

“Some” LHC Schottky Measurements

R. Calaga, T. Pieloni

CM16, May 16-18, 2011

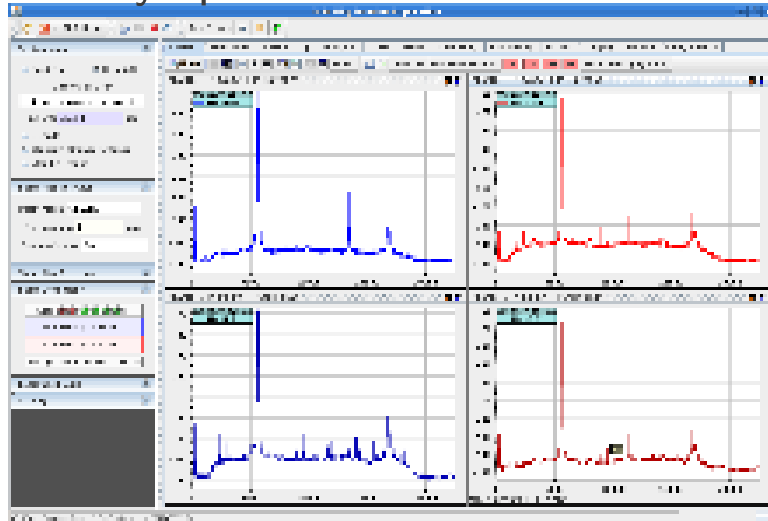
- Introduction
- 3 measurements examples from 2010-11
- Status and future

Special Thanks:

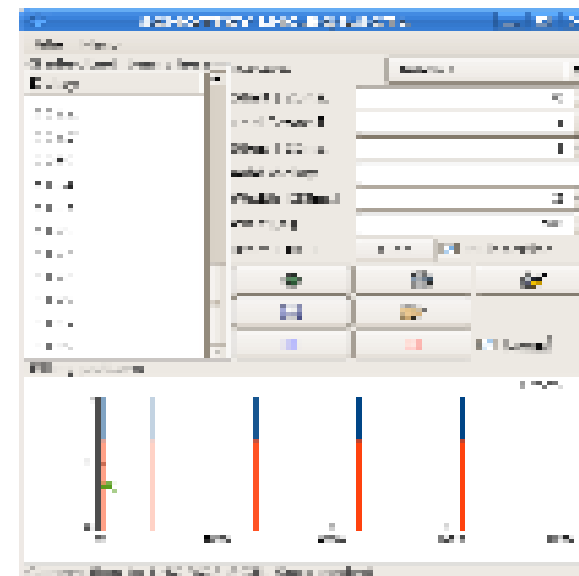
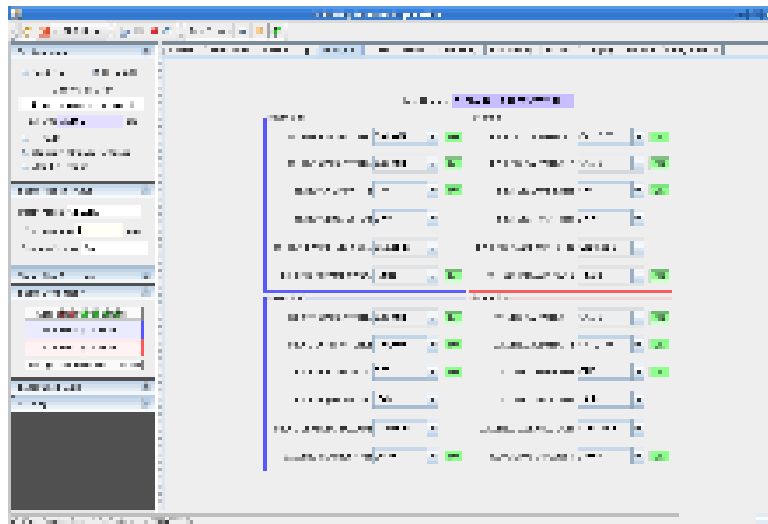
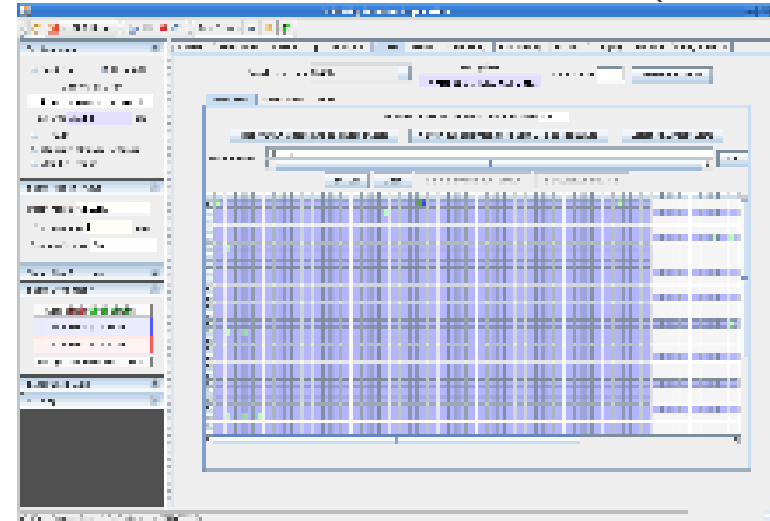
G. Crockford, M. Favier, R. Jones, T. Lahey, E. McCrory, N. Mounet

LHC Schottky GUI (old version)

Schottky spectrum



Bunch display (manual selection)

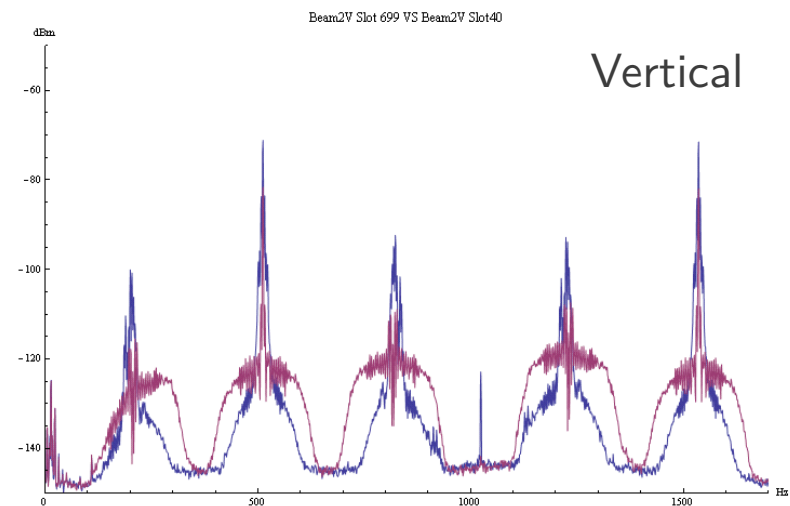
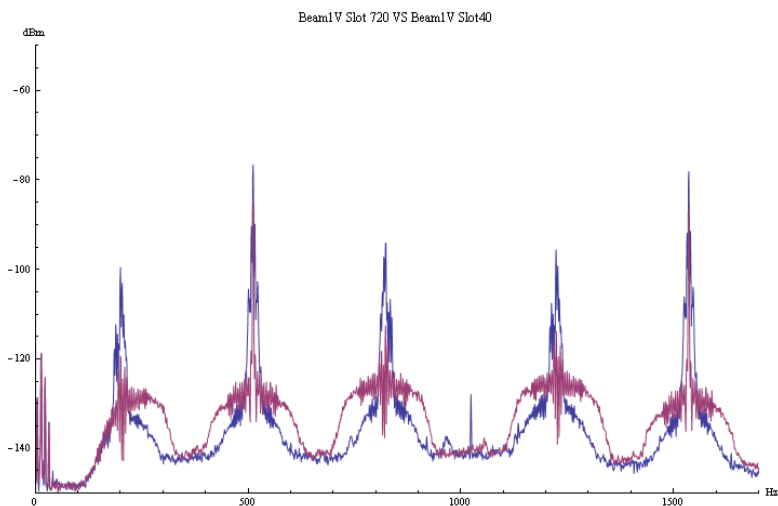
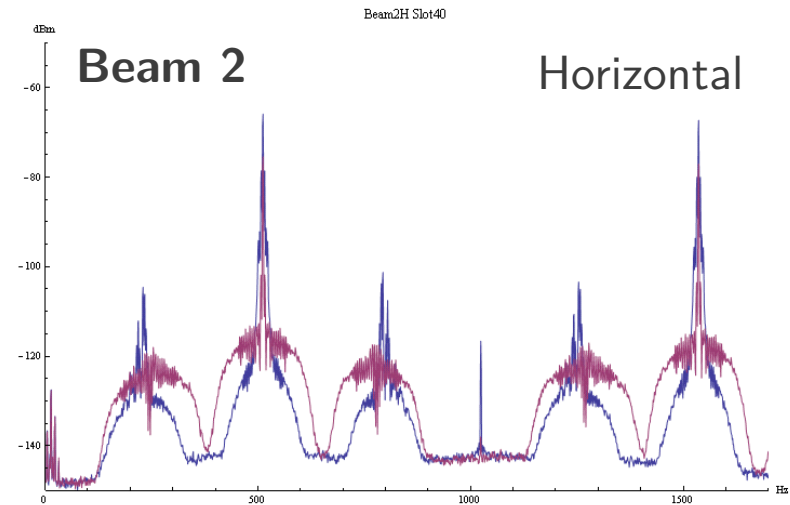
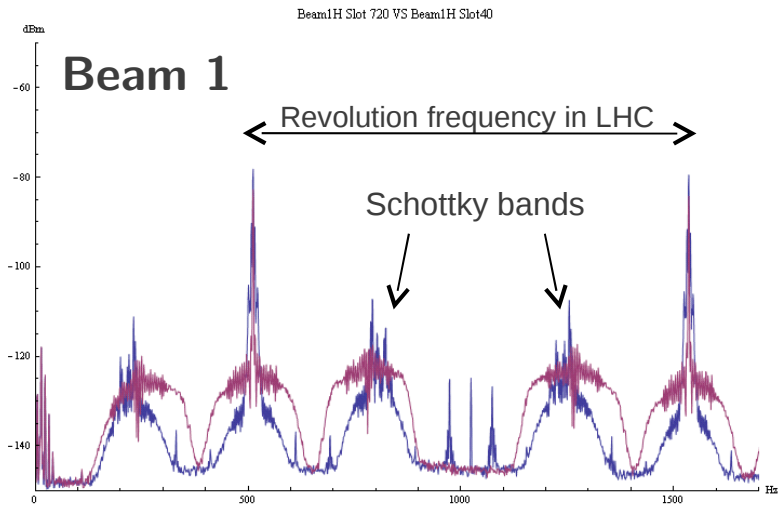


Old Playlist (E. Bravin)

LHC Schottky Spectra

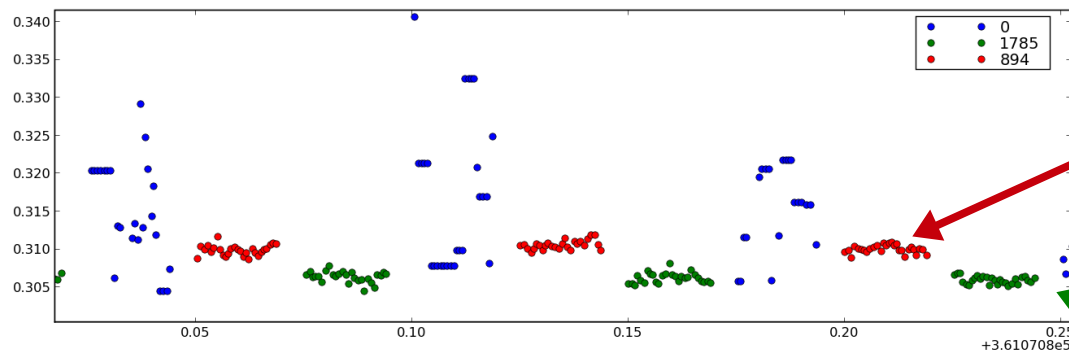
- Protons
- Ions

Bunch by bunch spectra (stable beams)

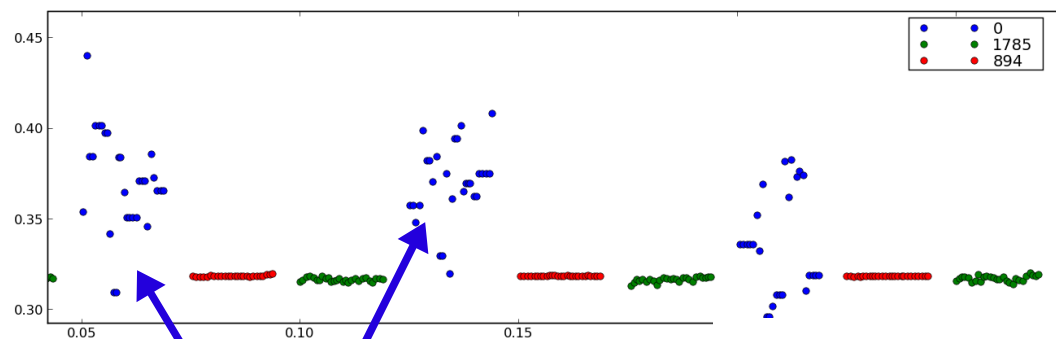


Beam-Beam, 3x3 Bunches

Bunches with 1 collision ALICE

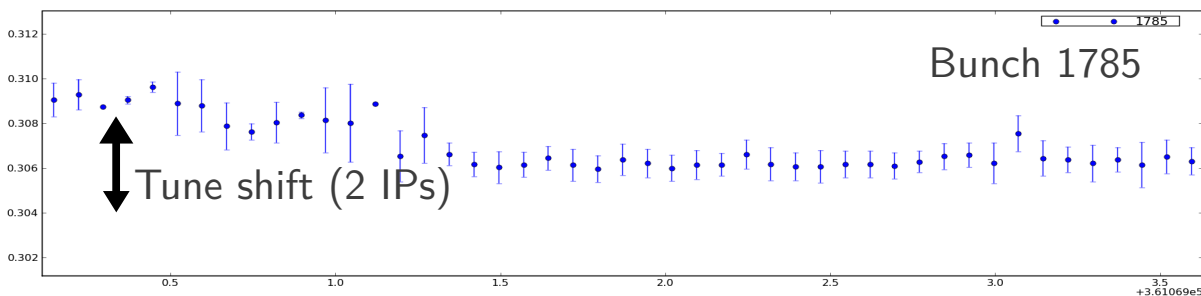


Bunches with 2 collision
ATLAS/CMS

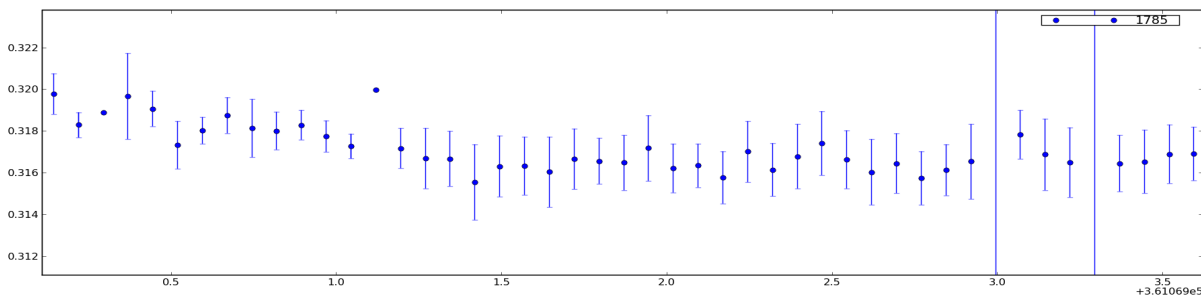


Bunch intensities: $\sim 1.15 \times 10^{11}$

Pilot bunch (noisy)



1st collisions of 2011
(Mar 11)



Schottky: Scrubbing Run

Apr 6-12, 2011

12b + 1008b (36bx36b x14)

LHC Page1 **Fill: 1694** **E: 450 GeV** **11-04-2011 01:22:47**

BEAM SETUP: INJECTION PHYSICS BEAM

BCT TI2: 5.52e+09 **I(B1):** 1.25e+14 **BCT TI8:** 7.01e+13 **I(B2):** 1.25e+14

TED TI2 position:	BEAM	TDI P2 gaps/mm	up: 11.28	down: 12.89
TED TI8 position:	BEAM	TDI P8 gaps/mm	up: 8.92	down: 9.62

FBCT Intensity and Beam Energy Updated: 01:22:46

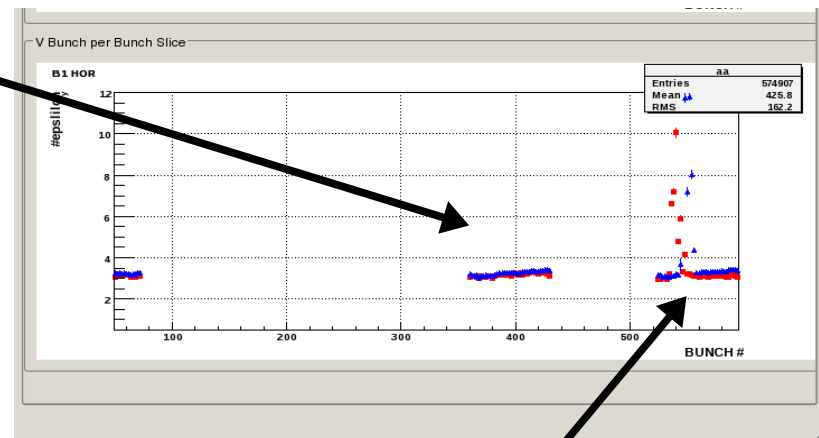
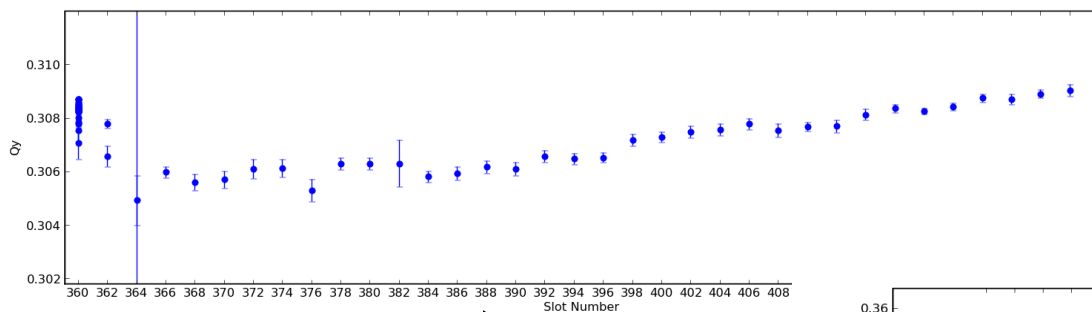
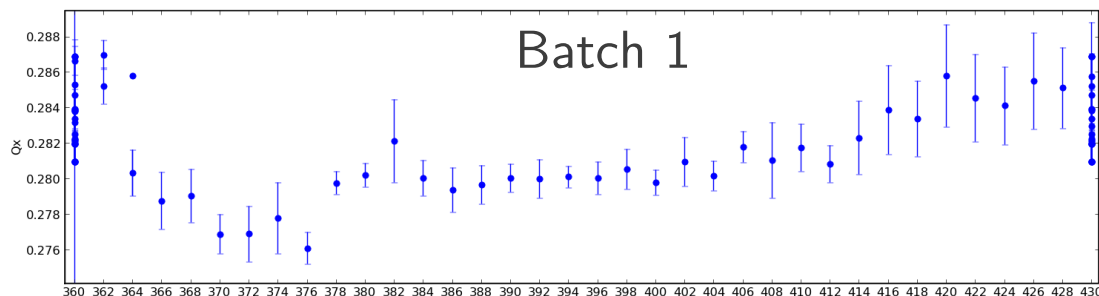
<p>Comments 11-04-2011 01:22:39 :</p> <p style="text-align: center;">Scrubbing with 1020 bunches per beam !</p> <p style="text-align: center;">About 1.2e14p per beam = 8.8 MJ</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">BIS status and SMP flags</th> <th style="text-align: center;">B1</th> <th style="text-align: center;">B2</th> </tr> </thead> <tbody> <tr> <td>Link Status of Beam Permits</td> <td style="text-align: center; background-color: green; color: white;">true</td> <td style="text-align: center; background-color: green; color: white;">true</td> </tr> <tr> <td>Global Beam Permit</td> <td style="text-align: center; background-color: green; color: white;">true</td> <td style="text-align: center; background-color: green; color: white;">true</td> </tr> <tr> <td>Setup Beam</td> <td style="text-align: center; background-color: red; color: white;">false</td> <td style="text-align: center; background-color: red; color: white;">false</td> </tr> <tr> <td>Beam Presence</td> <td style="text-align: center; background-color: green; color: white;">true</td> <td style="text-align: center; background-color: green; color: white;">true</td> </tr> <tr> <td>Moveable Devices Allowed In</td> <td style="text-align: center; background-color: red; color: white;">false</td> <td style="text-align: center; background-color: red; color: white;">false</td> </tr> <tr> <td>Stable Beams</td> <td style="text-align: center; background-color: red; color: white;">false</td> <td style="text-align: center; background-color: red; color: white;">false</td> </tr> </tbody> </table>	BIS status and SMP flags	B1	B2	Link Status of Beam Permits	true	true	Global Beam Permit	true	true	Setup Beam	false	false	Beam Presence	true	true	Moveable Devices Allowed In	false	false	Stable Beams	false	false
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AFS: 50ns_1164b_36x2bpi_18inj_scrub **PM Status B1** ENABLED **PM Status B2** ENABLED

Scrubbing Run, Fill 1674

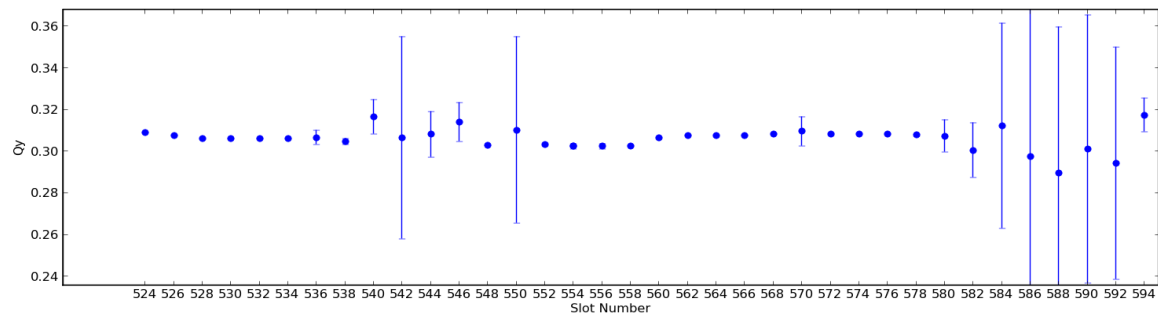
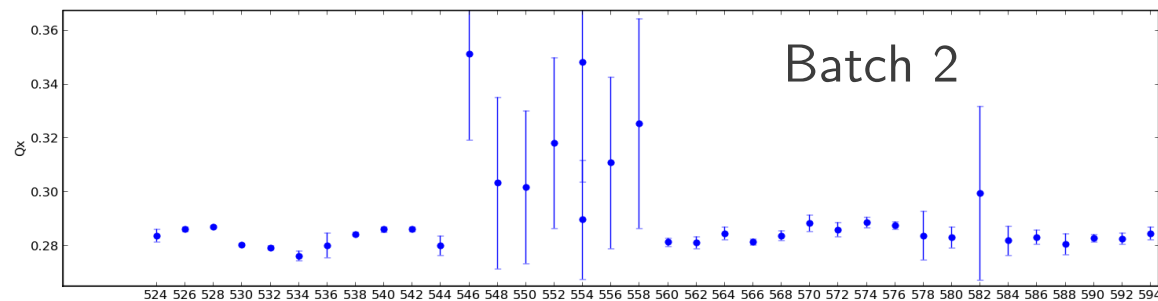
Apr 5, 2011

1st Fill, before scrubbing



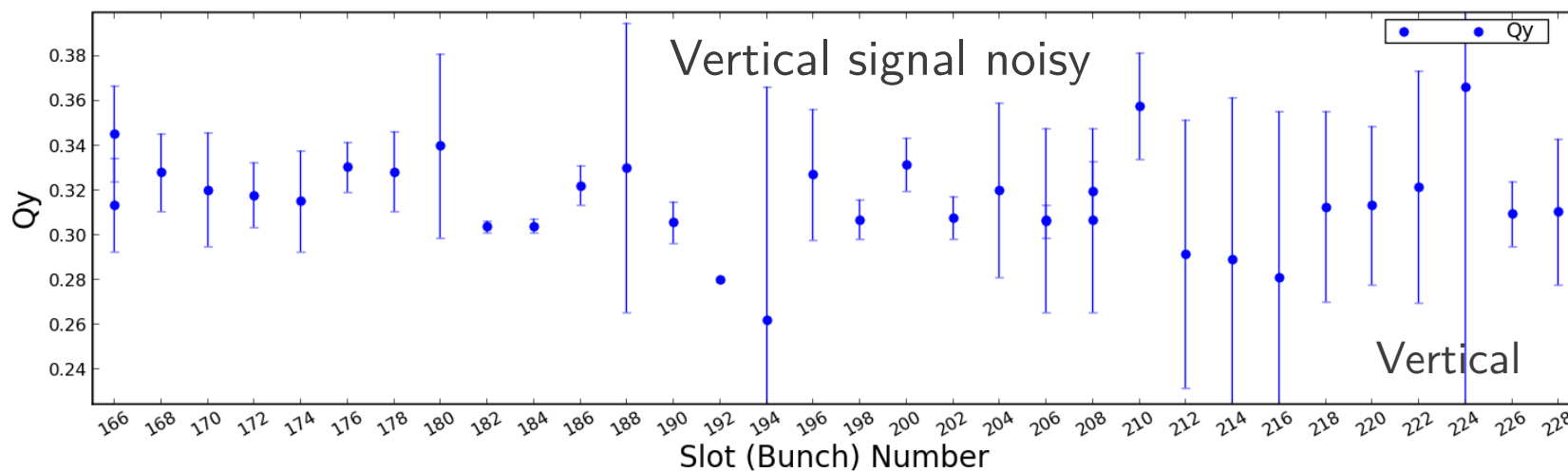
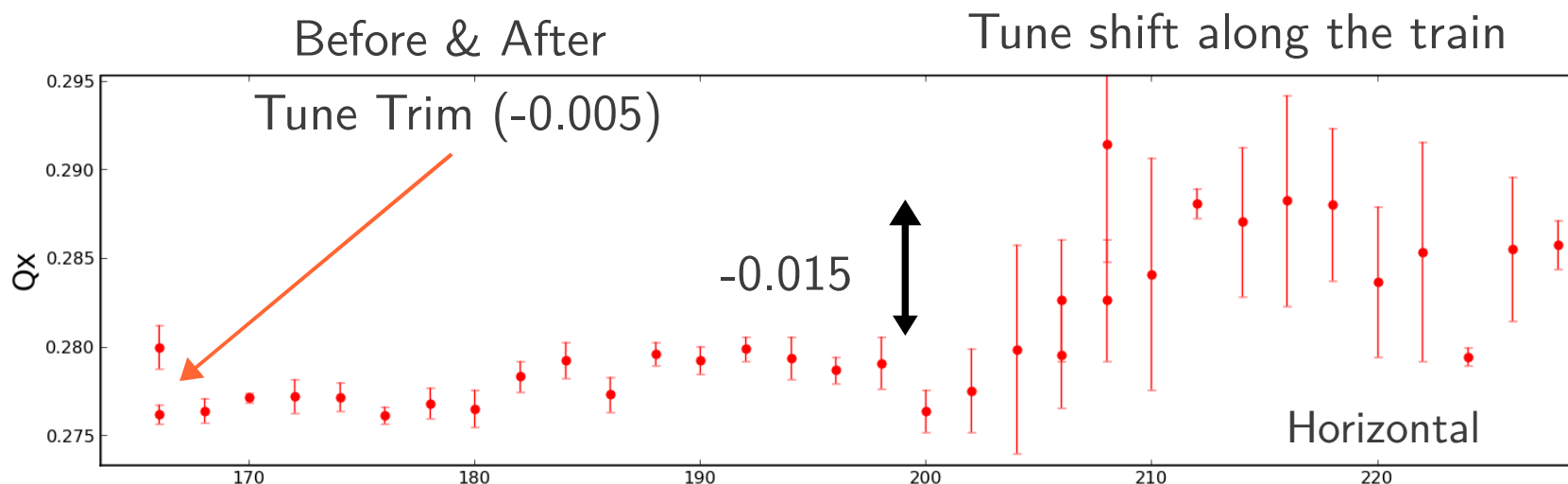
Beam 1 Schottky tunes

Beam 2 (extremely noisy)



Scrubbing Run, 1689

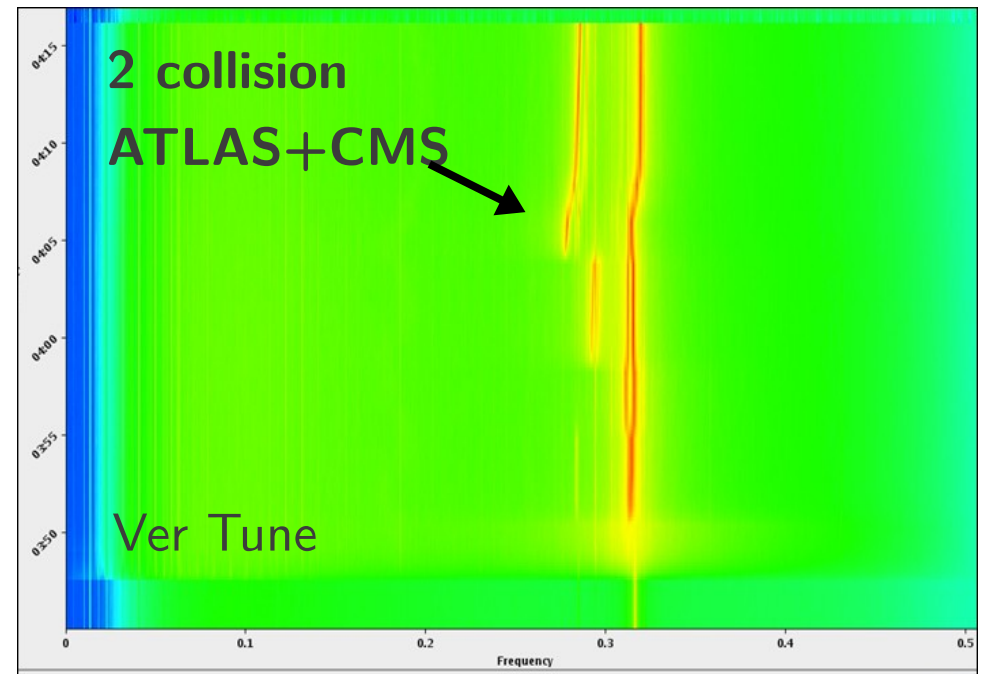
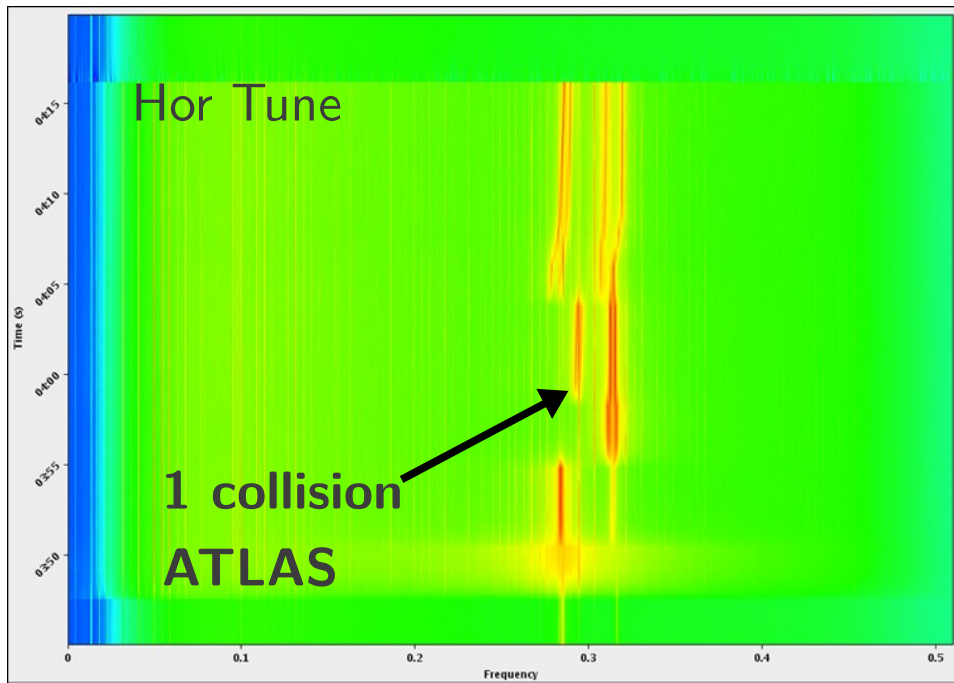
36b x 11 trains



Bunch Number along 1st train

Beam-Beam Exp, BBQ

BBQ Signals



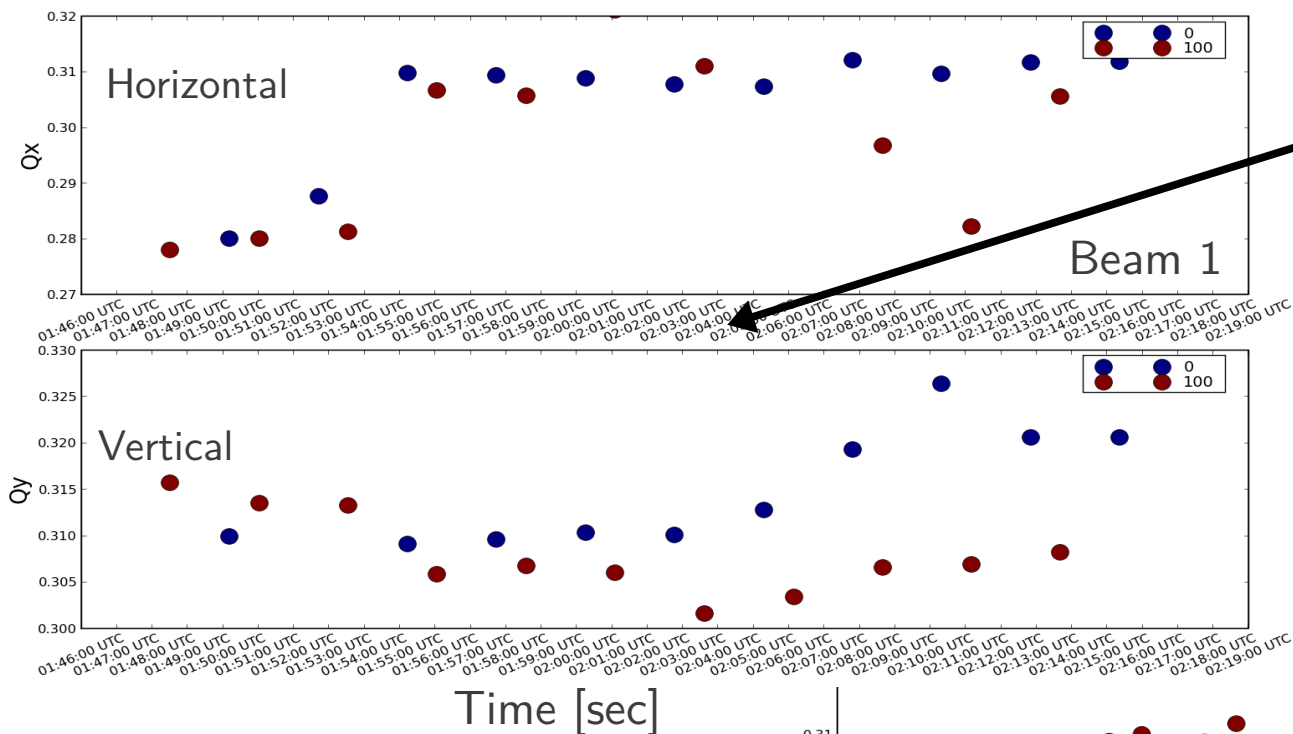
Bunch intensities: $\sim 1.9 \times 10^{11}$

Emittances (x,y): $\sim 1.3 \mu\text{m}$

Beam-beam tune shift $> 0.015/\text{IP}$

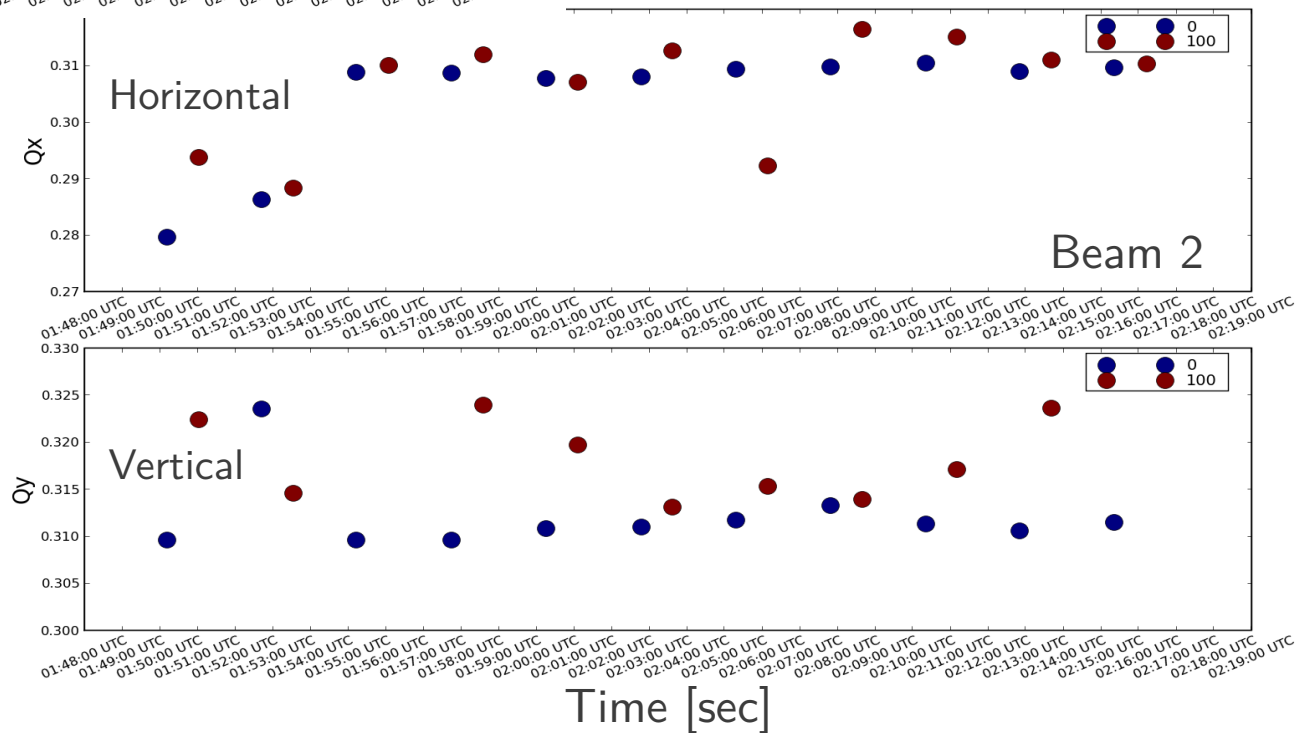
Schottky signal noisy

Beam-Beam Exp, Schottky



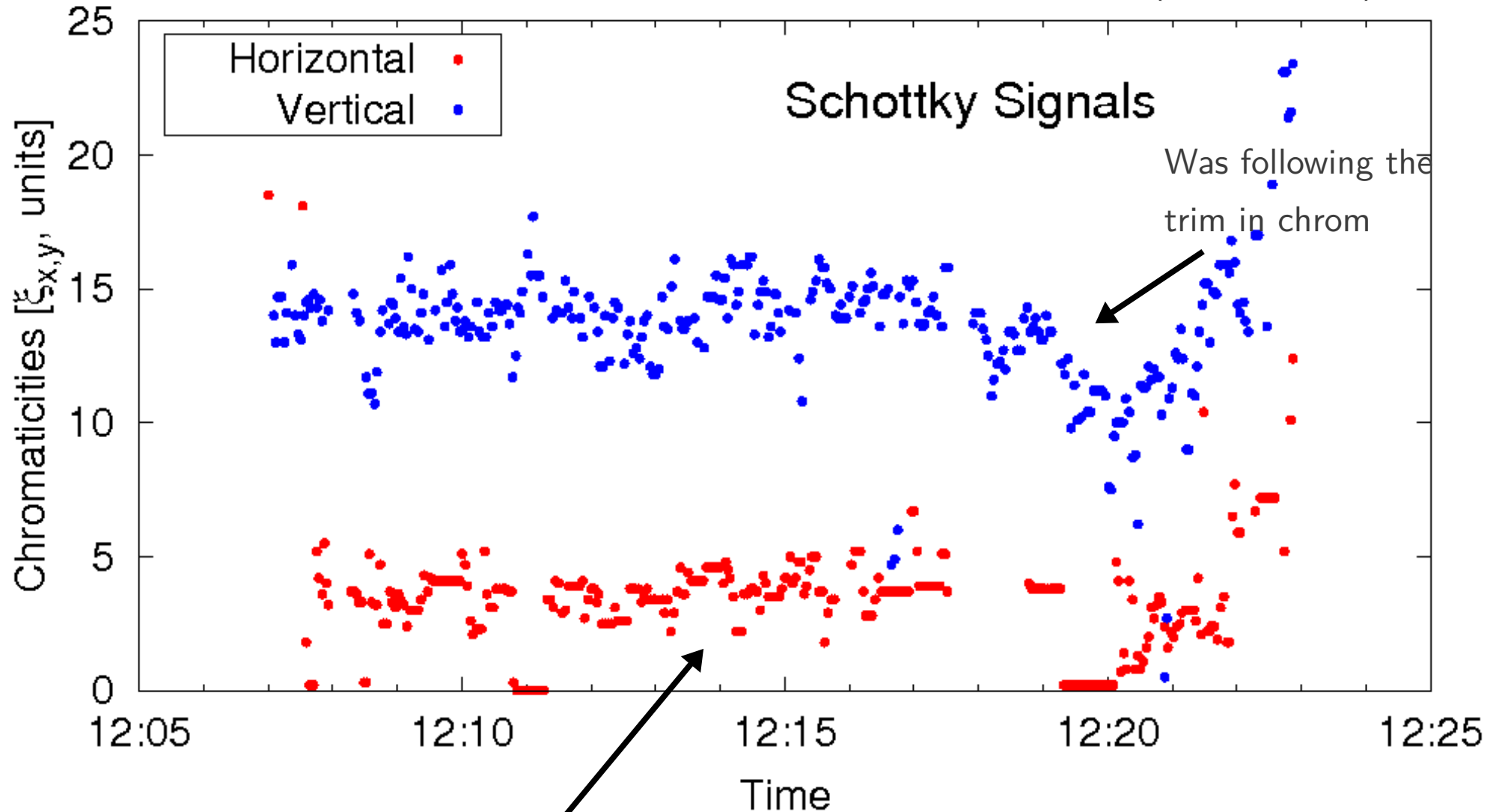
2 collisions
ATLAS+CMS

1 collision
ATLAS



Chromaticity, Pilot bunch

Injection setup for β -beat experiments (Apr 6, 2011)



Good chrom measurement for 20 min

Confirmed by classical radial modulation (horizontal, Beam 2)

Discussion, from user point of view

Schottky, **powerful & non-invasive** tool

- **System:** Decent signals (...sometimes, more reliability)
 - Excellent quality for ions (for protons → RF noise & coherent oscillations)
 - Never all signals (B1/B2, H/V, Intensities diff), needs manual input
- **Application:** Significant improvements/tools in 2011
 - Continuous monitoring of bunches & trains (Q, Q'...)

2010-11 Status

- But, still in debugging mode....

Future (?)

- Reliable signals (injection/top energy) → OP fixed display
- Less user tweaking → leading to operational tool (like BBQ)