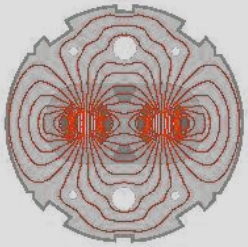
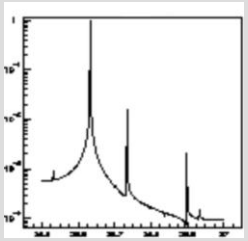
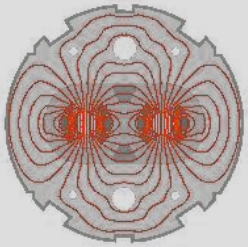


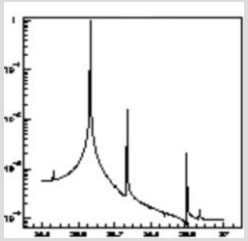
Non-Linear MD



- **Motivation for the experiment:**
  - **The measurement of the dynamic aperture has been an elusive goal for various large proton accelerators.**
  - **Taking into account measured or estimated harmonics, power supply ripple etc it has NOT been possible to determine the dynamic aperture experimentally to better than a factor of 2.**
  - **Moreover, machine conditions were not stable enough to achieve reliable results (example HERA).**
  - **➔ One was obliged to consider a safety factor of 2 for the LHC simulation studies.**
  - **At the LHC we have, at last, the chance to benchmark the simulation codes properly:**
    - **Good knowledge of harmonics and misalignments**
    - **Apparent little noise**
    - **Operationally stable**
    - **Aperture kicker strong enough for a direct measurement**
  - **➔ For the LHC upgrade studies we will not need to consider a safety margin of 2!**
  - **Last and not least: request by Yunhai Cai fro SLAC to provide this measurement for the community.**
- **Why now?**
  - **We are ready!**
  - **Last year the TCDQ could not be taken out ➔ severely limiting us.**
  - **One of the MD team basically got hardly any data.**
  - **The last MD is one year ago and experience of last year seems to indicate that a later date might be risky!**



Experimental Procedure



- **Team: M. Giovannozzi, E. Maclean, S. Redaelli, F. Roncarolo, F. Schmidt, E. Todesco, R. Tomás, J. Uythoven, G. Vanbavinckhove, W. Venturini Delsolaro**
- **1st MD: DA via Intensity Evolution based on Inverse logarithmic scaling law of DA established with tracking data**
  - **Technique: Creating Gaussian distribution (damper) and follow intensity over time using MCOs (also alternating signs) to make machine nonlinear**
  - **Machine & Tools: Beam1, MO off, probe beam, $1*10^{10}$p, wirescanner & synchrotron light monitor, bunch length, BLM, all collimators to 12 σ**
- **2nd MD: Detuning with Amplitude, Resonance Driving Terms, Dynamic Aperture**
  - **Technique: Systematic kicks with Aperture kicker (AC-Dipole), nominal + nl chrom knobs + testing skew sextupoles (sign!), collimator out till (>= 12 σ)**
  - **Goal: Driving Terms till about 10 σ, beyond 10 σ changing kick in small steps until losses become relevant**
  - **Machine & Tools: Beam2, probe beam, 2 μm, 2 bunches à $1*10^{10}$p, Aperture Kicker (>= 12 σ, MPP fully involved!), AC-Dipole, wirescanner, BPM, BLM**