Effect of ground motion on triplet and beam screen stability

Main pending points:

• Amplification factor for the triplet movement wrt the movement of the floor to be determined
• Estimate of the movement of the beam at the collimator from losses
• Check with the DOROS BPM if possible
• Check the spectral data for the BLM at the TCP
• Explore the possibility to perform ground motion measurements closer to the beam line or even on top of the magnets
• Explore the possibility to perform transfer function measurements on an existing LHC dipole.
Amplification factor for the triplet movement wrt the movement of the floor to be determined

• Transfer function from mechanical model now exist
• In principle more forgiving than present triplets
  (see Davide’s presentation at the last HL-LHC Collaboration Meeting)
Amplification factor for the triplet movement wrt the movement of the floor to be determined

• Measurements agreed upon so far:

  • Vibration measurements on an existing LHC dipole in 2019

  • Measurements on a Q2 prototype cold mass planned early 2020
    • Warm, using accelerometers

  • Possible measurements in STRING
    • optical – to be confirmed by alignment group
    • may cover cold measurements, coupling through interconnects, some technical noise sources
• Estimate of the **movement of the beam** at the collimator **from losses**
  • Rough estimate done (within a factor 2-3 from observation/prediction)
  • Strong dependence on beam halo distribution, difficult to do better than this

• Check with the **DOROS BPM** if possible
  • Not done so far, possibly to be prepared for Run3

• Check the **spectral data** for the **BLM** at the TCP
  • Some initial analysis done by Michaela in the past, but spectral data on **ADT** already confirmed consistency with **ground motion sensors**

• N.B.: For all signals, spectral data analysis is very limited unless done on fresh data
Clear correlation between GM and ADT spectra

Reference at 8:00 (local)
Spectrum for highest loss spike

ADT vertical plane baseline excitation.

Ground excitation at ~21Hz causes beam excitation

M. Schaumann, LMC - 15 Aug 2018
• Explore the possibility to perform ground motion measurements closer to the beam line or even on top of the magnets

  • **Ongoing, but not favored** by ground motion measurements team
  • Information on cryostat movement not really relevant
  • Main reason could be the **detection of technical noise**. However this makes sense only in **realistic conditions** (but without beam). Possible before beam at the end of LS2?

• Explore the possibility to perform **transfer function measurements** on an existing **LHC dipole**. > Planned (see previous slides).
Other actions - questions

• Vibrations of the beam screen:
  • no problem expected at high frequency since eigen frequencies are in the lower range. Main issue only if beam screen vibrates at tune frequency, 3 kHz and harmonics
  • Eigen frequencies of beam screen (13 Hz for Q1-type, 20 Hz for Q2-type) should in principle give negligible impact on field stability.
  • Still, some follow-up on vibration at these “intermediate” frequencies – evaluate maximum amplitude in resonant conditions (at 20 Hz beam screen “drags” about 10% of magnetic field).

• How far from dump threshold we would be for the expected vibrations in HL-LHC taking into account the higher beam current?
  • In principle the threshold will be scaled from the present situation with beam current – no big difference expected wrt LHC (Stefano confirms?)