

Workshop on Experimental Conditions and Beam-Induced Detector Backgrounds

Summary of Session 3 Discussions

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INTRODUCTION

The third session of the workshop addressed the issue of what the experiments require and provide for optimization of known background sources at the LHC, and the discussion generated by the presentations is summarised herein.

ATLAS (W. KOZANECKI)

The speaker was asked to discuss the role of LUCID in the ATLAS background monitoring. It was explained that LUCID was a conical Cerenkov Counter detector placed around the beam pipe close to the interaction point. Its primary function is to provide online luminosity measurements, but in addition the time resolution of LUCID could provide information on out of time hits, and so could potentially be used to identify background. It was stated that in principle LUCID could provide such information. However, it was stressed that the sensitivity of LUCID as a background monitor has not yet been studied.

R. Tesarek asked if there were any BLM monitors in direct line of sight with the IP. It was stated that all the ATLAS BLMs are mounted on the endplate of the inner detector, and so are not in line of sight with the IP. It was further mentioned that the signal expected from these BLMs is to be predominantly proportional to luminosity/ collision products, but *M. Mikuz* commented that these devices had been added to ATLAS primarily for the purpose of protection.

P. Grafstrom also commented that a re-evaluation of the simulation of scattering of primary particles off the TCT is needed, as the present level of detail is insufficient for a realistic detector level response to backgrounds. Further, this simulation should also include the response of the endcap muon chambers.

The issue of when to turn on the various ATLAS monitors that could provide background information was also mentioned, but was left as an open issue that is to be followed up. In particular *P. Grafstrom* commented that the danger levels for the various sub-detectors and monitors needs to be defined and calibrated before a turn-on policy can be specified. However it should be noted that the ATLAS BCM monitors are implemented for the

purpose of experiment protection, and are to always on when there is the possibility of beam in the machine.

CMS (J. SPALDING)

O. Bruning asked about the details of the “St Catherine’s Day Massacre event in CDF, and it was explained that this was an incident where Tevatron beam grazed the CDF beam pipe when exiting CDF. *J. Spalding* and *R. Tesarek* pointed out that this was an exceptional situation, and was related to a beam pipe misalignment due to fault installation. This mis-alignments situation resulted in a steady state source of SEU events until it was identified and corrected.

O. Bruning also asked about the expected performance of the CMS beam spot measurements reported by *J. Spalding*. It was explained that bunch by bunch monitoring measurements are to be maintained as running sums. For beam spot measurements, the expected time scale is of order of a few minutes, and should give a transverse position resolution to $O(\sim \text{few } \mu\text{m})$ and a z-position resolution to $O(\sim \text{few } 10\text{'s } \mu\text{m})$. For precision measurements of β^* and emittance, it is expected to take several hours for reasonable values to be obtained, as several million tracks are needed for the measurement.

Regarding the Beam Scintillator Counters (BSC) *M. Ferro-Luzzi* asked about the hit occupancies and readout, and it was stated that the readout is by standard TDC with a hit rate of $\sim 1 \text{ Hz/cm}^2$. *K. Eggert* questioned this for the BSC tiles installed in the forward region close to the beampipe, as the density of tracks in the TOTEM region is expected to be large.

ALICE (A. MORSCH ON BEHALF OF T. NAYAK AND A. DI MAURO)

It was noted by the speaker that ALICE has the most unfavourable Luminosity/Background ratio (at least factor of 1000 less than high luminosity experiments) and that the ALICE has been designed to perform tracking for 1000 times the pp multiplicity. This prompted *A Rossi* to ask if the forward detectors of ALICE could be used to reject beam gas events.

It was stated that this is to be done at the trigger level as such events can be identified as out of time events. *H Burkhardt* commented that for pp collisions and with

background problems from beam gas the effectiveness of such an approach would be diminished at higher luminosities. *K. Eggert* further commented that in order for a beam-gas rejection method to be established, you would need good minimum bias runs at low luminosities. *K. Eggert* also stated that this was the reason behind the request by ALICE and TOTEM for special low luminosity runs.

In regard to the question of assessing the beam gas background contribution *R. Assmann* noted that single beam running is planned, and that this may be useful to ALICE

The speaker was also asked if ALICE (and LHCb) could receive very high luminosities by accident. The answer is believed to be yes, and the speaker explained that BCM units are to be used, in part, to protect ALICE against such accidents

LHCb (G. CORTI)

As it was noted that the BCM is based on 16 1cm² diamond sensors (8 on each side of IP), *R. Tesarek* asked if LHCb was planning to have large area monitors (eg scintillators ala BSC) to measure beam losses. The speaker replied that at this stage no such monitors were foreseen. *R. Tesarek* also commented that for CDF the change in the signal to background ratio for changing conditions is of order 0.005, and is rather insensitive due to the slowness of controls system implementation. He pointed out that it would be to LHCb's benefit if there radiation monitoring could be done so that such insensitivity could be avoided.

In relation to the effect of beam gas on trigger efficiency, the speaker pointed out that previous studies indicated that if the vacuum pressure increases by a factor of 10 above the target value (ie to a pressure of 10⁷ millibar), the trigger efficiency loss rises to ~10%, due to beam gas events. The speaker was then asked to give an estimate on the maximum allowed pressure in the VELO, and she stated that this could be ~1000 times the nominal ie the maximum pressure allowed is of order 10⁻⁶ millibar. This raised the issue of what should be done to set and monitor acceptable operational limits on the vacuum pressure. This was left as an open issue.

In regard to the RADMON monitors deployed around LHCb the speaker was asked to comment on what they would measure and on their availability. It was then noted that the RADMON monitors installed around LHCb were standard RAMON monitors, and so could provide total dose measurements as well as dose rate, flux, flux rate, and SEU rates, and that these monitors were already installed.

FORWARD DETECTORS (M. DEILE)

After a review of the various forward detector systems, *B. Holzer* asked if it was foreseen to have an alarm system that can react on a fast timescale, especially for the forward detectors that involve or are near movable devices. The speaker replied that in the case of the Roman Pots, BLMs are mounted next to them, so that the protection mechanism of the BLMs, which is integrated into the Beam Interlock system, should give sufficient protection. In addition, there is an interlock based on the Roman Pot position as determined by contact switches.

For the forward detectors it was also indicated that if rates in either the detectors themselves, or the neighbouring BLMs were too high, the detectors would simply be turned off. However this raised a question from *K. Eggert*, as to whether the various forward detectors discussed here can survive if hit directly either by the beam or by significant beam halo. This question was left as an open issue, as the answer is not clear and cannot be generalized to all the forward detectors discussed in the presentation.

In regard to LHCf, the speaker was asked why a double arm cut on the extreme forward p-p production is foreseen to be applied as a means to reduce the effect from beam-gas background contributions: The physics motivation of such a cut was questioned, but was not clarified.

The speaker was also asked why the presentation did not include RP220 and the ZDC experiments, and it was stated that the focus of the presentation was on the forward detectors foreseen for the early running but that given the information received, some experiments were not covered.