Stefano Redaelli, 07-09-2004

42nd Meeting of the LHC Collimation Working Group, September 3, 2004

Present: Gianluigi Arduini, Ralph Assmann (chairman), Hans Braun, Markus Brugger, Helmut Burkhardt, Nuria Catalan Lasheras, Enrico Chiaveri, Bernd Dehning, Alfredo Ferrari, Doris Forkel-Wirth, Barbara Eva Holzer, Mario Santana Leitner, Matteo Magistris, Elias Métral, Suitbert Ramberger, Stefano Redaelli (scientific secretary), Guillaume Robert-Demolaize, Stefan Roesler, Alexander Ryazanov, Rudiger Schmidt, Markus Stockner, Helmut Vinke, Vasilis Vlachoudis, Jorg Wenninger.

1 MD planning for the collimator tests at SPS and TT40 - preliminary thoughts (G. Arduini)

See slides at http://www.cern.ch/lhc-collimation/files/GArduini_2004-09-03.pdf

1.1 Scheduled MD days and Tentative plan for measurements

Gianluigi Arduini (GA) presented a preliminary plan for the October MD's dedicated to the SPS and TT40 collimator tests. The plan is based on discussions with Ralph Assmann (RA). More details can be found at the web page:
`http://lhc-collimation-project.web.cern.ch/ lhc-collimation-project /md-sps-schedule.htm`
Three days in the **weeks 42**, **43** an **44** have been allocated for the collimator tests:

- from Monday 11/10 8:00 am to Tuesday 12/10 8:00 am (SPS test);
- from Monday 18/10 8:00 am to Tuesday 19/10 8:00 am (SPS test);
- from Monday 25/10 8:00 am to Tuesday 26/10 8:00 am (TT40 test).

Another full day MD has been foreseen in the **week 41**, from Monday 04/10 at 8:00 am to Tuesday 05/10 at 8:00 am, to prepare the SPS machine for the collimator test requirements. Namely, this MD will be devoted to the preparation of two types of coast beams at 270 GeV:

1) **TOTEM beam**: ∘ 1 to 4 bunches with 525 ns spacing
   ∘ $0.4 - 1.1 \times 10^{11}$ p/bunch
   ∘ $\epsilon^* \approx 1\mu$m

2) **LHC beam**: ∘ $n \times 4$ bunches with 25 ns spacing (n multiple of 12)
   ∘ 1.15×10^{11} p/bunch
   ∘ $\epsilon^* \approx 3.5\mu$m

Measurements of emittance, lifetime and beam stability are foreseen for both types of beams. In addition, instrumentation tests will be carried out, in particular for the LHC-type BPM's for the bunch-by-bunch mode over 1000 turns.

The **tentative plan** for the collimator measurements of weeks 41, 42 and 43 and the corresponding allocated time are summarized in the following table.

Date	Measurement plan	Time
Week 42 (11/10 8:00 am-12/10 8:00 am)	◦ Setting-up of TOTEM beam at 270 GeV	3h
	◦ Commission BLM's (measure of response function)	6h
	◦ Beam-based alignment of the collimators with small gaps (3 mm)	9h
	◦ Impedance measurements	3h
Week 43 (18/10 8:00 am-19/10 8:00 am)	◦ Setting-up of TOTEM beam at 270 GeV	2h
	◦ Impedance measurements	6h
	◦ Vacuum measurements with beam loss at shallow angles	3h
	◦ Setting-up of LHC beam at 270 GeV	3h
	◦ Measurements of trapped modes	3h
	◦ LHC feedback with beam loss (use BLM signal to steer the beam)	4h
	◦ Beam loss maps	3h
Week 44 (25/10 8:00 am-26/10 8:00 am)	◦ Setting-up acceleration up to 450 GeV and extraction with pilot beam	10h
	◦ Setting-up of extraction with pilot and LHC beams at shallow angles	2h
	◦ Collimator test	4h?
	◦ Material test	4h?

GA also commented on the required **instrumentation** for the various tests (see table in the slices). It is important to make sure that a good logging will be available in order to make correlated measurements of various devices, in particular for the BLM system. RA and Barbara Holzer will make sure that this will be ready in time. GA recommends to take profit of the existing logging for the standard SPS BLM's. Now data are averaged over 1 hour but it should be possible to reduce the acquisition time considerably (to be checked with Lars Jensen). It was also mentioned that the PLL's to be used for fast tune measurements are still in a development phase but they should be ready in time.

GA concluded his presentation by commenting that the **availability of some key people** (collimator control experts; BDI, RF, PS, PSB and control experts) must be guaranteed. It is assumed that the collimation core team will omni-present and ubiquitous!

1.2 Discussion

The presentation of GA triggered some discussions. Jorg Wenninger (JW) commented that to change cycles and set-up the TOTEM and the LHC beam a time longer than the allocated 2-3 hours will probably be necessary. GA replied that experience in setting up these beams will be acquired in the weeks 41 and hence the allocated time should indeed be sufficient. JW agreed.

Regarding the **commissioning of the BLM system**, GA has some concern that the low intensity of the TOTEM beam might not be enough to measure a decent signal. RA replied that the choice of a low intensity beam was taken because we need a low emittance beams in order to have a small beam size and test small collimator openings. The commissioning of the BLM system will be carried out by looking at the BLM signal versus collimator opening.

For the **impedance measurements**, two possible techniques are available: (a) measurements of tune versus beam intensity and versus collimator opening and (b) measurements of kick by asymmetric collimator gap. For both methods, the PLL monitors are the best candidates to provide fast measurements.

GA said that it should be verified if some measurements can be done in **parallel** with other. This could be the case, for example, for the measurements of trapped modes. The

experience shows that it is probably better to perform different tests in the corresponding allocated time in order to avoid interference with the people involved. RA commented that, once the MD plan will be finalized, we should definitely stick to it unless there are strong motivations to change plan. All the foreseen tests are very important and, as a base line, we should not sacrifice any of them.

Regarding the **collimator and material test at TT40**, GA thinks that **8 hours** may be too much for the proposed tests, which foresee to shot only a few bunches against the collimator and the material samples. Could we not envisage to use part of this time as a spare to be allocated for other experiments? RA believes that we should **not reduce this time** because we actually do not exactly know what to expect after the beam impacts. For example, strong out-gassing peaks are expected when the beam impacts on the collimator jaw, which may required a non negligible vacuum recovery time (0.5h?). In addition, some devices for some collimator tests, such as accelerometers to measure collimator vibrations and a camera required for the material test, have not been installed yet. If a time slot is no going to be found for these installations after the CNGS beam test, some MD time would need to be allocated for that. Hence, it is much preferred to **keep 8 hours** for the collimator test at TT40. RS commented that, in any case, since the set up of TOTEM or LHC beams requires 2-3 hours, it is probably not a good idea to change often the beam type.

Regarding the **installation of new equipment in the TT40**, Helmut Vinke (HV) commented that these installations should be done as close as possible to the TT40 test in order to have the longest cooling after the test with the CNGS beams (weeks 37 to 40), which will considerably activate the tunnel. It would be better to have everything installed by September the 6th (last foreseen SPS technical stop). Since this is not going to be possible, it should be kept in mind that any access after the CNGS test has to be approved by SC and has to be **planned in detail** to minimize exposition times of the personnel involved.

JW asked if we need to move the beam at TT40. RA answered that this is likely not the case, given that the beam is centred. We will move the collimator jaws with respect to the beam orbit and choose different impact parameters. Same procedure for the test with the material targets.

RA has prepared a web page with the preliminary plan of the SPS/TT40 tests. In addition, RA and GA will define in more detail the various people involved in the different tests. RA listed the following topics, which are under the responsibility of the collimation team and should be addressed satisfactorily before the October MD's:

- Better software control of collimator motors;
- Definition of the BLM positions in the SPS collimator;
- Logging and display of BLM data.

On the base of the discussions at today's meeting, RA will prepare a new list of topics and tentative plan and he will send it around for comments to the people involved. Everybody is welcome to give suggestions and comments.

2 Status of radiation impact studies at IR7 (M. Brugger)

The minutes are available on request from M. Brugger or S. Roesler.

2.1 Discussion

Bernd Denhing asked what is the error on the estimate of the doses on cables. MB answered that the statistics from the Montecarlo simulations is on the few percent level. The systematic

error is difficult to estimate. According to Alfredo Ferrari, a factor two uncertainty can be expected. RA pointed out that, in addition to the statistical and systematic errors, it should not be forgotten that the presented simulations use a perfect collimation system. Error from operation (beam/collimation system) may have a considerable effect on the estimates of radiation doses.

The next meeting will be Monday 20th September 2004, room 864-1-C02.