MPP meeting 30 April 2010

Original agenda:

- Update on BLM thresholds and filters (BLM team)
- Analysis of the 4 MB quench event (R. Appleby/R. Schmidt)
- Results of the de-bunched beam dumps (B. Goddard)
- AOB: squeeze factors (J. Wenninger)

Present:

Robert Appleby, Ralph Wolfgang Assmann, Nicola Bacchetta, Tobias Baer, Wolfagang Bartmann, Chiara Bracco, Mario Deile (Totem), Massimiliano Ferro-Luzzi, Brennan Goddard, Richard Hall-Wilton, Eva Barbara Holzer, Richard Jacobsson (LHCb), Mike Lamont, Daniel Macina, Annika Nordt, Giulia Papotti, Mariusz Sapinski, Rudiger Schmidt, Andrzej Siemko, Matteo Solfaroli Camillocci, Benjamin Todd, Sigrid Wagner, Siegfried Wenig (ATLAS), Jorg Wenninger.

Minutes:

Results of the de-bunched beam dumps (B. Goddard)

Brennan presented results on the 4 asynchronous beam dump tests done at 3.5TeV (with the assumption of uniform abort gap population):

- 3.5eV unsqueezed centered beam - 2 bunches
  - Losses in IR6 saturate - High losses in IR7 (0.2Gy/s) - Leakage from TCDQ < 1e-4
  - R.Assmann commented that one has to be careful with the conclusion because part of the losses on TCTs comes from the primary collimator shower.
- 3.5eV squeezed centered beam - 2 bunches
  - IR7 6e-1Gy/s - IR6 B2.TCDQ 14Gy/s - Leakage for B2 TCQD ~3e-3
  - Ralph Assmann commented that P1 seems to be exposed to the beam dump as P5, so the cause is not particles escaping the TCDQ and directly hitting the TCTs.
- 3.5eV squeezed centered beam - 2 bunches
  - IR7 6e-1Gy/s - IR6 B2.TCDQ 5Gy/s - Leakage from TCQD ~4e-3
  - Strange structure on the BSRA signal to be understood.
- 3.5eV squeezed beam with 1 sigma offset - 2 bunches – (considered the worse case for operation):
  - IR6 saturated - IR7 15Gy/s - Leakage from TCDQ ~2e-2 from BLMs (but saturated). Using abort gap population gives ~2e-3
  - No quench of Q4 (factor 10 above BLM threshold)
  - Experiments almost did not see anything with 5-7e9 in abort gap

Brennan stressed that results as to be considered as preliminary. Ralph Assmann commented that what we see as losses from the collimators in LSS6 is just one stage cleaning efficiency.

Estimation of leakage from TCDQ is about 1e-4 with unsqueezed beam and 2-4e-3 with squeezed beam. The effect of 1sigma offset seems not to be huge. There is a small difference between this case and centered beam one. It needs to be further investigated. Brennan said that BLM saturation in P6 needs to be addressed to make this calibration more accurate, together with measure of response for TCT/TCDQ/TCSG6. Rudiger said that Machine protection relies on very fast losses, then the addition of filters (as done for the injection phase) should be very careful considered. Ralph agrees.

Ralph Assmann worried about some losses which are seen for several hundred microseconds; this could mean that the beam is not completely gone. Brennan disagreed and said that the beam has surely gone and it could be a memory effect on the BLM. Barbara Holzer said that it could be (effect not seen in the SPS because cables are much shorter). Ralph Assmann commented that this memory effect could also explain some of the non-understood saturation behavior of the BLM. Later, the data from the experiments indicate that the beam loss is indeed short and does not exceed the expected time.

Asynchronous beam dumps (Sigi Wenig)

Sigi presented data showing the difference in the spread over bunch crossing between synchronous and asynchronous beam dump in ATLAS. In the asynchronous case beam spreads over 10-20 bunches. Brennan commented that the spread is quite long but that the data is very useful to the transfer line team. Rudiger asked if the BLM team was preparing fast monitors, to be installed at a few locations in LHC.

Experiments asked to be warned for the next tests so that they can increase the acquisition rate.

Update on BLM thresholds and filters (Barbara Holzer)

Following the requests made by Brennan for over-injection the threshold on 4 MBX monitors in P2 and P8 was increased (now allowing up to ~8e9); on the other hand the threshold on TCT has not been change yet.

The request for high intensity injection was of increasing the thresholds (of external monitors in that region) by a factor of 25. RC filters have been installed.. Some comments:

- Maximum current will be reduced by a factor of 8.3 by RC filter and additional factor of 3 with (future) thresholds
- Factor of ~10 between signal on external and internal monitors
- For moment the threshold values not changed!
- For all other energies the thresholds are now too high
    - A quench could occur

    - New thresholds to be calculated ASAP
- All these monitors set to maskable
- Estimate: Quench of magnet by outside shower if injection intensity 2e13

Two requested were made for the TCLA by Ralph:

a) All signal divided by thresholds values should be smaller than 0.01 taking the resonance crossing data from UTC: 15:35:00 28.03.2010, 15:28:38 28.03.2010, 15:25:48 28.03.2010 and 15:32:16 28.03.2010

b) The original number of protons allowed to hit the TCLA directly, should not increase by more than a factor of 4 (potential damage). To be confirmed by Ralph.

IP7

For the TCLAs in the shower on the TCPs the threshold has been already increased twice by a factor 50 with respect to starting of the 2010 run, now satisfying condition a); for the TCLA outside the shower threshold has been decreased by a factor 25 resulting only a factor 2 higher than initially specified (condition (a) and (b) satisfied).

IP3

TCLA: threshold is 50 times higher than original values. Constraint b) not necessarily satisfied for all TCLAs (not proven to be satisfied).

All monitors that don't help with protection have been disabled from the BIC.

Noise studies on BLM in R3 started!

Rudiger asked how the threshold changes are documented. The answer is that the changed are logged in TIMBER at least once a day and when energy changes. Then an ECR will be issued with all changes. Rudiger suggested issuing an ECR with the changes already implemented.

Analysis of the 4 MB quench event (R. Appleby/R. Schmidt)

Robert Appleby presented the analysis on the quench event of 18/04/2010 at 22:33 when 4 dipole magnets (A20R1 B20R1 C20R1 A22R1) triggered quenches when the beam was injected. Beam 1 was injected with intensity of 8E9. RQD.A12 was left at 350A instead of 760A by operational mistake. BPM.Q19.R1 as well as the ones in cell 20.R1 and 21.R1 already recorded +6mm while the BPM in cell 22.R1 has no data possibly because was perturbed. BPM registered losses starting on cell 18R1 then seen only on the TQD BLMs.

The calculated beta function clearly explodes. The peaks in the BLMs correspond perfectly with the peak in the beta function.

The spatial distribution of the magnets which quenched is not perfectly understood. On the other hand, the bigger margin before a quench occur for quadrupoles with respect to the dipoles together with the fact that the energy was smaller (current at 350A instead of 760A) can explain while only dipole magnets quenched.

Mike Lamont asked about ideas to make sure that this event cannot happen again. Jorg Wenninger commented that "Sanity Check" function in the sequencer to check the correct setting of the circuits must be used and in the long term a tool to survey all circuits has to be developed. Ralph Assmann stressed that the pilot pre-injection is a very important principle. Everybody agreed.

Squeeze factors (J. Wenninger)

A meeting has been held to clarify the main points to be considered for the squeeze factor:

- The timing system will be prepared to distribute the b* values
- The generation of the b* values is done by SIS which sends its results directly to the LHC timing system
- Experience will be fed into the design of the 2011 SMP version (V3)
- Collimator controls teams and other clients could test the use of b* values

b* can be reconstructed by the current of 2 selected power converters as shown in the table below:

IP	Ratio of magnet currents
IP1/IP5	RQ10-R5B2 / RQ7-L5B1
IP2	RQ5-L2B1 / RQ7-R2B2
IP8	RQ5-L8B1 / RQ7-R8B2

The algorithms (implemented in the SIS) works for the squeeze at 3.5 TeV and along the ramp (within 0.1 m). Only 2 telegrams (which will probably become 4 in the future) have been prepared:

- HX.BSTAR15-CTM IR1 and IR5 beta*
- HX.BSTAR28-CTM IR2 and IR8 beta*

Everything is already in place except the link SIS -> MTG and could be set operational sometimes next week.

AOB

The question of the beam dump at the end of a fill was addressed by Richard. Is it necessary to go through the long handshaking procedure for the experiments? This will be discussed between the experiments and the machine.

Scriba: Matteo Solfaroli