MD3343 Proposal: Automatic Parallel Alignment of Collimators

LHC Studies Working Group
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Introduction


- The user tasks were replaced with dedicated algorithms implemented in FESA
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B1/B2 alignments were NOT done in parallel, contrary to previous years
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**Advantage:** Individual collimator alignments allow for the crosstalk to be studied across beams
FESPA Implementation

- Efficient alignment of both beams in parallel using separate threads
- Usage of crosstalk analysis to determine the order of collimators to align
- Co-ordination between beams to avoid parallel alignment of crosstalk-prone collimators
- Preserve user freedom of Play/Pause/Stop the automatic alignment
Crosstalk Analysis

- Commissioning 2018 data crosstalk analysis

- **Example:** Impact on Beam 1 when aligning Beam 2
  - TCLAs experience most crosstalk as closest to TCPs
  - Similar crosstalk in Beam 1
MD Motivation

• This MD is required to test:

1. The **upgraded FESA class** which will now align both beams in parallel -> first implementation in FESA of any parallel alignment

2. The performance of the **Crosstalk Analysis** and improve the analysis according to the results from this MD
MD Request

- Beam below **SBF at injection** energy: up to 5 nominal bunches

- **Both beams** required for parallel test

- **Procedure**: Start automatic parallel alignment and verify the correct implementation or debug in case of issues, whilst observing the performance of the crosstalk analysis.

- Time: **8 hours**
MD4165 Proposal: BLM response at collimators

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• Studying the correlation of the chain of BLMs in the collimation region is useful to understand the evolution of loss measurements for:

1. Determining the calibration factors of the BLMs at selected collimators

2. Understanding the correlations between the BLM thresholds

3. Studying the crosstalk from different collimators

4. Benchmarking FLUKA and SixTrack simulations
MD Motivation

• During MD1653 we studied the correlation collimation BLMs at Injection and initial analysis of the results have shown that:

  - The signal of a BLM has a clearly linear dependence with the signal of BLMs upstream that collimator.

  - It is indeed possible to determine the calibration factor of BLMs at selected collimators, when protons of the beam halo directly hit the jaws.

• Repeating this at flat top would allow for extending the analysis and further understand the spatial evolution of loss measurements
Step 1: Get signal from individual collimators as primaries

- TCP
- TCSG
- TCSPM

### Case 1

### Case 2
Injection Analysis

**Step 2:** Combine TCP, TCSG signals to predict TCSPM signal

**TCP**  
**TCSG**  
**TCSPM**

![Diagram of signal combination]

**Graph 1:** TCP and TCSG alignment losses

- **TCP.D6R7.B2**
- **TCSG.D4R7.B2**

**Graph 2:** Calculated Crosstalk: TCSPM.D4R7.B2

- **TCSPM Raw**
- **TCSPM Calculated**
MD Request

- Beam below **SBF at flat top** energy: As many pilot bunches as possible

- **Both beams** required

- **Procedure:** Start with coarse collimator settings and scrape a small percentage of the beam with one collimator each time. Generate a gentle LM with the ADT for different combinations of the same collimators.

- Preparation is ready as the same test done at injection will be repeated at flat top.

- **Time:** 5 hours