

# Scope and priorities for 2006 LHC collimator beam tests:

*Draft RWA 2/10/2006 for discussion*

- **TT40**

1. **Repeat 2004 robustness tests** (essentially 5-6 full intensity shots at depths from 0-5 mm. Plus each 1 shot for 1, 2, 3 batches at 5 mm depth plus set-up shots at lower intensity).
2. Measure **jaw vibrations** during and after beam impact (at jaw support point and jaw middle point → doubles number of shots) as a basic cross-check of predictions (not possible in the LHC).
3. Investigate usage of accelerometers and microphones for **impact detection in the LHC** (iteration on 2004 results).

**Beam conditions:**

Energy	450 GeV
Bunch intensity	1.10E+11
Number of bunches	288
Emittance	~ 3.75 $\mu\text{m}$

**Collimator conditions:**

Same location in TT40 as in 2004 (under vacuum)

Horizontal collimator orientation

One jaw only will be installed

Window in the tank to measure vibrations with a laser vibrometer

**Beam required for test:**

Number of nominal shots on jaw

6 x 3.3e13

Beam-jaw alignment tolerance

1 mm

**Beam required for beam set-up:**

Same as in 2004.

- **LSS5**

1. Check and test as much of the **LHC collimator controls infrastructure** as possible (low level, medium level, top level with HW, FESA, logging, ... interfaces).
2. Assess limitations in applied controls approach and understand **areas to be improved** (calibration, reaction speed, refresh rates, safety related info, failures, ...).
3. **Beam loss observations** with collimators and BLM's (see list): time response, repopulation, loss maps, collimator jaw BB calibration, ...
4. **Impedance measurements** of jaws. Higher priority if **by-pass effect** can be measured.
5. **Vacuum** behavior during beam loss.

# SPS

Time allocated: 2 x 24 h

## (a) Low intensity measurements

Bunch population	1.1e11 p
Number of bunches	1 to 16
Beam energy	270 GeV
Emittance	~ 1 $\mu\text{m}$
H beam size at collimator	~ 0.4 mm
Beam orbit stability	~ 10 $\mu\text{m}$

## (b) High intensity measurements

Bunch population	1.1e11 p
Number of bunches	288
Beam energy	270 GeV
Emittance	~ 3.75 $\mu\text{m}$
H beam size at collimator	~ 0.7 mm

Time required [h]	Task
8	<b>Set-up of low intensity stored beam</b> (see above)
4	<b>Set-up of high intensity stored beam</b> (see above).
3	<b>Access</b> for installation of latest sensors, motors and for checks and debugging.
6	<b>Control software commissioning:</b> Commission control of collimator + sensors + switches+ BLM's from CCC. Check interlocks. Measure sensor offsets, linearity, mechanical play, ... and input to software database.
6	<b>Collimator calibration:</b> Calibrate jaw positions with respect to beam (a) by touching beam (non-destructive) and (b) by scraping (destructive). Determine accuracy of method and iterate if necessary (2nd phase control software commissioning).
6	<b>Impedance:</b> (a) Repeat the tune shift vs. collimator gap measurement, possibly for different emittances and bunch lengths. (b) Tune shift vs. position of single collimator jaw. (c) Verify the inductive bypass.
6	<b>Halo studies:</b> Re-population versus current, jaw setting, lifetime, .... Characterize beam loss tails for understanding required waiting time.
3	<b>Controls commissioning high I:</b> Temperature sensors, EM noise signals, cooling, ...
4	<b>Beam loss maps:</b> Beam loss maps at under controlled conditions, for various intensities. Loss maps with closed orbit bump. Loss maps and diffusion with non-linear bump.
2	<b>Vacuum pressure</b> at the LHC prototype collimator.

- Today we should try to **fill the outline from February with details...**
- This includes **beam conditions** for various tests (special 60 GeV for impedance measurement?), planned measurements, **time estimates** for various measurements, **priorities**, ...
- Final program: Aim for **October 23<sup>rd</sup>**.