

MD Proposals related to Ion Operation

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Content

- BFPP related
- Collimation
- Physics Beyond Colliders
- Highest performance

BFPP cross-section measurement

Motivation:

- The BFPP cross-section **can not be measured by the experiments.**
- **Current values are based on theory.**
- This measurement is important for the understanding of luminosity performance, scaling of FLUKA simulations and other studies.

Idea:

- **“counting” of BFPP ions w.r.t. luminosity.**
- Brainstorming phase - several ideas are under investigation:
 - **Available instrumentation:**
BLMs, cryogenic load
 - **Instrumentation potentially to be installed:**
dBLMs, instrumentation on TCLDs around IR2
- **Need to find a calibration of those instruments that correlates to no. of impacting particles**
 - Calibration fill with setup beam
 - Measurement at varying luminosity during physics fills

Time	>6 h
Beam	Pb
Bunches	pilots, trains
Intensity	setup + phys. fill
Energy	FT
Optics	collision

BFPP Quench Test

Motivation:

- Measurement of the **steady state quench limit**.
- Same test was performed in 2015, but results have large uncertainties due to problem with aperture misalignment.
- Repetition of this test was **scheduled in 2018, but MD time was lost** (no beam from injectors)

Procedure:

- Setup high-intensity physics fill until collisions.
- Separate beams.
- Adjust BFPP orbit bumps to lead BFPP ions back into MB.B11.
- Gradually increase luminosity until quench.
- Quench recovery.

Time	4 h + quench recovery
Beam	Pb
Bunches	Trains
Intensity	Std. Fill
Energy	FT
Optics	collision

Pb ion collimation studies

Collimation quench test

- 11T dipoles + TCLDs to be installed in LS2 to improve cleaning and mitigate intensity limits
- Need to investigate experimentally limits of the IR7 cleaning performance with new layout to validate the HL-LHC reach

Crystal collimation tests

- Crystal collimation demonstrated in Run 2 to give significant improvement to the Pb ion cleaning performance
- Need test of new controls, and possibly new crystal, in view of possible operational use
- High priority if the 11T dipoles would have delays

Presented in more detail this afternoon in talk on collimation MDs

Partially Stripped Ions (PSI)

Pb81+ beams

Motivation:

- Physics Beyond Colliders: The **Gamma Factory** initiative proposes to use **partially stripped ion (PSI)** beams as drivers of a new type, high intensity photon source.
- Proof-of-principle experiment is been prepared in the SPS.

Procedure and Goals:

- Similar procedure as in first MD done in 2018 and proposed for PSI crystal collimation MD (*was cancelled*).
- Repeat lifetime measurement
- Evaluate intensity limit introduced by stripping off e^- at TCP
 - Absorption of stripped Pb82+ ions in new TCLD
 - Crystal collimation, avoiding impact in DS by channeling out Pb82+ on absorber
- Loss maps without limitation in DS

Time	~12-16h
Beam	Pb81+
Bunches	Few pilots
Intensity	setup
Energy	FT
Optics	FT of std. cycle

Maximum Luminosity

Operation!

Motivation:

- In 2018, a max. luminosity of $L=6.4 \times 10^{27}$ was achieved, limited by available beam.
- In 2020, higher virtual luminosities are expected and are desired to be exploit in IP1/5. FLUKA simulations indicate that higher luminosities are safe with BFPP bumps, but experimental proof is necessary.
- **Risk of quenching MB.B11 or MQ.11.**

Procedure:

- Start from levelled luminosity in all experiments.
- Gradually increase luminosity target in IP1/5 with **optimized BFPP bumps in place from fill to fill** until max peak is achieved or quench occurs.
- *Submitted as MD in 2018, but was **evaluated as operational necessary task** during the run.*

Aperture Measurements

proton beams

operation?

Aperture check in IR8 for β^* -reach

- To meet future luminosity requests, might need to decrease β^* in IR8 for ions
- IR8 aperture never measured in detail
- Has lower β^* in ion runs (1.5m) than for protons (3m), but still in the shadow of other IRs
- Global aperture measurement in collision will not probe IR8 => Dedicated measurement needed

Other IRs:

- Should be covered by standard commissioning

Time	8 h
Beam	Proton or Pb
Bunches	Few pilots
Intensity	setup
Energy	FT
Optics	collision

Summary

BFPP related:

- **BFPP cross-section:** calibration fill + **operational data**
- **BFPP quench test:** setup of physics fill + quench recovery

Collimation:

- **Collimation Quench test**
- **Crystal Collimation**

Physics Beyond colliders:

- **PSI beams:** setup fill, Pb81+

Highest Performance:

- **Max. Luminosity test:** operation
- **Aperture IR8:** could be done with proton setup beams