LHC Beam Operation Committee

Notes from the meeting held on 15th March 2011 (PRESENT)

1. Wire Scanner and BSRT status – F. Roncarolo (slides)

Federico presented the status of the single bunch transverse size measurement devices available for the LHC:

Single bunch wire scanners went through important hardware and software modifications:

- Standard mode now allows single bunch measurements on all devices equipped with new electronics at 40 MHz bandwidth, front-end setup for single bunch selection and OP GUI new PRO version released. Still problem on Beam 1 due to 200 Hz baseline noise to be cured.
- Turn mode (10 ms averaging of signals): working fine for beam 2 while beam 1 needs new delay to open measurement gate at bucket 1
- General: front-end fits which are those saved in Logging database are not always correct, one has to check. Anyhow all profiles are logged so offline analysis always possible. Dedicated MD is needed to define absolute accuracy

The **BSRT** also had some hardware and software changes during shutdown period:

- Hardware: the optical path has been re-aligned and a slow camera translation stage has been added for additional remote focusing freedom. A new intensified fast camera has been installed. Alignment still to be improved (especially for beam1) as soon as external optical devices are delivered. Also the new Ethernet connection to the fast camera is not yet stable.
- Software and Controls: at the front end level an automatic optical filtering and camera gain setting has been implemented by use of image feedback at any beam energy and intensity in order to get rid of scaling of setting from theoretical tables. An automatic mirror focusing based on image acquisition feedback is almost operational.
- BI expert GUI: the BI expert GUI allows subscription to the FBCT readings to have bunch list for scans and allows bunch scans on demand. The scan dies as soon as the GUI is closed.
- OP fixed Display: for OP crew a fixed display developed by Laurette is available since start-up.
- OP GUI (LAFS): an OP GUI is available developed at an early stage but a full debug of the GUI has not been done yet. \LAFS people are ready to modify/upgrade it.

Future Work: at the front-end level a full commission and test of the stability of the automatisms implemented based on the image feed-back is needed. While a major upgrade to move profile fits from FE to daemon process on US45 PC can also be done and improve the fit quality. For the bunch scans there are still some open questions concerning if they should equip the FE with FBCT subscription and automatically initiate the scan Or if they should go for an upgrade of the OP GUI for manual bunch scans but in this case who will do it? Among the OP crew R. Giachino and G. Papotti have been trained to use the application.

Federico showed some cross calibration of BSRT versus WS which demonstrates that the camera translation allows to find a better focusing. Best correction factors versus energy this will also be published into the logging database. Many studies are still needed to understand absolute accuracy of the system: focusing, aberration and diffraction effects. For this purpose a machine study experiment request has been submitted.

Comments:

Concerning the Wire scanners: R. Alemany asked why the wires cannot fly simultaneously (beam 1 and 2 horizontal and vertical), Federico answered that horizontal and vertical plane cannot be measured simultaneously but beam 1 and 2 maybe can be. B. Dehning confirmed it is possible to measure beam 1 and 2 at the same time.

Concerning the BSRTs: Massi mentioned the fact that BSRT starts from slot 0 which can be confusing since the first available slot in the accelerator is number 1. Verena asked if the BSRTs can be used during the ramp, Federico said no, it is very difficult at this stage, they are aiming to have a reliable measurement at 450 GeV and 3.5 TeV then they will look in more detail to the ramp.

2. Status of Orbit Feedback Reference Orbit Handling– K. Fuchsberger (slides)

An orbit change during the squeeze was originally not foreseen but now a strategy has been defined and made operational. Kajetan defined first what is taken as reference orbit, which is the sum between a base-orbit and the overlays during the different beam modes. He went through the change in orbit during the squeeze. Before preparing for the ramp the system takes the injection orbit and check the overlay shapes then starts orbit change at the same time as the events triggering the start of the ramp and squeeze. During the squeeze a linear interpolation is used to scale the orbit during the process, at each the stop points the reference orbit used is the one calculated from the interpolation. For different LSS he showed also the maximum error which is seen by using the linear approximation during the squeeze, which never exceeds 0.6 mm. Some issues have been addressed as the NaN in the reference orbit, which has been fixed with the last OFSU release. Triggering of the scaling changes by

time events is already available in the low level software, but the implementation in the sequencer will need the definition of sequencer tasks and sequences. Also optics changes have been implemented in the system and they need to be tested further and made operational. Nevertheless a feed forward correction should be defined and applied during operation.

Comments:

Concerning the OFSU: R. Alemany mentioned that the OFSU operated by the sequencer frequently crashes, R. Steinhagen confirmed that massive changes have been implemented and to read back the applied settings there is always a delay of 10 s. Jorg again mentioned it does stop working frequently and R. Steinhagen confirmed that the problem would be fixed on new version. The new version was released in the week before the TS, but the number of crashes is till very high (a few per day).

3. Update on the field model: tune and chromaticity – E. Todesco (slides)

Ezio gave a fast update of the tune and chromaticity analysis among the 2011 fills.

Tune: from averaging over many fills of 2010 and the available data of 2011 it seems that the decay of the tune during injection in 2011 is only 70% of the decay observed in 2010. The amplitude of the decay is of 0.02-0.025 units with a time constant of 4000 s. A dynamic correction of the effect is available and ready for testing whenever OP will require it.

Chromaticity:

- The **decay** of the chromaticity during injection looks similar to 2010 experience. The amplitude of the decay is around 20 units with a time constant of 1000 s. A dynamic correction at injection is ready for testing whenever OP will require for it. During the ramp the model for the chromaticity evolution is not always correct. At the end of the ramp the chromaticity is perfectly corrected while at injection a residual 10-20 units of chromaticity variation is present like it is under corrected. A possible explanation of this effect can come from the hysteresis contribution in the MS magnets. These magnets are powered at 5-8 A at injection at this level of powering the hysteresis effect is around 10% which translates in around 10 units of not corrected chromaticity. Hysteresis effects of the MS are now available and ready to be implemented to reduce the uncorrected chromaticity to 8 units.
- **The snap-back** analysis among two ramps give 25-30 units of chromaticity variation. 18 units have been corrected, but it is visible that the correction underestimates the effect.. More statistics is needed to conclude.

Comments: Jorg commented that it is worth dedicating a long injection to see the implementation of corrections during the ramp. R. Alemany mentioned that with Marek they are working on making FiDEL operational from the sequencer and that they are testing now without beam. She mentioned that it would be worth asking for MDs time to test with beam. Jorg answer that it will be tested it in the next days during commissioning stages.

4. Filling Schemes. M. Ferro Luzzi (slides)

Massi gave an overview of the strategy of filling schemes he proposes for the 75 ns physics start-up in the next weeks. All constrains from the injectors extraction kickers timing and abort gap minimum window have been taken into account. Two main differences with respect to usual fillings schemes comes from experiments requirements and are: the presence of non-colliding bunches in IP1 and IP5 and small bunches added at the beginning of the scheme. This is mainly for TOTEM to commission their new T1 detector and take low pile-up diffractive data with T1 and T2 detectors.

5. AOB

Jorg remembered that the next meeting of the LBOC will take place in 2 weeks time. Next week the MDs committee will have the first meeting using the LBOC room time slot and remembered the deadline for MDs request submission on 16th March 2010.