Forward neutron A_N for various sqrt{s}

2008/07/30

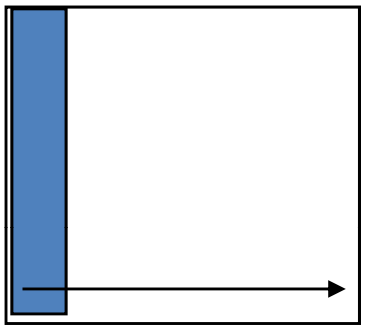
Manabu Togawa

Spin PWG

Comparison for LP trig. After axis scaling

Horizontal scan

ZDC detecor

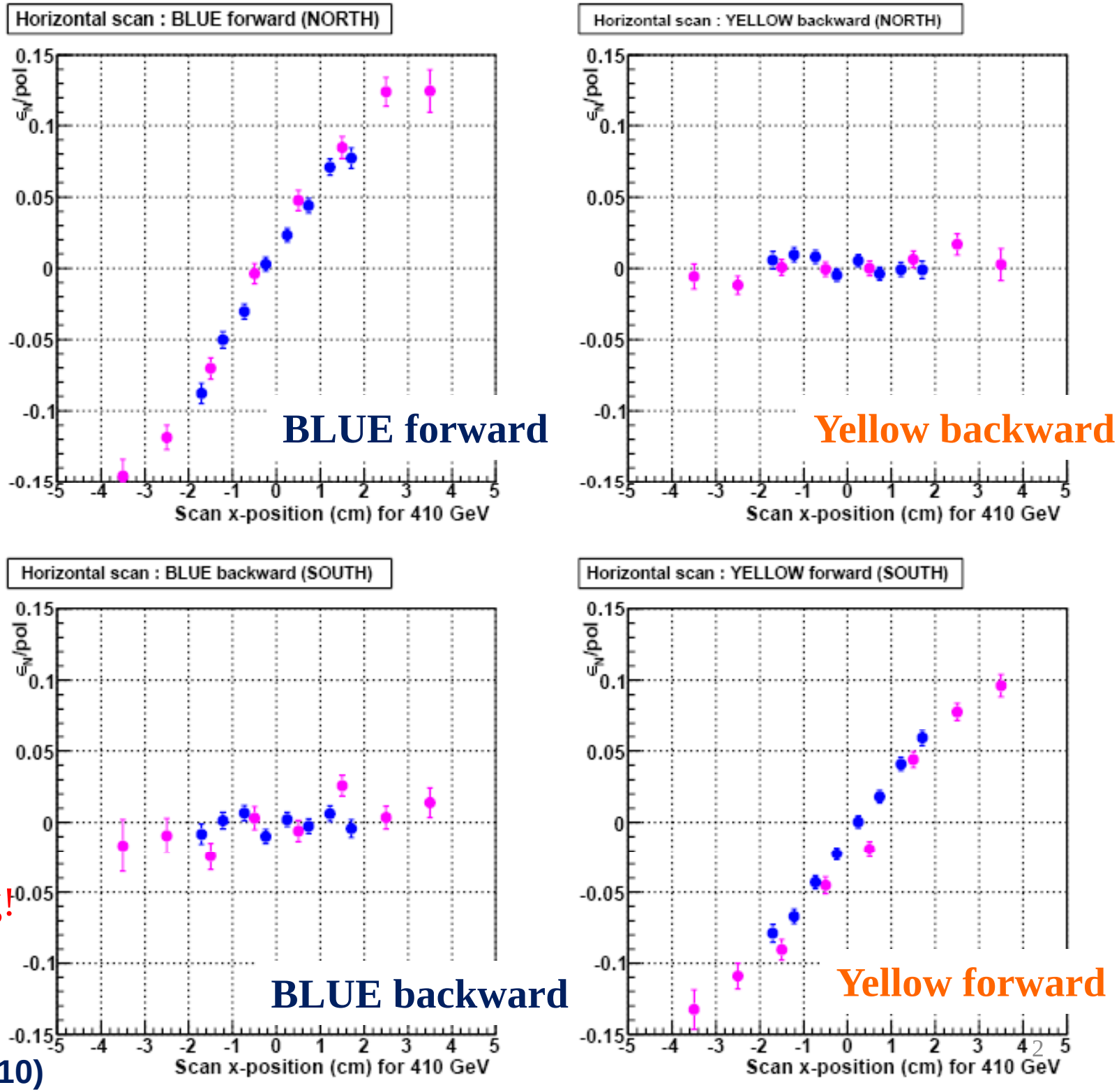


-5cm 5cm

$$A = \frac{N_+ - RN_-}{N_+ + RN_-}$$

It looks well scaling!

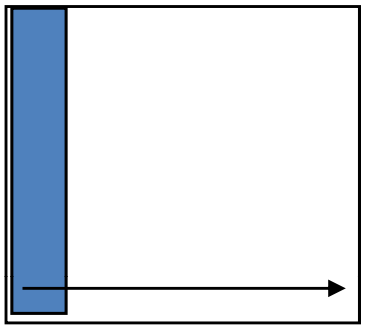
Magenta : 410 GeV
Blue : 200 GeV
(x axis is scaled by 410)



Comparison for ZDCN|S trig. After axis scaling

Horizontal scan

ZDC detecor

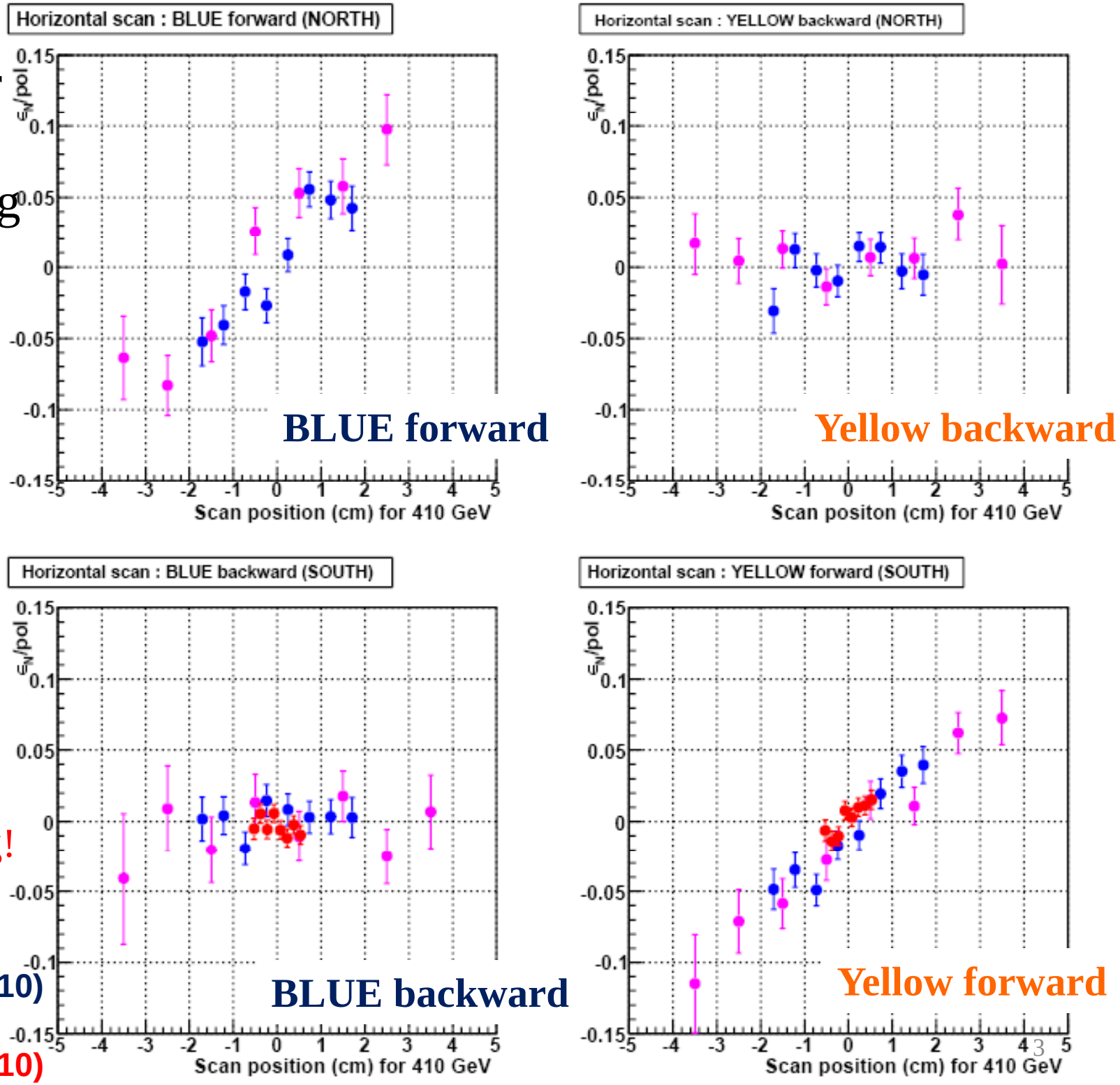


-5cm 5cm

$$A = \frac{N_+ - RN_-}{N_+ + RN_-}$$

It looks well scaling!

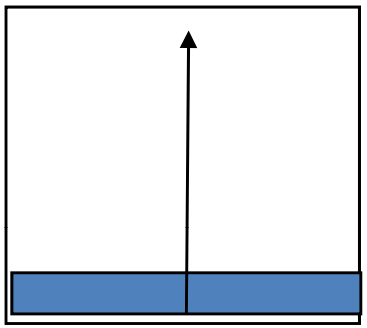
Magenta : 410 GeV
Blue : 200 GeV
(x axis is scaled by 410)
Red : 62.4 GeV
(x axis is scaled by 410)



Comparison for LP trig. After axis scaling

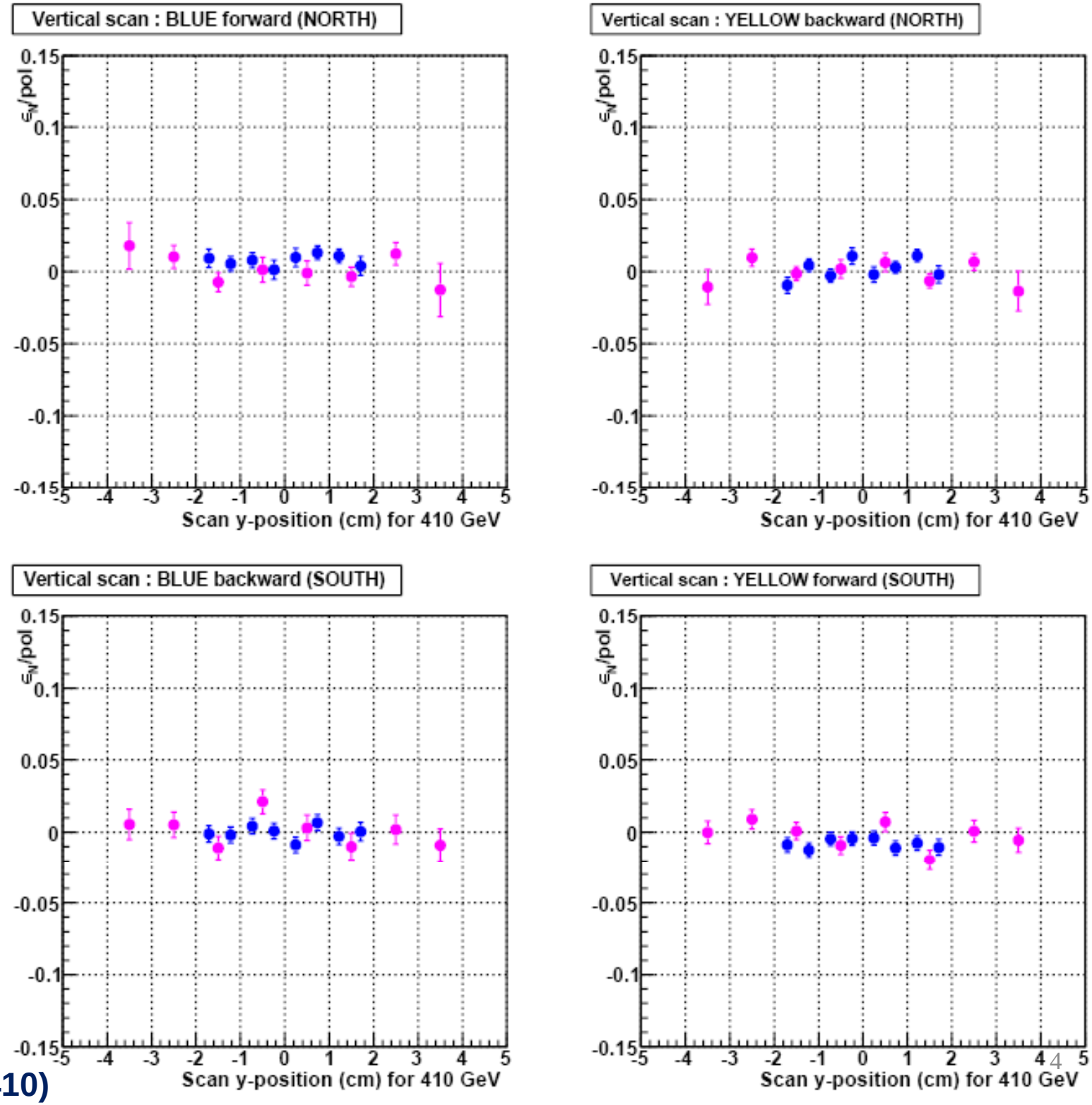
Vertical scan

ZDC detecor



-5cm 5cm

$$A = \frac{N_+ - RN_-}{N_+ + RN_-}$$

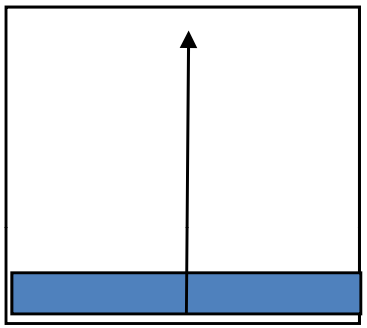


Magenta : 410 GeV
Blue : 200 GeV
(x axis is scaled by 410)

Comparison for ZDCN|S trig. After axis scaling

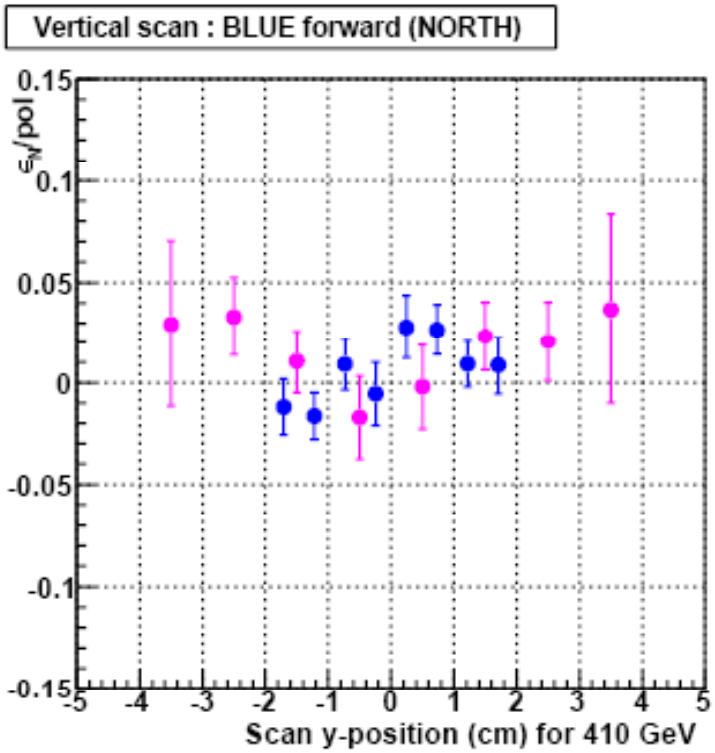
Vertical scan

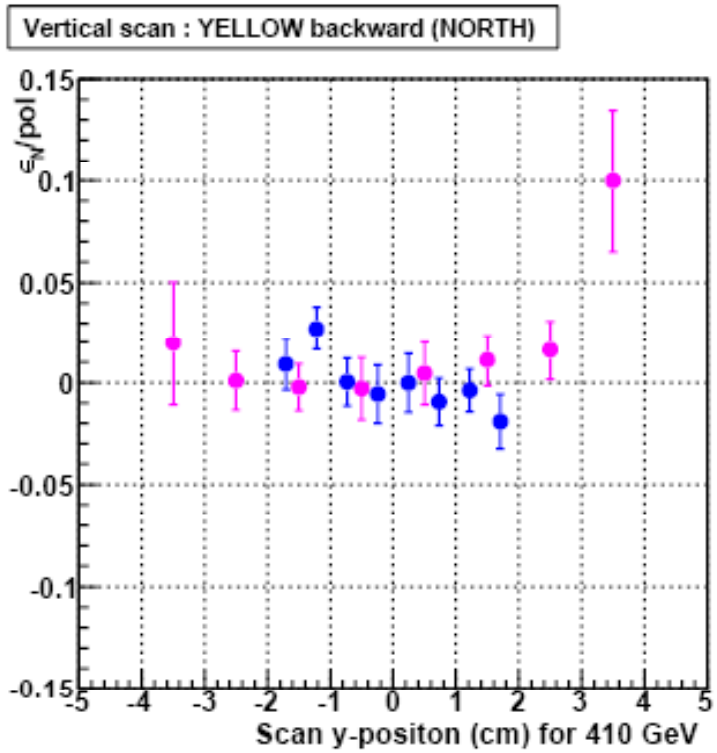
ZDC detecor

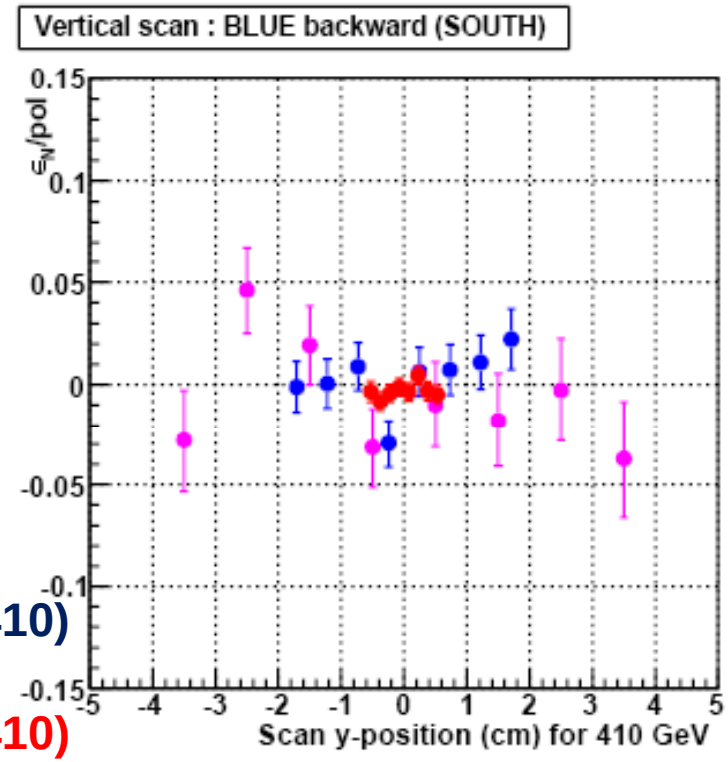


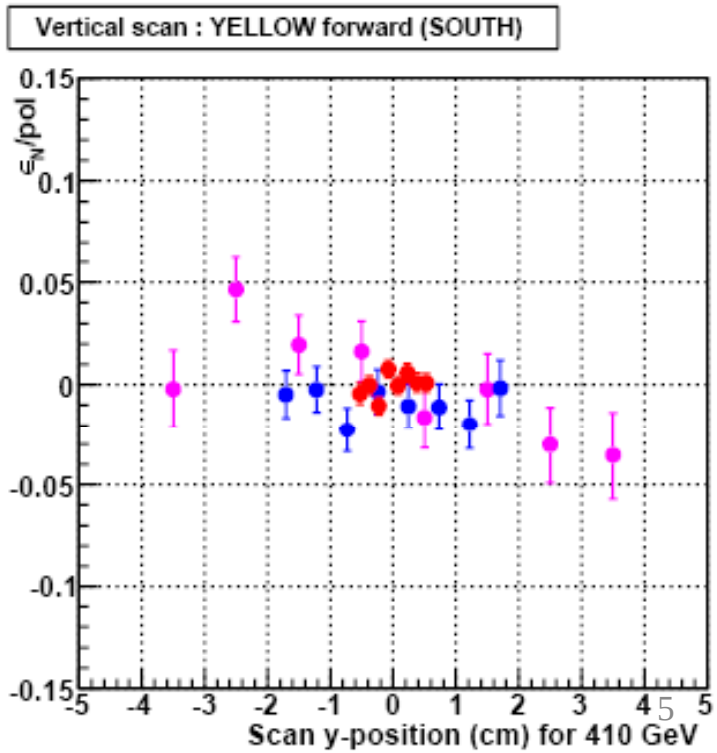
-5cm 5cm

$$A = \frac{N_+ - RN_-}{N_+ + RN_-}$$









Magenta : 410 GeV
Blue : 200 GeV
(x axis is scaled by 410)
Red : 62.4 GeV
(x axis is scaled by 410)

To do list

- Try to decompound the sine modulation
- Charged counter comparison for 62 GeV
- Bunch shuffling
- Analysis note
  - Will be submitted this weekend.

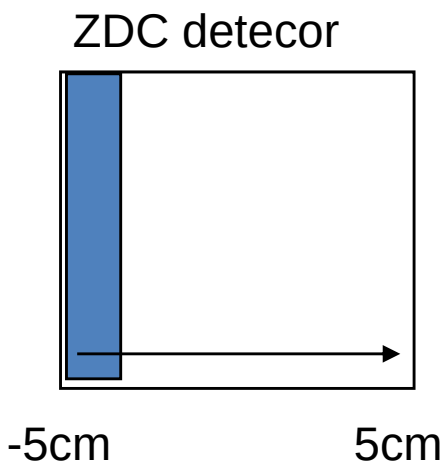
Decomposition

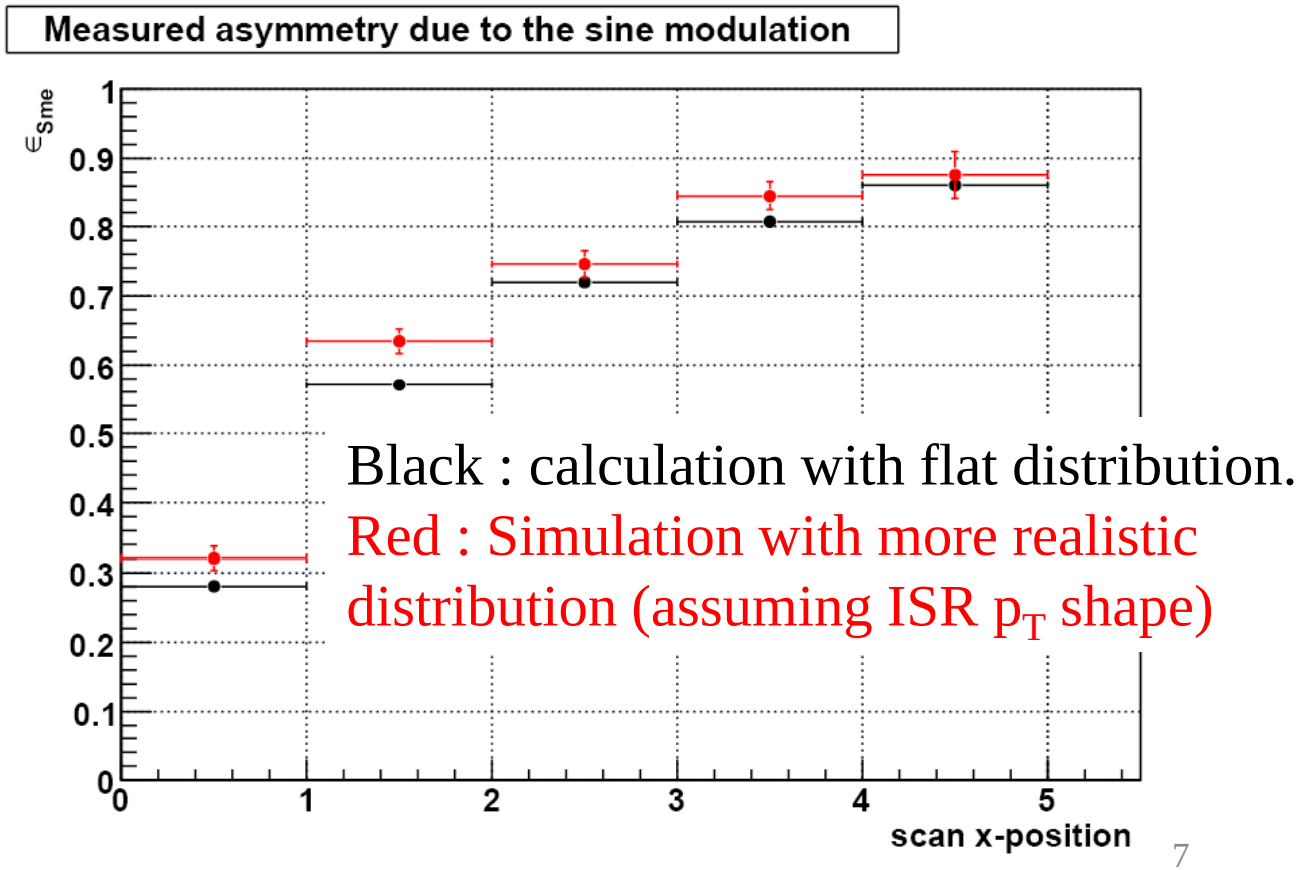
$$A \equiv A_N \cos(\phi) \quad \rightarrow \quad A_N \cos(\mathrm{atan}(y/x))$$

$$A_{Smeared} = A_N \cdot \varepsilon_{Sme}$$

$$= A_N \int_{x1}^{x2} \int_{y1}^{y2} \cos(\mathrm{atan}(y/x))\, dxdy \,/\, \left[(x2 - x1) * (y2 - y1)\right]$$

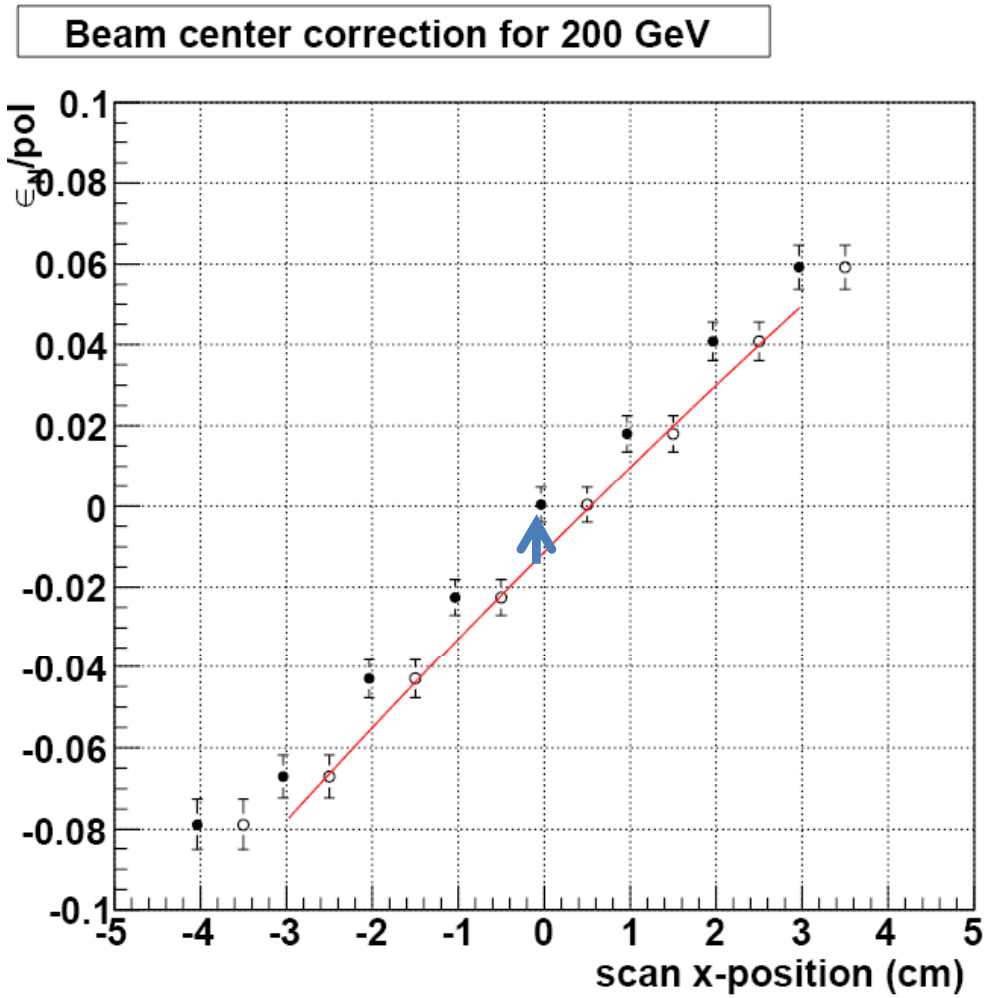
For horizontal scan case, for example,
x1=0, x2=1, y1=-5, y2=5 (cm)





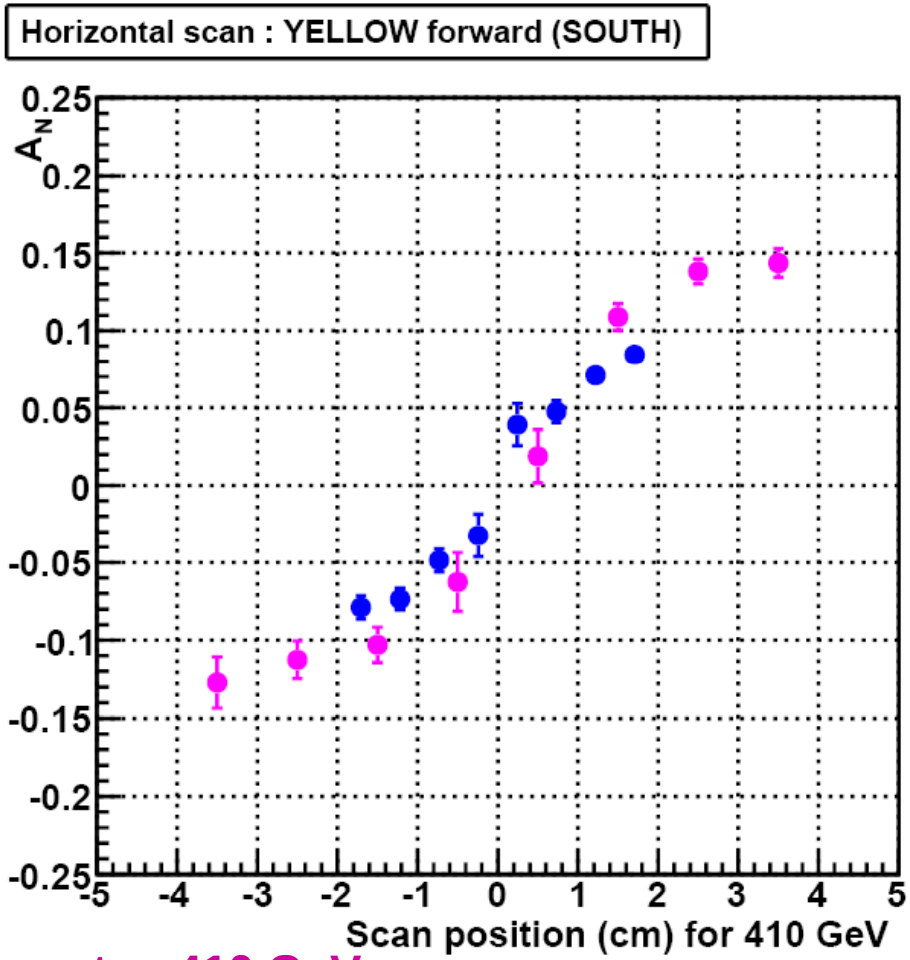
Beam center correction

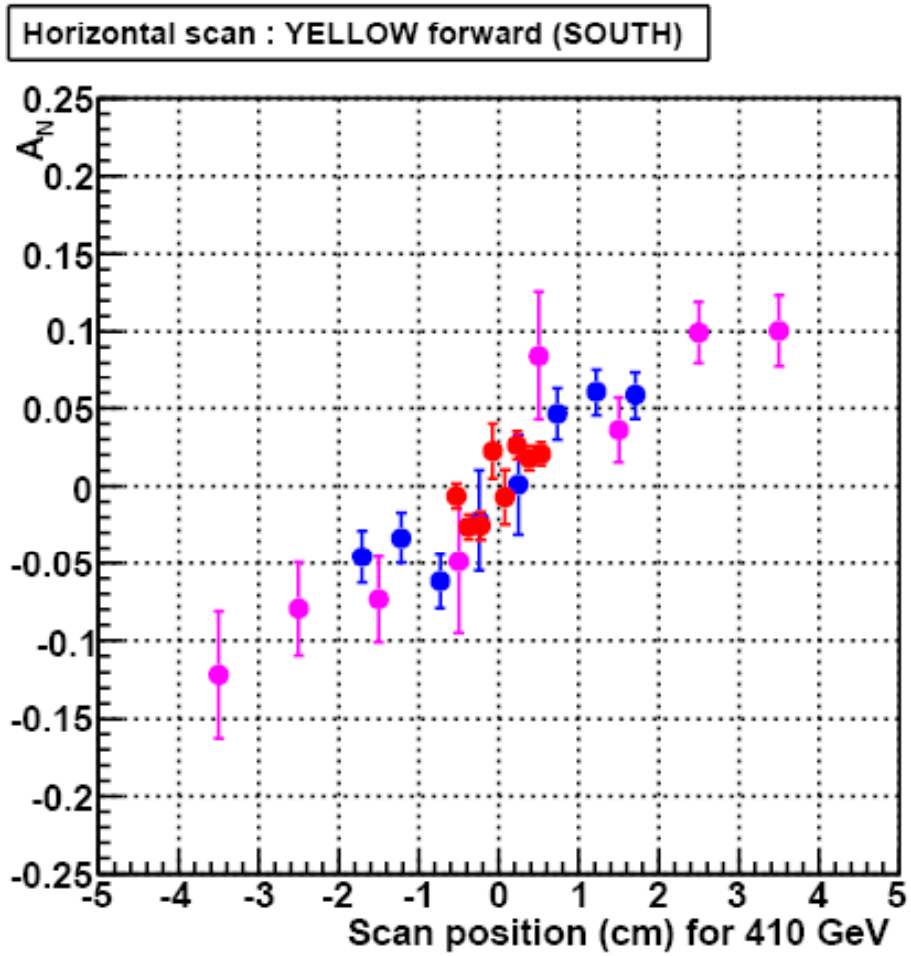
- For the sine module correction, beam center should be corrected.
  - Beam center should be $\varepsilon_N = 0$



Added as systematic error.

After correction (correct)
(Center correction for y)

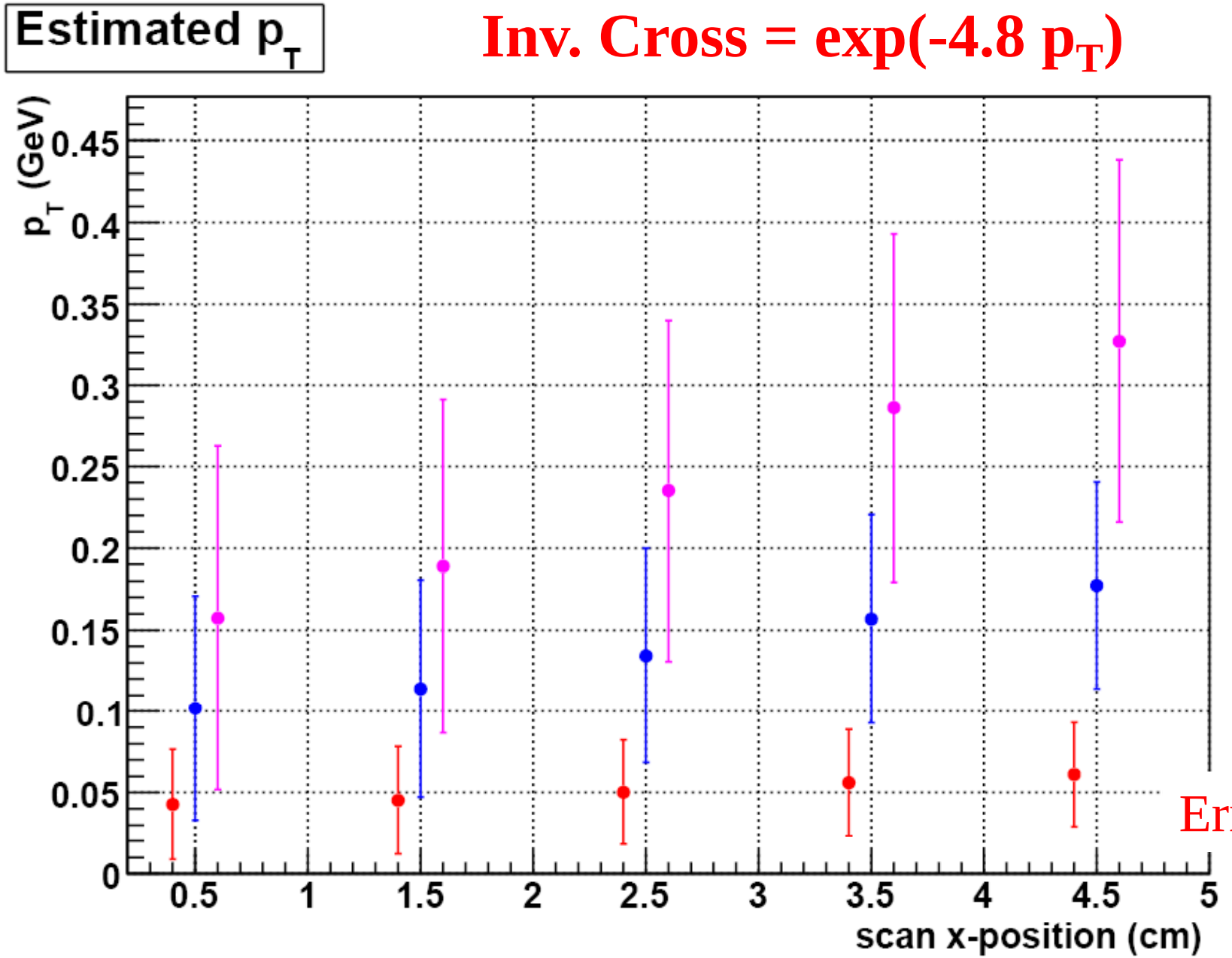




Magenta : 410 GeV
Blue : 200 GeV
(x axis is scaled by 410)
Red : 62.4 GeV
(x axis is scaled by 410)

Which is proper?
Add as a systematic? For x as well as y.

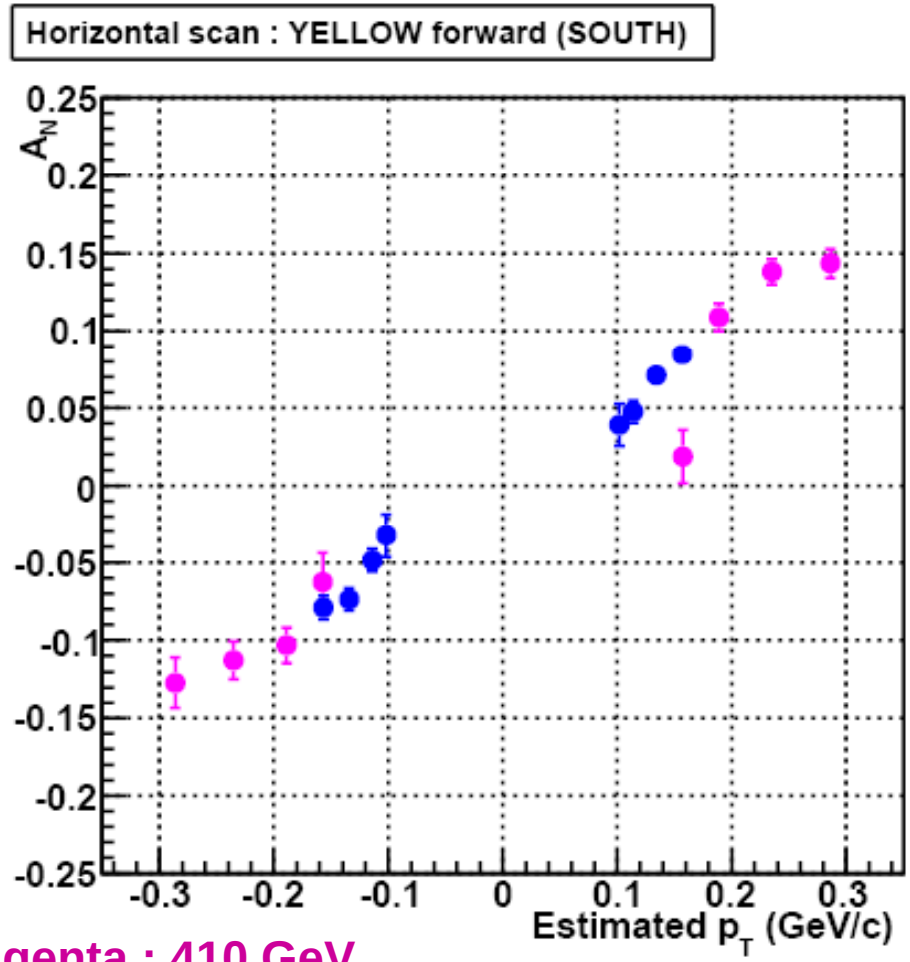
Estimated p_T using ISR p_T shape.

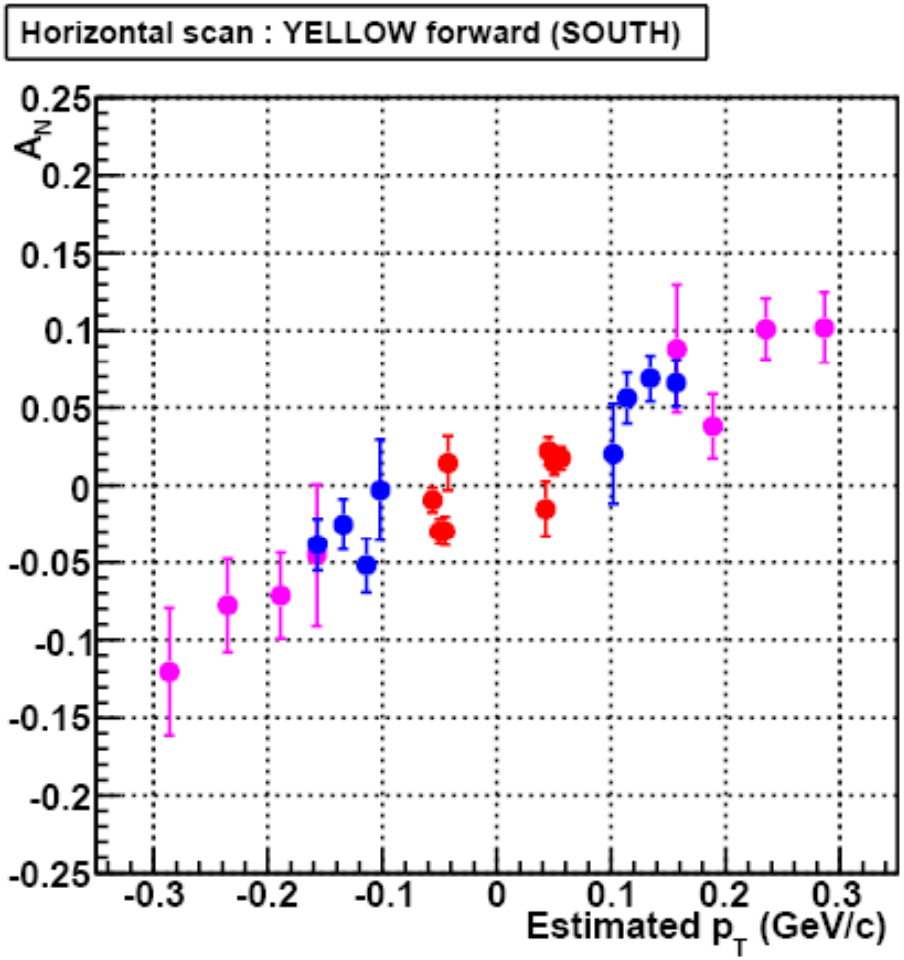


Inv. Cross = exp(-4.8 p_T)

Errors are RMS

After correction vs. expected p_T (Center correction for y)

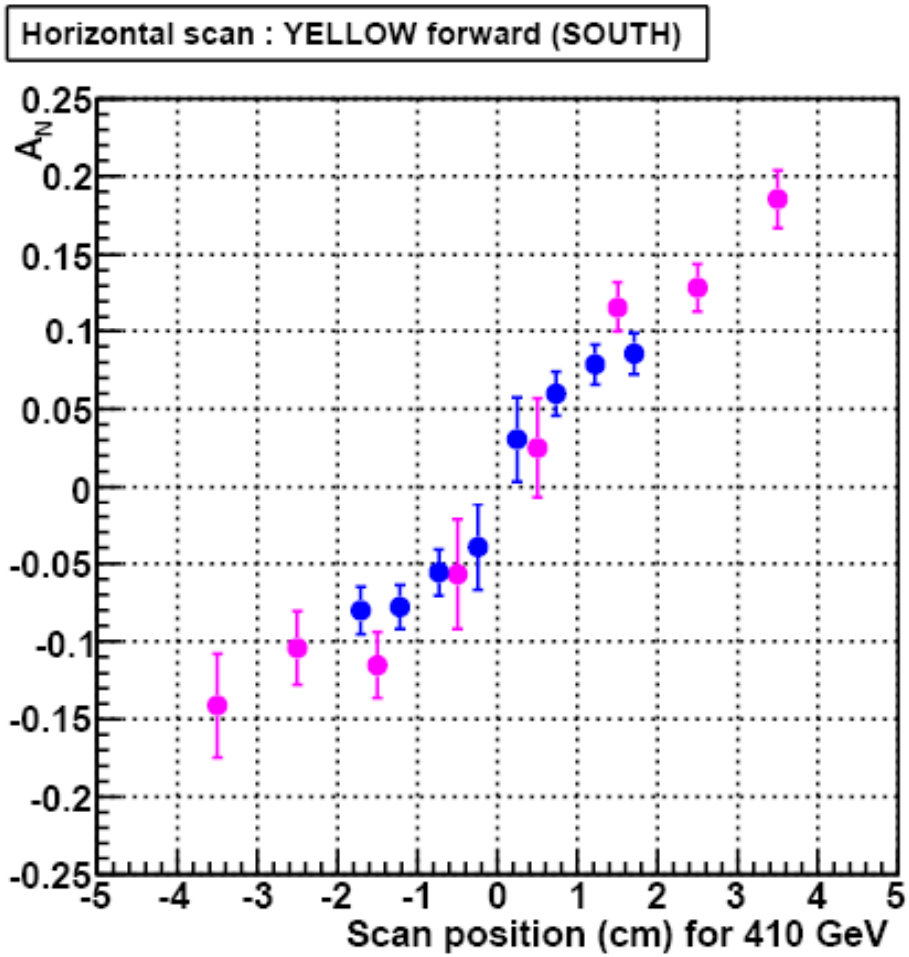




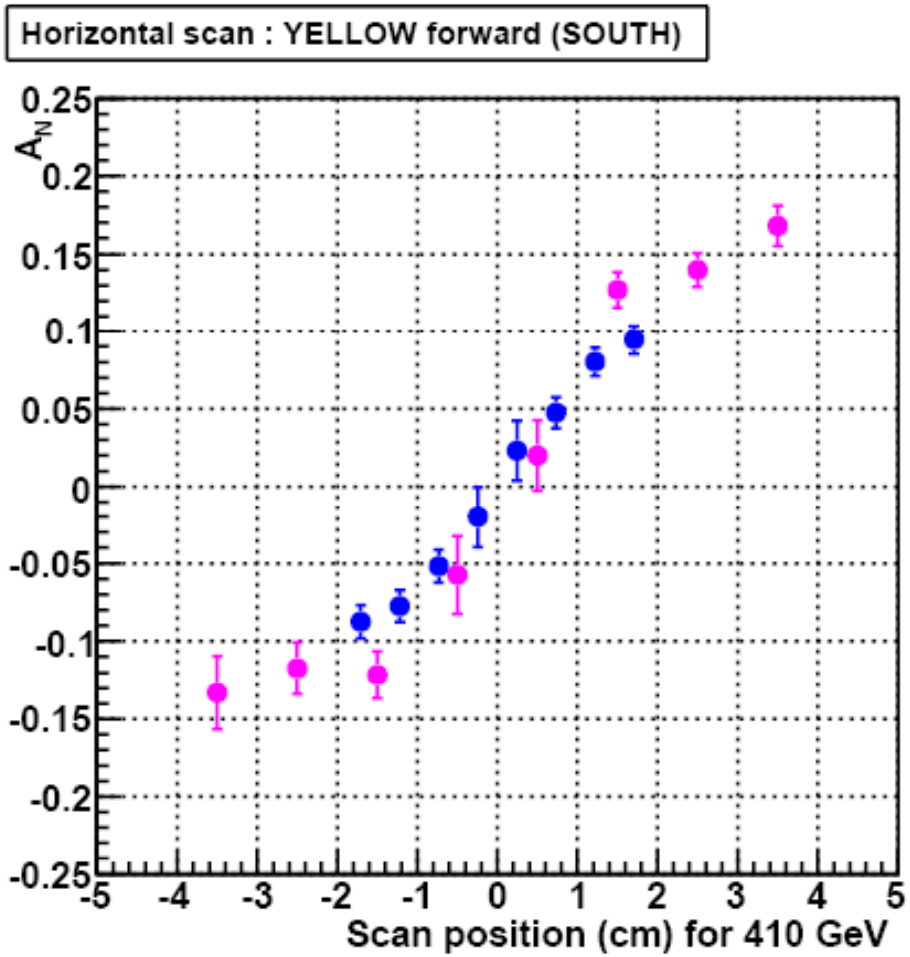
Magenta : 410 GeV
Blue : 200 GeV
(x axis is scaled by 410)
Red : 62.4 GeV
(x axis is scaled by 410)

Most inner part (2 bins) should be removed since it will be affected the dilution due to the position resolution. (~1 cm)

After correction with y cut (Center correction for y)



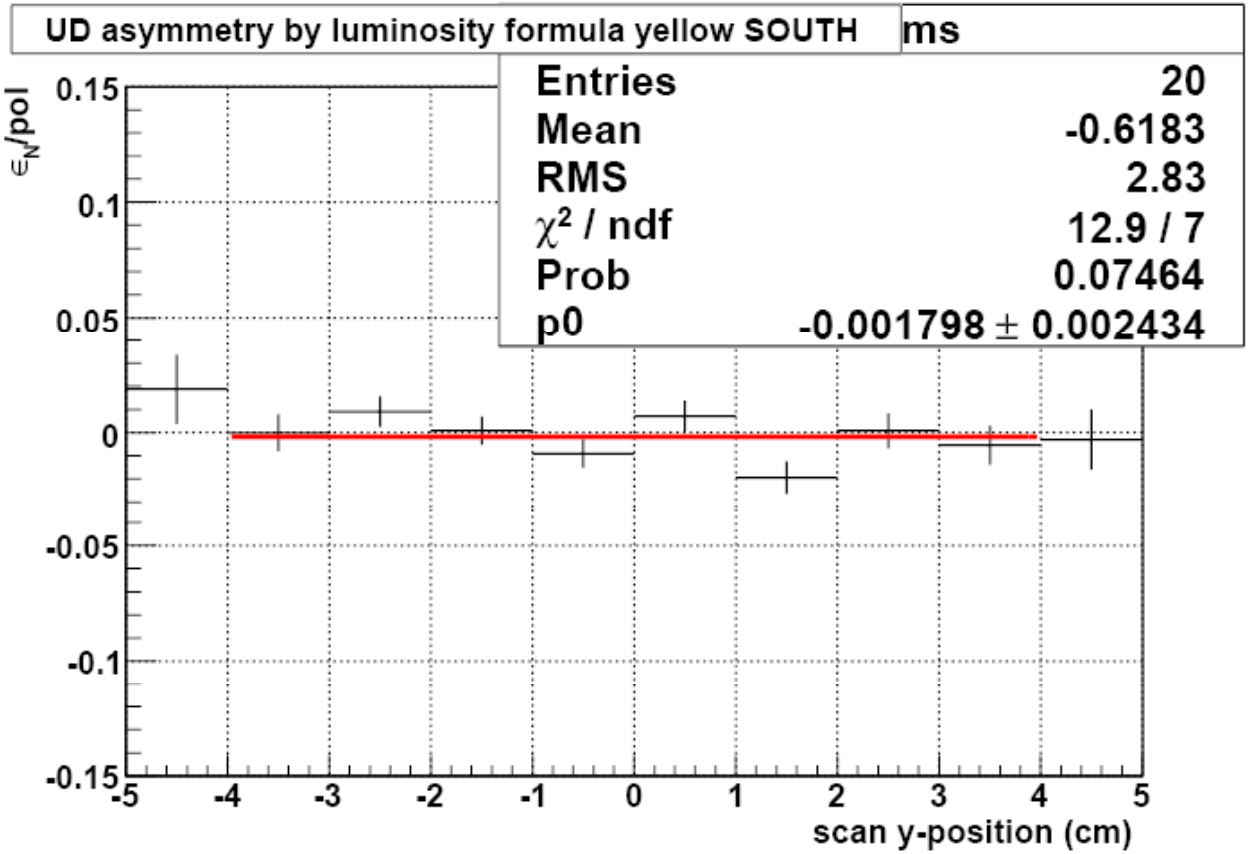
abs(y)<1



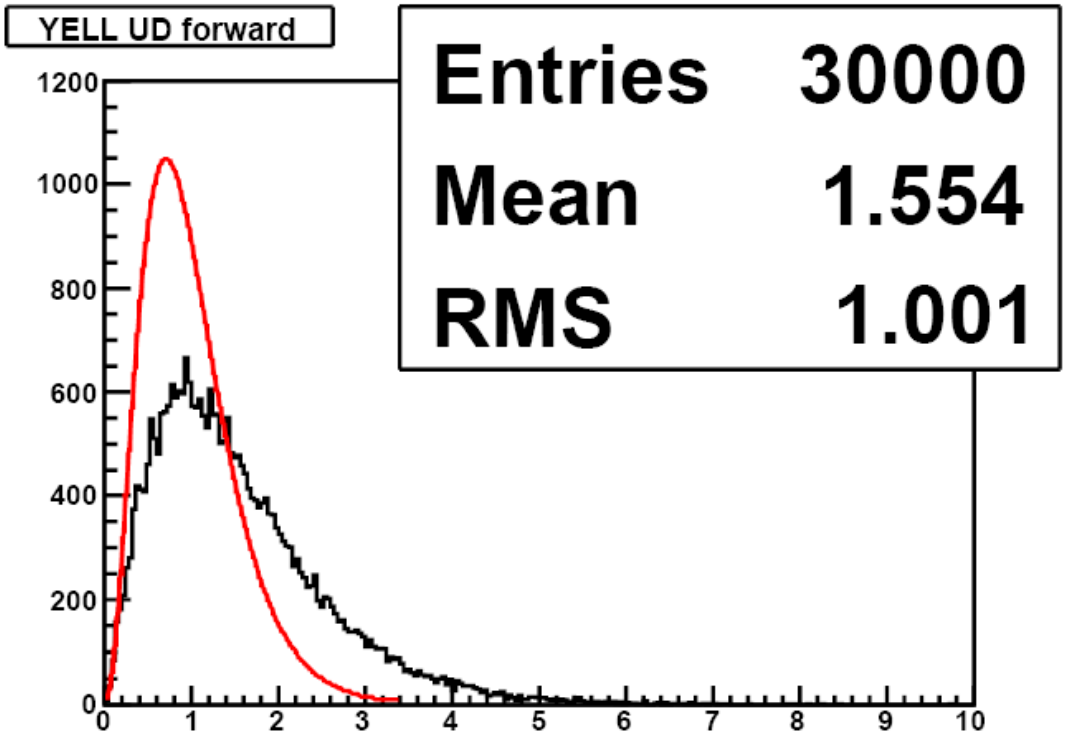
abs(y)<2

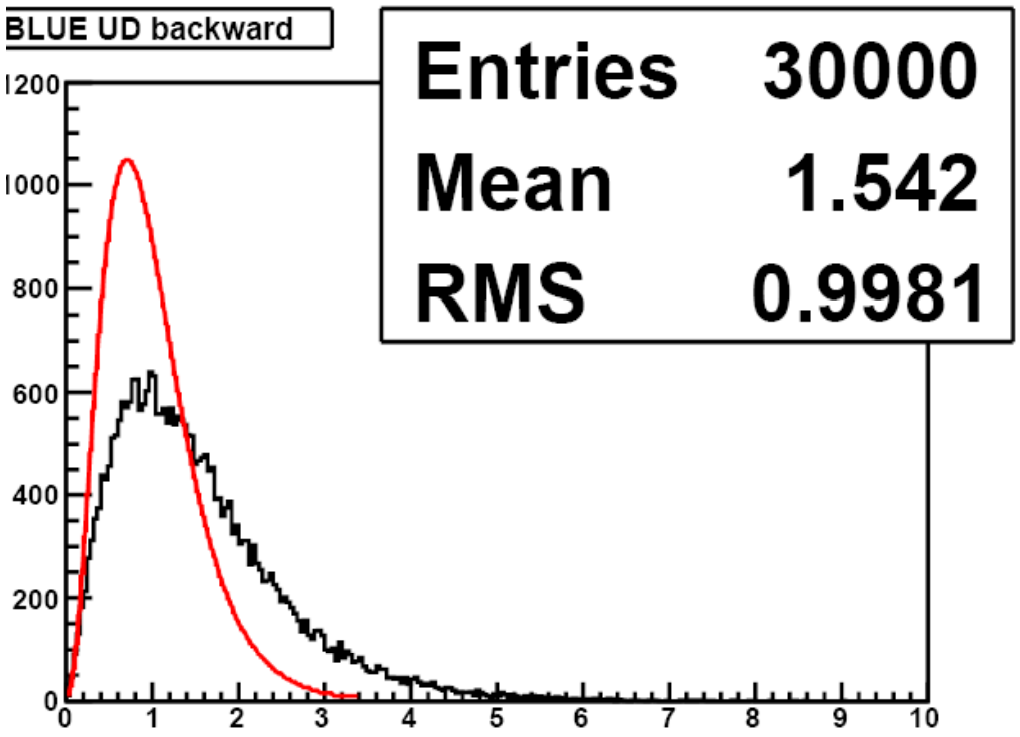
Bunch shuffling

- Use UD asymmetry.
- Fit -4 to 4 cm for shuffle result.
  - Mean : asymmetry after shuffle.



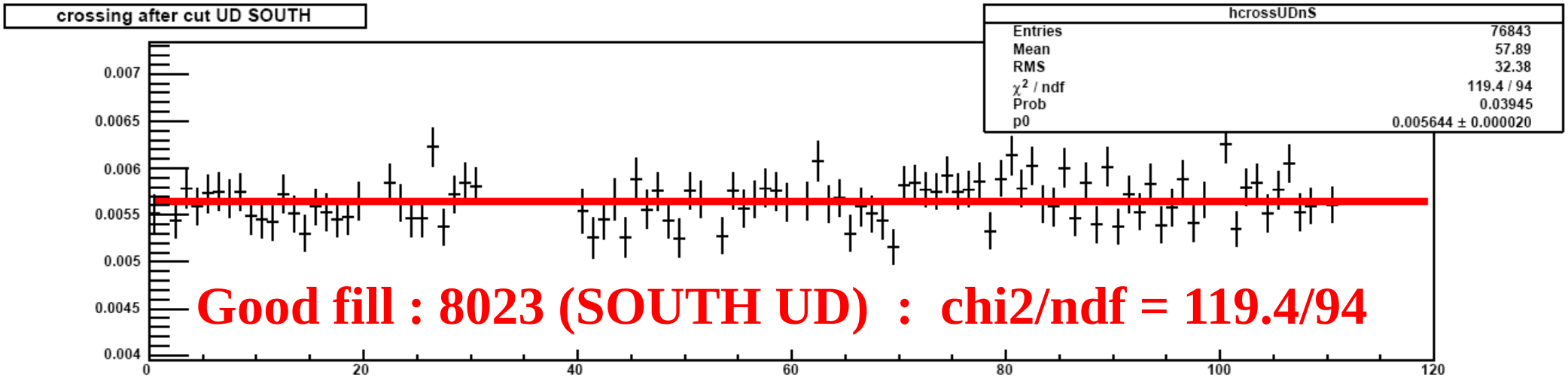
62 GeV (ZDCN|S)

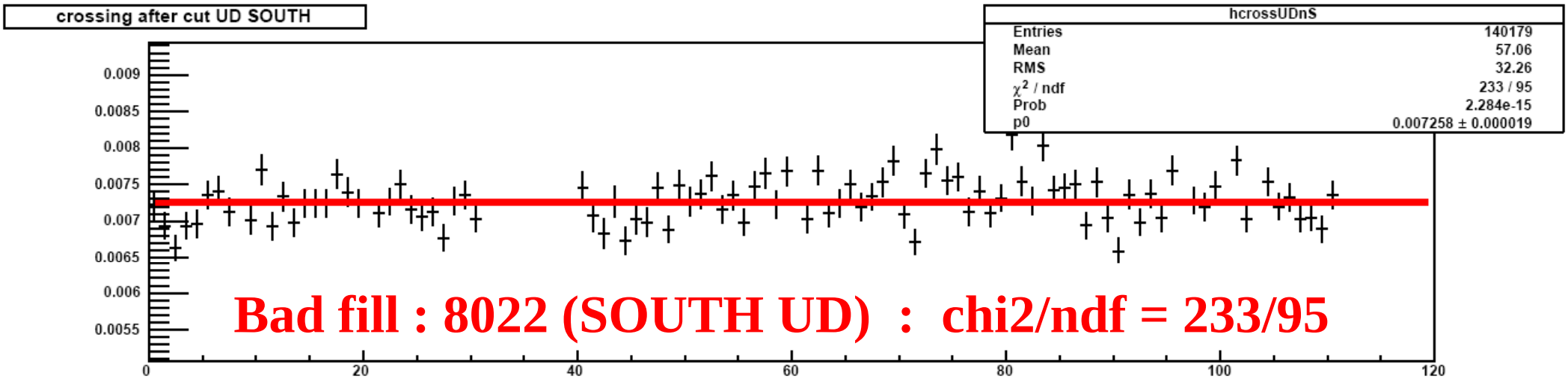




8 fills in total.
Not unit…

Neutron ID stability bunch by bunch





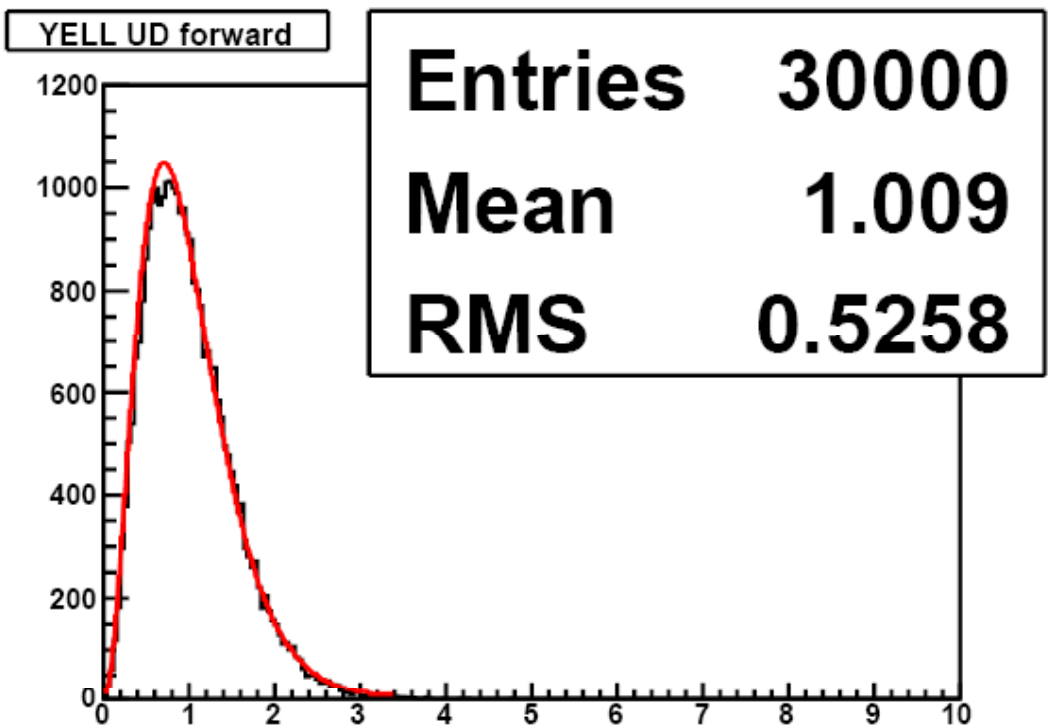
→BG level is unstable by bunch in some fill.

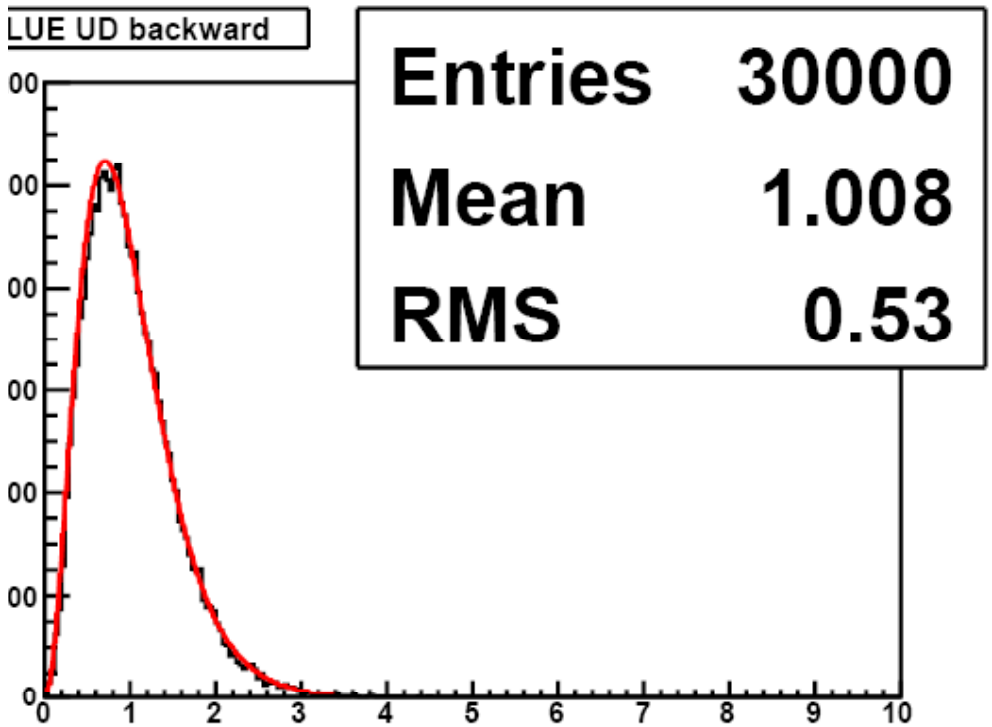
Chi2 list of neutron stability for transverse run (UD SOUTH case)

Fill#	Chi2/ndf
8005	0.795
8015	1.506
8016	1.463
8021	1.230
8022	2.452
8023	1.271
8024	1.665
8025	1.514

Error should be added by sqrt(chi2/ndf)*stat error

62 GeV (ZDCN|S) after adding noise





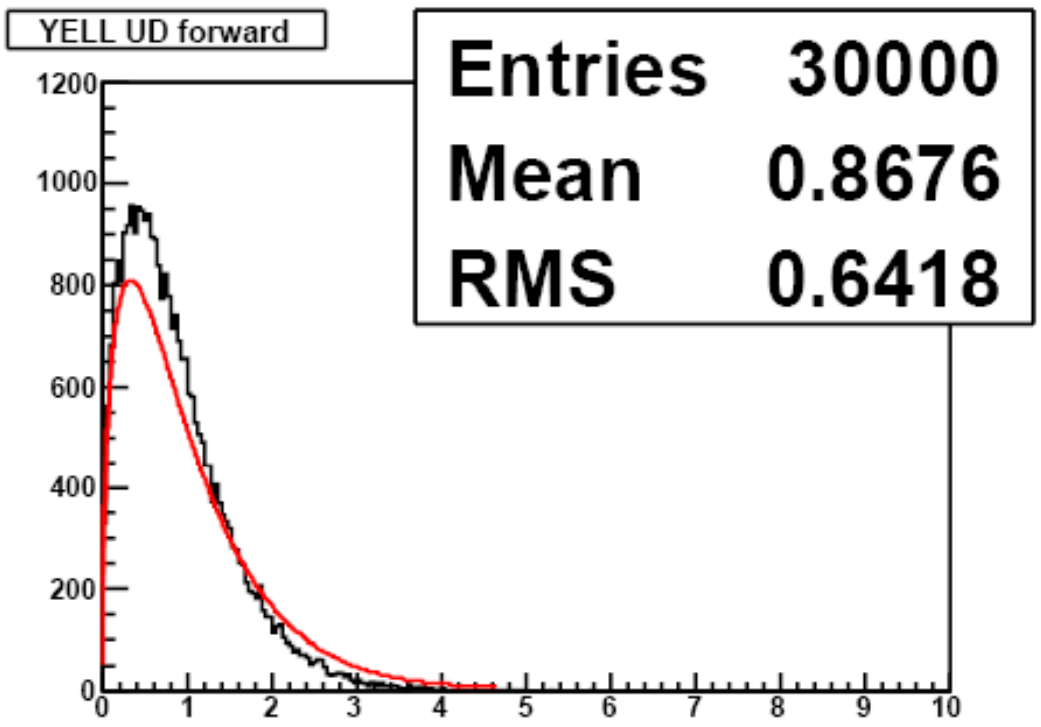
Almost unit…

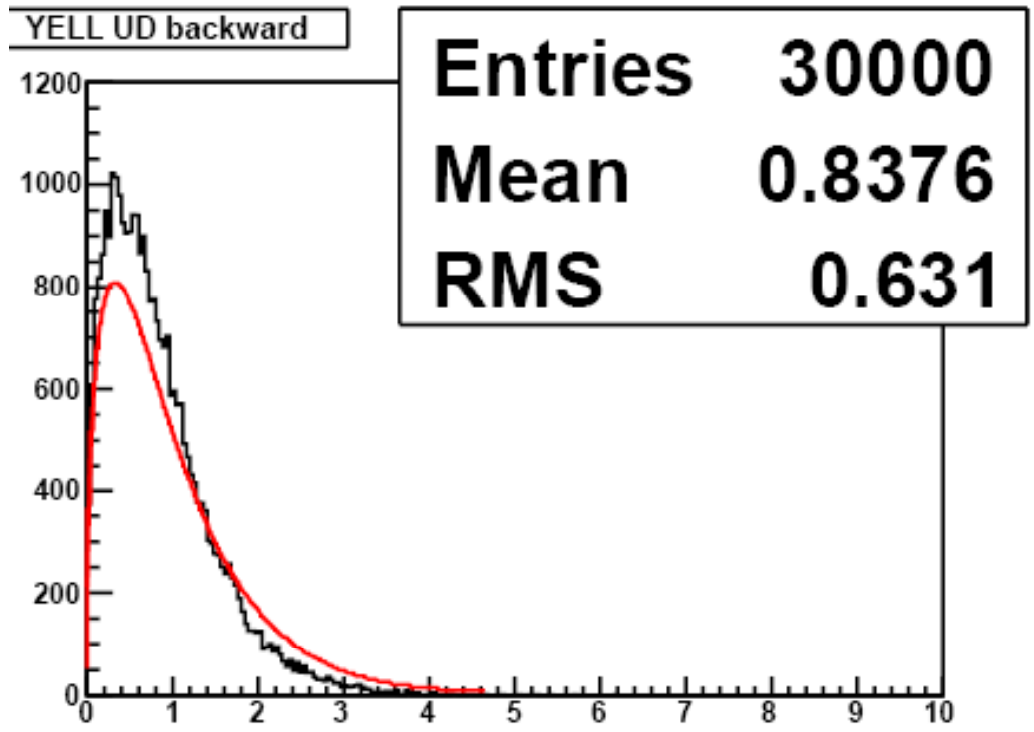
The reason is that BG is unstable bunch by bunch.

Errors be 2.09e-3 →2.58e-3.

Quadratic sub. as 1.51e-3 is added as systematic error

200 GeV LP trig.

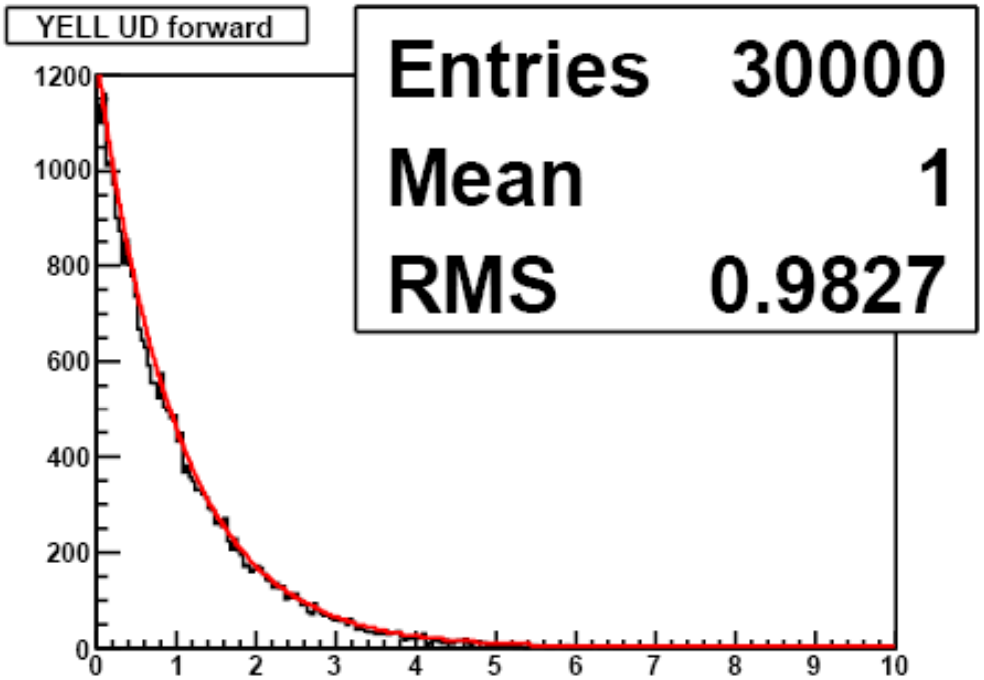


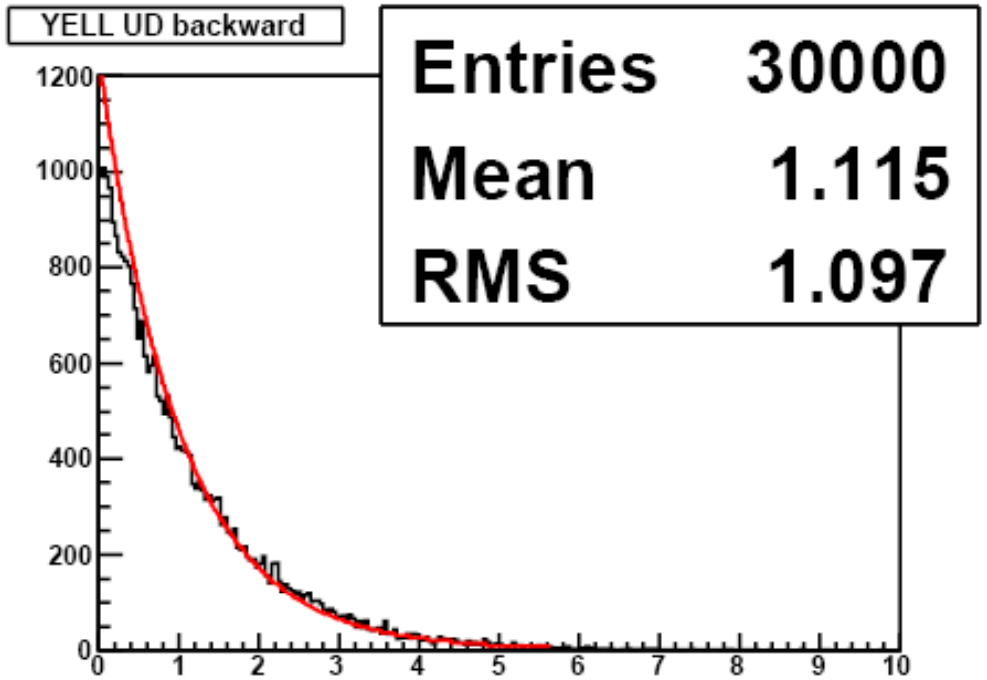


4 fills in total.

200 GeV ZDCN|S trig.

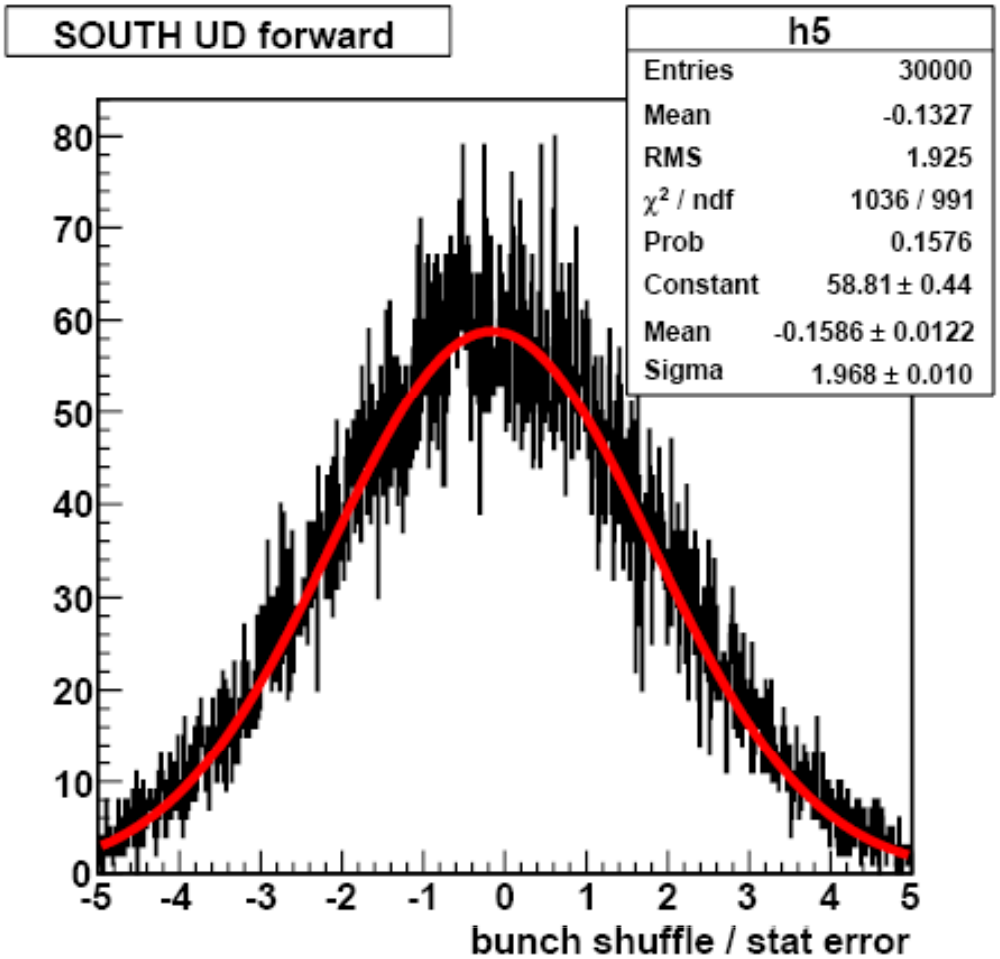
- l

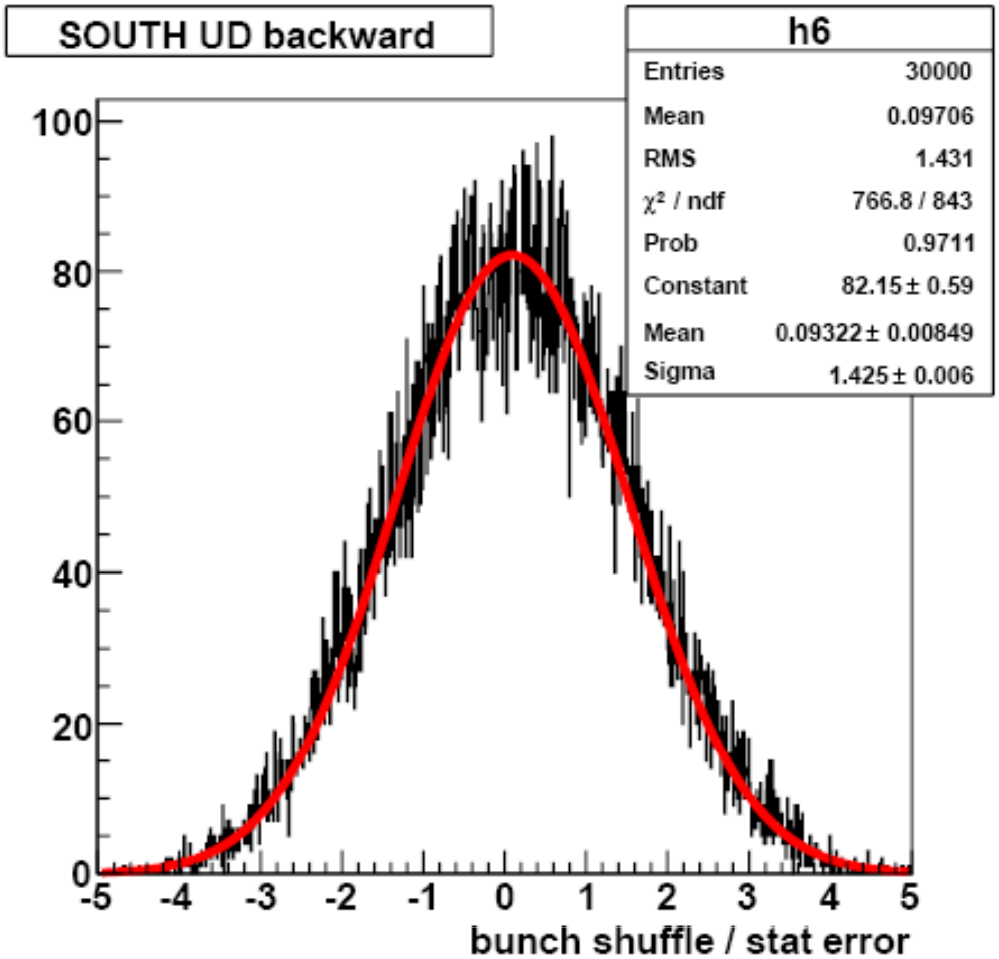




3 fills in total.

410 GeV LP trig.



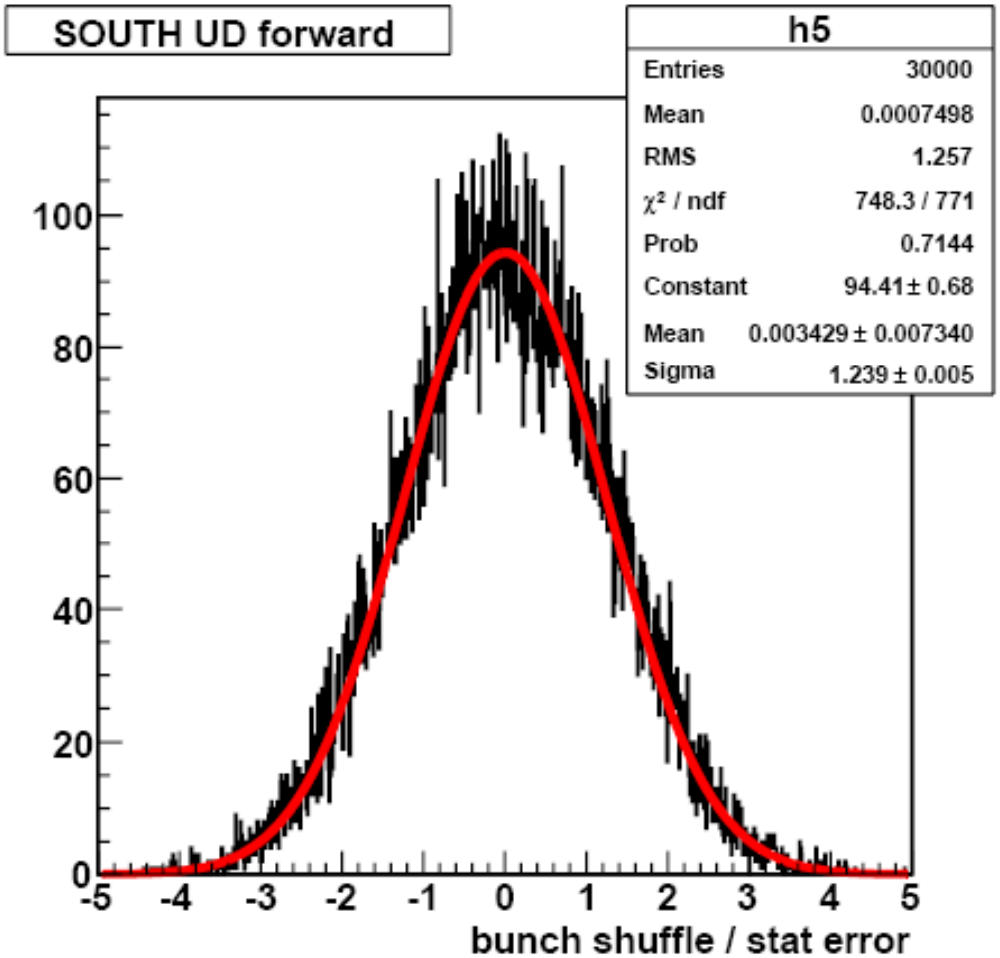


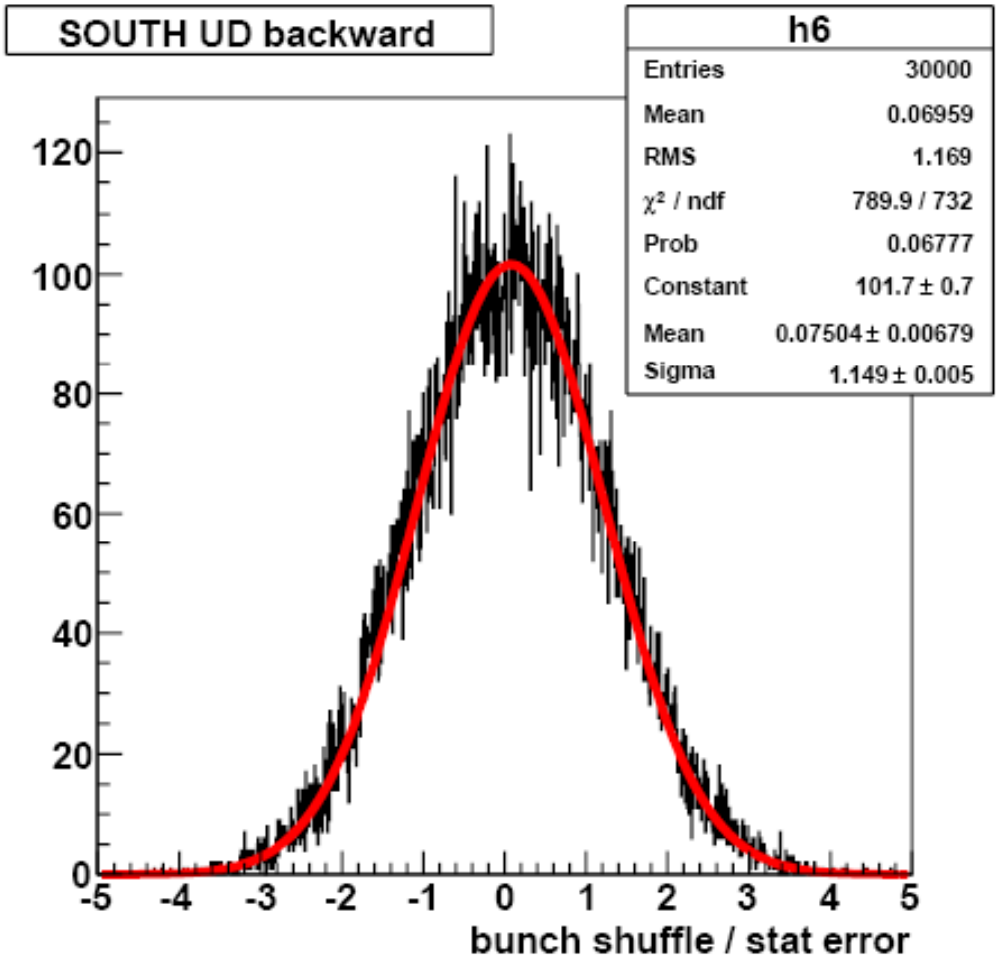
Just 1 fill.

Stat error (2.39e-3) should be 3.35e-3 (sqrt(1.968)).

Quadratic sub. as 2.35e-3 is added as systematic error.

410 GeV ZDCN|S trig.





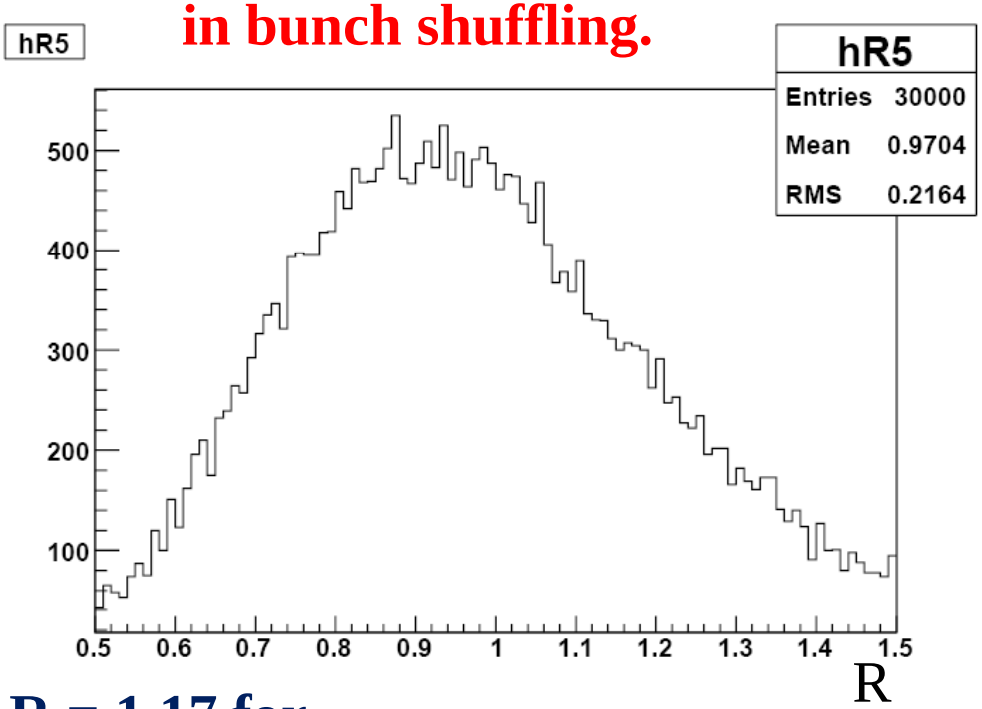
Just 1 fill.

Stat error (5.81e-3) should be 6.47e-3 (sqrt(1.239)).

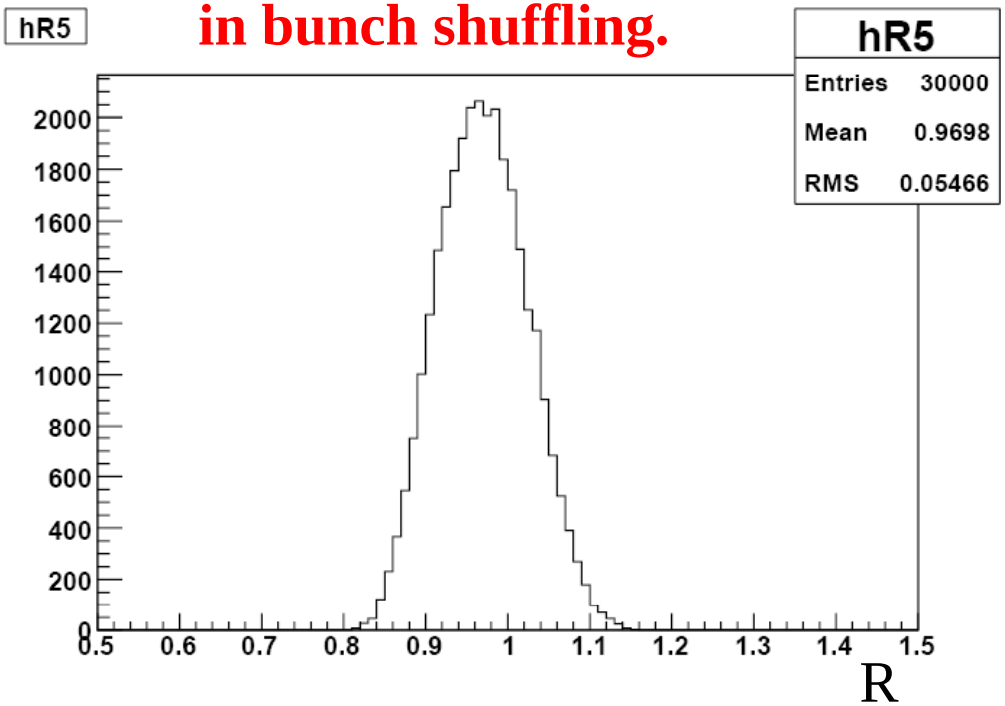
Quadratic sub. as 2.84e-3 is added as systematic error.

From relative luminosity?

410 GeV relalumi.
in bunch shuffling.

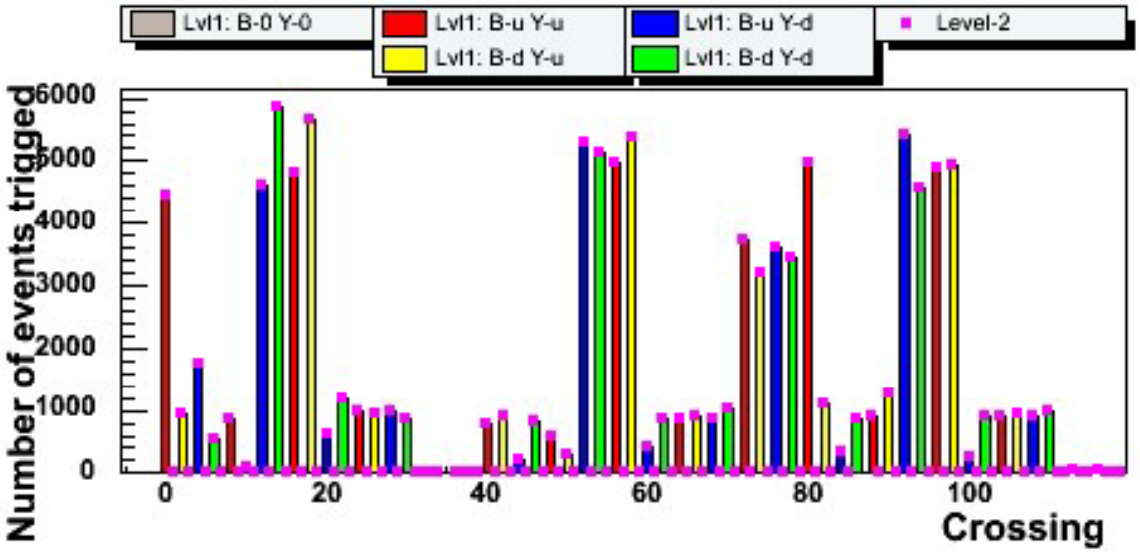


200 GeV relalumi.
in bunch shuffling.



R = 1.17 for
symmetry calclation

410 GeV



BG estimation from pythia

ZDCN|S

Sqrt{s} (GeV)	BG (proton) %	BG (Kaon) %	Multi hit %
62	16.6	0.5	0.5
200	1.6	1.0	6.7
410	0.2	1.3	18.5

BBCLL1&(ZDCN|S)

Sqrt{s} (GeV)	BG (proton) %	BG (Kaon) %	Multi hit %
200	1.2	1.0	6.0
410	0.3	1.4	18.0

For 200 GeV data, charged event of real data is 1.5 times higher than simulation. So, proton BG is increased times 1.5.
For 62 GeV data, fraction of charged event for **real** and **simulation** are **63%** and **69%**, respectively. They are roughly consistent.

Summary of systematics

Scaling error	ZDCN|S (%)			BBCLL1&(ZDCN|S) (%)	
Sqrt(s) (GeV)	62	200	410	200	410
Beam gas	2	<1	-		
Proton BG	16.6	2.4	<1	1.6	<1
Polarization	9.4	6.2	???	9.4	???
Total					

Offset error	ZDCN|S (A_N)			BBCLL1&(ZDCN|S) (A_N)	
Sqrt(s) (GeV)	62	200	410	200	410
Center correction	0.00072	0.0099	0.012	0.012	0.025

Correlated error	ZDCN|S (% of stat. error)			BBCLL1&(ZDCN|S) (% of stat. error)	
Sqrt(s) (GeV)	62	200	410	200	410
Bunch shuffling	72.2	-	98.3	-	48.9