MKI Visit 25/11/2009 Minutes

- Met at 9.30AM at Mike’s office at Prevessin (M. Barnes, F. Caspers, H. Day, E. Metral, N. Mounet, B. Salvant, C. Zannini and the fellow working with Mike: Rudi Rudi Henrique Cavaleiro Soares).
- Reminder:
  - There are 4 MKI kickers (of 3 m length each) at the 2 LHC injection points.
  - It was anticipated in the past that the beam-induced heating would be too high (reaching ~ 300 deg, whereas the ferrite should not go above the Curie temperature, i.e. it should stay below ~ 80 deg). Therefore, based on an educated guess, it was proposed to add a ceramic tube inside (with ~ 3 mm thickness), with 24 grooves (looking at the beam), in which a conductor is inserted. A longitudinal impedance measurement was performed in the past revealing a dramatic impedance reduction. The transverse impedances were not measured yet.
- Shown to clean room containing MKI open – ceramic tube with screen conductor insets not yet inserted into new MKI. Screen conductor inserts similarly not yet inserted into ceramic tube
- Mike explained the principles guiding the MKI kicker magnet design:
  - The system is designed to approximate a coaxial cable from the electrical pulse point of view (see pg 21 of CAS slides); Each cell of the magnet representing a capacitance to ground (capacitance discs to ground) and a series inductance (3 ferrite blocks forming a U-shape with an aperture through which the beam passes)
  - Each cell is ‘isolated’ by a HV conducting plate - to prevent field progression between cells and connect the capacitance to ground (to approximate a coaxial cable)
  - It was explained that the characteristic impedance of the MKI system is 5 ohms
  - Injection is vertical in the beam pipe

- Shown the ceramic tube along with screen conductors (24 slots in one tube). It was explained that the ceramic tube is primarily a holder for the screen conductors but also provides additional insulation to the HV (i.e. between screen conductors and HV busbar/ferrite). Capacitive coupling is made at one end of the ceramic tube using metallisation on the outside of one end of the ceramic tube; connected to beam pipe (via RF fingers) this provides a coupling to the conducting inserts: the other end of the screen conductors is connected, via RF fingers, to beam-pipe. This provides a continuous path for the beam image current whilst preventing eddy current loops.
- It was noted that with all 24 screen conductors in place; sparking/arcing was observed between the screen conductors and also tracking from screen conductors to ground. This was due to high potentials (10-45kV) being induced on the screen conductors (see pg 30 of CAS slides).
- Discussions as to the difference between current beam impedance simulation models (infinitely long and continuous ferrite block) and actual construction of MKI magnet (cells separated by conductive plate connected to ground, air gap between ferrite and ground busbar) occurred. Was
noted that the significance of these in terms of comparison of simulation and measurement were not well understood.

- Further discussions were had to clarify various methods used to try and reduce the arcing between screen conductors and from screen conductors to ground; e.g. removal of some of the metallisation on the outside of one end of the ceramic tube – but this caused high impedance resonances in the beam coupling impedance spectrum, and removal of selected screen conductors.
- Shown the PFN network used to generate the pulse which activates the kicker magnet system.
- Mike forwarded us the link to his CAS talk, "Injection & Extraction Magnets II: Kickers", from Bruges (June 2009): \\cern.ch\dfs\Users\b\barnesm\Public\CAS\Bruges\BARNES_CAS_June2009_Kickers.pdf.
- Many photographs were taken (see ?).
- Next steps:
  - Mike will inform us when the impedances of the MKI can be measured, before and after bake-out (certainly after Christmas).
  - Furthermore, we could/should also measure (as proposed by Mike), when we want (as it is available for measurements), the SPS MKD (without transition pieces).
  - Hugo will make electromagnetic simulations of the MKI as soon as possible (when he starts his PHD thesis), to try and reproduce the measurements.

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