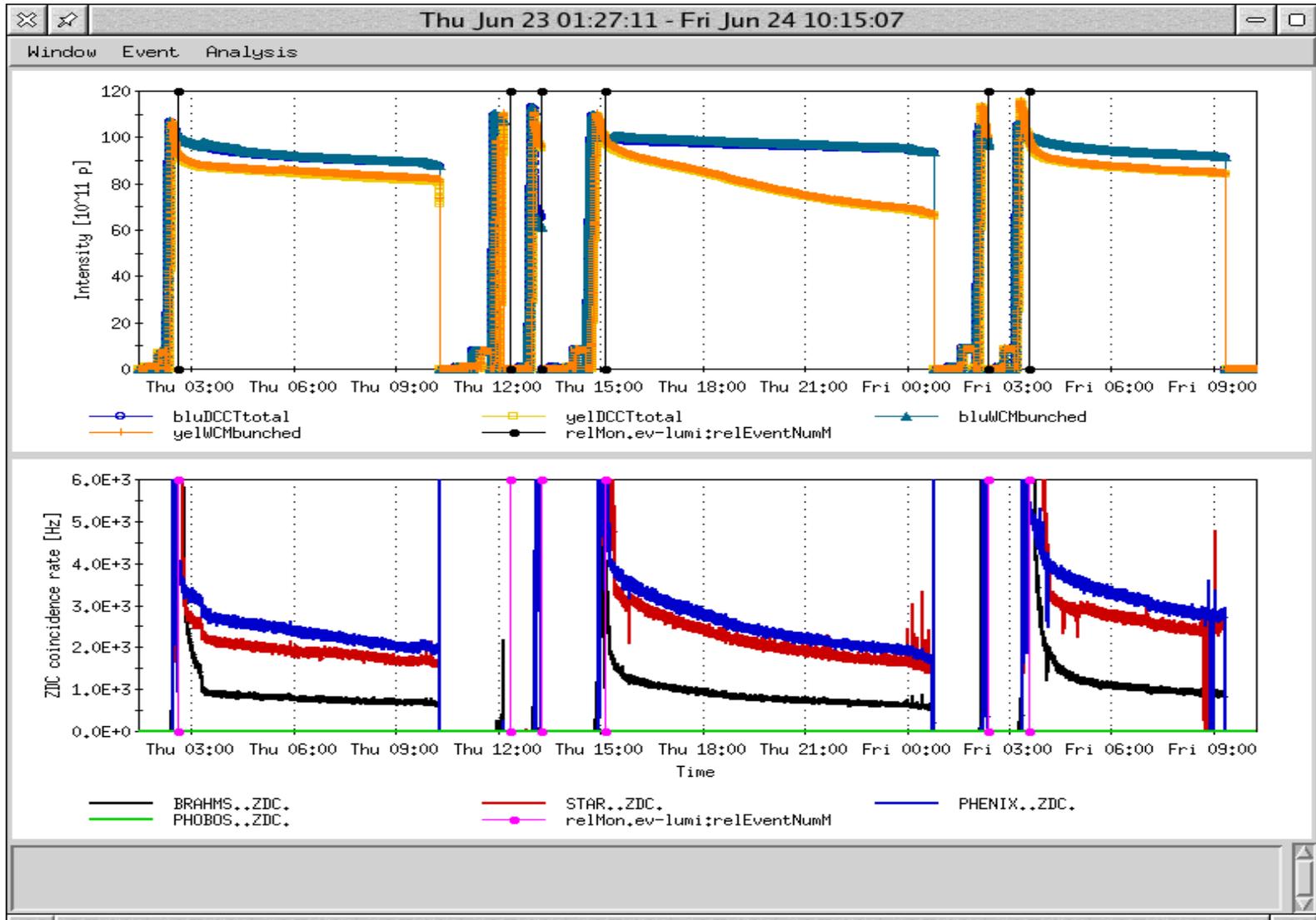


Luminosity Monitoring: RHIC ZDCs CDF & D0 LHC

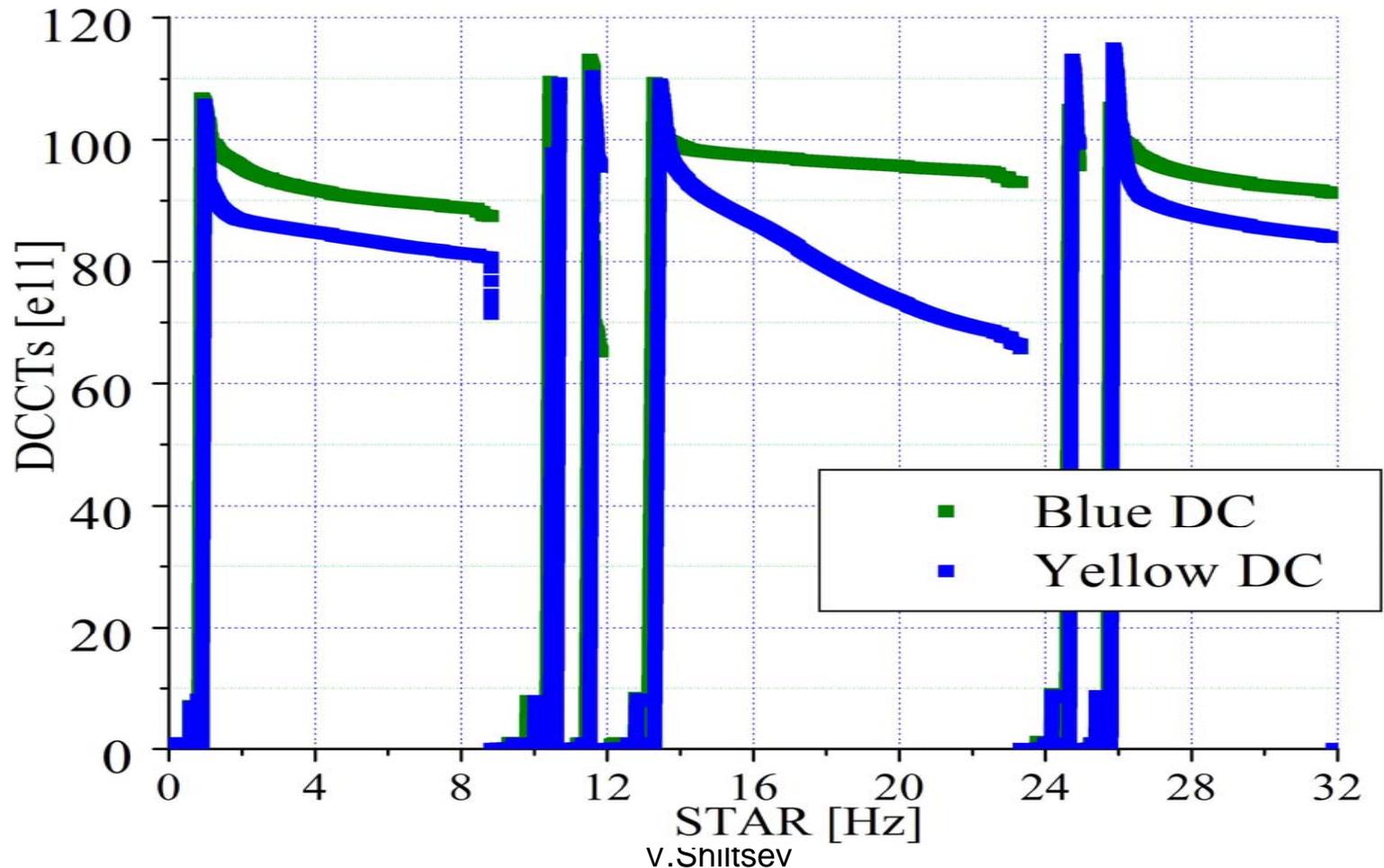
Nov 10 2005

V.Shiltsev

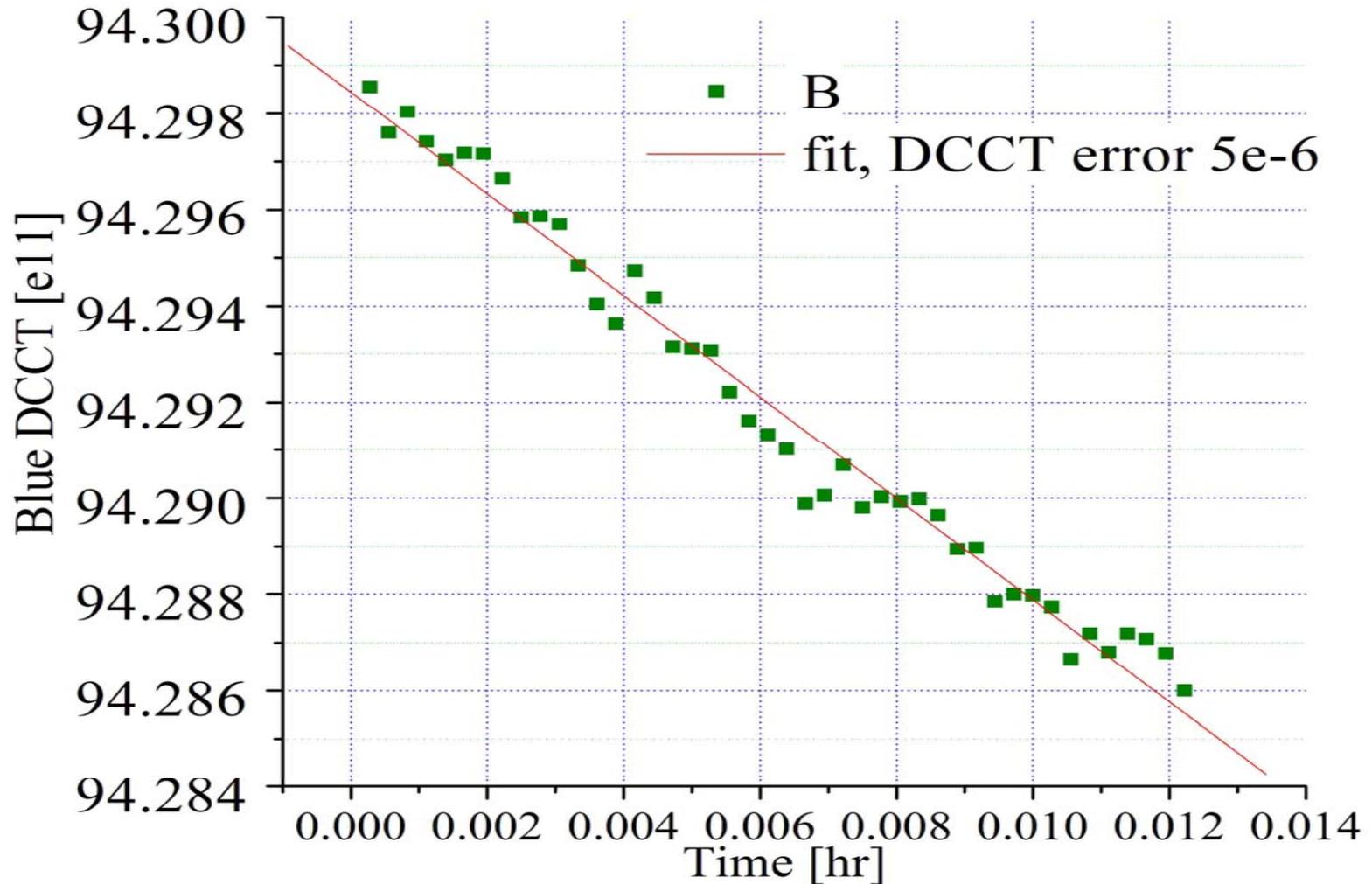
One Day in RHIC's life: 06/23/05



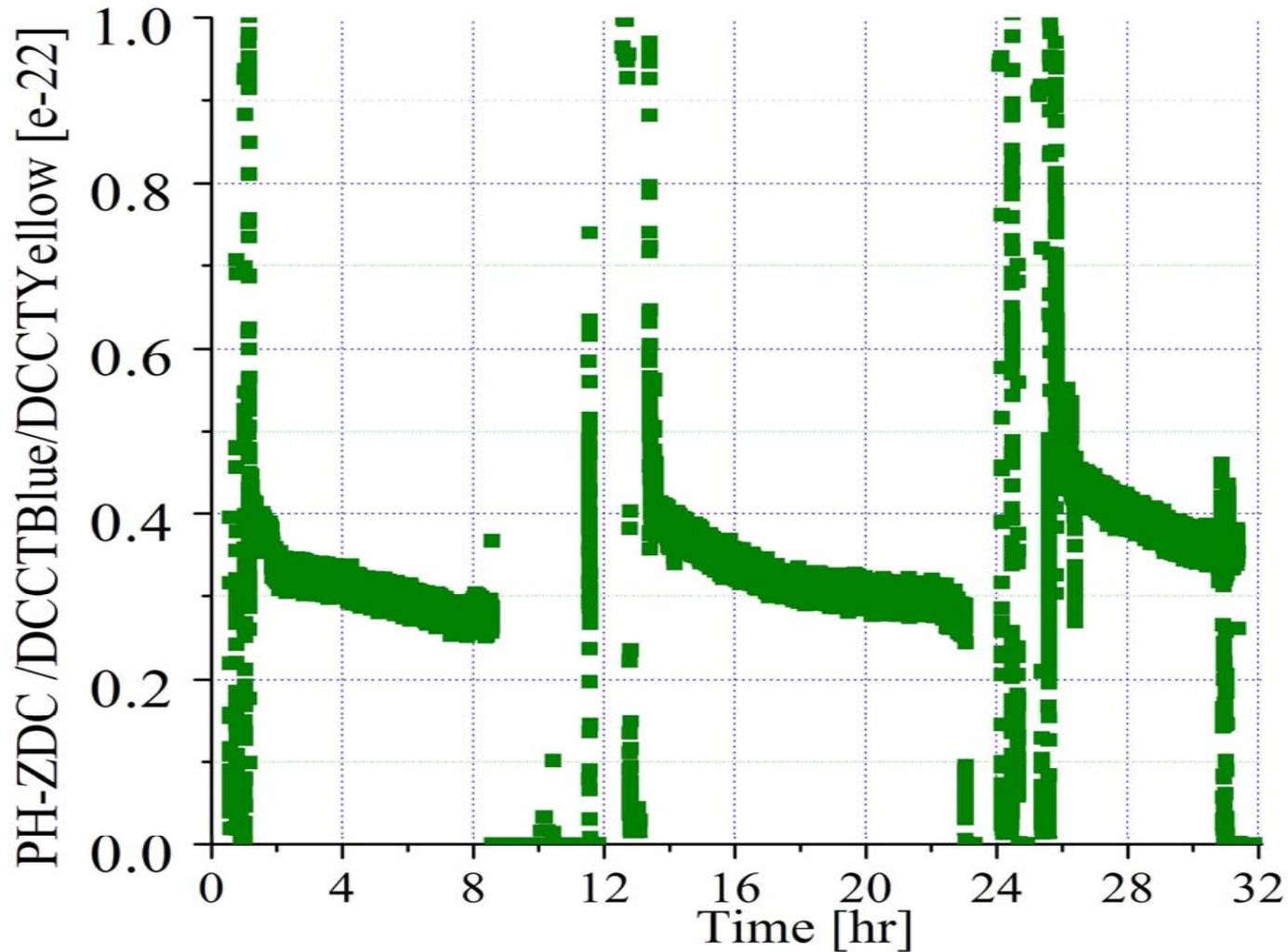
RHIC DCCT Signal



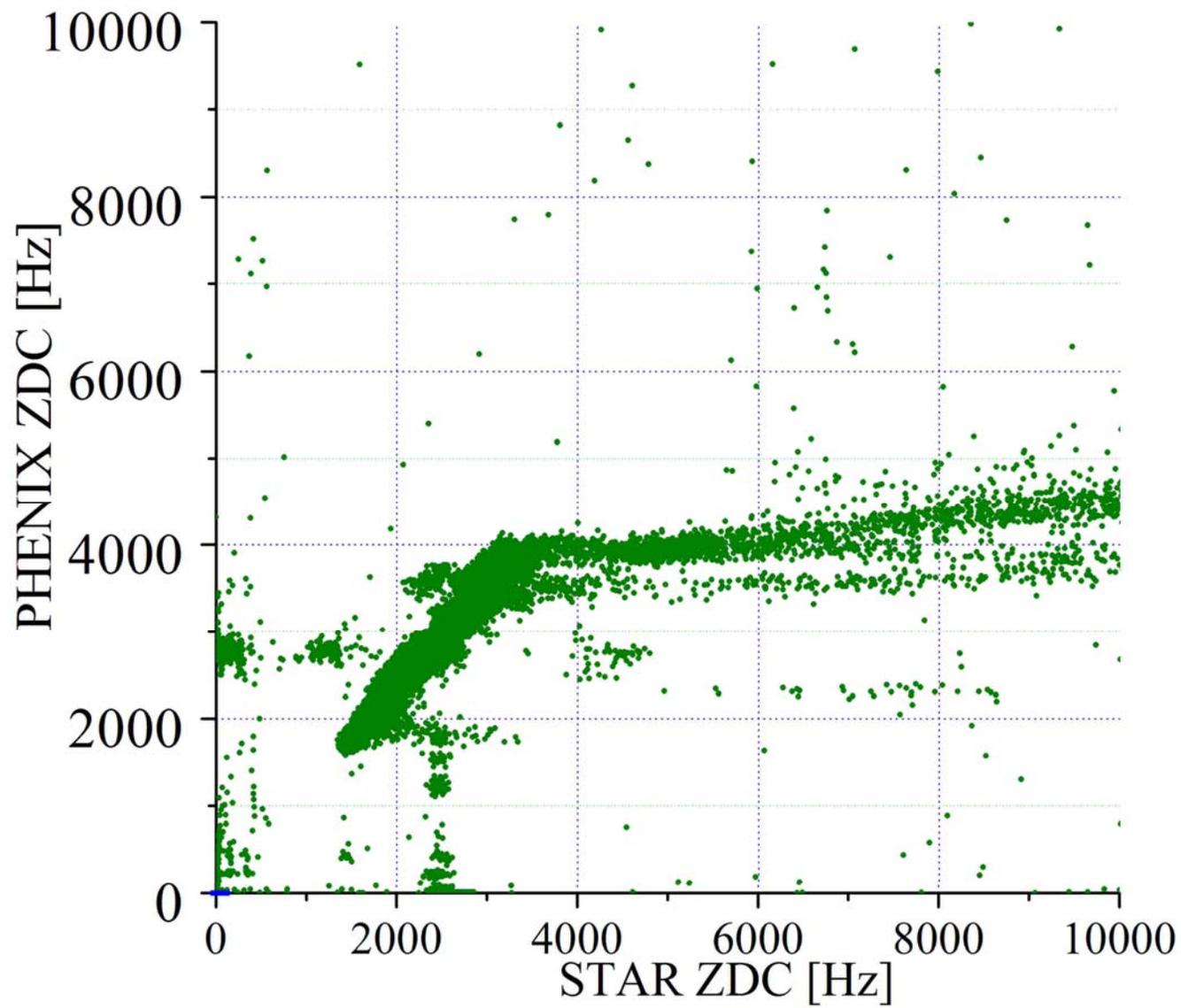
RHIC DCCT accurate to $5e-6$



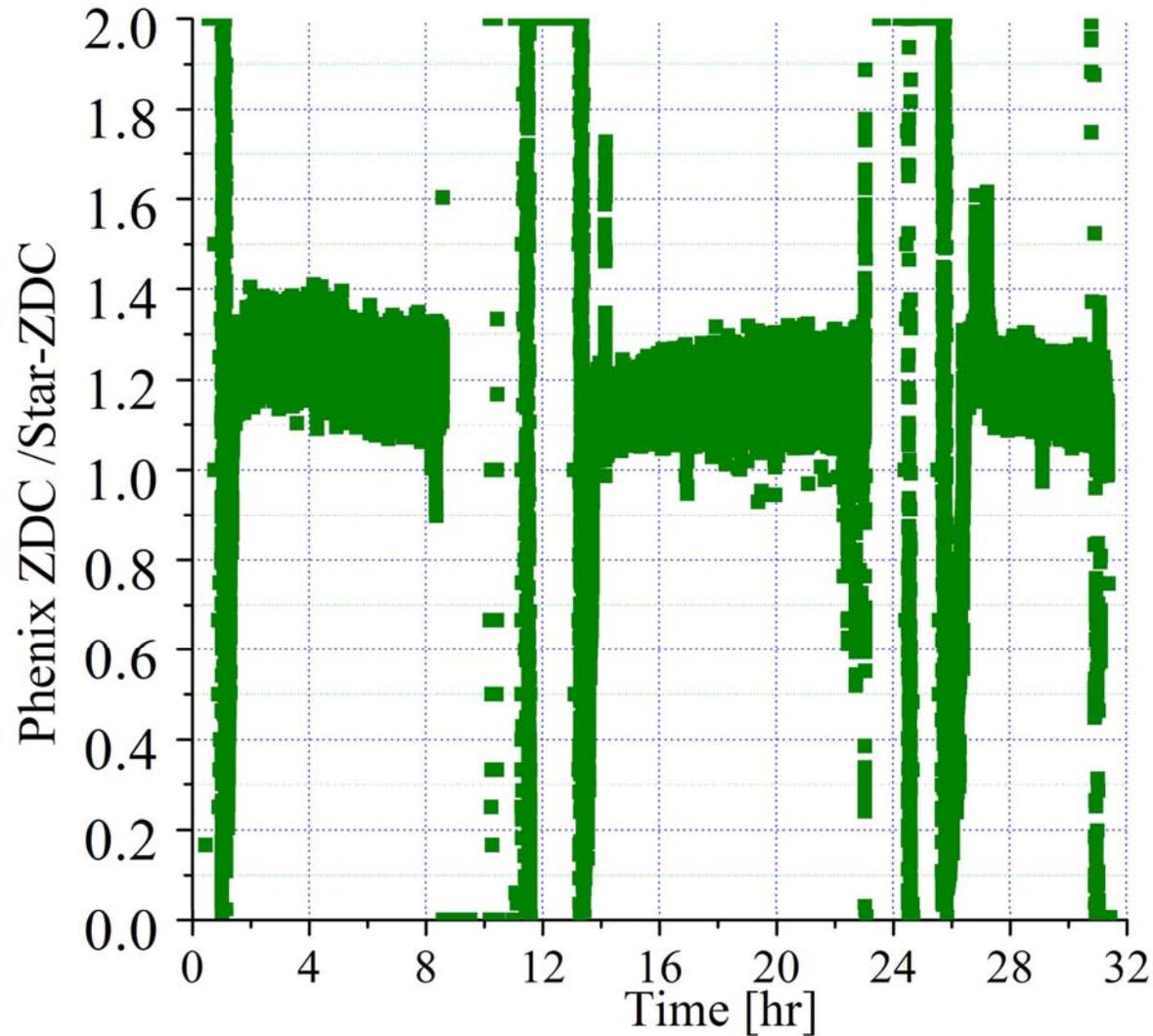
Lumi/N_1/N_2 ~ 1/emittance



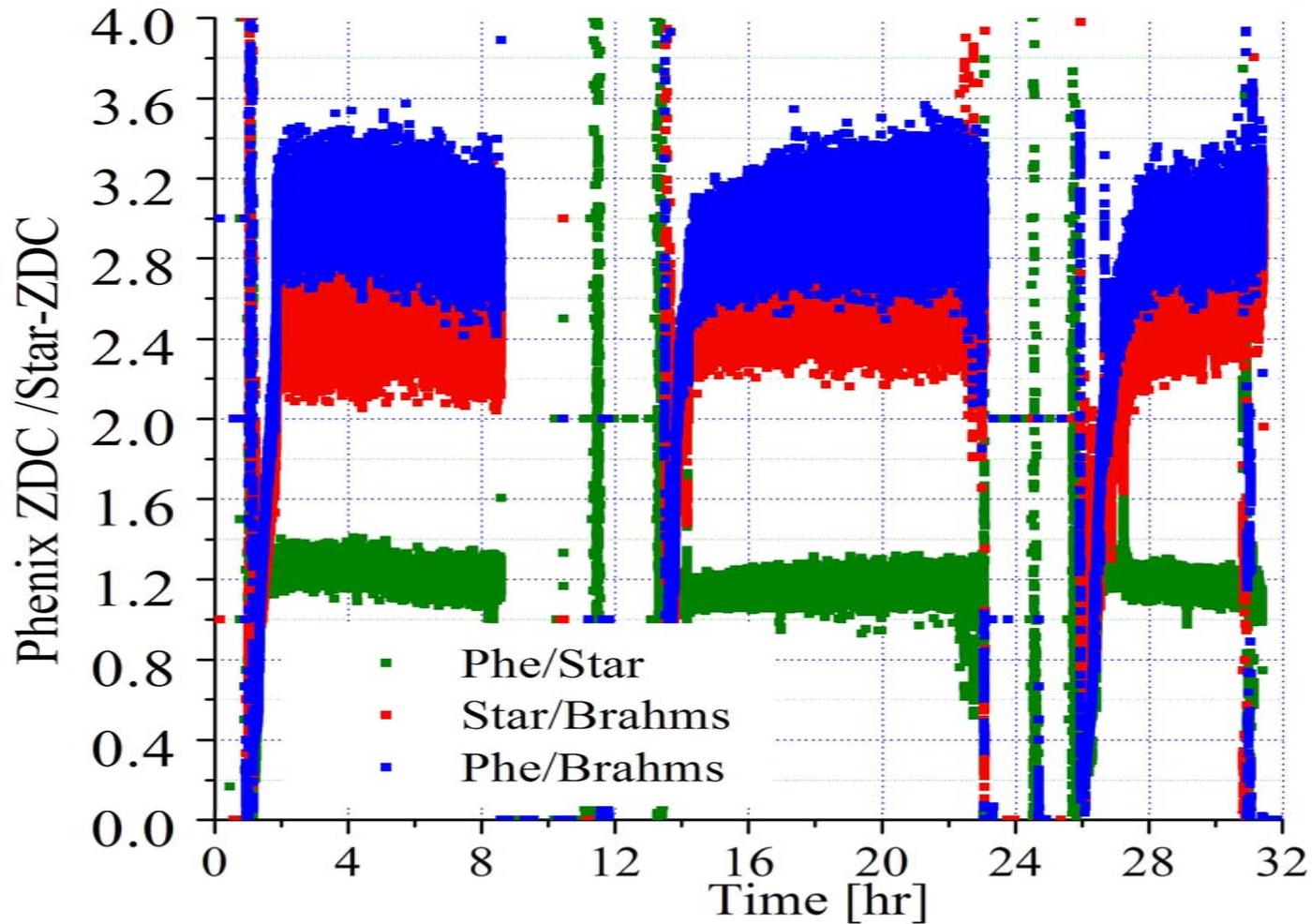
Phenix vs STAR



Phoenix over Star

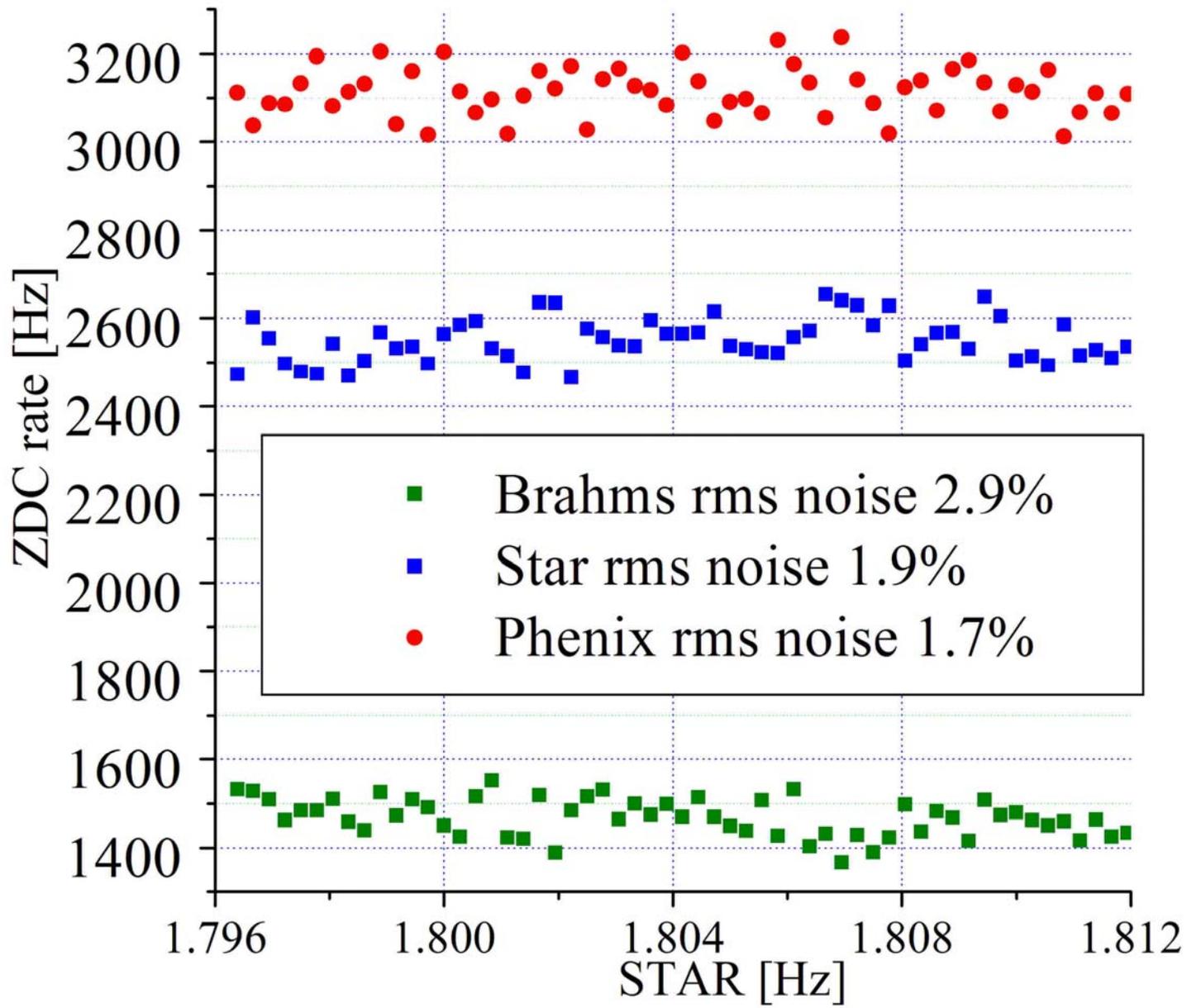


Detectors vs each other

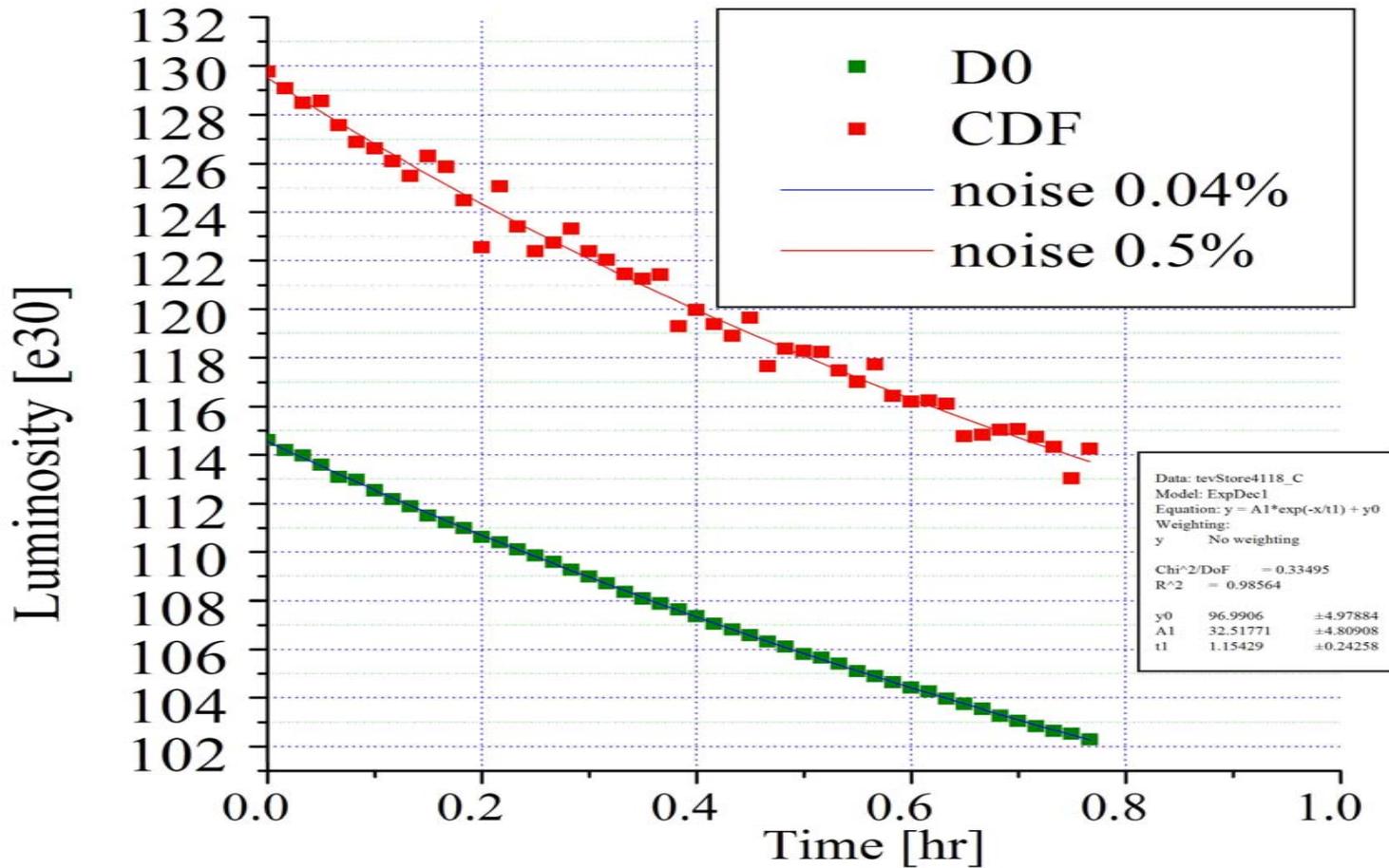


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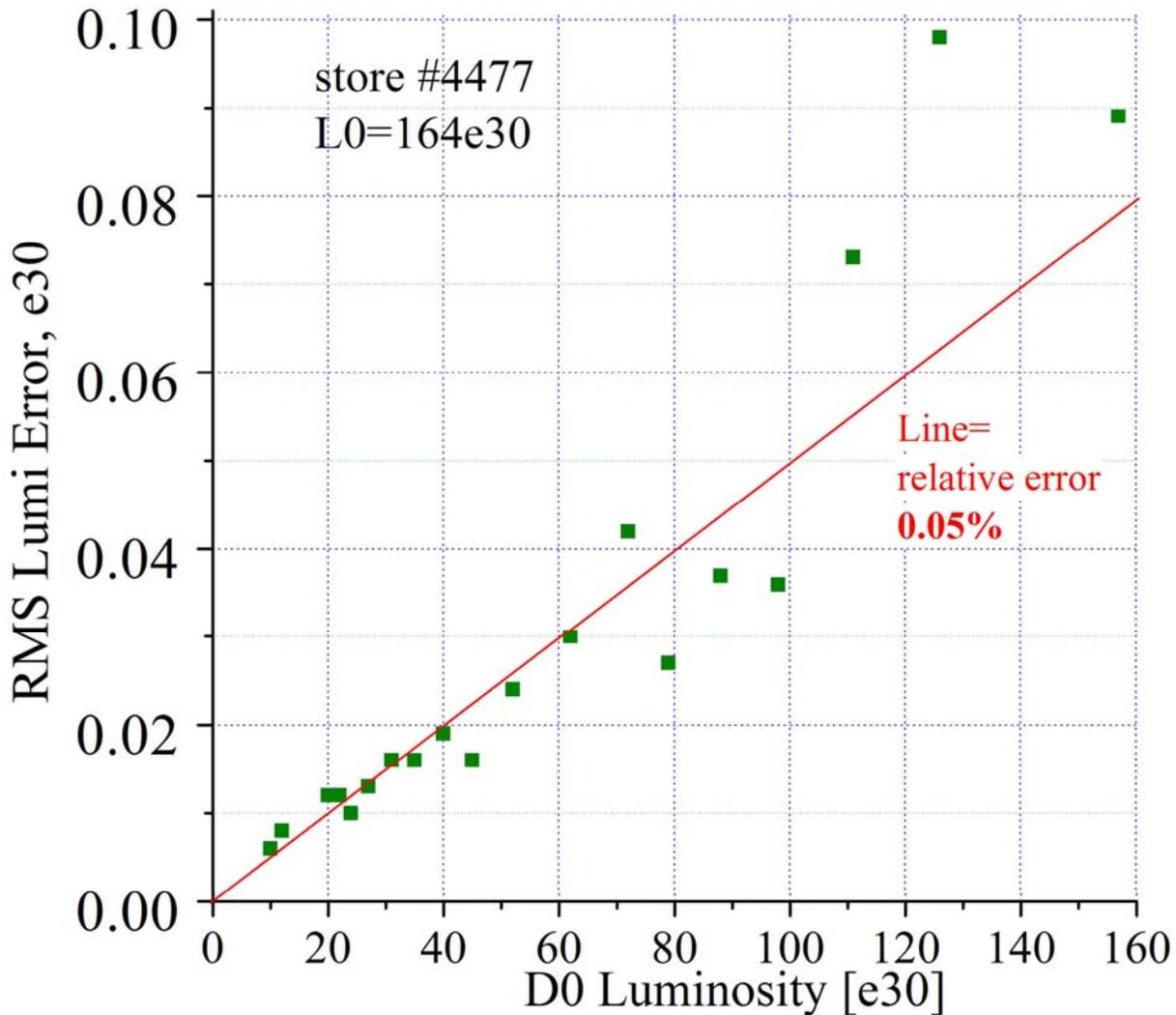
ZDC noise



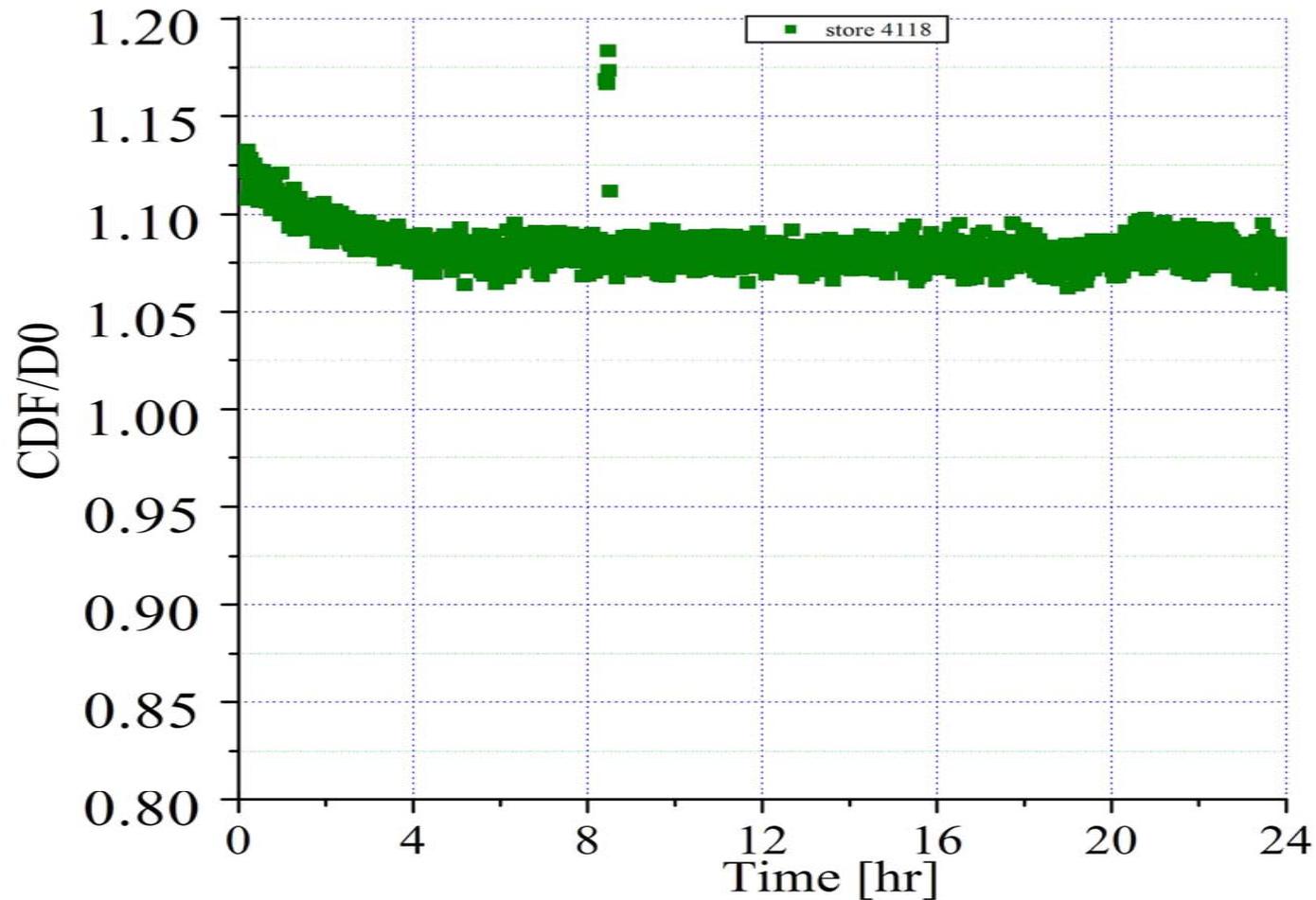
For comparison: CDF & D0



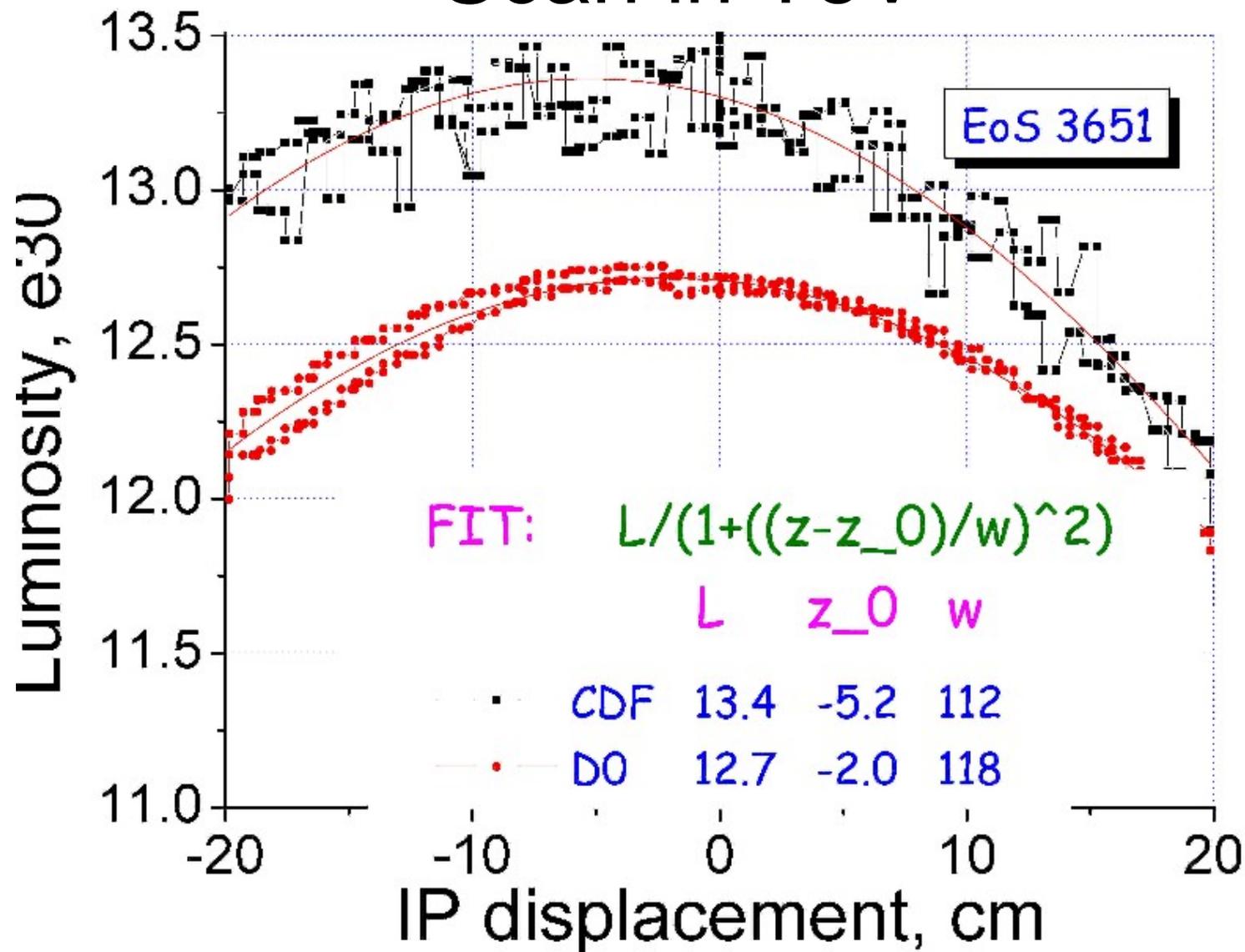
D0 Lumi Monitor Error vs L



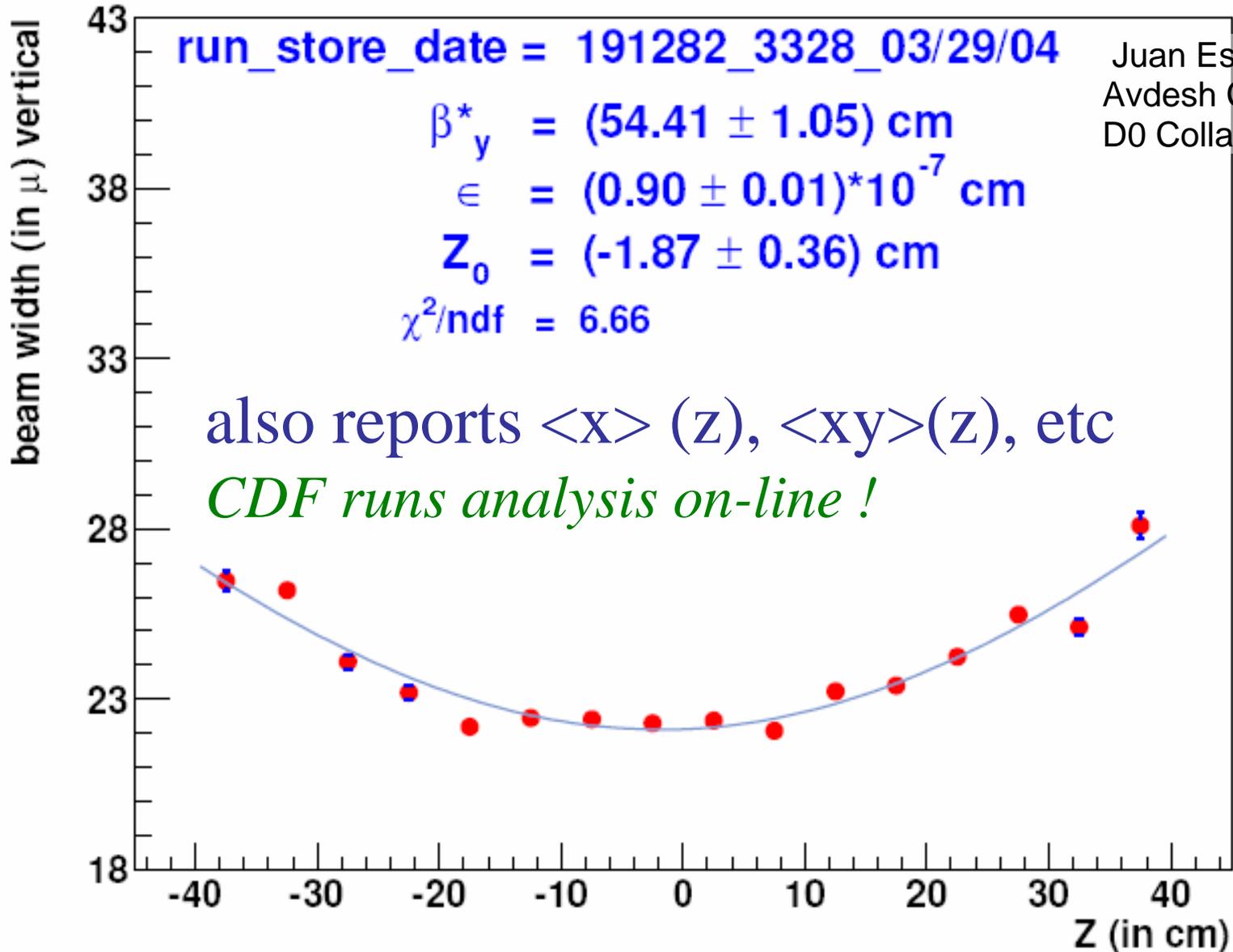
Ratio of two DIFFERENT LumiMon



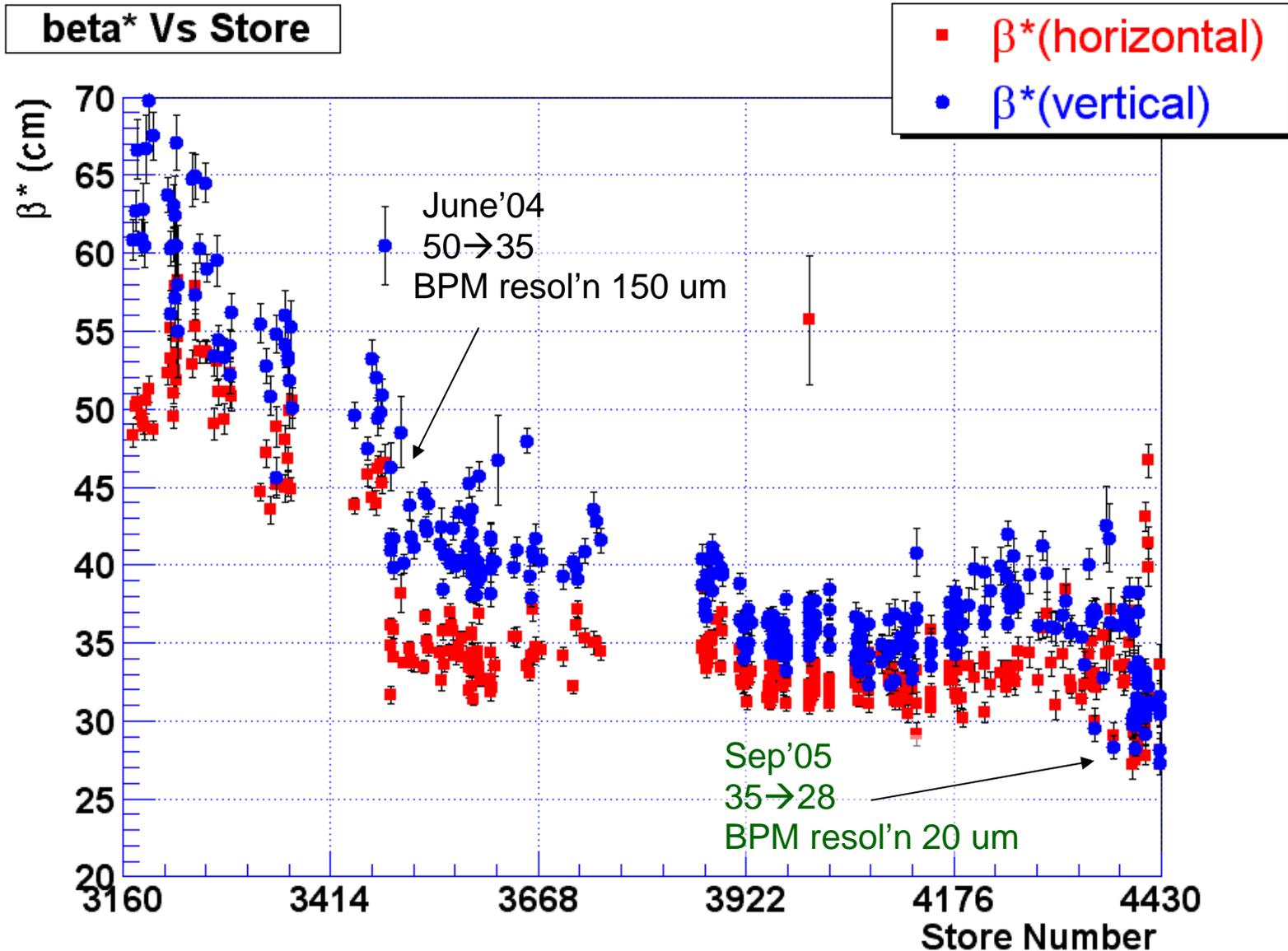
Example: 40 Min End of Store Scan in TeV



β^* from Luminous Region Analysis – Really Helpful



D0 Vertex Distribution Analysis



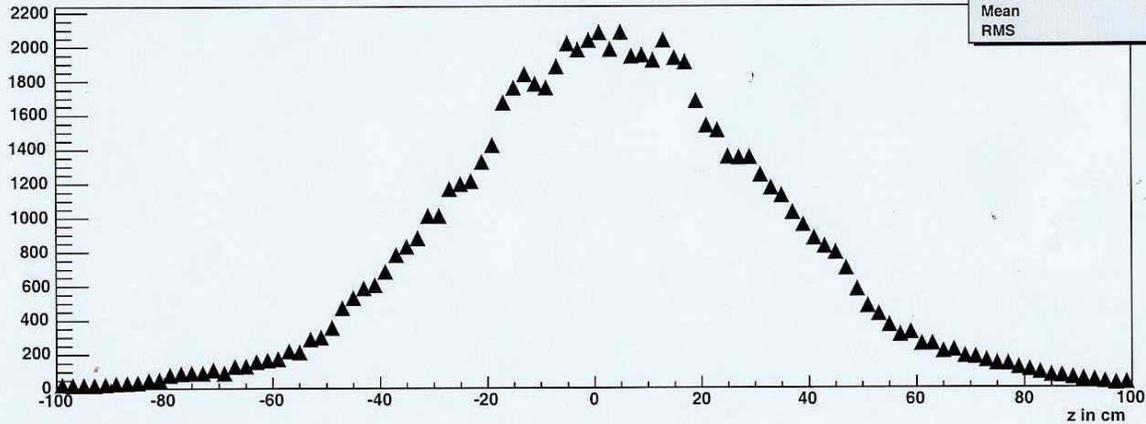
Another Example → in 3cm variation of IP z-position due to beam loading

BeamMon #1 CotPrimaryVertexMonitor vertices

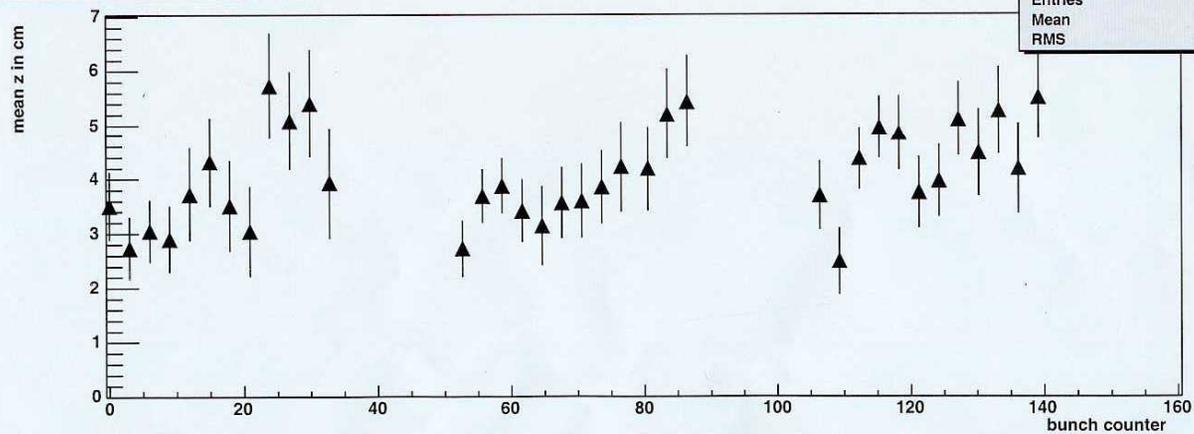
Run:167551 Event: 10508728 # of Events:79497 Time: Fri Aug 15 22:17:17 2003

Store #2953

vxprim vertices Run:164961



vxprim vertices Run:164961



5-20 μrad crossing angle

V.Shiltsev

Questions/Comments

- ❖ Effective cross section is 0.4% of inel in RHIC and ~9% in LHC. That gives counting rates of 4kHz at $L=1e31$ in RHIC and 90kHz in LHC at the same L
- ❖ Observed sec-to-sec lumi reading fluctuations are ~1.5-2% rms in RHIC at $L=1e31$
- ❖ I doubt that ZDC can be useful for tuning at $L=1e28-1e31$ in LHC
- ❖ It's hard to believe from the data I have that ZDC are background-free, instead, detector-to-detector ratios and drifts in calc'd effective emittance values are of concern
- ❖ Background rates are supposed to be higher at $L>1e33$, so it's not clear whether ZDC is right lumi-monitor $>1e33$ either
- ❖ For comparison, D0 and CDF rms fluct are ~0.05% and 0.5% correspondingly and that's just barely enough to do precise tuning over $\ll 1$ hr time range
- ❖ No money (see next slide); I see no accelerator physicist involved in the project and do not understand how it will push Accel Physics state-of-art in the US
- ❖ Longitudinal z-distributions would be of interest on bunch-by-bunch basis and for studies but no particular interest for low luminosity tuning

From Recent DoE Review (Nov'05)



LARP

Beam Instrumentation (Lumpkin & Zisman)

Choice of devices is appropriate; items will be of significant benefit to desired rapid commissioning of LHC.

Beam-based test programs provide validation of detector packages. Tevatron experiences indicate critical needs.

Ionization gas luminosity monitor to be checked at RHIC; 40MHz test done at ALS so criterion met.

PLL tune feedback monitor to be tested at RHIC and FNAL.

Schottky detectors for bunch-by-bunch beam sizes and tunes have been tested at FNAL and may be tested at RHIC.

Budget and schedule for three approved instrumentation tasks are reasonable, but there is no budget for other possible LHC needs (e.g., Zero degree calorimeter, Head-tail Monitor, and AC dipole).

From SY Zhang APEX'05

VIII. Post-Phobos Scenario

1. Brahms tolerance high

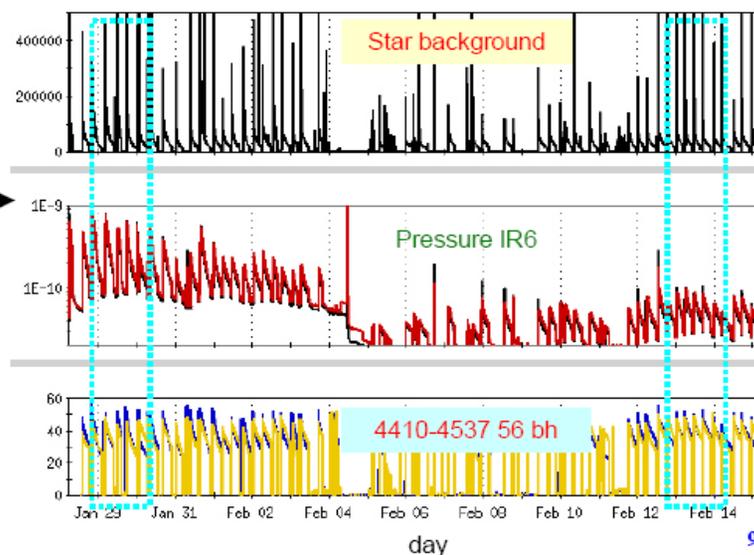
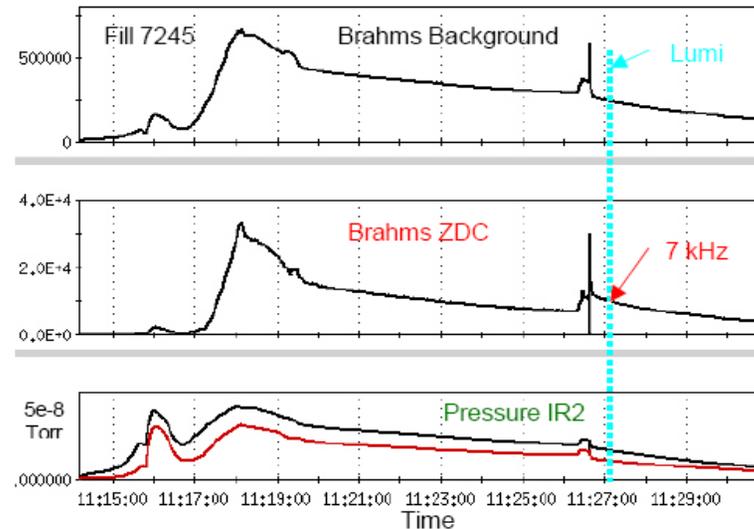
- Dependence of Brahms background on pressure rise.
- ZDC corrupted. At Lumi it is 7 kHz, should be ~ 1 kHz.
- Brahms tolerance is high, due to local shielding installed in 2003?

2. Star sensitive to static pressure?

- 4410- 4537 in 2004, all 56-bunch, and similar intensity, ~ 95 e9 Au.
- With static pressure at $8e-11$ Torr, the pressure rise is larger than that at $3e-11$ Torr static pressure. Why?
- This high pressure rise has caused background problems.

3. What will be a new limit?

- Phobos has limited luminosity in past runs, next limit?



D0 fake lumi vs halo rate

