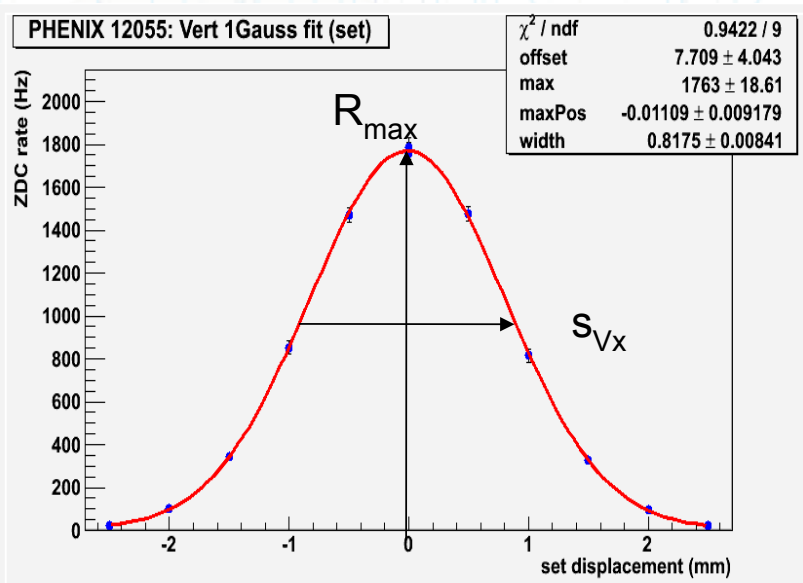
Cross section and luminosity Run11

PP @ 250 GeV
AuAu @ 100 GeV

A. Drees (K. Brown)

The Vernier Scan Method



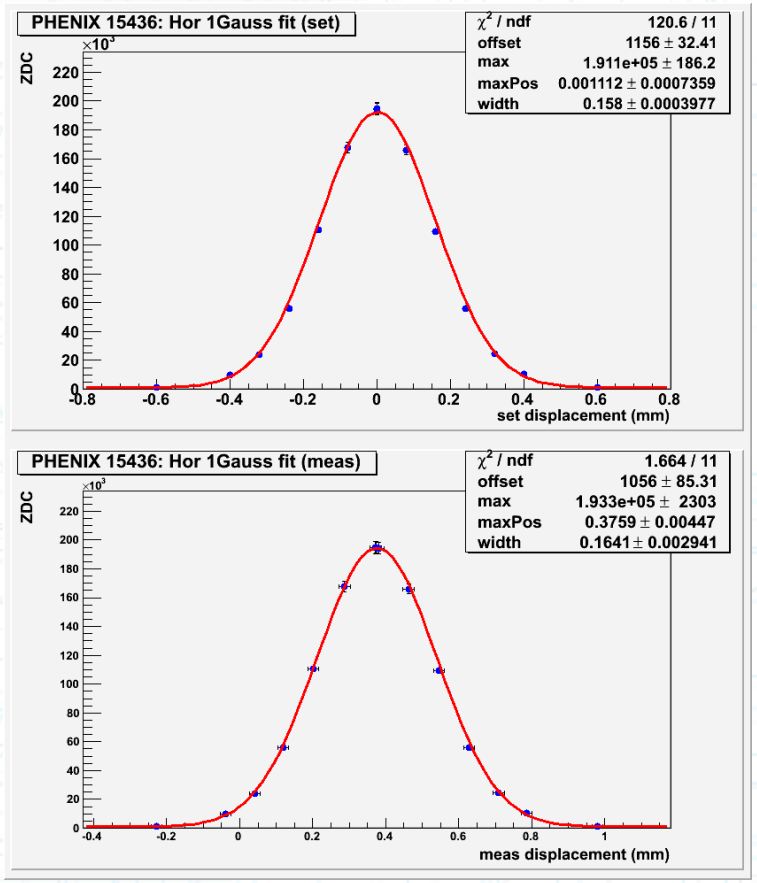
Data from a horizontal vernier scan in IP8 (PHENIX).

- Beams are swept stepwise across each other.
- Use one beam at the time, plane by plane.
- NEW: customized scans
- Apply Gauss-fit to collision rate vs. beam displacement.
- Obtain maximum signal amplitude R_{max} and beam width s_{Vx} and s_{Vy}.
- Compute cross section:

$$\sigma_{ZDC} = 2\pi\ R_{max}\ \sigma_{Vx}\ \sigma_{Vy}\ k_b/(f_{rev} N_1 N_2)$$

- N1 and N2 are ions/beam.
- Compute emittance from beam sigma (assumes b* and hour glass factor)
- R and R_{max} need accidental coincidence correction: point-2-point

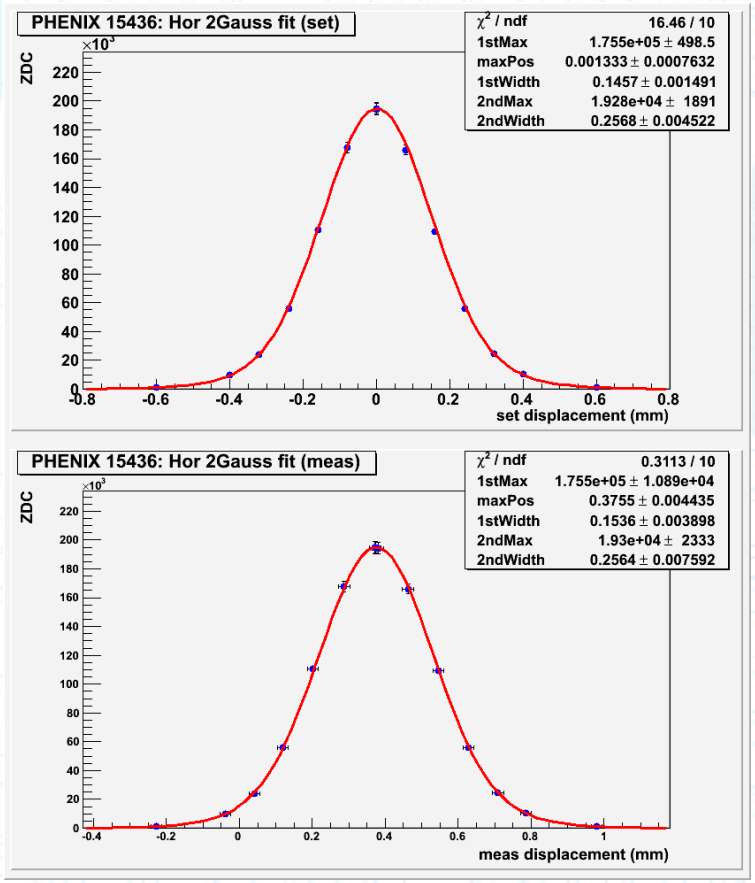
Gaussian beam shape?



- New software applies accidental coincidence correction point by point.
  - Shape "improved" with point 2 point correction
- Still bad chi2/ndf (> 10) for 1 Gauss fits for pp
- Fit is dominated by the tails and width over-estimated
- => use 2-Gauss fit

Apply 2-Gauss fits

- Chi2 reduced to 1-2
- Widths are combined into one 'effective' width
- NEW: Accidental coincidence correction "a la" STAR (thanks: J. Dunlop, internal note by A. Bridgeman, H. Spinka) added to software and included in this fit
- 2-Gauss fits and new correction scheme are really only needed (and used) for 250 protons.



run11
PP

Results from Vernier Scans

fill	s_{PHENIX}	s_{STAR}	VS: ε_H	VS: ε_V	IPM: ε_H	IPM: ε_V
	[mb] +/- 0.3	[mb] +/- 0.3	[p mm mrad]	[p mm mrad]	[p mm mrad]	[p mm mrad]
15044	3.02	3.5	15	15	9	14
15160	2.84	3.15	16	20	13	21
15255	2.85	3.06	16	19	12	18
15335	2.96	-	19	21	14	15
15376	2.89	3.01	20	21	14	20
15436	2.79	-	20	21	16	23
15457_1	-	3.0	24	23	15	17
15457_2	-	2.99	20	23	16	23
15466_1	2.80	-	19	21	14	16
15466_2	2.67	-	20	21	14	22

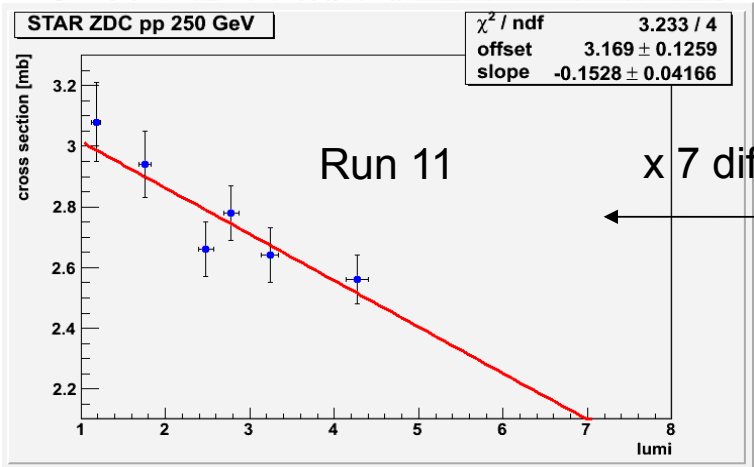
+/- 2

PP Results after new correction scheme. Hour glass factor and b* values are needed inputs to calculate emittance from beam size. Hour glass factors (at the end of stores!) are between 0.56 and 0.67 (STAR) and 0.52 and 0.63 (PHENIX)

A. Drees (K. Brown)

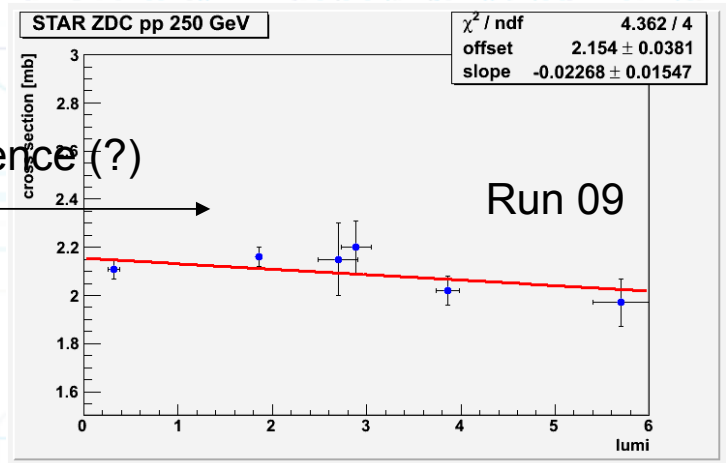
Compare run09 and run11

Without new acc. coinc. correction (for both runs)!

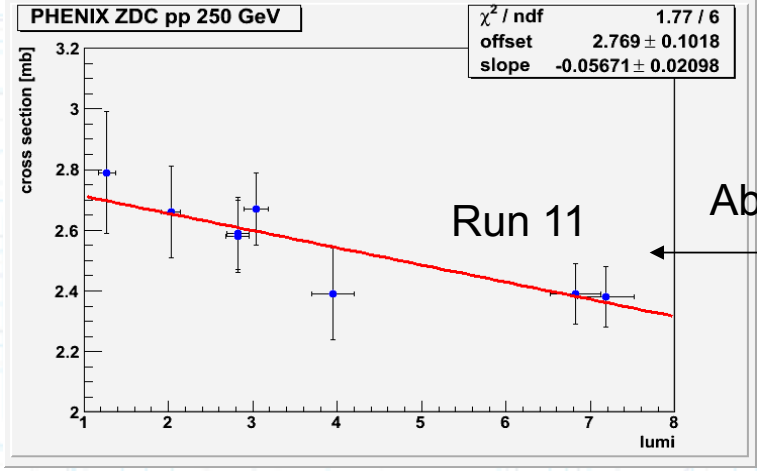


Run 11

x 7 difference (?)

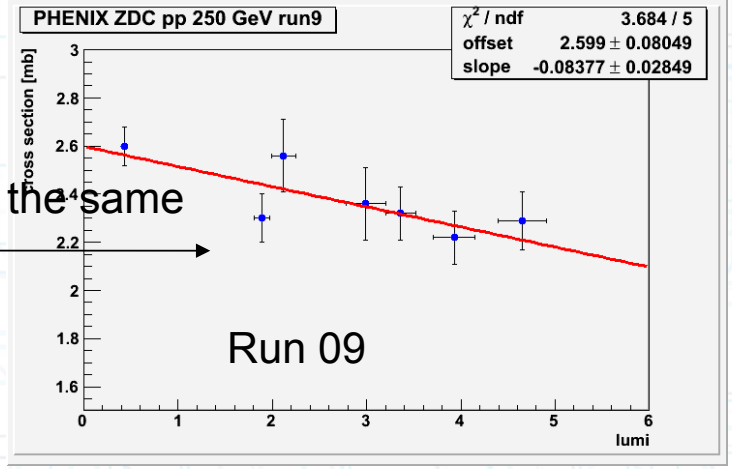


Run 09



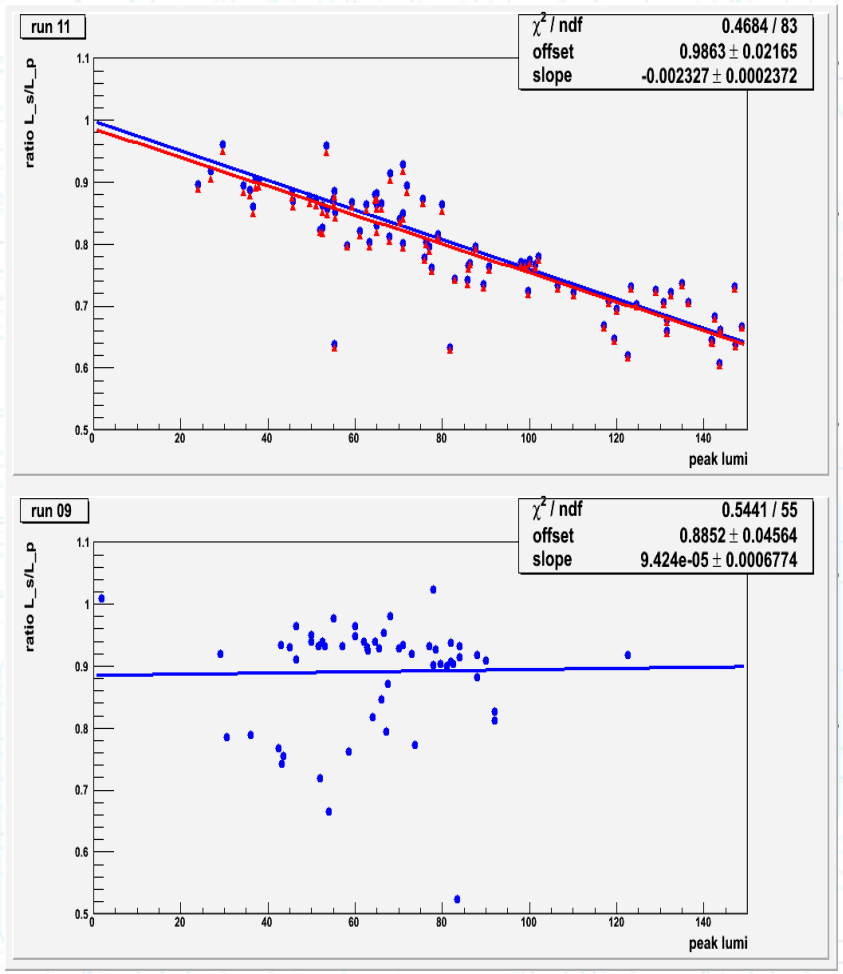
Run 11

About the same



Run 09

Compare run09 and run11 (II)



Courtesy P. Ingrassia :)

Old correction scheme used in both data sets

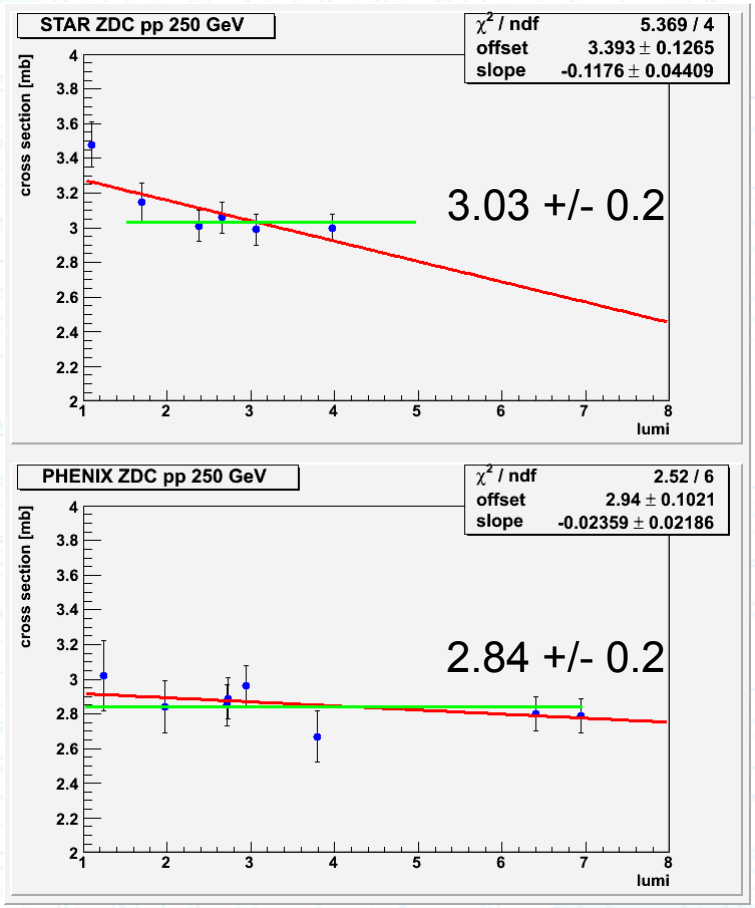
Each datapoint represents the ratio of integrated luminosities in one store

No correlation with peak lumi in Run09

Strong correlation with peak lumi in Run11

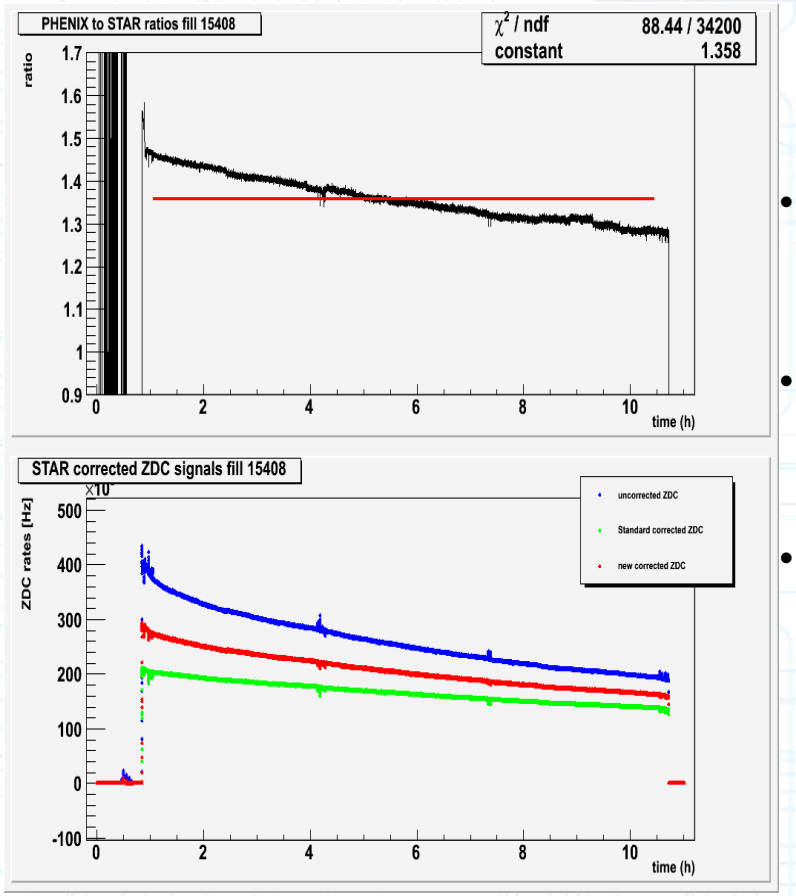
Integration using new correction not yet available

Cross sections after p2p-correction and new acc. coinc. correction



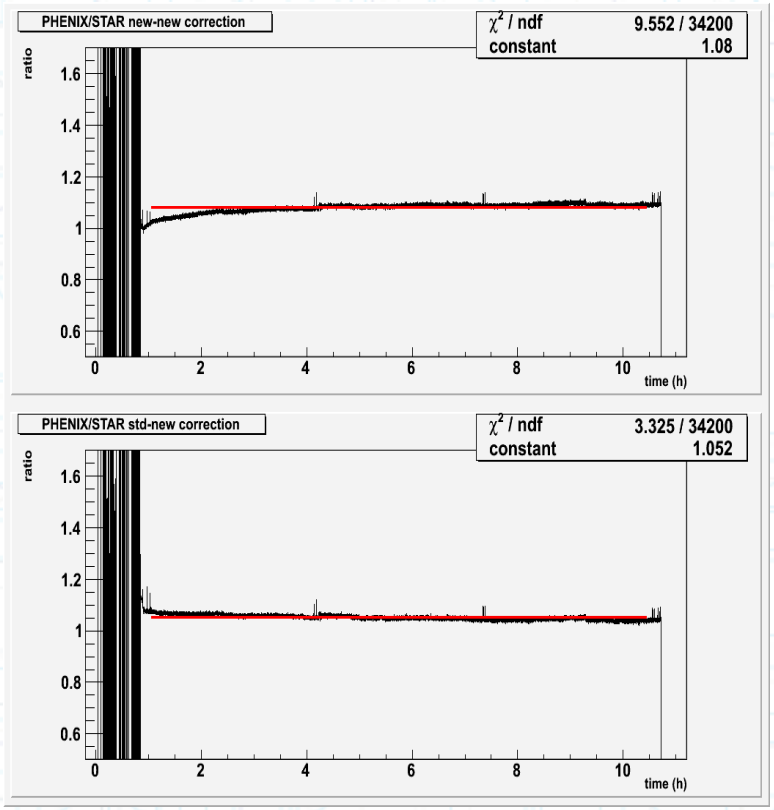
- 1st data point for STAR excluded from p0-fit (but not p1-fit)
- Slope reduced in both experiments compared to old correction
  - fac. 1.3 STAR
  - fac. 2.5 PHENIX
- New correction scheme needs to be added into 'book-keeping'
- Are we done yet? Not quite ... ->

… looking at PHENIX/STAR ratios with and w/o new correction (store by store)



- Top: ratio of collision rates changes by about 25% during a store (new feature, not present in run9)
- Bottom: uncorrected ZDC rates (blue), old correction (green) and new correction (red)
- Overall ratio is too large even including cross sections, fillpattern and b*.
- A variety of ZDC signals from both experiments is available:
  - Coincidence rates with and w/o long deadtime
  - Singles rates with and w/o long deadtime

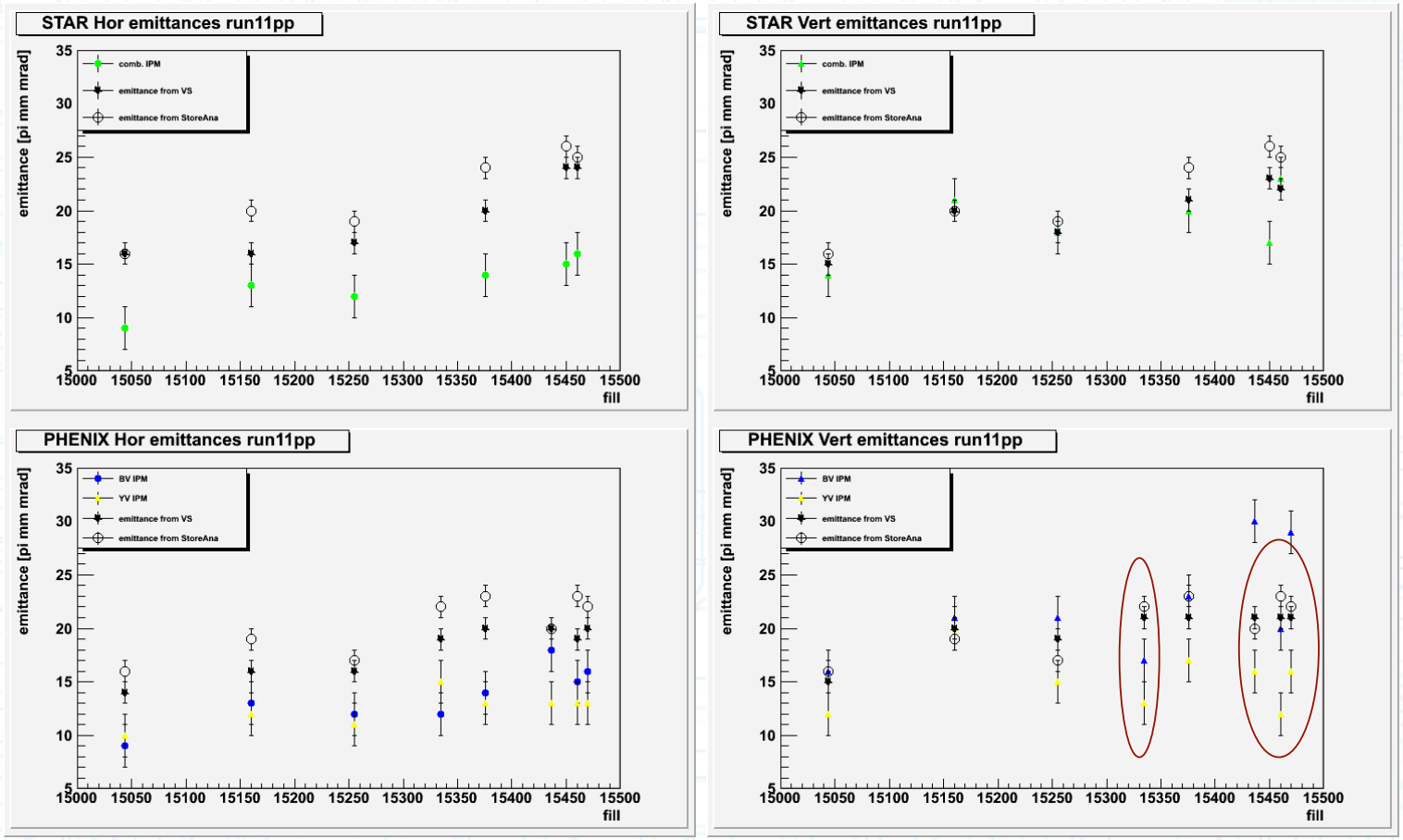
... remaining issue of PHENIX/STAR ratio during the stores ....



- Ratio keeps having a strong slope using the old (=std.) correction in both or the new.
- Top plot is the results after mixing of input signals in PHENIX: standard ZDC coincidence but short deadtime singles. :(
- Bottom plot (truly constant!) is the result after using the 'good old' standard correction for PHENIX but using the new way of correction in STAR.
- ... still thinking about it .... work in progress

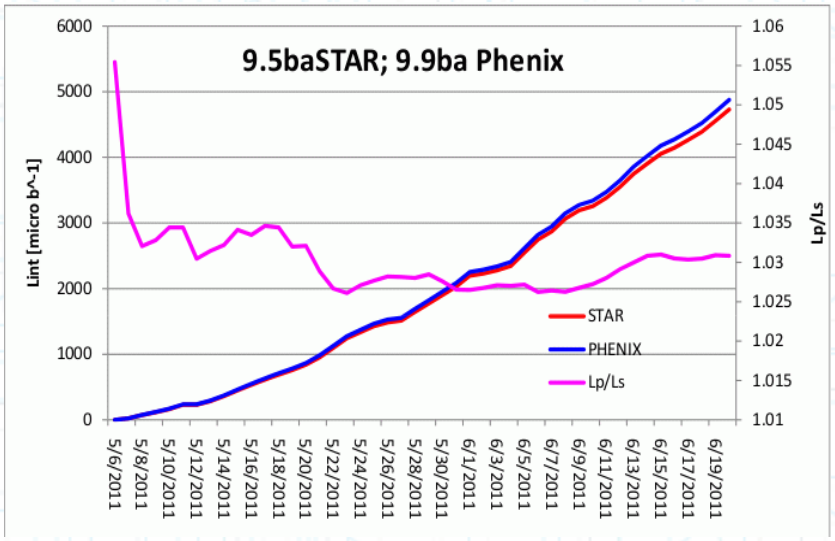
PP emittances from VS

VS and lumi results should be between IPM numbers.



Notes: IPM Hemit are always below VS/lumi results. IPM Vemit and VS/lumi results are consistent except for cases with AnDY separation bumps in. Results from lumi give only one number (“effective” emittance).

... just a few words on AuAu cross section (100 GeV)



courtesy P. Ingrassia :)

- Pretty consistent picture.
- Ratio constant (STAR ZDC HV was changed in the 1st few days!)
- Ratio indicates that the b* value in STAR was slightly smaller than in PHENIX.
- Au numbers can be considered 'final'.