Summary Notes: 12th Meeting of Sub Working Group on the Commissioning of the Machine Protection System, Wednesday 19th December 2007

Present: Ralph Assmann, Bernd Dehning, Eva Barbara Holzer, Verena Kain, Mike Lamont, Alick Macpherson, Laurette Ponce, Stefano Redaelli, Rudiger Schmidt, Mariusz Sapinski, Jan Uythoven, Jorg Wenniger

CC: Reyes Alemany, Roger Bailey, Brennan Goddard, Magali Gruwe, Bruno Puccio, Walter Venturini, Markus Zerlauth

BLM experience at HERA – Bernd Dehning

- Bernd presented a summary of HERA operation and BLM performance.
- Points to note:
  - 64% of the quenches had a loss duration < 200 turns (5ms). Their BLMs are slow (> 5 ms) and can not capture the fast losses.
  - Coincidence of 4 BLM monitors are required to trigger a dump, out of a total of about 200 BLMs installed.
  - Most of the quenches did not occur at injection energy
  - HERA has only adjusted their BLM thresholds once in 11 yrs of operation (note that the thresholds have been observed to be low – by up to a factor of 10 below their theoretical quench level and a factor 50 -100 below the expected real quench level)
  - The lowest number of quenches are observed during the initial running period (commissioning) of HERAp
  - The number of quenches normalized to the beam current was constant over several years, only decreased as special efforts were made to reduce the number of quenches
- Bernd reiterated that based on his HERA to LHC considerations, the MPS system priority should be:
  1. Safety:
     - Here it was stated that we must be aware that allowing procedures for threshold changing potentially reduces reliability as well as brings perhaps unnecessary risk.
  2. Operational efficiency.
     - In Bernd's view, the masking of BLMs will not automatically imply an improved operational efficiency, and may compromise safety.
       - Bernd is asking if the masking functionality (in light of the MPS requirements on the BLM system) is needed

- Additional post-meeting comment from Bernd: A gain in operational time can only be expected if a monitor threshold is set wrongly or a channel is not working at all. Since it is not clear if a pilot intensity at 7 TeV is damaging the hardware, it could be the case that this masking will only be possible at 450 GeV. Recalling the HERA experience that most of the quenches occurred at top energy a judgement is needed if the potential gain can be justified compared to the reduction in safety.
  - Note: Jorg maintained that the masking functionality is needed for the commissioning phase.
    - Comment from Bernd: Please can the requirement for masking be clearly specified ie which system, what is the expected gain, and why.
  - Note: the masking is being done at the level of the BIC (special entry)
    - The Reliability of the Safe Beam Flag is important. Rüdiger will present this in one of the next meetings.
  - Note: At this stage the operations use of the masking vs disabling of BLM channels has not been discussed
    - Masking masks all BLM channels connected to the maskable input of a BIC. eg all channels configured as mask-able can be switched off for one octant
    - Disabling only affects a single monitor, but monitoring for that monitor is lost
      - Note: if the channel still works monitoring is available, disabling is cutting "only "the connection to the BIC.

BLM experience at the Tevatron – Ralph Assmann

- Ralph discussed the Tevatron collimation system and it use of Tevatron BLMs. The key points were:
  - Tevatron Collimation is only setup by experts, and operators only run pre-defined sequences
  - During tuning of collimator positions the BLMs are all bypassed, and losses on collimators go up to 80% of the quench threshold
  - The Tevatron has a stable algorithm with peak maximum loss rate that is 6 times the maximum loss rate for a fully setup LHC collimation system
- Collimator setup must be done differently to the Tevatron
  - Tevatron sets up the collimators with a full intensity beam every time before they go into physics. LHC will have to set up the collimators with a few nominal bunches
    - Comment from Bernd: This has to be seen. I think the step in intensity is too large to judge for full LHC intensity from the losses from few bunches (factor 1000 difference). Likely intermediately intensities have to be used too. To make this extrapolation from low losses at the injection energy to losses near to the dump

threshold the fluctuation in the measurements must be 1E-3 (dI/I), that is not possible with the BLM system. We assume that the fluctuation will be of the order of few percent 2-3 E-2).

- o Automatic procedures are being developed and beam intensity info must be available at a reasonable rate (100Hz).
- o For these procedures the collimation system wants ability to change BLM threshold/quench level in a localised region
  - Comment from Bernd: Such changes can occur in periods without beam in the machine.
  - Who is allowed to change the BLM thresholds?
- o The procedure for setup is shown in the figure below:
- o Note that the "Good" status is determined by generating diffusive beam loss in one plane and then recording the intensity loss rate and the BLM readings. The diffusion speed is then increased until target loss rate (efficiency) is reached (=> Good), or BLM generated abort/quench.
  - The measure cleaning efficiency depends on the max (dI/dt) at the BLM abort limit/quench limit, hence the collimation system needs adjustable BLM thresholds.
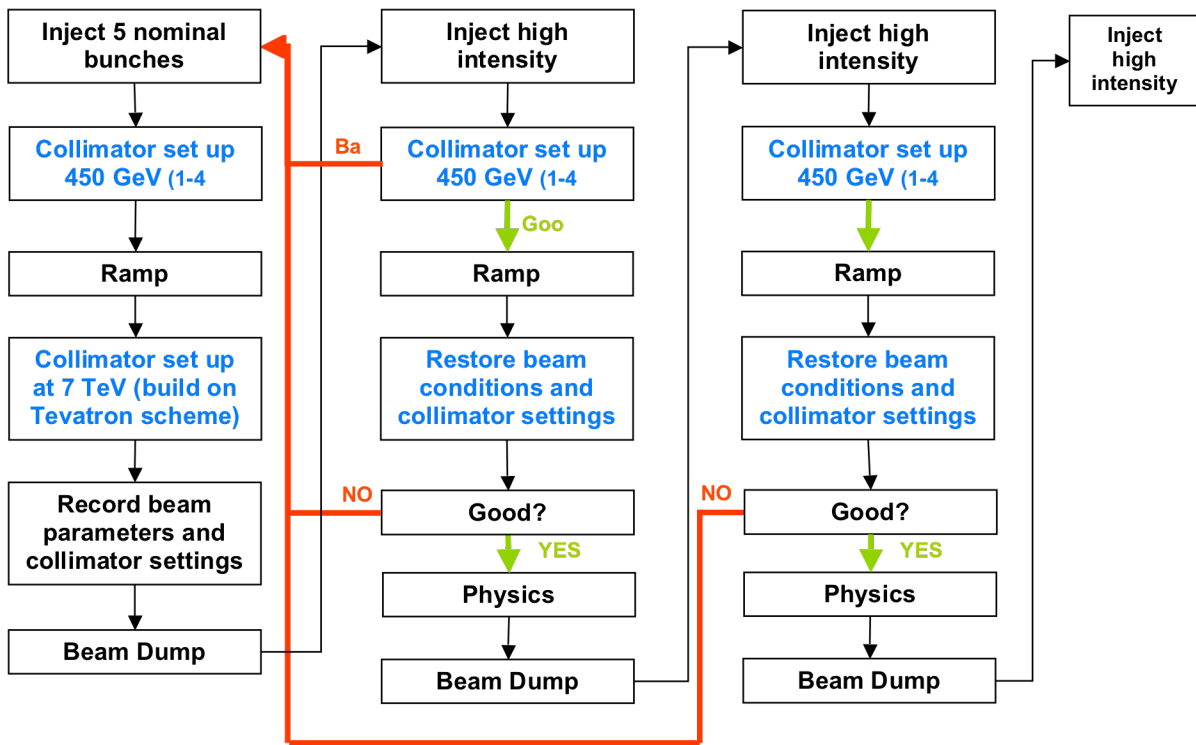
BLM threshold setting and operation – Laurette Ponce

- Due to a shortage of time, Laurette was not able to present much. However several questions were raised. Clearly, in order to make sure the BLM threshold setting and operation is as expected, a further dedicated discussion is needed.

- o Questions raised:
  - Can a significant increase in number of families be supported by the database? Still no answer from the CO group by the time of the meeting.
  - Can the family structure be divided by sector, so that there are no ring wide families?
  - What is the policy for BLM threshold settings for ion runs?
  - Is it possible to change the threshold on an individual monitor? If so, can it only be done by the BLM expert, or are operators allowed some limited degree of adjustment?

AOB

- Next MPSC meeting
  - o **Date: 9th January 2008**
  - o **Time: 10:00 - 12:00**
  - o **Room:** 865-1-D17