SPS

Machine Coordinator last week	Michael Schenk
Machine Coordinator this week	Arthur Spierer

Beam Scheduled

LHC	Yes	***NA***	Yes (BC)	***AWAKE***	No	***HiRadMat***	No

Beam Availability by Destination (AFT)

LHC	89.8 % (*)	***NA***	--	***AWAKE***	--	***HiRadMat***	--

Facility Status

Summary

Another busy week at the SPS with focus on target steering and BSI calibration for North Area (NA) beams, high-intensity scrubbing whenever possible, beam to AWAKE area, setting up HiRadMat bunch rotation, and a test of the operational hybrid beam up to 450 GeV (8b4e + standard 25 ns). Pilots and Indivs delivered to LHC whenever requested.

NA beam

- Beam steering to targets T2/T4/T6, achieved by Wednesday evening.
- Adjustments of calibration factors by BI for intensity and multiplicity readings on SPS page 1.
- Successful installation, irradiation, and removal of foil stacks on Friday with stable beam and equal sharing on targets T2/T4/T6 for BSI calibration.
- Mini-scans for all targets as well as BSM scans in T2 and T4 (multiplicity and symmetry) were performed to obtain new references.
- NA beam commissioning started on Friday evening and continued during the weekend with beam in all secondary lines, slightly ahead of schedule (planned start Monday, 17.04.)
- Various tests were made with adaptive Bayesian optimization for spill noise corrections. Promising results on the 100 Hz noise line. To be continued.
- Clean-up of rf settings to improve spill structure.

Hybrid beam

- Cycle with 6 injections was prepared and set up with Indiv and 1x12b. An extensive test was carried out on Thursday where 1 batch of 8b4e (56b), and up to 5 batches of standard 25 ns beam (36b per batch) were brought to flat top at 1.8E11 ppb, bunch length 1.6 ns, however yet with significant amount of uncaptured beam. Transverse emittances unknown.

Scrubbing & high-intensity beams

- Scrubbing continued, time, MKP temperature, and ZS spark rate permitting. Typically started in the evening and into the night, pushing intensity with single batch on long 400 GeV long flat-top cycle for different settings of longitudinal blow-up (up to 1x72b at 2.3E11 ppb). Eventually put on hold due to increased ZS tank 5 spark rates (see below).
- A special scrubbing period was carried out on Wednesday with MKDH vacuum threshold at 1e-6 mbar and according voltage limits for energy limit 400 GeV (while LHC in access). No interlocking MKDH spikes during that phase (9 AM to 3 PM). One MKP spark required reset by expert. Up to 4x72b at 2.05E11 ppb at 400 GeV. Facing some transverse beam instabilities.
- Test of automatic optimization of longitudinal blow-up.

AWAKE: bunch rotation was set up, beam permits signed on Wednesday and single bunches (1E11 p) were successfully extracted to the experimental area on Thursday with bunch rotation.

HiRadMat: turn-by-turn diagnostics set up and bunch rotation was fine-tuned with extraction to TED.

Issues / follow-ups	- **SFTPRO**
	  ○ Vacuum valves in TDC2 area were closed until Wednesday morning while beam had already been extracted to targets overnight. Went unnoticed as BIC (BA3 > “TT80 Vacuum”) was accidentally still masked on OP side since 21.03.
	  ○ Beam occasionally still unstable during the ramp, both in H and V. Checks and adjustments on transverse damper, chromaticity, and octupoles were made, improving situation, but beam not always stable yet.
	
	- **Hybrid beam**
	  ○ Longitudinal quadrupolar coupled-bunch mode observed in PS; different energy matching settings found for 8b4e and standard beams, respectively, likely able to explain part of uncaptured beam.
	
	- **Scrubbing & high-intensity beams**
	  ○ ZS tank 5 started sparking frequently during Friday night on scrubbing cycle. This started unexpectedly without change of ZS parameters. Persists even after ZS conditioning performed by expert on Sunday morning. To be investigated next week. Scrubbing “on hold”.
	
	- **Other**
	  ○ Cavity power limits measured: found Siemens to be limited to 800 kW rather than 1.05 MW. To be investigated.
	  ○ False fire alarm in BA5 on Thursday afternoon required fire brigade intervention as fire doors BA4, 5, and 6 closed (~1 h).
	  ○ All 4 wire-scanners found to be broken since last week – reason not fully clear yet. Further investigations and potential replacement(s) on Wednesday, 19.04. during access.
	  ○ Mains and 400 V transformer trip on Tuesday (~2.5 h).
	  ○ MBE2103 and bypass did not restart after mains / 400 V transformer trip (in BA2), required expert intervention (~3.5 h, for NA).
	  ○ Electrical glitch on Wednesday evening causing mains to trip (~1.5 h).
	  ○ Two alarms by MKE6 required access by Piquet for inspection.
	  ○ MSE6 required conditioning.
	  ○ Various investigations by experts to look into 800 MHz cavity trips.
	  ○ SPS SIS lagging. Server was in CPU mode “energy saving”. Now put to “max. performance” to see if that resolves issue.

Plans	- NA beam commissioning continues. - SFTPRO: crystal alignment; investigate losses in BA80; timing tests with NA for dedicated LHC filling, potentially on Wednesday. - LHC: multi-bunch beams; BQM checks on all LHC-type beams. - MKP alignment. - Finalise feed-forward commissioning. - HiRadMat: check beam spot size on BTV in experimental area. - Wednesday, 19.04.: long access for tunnel inspection (to be done once per month); wire-scanner replacement(s): one spare to be installed in BA4, discussion between BI, SPS and LHC OP on Monday to take final decision on installing a spare in BA5 as well. - From last week: vacuum valve VVFA_610213 did not interlock extraction to LHC B1 as in undefined state (already clear: once valve state read properly, interlocks behave properly, too); PC RQID.660440 investigations.

Intervention Request				
Yes	***Duration***	12 h (+ pump-down)	***Date/time***	19.04.23, from 8 AM
Reason	Inspection of tunnel cracks; installation of spare wire-scanner(s).			
Impact				

(*) Note that the scrubbing cycle also uses destination LHC which hence falsely impacts the availability for LHC. Tried to take that into account by manually fixing AFT.