J-PARC Hadron Facility

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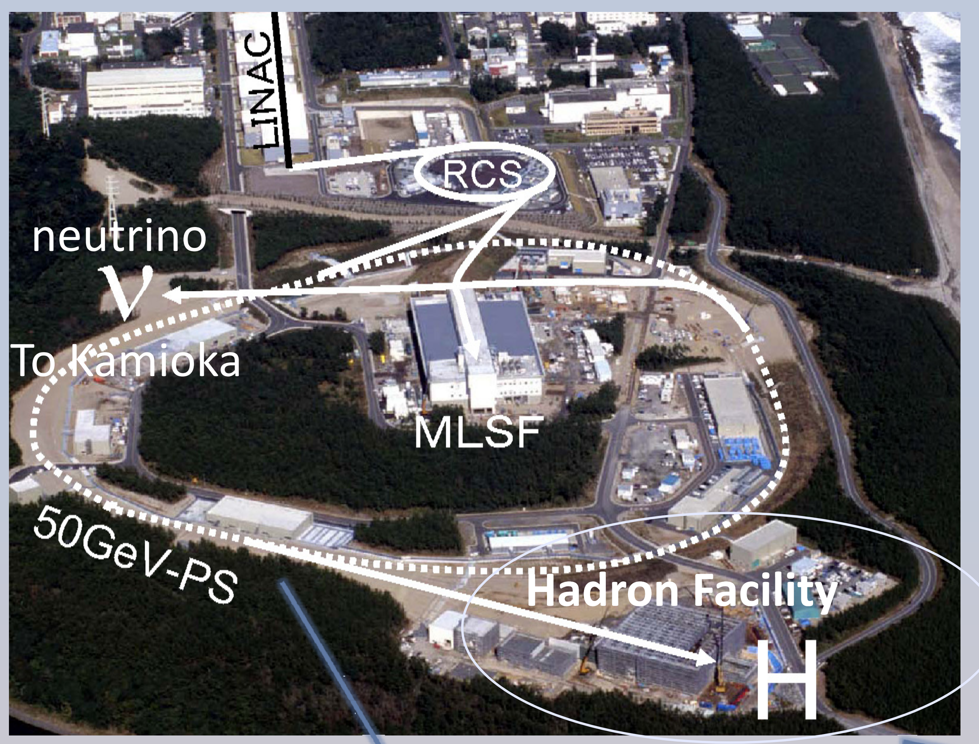
J-PARC 50GeV Main Ring



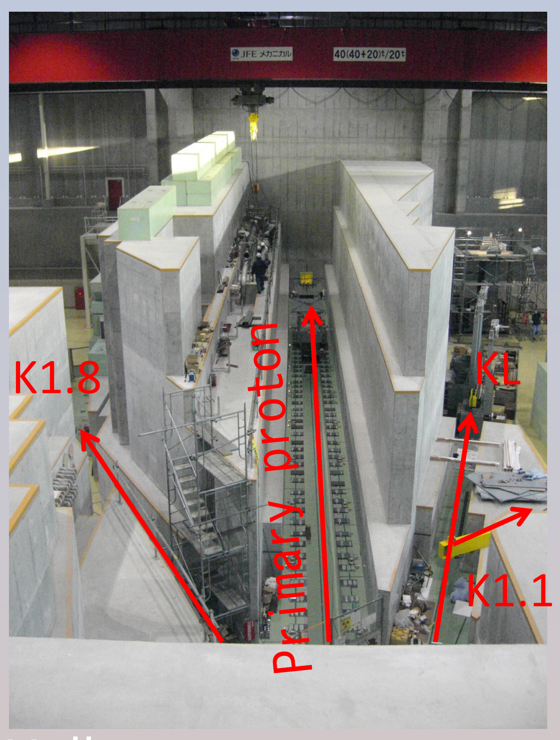
Introduction

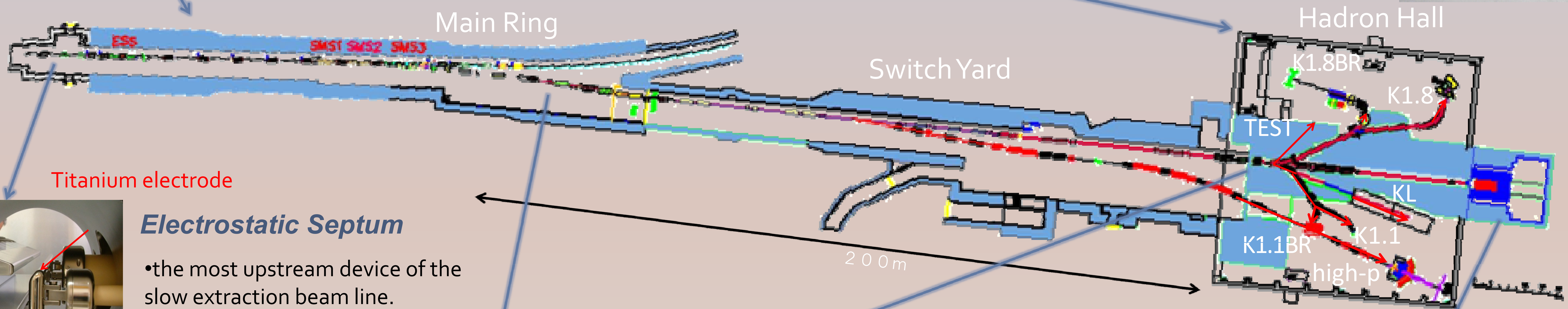
J-PARC (Japan Proton Accelerator Research Complex) is a new accelerator facility to produce MW-class high power proton beams at both 3 GeV and 50 GeV. The Main Ring (MR) of J-PARC can extract beams to the neutrino beam line and the slow-extraction beam line for Hadron Experimental Facility (Hadron Hall). Civil construction of Hadron Hall was completed in June, 2007.

Slow-extraction beam line

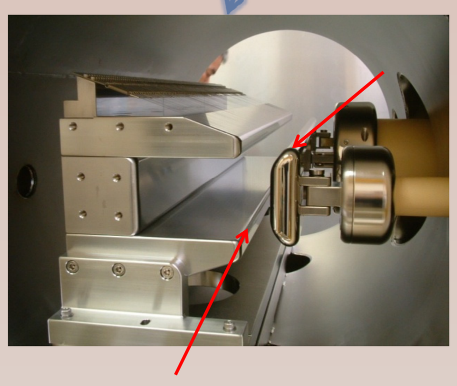
The slow-extraction beam line handles the beams of 3×10^{14} protons extracted "slowly" in about 2 second duration per 6 second accelerator cycle. The extracted beams are transported to Hadron Hall and irradiated on the production target (T1) to produce secondary particles (kaons and pions). The secondary beams are transported to experimental area for nuclear and particle physics experiments. The beam "Switch Yard" has capabilities to separate a small portion (2% loss) of the primary beam and place a production target (0.2% loss) that can provide test beams for future extensions.

Hadron Hall





Titanium electrode



ribbon

Electrostatic Septum

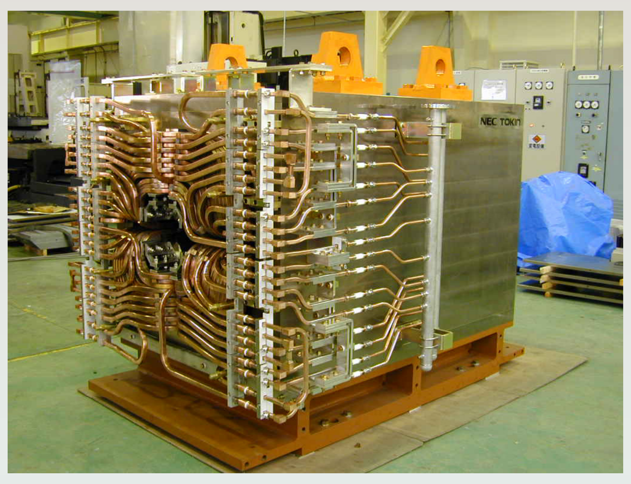
- the most upstream device of the slow extraction beam line.
- "shave" the proton beam under a high electric field(170kV/25mm) between the titanium electrode and tungsten ribbon

Radiation Hardness

- To handle the high intensity proton beam, beam line components are designed to have enough radiation hardness.
- Design of working spaces, remote maintenance system and quick connection system have been developed.

Radiation-hard Magnet

- Made of fully inorganic materials.
- Lifting tackle which automatically locks
- "Knife switch" – electrical connection system; up to 3000A
- Quick coupler



Lifting

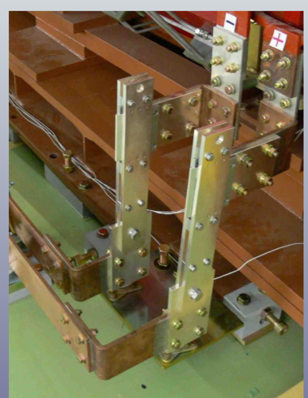
Water Connection

- no bolt
- 2 inch. diameter
- operation with 2 MPa

Vacuum Connection

- all metal
- remote handling
- leak rate: 10^{-11}Pa・m³/s
- large diameter: 500mm

Electrical Connection



Max. 3000A

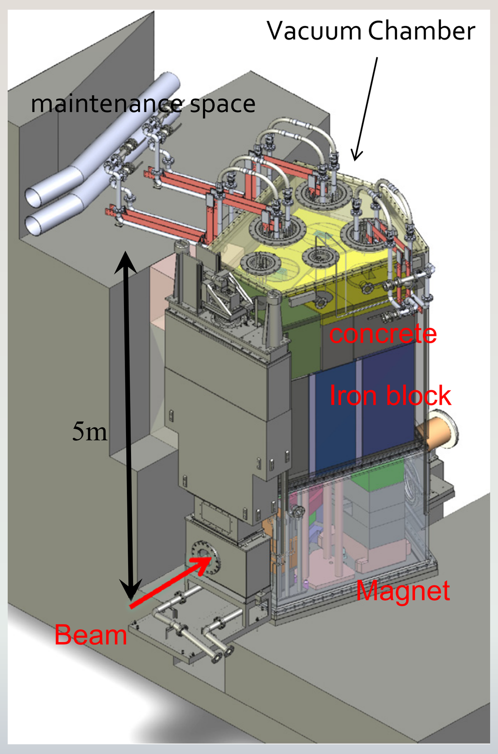
Production Target & Central Vacuum Chamber

The production target(T1) :

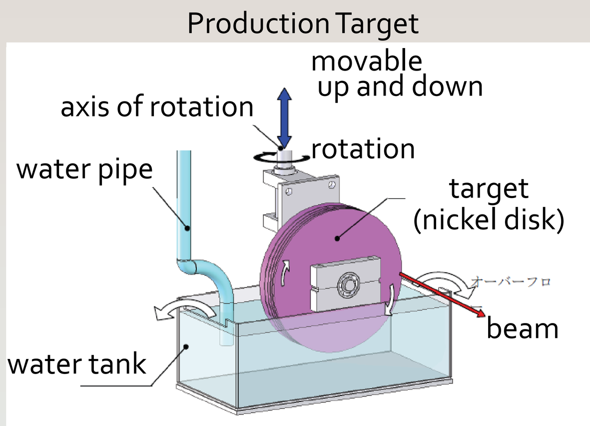
- nickel disks
- diameter is 36cm
- thickness is 54mm(corresponds to 30% loss)
- rotating in a water tank to remove the heat deposit ion of the primary beam . (85rpm)

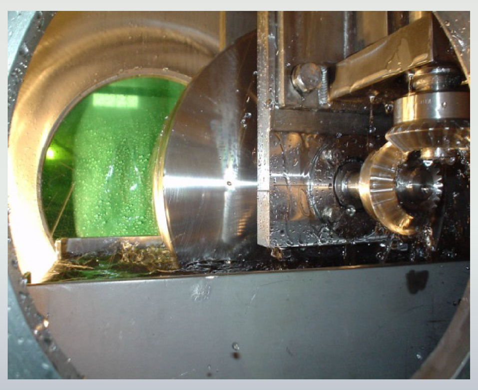
Vacuum Chamber:

- storage for magnets
- no beam duct
- water pipes and power cables are drawn out to the maintenance space.



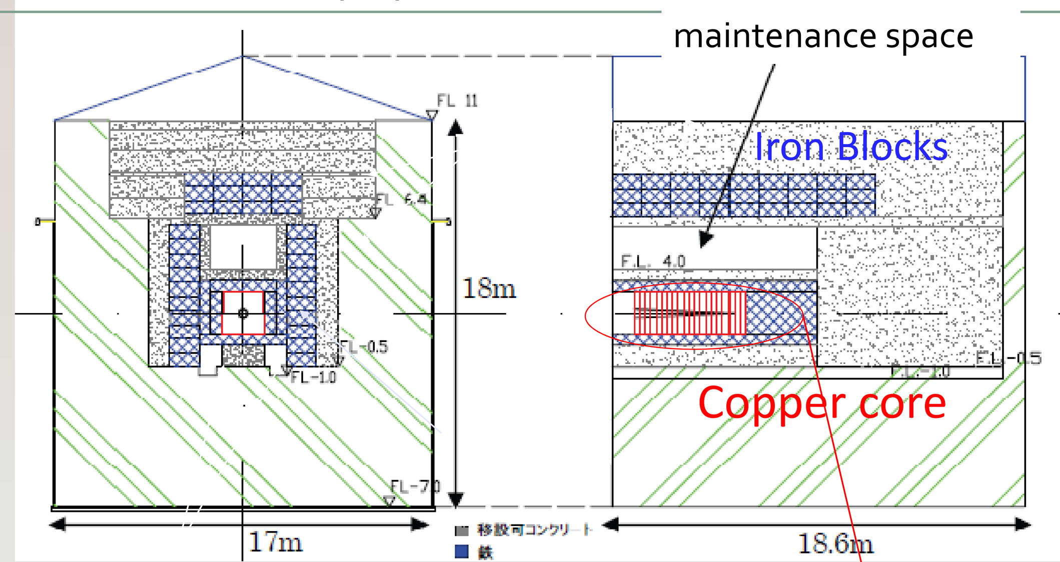
Production Target

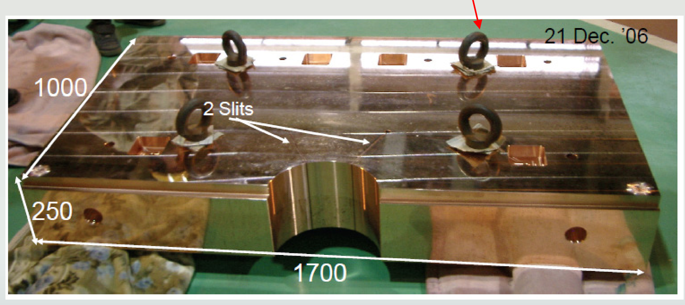


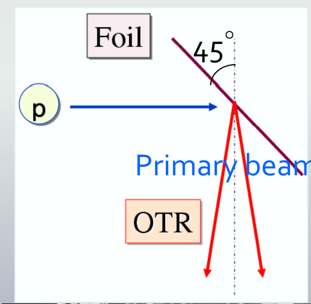


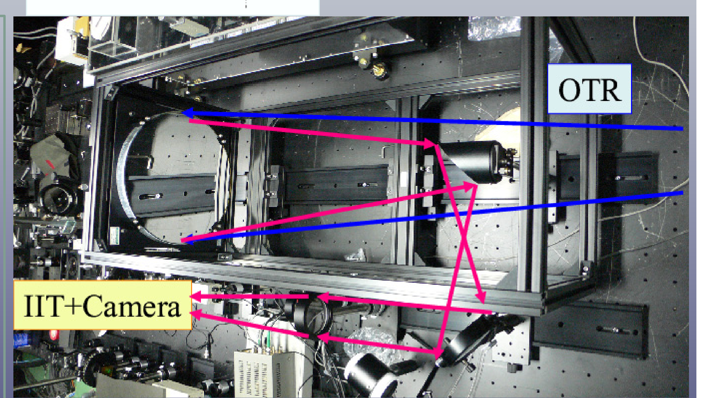
Beam Dump

- Located at the end of the primary beam line.
- Absorb beam power of 750kW safely.
- Core part consists of 40 oxygen free copper blocks(1000 tons).
- The copper core is cooled by water to reduce the temperature rise up to 200 Celsius.
- Surrounding materials are concrete and iron blocks.
- Movable on rails – keep up with an extension of the hall at Phase II

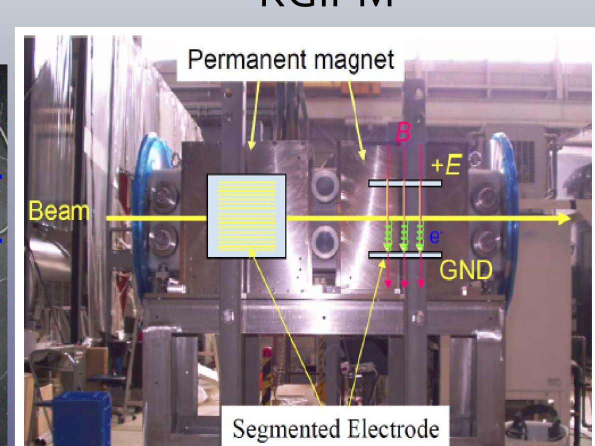








RGIPM

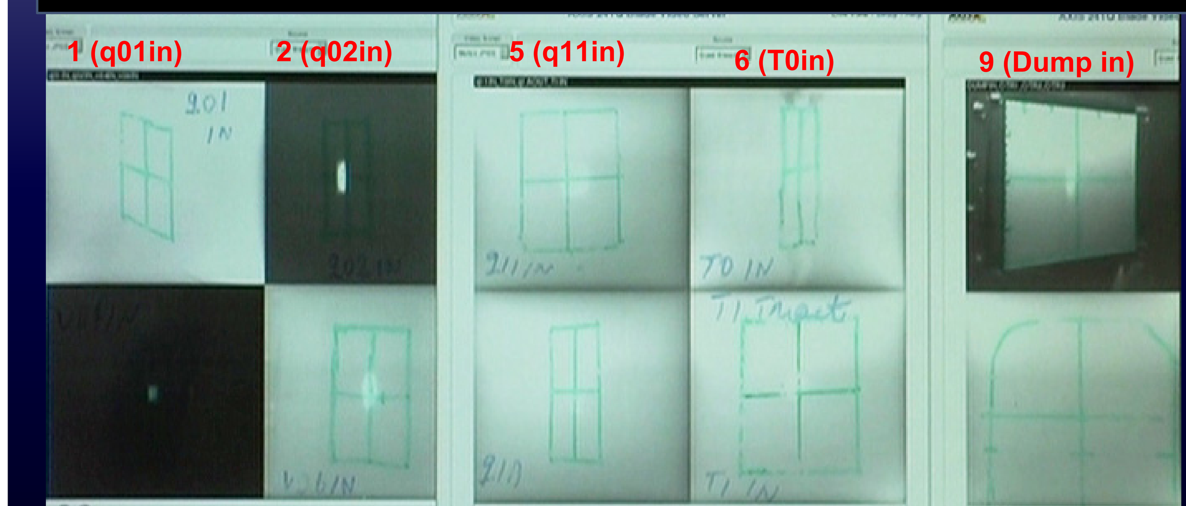


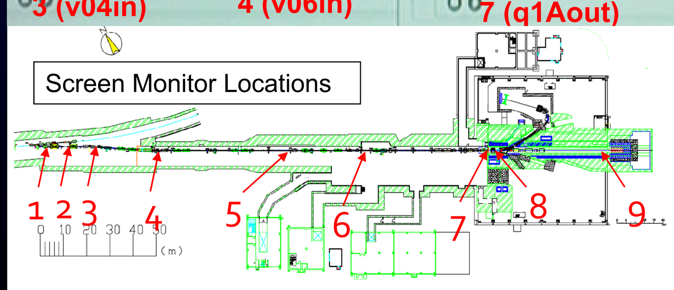
Beam Monitor

- Measure profile and intensity of the primary proton beam
- OTR(Optical Transition Radiation monitor) measures 2-dimensional profile images by detecting transition radiation generated on the surface of a thin metallic foil.
- Residual Gas Ionization Profile Monitor measures X/Y profile by detecting ionization electrons of residual gas in the beam pipe with no beam loss.

Resent Results

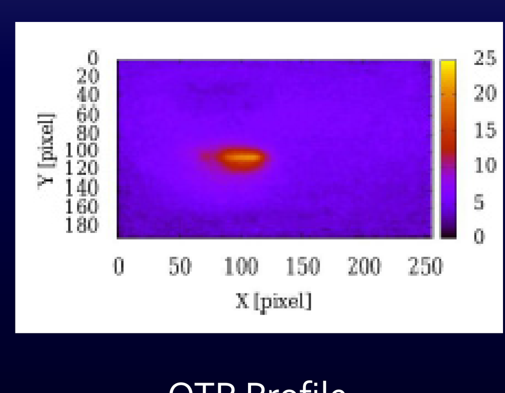
First Beam Profiles measured with Screen Monitors



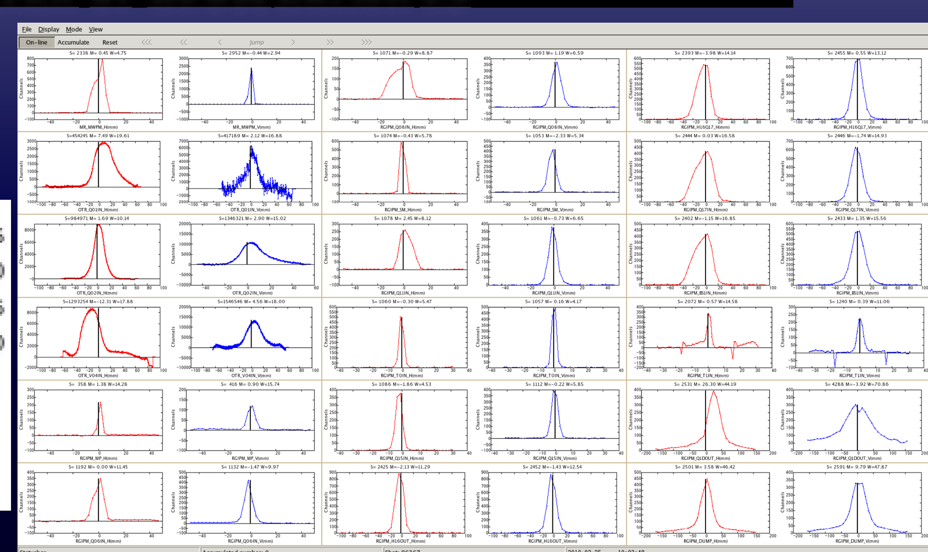


Jan. 27th 2009

TYPICAL BEAM PROFILES



OTR Profile
(Oct. 2009)



RGIPM Profile

The first beam from the Main Ring was successfully extracted on 27th. January 2009. The beam profiles are measured with the OTR and RGIPM.