

MSWG Meeting 15-Feb-2013

Present:

J Wozniak, K Cornelis, J Allica, L Soby, K Hanke, R Garoby, L Drosdal, O Mete, L Sermeus, S Hancock, W Bartmann

Agenda:

Approval of minutes

Main presentations:

- Upgrade of injector FBCTs, status and outlook – L Soby
- SPS scraping MD results – O Mete

LBOC report – W Bartmann (5')

MDs report- G Rumolo (5')

AOB

The minutes of the last meeting were approved.

Upgrade of injector FBCTs, status and outlook – L Soby

L Soby presents the upgrade plans, standardisation of the FBCT hardware, replacing analogue integrators by cross calibrated VME cards with remote control (TRIC cards) and consolidation of the DCCT electronics and upgrade of the FESA class. This upgrades aim at an improvement of the relative accuracy of the intensity measurements. He also showed a list of FBCTs which will be changed during LS1.

The TRIC acquisition system allows digital signal integration and on- or offline calibration. Online calibration introduces noise to the signal. Averaged and frozen calibration factors give a factor 10 improvement for the shot-to-shot precision. The integration can be in parallel or Linac mode. The acquisition system can be managed remotely.

To improve the relative accuracy error (for transfer efficiencies), the TRICs need to be calibrated to a reference TRIC which reduces the relative error from +/- 1.5% to +/- 0.2 %. Further improvement envisaged with commercial current reference during LS1.

Cross calibrating the FBCT with DCCT depends on the machine, for the PSB the uncertainty is dominated by the DCCT for the high intensities due to the limited ADC resolution. The PS lines are noisier than the PSB lines.

For the PSB injection transformers the number of turns has to be reduced in order to improve the signal quality with L4 type beams, the according time constant is still fine.

For the L3 BCTs, comparing the old system with the TRIC: the 2% difference on ITL.BCT05 comes from an error in the calibration current and is understood; the 6% difference for the ITF.BCT15 is related to baseline distortion and BI are working on a firmware based BLR.

First measurements with a TRIC on L2 give good results on total intensity and total average current. No intensity per ring is required, except for BI.BCT10, and BI +OP is working on a solution for this.

For the new 10 FBCTs to be installed in the transfer lines, a prototype (FT16.BCT203) was qualified. The beam position dependency is 1% for +/-30 mm which is a factor 60 improvement compared to the LHC FBCTs. Short bunch lengths result in reflections, and the signal is not back to the baseline within 25ns, and thus no bunch by bunch measurement is possible for 25 ns beams. The measured bunch length dependency is less than 0.5%.

Discussion:

R Garoby asks whether the improvement of the relative accuracy is the accuracy between devices or beam types – the accuracy between devices will be improved. Concerning the resolution, single bunches cannot be resolved, only pulses.

K Hanke answers that BI.BCT10 and BI.BCT20 shall be modified in LS1.

K Cornelis asks if the bunch length calibration is dependent on single bunches or bunch trains – the calibration curve is rather flat for the range of a few kHz to 200 MHz, so no changes are expected.

KC comments that traceability of hardware changes is required.

SPS scraping MD results – O Mete

O Mete presents the concept of a scraping system based on a magnetic bump. To proof the concept two MD sessions took place using extraction bumpers in LSS6 to displace the beam horizontally onto the TPSG. Beam type: Single LHC bunches with Q26 optics. Orthogonal steering knobs were used to control the beam position and angle at the TPSG.

To determine the cleaning duration the first derivative of the intensity curve is taken; this together with the intensity drop before and after the cleaning are used to determine the cleaning speed. This method might be sensitive to cycle-to-cycle intensity fluctuations. Changing the beam angle – to optimise the cleaning speed - results in different locations for the loss peaks; shallow beam angles concentrate losses on the TPSG with little leakage to the septa, strong beam angles show little losses at the TPSG and a loss peak at the MSE1. Offset values in the bumpers and/or orbit deviations suggest that the case where the beam is aligned to the scraper happens for a non-zero angle.

Larger bump durations do not improve the cleaning speed significantly within the measured error bars. Shorter bump durations are operationally advantageous considering bumper rise/fall times for different adjacent actions (scraping, extraction etc.). On the other hand, the bumper current stability sets a lower limit. This was measured as 150 ms for the LSS6 horizontal extraction bumpers.

Performing a full beam scan allows to measure the beam profile which were confirmed by wire scanner profiles and the conventional scraper.

Comparing the fixed vs. movable scraping shows that cleaning with the movable scraper takes longer; scattered particles circulate for many turns until they are absorbed.

Using a predefined stepped bump amplitude function during a cycle allows a full profile measurement within a cycle; the movable scraper scan needs several cycles and is prone to cycle-to-cycle differences.

The system was proved to be working.

A review taking place on this subject recommended keeping the old system operational and the magnetic bump system documented and ready for possible upgrades in the future. Crystal extraction to be further studied as alternative.

Several actions on the existing system are presented.

Discussion:

K Cornelis is wondering why losses move further downstream when the beam becomes better aligned to the absorber.

KC mentions that the profile scan within one cycle - if done at 26 GeV – could be performed with existing correctors. Concerning the maximum beam sizes, in the vertical plane the CNGS beam at injection has to be taken, in the horizontal beam the FT beam at extraction.

R Garoby comments that there were lifetime tests of the bellows of the present system.

KC comments that the damage limit tests will be done the following day; the plan is to break the spare system with a full beam impact and afterwards perform another scraping test to see its behaviour.

RG mentions that crystal collimation is an interesting option to study but it should not impact on time and resources of other LIU studies. KC states that crystal collimation is attractive due to bigger impact parameters but has the disadvantage of reflecting the beam through itself; it is probably more interesting for heavy ions in the LHC.

MD report:

An exhaustive MD program was going on in the injectors and quench tests in the LHC until the last minute of beam.

LBOC report

No LBOC

AOB:

During LS1 the meeting slot could be moved to Tuesday morning (instead of the FOM). The next meeting will be kept as usual on Friday afternoon.

Next meeting: 15-March 2013