Minutes of the MPPr 1st April 2011

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Scrubbing run

During the scrubbing run the LHC will operate with high intensity beam, possibly up to 1400 bunches. It is intended to use filling patterns with 75 ns, 50 ns and possibly 25 ns bunch distance.

For a bunch distance of 75 ns the bunch intensity is 1.2*10E11, for 50 ns between 1.3 and 1.4*10E11. With an emittance of 2.4 um injection of many bunches should be not too difficult, with an increased emittance of 3.5 um the injection setting up might be more difficult. The emittance to be used will be decided during the injection tests.

This run is intended to reduce the effects of electron clouds, but is also a challenge for the RF system that will operate with a very large number of bunches. With such high beam intensity, damage to RF components cannot be excluded in case of failures and insufficient protection.

RF system during scrubbing

In case if a klystron trip the beam can induce voltage and power in the circulator load. An interlock monitors the power dissipated in the load (“Watcher High”). If above threshold, the cavity will be switched off and a beam dump is triggered.

At injection, the external Q value (Qext) should be set to a value of 20000, this should not be changed for injection. This limits the maximum voltage that can be induced in the cavity to below 1.2 MV. **Before a ramp is launched, RF needs to intervene.**

The power extracted by the HOM dampers (4 dampers per cavity) scales with the beam current squared and increases with reduced bunch length. It does not depend on the beam energy. An interlock monitors power and temperature of all HOM dampers, and if above threshold, switches the RF off for this cavity. Normally the beam keeps circulating. This interlock is operational. On the longer term this will also dump the beam in case for routine operation with high intensity beam (more than, say, 1000 bunches).
A software interlock will be used for the scrubbing run, measuring the same parameters, and requests a beam dump when the predefined threshold is exceeded. This interlock updates the values every 4 s, and also dumps the beam if no new data arrives after a timeout of 12 s.

In the discussion it was suggested to test the case of a Klystron trip with several hundred bunches. The interlocks introduces for the scrubbing run need to works correctly, possibly some checks have to be done. It was also pointed out that members from RF will monitor signals from the RF system during intensity ramp-up.

Intensity ramp-up

The scrubbing run will proceed with steps of 200 bunches. As for increasing the intensity for physics, a (modified) checklist needs to be filled out before the next step. A draft template for a checklist for the scrubbing run is available under EDMS document 1138527 and needs to be completed. Members of the RF group will complement the checklist for the RF system.

Other issues

Collimators and beam losses: since three collimators were realigned, loss maps at injection are required to validate the hierarchy of the collimation system. One TCT in the horizontal plane had a tilt and was realigned by 1.5 mm. Loss maps at 3.5 TeV might also be required (to be decided later). The EIC should frequently enter beam loss patterns in the eLogbook to help for later analysis. In particular after partial beam loss such loss patterns are very useful and it is proposed to note down the time of the beam loss. (e.g. beam loss due to a cavity trip).

Beam Position Monitors: It is proposed to perform recalibrations of the BPMs in regular intervals, this will be included in the checklist. The performance of the system should be checked if the bunch intensity is very high (bunches with an intensity of up to 1.6*10E11 might be injected).

Beam Dumping System - TSU: the system still operates with the 2010 version of the firmware.

SMP and CISV: a special timing receiver card (CISV) distributes the safe machine parameters (energy, SBF, …). A recent update of the firmware in all timing receiver cards was done. Normally, this should not affect the CISV firmware. Since there were wrong entries in the database after some modification of the ATLAS CISV cards had been performed, the firmware for CISV in ATLAS was not correct. This was detected and had not consequences. The same cards are used in the BLM system and other system. A software interlock would detect a failure of energy distribution to the BLM system. CISV cards with correct jumper setting cannot be remotely programmed; the cards in ATLAS did not have this feature. The question to ensure the correct operation of CISV cards will be addressed.