SESSION3 SUMMARY

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SESSION III

In this session the experiments (ALICE, ATLAS, CMS and LHCb) presented their strategy for monitoring background, disentangling the various types (when applicable) and exchanging background-related information with the machine. The last presentation was dedicated to Roman Pots (TOTEM, ALFA), LHCf and FP420.

It appeared that experiments have so far focused their attention to beam losses on severe failure scenari and protection of the experiment. Beam-induced background has (naturally) been given less priority. In this respect, the preparation for and realisation of this workshop have favored the creation (or consolidation) in each collaboration of a group of physicists to work on these issues. Understanding backgrounds at start-up should benefit from this increased momentum.

It was generally agreed that background is rarely disastrous, but can often be quite a nuisance and difficult to tackle. The example of an excess at high values of missing transverse energy (E_T) observed in CDF was given to illustrate that these background-contaminated data were not lost and could be cleaned up offline, with extra work. Slow-varying backgrounds are generally thought to be less problematic than sudden bursts ("spikes").

Given the different running conditions and detector configurations, the experiments will have different sensitivities to background rates. For example, ATLAS and CMS have been designed for high luminosity (10^{34} $\mathrm{cm}^{-2}\mathrm{s}^{-1}$) and therefore one expects no substantial contribution to the integrated dose by steady state beam-induced background. ALICE and LHCb will run at lower luminosity and without TAS/TAN absorbers around the experiment. Thus, they are potentially more exposed to degraded beam conditions. ALICE in particular will normally run at 10^{29} $\mathrm{cm}^{-2}\mathrm{s}^{-1}$ (and generally at $< 3\times10^{30}$ $\mathrm{cm}^{-2}\mathrm{s}^{-1}$) and, being designed for such luminosity, is likely to be (of the four large experiments) the most sensitive to beam-induced background. In fact, for ALICE, nominal backgrounds are expected to contribute a few percent to the total dose.

Furthermore, it was pointed out that, because of the lower luminosity and the fact that the machine will be less well understood, beam-induced background are likely to be a bigger issue during the initial runs.

It was also reminded that all electronics of the experiments around the detectors have been carefully designed or chosen such as to be compatible with the expected particle flux at nominal luminosity. Therefore single event effects are not expected be an issue.

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Some of the experiments may have the capability to distinguish, by timing, the backgrounds induced by the two beams. For example, ATLAS will use time correlations within the Beam Conditions Monitor, Minimum Bias Trigger Scintillators halo trigger and Forward Muon trigger to disentangle backgrounds from the two beams. The first two should always be on, the third only when beams are stable. Several other detectors (Forward Muon Chambers, Transition Radiation Tracker, Pixel and Semiconductor Tracker, Luminosity Cerenkov Integrating Detector) will be used to monitor occupancies per bunch crossing. However, these detectors are mostly off when beams ar not declared stable (except LUCID).

A number of signals to be exchanged beteween the experiments and the CERN control room (CCC) were proposed and discussed. In particular, it was proposed to add the following to the list of parameters transmitted by the CCC via DIP:

1. the beam life times,
2. BRAN rates and luminosity,
3. the extrapolated positions and angles at the IP,
4. vacuum pressure readings in the vicinity of the experiments,
5. the positions of collimators and beam losses.

The questions addressed to the experiments concerning special beam conditions were partially answered. Negative effects due to bunch-to-bunch luminosity variations, luminosity and background variations during a fill, and fill-to-fill variations are difficult to quantify and will require first real data to be properly assessed. ATLAS mentioned that 20% bunch-to-bunch luminosity variations may be tolerable, though this would need further studies.

Concerning vacuum in the IR, it seems that actual or expected vacuum conditions give large margins (more than one order of magnitude) to what could cause a nuisance to the experiments. The effect of the tertiary collimator vacuum and other elements that may cause local pressure bumps (such as elements that warm up due to beam losses) was not yet included in simulations and needs to be looked at.

The effect of satellite bunches is also difficult to quantify. Interestingly, it was pointed out by ATLAS and LHCb that the experiments may be able to actually measure the relative charge in some satellite bunches (at ±2.5 ns from the main bunch) by reconstructing collisions at IP±37.5 cm. This may prove useful for understanding the machine. It was also said that such displaced collisions may be useful for alignment (in particular, to constrain so-called 'weak modes') and a small amount of beam time with such collisions might be requested by the experiments.

Locally non-colliding bunches may also prove useful for understanding backgrounds from each beam and might be requested by the experiments in special fills. Though, it is not clear to what extent such bunches will be representative of the other bunches.

In general, it is thought that several signals will be combined by the experiments to create a few (2 to 4?) 'background figure of merit values' (sometimes termed BKG1, BKG2, ...). The details of this combination are yet to be worked out and may well need to evolve with time, especially during the first run. The experiments might start with simple one-to-one relations between BKG values and the normalised rates measured by selected background-monitoring detectors.

ALICE expressed worries about quartic halo background which may be the largest source for them. They request that the tertiary collimators be not put more inward than required by protection of the triplet magnets. It was also pointed out that background conditions between experiments should be compared with care, as for example the impact of a given absolute background rate may be much worse for a low-luminosity experiment as it is for a high-luminosity experiment.

All experiments have dedicated detectors to monitor luminosity and backgrounds, such as the Beam Conditions Monitor (BCM). The primary role of the BCM is to protect the experiment against beam-induced damage. They are therefore designed for detecting abnormally large background rates that could lead to destruction of equipment. Such rates are generally orders of magnitude higher than the rates of backgrounds which may already affect data quality. Therefore, the sensitivity of the BCM may not be optimal for monitoring ordinary backgrounds.

In general the subtraction of the luminosity signal from background-monitoring signals appeared not to be thoroughly addressed.

For forward detectors, current simulation results indicate that halo from distant beam-gas scattering is expected to be the dominant background source at low luminosity (around $10^{29}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$), while background from secondary interactions due to IP collisions may become dominant as one approaches high luminosity ($\sim 10^{33}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$).

Concerning simulation studies, several signs were given indicating that future work should be coordinated such as to promote a more coherent approach among machine and experiments.