LHC Beam Operation Committee

Notes from the meeting held on 8th May 2012

Participants

1. BE-CO work for the TS#1 – Outcome of the Actions (Pierre Charrue)

P. Charrue summarized the actions of BE-CO during the Technical Stop #1 (TS#1) and pointed out the differences to the initial planning. **Most of the foreseen interventions were completed without problems; a few planned interventions were postponed to the next TS. See slides for details.**

Discussion:

G. Arduini noted that there was a **problem with the DIP handshake** during recovery from the TS and a **problem with the execution of the BLM sanity checks** after the TS.

ACTION: P. Charrue will follow up, if the issues are related to BE-CO changes.

2. Losses in Ramp and Squeeze (Jorg Wenninger)

J. Wenninger summarized the problem of beam losses during ramp and squeeze. He showed that the losses increased from 2011 to the first quarter of 2012 and are even higher after TS#1. While the losses during the ramp are diluted and could be explained by the movement of the collimators, very sharp loss spikes are observable in the squeeze. **The losses during ramp and squeeze are much larger for B2 than for B1.**

The loss structure during the squeeze is very reproducible. Two categories of losses are observable: Losses that occur at (or close to) the matched optics points and losses at intermediate squeeze steps (mainly between 2.5m and 2m β^*). **J. Wenninger showed that some beam loss spikes can be correlated to orbit excursion spikes at the primary collimators (TCPs).** He showed that in the current operational situation, **an orbit shift of 100µm at the TCPs implies a high risk of reaching beam losses above the BLM dump thresholds.** A batch-dependent difference in the loss pattern was observed with particularly high losses for the first 12 bunches. The effect could be attributed to a lower transverse damper gain for these bunches. The losses were equalized by using the same damper gain for all batches.

J. Wenninger presented that a beam based measurement of the collimator centers was performed, which showed a **shift of the center of some collimators of about 100µm.**

In order to reduce the orbit excursions during the squeeze, a **test with 10 times increased orbit feedback (OFB) bandwidth** was performed (2 bunches/beam). **The orbit excursions during the squeeze were significantly reduced.** The corresponding orbit corrections are (partially) fed forward for the following fills.

J. Wenninger pointed out that the beam loss issues is thought to be related to an **increased tail population.** Thus, a scraping at injection could mitigate the losses. He stressed that the diagnostics for transverse tails in the LHC is very poor.

J. Wenninger presented that rMPP proposes consistent settings of the BLM thresholds in IR7 which correspond to total beam losses of 200kW (present settings ≈50-100kW).

Discussion:

R. Bruce underlined that a few percent of losses during the ramp are expected due to the closing of the primary collimators. He also stressed that the spatial loss pattern is very similar to the loss maps.

John Jowett pointed out that the optics in IR7 is slightly different between B1 and B2.

G. Papotti noted that she recently observed an unstable pilot at 450GeV in B1 horizontal with a chromaticity of -1.5 units. Such instabilities were only observed at much lower chromaticities (≈-10 units) in 2011.

G. Arduini confirmed that the orientation of the collimator center shift and the direction of the orbit excursions can explain the loss spikes.

B. Holzer asked if there are arguments against increasing the OFB bandwidth. R. Steinhagen replied that the OFB could diverge if the orbit perturbations are too large (as already seen during a high bandwidth OFB test in 2011). Furthermore, a higher OFB bandwidth implies that more BPM noise is transferred to the beam.

3. Observation of Losses and Instabilities during Collisions (Xavier Buffat)

X. Buffat presented an analysis of the beam lifetimes during the PHYSICS beam process (BP) for the fills 2533 and 2536 and presented an update on the instabilities observed in fills 2488 and 2535.

X. Buffat showed that high losses occur at the end of the PHYSICS BP. He presented the tune footprints and underlined the **significance of the long-range beam-beam (LR) interactions in IP2 for the tune footprint.** In accordance with that, the bunches with full LR in IP2 have the highest beam losses.

A larger crossing angle in IP2 could mitigate the issue (aperture margin is sufficient for 150μrad). Also an optimization of the tune is expected to help. Thus, **a tune scan is proposed.**

X. Buffat summarized the instabilities observed during the IP1/5 leveling tests (fill 2488) and the length-scale calibration (fill 2535). He pointed out that, unlike mentioned earlier, **the instability in fill 2488 is not correlated to a leveling in IP8.** X. Buffat explained that bunches are grouped via collisions partners. It is expected that initially only very few bunches were unstable and the instability

was then transmitted to the other bunches of the group by beam-beam interactions. In consistence with that, **the unstable bunches in fill 2488 and 2535 belonged to the same group.** The groups of bunches which became unstable consisted of few bunches only, for which a strong coherent motion can be easier excited.

The initial source of the instabilities is still unknown. It is expected that an increase of the transverse damper gain could counteract the instabilities.

Discussion:

F. Zimmermann noted that the skew crossing in IP8 leads to a coupling. W. Herr concluded that this would lead to a folding of the tune footprint.

W. Hofle asked about the difference of the amplitudes of σ and π-mode oscillations. X. Buffat replied that this is unknown, because with the BBQ it cannot be distinguished between different modes of coherent oscillations.

X. Buffat proposed to do a tune-scan in the beginning of a fill, since the effect at the conditions at the end of a fill are different.

AOB

Addendum by Pierre Charrue (email):

> I have organized a meeting between BT and CO on the **issue of the failure of the WIENER crate power supply.** After some discussions, we arrived to the following conclusions:
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> - **The cabling and protection enhancement proposed and deployed by BT and EN/EL during the Technical Stop are offering a much better protection and redundancy**, therefore the probability to fall in the situation that would provoke an async dump due to failures of the WIENER power supply is very low.
> - The BE/CO group will develop and deploy a simple **FESA server that will monitor the state of the WIENER power supplies.** This FESA server data will be available to DIAMON/LASER and SIS to display in the CCC and to take actions (DUMP or INJECTION veto)
> - This FESA server is now under development and tests and will be deployed most probably during the next Technical Stop (End June)

Upcoming meetings:

Tuesday, 22nd May 2012 15:30 in 871-1-011: LBOC

Reported by Tobias Baer