

Joint LIU / HL-LHC meeting 15 October 2015 - Auditorium 774

Chairpersons: Malika Meddahi / Giovanni Rumolo– Lucio Rossi / Oliver Bruening

Aim:

- to discuss 'LIU / HL-LHC' interface subjects
- to discuss possible improvements (strategies, equipment improvements, schedule, beam parameters) beneficial for both projects
- to clarify misunderstanding and identify parameter mismatch
- to update parameter tables if needed
- to ensure coherency of timeline and decisions between the two projects (e.g. ions)

8:30 – 8:45 - Welcome coffee

8:45 – 10:15 - Session 1 – C&S review outcome (Baseline updates and consequences on beam parameters) – Chairs: Giovanni Rumolo / Oliver Bruening

Keywords: Baseline machine configurations, baseline beam parameters, proton and ion operation, schedule, upgrade options, (staged) project implementation, performance limitations, failure risks

1. Protons: Updates on HL-LHC baseline and options (incl. staged implementation), performance reach, schedule – Gianluigi Arduini – 15'+5'
 - Required baseline beam parameters at exit of SPS and during collision in the LHC.
 - Vibration studies and resulting effort to take hollow electron lens into HL-LHC Baseline (margins against losses due to cultural noise and earthquakes).
 - New schedule for the civil engineering and plan to finish underground excavation work within LS2 (surface buildings and infrastructure installations during Run3 and LS3).
 - Staged Crab Cavity installation (half in LS3 other half in LS4).
 - Presentation of IR layout (L^* , magnet apertures, parameters and powering).
 - Decision to NOT install a new cryo plant in IR4.
 - Performance projections with new schedule (longer proton runs during Run5 and Run6).
2. Protons: Updates on LIU baseline and options (incl. staged implementation), parameter reach, schedule – Hannes Bartosik– 20'+5'
 - New LIU baseline for protons after C&S Review and all LIU intermediate reviews (September 2015) including final CtC.
 - Beam parameter reach vs. achieved, assumptions and limitations for each machine (Linac4, PSB, PS, SPS)
 - Gap with the HL-LHC requirements?
 - Means to extend the parameter reach: which additional options? At which price (schedule, cost)? What can be staged after LS2?
3. Ions: Updates on HL-LHC baseline and options (incl. staged implementation), performance reach, schedule – John Jowett – 15'+5'
 - Recall of the baseline ion running schedule (Run3 and Run4) with summary of the different configurations.
 - Listings of the required ion beam parameters at SPS exit.
 - Luminosity trade off due to different luminosity sharing configuration between ALICE, ATLAS and CMS.

- Quench limit estimates for the ion beam operation and implications for the ion beam collimation.
 - Option of extended (more than one month per year) ion runs during Run3 and Run4 for pushing the integrated luminosity for the ion upgrade runs and/or different luminosity sharing.
4. Ions: Updates on LIU baseline and options (incl. staged implementation), parameter reach, schedule – Simone Gilardoni – 20'+5'
- New LIU baseline for ions after C&S Review including final CtC
 - Beam parameter reach vs. achieved, assumptions and presently known limitations (Linac3, LEIR, PS, SPS)
 - Gap with HL-LHC requirements!
 - Which are the risks and which are the margins to improve the present parameter reach and approach the HL-LHC requirements? List options, including post LS2 staged ones (e.g. SPS injection upgrade, additional new equipment or other major upgrades)

10:15 – 10:45 – Coffee break

10:45 – 12:15 - Session 2 – 2015 operational experience – Chairs: Hannes Bartosik / Mike Lamont

1. Linac4 status – any changes for HST, LIU parameters, schedule? – Alessandra Lombardi – 15'+5'
 - Status of Linac4 commissioning
 - H⁻ source performance and beam parameters reached so far
 - Any impact on the LIU beam parameters or high intensity beams in the PSB?
 - Any changes for the Half-Sector-Test (end 2016 deadline) and schedule in general?
2. Proton beam operation and MD in the injectors – outcomes for LIU and HL-LHC? – 25'+5'
 - PSB& PS – Guido Sterbini
 - Operational experience with 25 ns beams in 2015: larger longitudinal emittances for the PSB-PS transfer?
 - Conclusions on the Finemet cavities from HW tests and beam dynamics studies in PSB/PS and experience with the digital LLRF control in the PSB
 - Results from MDs on space charge and brightness limitations in PSB/PS
 - Results from longitudinal MDs in the PS (longitudinal instabilities, bunch rotation)
 - Commissioning of the PS transverse feedback
 - SPS – Verena Kain
 - Operational experience with 25 ns beams in 2015
 - MDs on longitudinal instability limits, acceleration of high intensity beams, bunch rotation at flat top and studies for the impedance reduction campaign
 - Results from the high intensity scrubbing runs and decision "coating vs. scrubbing"; time needed for scrubbing (x weeks/y?)
 - Results from space charge MDs
3. 25 ns operation and MDs in the LHC – findings and consequences for the LIU and HL-LHC? – Gianni Iadarola – 15'+5'
 - E-cloud in the LHC - scrubbing successful for 25 ns operation? Fitting expectation? Outlook for HL-LHC parameters?
 - Remaining limitations from e-cloud and/or other instabilities; consequences on beam parameters?

- Emittance evolution along the cycle (blow-up along the ramp? Radiation damping?); confirming the budget assumptions made for emittance and beam losses?
 - First conclusions on machine performance (availability, running at 6.5 TeV, UFOs and potential impacts, beam induced heating ...)
 - First operational experience of running at 25 ns bunch spacing – possible implications for HL-LHC?
 - Reconditioning time?
 - Main relevant results from the MD blocks
4. Ion operation in the injectors – Django Manglunki – 15'+5'
- Results from MDs with Ar in LEIR and SPS
 - Commissioning of ion chain for Pb in 2015
 - Beam parameters reach and bottlenecks

12:15 – 13:30 Lunch break

13:30 – 15:00 - Session 3 – Shutdown planning - Chairs: Katy Foraz / Beniamino Di Girolamo

Items to cover:

- Work to be done in Run2 YETS and EYETS, including de-cabling, for LIU and HL-LHC
- Work to be done in LS2 (LIU and HL-LHC anticipated), and LS2 length
- Work to be done in LS3 (LIU delayed and HL-LHC) and LS3 length
- **CONS** project activities linked to LIU and HL-LHC projects to be taken into consideration in the LIU and HL-LHC talks
- To note: Detailed injectors beam commissioning timeline, with all beam types details, will be covered in another LIU dedicated meeting

Talks: Keywords for all talks: Project, baseline, schedule and contingencies, priorities, impact, resources, preparation status, risks and mitigation

1. Framework schedule - Marzia Bernardi – 15'+5'
2. HL-LHC – Paula Alvarez Lopez – 15'+5'
3. LIU - Julie Coupard – 15'+5'
4. Decabling - Sebastien Evrard – 15'+5'

15:00 – 15:30 Leg stretch – Coffee

15:30 – 17:00 - Session 4 – Beam tests in injectors and LHC needed for LIU and HL-LHC – Chair: Verena Kain / Rhodri Jones

Items to cover:

- Joint LIU / LH-LHC MD needs in the injectors and in the LHC
- Equipment installation needed from CERN projects in the injectors and LHC:
 - a. Crab-in-SPS: needs, integration studies, timelines
 - b. Collimators in SPS: needs, timelines
 - c. Instrumentation in SPS

Talks:

1. Required Beam Tests for LIU before LS2 - Elena Shaposhnikova – 15'+5'
 - a. Cover all injectors and ions
 - b. Impedance, 800 MHz, transverse damper,...
 - c. Proposed measurements, required instrumentation and sensitivity
 - d. Open questions, impact of possible outcome
 - e. Test slip stacking, incl. requirements
2. Beam Tests for HL-LHC before LS2 – Yannis Papaphilippou – 15'+5'

- a. In SPS and LHC
 - b. BBLR, crab cavities, halo control, quench test with ions, COLDEX,...
 - c. Measurement goals and open questions
 - d. Proposed measurements and observables. Is the instrumentation adequate? Is the test bed adequate?
 - e. MD time requirements versus available time and operational complications/impact
3. HiRadMat LIU and HL-LHC beam requests – Anton Lechner – 15'+5'
- a. Proposed tests' for LIU and HL-LHC. Should there be any additional tests (damage limit of super conducting magnets? Collimators?)
 - b. Beam requirements (incl. how to get closer to LIU / HL-LHC beam specs? What parameter phases could be explored? Timeline compatibility with decision taking for design choices?)
 - c. What would it require to reduce compatibility issue with LHC operation?
4. Injector instrumentation and tools for LIU and HL-LHC: - Bettina Mikulec – 15'+5'
- a. Requirements for additional instrumentation and tools for LIU in injectors and HL-LHC in LHC and plans
 - b. Concerns:
 - i. reproducibility,...
 - ii. orbit in the SPS
 - iii. creation of transverse tails in the injectors
 - iv. halo control in the LHC
 - v. changes to BI requirements (e.g. SPS BLM due to Q20 losses...)
 - vi.
 - c. Automatic quality checks?
 - d. Beam quality tracking

17:00 – 17:15 : Leg stretch

17:15 – 18:45 - Session 5 - Other possible non-baseline improvement towards reaching target goals (beam parameters and luminosity) and implications – Chairs: Brennan Goddard / Gianluigi Arduini

Items to cover:

- LIU: PS, SPS impedance reduction, other beam schemes, new feedback systems, HBW feedback interests
- HL-LHC: RF 200/800 MHz options and bunch length for HL-LHC, measures against transverse emittance blow up in LHC
- Improvements implications (on baseline/resources/schedule)
- Decision process timeline and requirements

Talks:

1. Further Impedance reduction in the injectors: What can it bring us?- Benoit Salvant– 15'+5'
 - Expected impedance-related limitations after LIU upgrade:
 - PSB, PS and SPS
 - Impact on performance reach for beam parameters (instability thresholds,)
 - Impact on operational aspects (scrubbing, kicker heating, outgassing, ...)
 - Potential non-baseline improvements and potential performance gains
 - PSB (kickers, vacuum system, RF, ...)
 - PS (kickers, vacuum flanges, RF, ...)

- SPS (extra flange shielding, MKP/MKE/MKQ kickers, MST/E septa, cavity HOMs, ground loops, ...)
 - Implementation issues including timescales and feasibility
2. Lower or higher harmonic RF system in LHC - Juan Esteban Muller – 15'+5'
- 200/400 MHz:
 - Expected parameters: are these realistic?
 - Expected gain in performance compatibly with known limitations (e.g. beam stability, increased impedance, longer bunch length at SPS extraction and possible associated gains)
 - Compatibility with crab cavities
 - Risk mitigation: electron cloud?
 - Implications on ion beams?
 - When should we take a decision? What are the steps of the decision making process, what's needed?
 - 400/800 MHz:
 - Do we really need it? Why?
 - Do we have a mode of operation that is compatible with enhanced transverse AND longitudinal stability? Is there a corresponding realistic technical solution?
 - Alternative solutions (longitudinal bunch shaping)
 - Implications on ion beams?
 - When should we take a decision? What are the steps of the decision making process, what's needed?
3. Wide-band feedbacks – Kevin Li– 15'+5'
- What is the development status and feasibility outlook for SPS and LHC?
 - What could it bring us in PS, SPS, or LHC?
 - Is it needed for normal operation, e.g. against ecloud instability?
 - Can it stabilise scrubbing or doublet beams?
 - Can it help fighting the instabilities due to Crab-cavities in HL-LHC?
 - What would be the characteristics of such a system? Gain, bandwidth, kick, H+V plane?
 - What implementation issues could exist, including timescale?
 - Do we need a stronger (or higher bandwidth) conventional damper?
 - Identification of sources and measures against transverse emittance blow up in the LHC
4. Different bunch/batch schemes –Heiko Damerau – 15'+5'
- What is the operational status of the different possible bunch schemes (80b, 8b+4e, BCMS, ...)
 - What could it bring us in SPS or LHC?
 - Performance gain (e.g. 80b more colliding bunches for same pile-up)
 - Risk mitigations (e.g. BCMS margin for LHC emittance growth, 3x80b reduction of total SPS current, 8b+4e ecloud, ...)
 - What is the impact of each scheme on other systems (e.g. protection devices, RF and beam loading, dampers, kickers, ecloud, ...)

19:00: Aperitif and dinner – Location to be defined

To note: Following the event, Chairs will be asked to provide 1-2 summary slides of their session, including main outcomes and follow-up actions