	D	D	D	D	D	D	30	O	O/M	M	M	M/S	S	30	O	O	O	O	O	O	30	D	D	D	D	D	D
31	D	D	D	D	D	D								31	O	O	O	O	O	O	31	D	D	D	D	D	D
Total Hours - May							Total Hours - June							Total Hours - July							Total Hours - August						
Total Days - May							Total Days - June							Total Days - July							Total Days - August						
744							720							744							744						
31							30							31							31						

Unscheduled

Ops

Maintenance
is canceled



Schedule

September						
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	D	D	D	D
15	D	D	D	D	D	D
16	D	D	D	D	D	D
17	D	D	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	S	S	S	S
29	S	S	S	S	S	S
30	S	S	S	S	S	S

Total Hours - September 720
Total Days - September 30

October						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	S	S	S	S	S	S
2	S	S	S	S	S	S
3	S	S	S	S	S	S
4	S	S	S	S	S	S
5	S	S	S	S	S	S
6	S	S/M	M	M	M/S	S
7	S	S	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/S	S
14	S	S	O	O	O	O
15	O	O	O	O	O	O
16	O	O	O	O	O	O
17	O	O	O	S	S	S
18	S	S	S	S	S	S
19	S	S	S	S	S	S
20	S	S/M	M	M	M/S	S
21	S	S	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	O	O	O	O
27	O	O/M	M	M	M/S	S
28	S	S	O	O	O	O
29	O	O	O	O	O	O
30	O	O	O	O	O	O
31	O	O	O	S	S	S

Total Hours - October 744
Total Days - October 31

November						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	S	S	S	S	S	S
2	S	S	S	S	S	S
3	S	S/M	M	M	M/S	S
4	S	S	O	O	O	O
5	O	O	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/M	M	M	M/S	S
11	S	S	O	O	O	O
12	O	O	O	O	O	O
13	O	O	O	O	O	O
14	O	O	O	S	S	S
15	S	S	S	S	S	S
16	S	S	S	S	S	S
17	S	S/M	M	M	M/S	S
18	S	S	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	S	S	S	S
25	S	S	S	S	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

PPS recertification due in November
Total Hours - November 720
Total Days - November 30

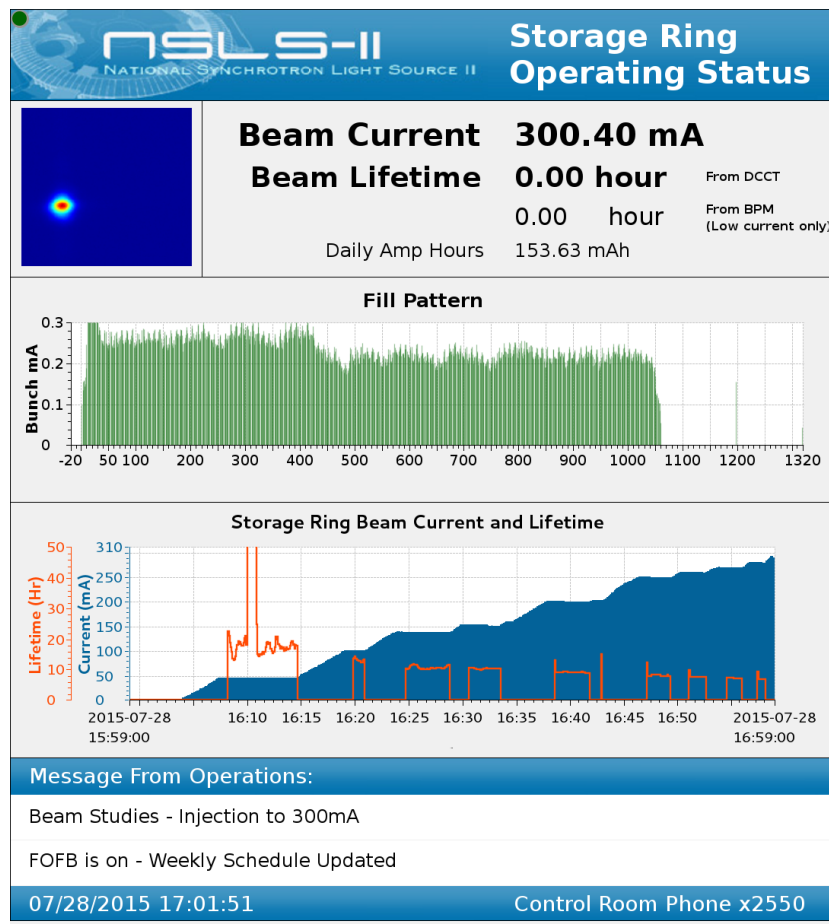
December						
Day	Half Shifts					
	0-4	4-8	8-12	12-16	16-20	20-24
1	D	D	D	D	D	D
2	D	D	D	D	D	D
3	D	D	D	D	D	D
4	D	D	D	D	D	D
5	D	D	D	D	D	D
6	D	D	D	D	D	D
7	D	D	D	D	D	D
8	D	D	D	D	D	D
9	D	D	D	D	D	D
10	D	D	D	D	D	D
11	D	D	D	D	D	D
12	D	D	D	D	D	D
13	D	D	D	D	D	D
14	D	D	D	D	D	D
15	D	D	D	D	D	D
16	D	D	D	D	D	D
17	D	D	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

Total Hours - December 744
Total Days - December 31

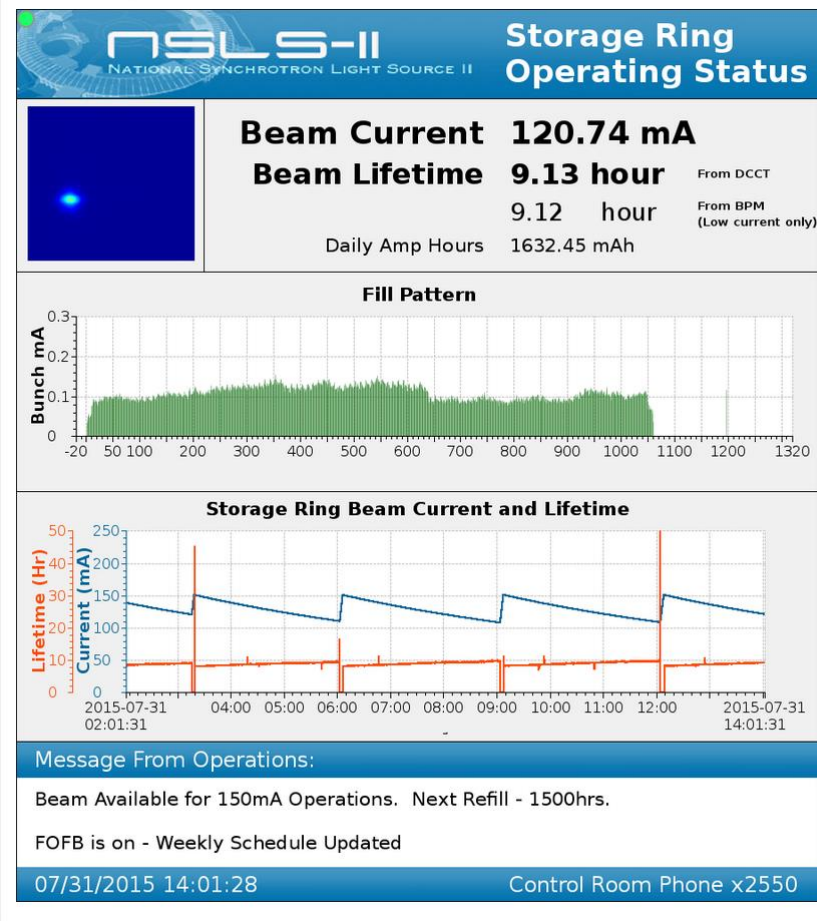


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ENERGY

Storage Ring Performance



300 mA!

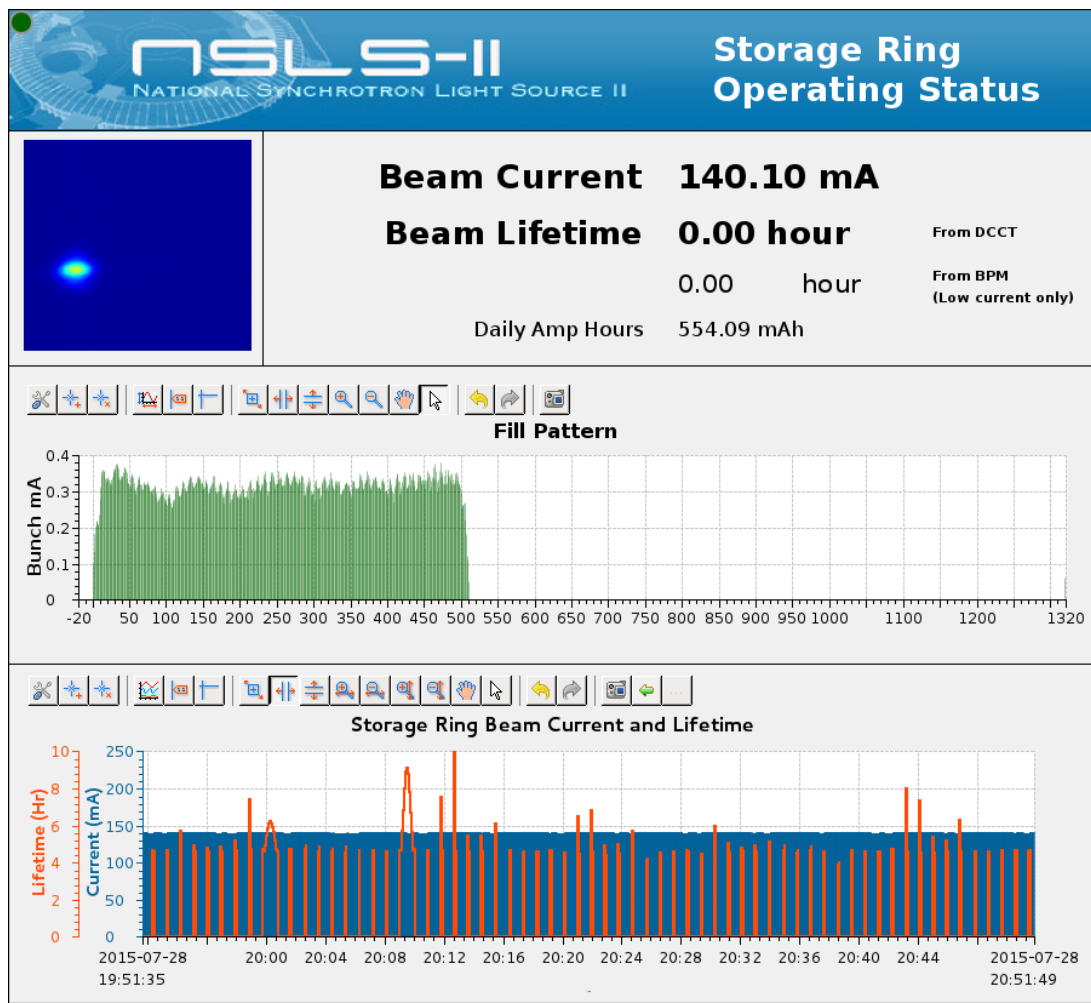


Routine Ops at 150 mA



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Storage Ring Performance



Preparation for Top-Off operation continues at a good pace.

- ✓ 20% bunch-to-bunch variation has been achieved (ignoring the leading and trailing bunches)
- ✓ 0.5% variation in ring current has also been achieved.

The Top-Off Safety System fabrication and installation is continues on schedule.

Results from Top-Off Injection Studies on July 28th



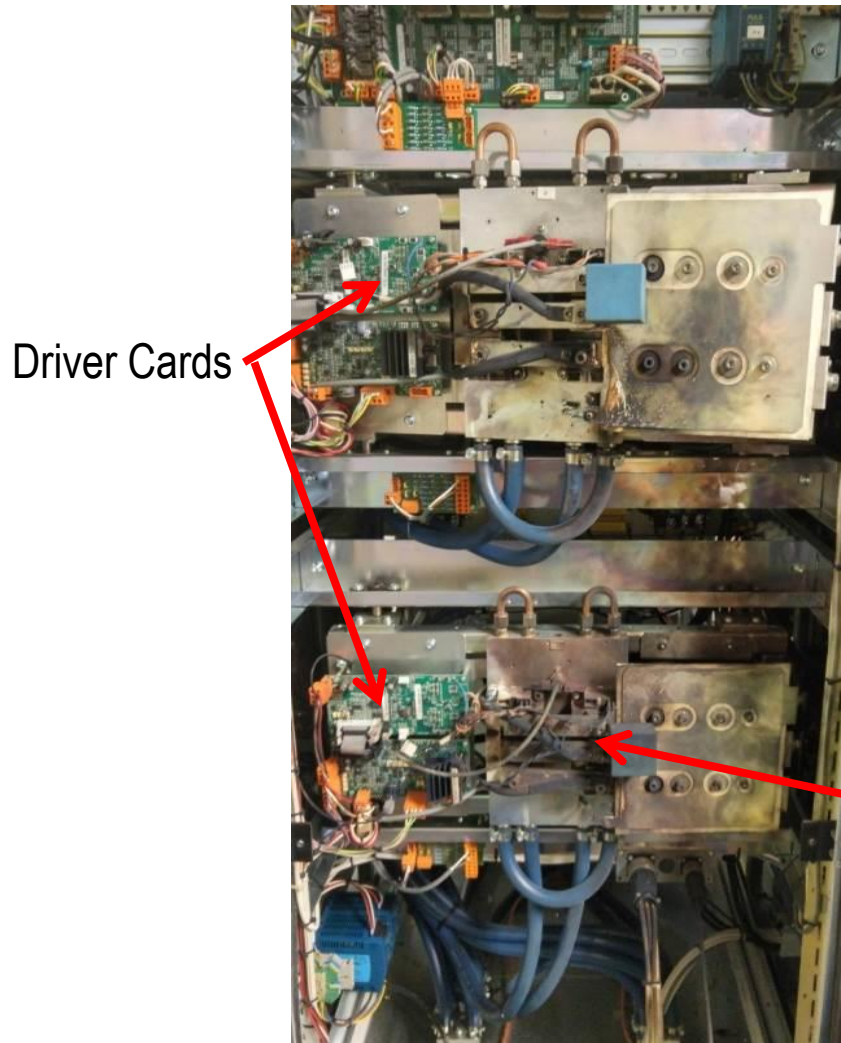
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Booster Dipole BD1 Power Supply Failure

- At 1:31 am on July 12th the Operator on-duty received an alarm that the BD1 power supply had tripped off.
- The booster dipoles are fed in 2 strings with 2 separate but identical power supplies, BD1 and BD2.
- The power supply ratings are 750 A and 700 V which is required to drive the magnets to full field @ 3GeV in only 300 ms. The supplies were manufactured by Danfysik
- After attempts to reset the supply via the control system an operator and floor coordinator inspected the supply and found that both the DC output breaker and the AC line breaker had opened.
- Calls went out to technical experts.
- Upon their arrival on Sunday morning, they found that the supply had extensive damage from internal arcing.
- This was obviously going to require some time to complete the repair.



Booster Dipole BD1 Power Supply Failure



Damaged IGBTs and Their Driver Cards
in the BD1 Power Supply

{ IGBT stands for Insulated Gate
Bipolar Transistor }

IGBTs Mounted Behind
Cooling Plate

Booster Dipole BD1 Power Supply Failure

- The root cause is believed to be a damaged high voltage cable in the power supply.
- Repairs were completed late on Monday. After careful inspection and testing in an inactive state the power supply was re-energized.
- At this point the supply failed again in the same manner.
- Following additional failures we obtained an AC transformer that allowed us to perform tests at current-limited, intermediate voltages giving us insight and control of the method of failure.
- We were also fortunate to redirect the Danfysik engineer who designed and built the power supply from his vacation in Canada.
- It was discovered that the specifications for our spare IGBTs differed from the original IGBTs but had the same part number. The gate drive resistance needed to be 4 ohms for the spare components instead of 2 ohms required and built into the supply for the original components.

Booster Dipole BD1 Power Supply Failure



BD1 IGBT Failures

An Original IGBT

A Replacement IGBT

Booster Dipole BD1 Power Supply Failure

- Following complete replacement of all IGBTs with an upgraded part, the power supply was able to be returned to full service on July 24th at 3:05 pm .
- Our thanks go out to everyone involved with the repair for the long and frustrating hours spent chasing this problem.
- Despite the high power that they were working with, all activities were conducted with safety having the utmost importance.

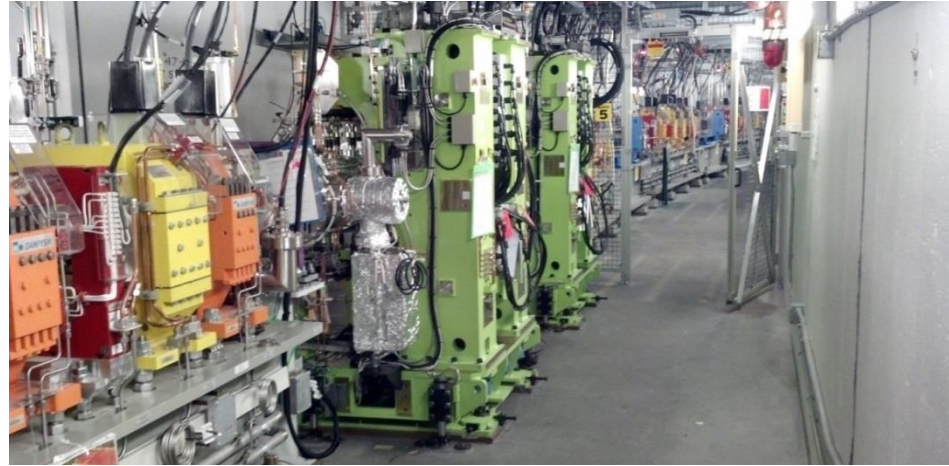
Spring Shutdown Highlights

- Installed three ABBIX IVUs in cells 16 & 17 (AMX/FMX & LIX)
- Finished installation of ABBIX front ends
- Baked & final surveyed IVU straights & front ends
- Began testing IVU controls In-situ
- Cable pulling and floor prep work for NEXT front ends
- Modified ratchet wall for Partner (XFP) beamline
- Installed compound refractive lens in IXS front end
- Installation work for Top-off injection
- Preparation work for future second RF cavity
- PPS re-certification of linac, booster, SR, & 3 beamlines

Spring Shutdown Highlights



LIX IVU in Cell 16



AMX/FMX IVUs in Cell 17



AMX/FMX Front End in Cell 17

Provided by Greg Fries

Aug-Sep Shutdown Plans

- Install NEXT IVU in cell 4 (ISR)
- Finish installation of NEXT ISR & ISS front ends
- Installation work on balance of NEXT front ends
- Cable pulling & floor prep work on Partner & BDN front ends
- May install second RF cavity, not yet determined
- Repair broken pole tip on IXS IVU
- Finish Top-off injection installation, testing & installation
- PPS certification of ABBIX LIX beamline
- PPS re-certification of 3 beamlines

Provided by Greg Fries

Closing Remarks

Except for the booster dipole failure, NSLS-II has performed very reliably and with the performance that we expect at this early stage

We expect that Top-Off operation will commence on schedule early in FY16

We are pleased to welcome and support our first users
Installation of new beamline components continues at a quick pace

Thank you

