

Plans and opportunities for studies and tests at CERN and elsewhere

- Issue: Interaction of high power proton and heavy ion beams with materials.
- Final truth: Experiments!
- Risk issue: Only tested and fully qualified materials/collimators can be installed into the operating LHC accelerator.
- What are plans and opportunities for studies and tests at CERN and elsewhere?
- Goal:
 - Make sure facilities and tools for required tests exist.
 - Profit from synergy and available expertise.
 - Avoid duplication of work.

What Do We Want to Test?

- Qualify candidate materials:
 - Blocks of CFC, C, Glidcop, diamond-based metal composites, copper composites, AU coated copper, Boron Nitrite, ...
 - Do not forget: Cu or CuNi water pipes, SC cables, ...
- Qualify collimator assemblies:
 - Proton collimators: 3 phase 2 secondary collimators
 1 primary/scrapper collimator (with crystal) – also
 for ions
 - Ion collimators: “catcher“ collimators in cold regions
 1 magnetic collimator

Measurements of Interest: Materials

- Materials (both p and ions):
 - Mechanical properties (well defined norms) for different radiation doses
 - Electrical properties (well defined norms) for different radiation doses
 - Radiation resistance
 - Damage thresholds
 - Pressure increase in water pipes
 - Desorption
 - Vacuum properties versus temperature

Measurements of Interest: Collimators

- Collimators:
 - Robustness against beam shock impact
 - Cooling efficiency
 - Geometrical stability (flatness, deformations, ...)
 - Ion interactions
 - Proton interactions
 - Vacuum in operation
 - Impedance
 - RF trapped modes
 - Vibrations

Where to Perform Tests?

- Material characterization:
 - Turin
 - CERN
 - EPFL
 - GSI
- Radiation damage and change of properties in irradiated materials (mechanical and electrical):
 - BNL
 - Kurchatov

Where to Perform Tests?

- Tests with ion beams:
 - GSI (different facilities)
- Tests with proton and ion beams:
 - Stage 1: CERN beam test stand (450 GeV p, 2.4 MJ, 6.25 μ s, 1 mm², 25 ns time structure)
 - Stage 2: CERN LHC (7 TeV p, 360 MJ, ~70 μ s, 0.04 mm², 25 ns bunch structure)