

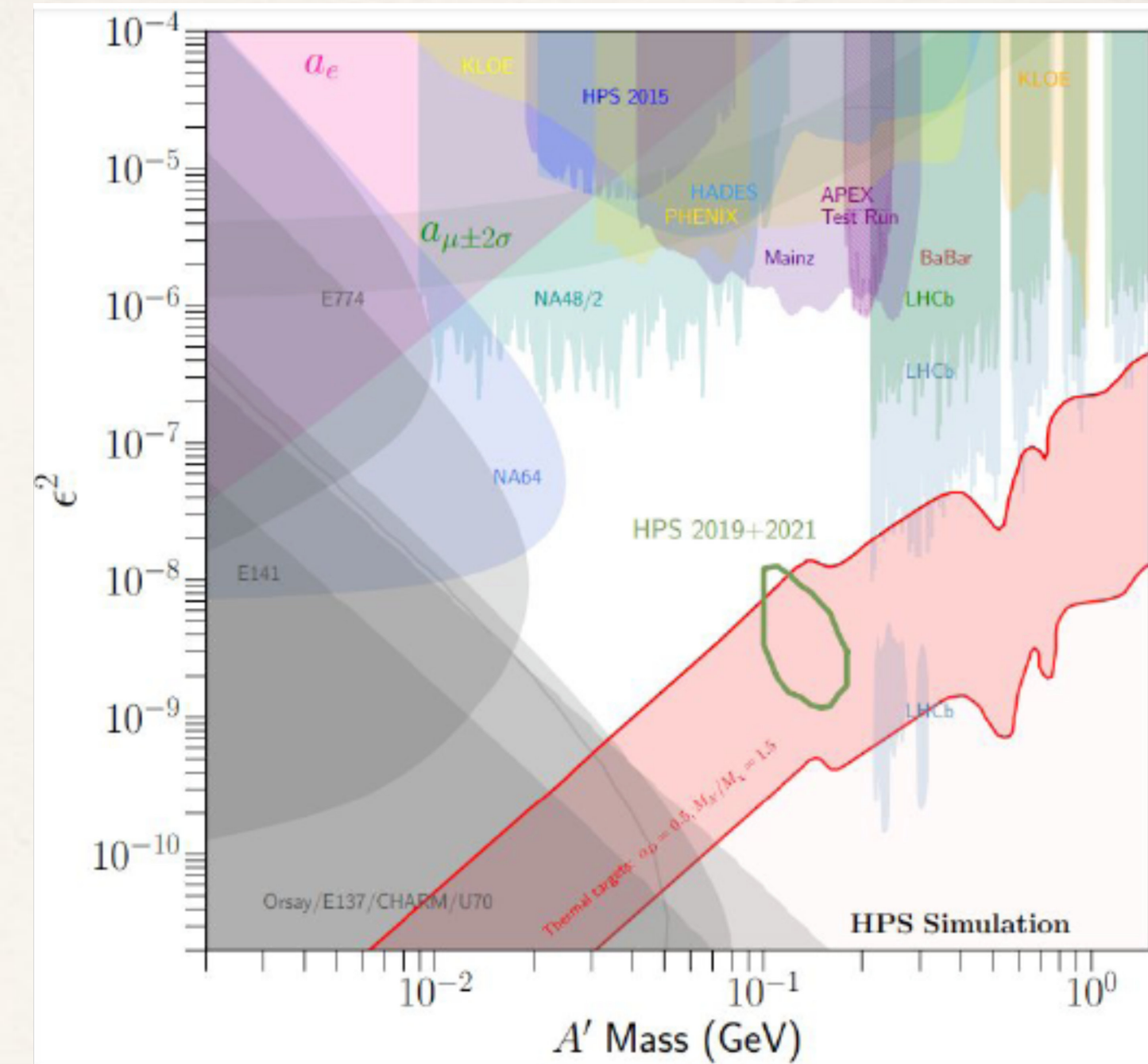
Summary of the 2021 Run

HPS Collaboration Meeting, online, November 15-17, 2021

November 15, 2021

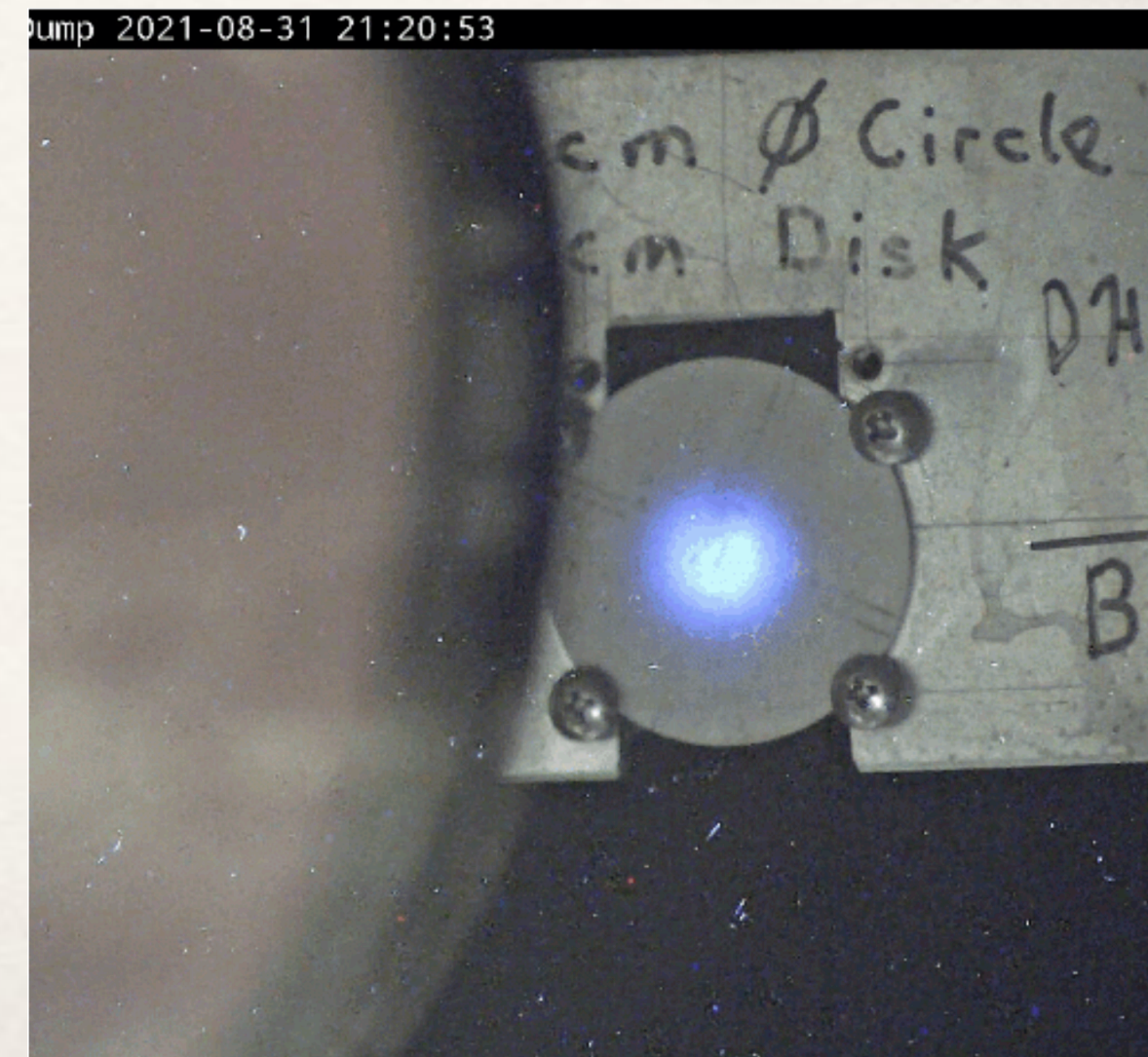
HPS 2021 Run - As Planned

- ❖ Request: 4 PAC weeks at 3.7 GeV.
- ❖ First scheduled (July 2020) to run at 3.7 GeV, from June 21st until August 14 = 55 days, or ~3.5 PAC weeks with 6 days commissioning.
- ❖ On March 16, 2021, schedule was changed to August 23 to October 16, still 55 days, but with 2 days lost to pass changes for Hall-C, and 2 days at 1.9 GeV
 - ❖ Expected luminosity: 200 fb⁻¹.
 - ❖ Shifts were generated for August 22 - October 17. Due to travel restrictions, we decided worker shifts should be remote.
 - ❖ Quite some pressure on the SVT group to get all the parts for the SVT on time.
- ❖ Due to accelerator issues, the run was extended by 2 1/2 weeks, until November 5th. Official schedule: Sept 7 - Nov 5.

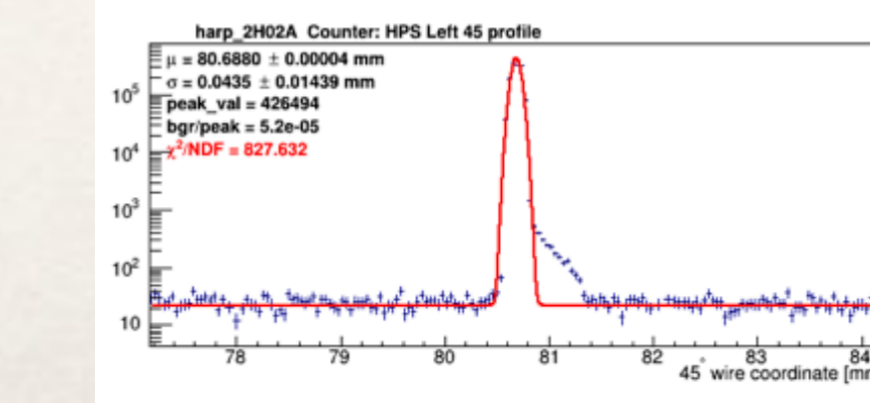
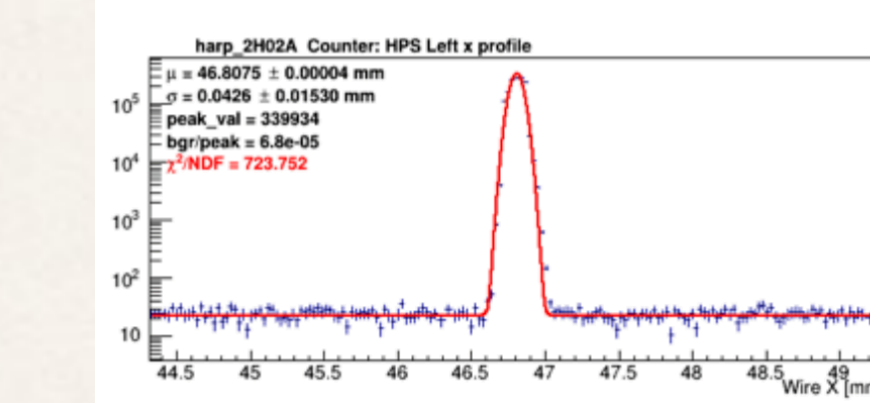
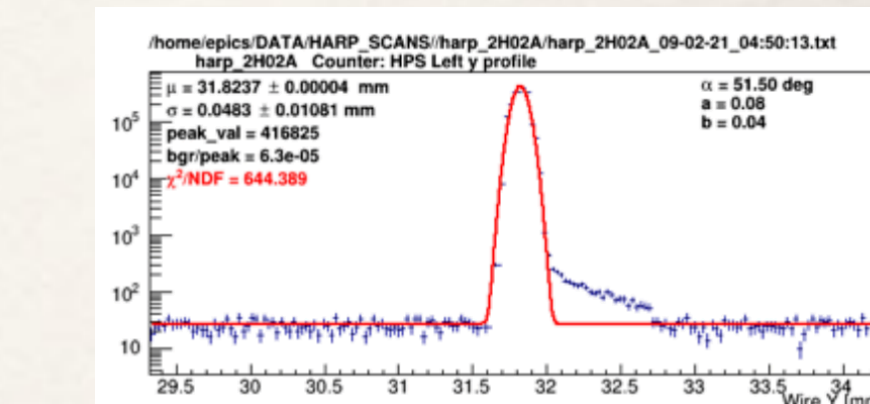
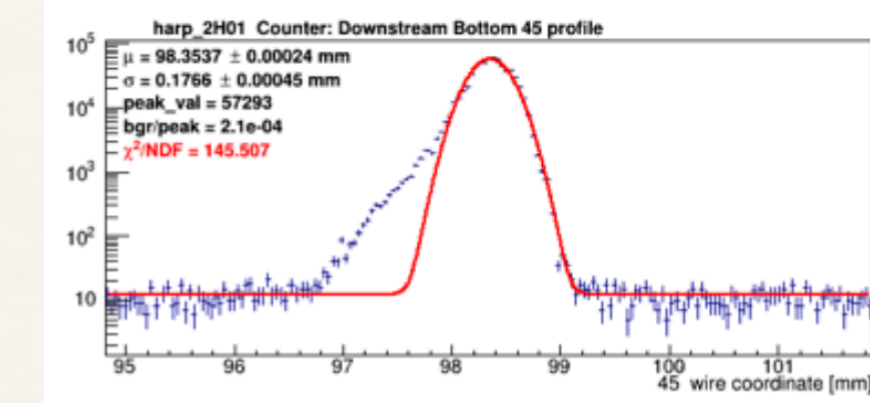
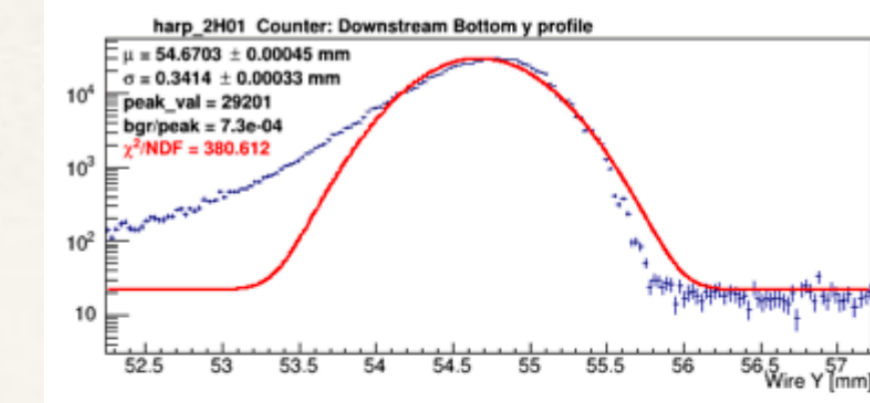
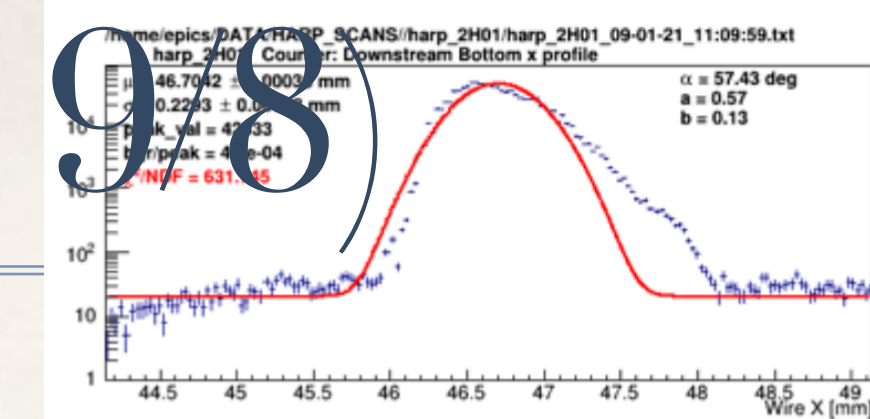


Finish HPS Installation - Week 1,2 (8/23 - 8/31)

- ❖ 8/23-25 (Mon - Wed): Complete SVT repairs: Replaced damaged layers, reshuffled modules, install new FEBs.
- ❖ 8/26 (Thursday): Surveyed & aligned SVT, calibrate SVT movers, finish putting beam line together.
- ❖ 8/27 (Friday): Survey beam line. Replace conductive SVT box support with non-conductive one.
- ❖ 8/28 (Sat) Connect dipole, fix vacuum leak, install target, close HPS, pump down.
 - ❖ SVT top runs into hard stop, losing alignment.
- ❖ 8/29, 30 (Mon): Re-survey SVT removing only front flange, work finished in 1 day. Pump down HPS.
- ❖ 8/31 (Tues): Machine maintenance day. SVT movers checked in vacuum.
 - ❖ Turbo pump reset gets vacuum to 7×10^{-5} torr.
- ❖ 8/31 (Tuesday 8pm) First beam on Tagger dump!



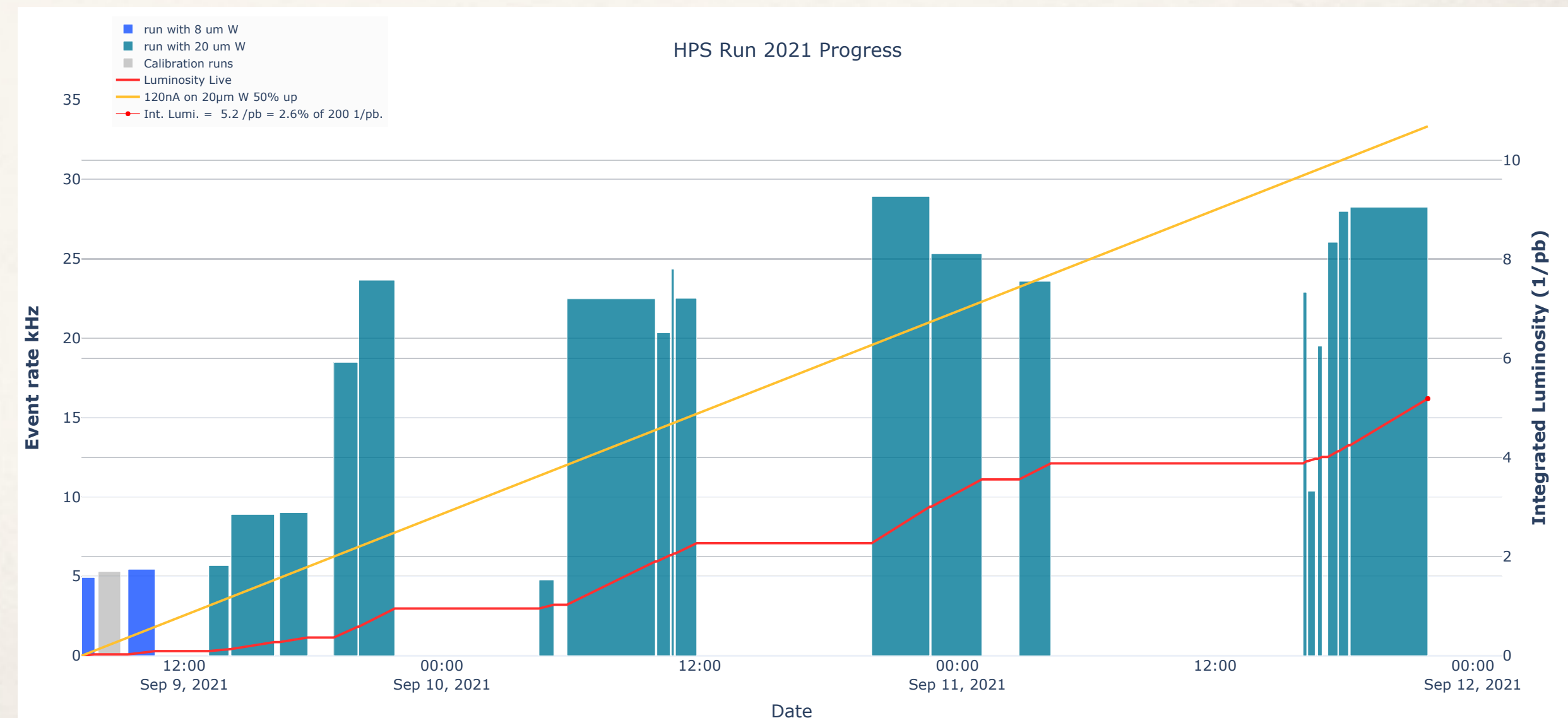
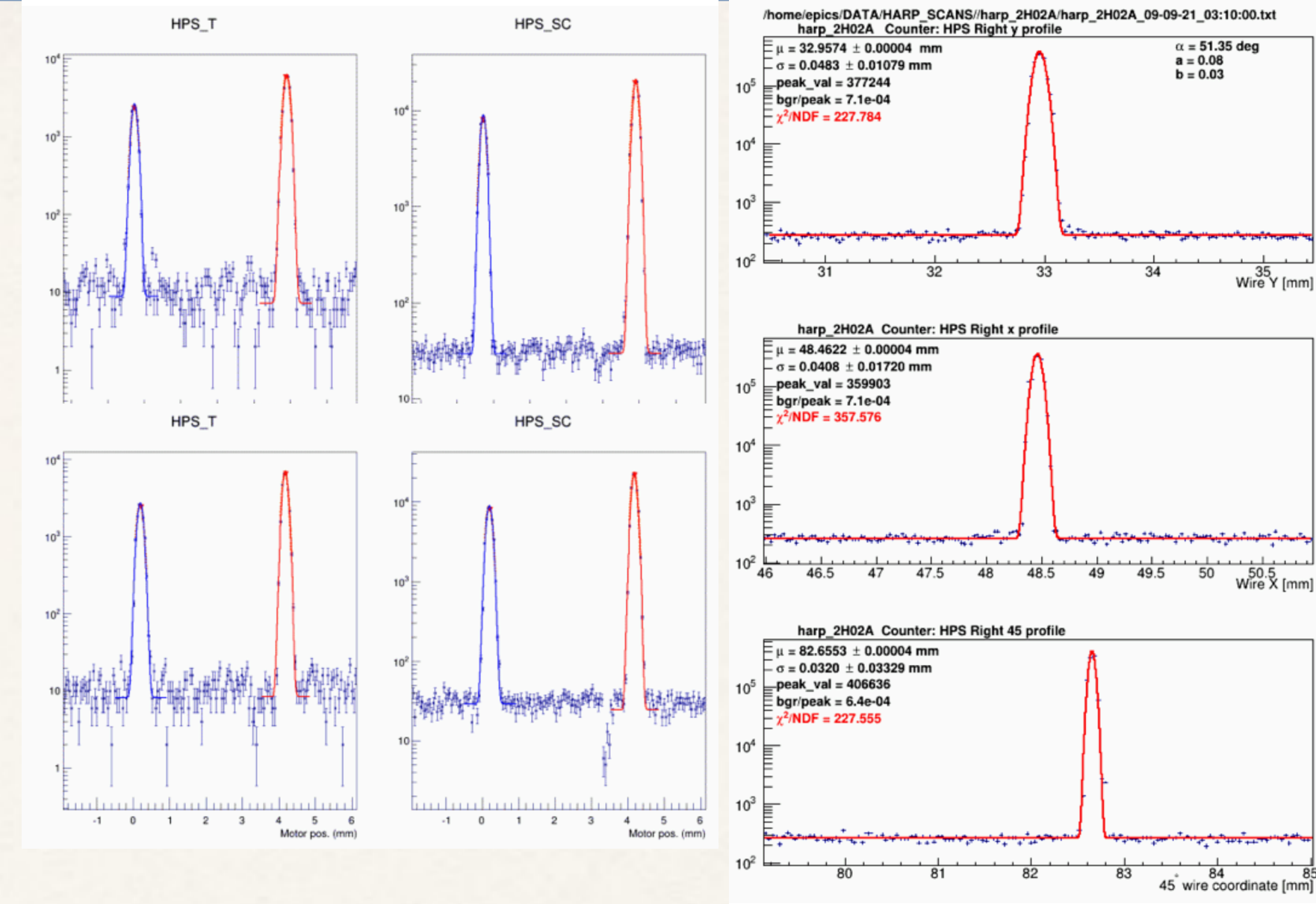
HPS Commissioning - Week 2½, 3½ (9/1 - 9/8)



- ❖ 9/1 (Wed): Beam tuning. Issues with beam tails.
 - ❖ SVT baseline runs as SVT is cooling
- ❖ 9/2 (Thur): Continue beam tuning. Accelerator RF work to try resolve tail.
- ❖ 9/3 (Fri): Continue beam tuning. Issues with orbit lock were resolved.
 - ❖ Hodoscope and Faraday Cup calibration.
- ❖ 9/4 -5 - No beam on the weekend as Hall-C is setup for 5 pass.
- ❖ 9/6 (Mon): Acceptable beam by 5:30am.
 - ❖ Trigger validations: Moller trigger test, hodoscope only trigger, calorimeter only trigger.
 - ❖ SVT Commissioning - All detectors on, SVT at 1.5 mm.
- ❖ 9/7 (Tues): SVT to 1mm. First run with tracks in DQM.
- ❖ 9/8 (Wed): Beam tuning.
 - ❖ Injector work to check tail issue. - opportunistic access to fix ECal noise, SVT camera, RF signal cable.

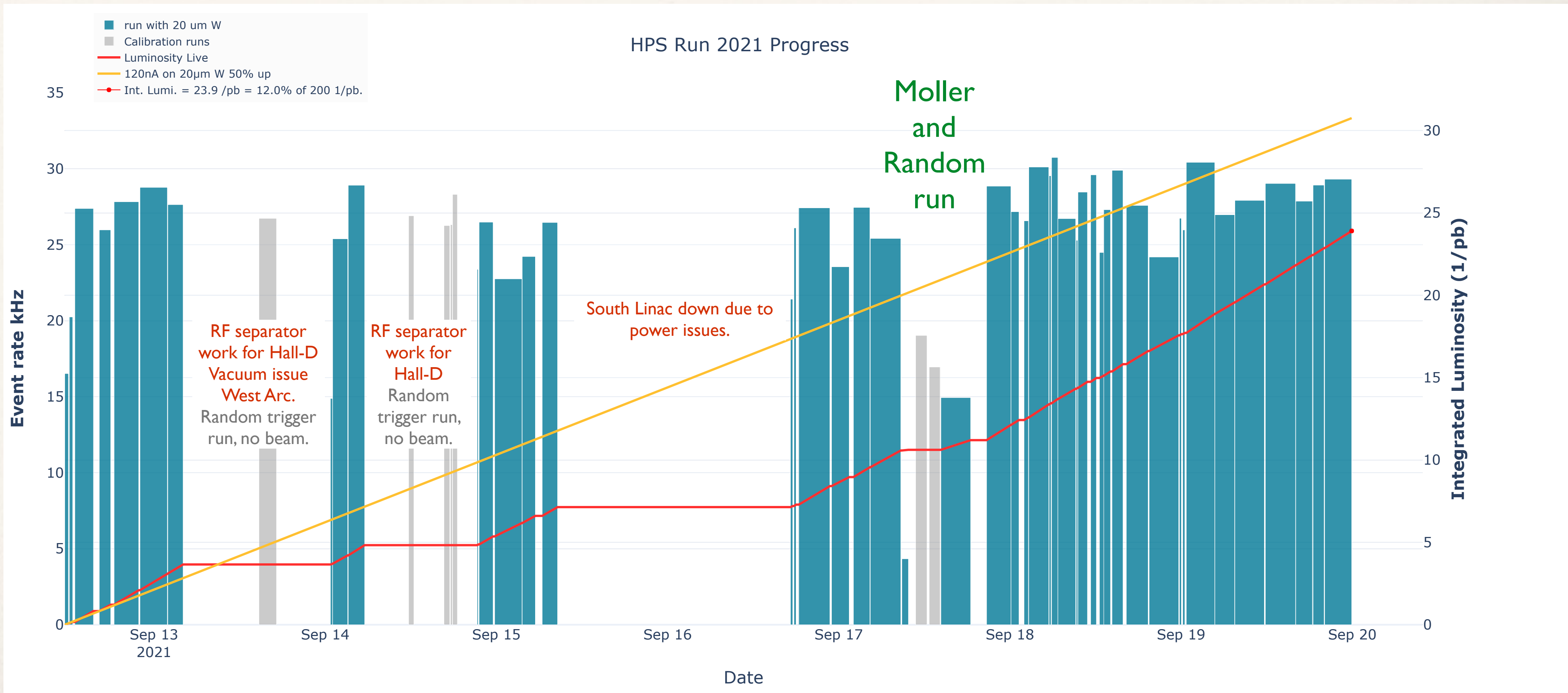
HPS Production - Week 3 $\frac{1}{2}$ (9/9 - 9/12)

- ❖ 9/9 (Thur): 6am good beam, no tail. 8am - Production running.
- ❖ Test trigger rates with $8\mu\text{m}@ 300\text{nA}$, $20\mu\text{m}@ 120\text{nA}$
- ❖ Resolved issue with low live-time => networking between DAQ computers.
- ❖ HPS Dipole trip - no clear reason. (No detector issue this time!)
- ❖ 9/10 (Fri): Production running.
- ❖ Breaker trips due to power surge. ECal HV power supply damaged, replaced.
- ❖ 9/11 - 12 (Sat, Sun): Lots of accelerator issues.
- ❖ Cameron improves load balance of SVT. Live time to 82% @ 30kHz.
- ❖ 9/12 - Int. Luminosity = $5.2 \text{ pb}^{-1} = 2.6\%$



HPS Production - Week 4 (9/12 - 9/20)

- ❖ RF Separator work and issues with accelerator made for inefficient running during start of week.
- ❖ Second half is very good.
- ❖ Special runs: Moller only, Random trigger with beam.



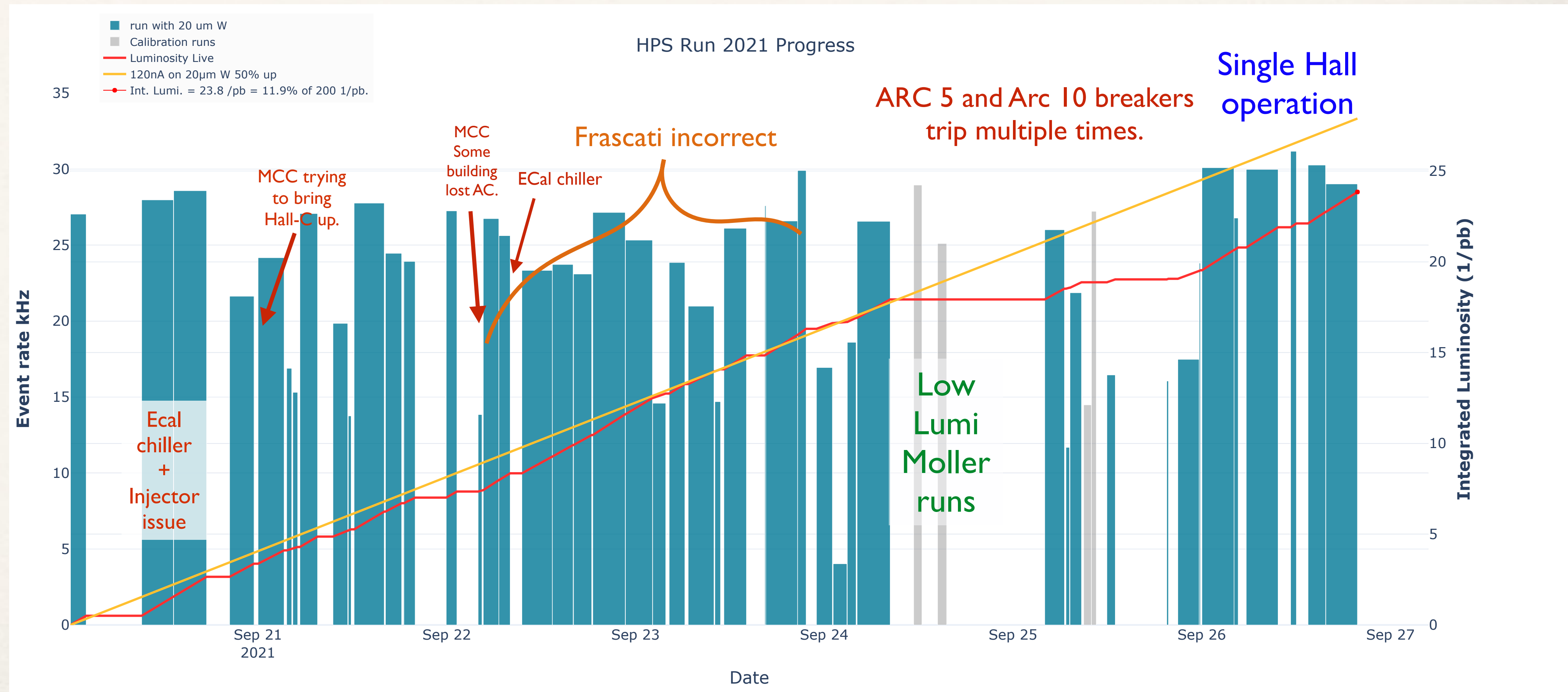
❖ Int. Lumi this week: 23.9 pb⁻¹ = 12% (expect 8 days= 32.6 pb⁻¹ so 73% for this period)

HPS Production - Week 5 (9/20 - 9/27)

- ❖ Ecal chiller issues + accelerator issues cause several ~4 hour blocks of downtime.
- ❖ Frascati not properly energized (i.e. wrong) for runs 14338 14355
- ❖ Low luminosity Moller runs, full luminosity random runs.

❖ After multiple trips of Arc 5 & 10 breaker, some single hall running.

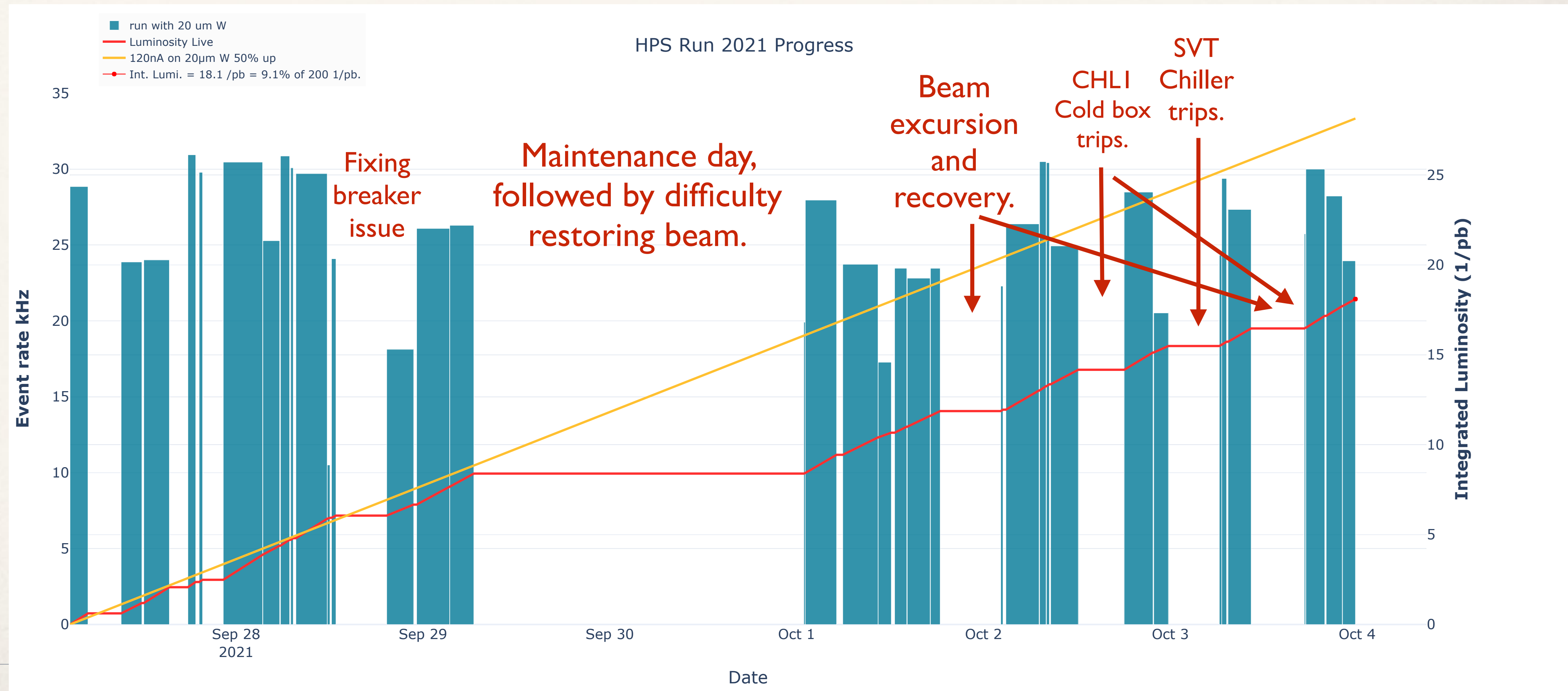
❖ Int. Lumi this week: 23.8 pb^{-1} = 11.9% (expect 7 days = 28.5 pb^{-1} so 83% for this period)



HPS Production - Week 6 (9/27 - 10/4)

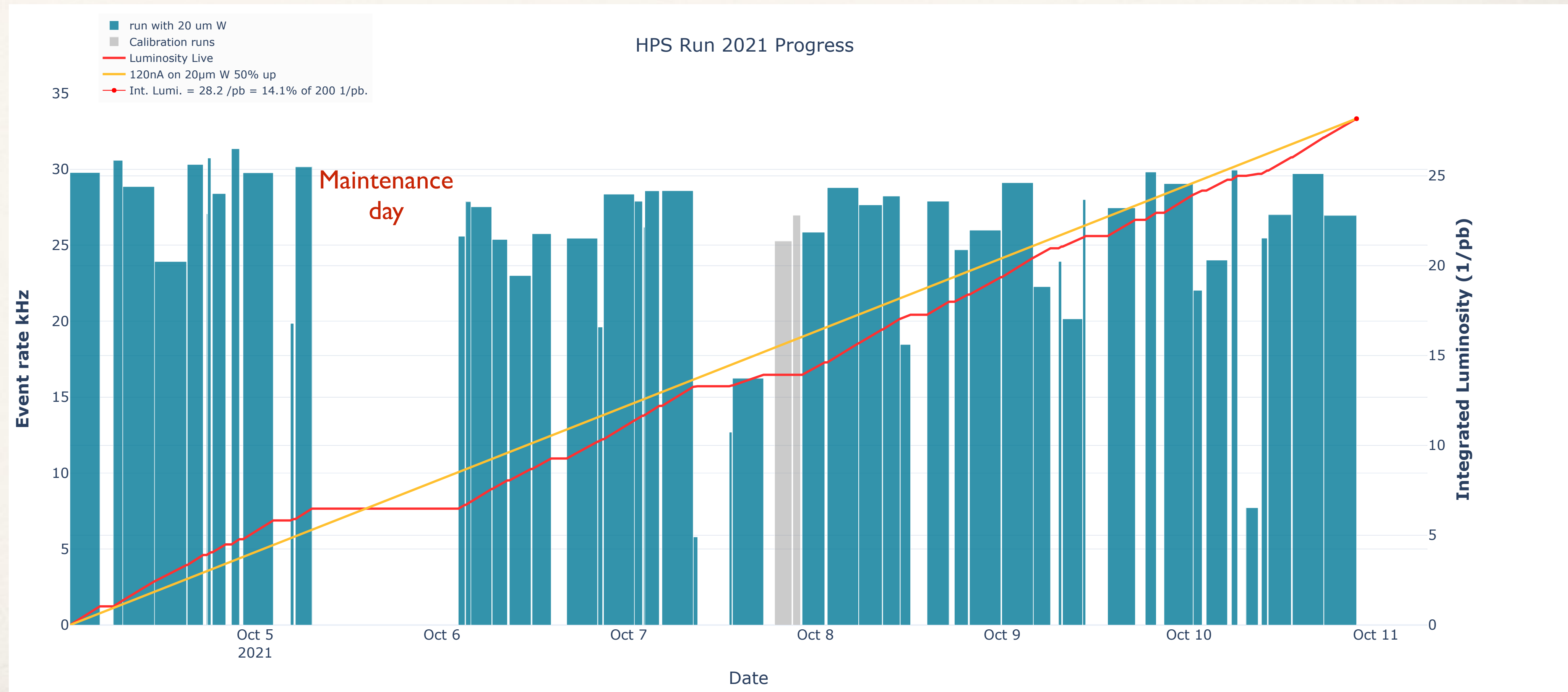
- ❖ Tuesday 9/28 - breaker getting repaired, 5 hours down.
- ❖ Wednesday 9/29 - Maintenance day. Difficulty restoring beam. No beam until Thursday midnight.
- ❖ Friday 10/1 - 6:30pm beam excursion. Recovery takes until 2am next day.
- ❖ Sunday 10/3 - 10:20am, another beam excursion, orbit locks were off! + another cold box trip.

- ❖ Int. Lumi this week: 18.1 pb^{-1}
 $= 9.1\%$
 (expect 7 days = 28.5 pb^{-1}
 so 63% for this period)



HPS Production - Week 7 (10/4 - 10/11)

- ❖ Good production running. Calibration runs: Low luminosity Moller and random trigger run.
- ❖ 10/5 Tuesday - Maintenance day. Beam restored by 10:30pm.

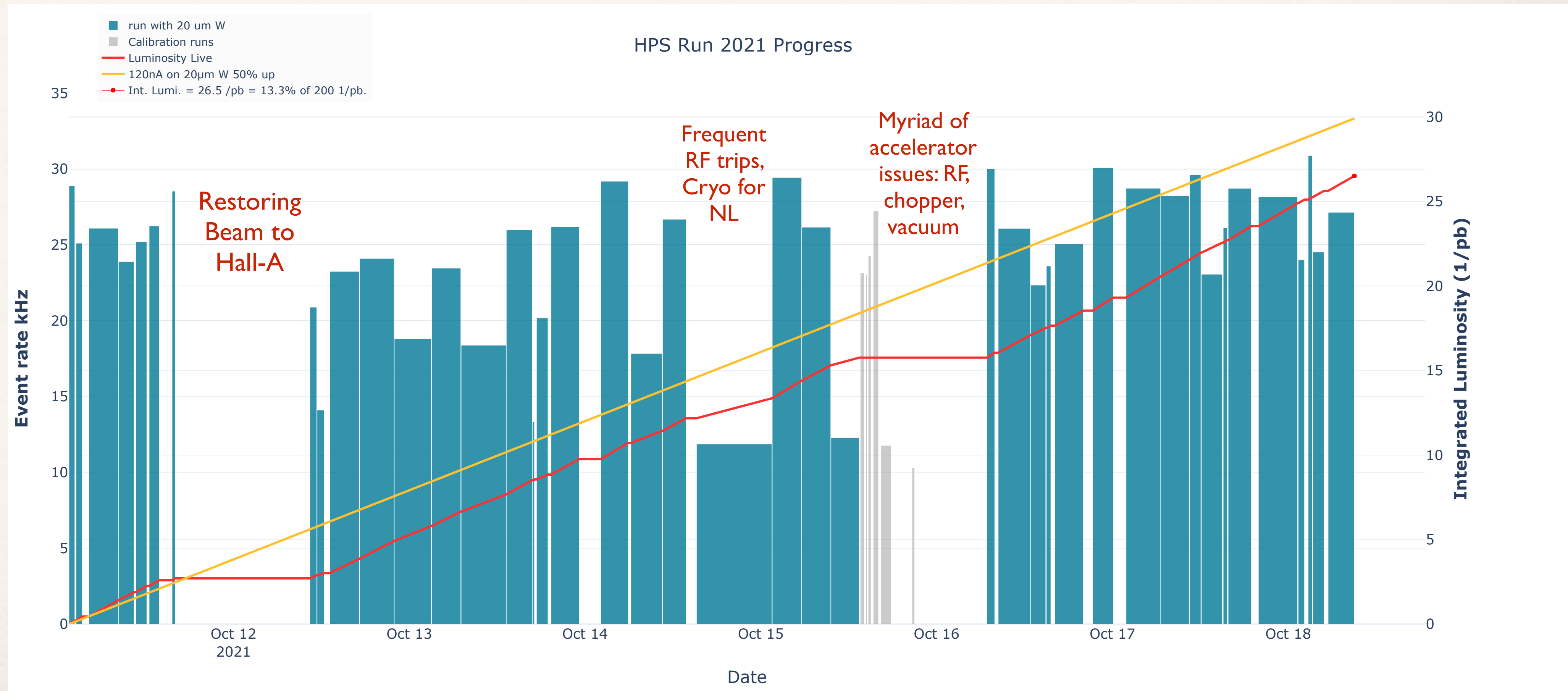


- ❖ Int. Lumi this week: 28.2 pb⁻¹ = 14.1% (expect 7 days= 28.5 pb⁻¹ so 98.7% for this period)

HPS Production - Week 8 (10/11 - 10/18)

- ❖ Reasonable production running. Some low luminosity Moller runs.
- ❖ 10/11 Monday 4pm - MCC restoring beam to Hall-A, beam not back until Tuesday 10am.
- ❖ 10/15 & 10/16 Thursday, Friday - lots of different accelerator issues.

- ❖ Int. Lumi this week: 28.2 pb^{-1}
 $= 14.1\%$
 (expect 7 days = 28.5 pb^{-1}
 so 98.7% for this period)



HPS Production - Week 9 (10/18 - 10/25) Extension

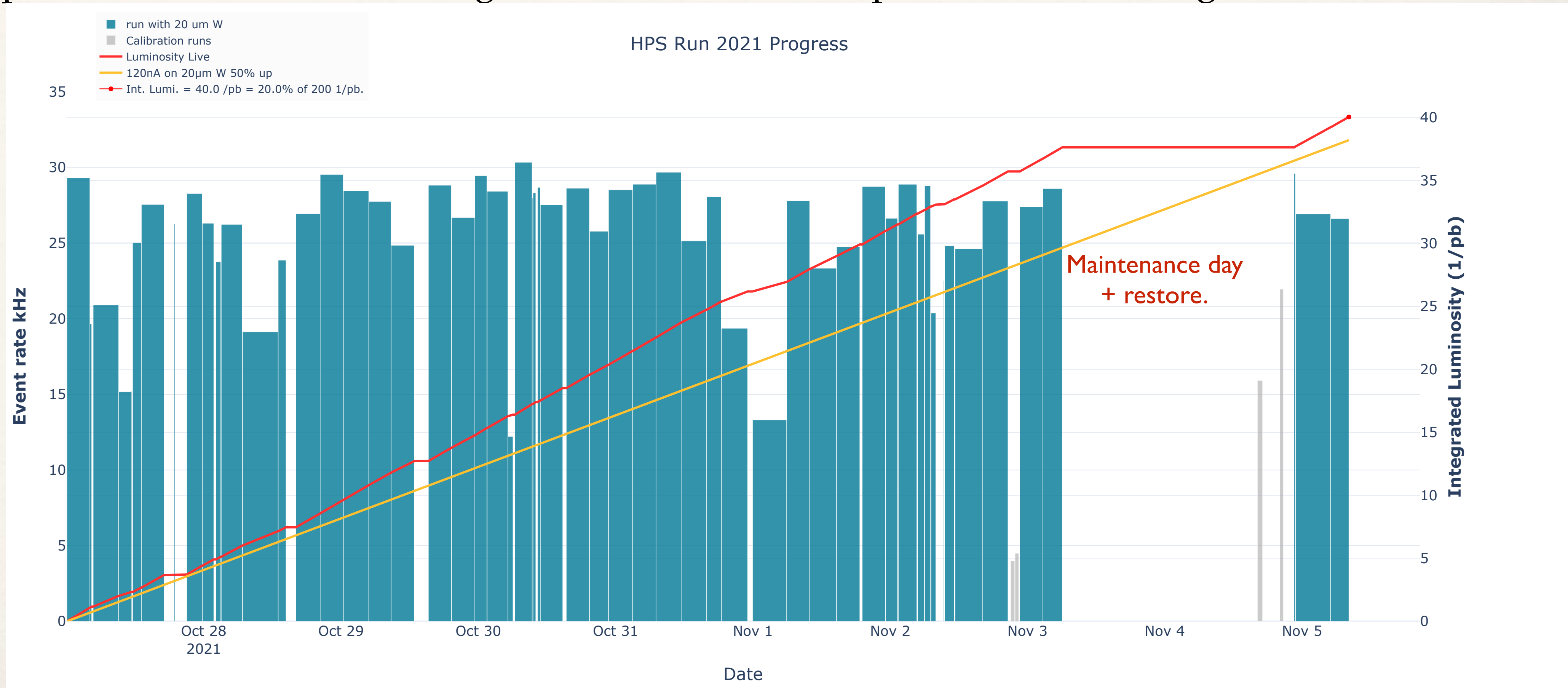
- ❖ 10/18 Monday 9am - Beam taken away to setup 1-pass running, so Hall-C can have 2-pass.
- ❖ 10/19 Tuesday - some beam at 4pm to F-cup. Then LCW leak onto power unit. Recovered Thursday 6am.
- ❖ 10/21 6am - some running until 10/22 7am, then beam issues until Saturday 10/23 9am.
- ❖ 10/23 - 24 - good running at 1.9 GeV. Two dedicated Moller runs.



❖ Int. Lumi this week: 0 pb⁻¹

HPS Production - Week 10+ (10/26 - 11/5) Extension

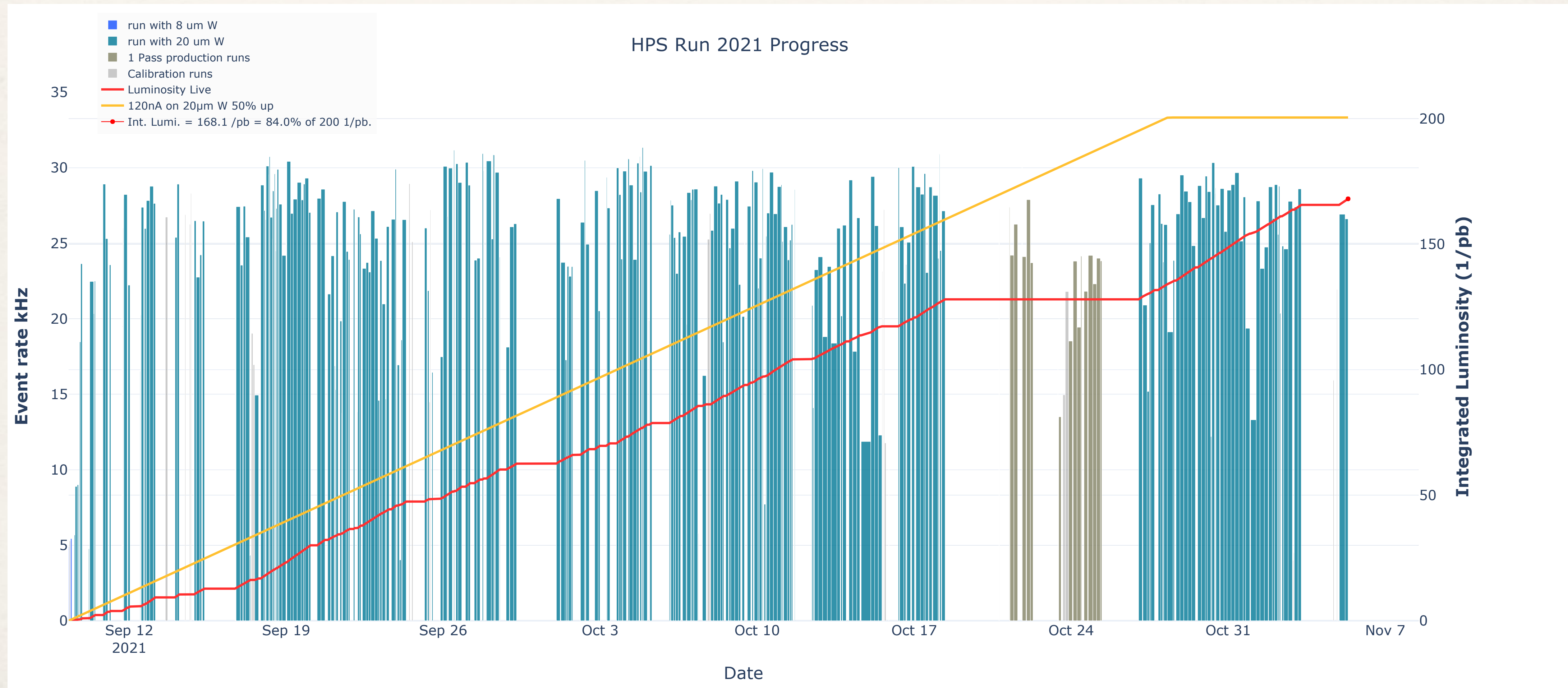
- ❖ 10/26 Monday - Energy secretary visits, then beam restore for 2-pass.
- ❖ 10/27 Wednesday - Beam back at 0:04. Then running very smoothly! 2 runs with SVT wire as target.
- ❖ 11/3 Wednesday, 6am - Beam off for maintenance day.
- ❖ 11/4 Thursday 4pm - Beam restored. 2 Straight track runs + finish production running.



❖ Int. Lumi these 11 days : 40 pb⁻¹ = 20% (expect 11 days= 44.9 pb⁻¹ so 89% for this period)

Full run period.

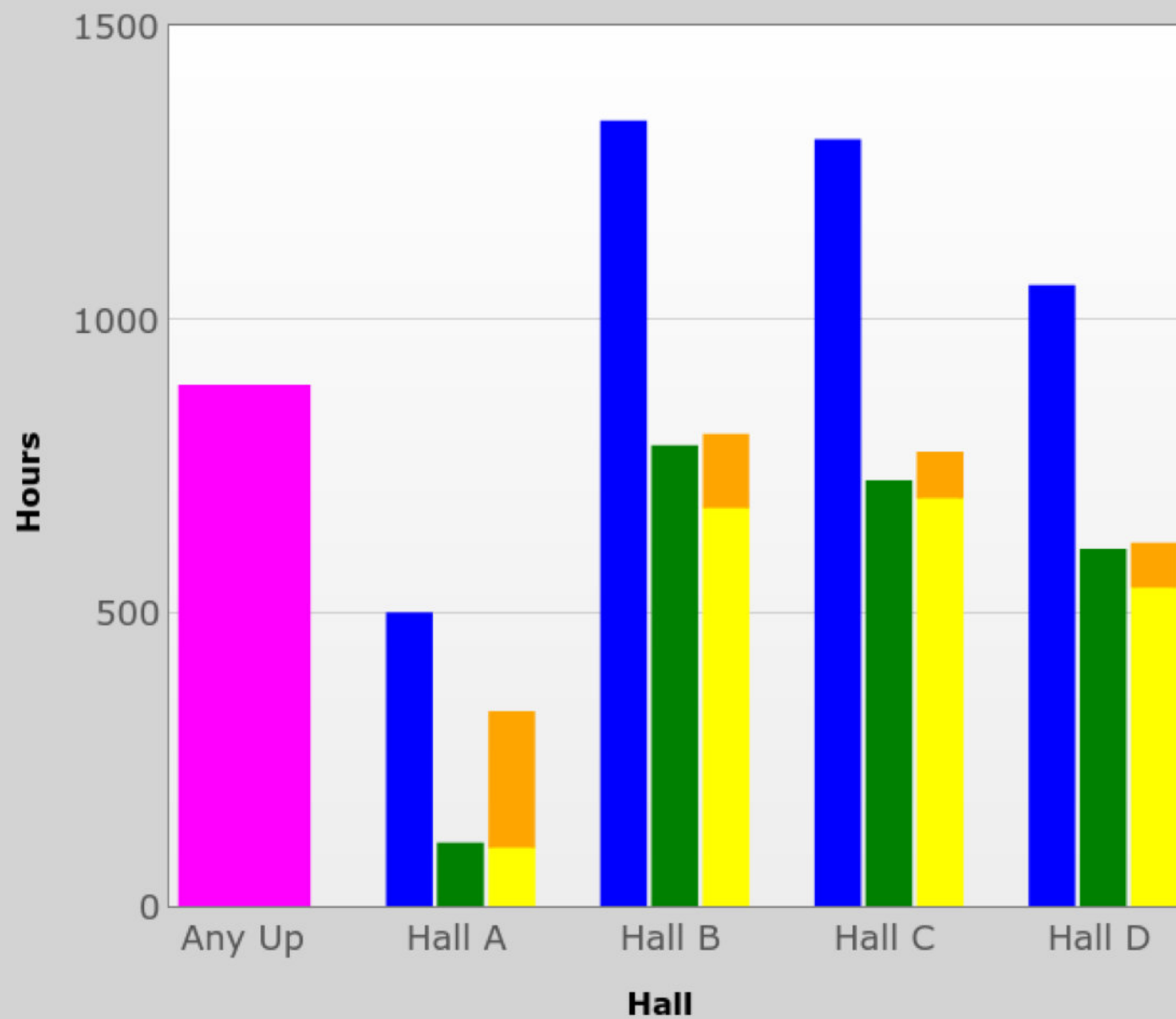
- ❖ Total luminosity is 168.1 pb^{-1} or 84% of 200 pb^{-1} a total of 222 mC of charge (both energies).
- ❖ Total number of events, all runs, is 69 billion, 839 TBytes of data.



Summary of Beam Time Used.

Physics Time Accounting

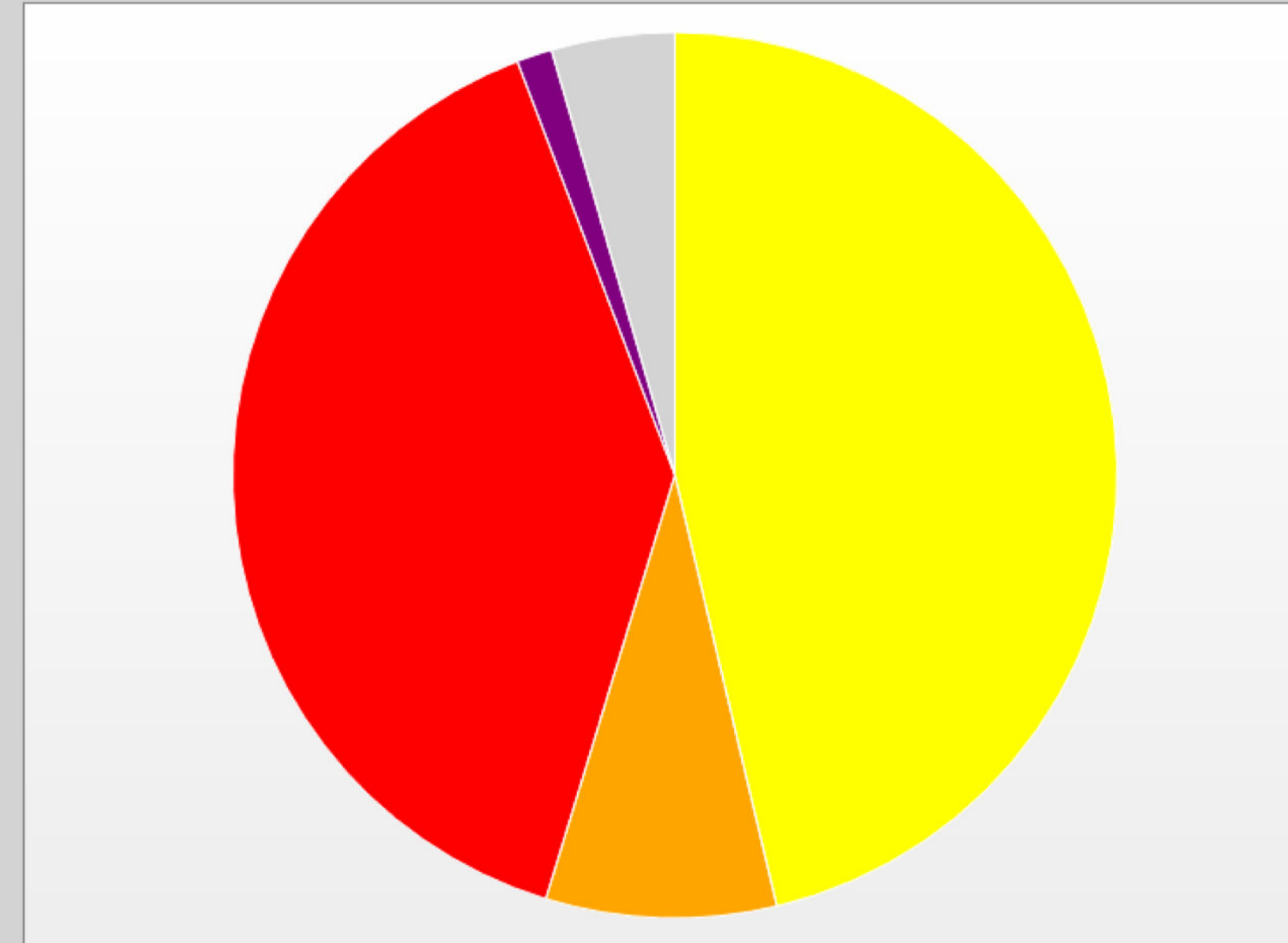
Available Beam from September 7 - November 7, 2021 (07:00 - 07:00)



	A	B	C	D
Sched.	497.0	1,335.0	1,303.0	1,055.0
UP	104.8	781.4	722.2	605.6
ABU	99.4	678.2	694.7	542.3
BANU	229.2	123.3	76.6	73.7
	328.6	801.5	771.4	616.0
	66%	60%	59%	58%

Physics Time Accounting

Hall B Beam from September 7 - November 7, 2021 (07:00 - 07:00)



ABU	678.2	(46.3%)
BANU	123.3	(8.4%)
BNA	578.6	(39.5%)
ACC	18.9	(1.3%)
OFF	0.0	(0.0%)
Unknown	66.0	(4.5%)

- ❖ From 9/7 -> 11/5 = 59 calendar days
- ❖ ABU = 678.2 hours = 28 days 6 hours
- ❖ BANU = 123.3 hours = 5 days 3 hours ==> Hall Efficiency = 84.6%
- ❖ Total production data for 3.7 GeV to tape = 168.1 pb⁻¹ or 84% of 200 pb⁻¹
- ❖ Remaining beam time: **102 PAC days.**

Conclusion

- ❖ We had a challenging, but in the end very successful run.
- ❖ Accumulated 84% of the expected data.
- ❖ Remote shifts worked.
- ❖ The HPS detector worked very well this run.
- ❖ Later today and tomorrow, presentations on detector performance and first look at the data.
- ❖ **THANK EVERYONE FOR A SUCCESSFUL RUN!**

