

RHIC Polarization Variation with Time

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Motivation of the Bunch Polarization Study

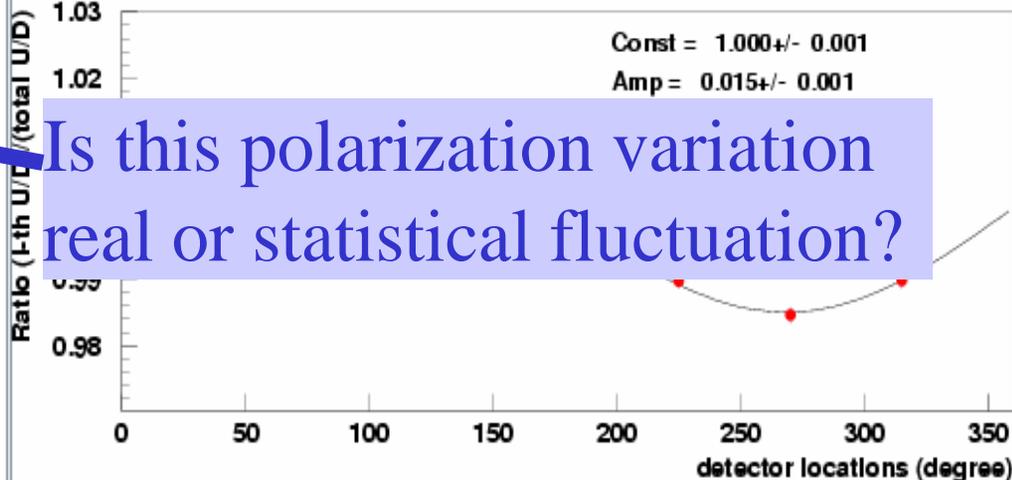
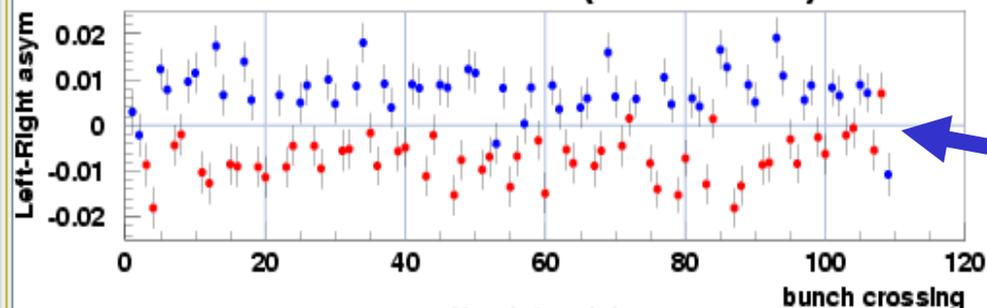
PolarControl Polarization Analysis Summary

YELLOW Polarization Summary

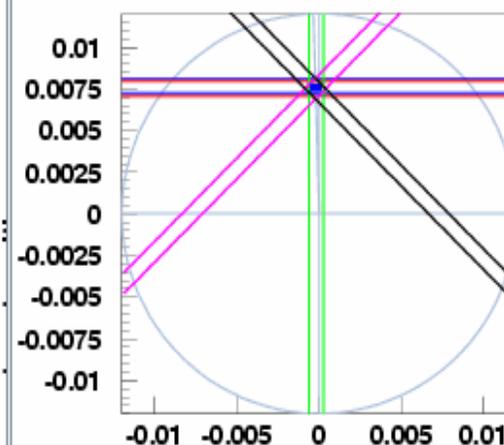
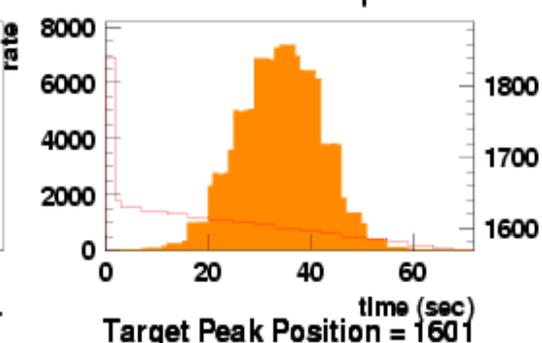
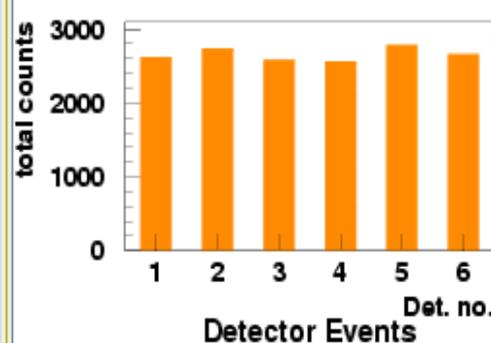
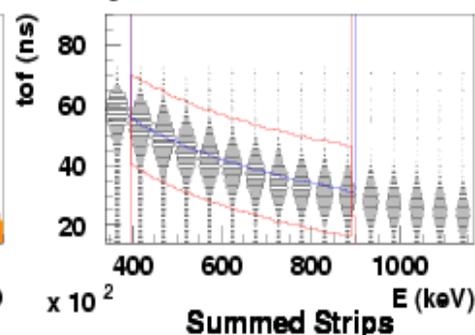
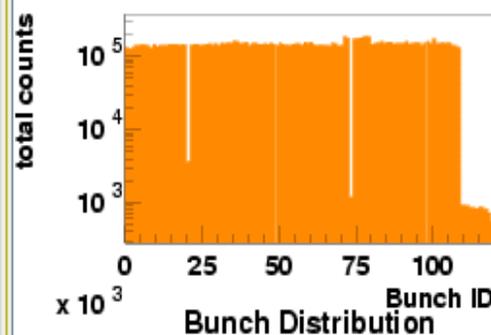
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RUN 7891.102 (YELLOW)

Run 7891.102 Pol=0.621+/-0.025



Is this polarization variation real or statistical fluctuation?



Polarization Vector

Ave. A_N = 0.01221

BLUE AREA

Xfit = 0.0076+/- 0.0003

Yfit = -0.0002+/- 0.0004

BLUE LINES

X90 = 0.0076+/- 0.0004

RED LINES

X45 = 0.0075+/- 0.0004

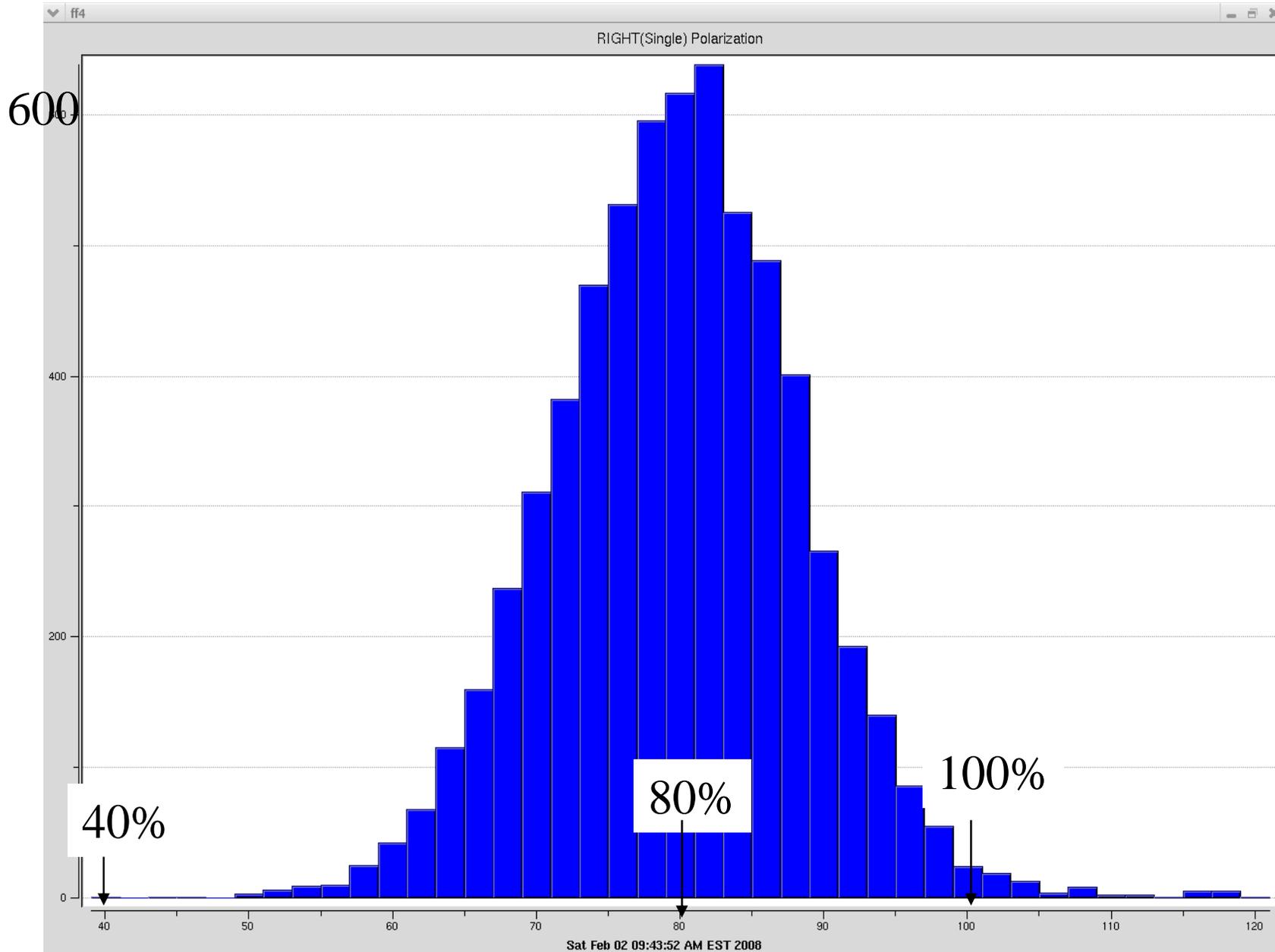
GREEN LINES

Y45 = -0.0002+/- 0.0004

Pink/Black Lines : Cross Asymmetries

Close

Polarization from 200MeV Polarimeter



Large variation is probably due to the limited events per bunch, or something else?

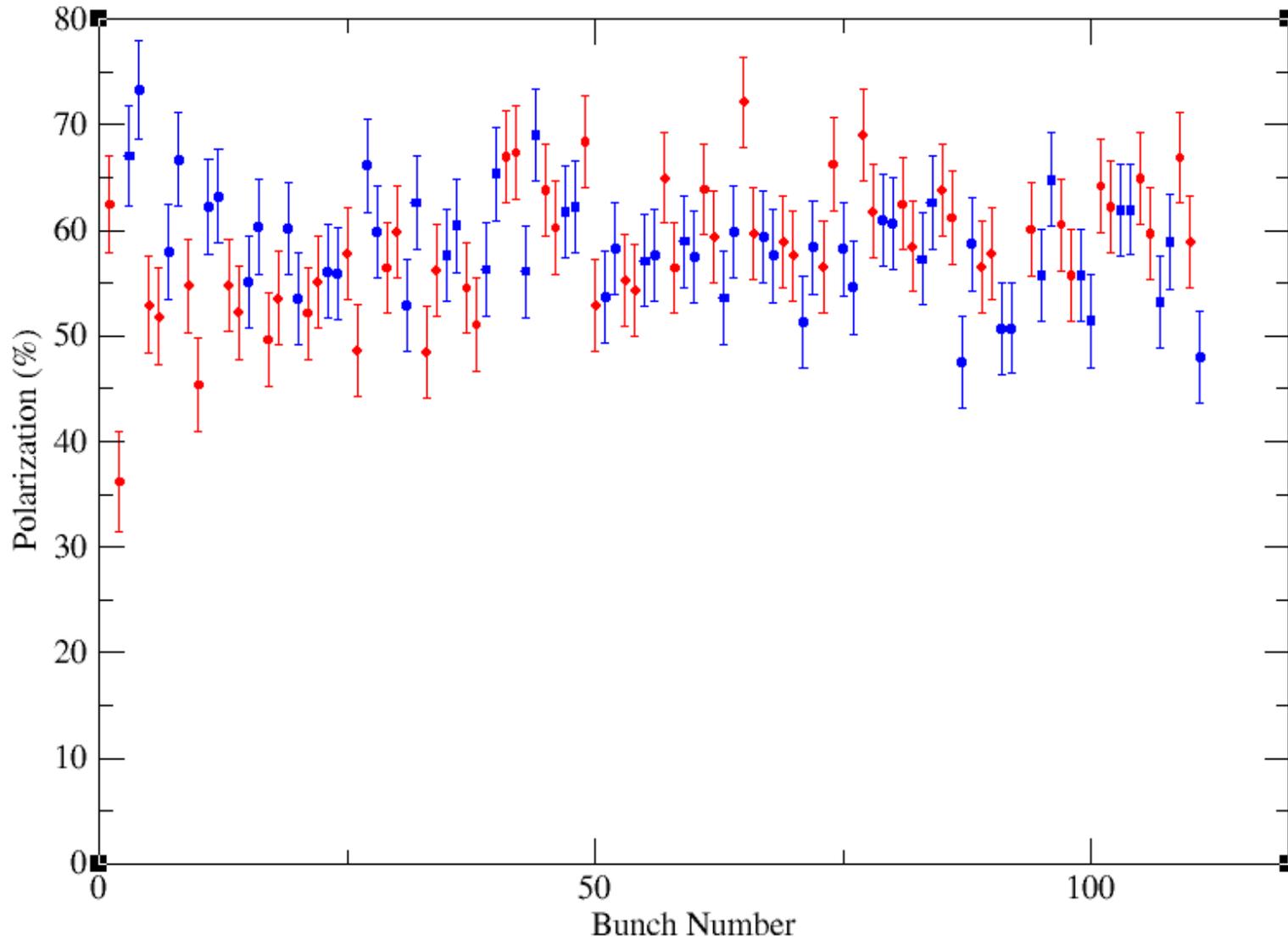
Bunch by Bunch Polarization Measurement

- Identify if there is polarization variation from shot to shot and the sources of the polarization variation (by correlation plots) and consequently to look for solutions.
- This experiment is a mixed one involved both AGS and RHIC. The polarization measurement will be done in RHIC while many other beam parameters (emittances, orbits) will be documented in the AGS and AtR.
- Only RHIC can provide long measuring time to get small error bar for bunch polarization.

What Can Be Learned?

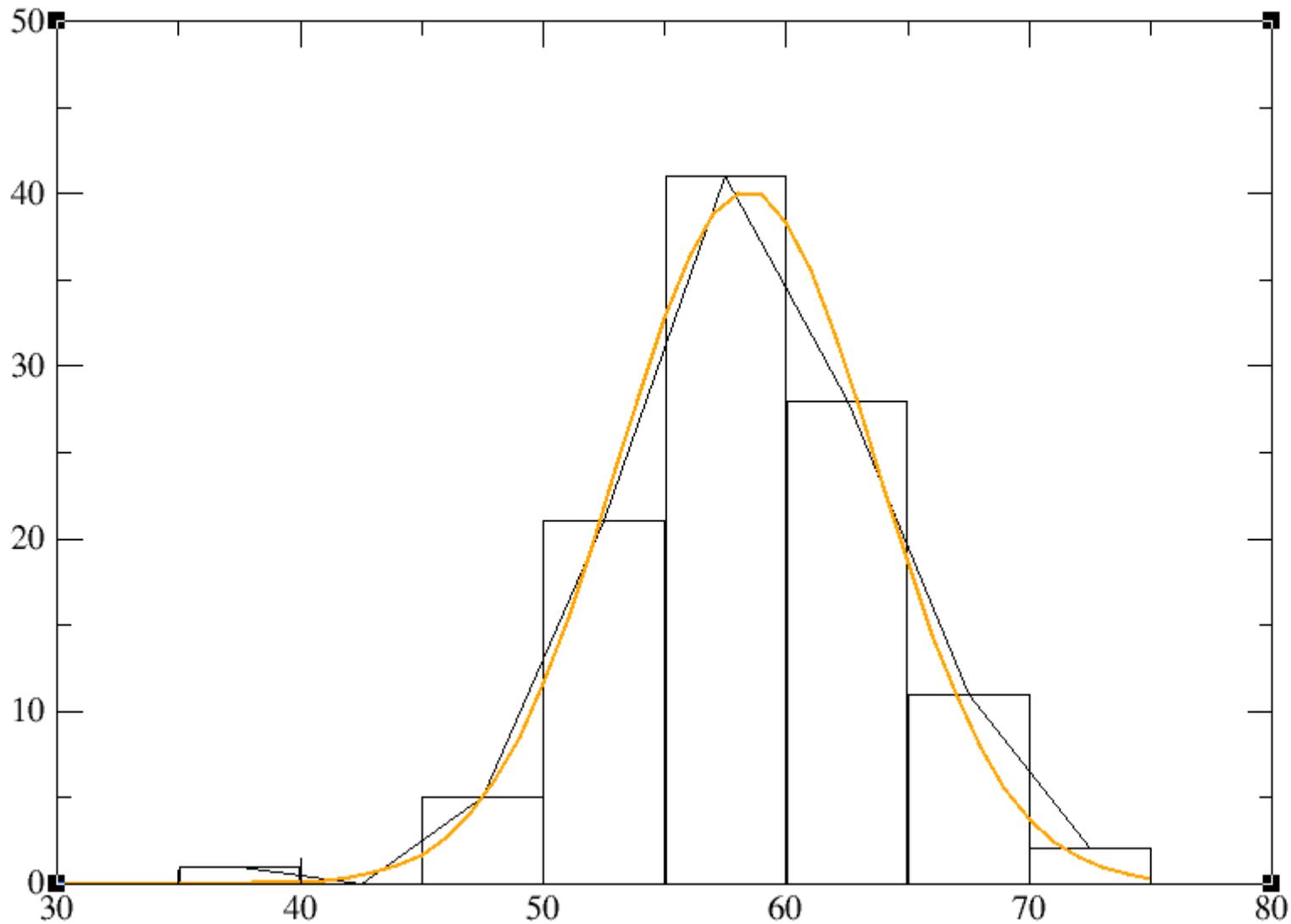
- It has been done in run6. The data taken does show a stable AGS (Variation of emittances and intensity are less than 10%).
- Another two hours experiment with intensity 1.5×10^{11} can reduce error bar by half.
- Record data from RHIC polarimeter, RHIC IPM, AGS polarimeter, AGS IPM, AtR flags.
- What this experiment can tell: if there are effects from sudden change of emittance due to injection (LtB and/or BtA) hiccup and beam instability; source polarization variation.
- What this experiment can't tell: effects due to betatron tune variation along the ramp from shot to shot.

Polarization vs. Bunch Number



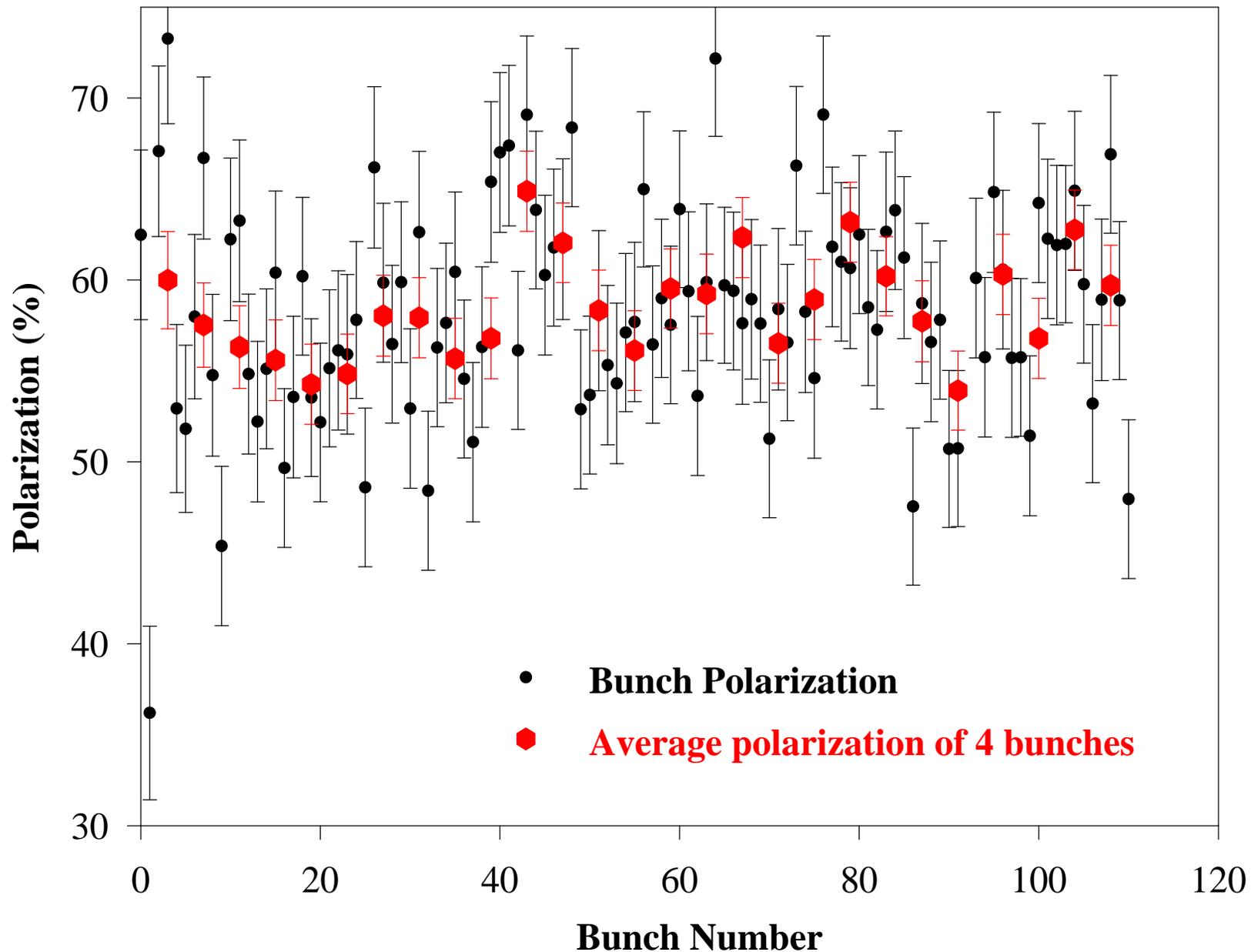
Averaged over 420 million events. Error bar for each bunch is 4.7%. Data taken in 20 minutes with $110 \cdot 1.4 \cdot 10^{11}$ at injection.

Polarization vs. Bunch Number (2)



Gaussian fit gives central polarization 58.4% and variation of 5.3%.

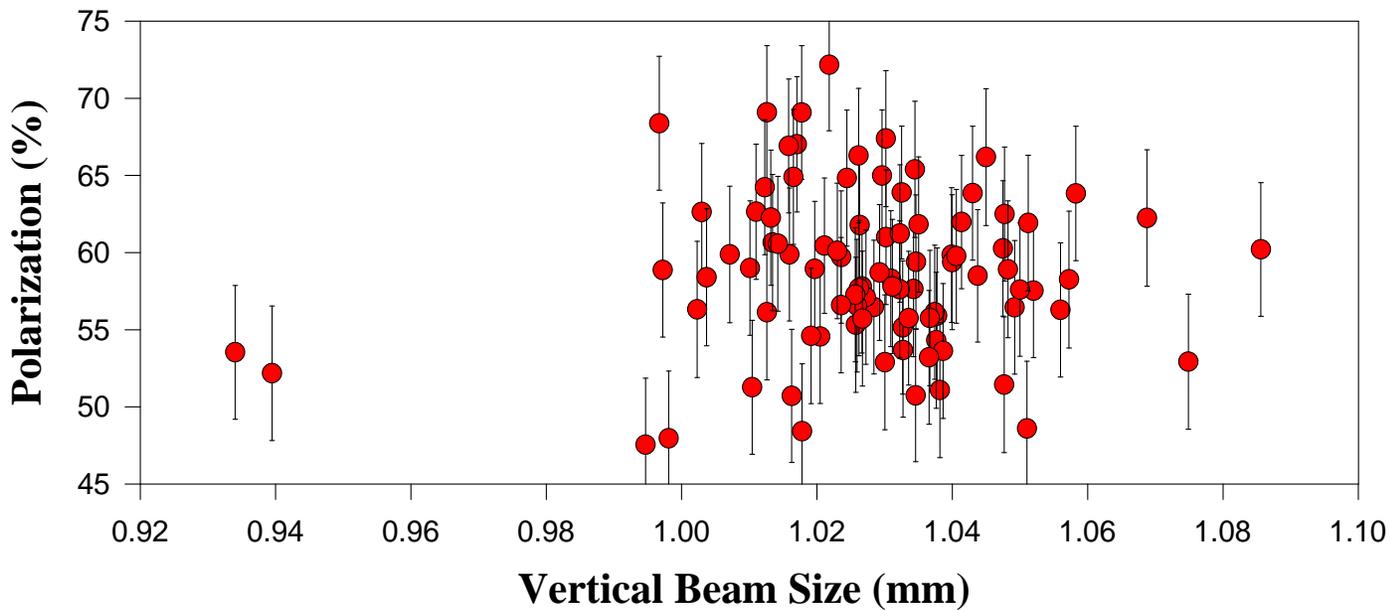
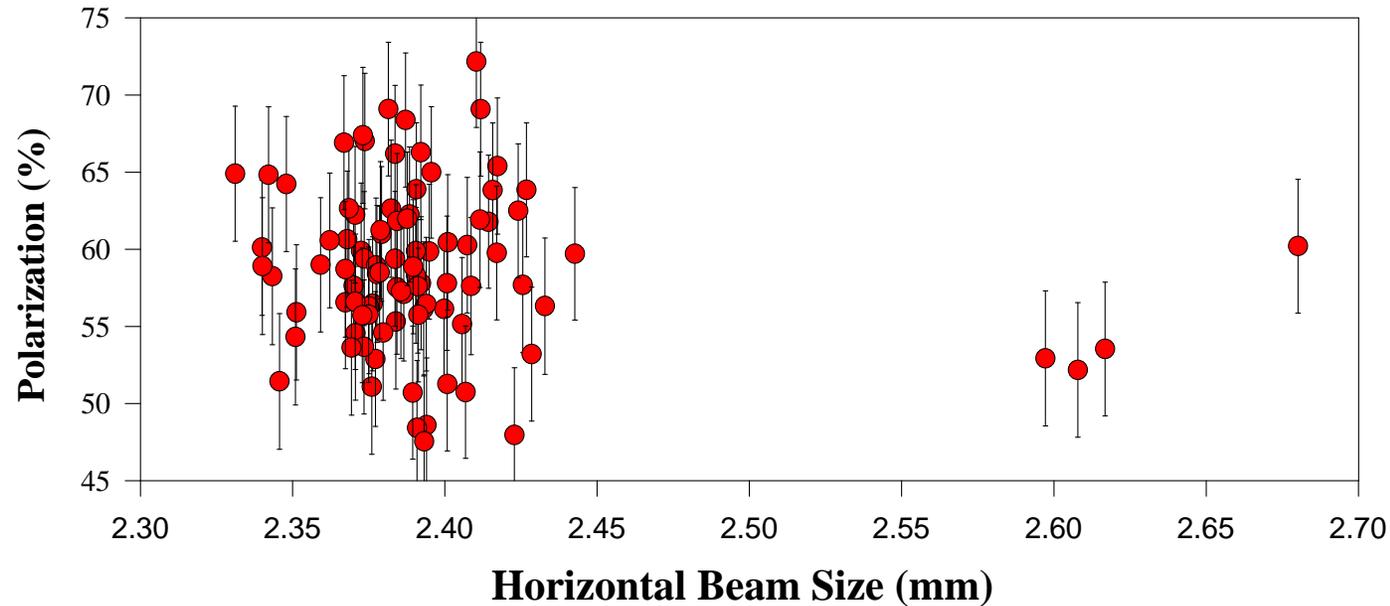
Polarization vs. Bunch Number



Need to reduce the error bar by half: increase measuring time four folds.

Polarization vs. Beam Sizes

Beam sizes measured with Uf5, presumed no dispersion.



NO correlation.

Summary

- The data taken so far does show a stable AGS (Variation of emittances and intensity are less than 10%).
- Another two hours experiment with intensity $>1.5*10^{11}$ and polarization of 60% can reduce error bar to half.