Fermilab

LARP
4.8 GHz LHC Schottky
Beam Diagnostic System

Ralph J. Pasquinelli

November 8, 2010

All Experimenters Meeting

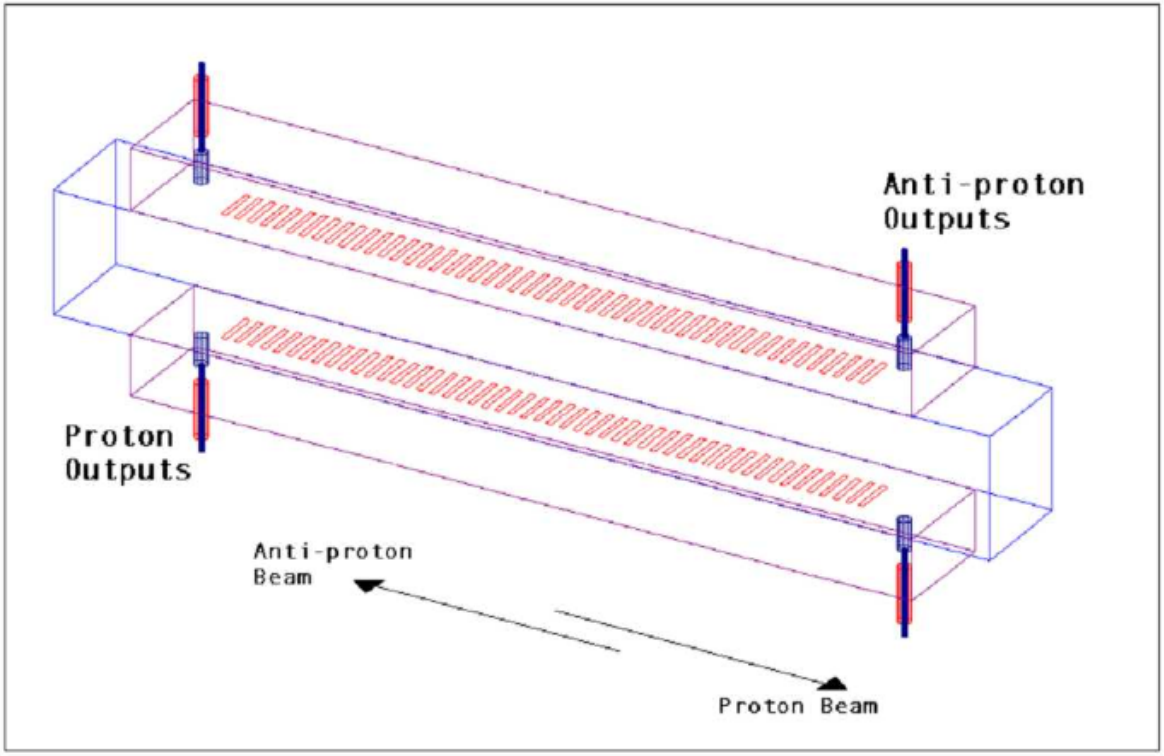
Fermilab LARP LHC Schottky

Tevatron Schottky System Operational 2003

LHC Schottky System Approved by LARP 2004

LARP LHC Schottky

Slotted Waveguide Pickup



Pickup Designed @ Fermilab in 2005

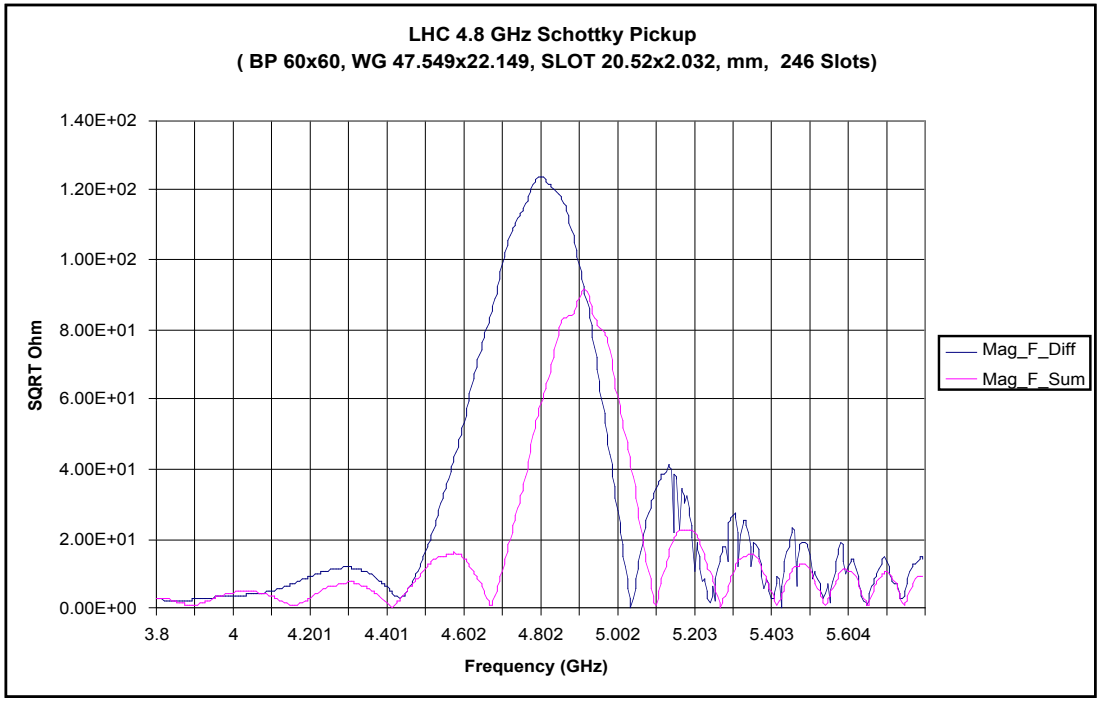
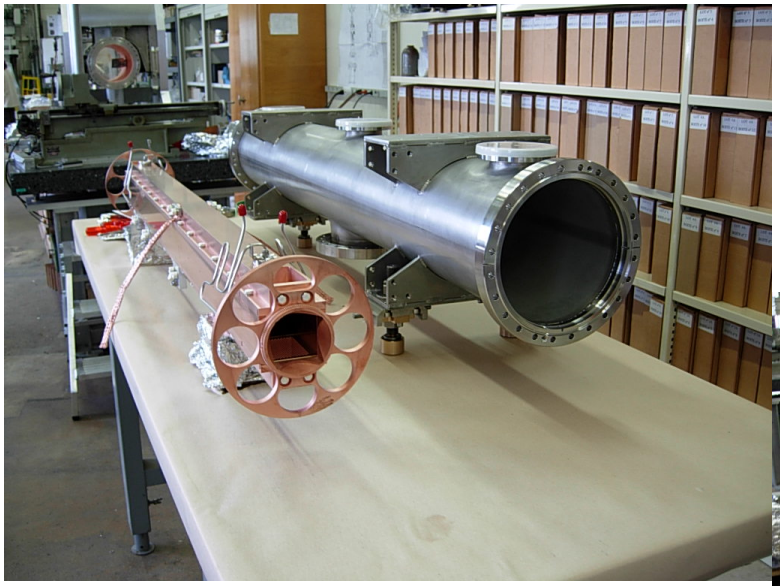


Figure 2. Impedance of LHC Schottky pickup

LARP LHC Schottky



Pickups Fabricated at CERN Autumn 2006

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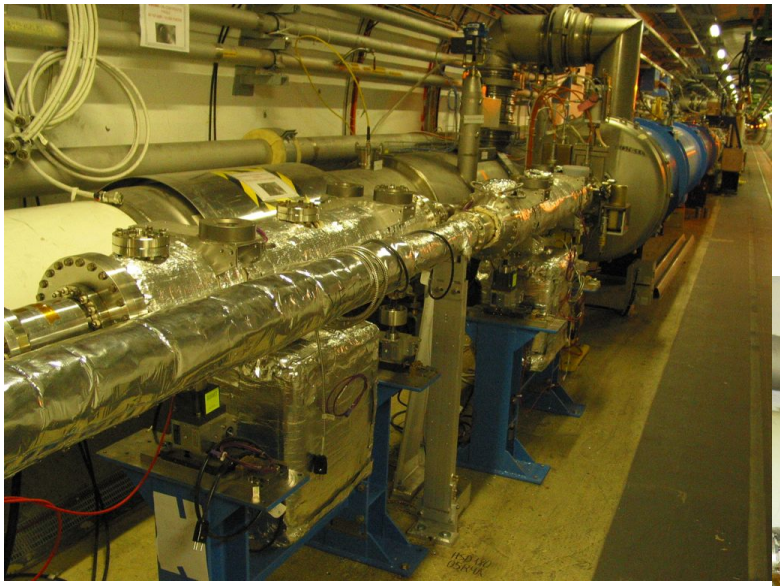
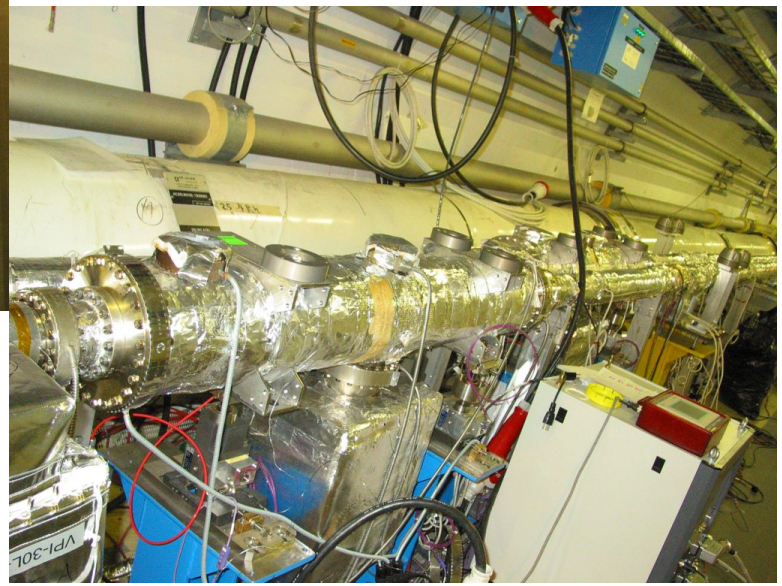
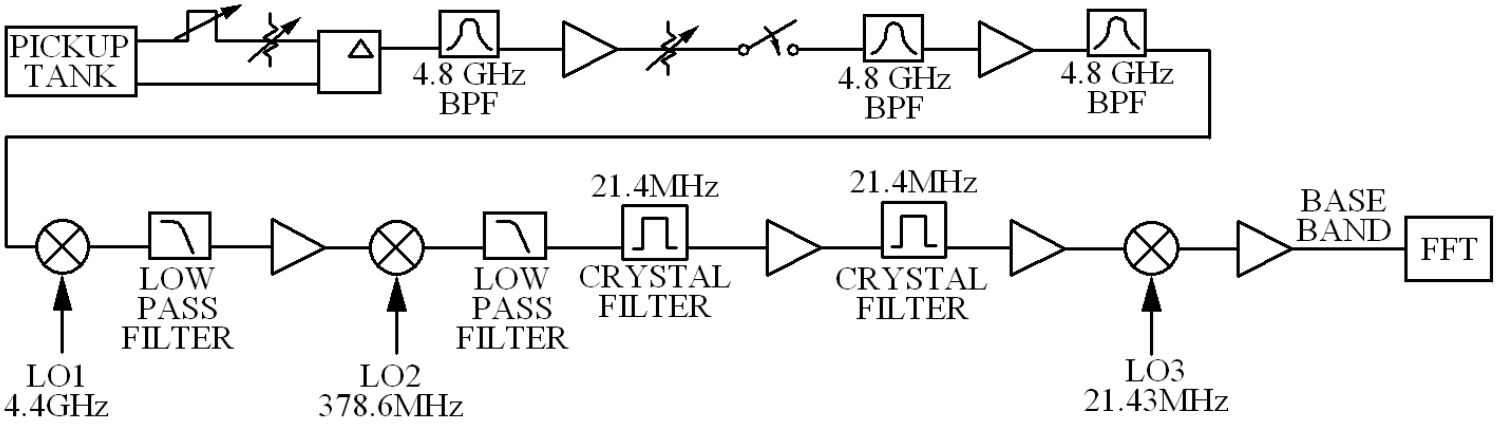
LARP LHC Schottky



Pickup tanks installed at LHC Point 4, Spring 2007



LHC Schottky Triple Heterodyne Block Diagram



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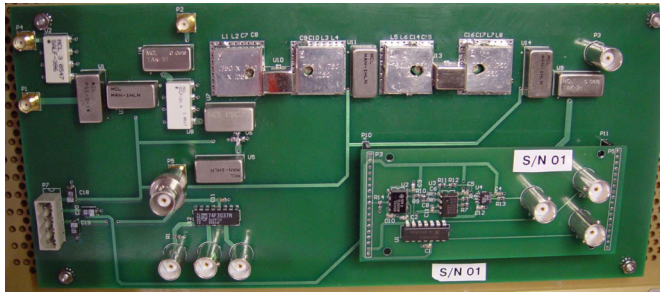
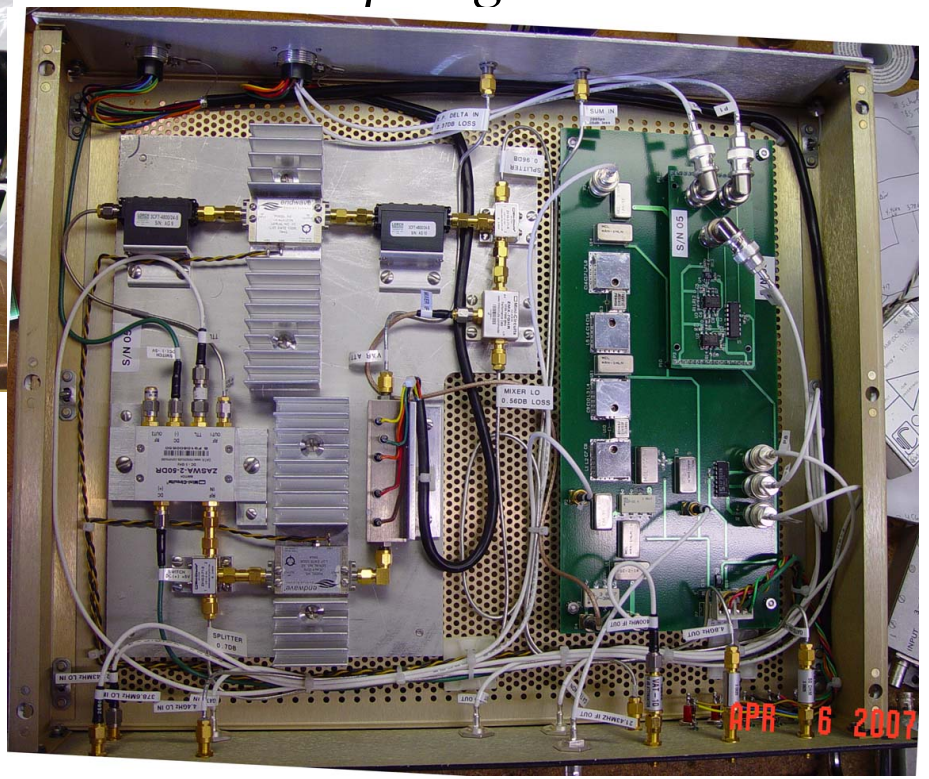
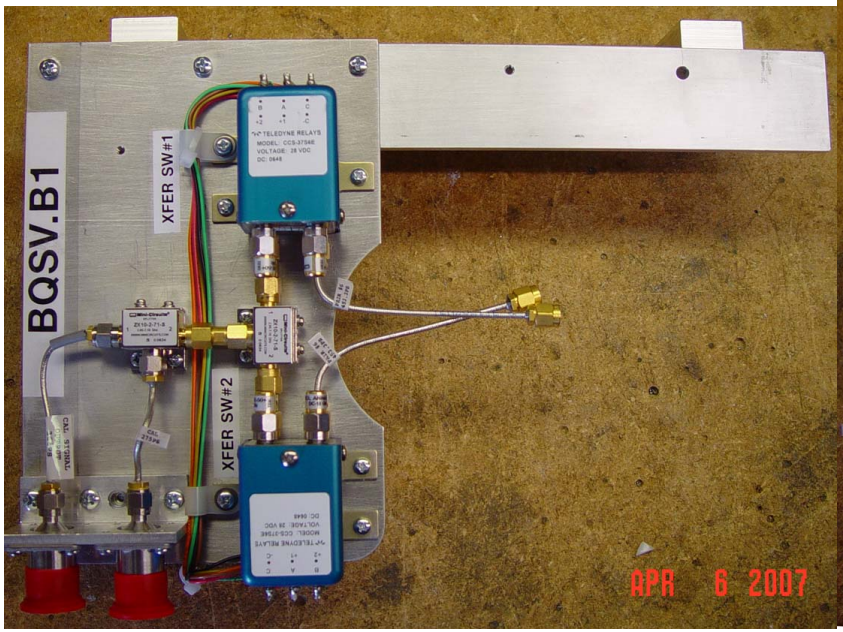
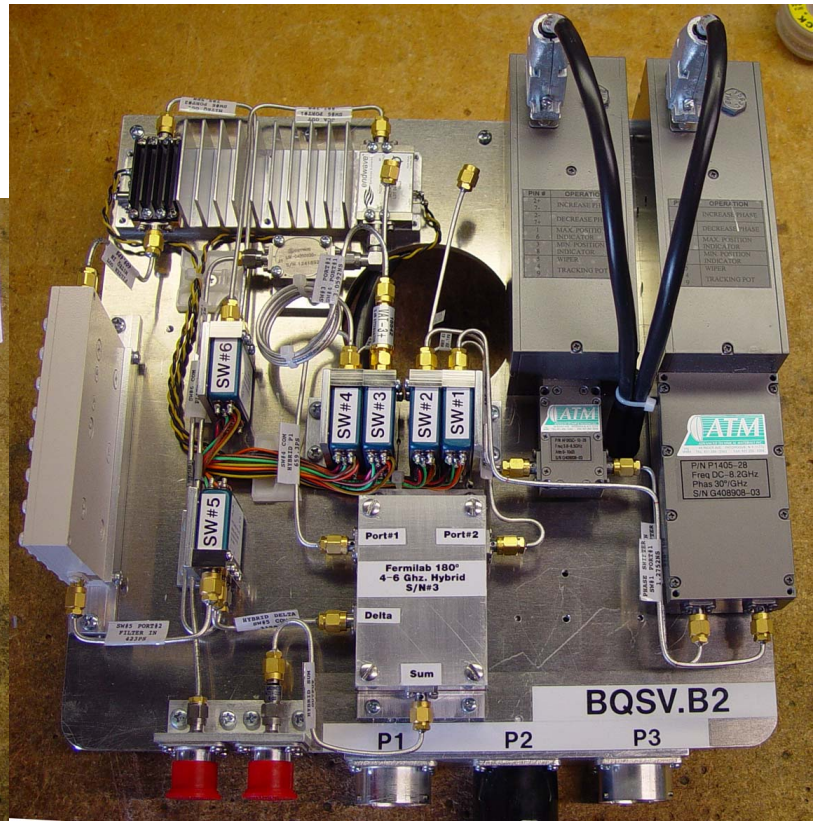
Signal Processing Chassis Spring 2007





Pickup Plate Hardware



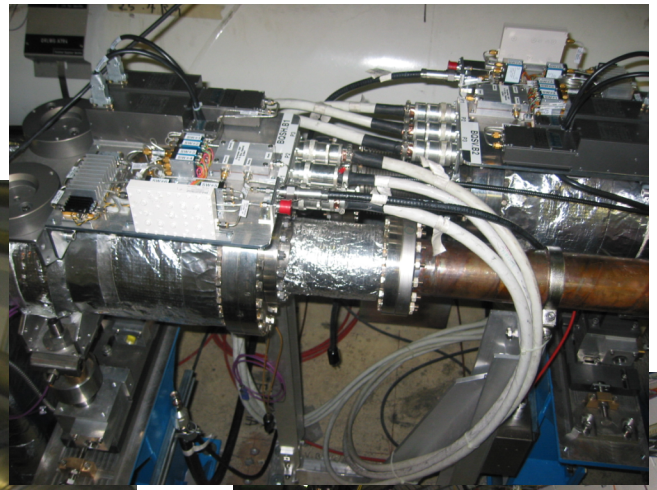


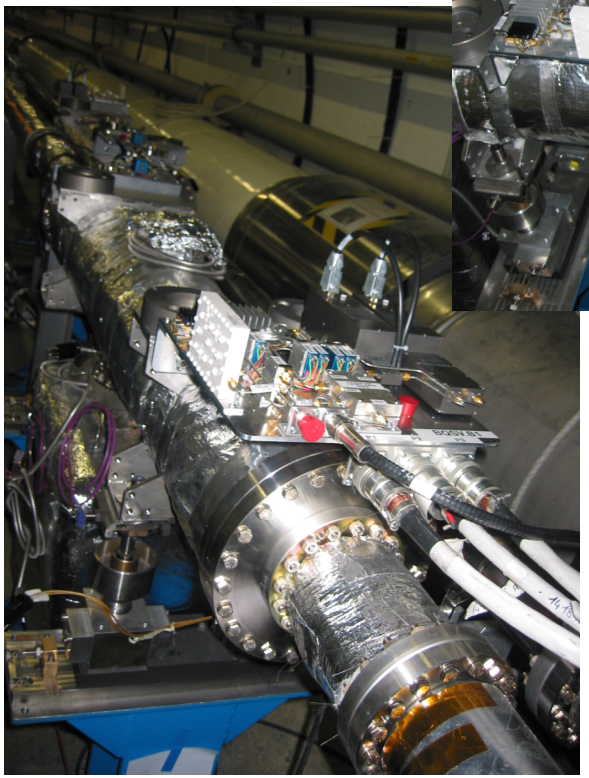
LARP LHC Schottky

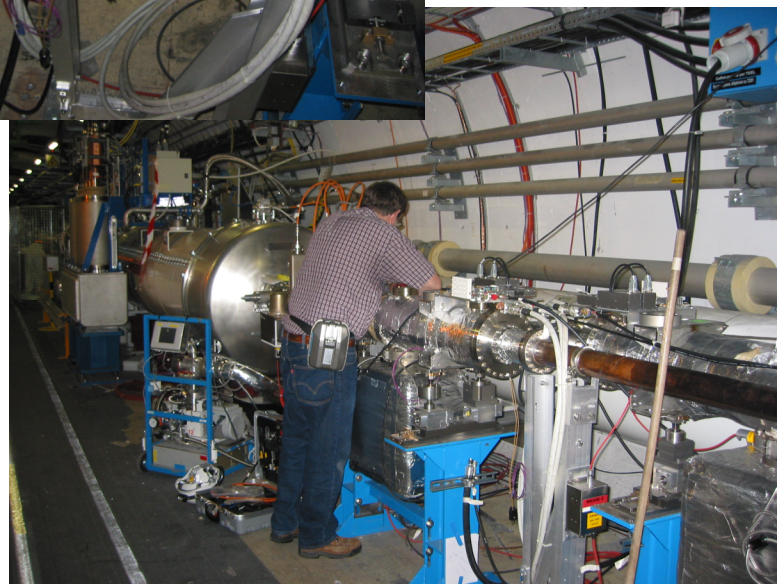
Crated up and on its way to CERN April 2007!

LARP LHC Schottky

Pickup Hardware Installed May 2007







LARP LHC Schottky

Point 4
Alcove
Hardware
May 2007

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Touring Hardware Installation May 2007

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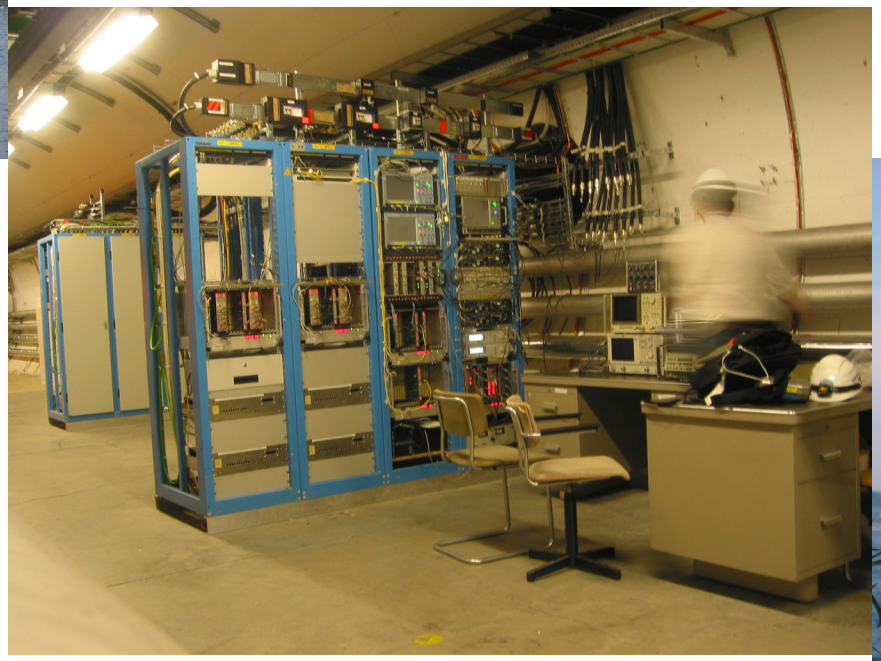
Installation of controls interface



May 2008

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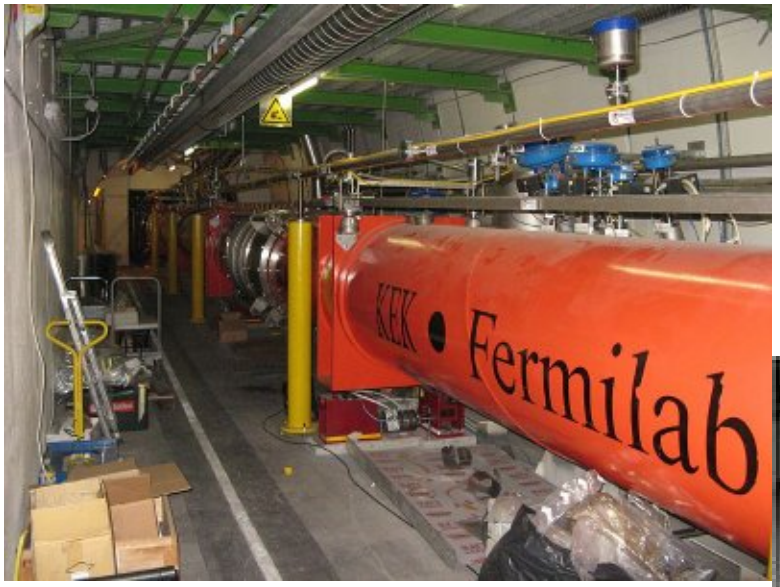

A slight delay in plans…

2008

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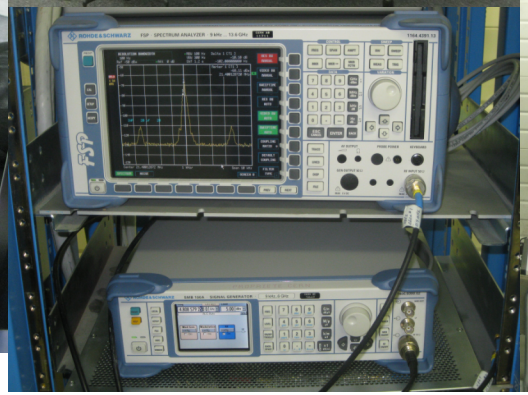
Two Beam Commissioning Trips to CERN

April 2010
October 2010

Fermilab LARP LHC Schottky



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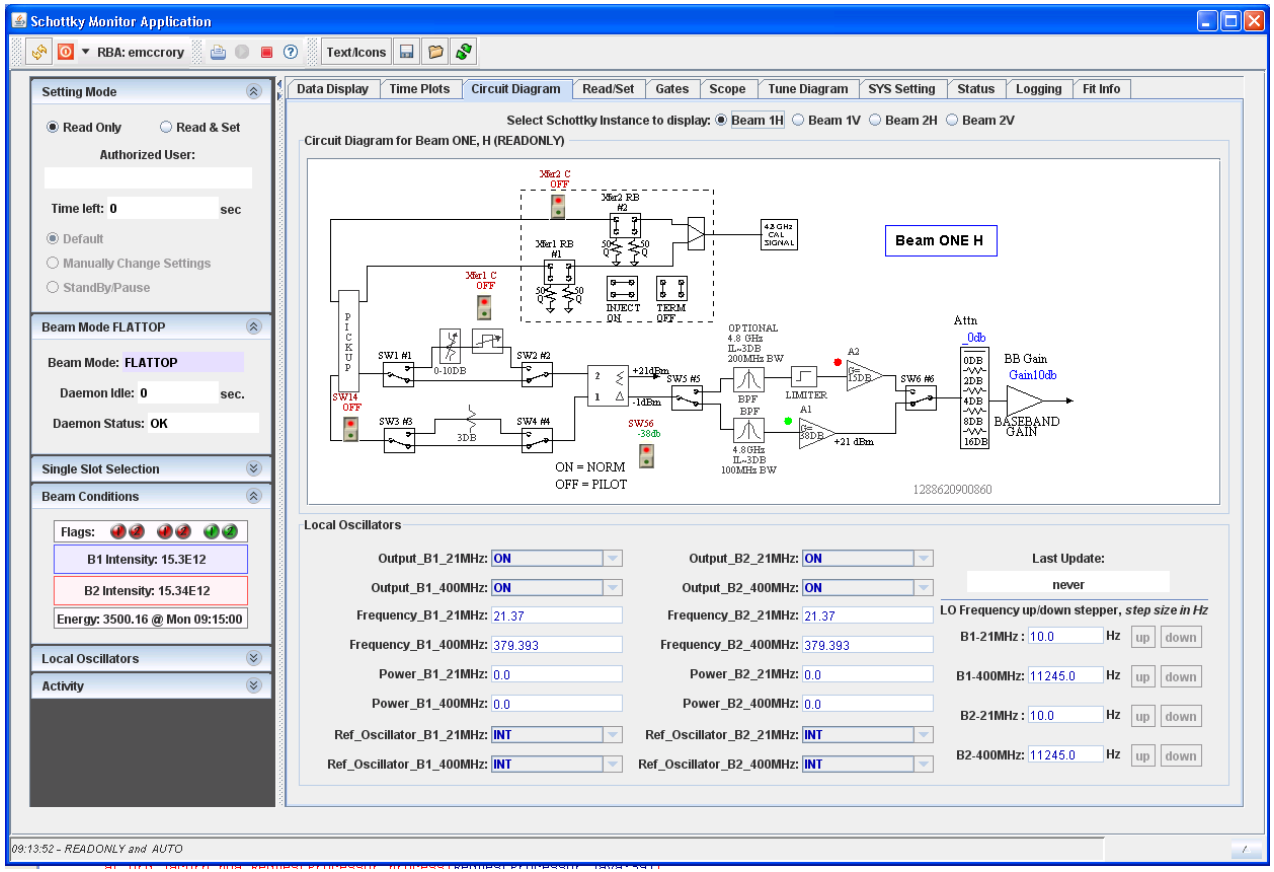
Interactive Graphics Control



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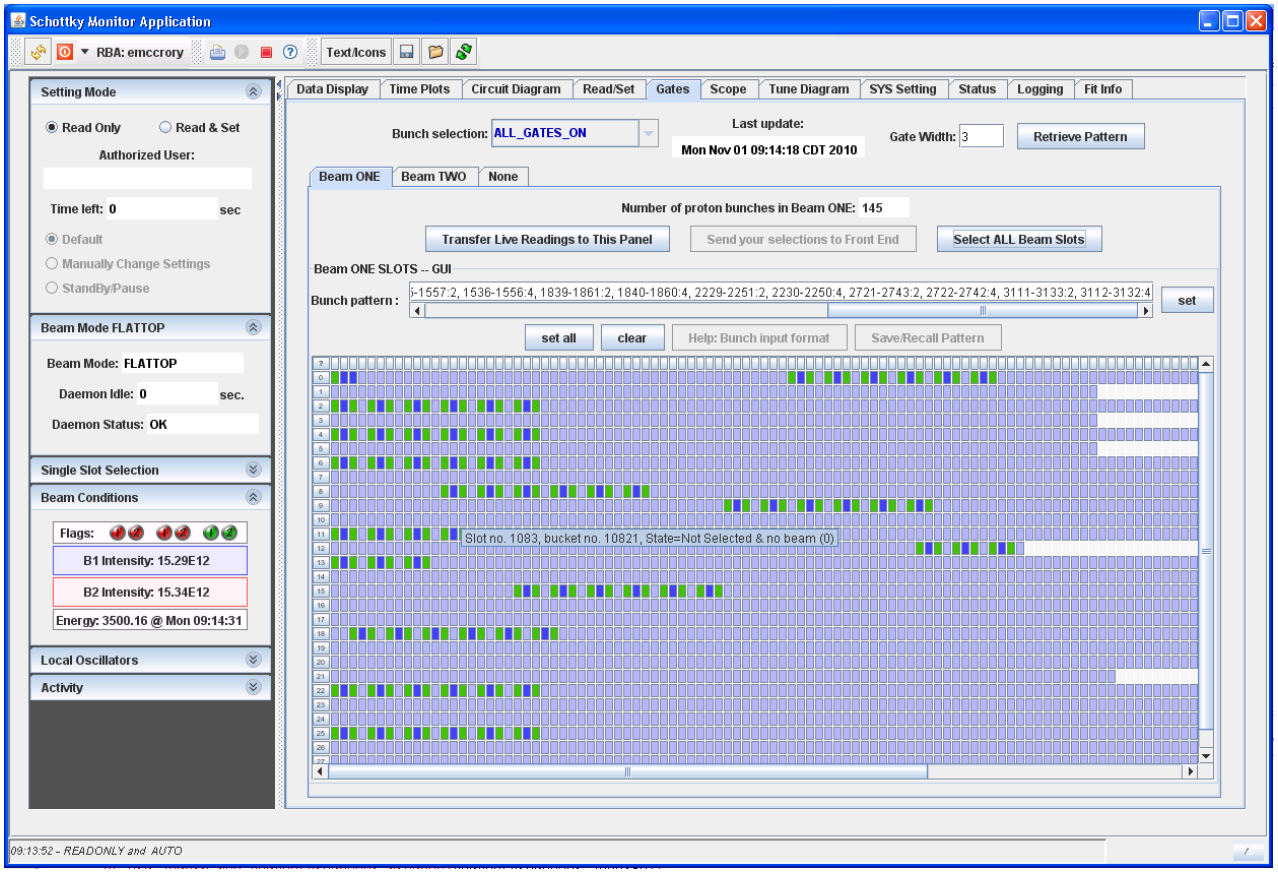
Automated Gating Control



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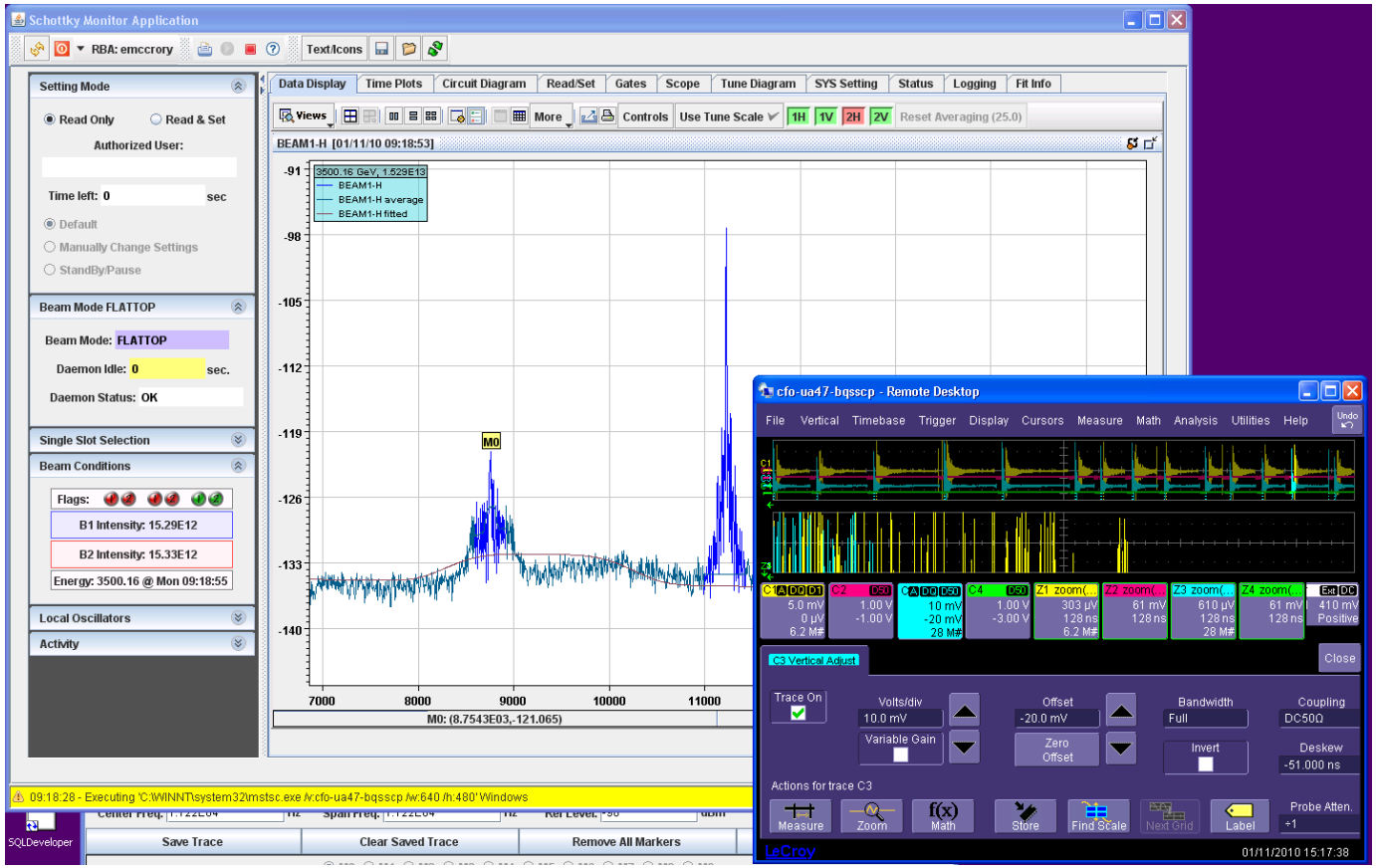
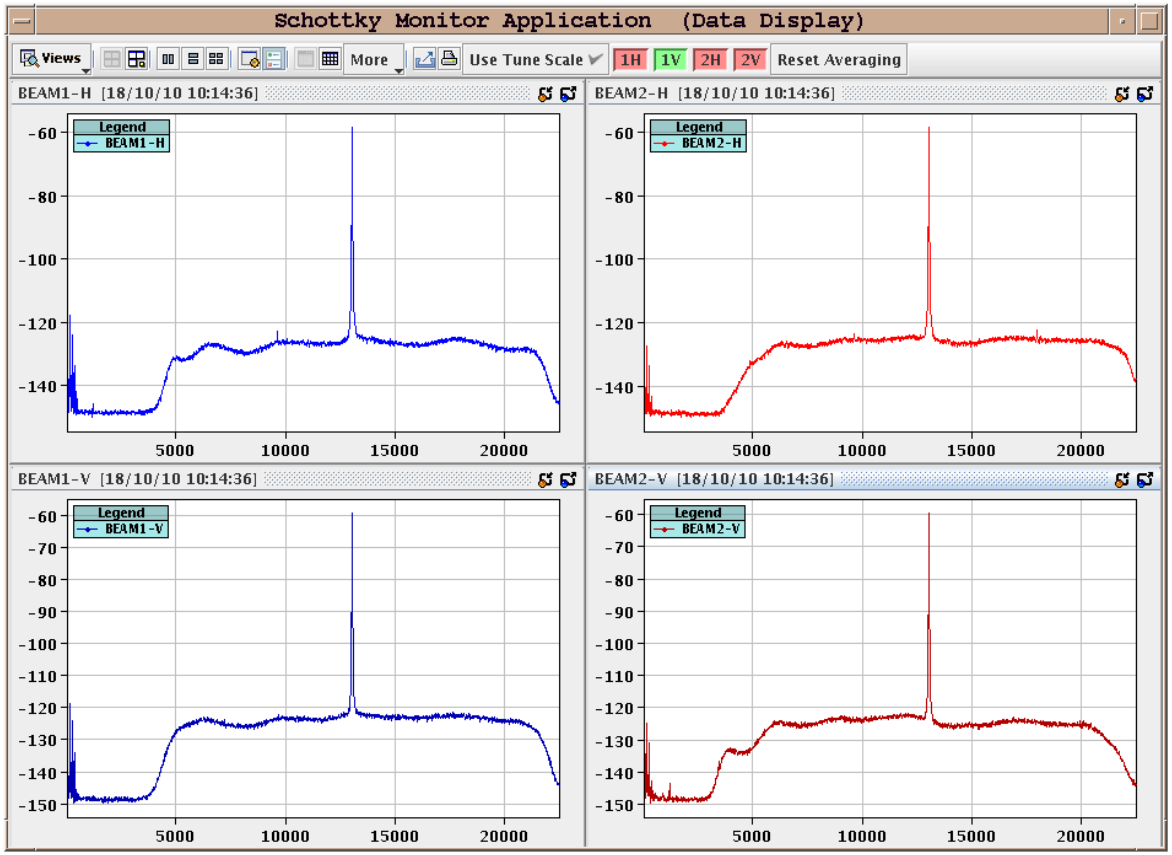
Remote Control of Gate Timing Oscilloscope



Built In Calibration Capability



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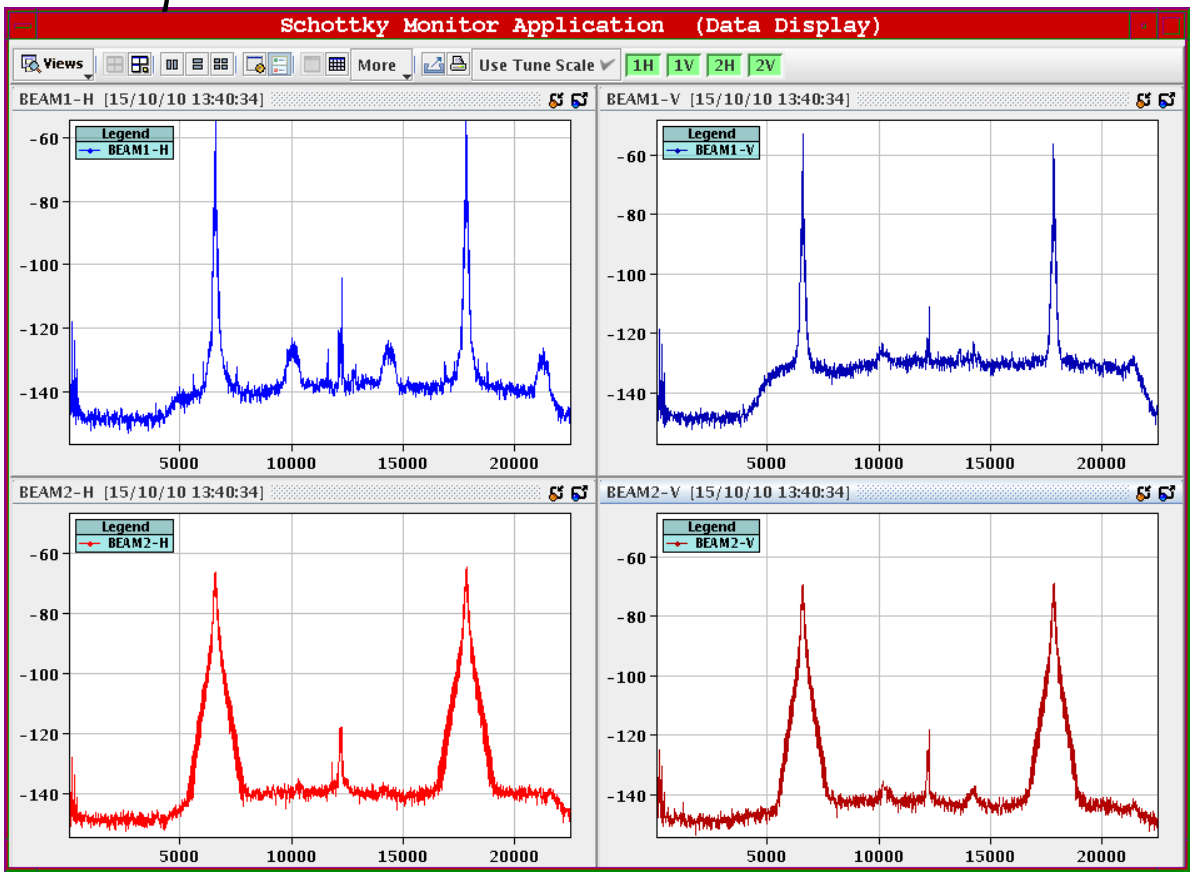
Spectra Reveal Coherent Phenomena



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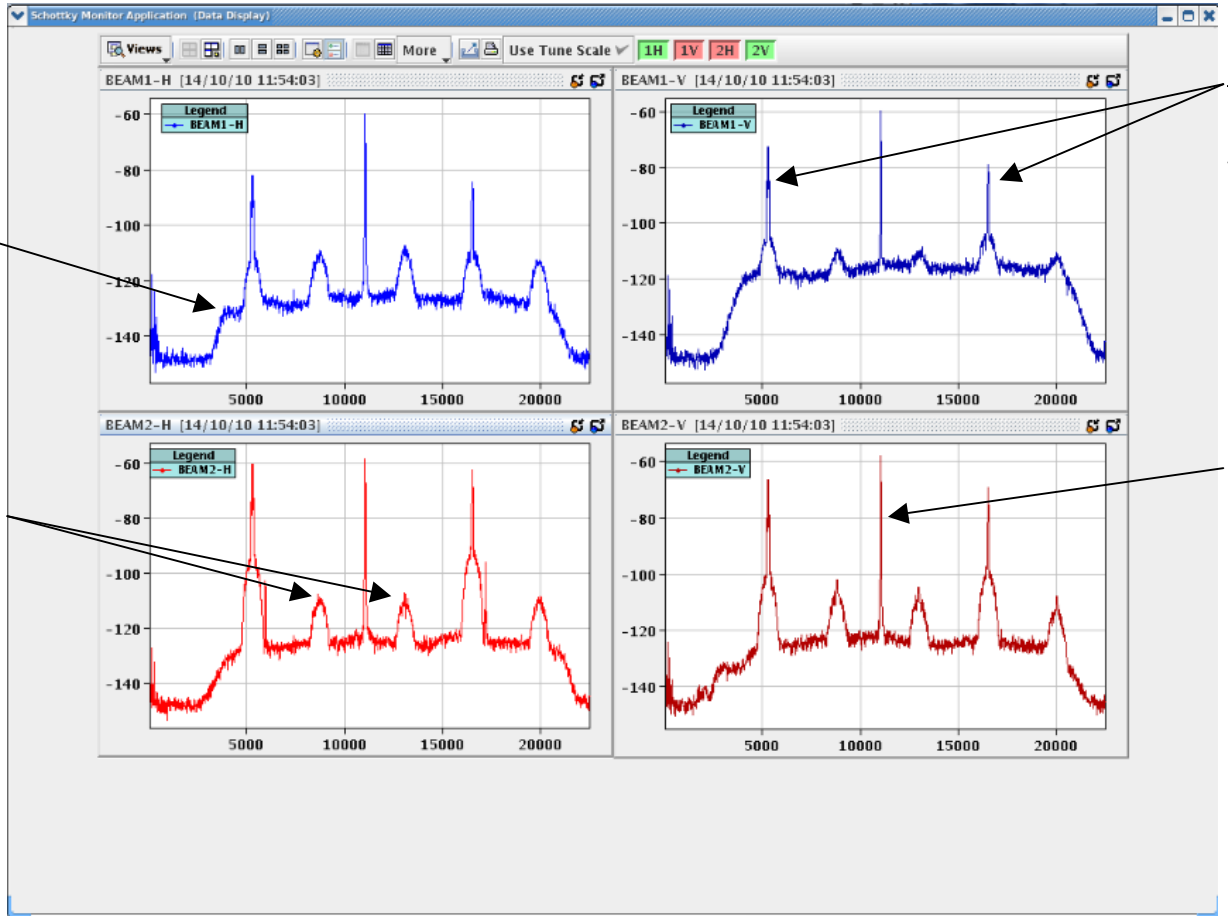


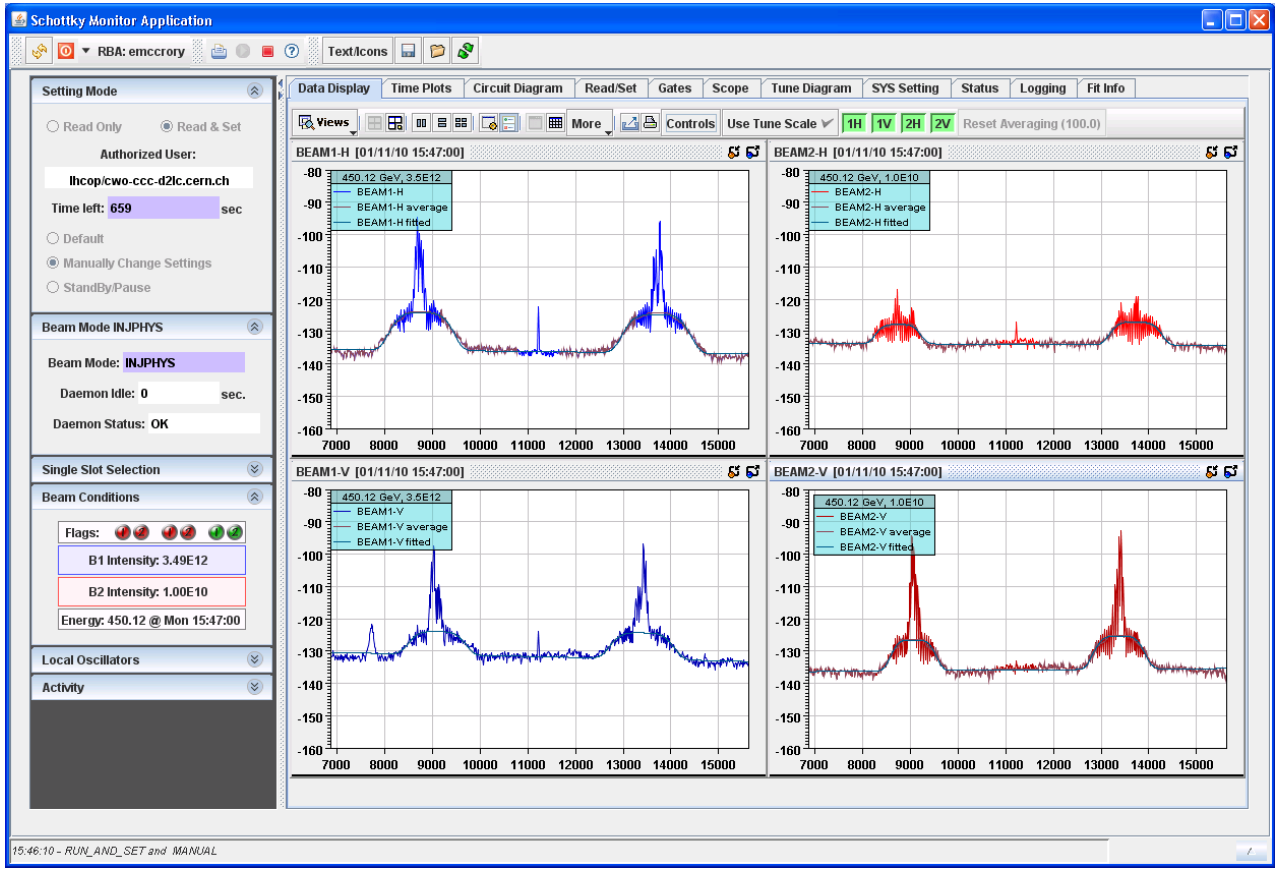
Noise Floor

Tune Sidebands

Revolution Lines

Calibration Signal

Fit to Tune Sidebands



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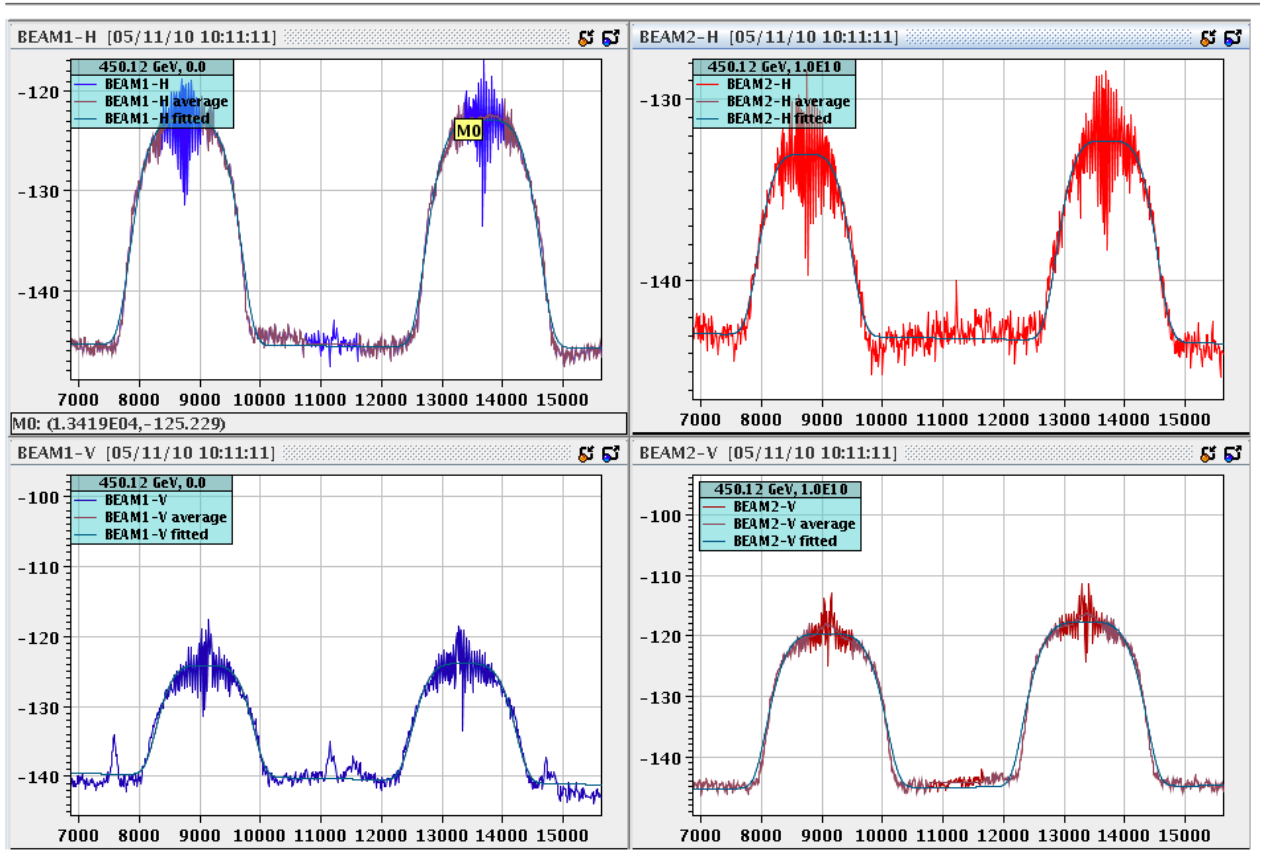
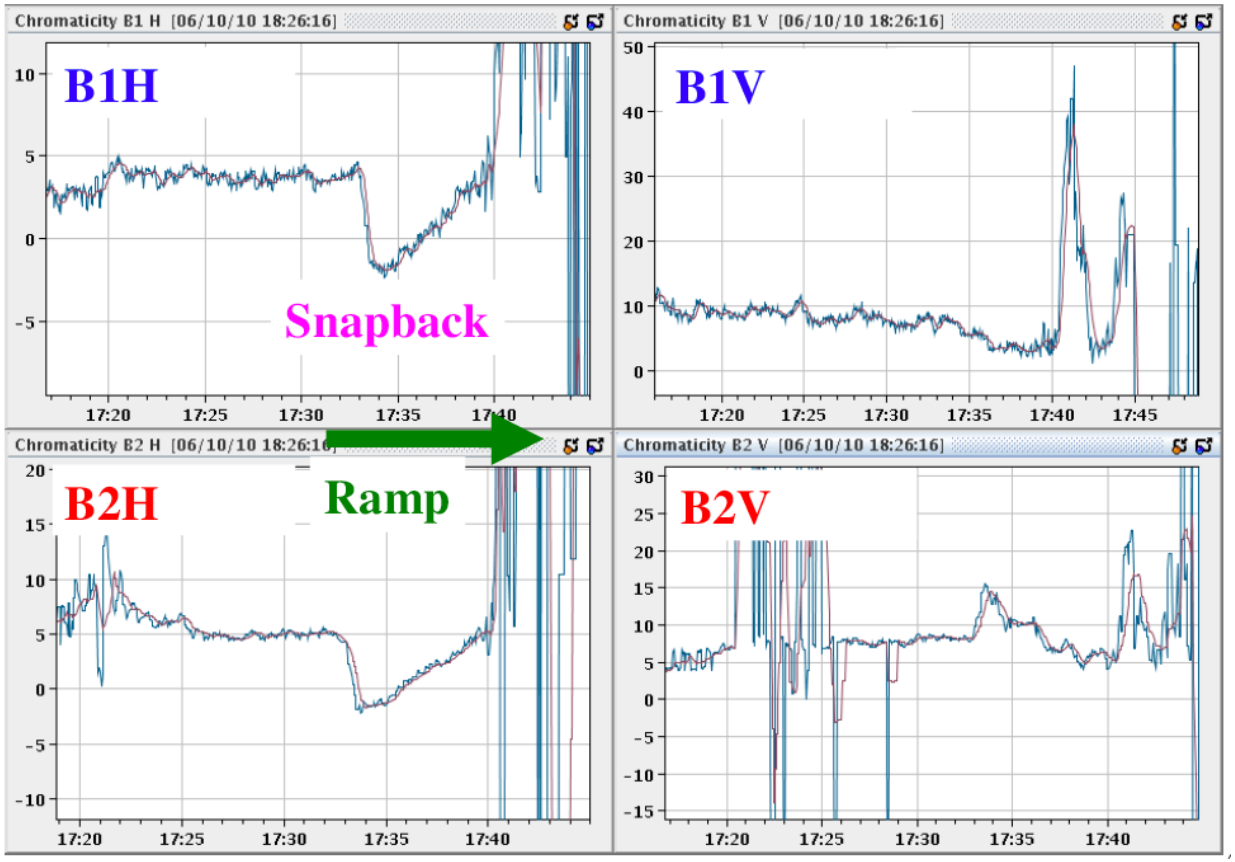
Lead Ions at 450 GeV Injection



Chromaticity Measurements



Data Logged Tunes

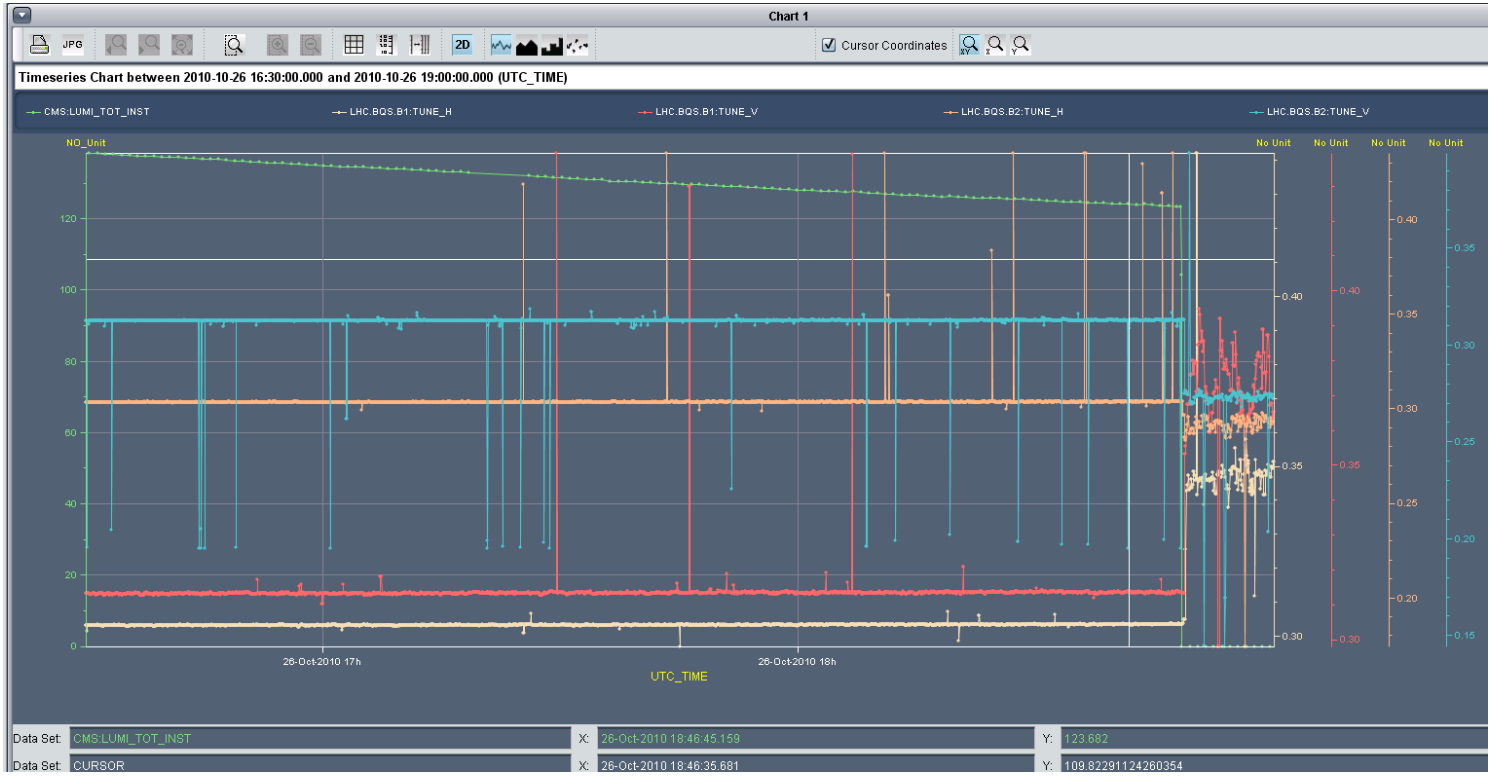
Luminosity

Beam 2V

Beam 2H

Beam 1V

Beam 1H



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LARP LHC Schottky

- ***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*

- ***Things that still need to be done***
  - *Measure pickup response in the tunnel*
  - *Remote control of calibration signal generator*
  - *Implement front end common mode rejection hardware*
  - *Application software becomes operational in the CCC*

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October 2010

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CERN