MPP meeting 5 August 2011

Original agenda:

- LHC Beam Beam Compensator – a first proposal (R.Steinhagen)
- Machine Protection issues & proposal for Pb-p run (J.Wenninger)
- Losses during recent injection events – observations and risk for ALICE detector (P.Martinengo, tbc)
- ATLAS BCM/BLM thresholds – motivation/concerns wrt to protection of the silicon detectors (T.Pauly/S.Wenig)
- AOB

Present:

M. Zerlauth (TE/MPE), M. Koratzinos (TE/MPE), R. Jones (BE/BR), A. Dabrowski (PH/CMX), M. Gutmoff (PH/CMX), B. Todd (TE/MPE), S. Wagner (TE/MPE), R. Kass (PH/ATL), H. Kagan (PH/AT), E. B. Holzer (BE/BI), M. Deile (PH/TOT), B. Puccio (TE/MPE), M. Lechman (PH/AID), J. Jowett (BE/ABP), F. Zimmermann (BE/ABP), J. Wenninger (BE/OP), S. Mc Mahou (PH/ATLAS), H. Merrit (PH/ATLAS), T. Pauly (PH/ATLAS), E. Nebot (BE/BI), B. Dehning (BE/BI).

Minutes:

LHC Beam Beam Compensator – a first proposal (R. Steinhagen)

Ralph presented the proposal for the beam-beam compensator (BBC) prototype to be installed in the LHC. Four locations have been reserved left and right of IP1 and IP5. They are located at 105 meters from the IP where the phase advance from the IP is about 2.6 degrees.

Additionally, four other alternative locations are considered for the BBC. The first alternative location is just before the TAN absorber. The beam separation is 165mm (55mm more), this is important as the wire interacting with the beam has to be installed between the two beams. The disadvantage is that it is before the TAN so there is lot of debris coming from the experiments, especially neutrons. This neutron flux will provoke out-gassing. The design for installation in this location will be more complex so it will not be ready for the first long shutdown (it takes 1year to be manufactured by the companies).

The second alternative location is where the TCT is. The BBC system will be integrated with the TCT. In this way the system will reuse all established infrastructure and the integration will be easier. Also the

design will be robust against the beam. Installing this option is excluded for the first long shutdown, as the new TCT design with pickups is already started, but the location can be prepared for the following. The third option will integrate it with the roman pots in XRP1 (147m from the IP). Those RP are used for high beta star optics and they have never been used so far.

The last location is between Q4 and Q5 where there is a lot of space. For this location a BBC system based on a TCT will be used. In this way the system will be robust and safe because the water pipes can be placed further away and jaws will act as a heat sink for the wire. The main disadvantage is that the 26 degrees phase advance for this position might be too big. Studies are being done in order to confirm or reject this location. **Frank** commented that 26 degrees is too much as the margins for the BBC are in the order of a few degrees only.

Markus agreed that it must remain in the shadow of the TCT. **Ralph** commented that BBC will be only used during special MD. **Jorg** pointed that event in the case that it self-destructs during an MD it will be still ok as long as it retracts and the water cooling circuit remains intact.

Protection issues & proposal for Pb-p run (J. Wenninger)

Jorg presented the first iteration for the Machine Protection and Interlocking of proton-ion operation. Two major points have been are considered: each ring must be able to receive protons or ions without relying on a fixed mapping between ring and particle type and injected beams will by definition be considered unsafe.

In the worst case scenario where if wrong type particles are extracted from the SPS, they will never make it to the LHC (due to the energy acceptance of the transfer lines 0.4%). -> LHC is safe and therefore we must protect the extraction lines Ti2 and Ti8.

For the LHC the RF frequency differs in 5.3 kHz so this will be the simplest way to identify particle type for each ring. For the SPS it must be measured at extraction but there are no fast measurements available. However, for the SPS it will be possible to identify particle type by measuring the beam position at two locations with a dispersion of about 2 meters. Also beam momentum at SPS injection can be used (9GeV difference).

Jorg explained the conditions applied for SPS extraction/LHC injection for both protons and ions. LHC RF frequency must match the reference, LHC CPTY telegram must be consistent, SPS user name must be correct and injection line TT10 settings must be consistent. In this way SIS will only allow injection if SPS and LHC ring are consistent.

Markus proposed to move some collimators in the transfer lines to protect them from wrong particle extraction. **Jorg** commented that almost all collimators in the transfer lines are placed at the end but there are some momentum collimators in Ti2 that have never been used and can be used to protect the line.

Ben asked what would be the SBF intensity threshold for the case of p/ion runs. **Jorg** answered that the most conservative must be used.

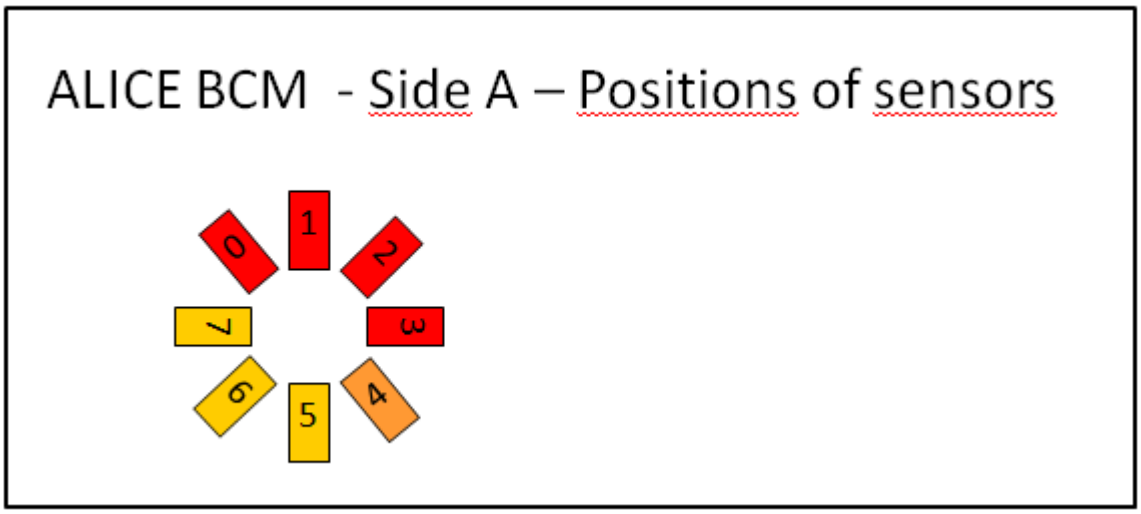
Markus proposed to profit from MD to test the new logic in the SIS.

Losses during recent injection events – observations and risk for ALICE detector (M. Lechman)

Mateusz presented the observations made by Alice BCM and sub-detectors during kicker failure. Alice experiment has two BCM stations: BCM-A (left IP2) and BCM-C (right IP2). Both stations consist of 8 diamond detectors placed around the beam pipe. The logic to trigger a beam dump is the following: fast abort if 3 out of 4 adjacent sensors exceed the threshold in RS1 or RS2, slow abort if RS32Sum exceeds threshold.

On the 28th July 2011, BCM triggered a beam dump twice: at 16:30 and 18:03.

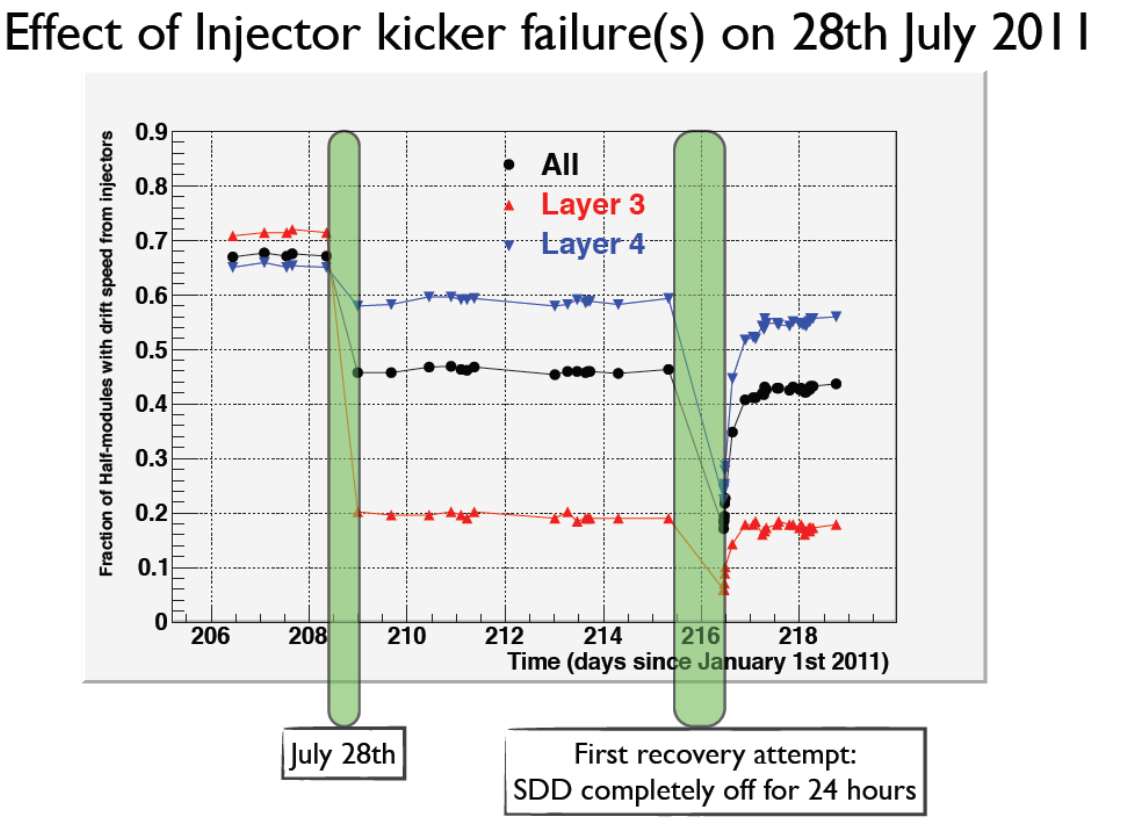
The first event exceeded 80 times the threshold on RS1 (500 nA) and RS2 (250 nA) on station A. This corresponds to a fluence of 2E6 part/cm^2. Typical background values for RS1 & RS2 are in the order of <18nA (to be confirmed by **Antonello**). Sensors on the top showed the highest values (picture below). Values of BCM-A where higher than BCM-C, this is what they normally observed in the past during injections.



The second event exceeded 3559 times the RS32Sum threshold (16 nA), 2290 times RS1 and 3363 times RS2. This corresponds to a fluence of 84E6 part/cm^2.

Mike: the 1st event looks like the beam hits on the TDI and creates a shower while in the 2nd the hit is shallower.

The second event affected all Alice subdetectors. All were recovered using standard procedures but the SDD subsystem (see image below). Alice recovery time from standard trips is around 1-2 h.
Investigations are still ongoing for the SDD, for the moment only 20% on layer 3 and 60% on layer 4 have good drift speed from injector. It can be that the damage is permanent; in this case we have to think of a different calibration strategy (Leonardo Milano).



Mateusz concluded that they are very close to limits of safety and they are not protected against these events even if the DUMP signal is sent.

Markus commented that events like the 1st one are more frequent as the beam goes to the TDI; the worst case scenario when operating with 25ns, increased intensity and reduced emittance, is that up to 400 bunches might graze the TDI which translates into 3-4 times more losses downstream. On the contrary events like the 2nd one should happen much less frequently.

Francesco explained, by email, that Alice SAFE status was and is defined as all the powers (HV/MV and LV) ON. This option was taken based on simulations of radiation effects on the detector and the fact that it is needed for the injectors to calibrate the detector during the RAMP-UP phase before STABLE BEASM (switching OFF and ON the HV takes some time).

It is still unknown with 100% confidence level if the damage occurred in the MOS injectors themselves (i.e. on the sensors) or (even if less likely) on some electronic components of the injector polarization and triggering circuit which is on the boards located in the so-called end-ladder locations.

However, it is being considered to modify the SAFE sate for the future in order to reduce the HVs during INJECTION phase and ramp them up to operation value at the end of INJECTION phase. In this way, it is still possible to perform the needed calibrations during the RAMP-UP phase (as it is being done), before STABLE BEAMS. This should help in prevent such accidents in the future. During next TS some test to check this configuration will be done and eventually a proposal for a new DCS configuration for the SDD will come out.

ATLAS BCM/BLM thresholds – motivation/concerns wrt to protection of the silicon detectors (H. Merrit)

Hayes presented the investigation concerning the dump of July 31st, 2011. Atlas has active BLM monitors (diamond sensors) that trigger a beam dump and BCM monitors (diamond sensors) that measure luminosity.

At 6:47 am, activity was seen on all BLM and BCM sensors. All twelve BLM detectors exceed BLM abort threshold (230 hits) during at least 4 orbits. BLM´s average background signal is around 50. **Hayes** commented that the threshold is set based on the silicon tracker damage limit.

BCM PM buffer show activity 2ms before dump (measured in the high gain channels). The timing of the BCM signals suggests that particles were coming from 'C' side to 'A' side. 'A' signal is delayed 12 ns from 'C' signal and this corresponds to the 12.5ns of ToF from 'C' to 'A'.

Mike asked about the granularity of the sensors. **Hayes**: 1.5 MIPS.

BCM background rates during the fill show two luminosity scans before the spike from the event. This occurred during ADJUST before STABLE BEAMS could be declared.

Jorg explained that initially they though the UFO happened on beam 1 at around Q4 but now they suspect it was on beam 2 at Q1.