Fermilab

LARP LHC 4.8 GHz Schottky System Initial commissioning with Beam

Ralph J. Pasquinelli

Fermilab

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Tevatron Schottky System Operational 2003

LHC Schottky System Approved by LARP 2004

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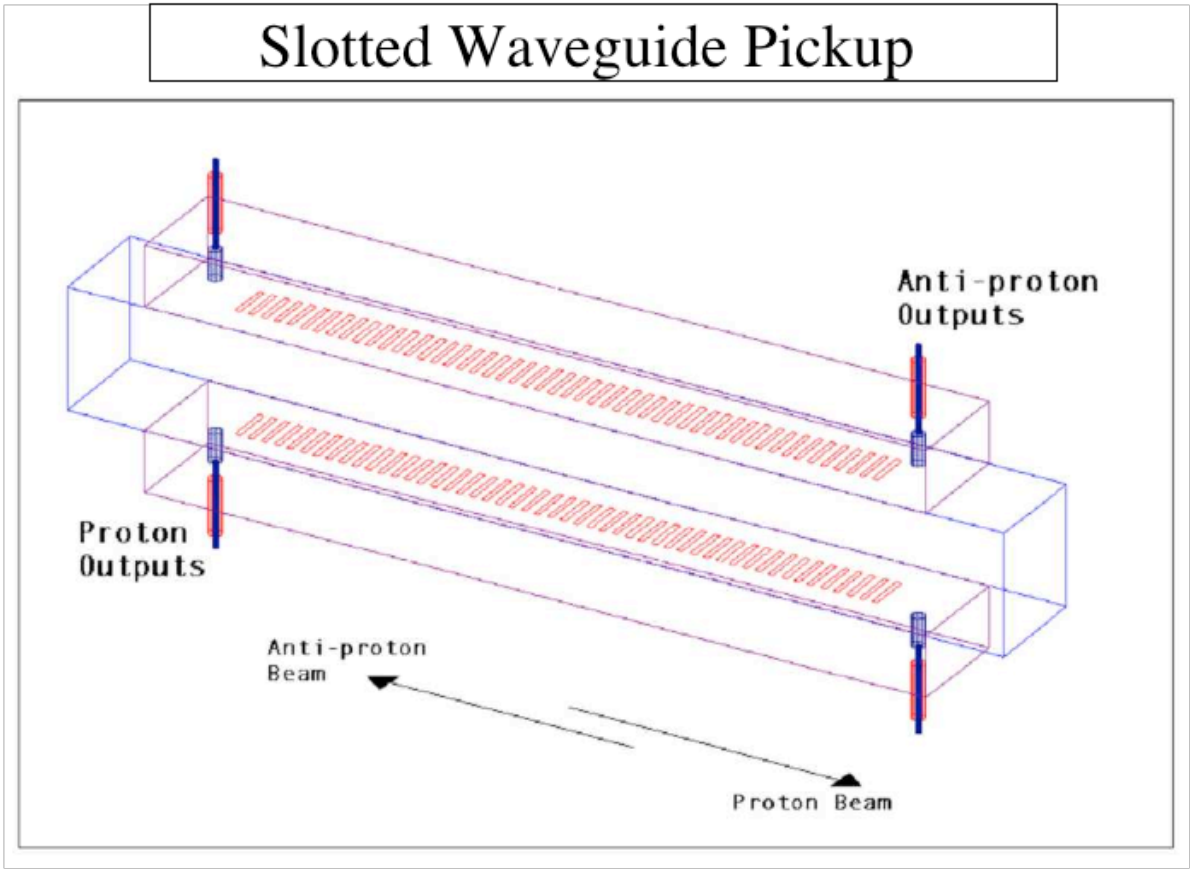
Slotted Waveguide Pickup
Anti-proton
Outputs
Proton
Outputs
Anti-proton
Beam
Proton Beam

Pickup Designed @ Fermilab in 2005

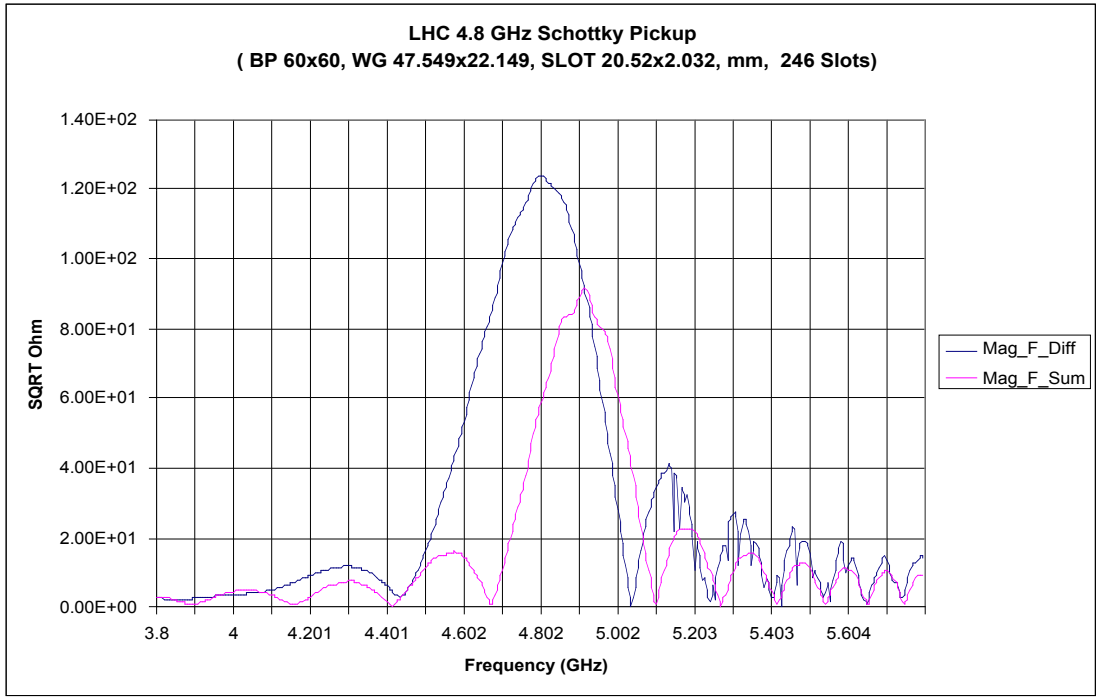

Figure 2. Impedance of LHC Schottky pickup

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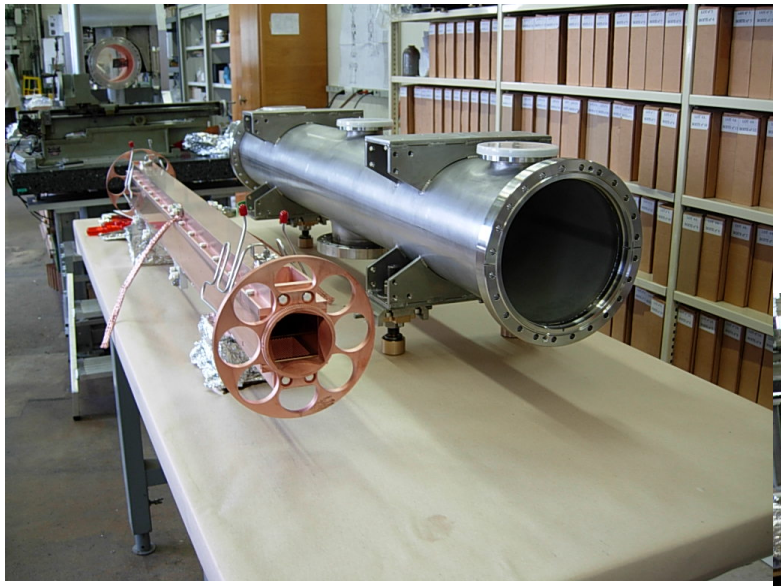

Pickups Fabricated at CERN Autumn 2006

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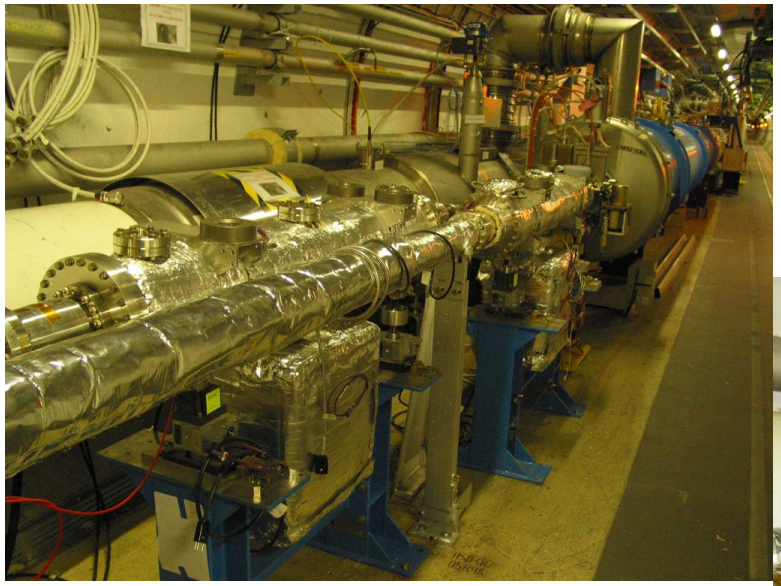
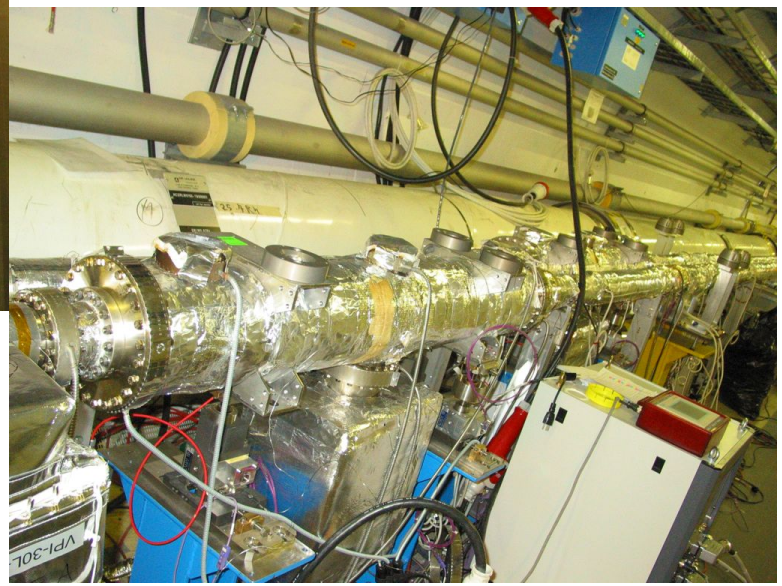


Pickup tanks installed at LHC Point 4, Spring 2007



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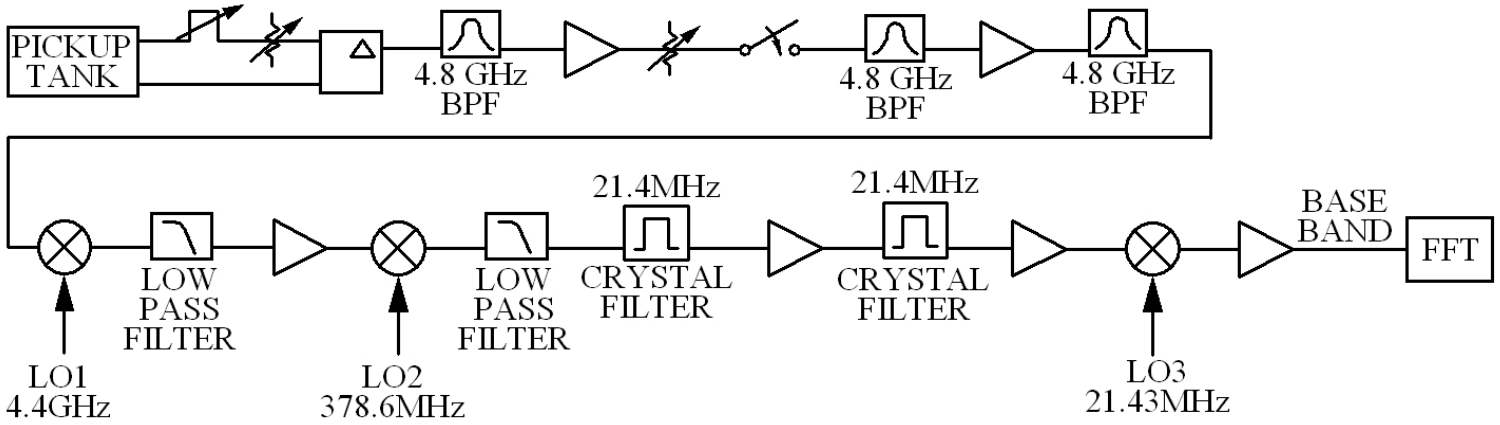
LHC Schottky Triple Heterodyne Block Diagram



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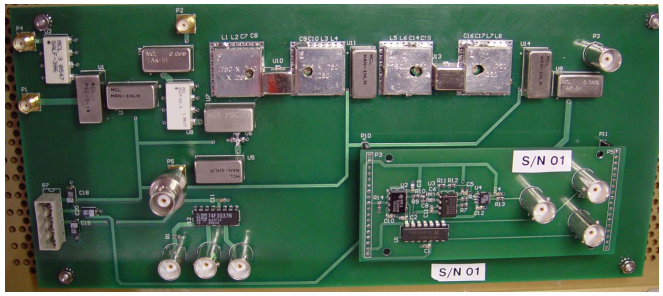
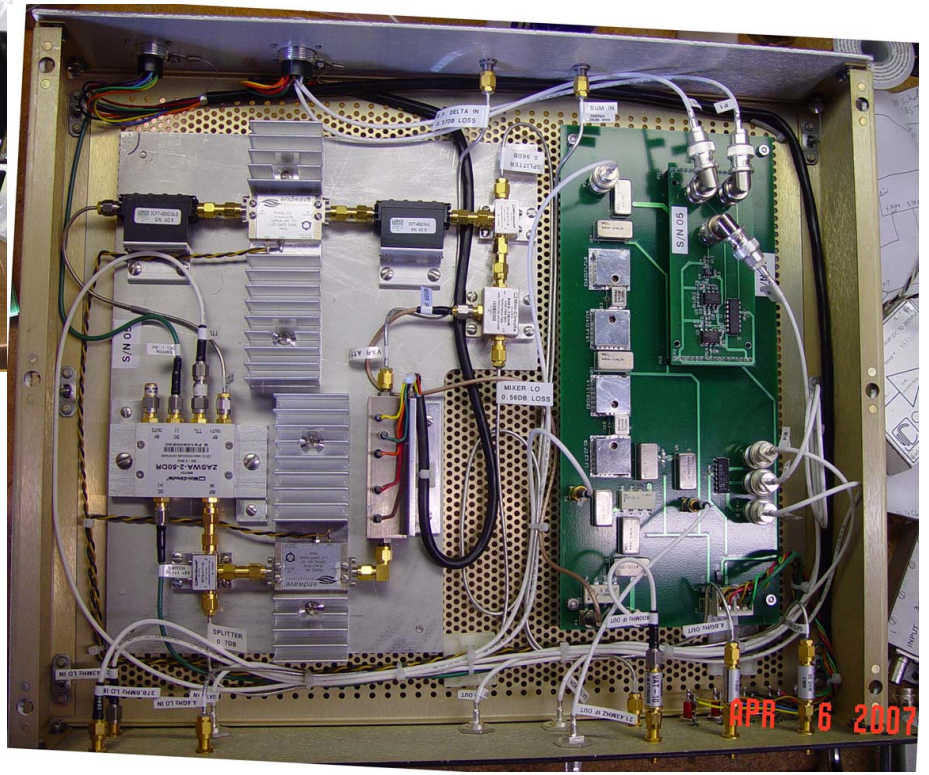
Signal Processing Chassis
Spring 2007





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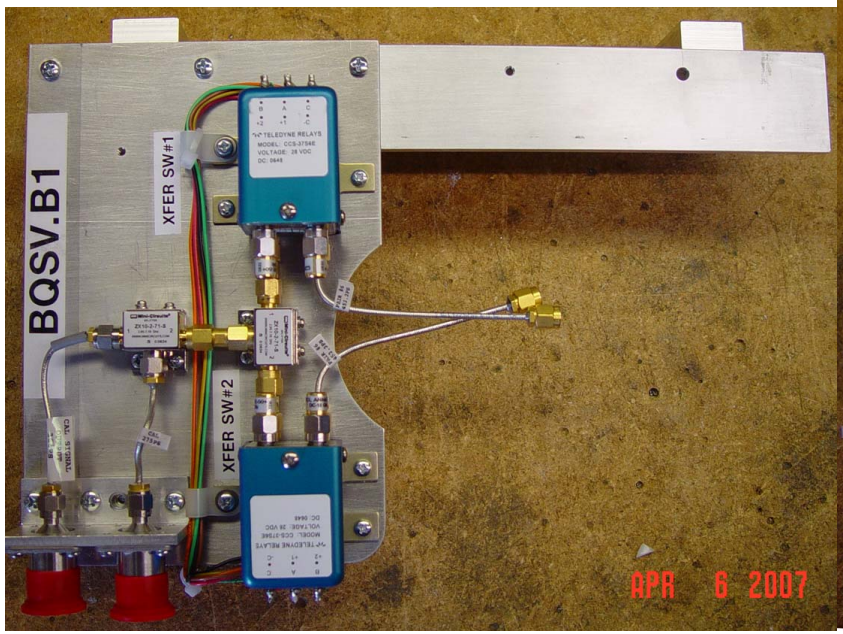
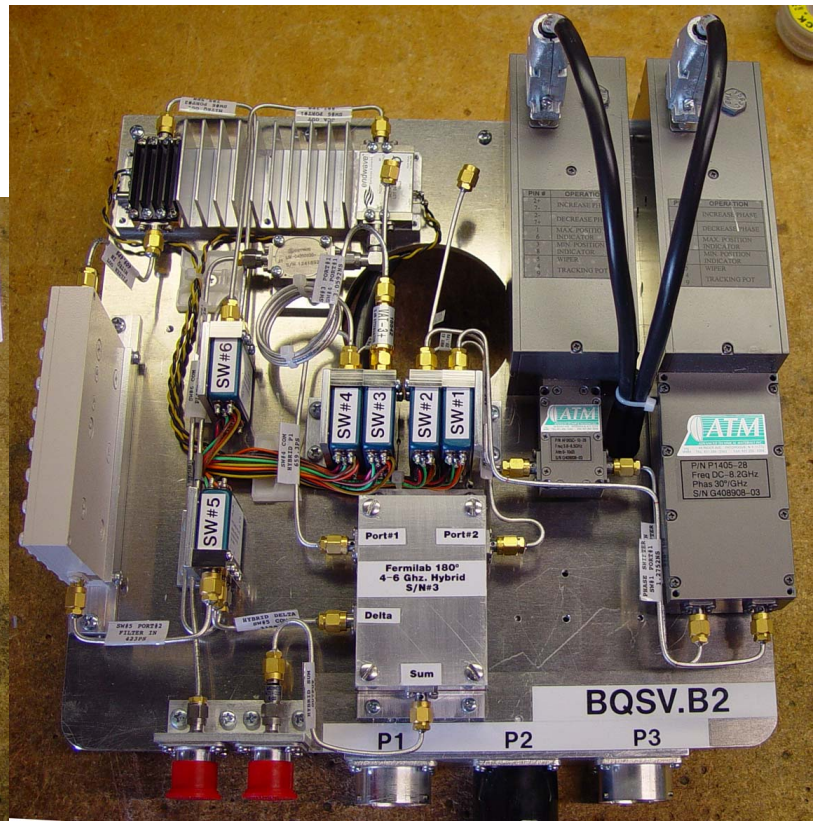
Pickup Plate Hardware





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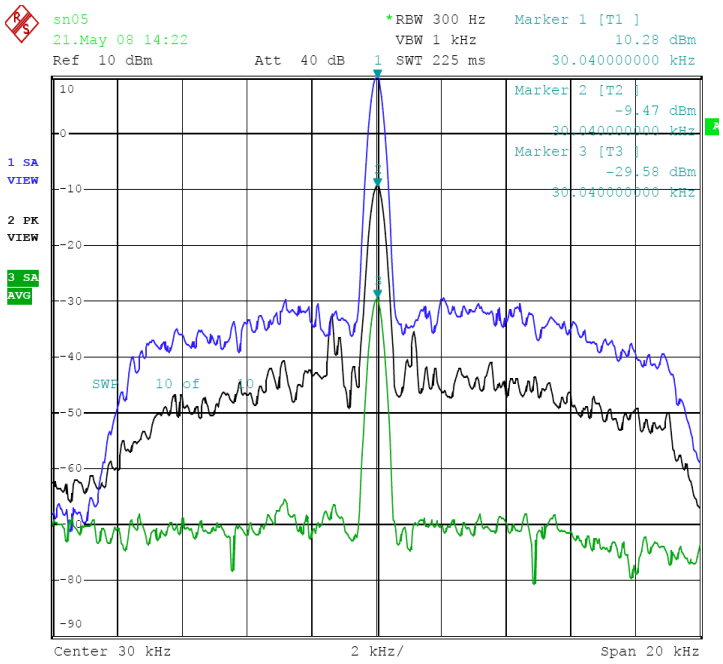
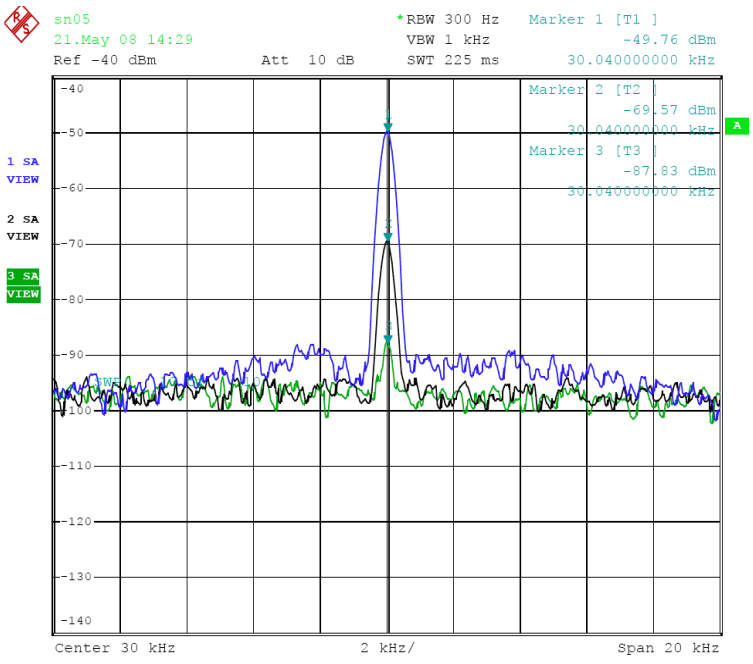
Measured 100 dB instantaneous dynamic range in Signal processing, +10 dBm to -90 dBm input





10 dB per division

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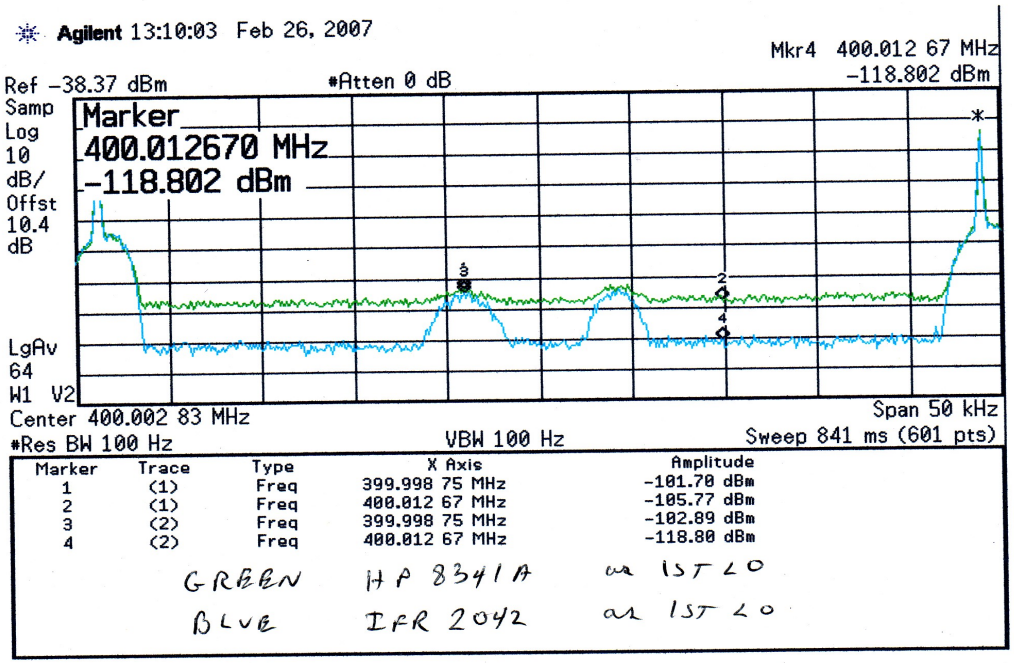
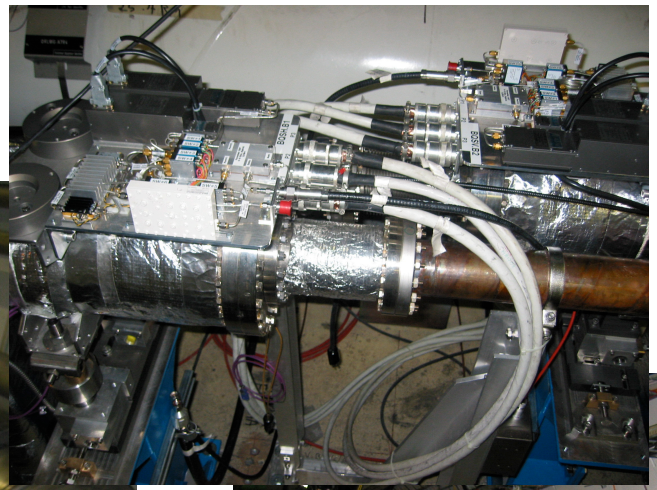
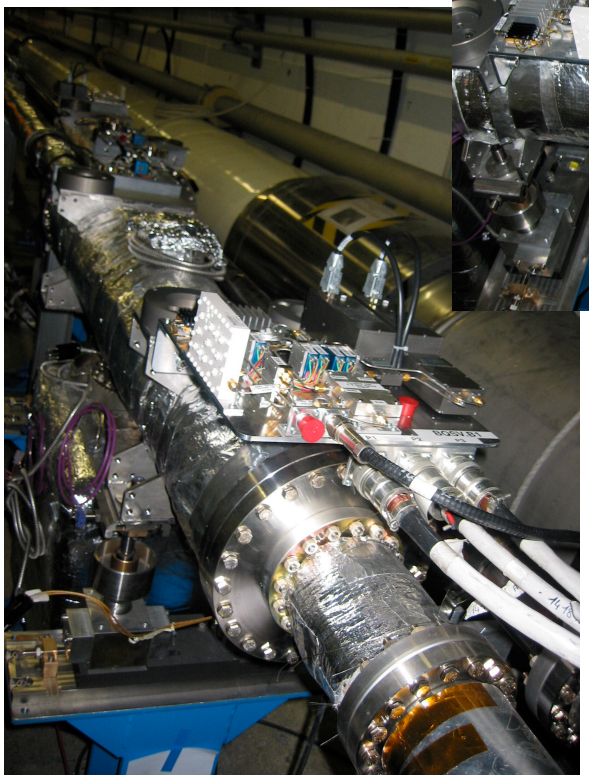
Importance of low phase noise in local oscillators

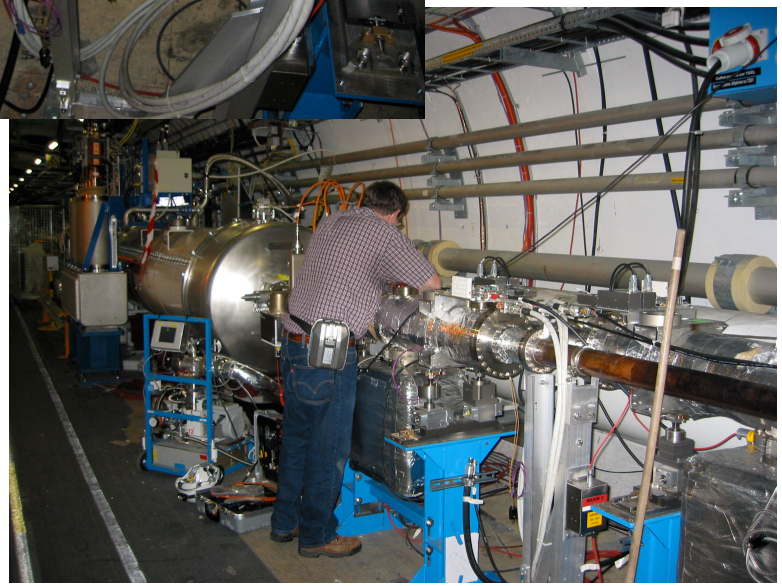


Crated up and on its way to CERN April 2007!

Pickup Hardware Installed May 2007







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Point 4 Alcove Hardware May 2007

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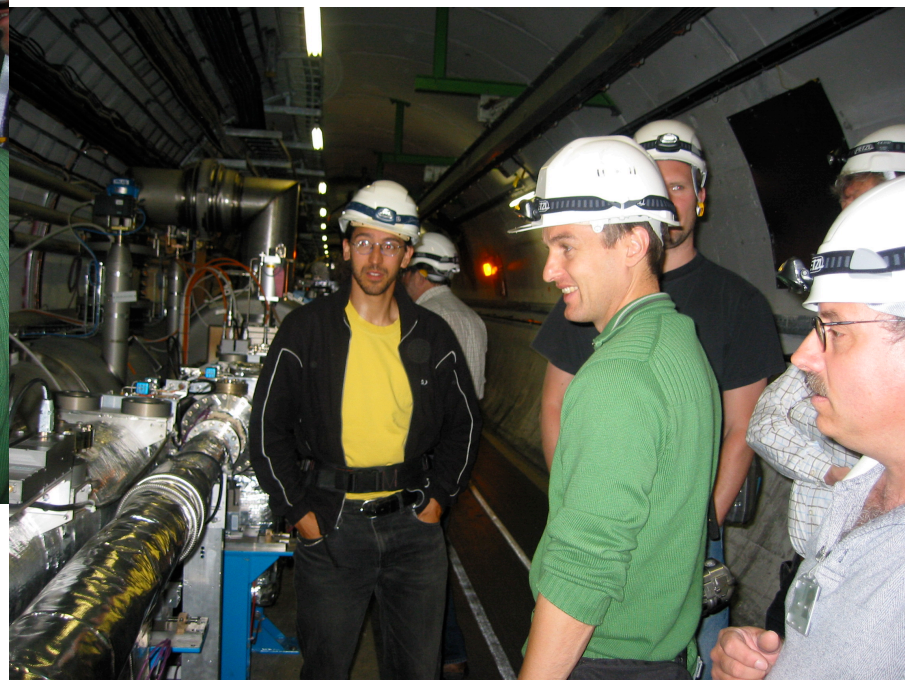
Touring Hardware Installation May 2007



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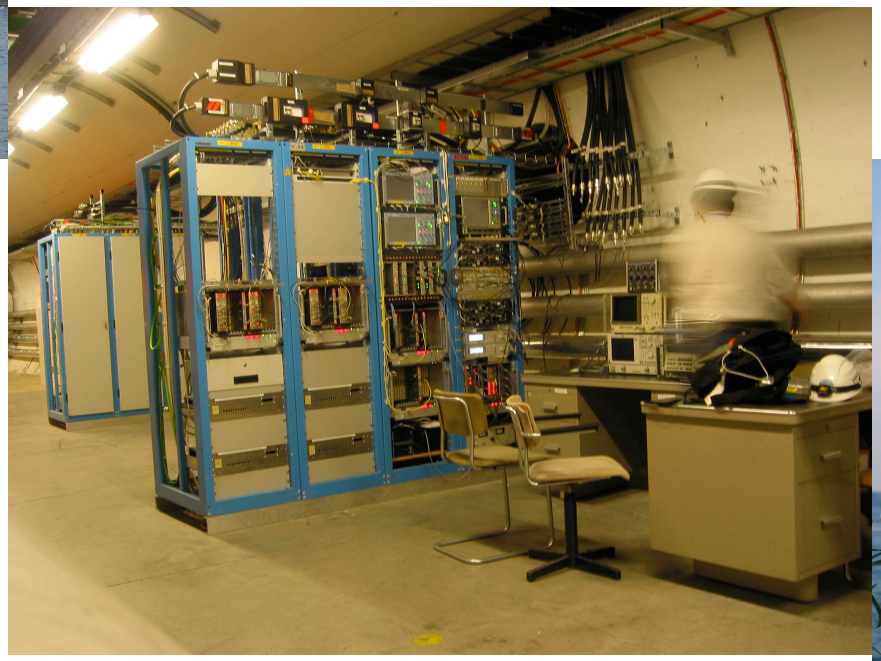
Installation of controls interface



May 2008

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Two Beam Commissioning Trips to CERN

April 2010
October 2010

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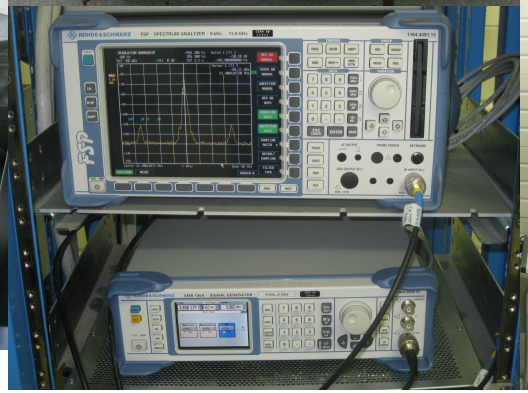

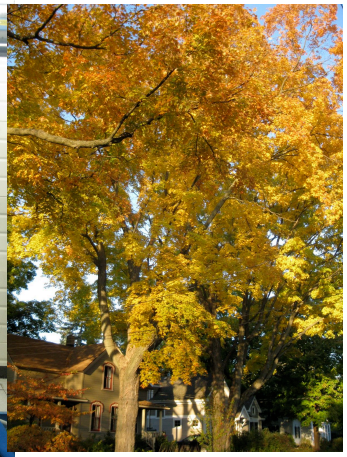

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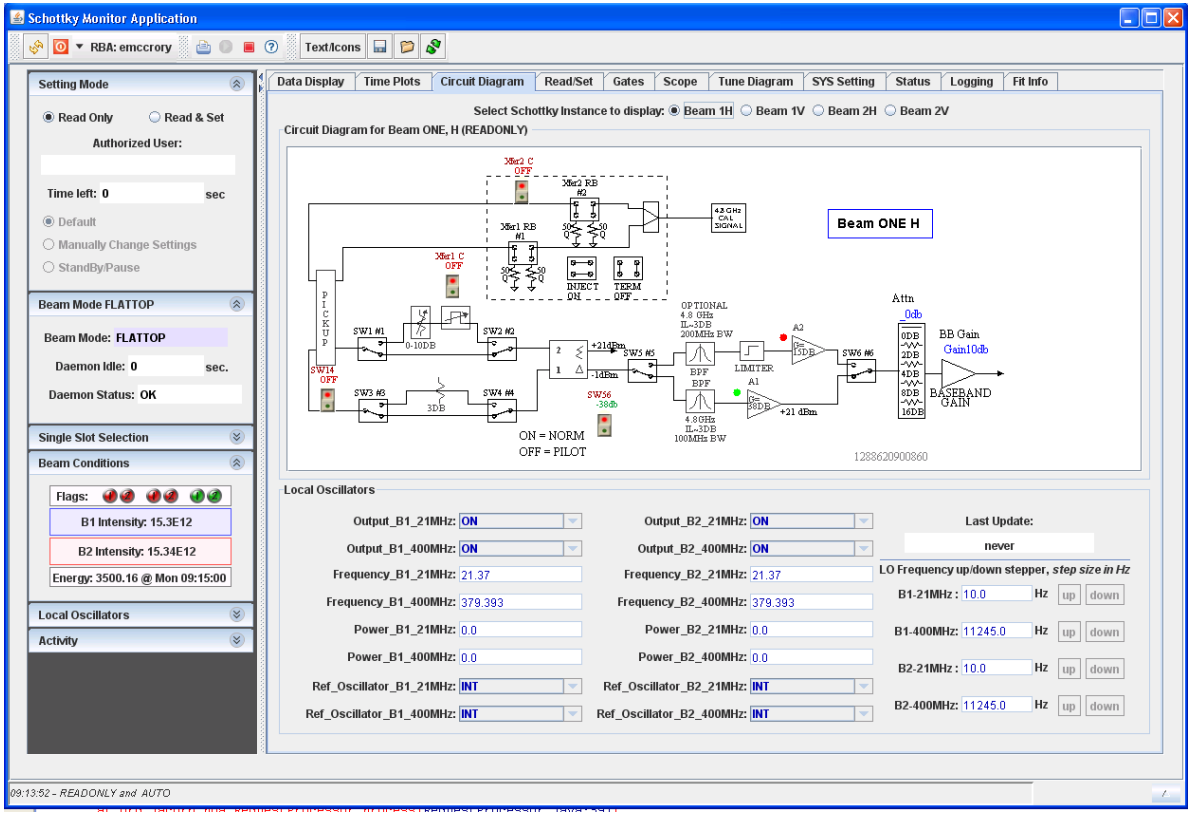
Interactive Graphics Control of Hardware



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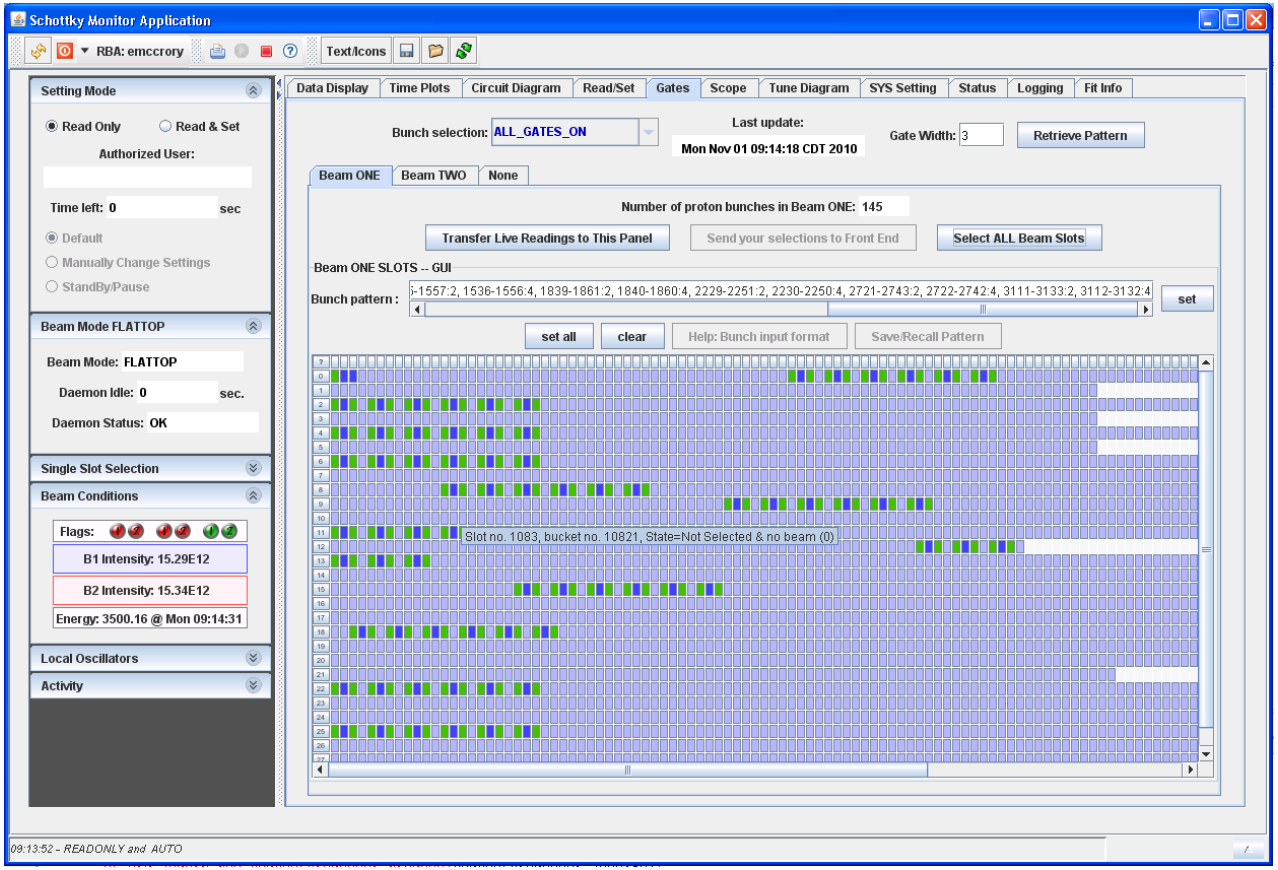
Automated gating control allows any number of bunch configurations



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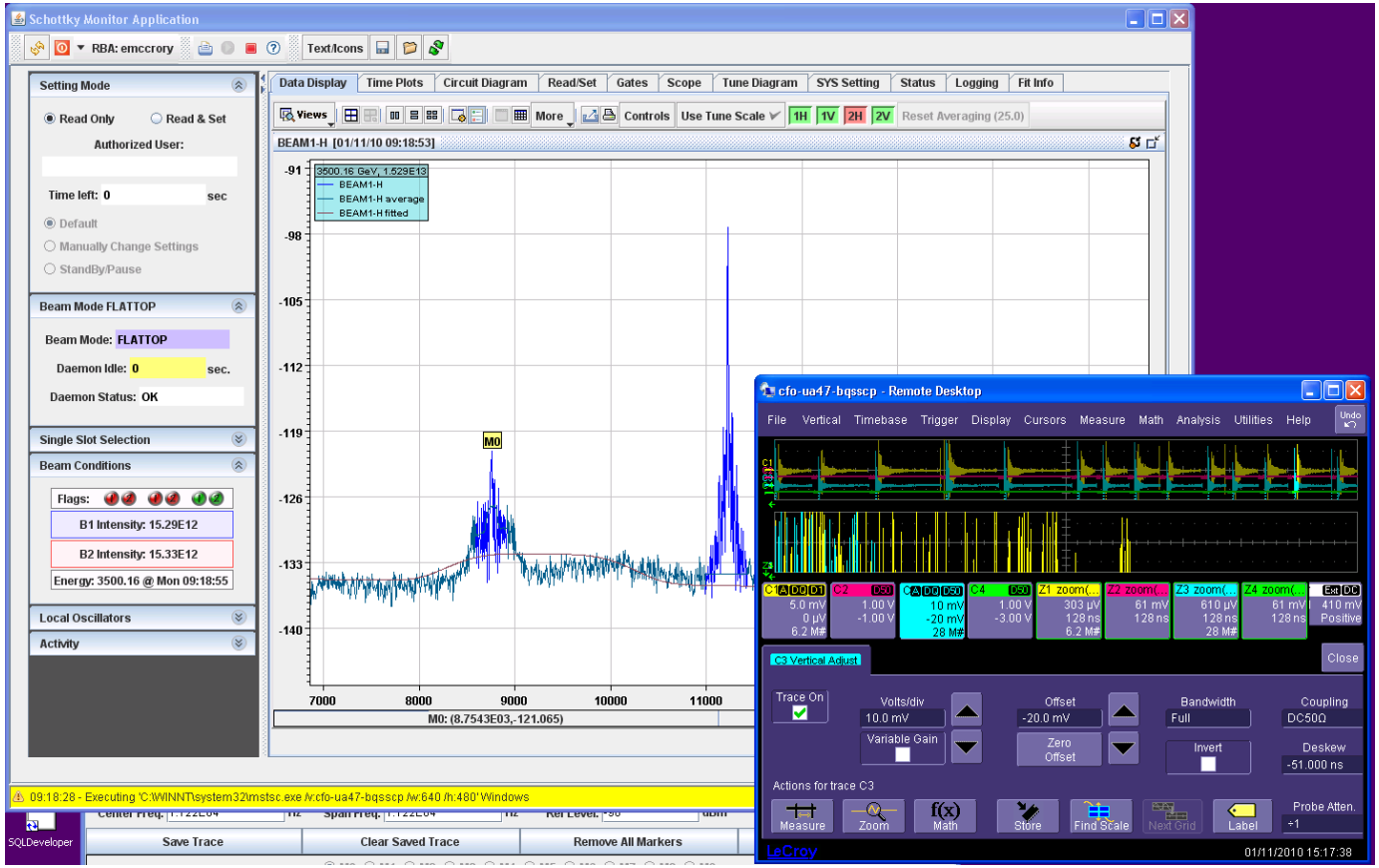
Remote Control of Gate Timing Oscilloscope



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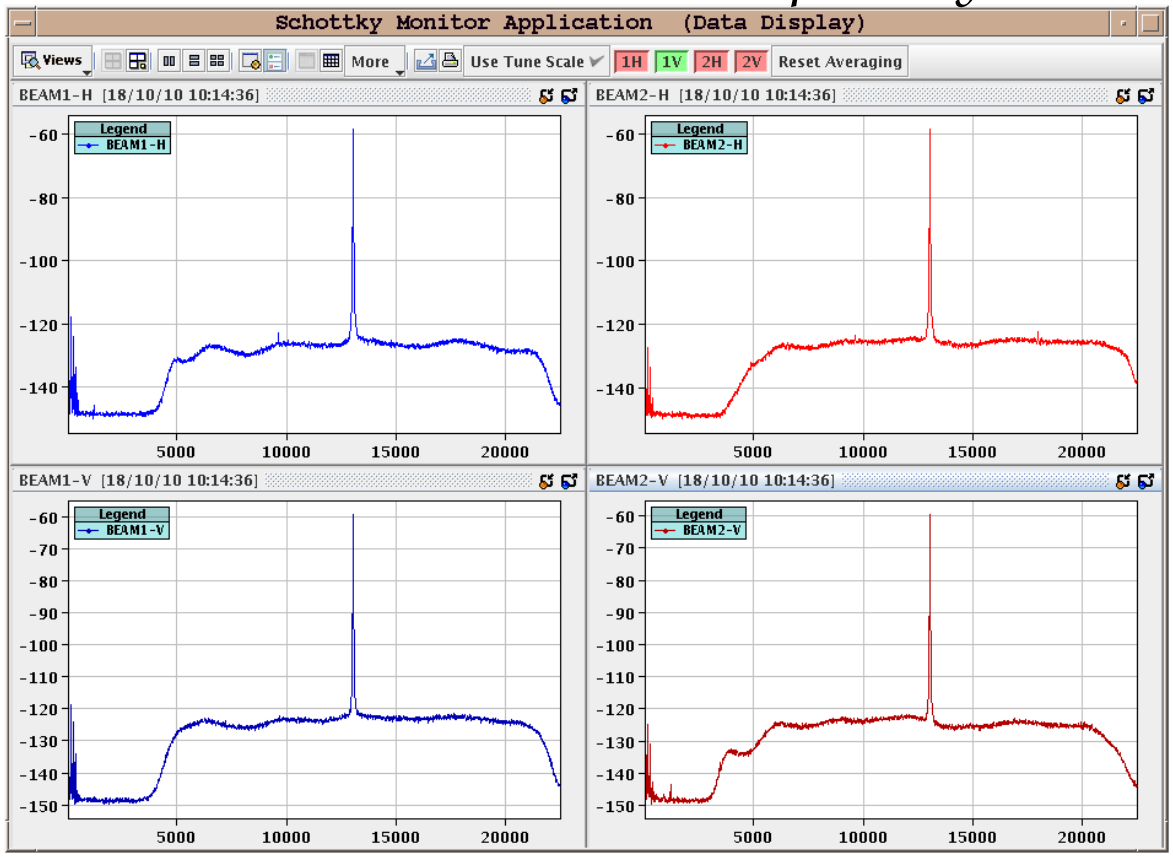
Built In Calibration Capability



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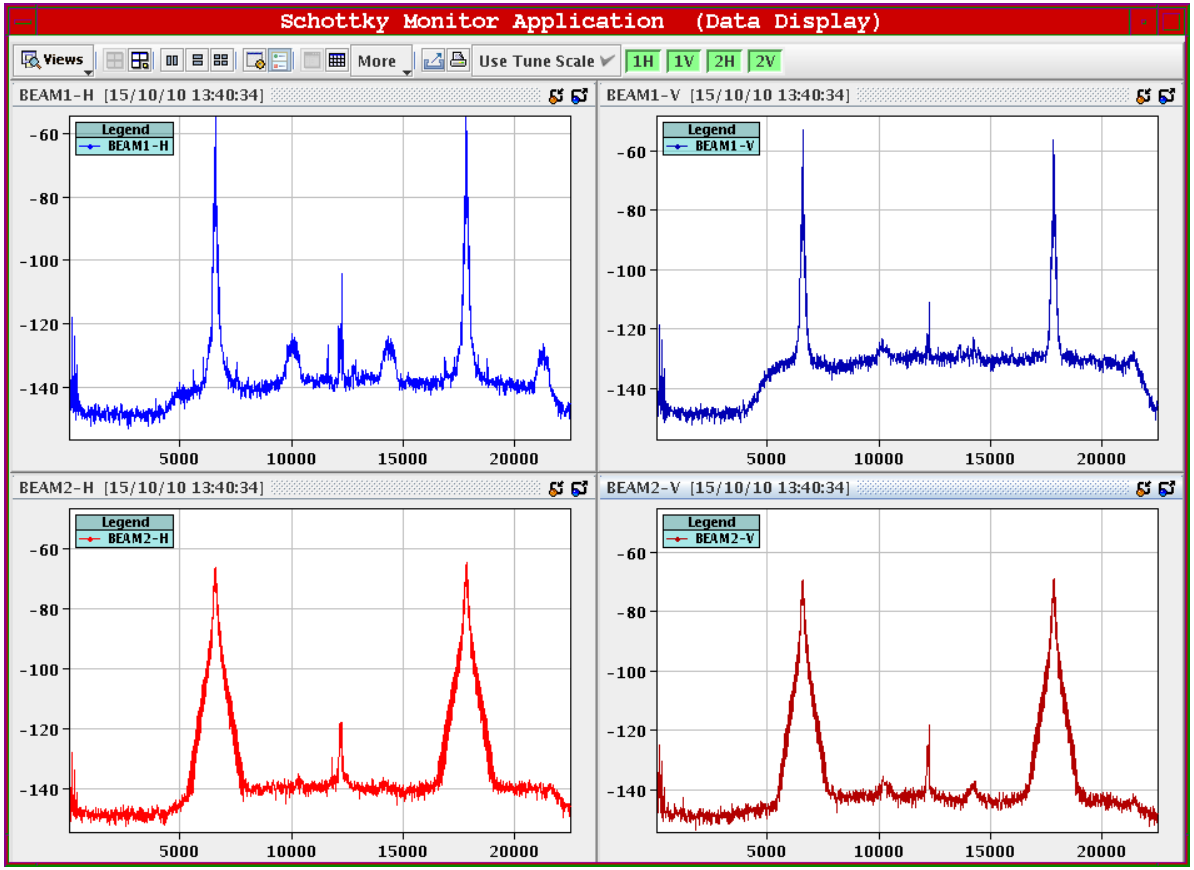
Spectra Reveal Coherent Phenomena



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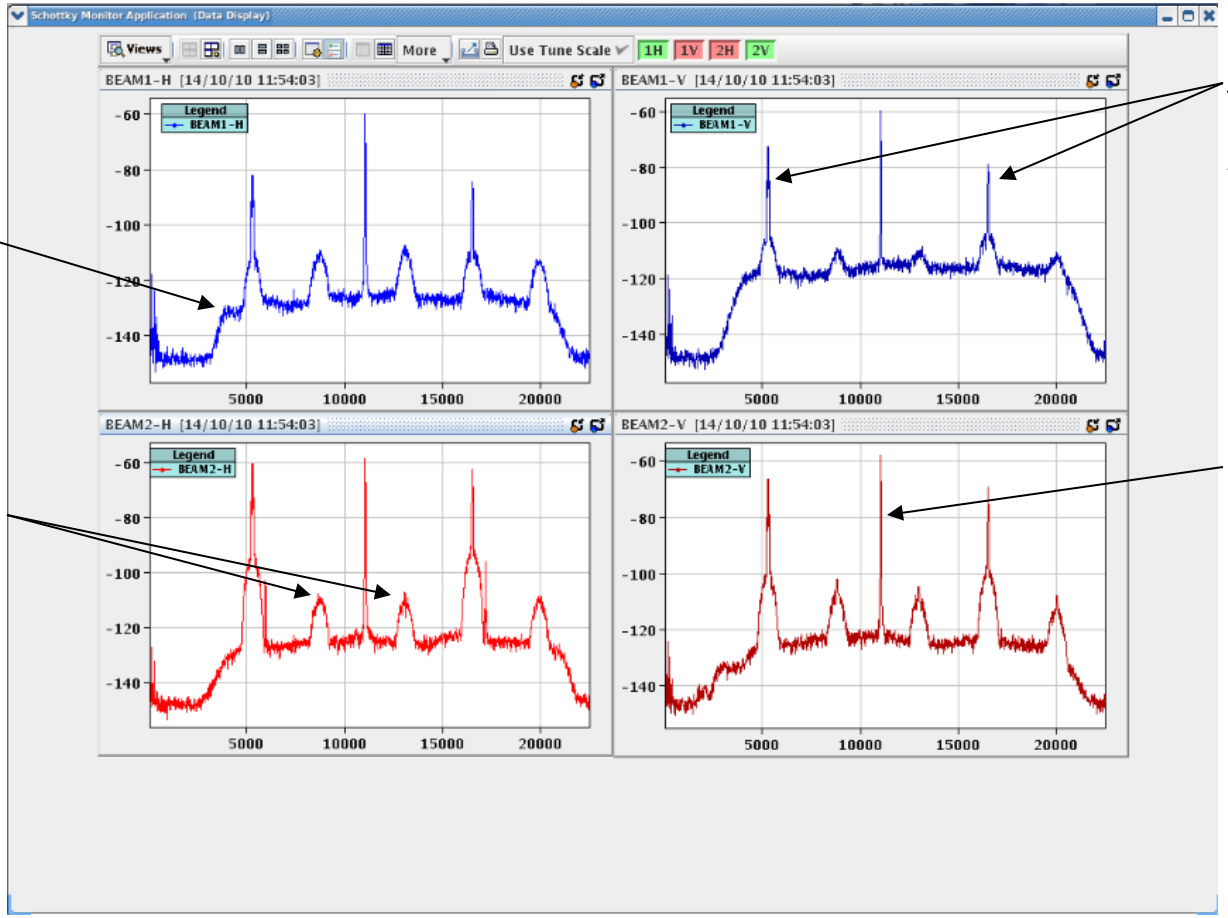

Noise Floor

Tune Sidebands

Revolution Lines

Calibration Signal

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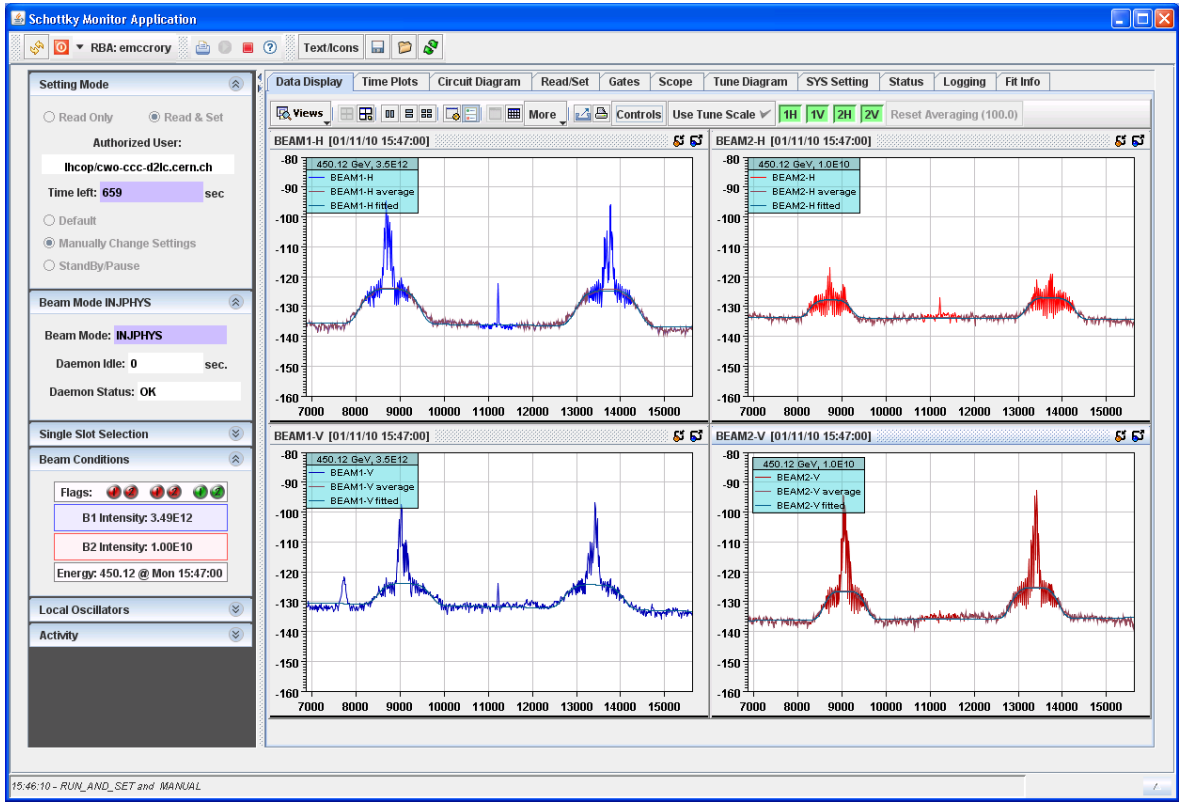
$3.4x10^{12}$ Protons 450 GeV
Fit eliminates coherence



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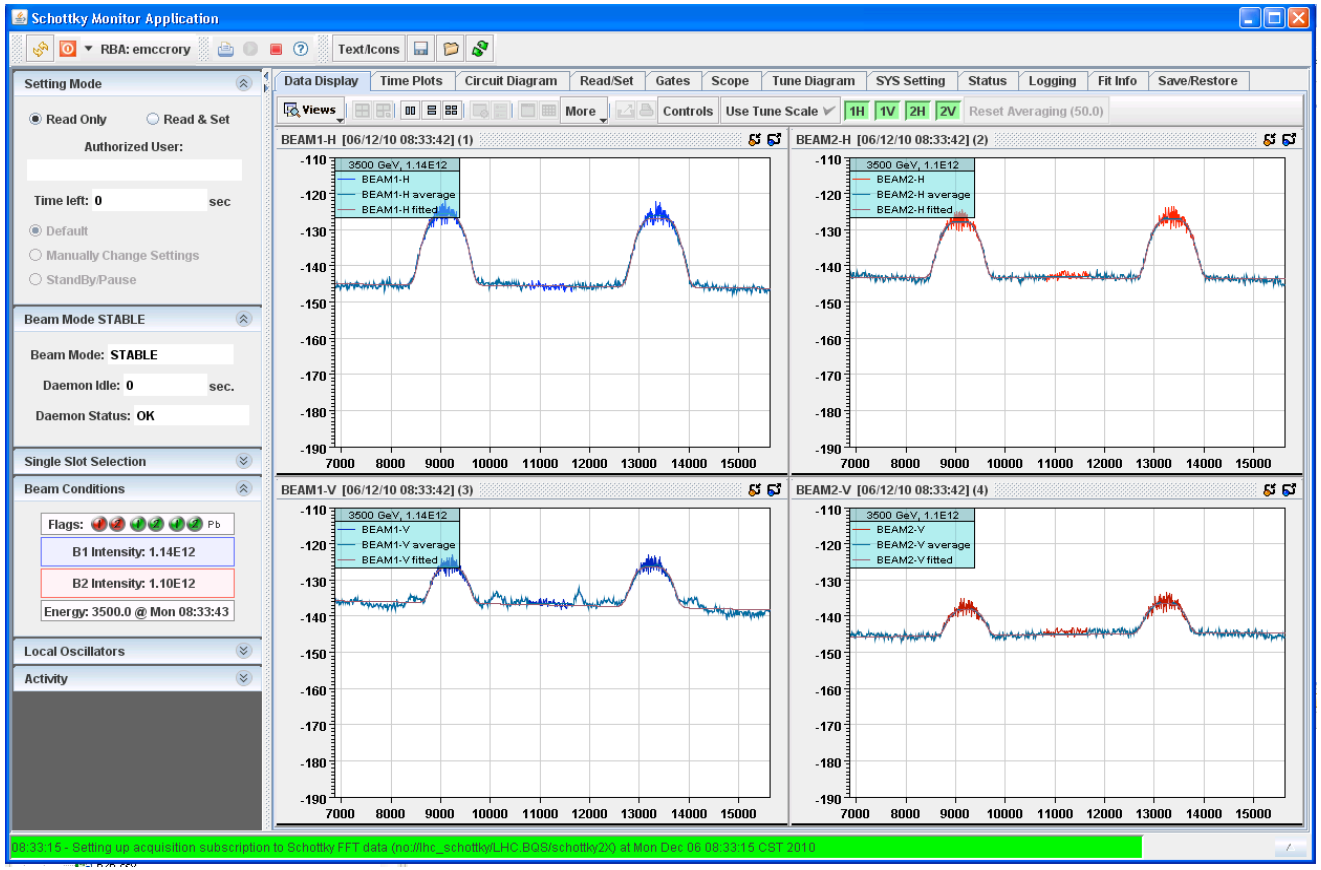
Lead Ions 1.1x10^{12} at 3.5 TeV



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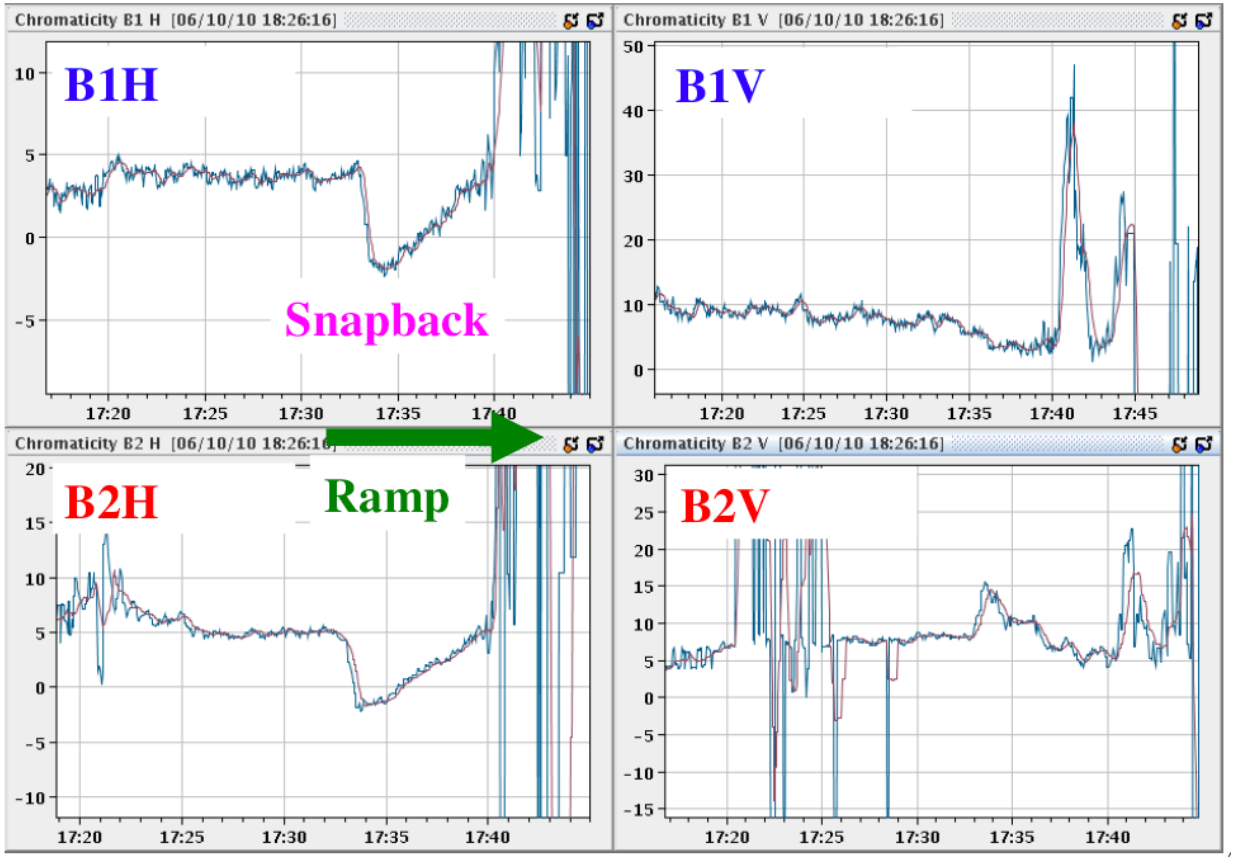
Chromaticity Measurements Protons during Energy Ramp



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Data Logged Tunes

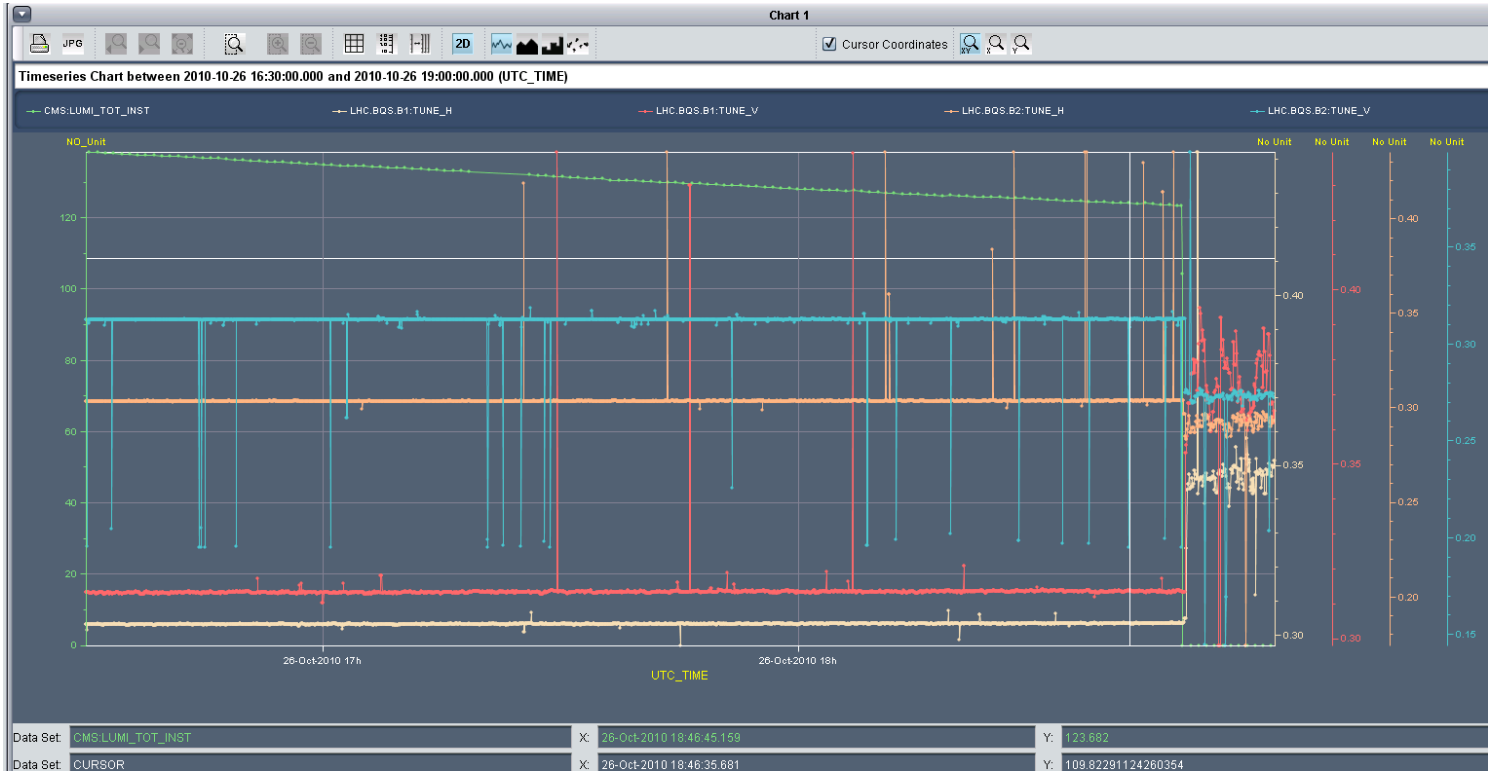
Luminosity

Beam 2V

Beam 2H

Beam 1V

Beam 1H



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- ***Capabilities and Commissioning***
  - *Non invasive measurements*
  - *Bunch by bunch transverse measurements*
  - *Measures single bunch with 10^{11} protons/bunch*
  - *Verified tunes track with other tune measurements*
  - *Chromaticities and Momentum spread measured*
  - *Signal tracking for ramped beam measurements*

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October 2010

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CERN

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