



TT40 and SPS collimation Tests Planning

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TT40 MD (1/3)

Robustness Test LHC collimator
Thursday 09/11

Names of people in the CCC to
be defined!

Input from: R. Assmann, G. Arduini, A. Bertarelli, V. Kain, J. Wenninger

Access for laser installation: 08/11 PS-ION-MD
08:00-10:00

Change of SPS cycle and check of acquisition and control instruments

Check of:

- BLM acquisition
- Motors
- Sensor readout

Beam conditions: No beam

Participants: AB/OP - BLM team - collimation team - motor team

10:00-12:00

SPS set-up

- Check and reset-up of the extraction with pilot plus intermediate beam intensity.
- Beam measurements at the SPS

*Beam conditions: #batches = 1 (12-48 bunches)
 $I_{\text{bunch}} = 1.15 \cdot 10^{11}$ p/bunch*

Participants: AB/OP



TT40 MD (2/3)

12:00-14:00

Beam based alignment with intermediate intensity (12 bunches)

- Set reference positions for the 5 steps movement of the jaw
- Reproducibility of the orbit in the line
- Parasitic set-up of laser, accelerometers and microphones.

Beam conditions: #batches = 1 (12 bunches)

$$I_{\text{bunch}} = 1.15 \cdot 10^{11} \text{ p/bunch}$$

Participants: AB/OP- collimation team - laser team- BLM team

14:00-17:00

Intensity increase over 4 cycles measurements of about 30 minutes

Each measurements cycle (~ 30 minutes) consists in:

- Extraction on TED until reaching good extraction of nominal batches (from 1 to 4 batches)
- Extraction on collimator (fixed impact parameter $b = 5\text{mm}$)
- Collimator cool-down (~ 10-15 minutes)

For each shot simultaneous measurements with accelerometers, microphones and laser (as close as possible to the jaw's center).

Beam conditions: #batches = 1- 4(60 bunches)

$$I_{\text{bunch}} = 1.15 \cdot 10^{11} \text{ p/bunch}$$

Participants: AB/OP- collimation team - laser team- BLM team



TT40 MD (3/3)

17:00-20:00

Scan with 4 nominal batches over different impact parameters: $b = 4 \text{ mm}, 3 \text{ mm}, 2 \text{ mm}, 1 \text{ mm}, 0 \text{ mm}, -1 \text{ mm}, -2 \text{ mm}$.

Laser measurements at the central and/or end position of the jaw (to be discussed).

Beam conditions: #batches = 4 (60 bunches)

$I_{\text{bunch}} = 1.15 \cdot 10^{11} \text{ p/bunch}$

$I_{\text{tot}} = 2.76 \cdot 10^{13} \text{ p}$

Participants: AB/OP- collimation team - laser team- BLM team

4 hours margin left for:

Laser measurements at low intensity (2 batches) for new settings: different positions, acquisition frequency..... (15 minutes for each shot: 16 more measurements are possible).



Summarizing table for TT40 tests:

#Extraction	#batches	b [mm]	AF	Laser meas. points			
				1	2	3	4
1	1	5	High			X	
2	2	5	High			X	
3	3	5	Low			X	
4	4	5	Low			X	
5	4	5	High			X	
6	4	4	High			?	?
7	4	3	High			?	?
8	4	2	High			?	?
9	4	1	High			?	?
10	4	0	High			?	?
11	4	-1	High			?	?
12	4	-2	High			?	?

High intensity
extraction
commissioning

Studies at high
intensity

Further studies
at low intensity



SPS MD1 (1/4)

Names of people in the CCC to be defined!

Control Test at low intensity
1st day Tuesday 31/10

08:00-12:00

Set-up of low intensity stored beam

- Optional access (if needed) for last installations, checks and debugging
- *08:00-012:00*: Change of SPS cycle
- *09:00-12:00*: Preliminary control tests and jaw calibration without beam

Beam conditions valid for all the tests:

1 bunch

$I_{\text{bunch}} = 1.15 \cdot 10^{11}$ p/bunch

Energy = 270 GeV

Emittance $\sim 1.5 \mu\text{m}$

Horizontal beam size at collimator ~ 0.4 mm

Beam orbit stability $\sim 100 \mu\text{m}$ (without orbit feedback)

Participants: AB/OP- motors and control teams - collimation team



SPS MD1 (2/4)

12:00-15:00

Control software commissioning:

- Commissioning control of collimators, sensors, switches and BLM with beam
- Check interlocks
- Calibration of sensor offsets, linearity, mechanical play.....
- Input of calibration to software database
- BLM readings

Participants: AB/OP- collimation team -BLM team

15:00-18:00

Collimator beam based calibration + use of controls

- Calibrate jaw positions with respect to beam:
 - a) by touching the beam (non-destructive)
 - b) by scraping the beam (destructive)
- Determine accuracy of method and iterate if necessary

Participants: AB/OP- collimation team



SPS MD1 (3/4)

18:00-20:00

BLM tests

Participants: AB/OP- collimation team-BLM team

20:00-02:00

Beam loss studies

- Loss maps under controlled conditions
- Loss maps with closed orbit bump
- Halo studies
- Parasitic impedance measurements + control BBQ system

Participants: AB/OP- collimation team - BLM team



SPS MD1 (4/4)

02:00-06:00

Impedance (input from impedance team):

- Measurements of the real part of the impedance (damping or growth rise time of instabilities)
- Repeat the tune shift vs. collimator gap measurements.
- Tune shift vs. position of single collimator jaw
- Verify the inductive bypass effect (half-gap as small as possible 0.5mm)

Participants: AB/OP- Collimation team - Impedance team- BLM team

06:00-08:00

Aperture measurements with scraped beams

Participants: AB/OP- collimation team



SPS MD2 (1/3)

1) Control Test at low intensity

2nd day Tuesday 07/11

08:00-12:00

Change of SPS cycle and set-up of low intensity stored beam

Beam conditions :

1 bunch

$I_{\text{bunch}} = 1.15 \cdot 10^{11}$ p/bunch

Energy = 270 GeV

Emittance $\sim 1.5 \mu\text{m}$

Horizontal beam size at collimator ~ 0.4 mm

Beam orbit stability $\sim 100 \mu\text{m}$ (without orbit feedback)

Participants: AB/OP- motors and control teams - collimation team



SPS MD2 (2/3)

12:00-16:00

Control software commissioning and Collimator calibration

- **Implementation from feedback of MD1**
- **Systematic studies (accuracy...)**

Participants: AB/OP- collimation team -motors and control teams

16:00-22:00

Collimation beam loss studies

Participants: AB/OP- collimation team - BLM team

22:00-04:00

Impedance studies

Experimental parameters studies:

- **Change of tune**
- **Change of bunch length (20-30%)**
- **One jaw only**
- **Increase of emittance**

Participants: AB/OP- collimation team - Impedance team- BLM team

4 hours of margin left.



SPS MD2 (3/3)

2) Control Test at high intensity 2nd day Tuesday 07/11

8-10 hours to:

Change of SPS cycle and set-up of low intensity stored beam

Beam conditions for high intensity :

288 bunches

$I_{\text{bunch}} = 1.15 \cdot 10^{11}$ p/bunch

Energy = 270 GeV

Emittance $\sim 3.5 \mu\text{m}$

Horizontal beam size at collimator ~ 0.7 mm

Beam orbit stability $\sim 100 \mu\text{m}$ (without orbit feedback)

Impedance
measurements!