Workshop on Experimental Conditions and Beam-Induced Detector Background
Summary of Session 2 discussions

Chairmen: H. Burkhardt, M. Ferro-Luzzi - Scientific secretary: S. Redaelli
CERN, Geneva, Switzerland

INTRODUCTION

The second session of the workshop addressed the prediction of known background sources at the LHC, the available knobs to optimize the machine-induced background and the experiment protection.

ESTIMATES OF RESIDUAL GAS PRESSURE IN THE LHC (A. ROSSI)

M. Huhtinen expressed concerns about the vacuum measurements shown for SPS collimator tests with beam that took place in 2004. Should we expect the same levels for the Tertiary collimators (TCT's) close to the detectors? *S.Redaelli* replied that this is not the case because the materials are different (Carbon instead of Tungsten). Tungsten collimators have not yet been tested with beam. *R. Assmann* warned that the out-gassing will manly take place at the collimators in the dedicated cleaning regions, which are exposed to large losses. The TCT's close to the experiments act as triplet protection and are not supposed to get high beam loads during standard operation. *M. Huhtinen* stressed that we then urgently need vacuum estimates for the TCT's with realistic loss rates.

H. Burkhardt commented that it will be important to monitor the vacuum levels at the machine start-up to feed this experience back into the simulations. In particular, it will be useful to determine basic scaling laws of the vacuum level against basic beam parameters in order to be prepared for the following commissioning stages.

W. Kozanechi asked about the estimates shown of collimator flange heating and corresponding out-gassing. The presented value of about 10^{-9} bar would be too large even for the vacuum of the cleaning insertions. *R. Assmann* replied what was shown by A. Rossi is not the typical case during beam operation but refers to a worst case scenario used as a criterion for the system design. The out-gassing in this case will not be steady but will last at most for 10 seconds. This was considered by AT-VAC to be acceptable.

M. Ferro-Luzzi asked if vacuum leaks can be detected with beam loss monitors (BLM's). In particular, if we encounter a beam-gas background problem due to a possible Helium leak in a cold section, could the BLM's give information for localizing the leak and with what longitudinal accuracy? This is not clear because with the present system the spacing between the monitors might not be optimized to detect leaks. *H. Burkhardt* suggested that we could envisage dedicated beam time to address this issue, for example by creating on purpose controlled vacuum bumps. *W. Kozanechi* also liked this idea and stated this should be followed up.

SIMULATION OF MACHINE BACKGROUND (V. TALANOV)

A. Morsch commented that the tertiary collimators are not needed in IP2 with un-squeezed optics because the triplet aperture is not critical. He is strongly against the possibility of closing them and using the IP2 as a cleaning insertion. This topics was addresses in detail in R. Assmann's talk, where it was clarified that the TCT in IP2 are only supposed to be used for the early commissioning phase with reduced β^*.

A. Morsch also stated that IP2 has been treated less well than other interaction regions as far as detailed loss studies are concerned. He expressed the request that, as an outcome of this workshop, the inputs for background studies shall be provided for the relevant machine configurations.

MACHINE-RELATED BACKGROUNDS: THEIR ORIGIN AND LOADS ON ATLAS/CMS (N. MOKHOV)

W. Kozanechi expressed concerns about the plot in page 10 of N. Mokhov's slides, where muon fluxes up to 10^{11} are quoted. Indeed, after the meeting N. Mokhov clarified that there was a typo in the vertical scale of the plot: given number have to be reduced by a factor 10^6. The slides on the workshop web site have been updated accordingly.

M. Huhtinen commented that the sharp reduction of muons that occurs at about 500 meters from the IP (see slide 8 of N. Mokhov's talk) is actually an artifact of the simulations because the model does not includes the arc further downstream. N. Mokhov agreed however commented that the sources of muons in the machine regions that are not modelled do not contribute significantly to the background and therefore they can be safely neglected.

W. Kozanechi asked if the output of N. Mokhov's simulations can be used as an input both for ATLAS and CMS background studies. Nikolai replied that this is indeed the case.

EFFECTS OF BACKGROUNDS ON EXPERIMENTS (M. HUHTINEN)

K. Eggert asked if the diffractive protons that leave the interaction point are expected to be a source of background for the other experiments. For example, this can clearly

become an issue for ALICE that could collect the ATLAS physics debris in beam 1 direction.

Responding to a question brought up by M. Huhtinen about the statistical weight and data biasing in the background simulations, *N. Mokhov* stated that a new version the MARS code is being prepared which will address these issues.

A. Morsch pointed out that the statement about ALICE, that beam-gas rates are predicted to contribute 10% of the absorbed dose, was based on conservative assumptions. In the light of the actual pressure achieved, this could be an order of magnitude less.

COLLIMATION (R. ASSMANN)

M. Lamont asked about the settings of the beam dump collimators (TCDQ elements). There is only a margin of half betatron sigma between the settings of the TCDQ and of the secondary collimators in the betatron cleaning insertions. Clearly this is difficult to control operationally. R. Assmann replied that this is a known concern. The scale for collimator settings is set by the aperture of the machine. The presented settings were agreed with the injection and beam dump teams and we cannot easily relax them if we want to protect the machine aperture while ensuring the required cleaning performance.

M. Lamont also asked what is the damage limit for the tertiary collimators. R. Assmann replied that one nominal bunch at 7 TeV can potentially destroy them.

H. Burkhardt suggested that with reduced beam emittance we could relax the collimator settings. On the other hand, R. Assmann warned that beam with smaller emittance will also be more dangerous because the energy density will be larger.

J. Spalding asked some details about the working assumptions for the asynchronous beam dump failure scenarios. R. Assmann clarified that the TCT's will be set such that the triplets are always in the TCT shadow. More detailes about the simulation assumptions were provide to J. Spalding after the workshop.

EXPERIMENT PROTECTION (D. MACINA)

A. MacPherson asked if the protection of the level 2 trigger relies only on data communication with DIP and if this is considered to be safe enough. D. Macina replied that of the experiment protection interlocks, only (and temporarily) the threshold value of the SPS Probe Beam Flag is transmitted by DIP. The rest is via the BIS or GMT. Therefore, what relies on DIP is not the full detector protection but rather the protection against scenarios that are not considered as catastrophic. An example is the switching off of high voltages, which is recommended in case of injection failure but is not expected to put in danger the detector in case of failure of DIP signals.