Landau damping: BTFs and diffusion mechanisms

The BTF system has been set-up (GUI, excitation amplitude), several configurations have been tested (energy, intensity, emittances, single bunch, trains, ADT gain)

Completely transparent to the beam no emittance neither losses observed

To do list for the 2016:

Parasitically to beam commissioning:
• calibration of the excitation amplitude kick together with the BI team
• cabling for B2 needs to be checked (BI team)
• investigation of the spikes on the BTF signal: are they noise or real signal?
• investigate excitation of pi-mode (observed at injection)

BTFs and diffusion mechanisms MD:
• repeat octupole scan at injection and at flat top to measure SD (higher resolution required)
• crossing angle scan to investigate the effects on SD of beam-beam long range interaction and octupole interplay
• Impact on SD of diffusive mechanism due to resonances/noise
• Establish scaling laws for chromaticity and spread measurements from BTF
BTFs and diffusion mechanisms MD

Procedure (8h):

- Inject beams: 1 trains in Beam 2 and single bunch in Beam 1
- Turn off the ADT on single bunch and measure the BTF for different octupole currents
- At flat-top reduce the ADT gain and perform BTF measurements on the single bunch changing the octupoles currents (above 450 A)
- ADT off and measure BTF with full octupole current 550 A.
- Turn on the feedback gain back to operational conditions and proceed through the betatron squeeze.
- At the end of the squeeze reduce octupole currents (above 350 A) to measure LR contribution
- Back to nominal configuration of octupoles measure BTF for different tunes
- Reduce chromaticity in steps from 15 to 10.
- Proceed for collisions.
- With IP1 and IP5 optimized switch off the ADT on single bunch and perform BTF as a function of separation offset
- Reduce crossing angles in IP1 and IP5 corresponding to a reduction of beam separation of STEP (e.g. 1 sigma) and take a BTF measurement at each step switching off the ADT (collimator settings and interlocks as done during the LR MD)
- Tune scan with BTF measurements at each tune change
Mode coupling beam-beam and impedance MD

Observations of instabilities while leveling luminosity with a transverse offset at the interaction point during the 2012 physics run of the LHC suggests that the beam stability in this configuration can be critical.

Goal of the MD: probing the stability of beams colliding with a transverse offset

Indeed in this configuration the reduction of the stability diagram and the coupling of impedance and beam-beam coherent mode are crucial

Observation of bunches colliding only in IP8 becoming unstable while leveling luminosity with a transverse offset motivates the investigations, in order to understand and possibly mitigate such instabilities.
Mode coupling beam-beam and impedance MD

Procedure:

• Measure chroma with probe
• Inject 1 low intensity bunch in each beam (1E11)
• Inject 1 intermediate intensity bunch in each beam (1.5E11)
• Inject 1 high intensity bunch in each beam (2E11)
• Lower damper gain to operation-like settings
• Turn the damper off, check stability with BBQ (if needed, increase octupole until stable)
• With damper on, bring the beams in collision in IP1 and optimize
• Turn off damper
• Increase separation in steps in IP1, check for stability - Be ready to turn damper back on to save the beam in case, and move on with separation scan until the beam is again stable without damper
• Repeat last steps with both IP1 and IP5 simultaneously

• Repeat as above with different chroma