

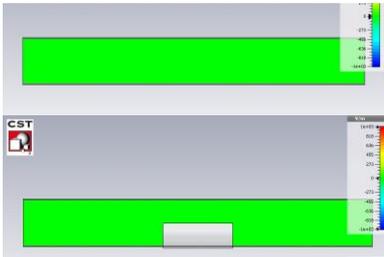
Introduction to the session on impedance measurements

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Speakers: Lee Carver, Wilfrid Farabolini, Andrea Latina

Impedance?

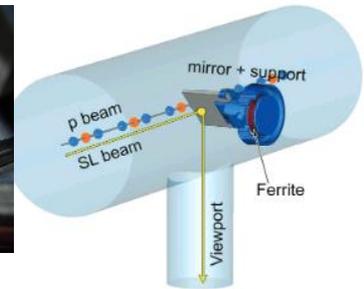
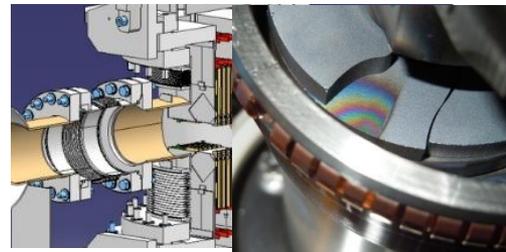
- When an ultrarelativistic beam of particles traverses a device which
 - is not smooth
 - or is not a perfect conductor,it will produce electromagnetic RF wakefields that will perturb the following particles
→ resistive or geometric **wakefields** (in time domain) and **impedance** (in frequency domain).
- Example of wakefield perturbation caused by an obstacle in a beam pipe:



In a smooth round beam pipe

In a round beam pipe with a sharp obstacle → resonant RF mode
(e.g. collimator, Roman pot for forward physics, synchrotron radiation monitor)

*“LHC beam unstable!
Need to dump
and refill!”*



Impact of impedance?

- 1) **Energy is lost** by the beam → dissipated in the surrounding chambers → beam induced heating
- 2) **Resonant kicks** to following particles → instabilities → beam loss and blow-up

→ More beam intensity → more impedance perturbations → more damage and beam quality issues
→ Impedance is a **critical limit to increase the performance** of several accelerators
→ Requires strict follow-up and support → **mandate of the impedance working group at CERN**

Existing tools to measure impedance

- Simulations/computations

downsides:

- are **assumptions** correct?
- **non conformities**?

- Measurements on the bench with probes, beads, wires or coils

downsides:

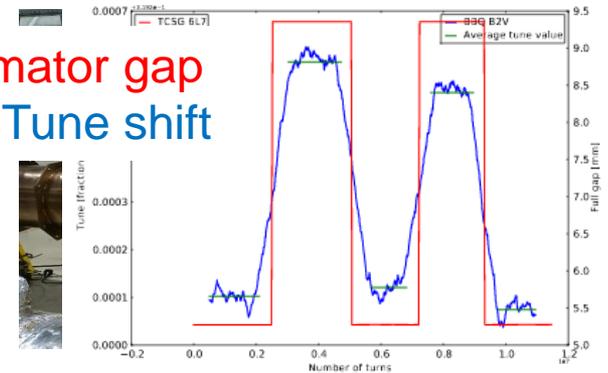
- fields are **perturbed** by the field probing devices
- often **qualitative**, not quantitative estimate

- Measurements with beam in actual machines

downsides:

- very **expensive** in terms of installation and machine time
- **too late** to correct if already installed

Collimator gap
LHC Tune shift



→ Impedance measurements with an electron beam would be an elegant option!

Session on impedance measurement

→ Address the following question:

“Can CALIFES be used as a complementary tool to existing techniques to measure and study impedance?”

Many thanks to the 3 speakers for having agreed to contribute to this session!