

Lumi leveling with crossing angle

C. Liu, A. Marusic, Y. Luo, V. Ranjbar, G. Robert-Demolaize, M. Minty and operations

Apr. 15, 2016

APEX meeting

Motivation

- Lumi leveling for STAR 250 GeV pp program in 2017.
- Due to polarization profile, the offset leveling was ruled out.
- One other candidate is beta squeeze.

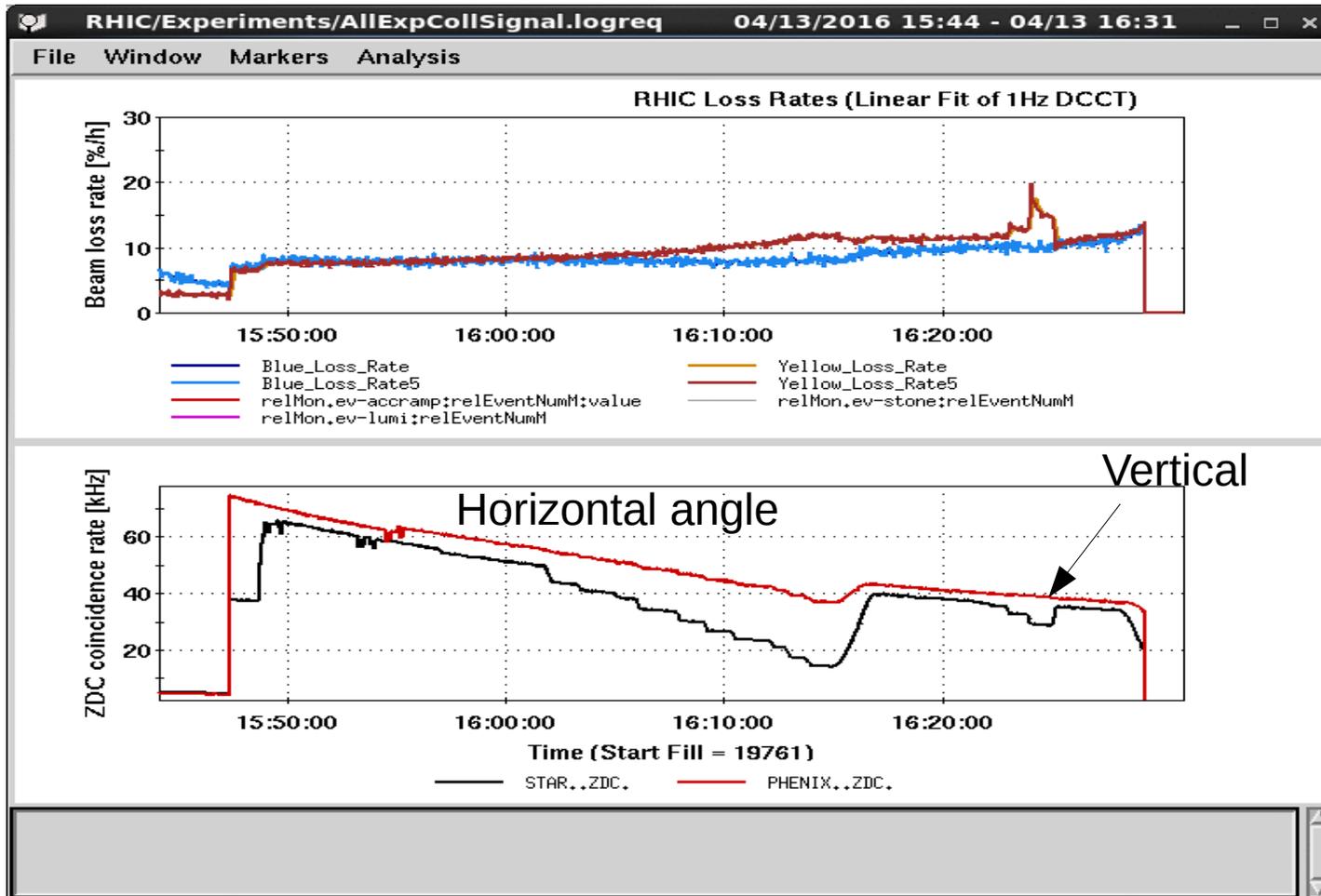
Goal

- Compare experimental data with theoretical calculation.
- Figure out finest controlling precision of the angle and corresponding lumi change.
- Observe possible beam-beam driven beta-synchrotron coupling.

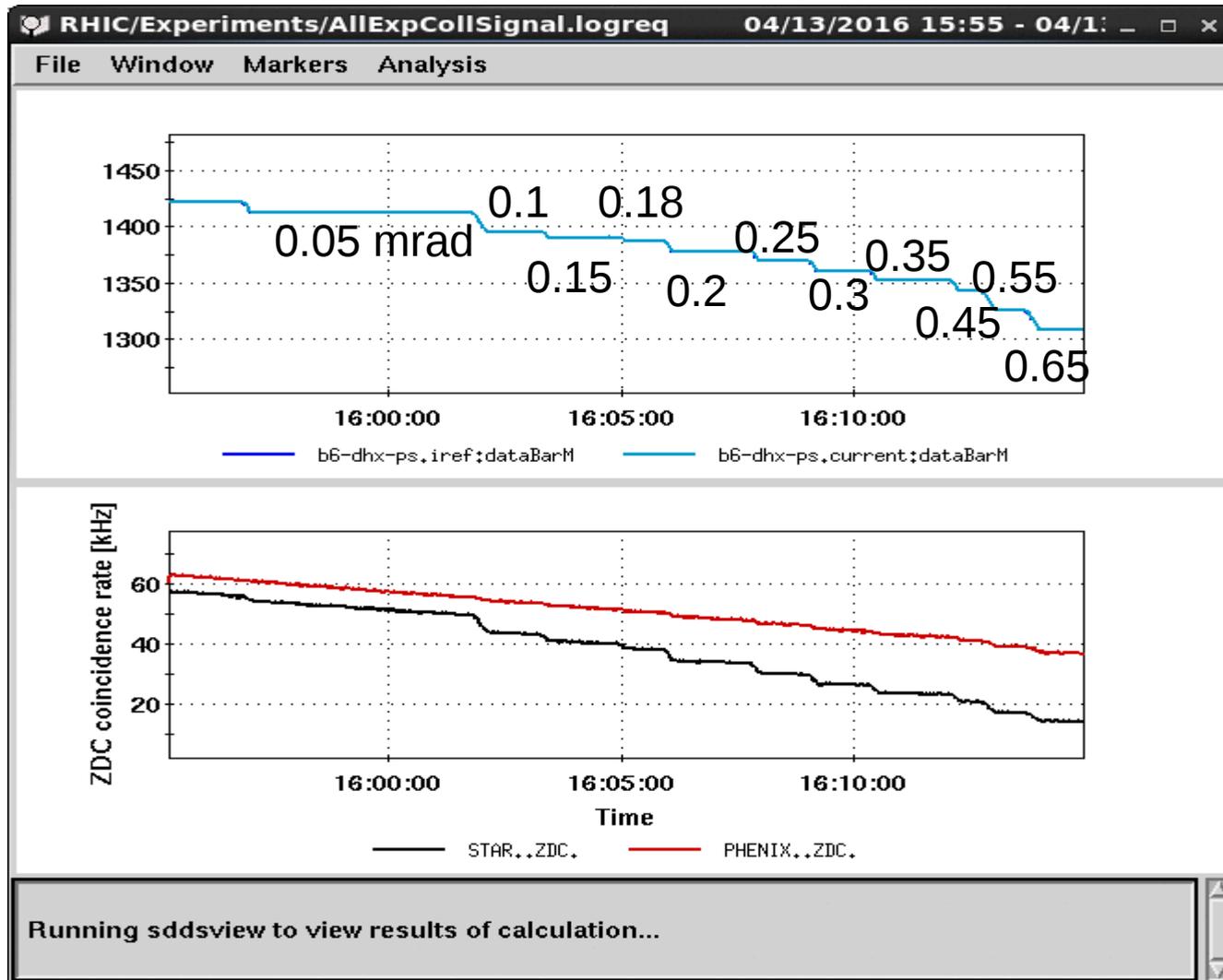
Experimental conditions

- 56*56 bunches, 2E9 ppb.
- Turn off re-bucketing, SC cooling, periodical orbit feedback and leveling with offset.
- Dial in horizontal crossing angle by DX D0 magnets.
- Dial in vertical crossing angle by dipole corrector magnets.

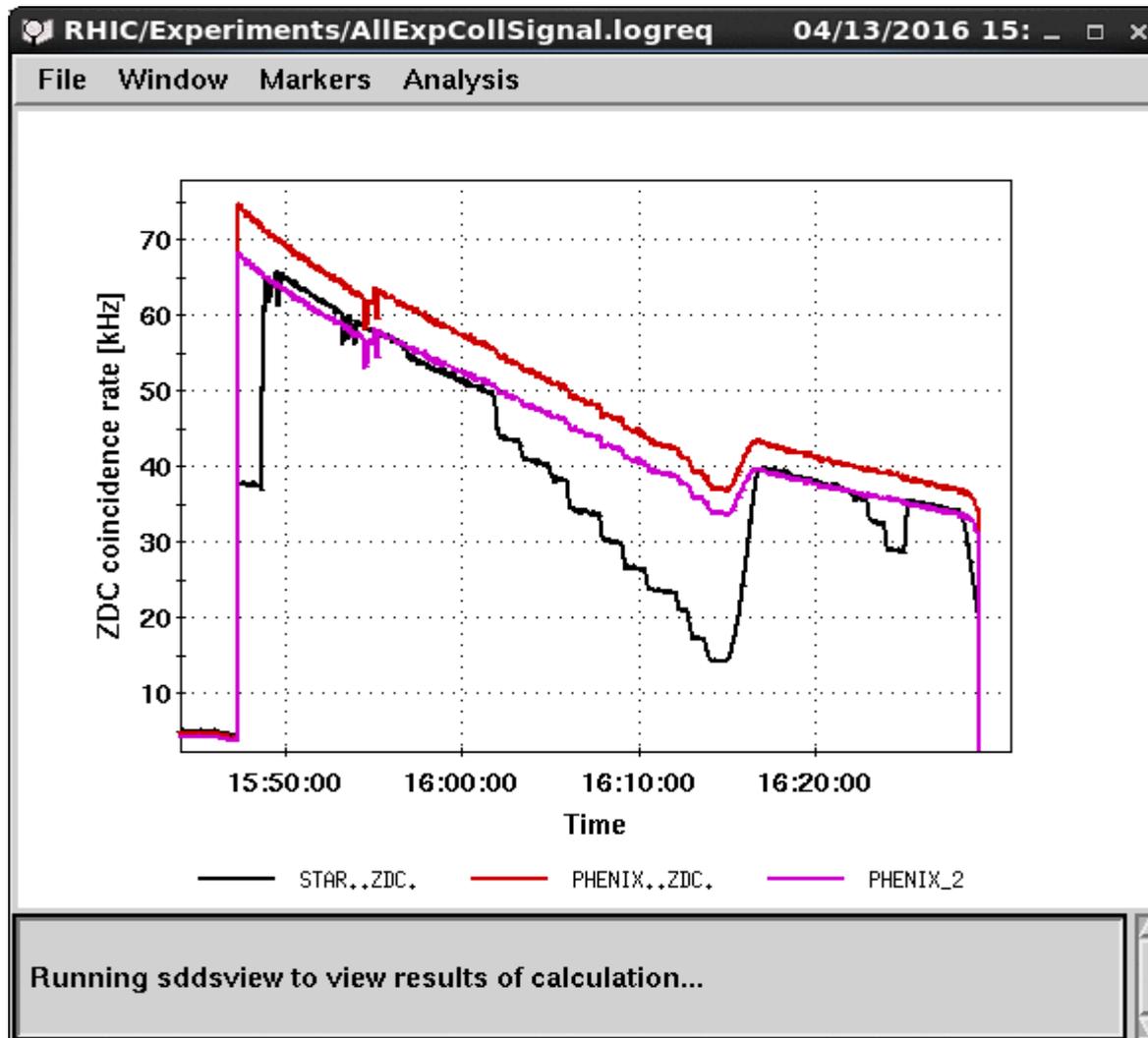
Rate and beam loss



Rates, dx current, crossing angle

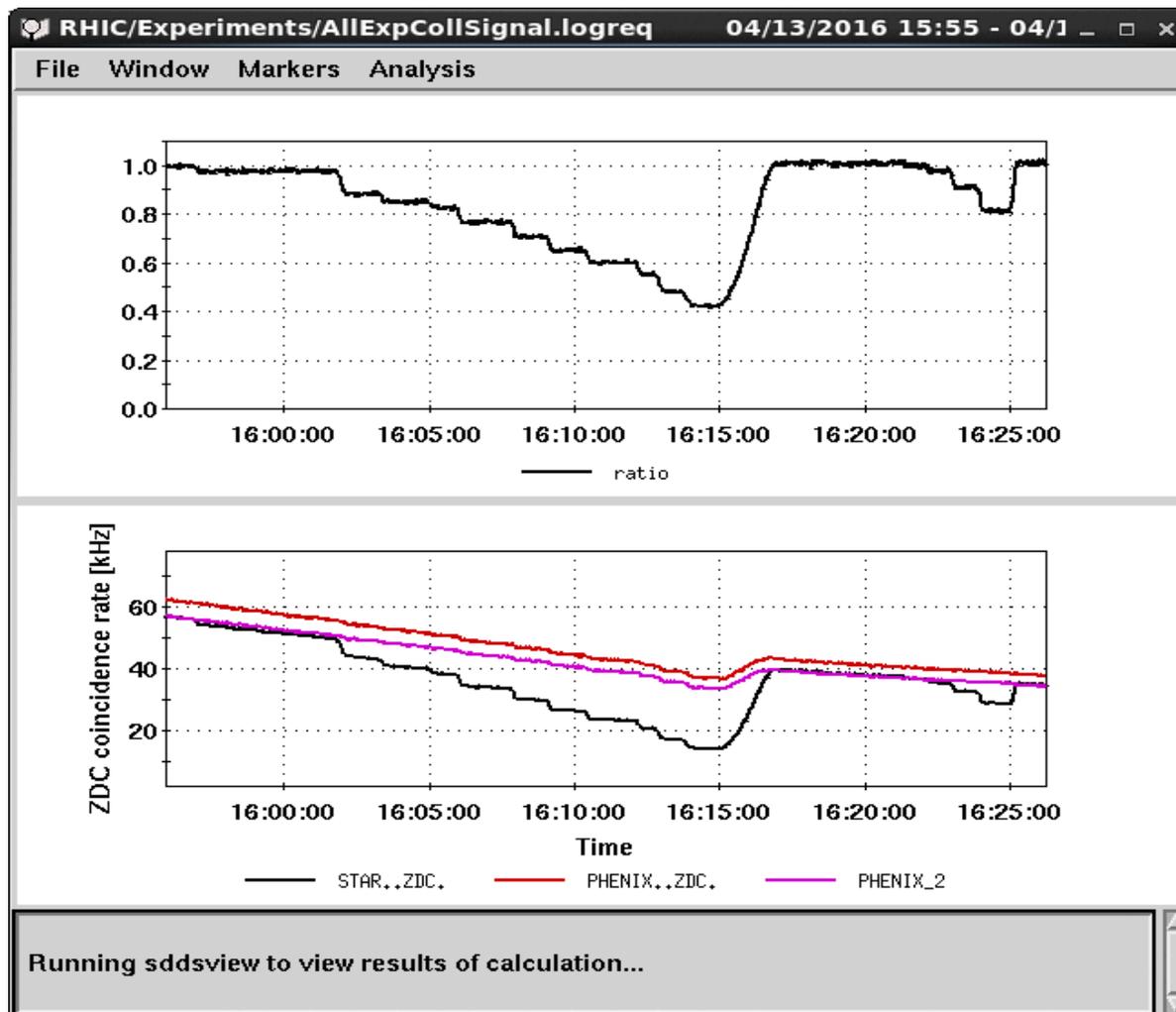


PHENIX as baseline



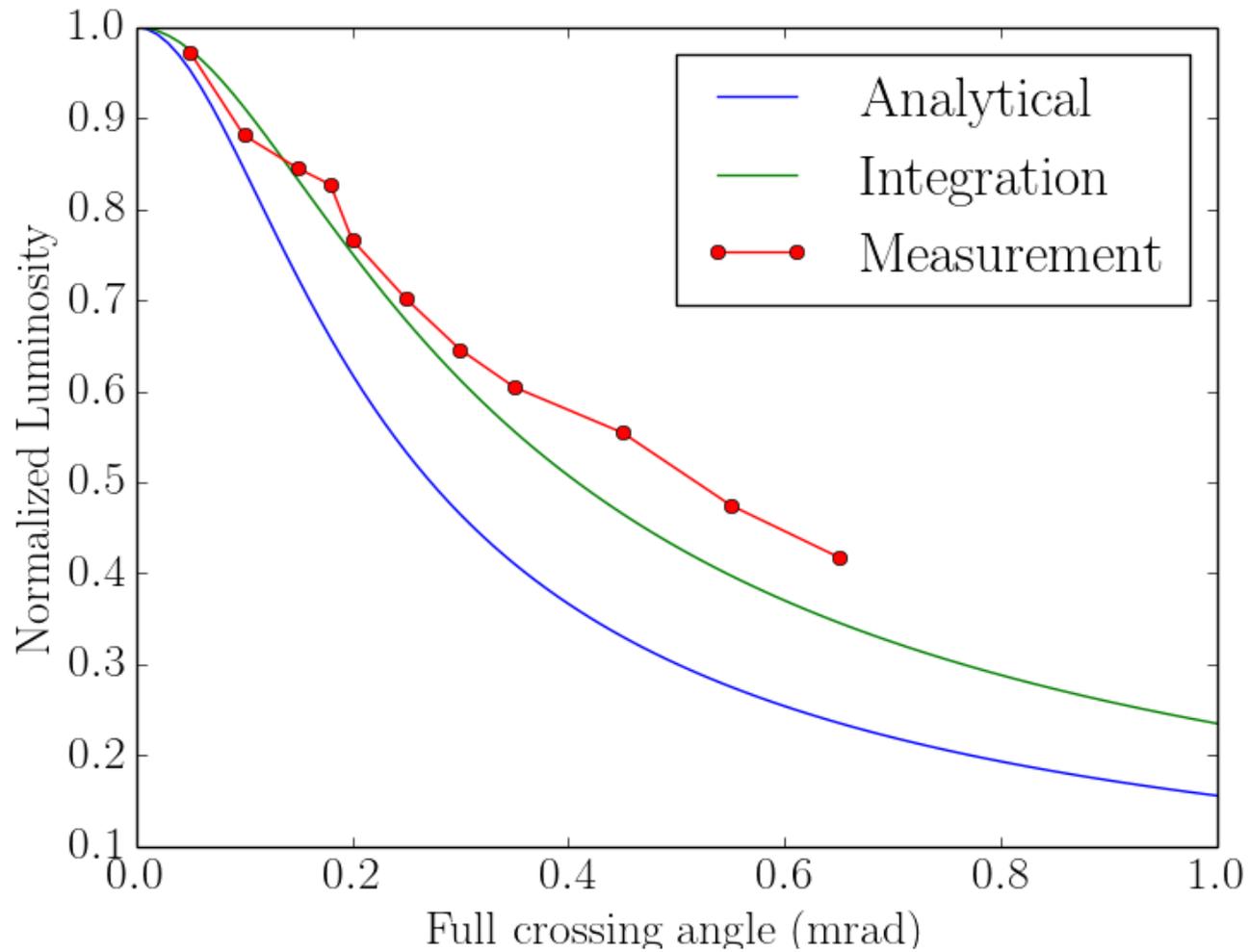
PHENIX ZDC scaled by 0.914.

Reduction ratio



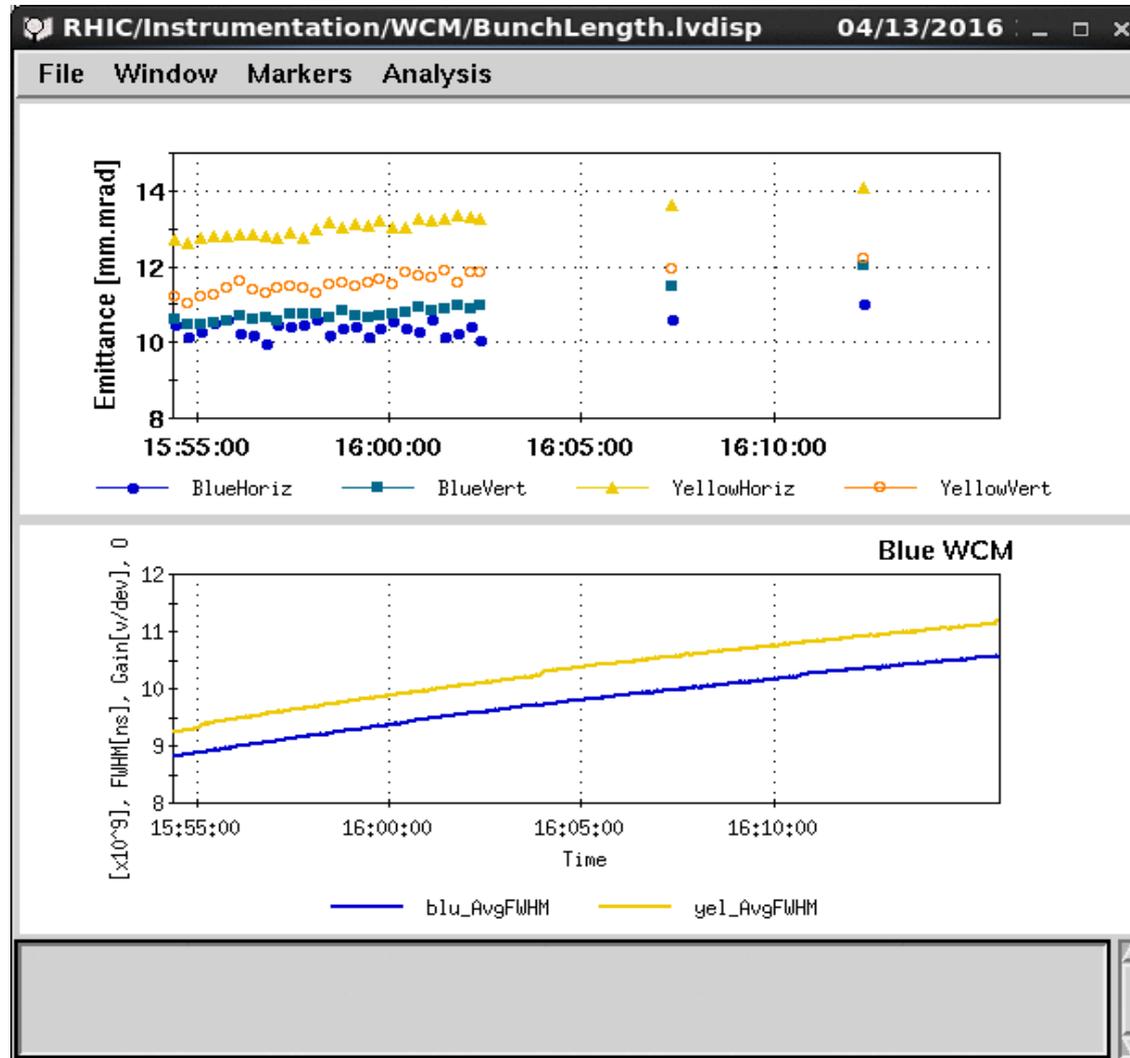
$$\text{Ratio} = \text{STAR..ZDC.} / \text{PHENIX_2}$$

Comparison



ZDC rate is not proportional to Lumi (Wolfram), further analysis is required.

Diffusions



Emittance and bunch length change over time have effects on the Lumi dependency on crossing angle.

Summary

- Horizontal crossing angle by D0 DX magnets is promising, it can go to 3 mrad in full angle limited by DX aperture.
- Vertical crossing angle by dipole corrector caused beam loss at triplet with 0.2 mrad for Yellow beam.
- Reasonable agreement between experiment data and calculations, to be compared by anybody interested.
- A step size of 0.01 mrad for implementation.