Impact of Orbit Harmonics

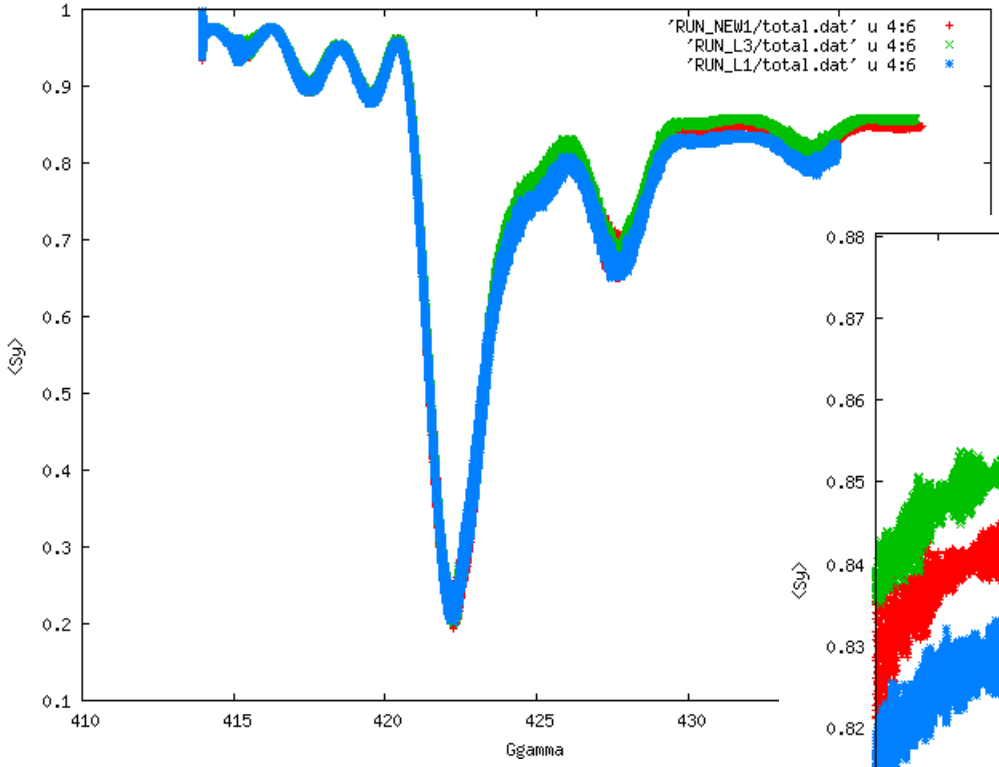
Outline

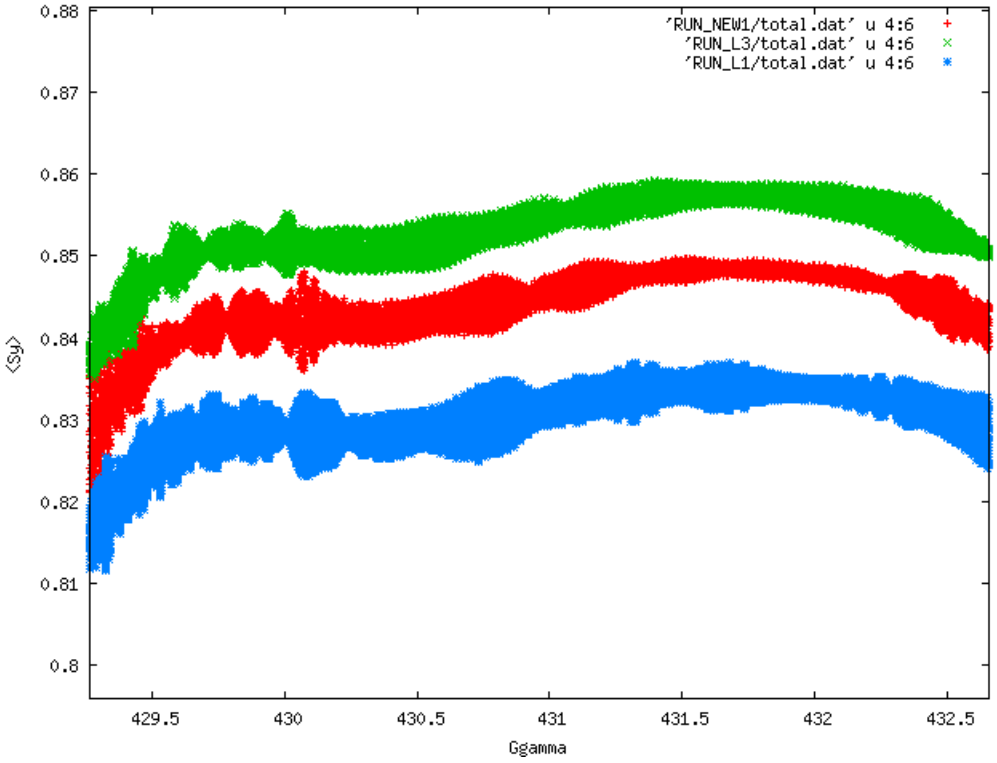
- Why are we interested in exciting a harmonic?
  - More predictable effect on polarization. We have some understanding of this based on the old method of harmonic carried out in the AGS before we had partial snakes.
- What does simulation Tell us ?
- How should we do it?

Impact of Orbit

- Still and open question in RHIC.
  - We are not certain at what level and what kind of orbit we can tolerate with out appreciable effect on polarization.
  - It would be instructive to not just increase or decrease over all rms orbit but to increase or decrease imperfection resonance strengths since we believe this is the ‘important’ number for polarization losses. One way to do this is through targeted harmonic excitation.

Tracking results vs. Imp. Resonance strength.

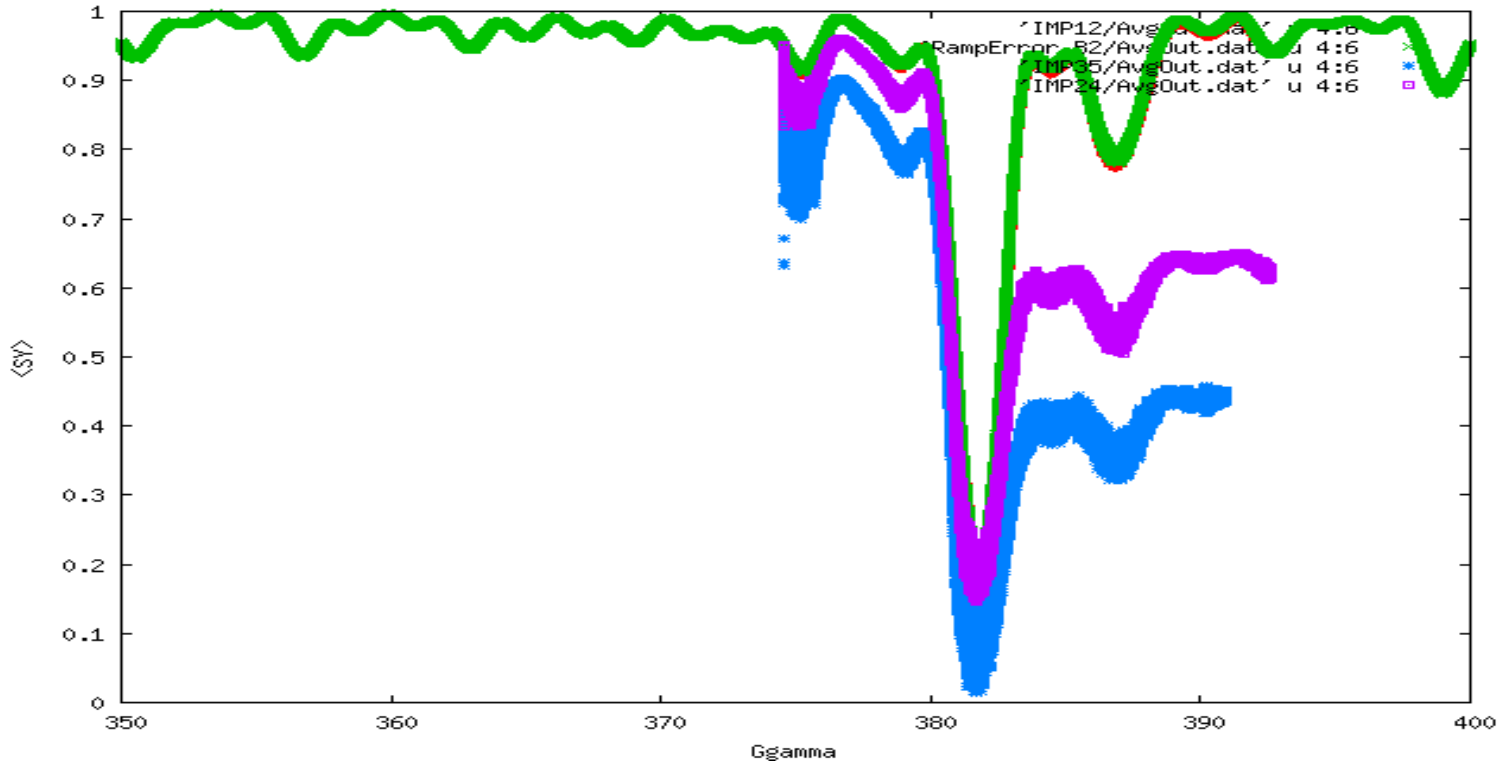




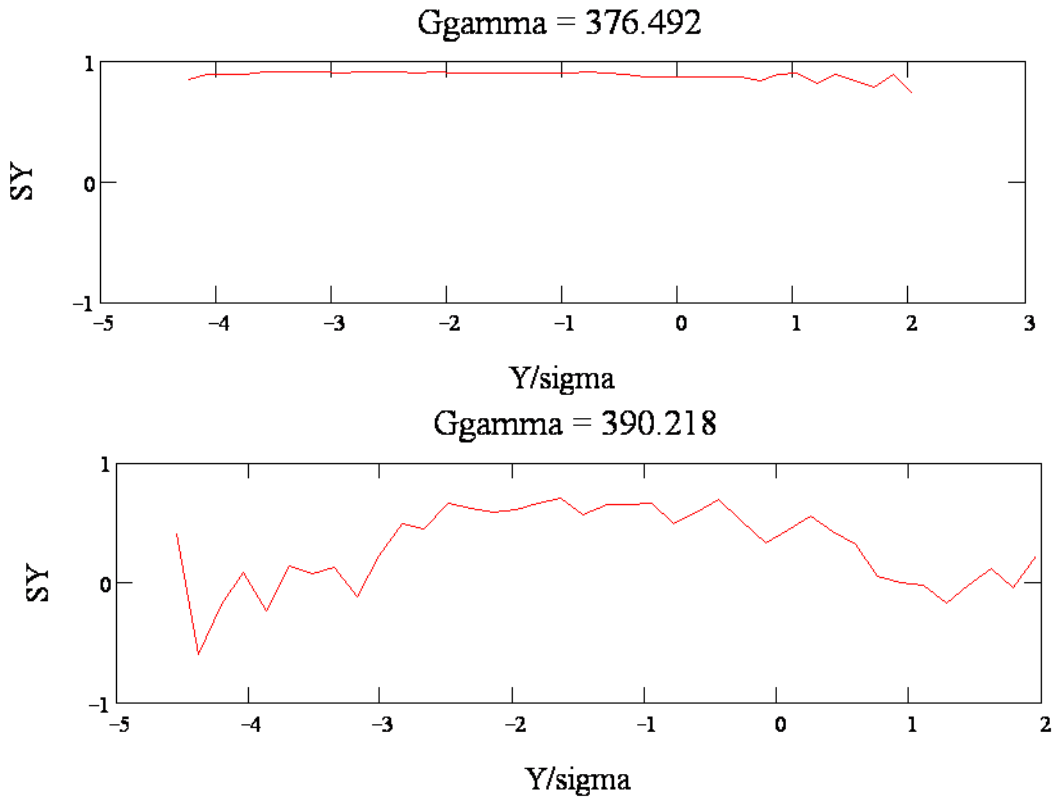
Going from Imp = 0.012, 0.03, 0.08
Yrms from 0.012 to 0.3 mm

Distorting harder we get more losses

- If we excite 29th harmonic and drive imperfection above 0.2 then we see significant effects on polarization with yrms > 0.6 mm.



Changes in profile



One of the signatures we expect would be a shift in the stable spin direction
The central peak moves downward.

Summary of Tracking Results

- We should see an observable effect if we drive our imperfection resonance above 0.2 which still keeps the orbit < 1 mm rms. We also expect to see an observable change in p0 the peak asymmetry which correlates with the orbit.

Approach

- We will construct Harmonic circuit similar to the one in the AGS. To excite a given Harmonic and drive a particular Imperfection resonance strength.

$$C_j = a_j \cos(\theta_j k) + b_j \sin(\theta_j k)$$

Here θ is the orbital angle in RHIC and k the harmonic we want to excite. I have compiled a list of correctors and their orbital angle we would just need a script to apply these to the Ramp Manager.

Then we can set the correctors to excite a particular K values during one of the last two intrinsic resonance crossings. In this way we can benchmark the sensitivity of our polarization to the Imperfection resonance strength during an intrinsic resonance crossing. We can also make use of the two ramps developed in the previous experiment to better isolate the location of the effects on the ramp.