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/scraper 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 μs, 1 mm^2, 25 ns time structure)
  - Stage 2: CERN LHC (7 TeV p, 360 MJ, ~70 μs, 0.04 mm2, 25 ns bunch structure)