LHC Beam commissioning working group

Tuesday 12 January 2010

Notes on the informal discussion on "LHC Q stability revisited" by M. Gasior & Ralph J. Steinhagen

Slides of M. Gasior & Ralph J. Steinhagen.

To be addressed:

Measurements to be made in order to conclude that the 8 kHz is coming from the UPS system -switch mode frequency.

Work implication of changing the switch frequency of the UPS?

What are the components which propagate the signal to the beam? One is the transverse damper but is not the only one as when the transverse damper is off, signal propagation can still be here.

Observations and possible lines of investigation:

- Residual tune stability: RQT[D/F] circuit current ripple and any other sources? RQTD/F circuit noise of several mA? To compensate for this effect it would need increasing the dp/p modulation to levels which are then not transparent anymore to the beam. To note: tune shift of 17 possible at injection with these magnets. To check: Can the MQT[D/F] corrector circuit stability be improved?
- Broad frequency "hump" driven beam excitation: hump predominantly observed in the vertical plane, originally thought to be a fixed, but actually it is more a fast frequency shifting oscillation with the mean drifting slowly between 0.25 –0.32f_{rev}. Moves a lot, continuously, so makes it very hard to find an ideal tune.
- Hump on beam 1 is correlated with the one on beam 2. A "1/f" shape spectrum observed for the hump, which tends to indicate that the source is coming from some electronics. The tune ripple spectrum is flat.
- Looked that this hump became more apparent around 2009-11-28 – 2009-12-03.
- Observation of the hump moving during the chromaticity measurements. But some time also not moving.
- Coupling b1/b2 is about 0.15 with only 3e9 p/bunch, coupling through collisions.
- 'Hump' at 1.17 TeV? Tune spectra before (450 GeV) and after (1.18 TeV) for the ramp #6 indicates that i) Central frequency is shifted down ii) Amplitude seems to approximately scale with energy (-8dB reduction).
- Clear vertical beam blow up observed as well by the synchroton light monitors.
- Many different observations were made on the beams. Next beam period: to check consistently the beam sizes, chromaticity, vertical blow up, while performing the tune measurements.

- To investigate:
    - Do measurements with single beam show as well a vertical blow up?
    - Investigation on the possible hump source: an active element which acts on the two beams at the same time, the same amount. Need a vertical dipole source somewhere, which act on both beams.
    - All solenoids were brought up around that time, also the MCB. Any hump signal before the solenoids were switched on?
    - Culprit frequency oscillation is around 3.5 or 7.8 kHz. Water cooling system? Beam screen vibration? Any other equipments?
    - Mode spectra which give possible beam blow-up? To note: noise on the tune does not always give beam blow up.

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