# Run15 pp Achievement and pAu status

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RIKEN/RBRC

# Run 15 plan based on 22 weeks cryo operation
## with 10 day extension of the 100 GeV pp run

- 20 Jan, Begin cool-down to 4.5K
- 21 Jan (morning), Blue cold
- 22 Jan (evening), Yellow cold
- 23 Jan (after midnight), Beam in Blue
- 7 Feb, First overnight stores for experiments
- 10 Feb (3 days early) store 18662, Begin 9 week **√s=200 GeV pp** physics run

- 14-17 Mar, Power Dip downtime

- 27 April (Mon, 0700), End 10.9 week √s=200 GeV pp physics run

- ~~8~~ **4** May (~~Fri~~ **Mon**), ***[4 days early, store 19020]***
  Begin 5 week **√s=200 GeV/n pAu** physics run

***today, 12 May…***

- ~~12~~ **8** June (~~Fri~~ **Mon**), End 5 week √s=200 GeV/n pAu physics run

- ~~15~~ **11** June (~~Mon~~ **Thu**), Begin 2 week **√s=200 GeV/n pAl** physics run
- 19 June (Fri), End **8 day (???)** √s=200 GeV/n pAl physics run

- 19 June (Fri), begin cryo warm-up
- 23 June, cryo warm-up complete, ***22.0 cryo weeks*** of operation

See http://www.rhichome.bnl.gov/AP/Spin2015/ for the Run Coordinator's detailed plan

http://www.bnl.gov/cad/esfd

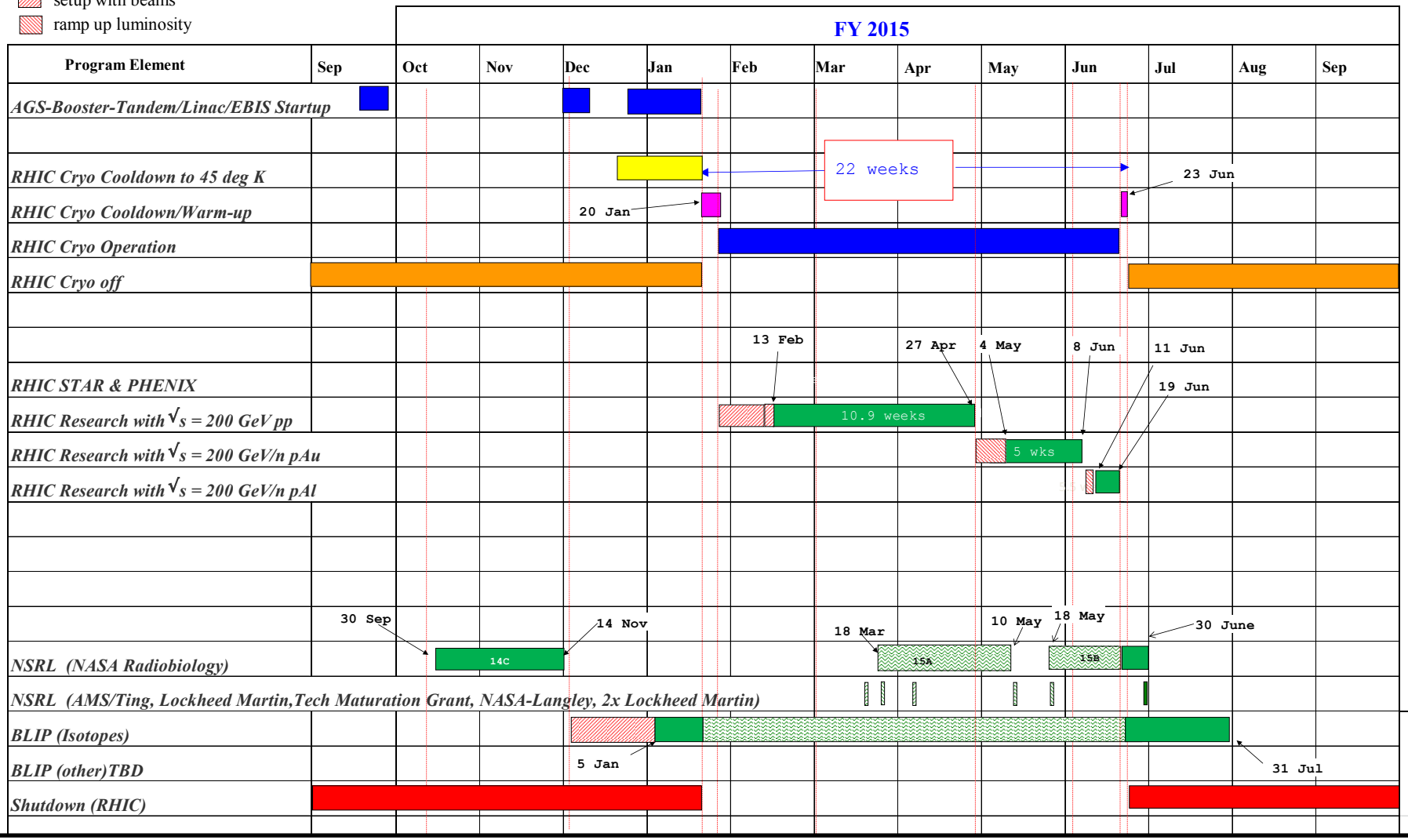
Scheduling Physicist: Makdisi/Pile

# C-A Operations-FY15

7 May 15

*as run,planned*

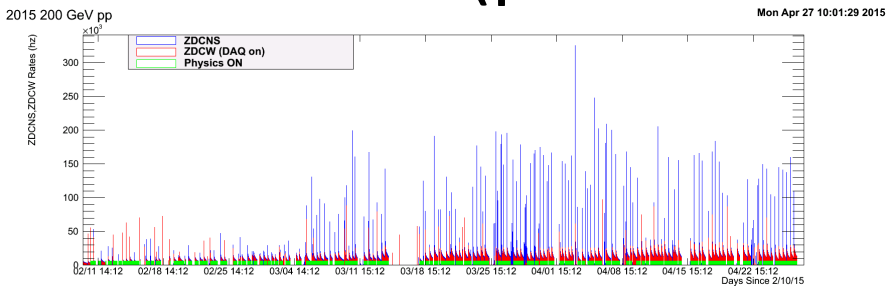
concurrent with RHIC
setup with beams
ramp up luminosity

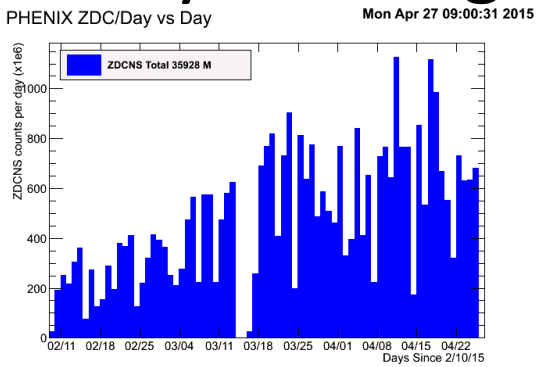


# PP ACHIEVEMENT

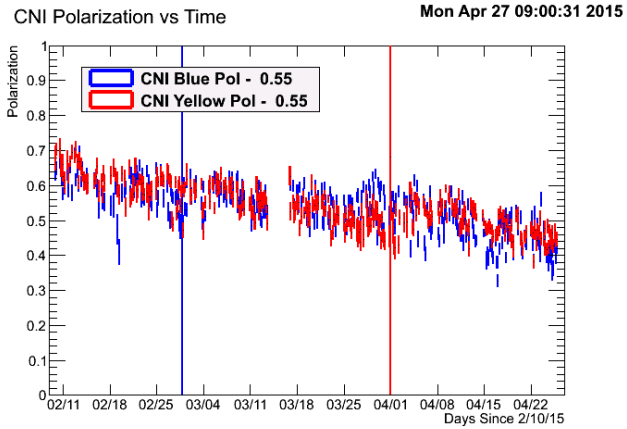
# p+p Overview

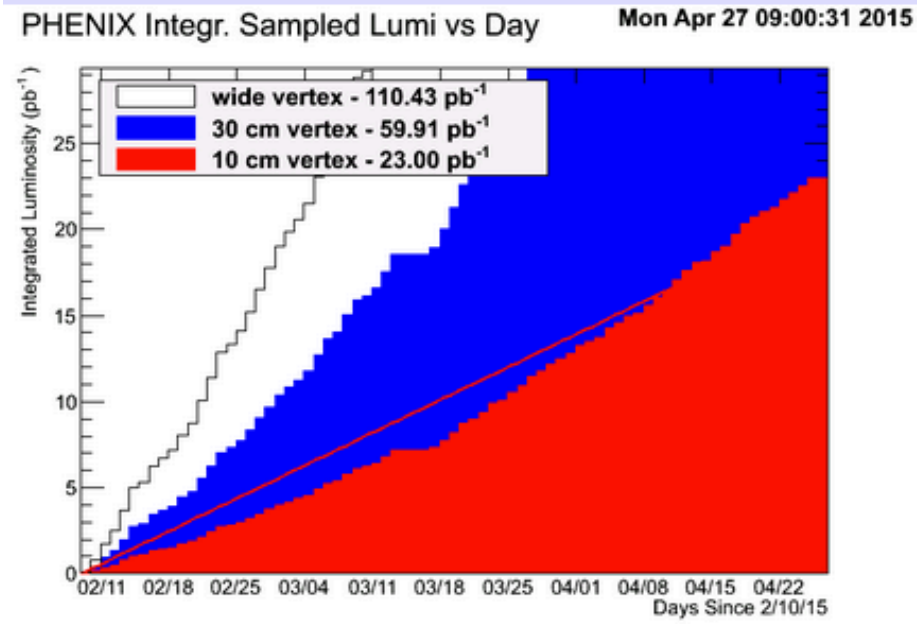
- RHIC run went somewhat smoothly with a gap in the middle (power fault).

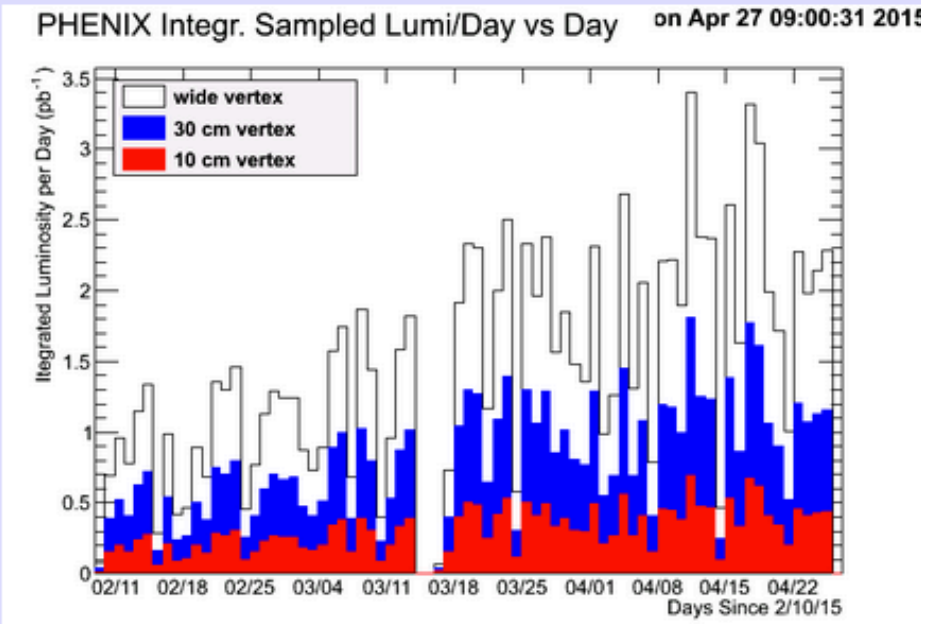


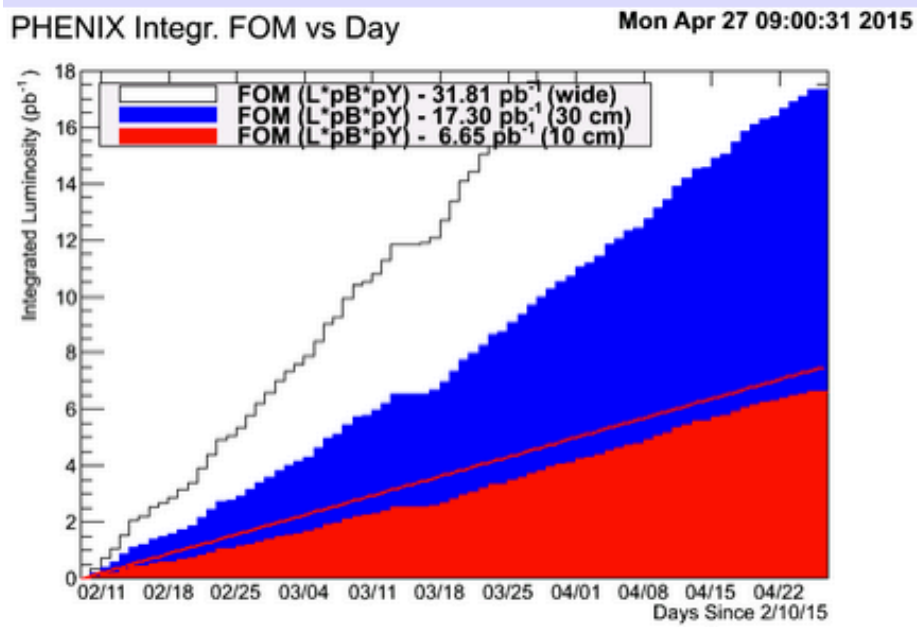



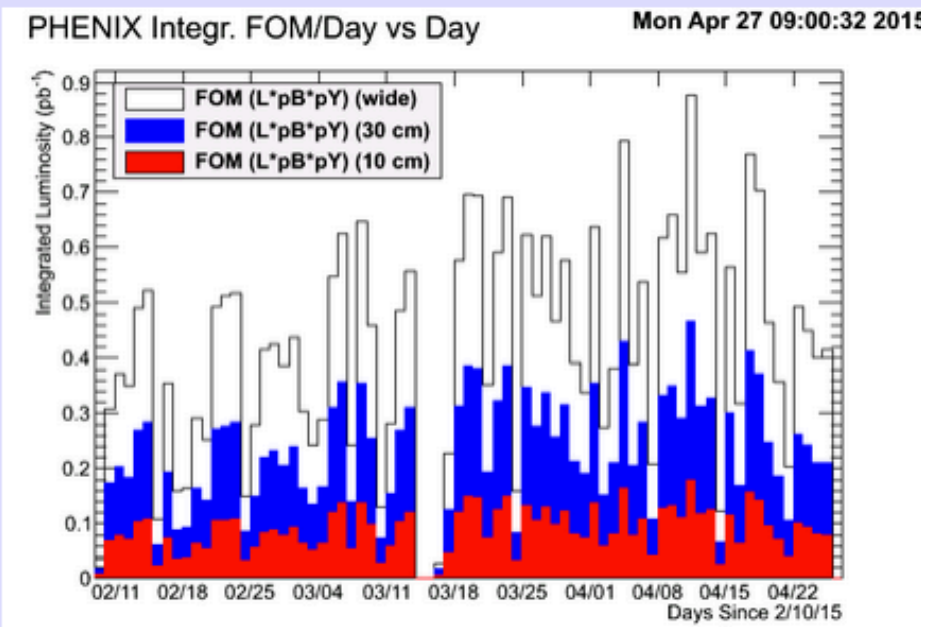

- But polarization got steadily worse



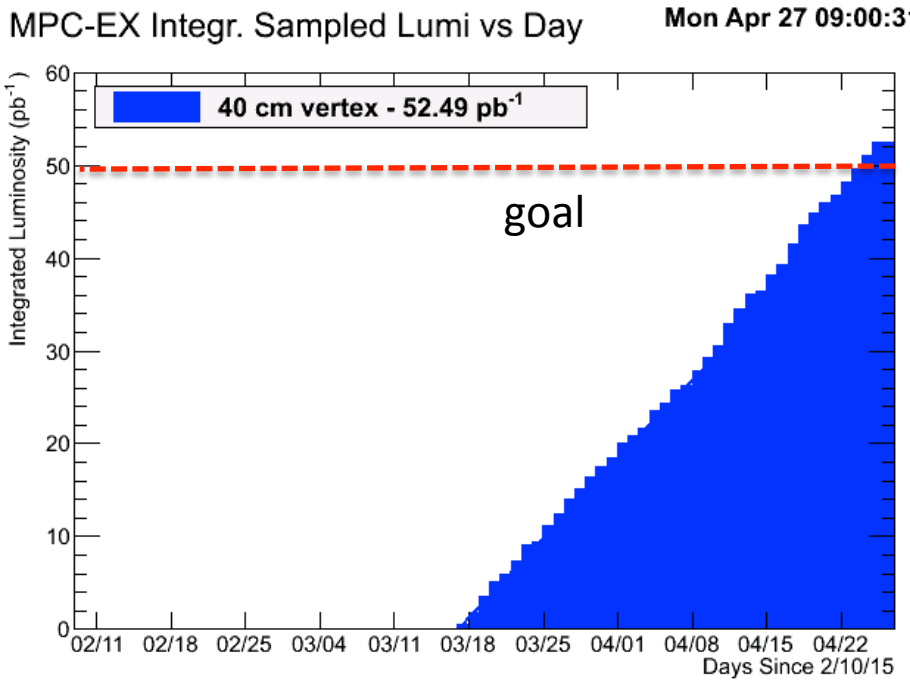

PHENIX Integr. Sampled Lumi vs Day
Mon Apr 27 09:00:31 2015
wide vertex - 110.43 pb-1
30 cm vertex - 59.91 pb-1
10 cm vertex - 23.00 pb-1
Integrated Luminosity (pb-1)
Days Since 2/10/15

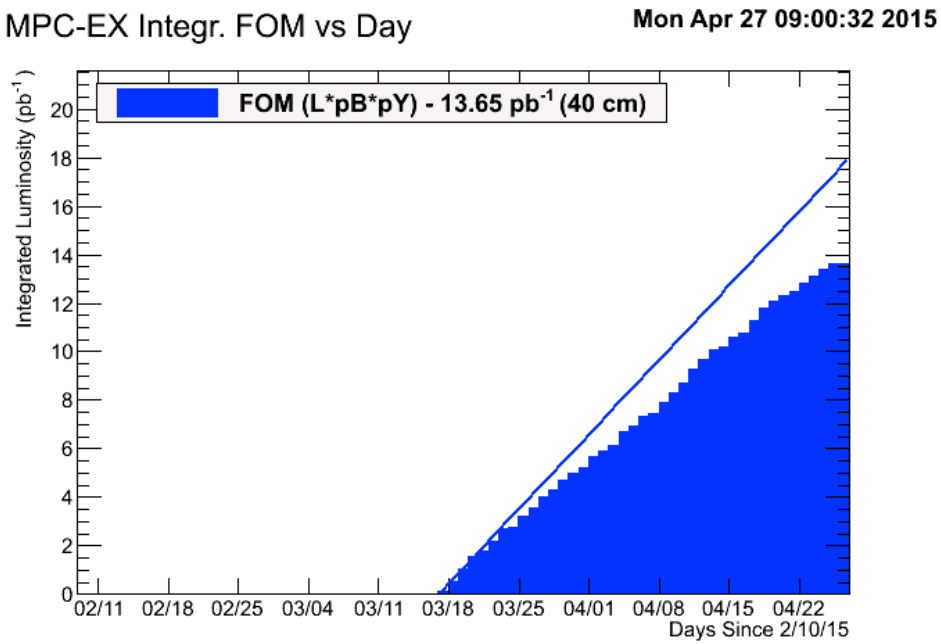

PHENIX Integr. Sampled Lumi/Day vs Day
on Apr 27 09:00:31 2015
wide vertex
30 cm vertex
10 cm vertex
Itegrated Luminosity per Day (pb-1)
Days Since 2/10/15


PHENIX Integr. FOM vs Day
Mon Apr 27 09:00:31 2015
FOM (L*pB*pY) - 31.81 pb-1 (wide)
FOM (L*pB*pY) - 17.30 pb-1 (30 cm)
FOM (L*pB*pY) - 6.65 pb-1 (10 cm)
Integrated Luminosity (pb-1)
Days Since 2/10/15

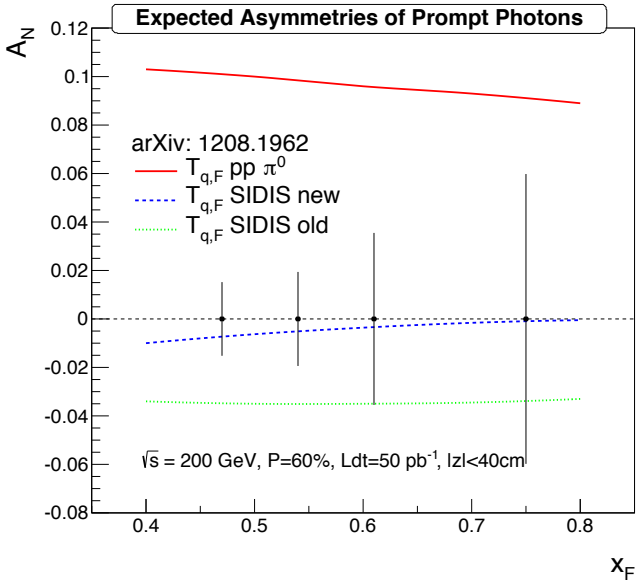

PHENIX Integr. FOM/Day vs Day
Mon Apr 27 09:00:32 2015
FOM (L*pB*pY) (wide)
FOM (L*pB*pY) (30 cm)
FOM (L*pB*pY) (10 cm)
Integrated Luminosity (pb-1)
Days Since 2/10/15

# MPC-Ex Integrated Luminosity Goal

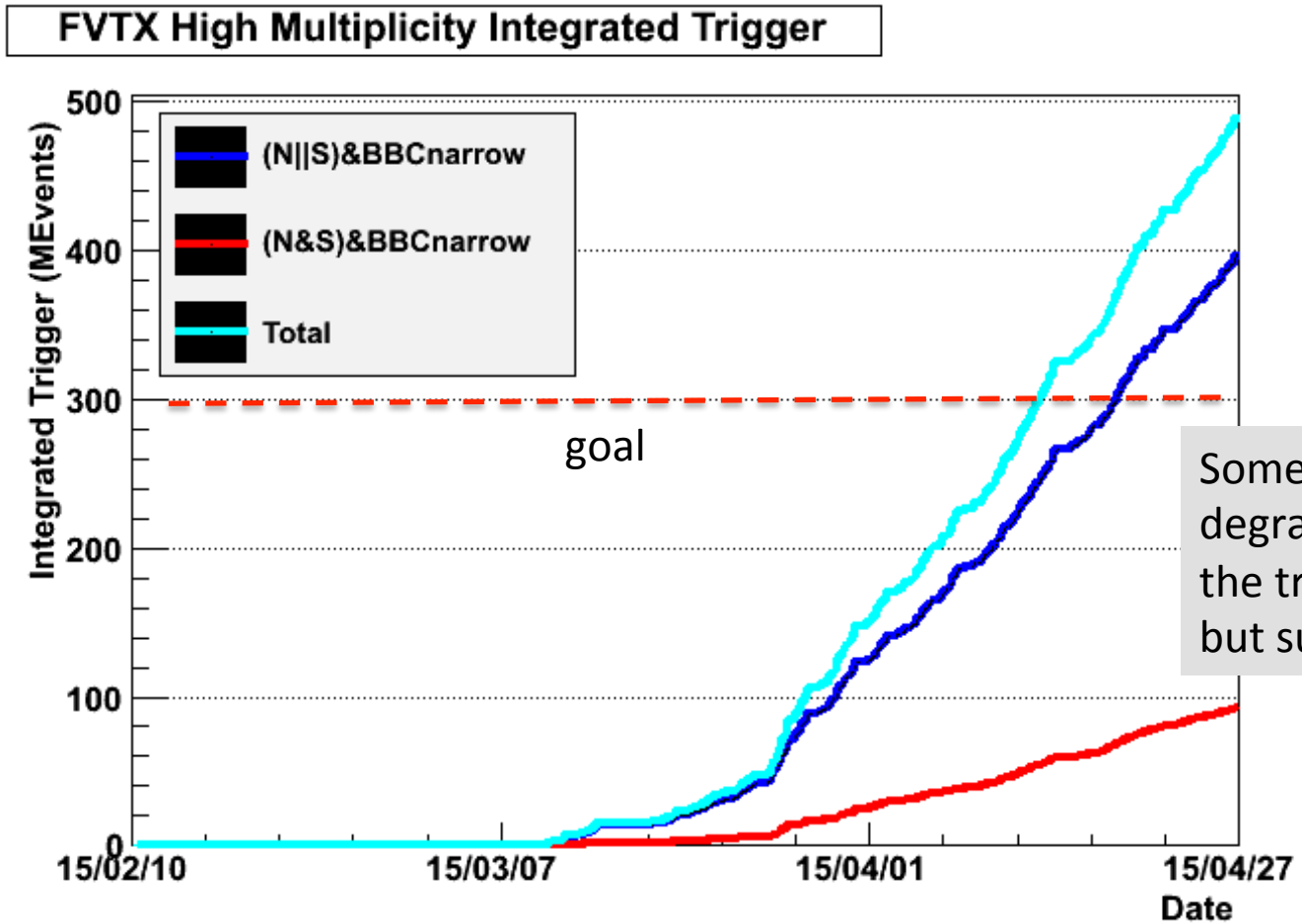



Luminosity wise, we achieved the goal while the achievement is 77% for FOM



# FVTX High Multiplicity Trigger




Some loss due to the degraded performance of the trigger than assumed, but successful in gerenal.

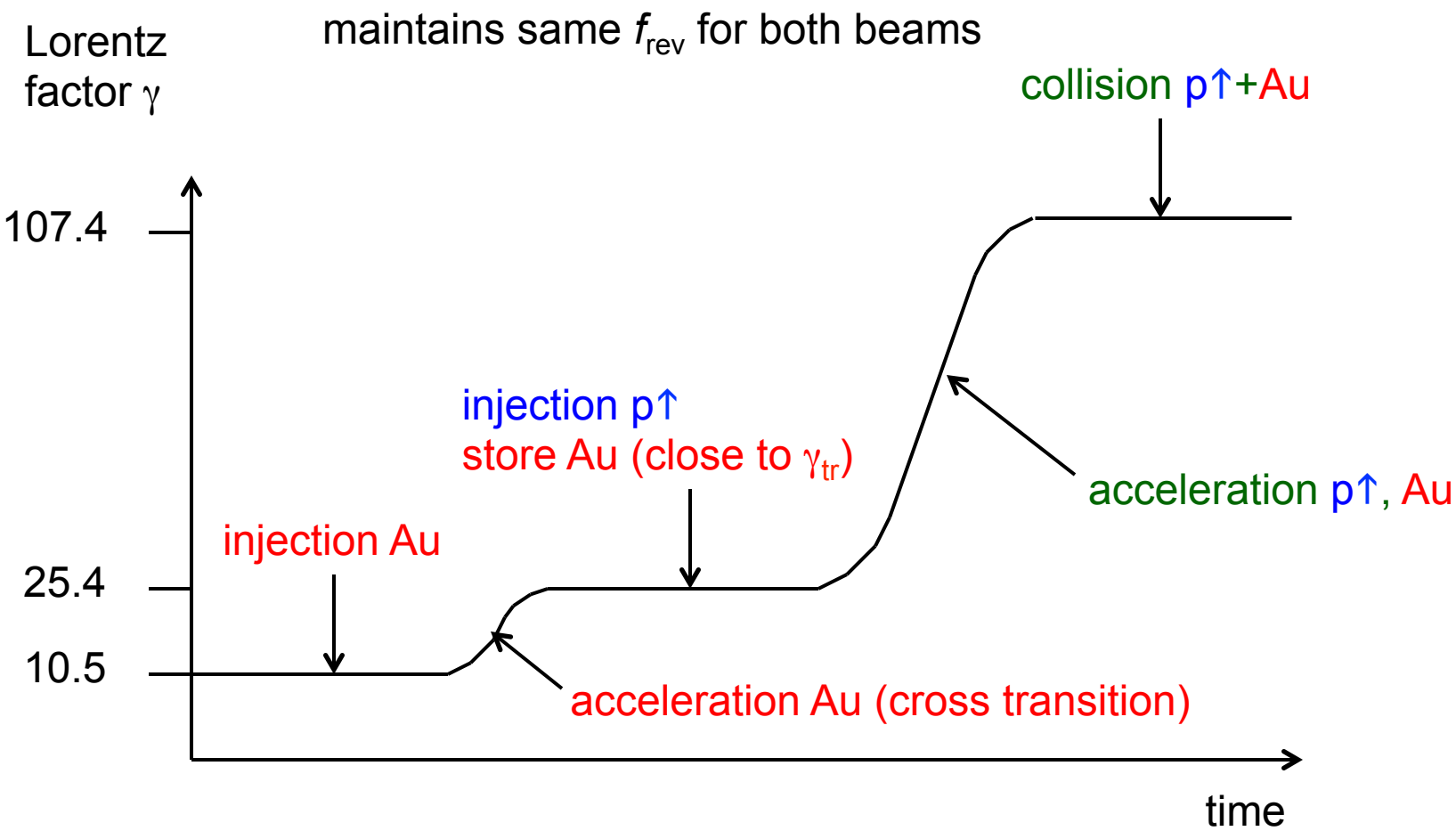
Challenges:

New Ramp Design

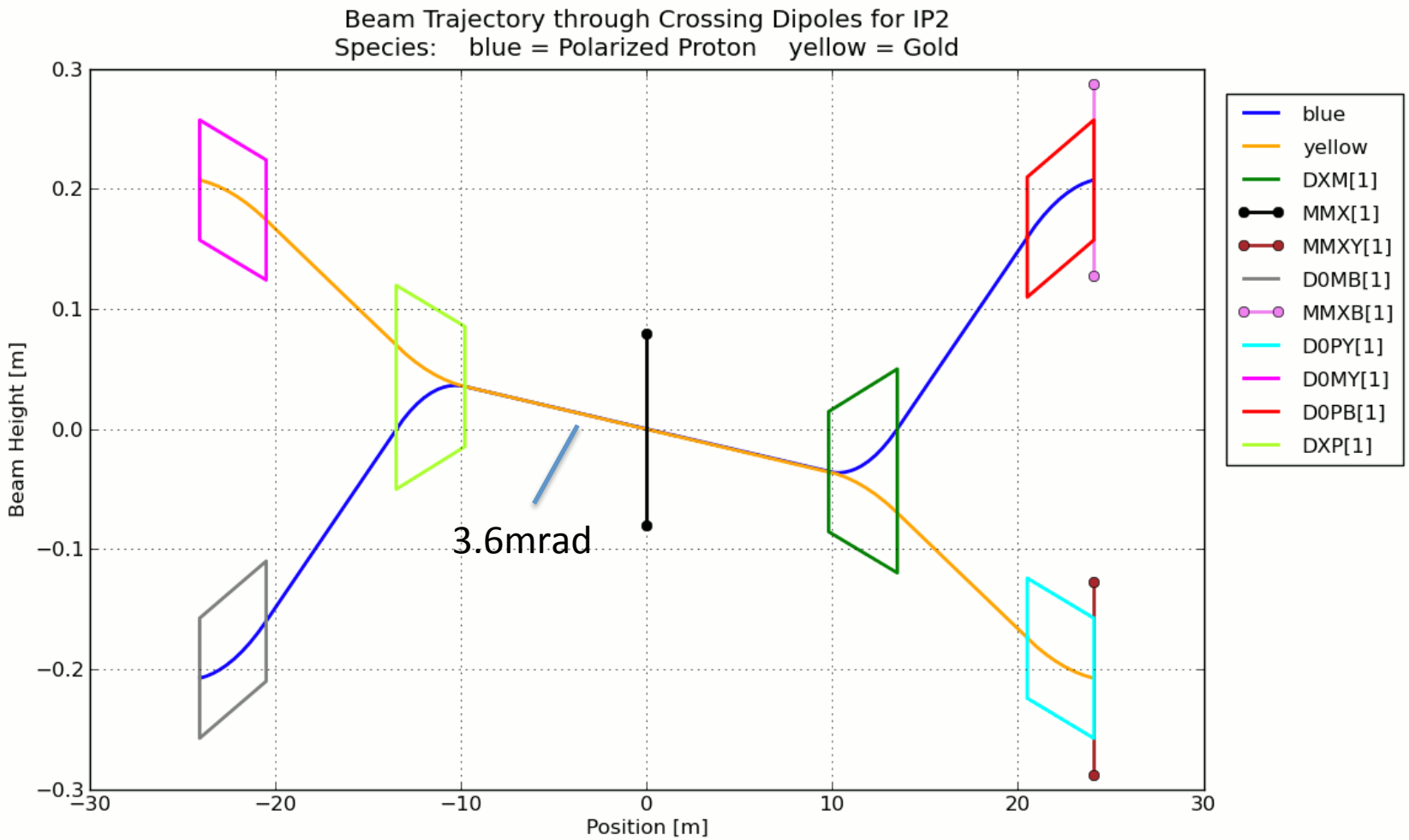
Beam Aperture limit

# RHIC STATUS

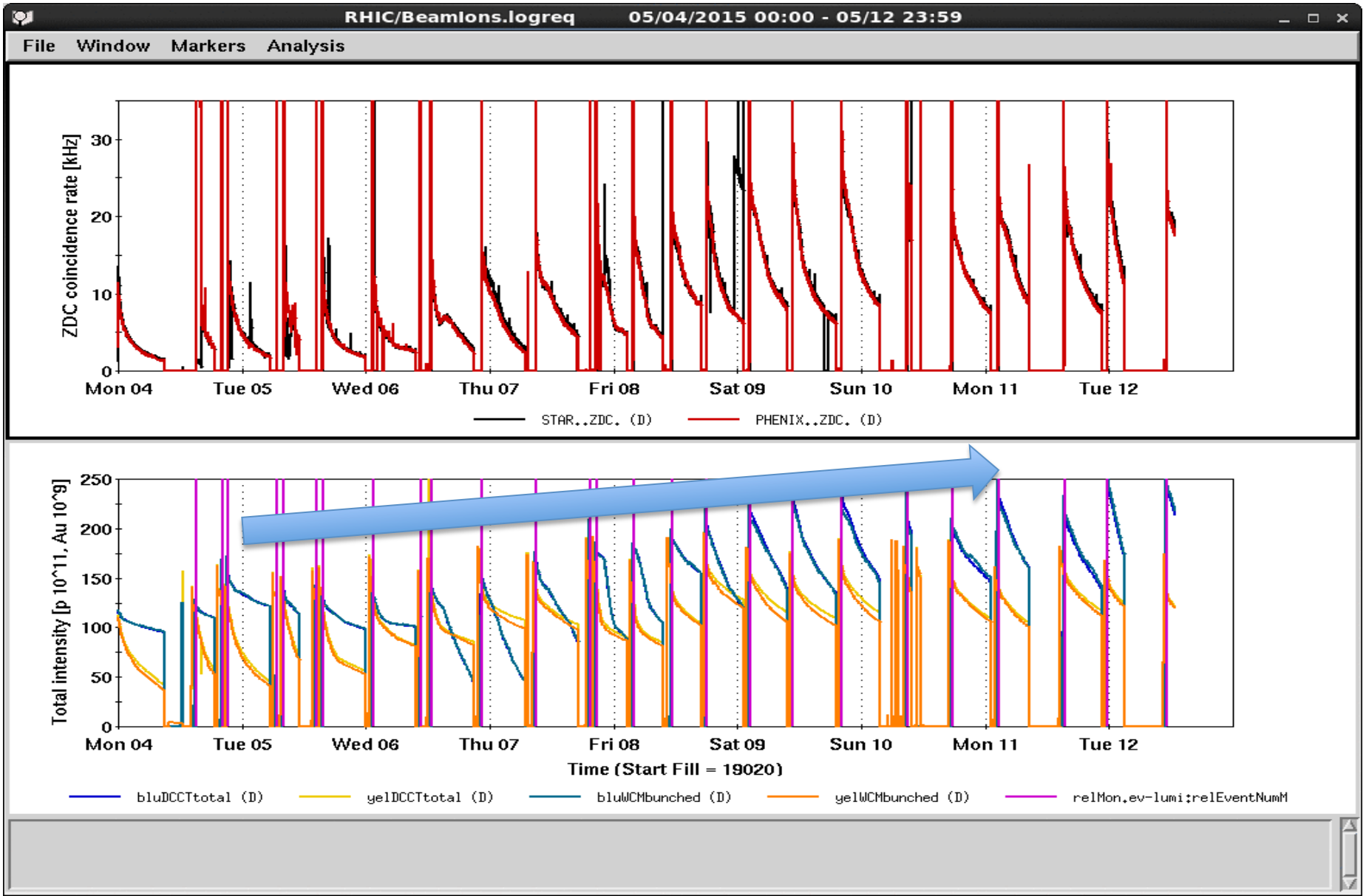
# Unique Ramp design for pAu



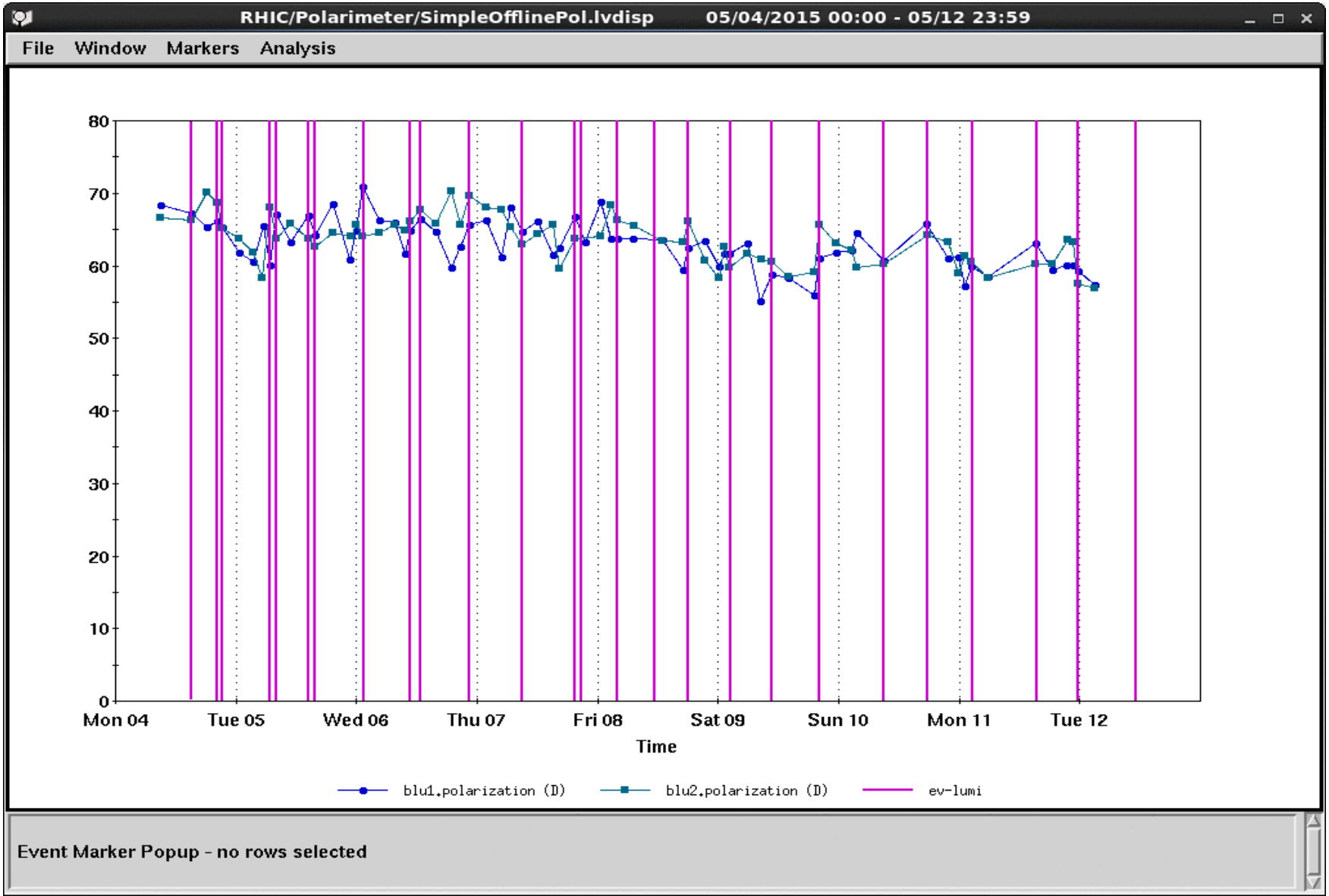
# Beam Angle at IR



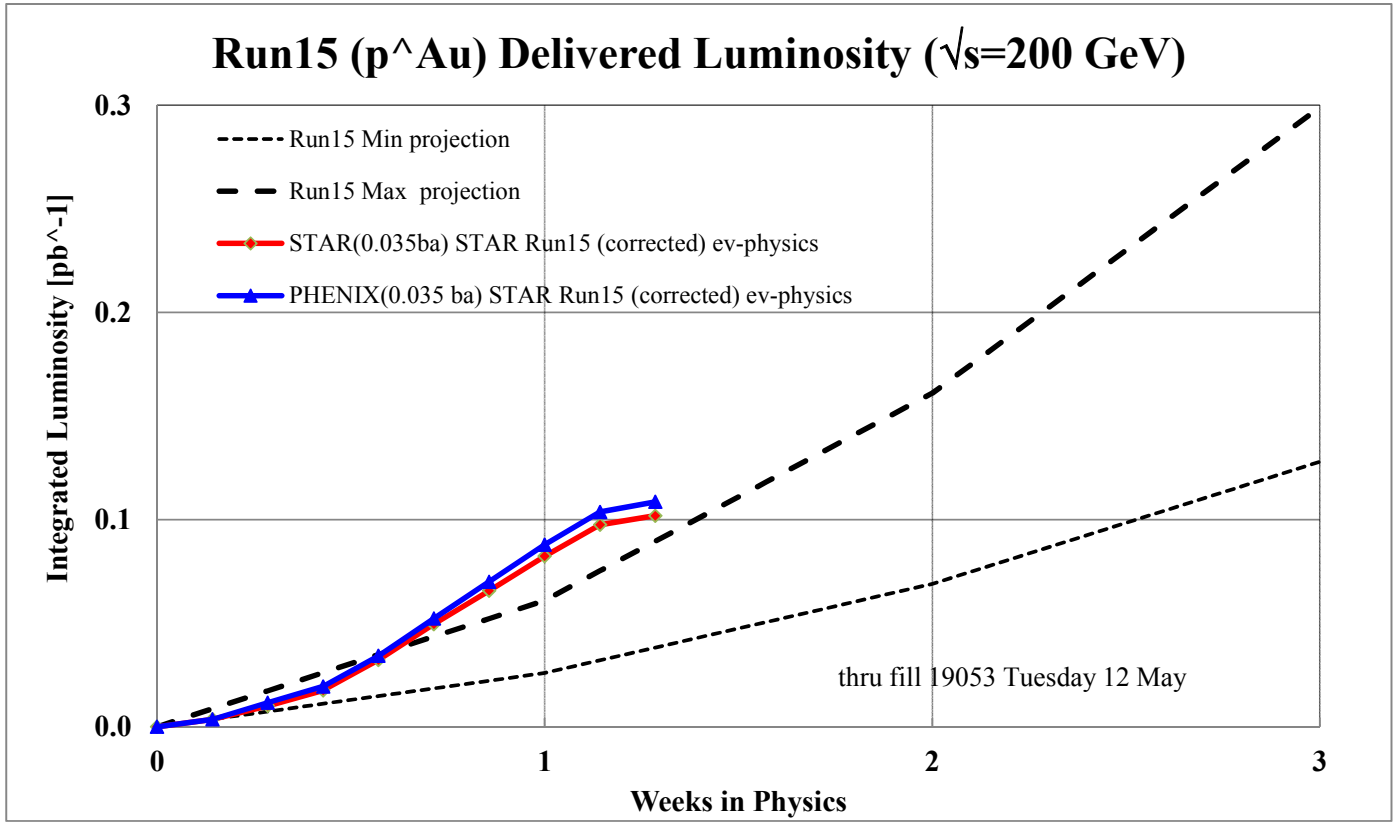
# Collision rate



# Polarization



# Luminosity


Run15 (p^Au) Delivered Luminosity (√s=200 GeV)
Run15 Min projection
Run15 Max projection
STAR(0.035ba) STAR Run15 (corrected) ev-physics
PHENIX(0.035 ba) STAR Run15 (corrected) ev-physics
thru fill 19053 Tuesday 12 May
Integrated Luminosity [pb^-1]
0.3
0.2
0.1
0.0
0
1
2
3
Weeks in Physics

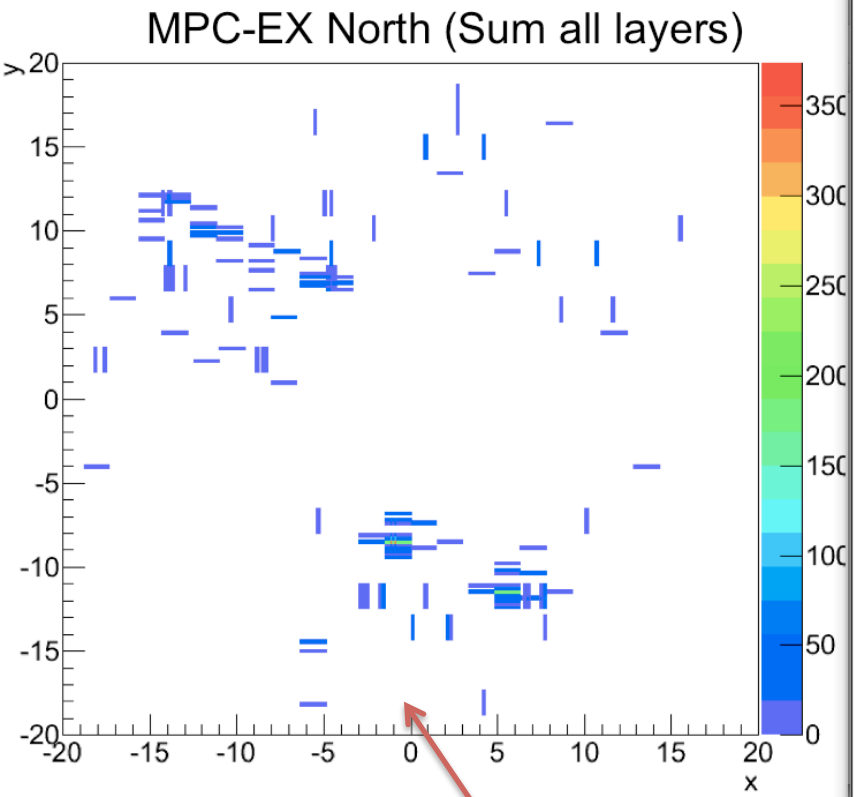
# PHENIX

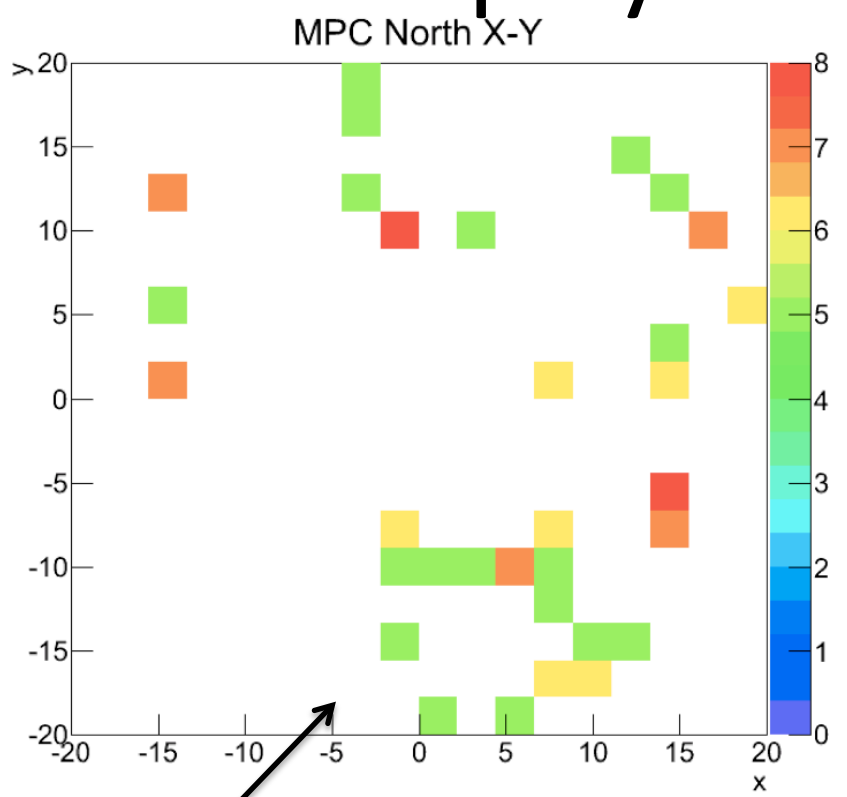
# MPC-EX

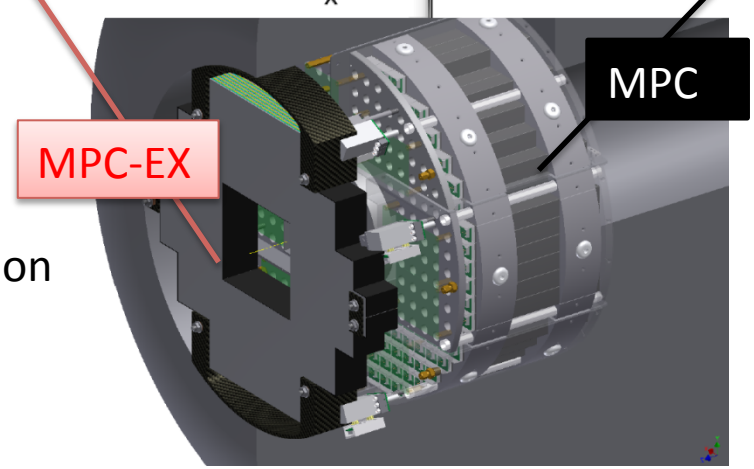
# MPC-EX Status [Good News]

- Made the switch to p+Au running:
  - Updated ramp ranges (gain) for deep layers
  - Added spy channels (no zero suppression) to readout to track pedestals
  - Some concerns about beam losses and increased leakage currents (rad damage)
- Detector Status:
  - About 88% live channels in North, 80% in the south
    - South has bad layer ST0
    - Main loss is SVX's in position 1,3 in chain (masked off)
    - Another 1-2% for hot/uncalibrated channels

# MPC + MPC-Ex Event Display



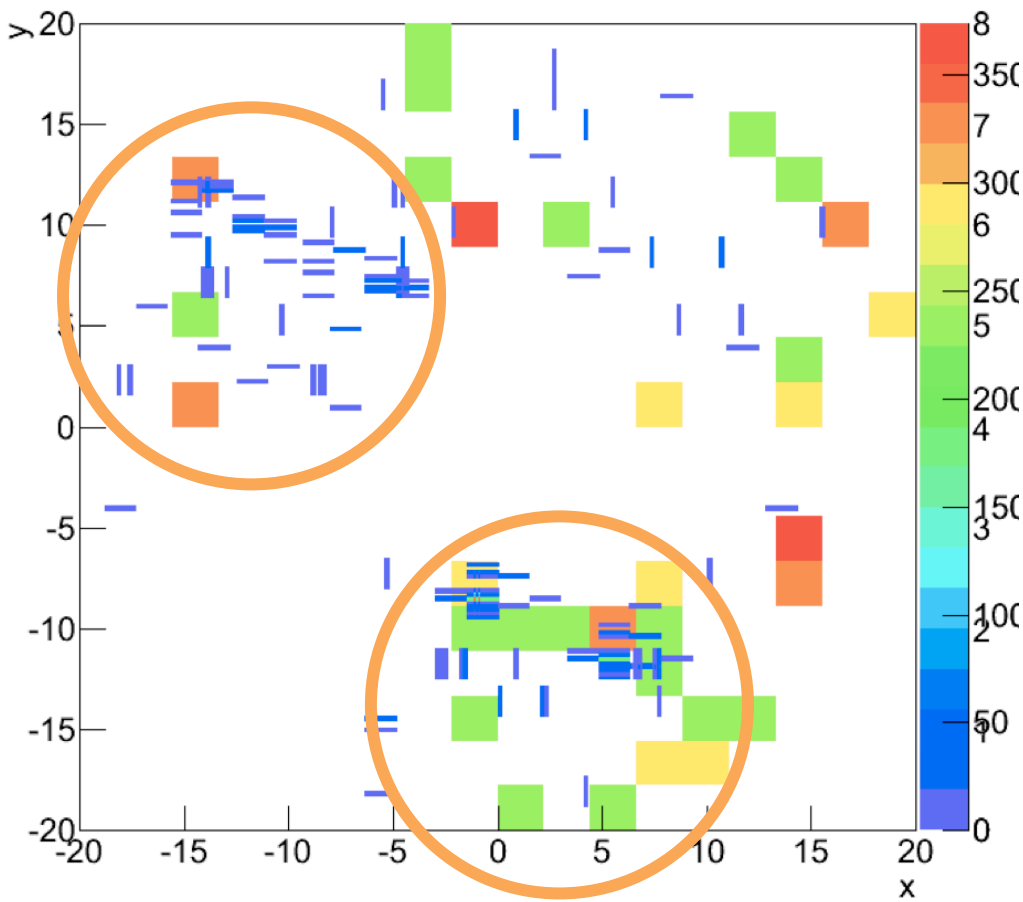




Fine Position Resolution

Coarse Position Resolution

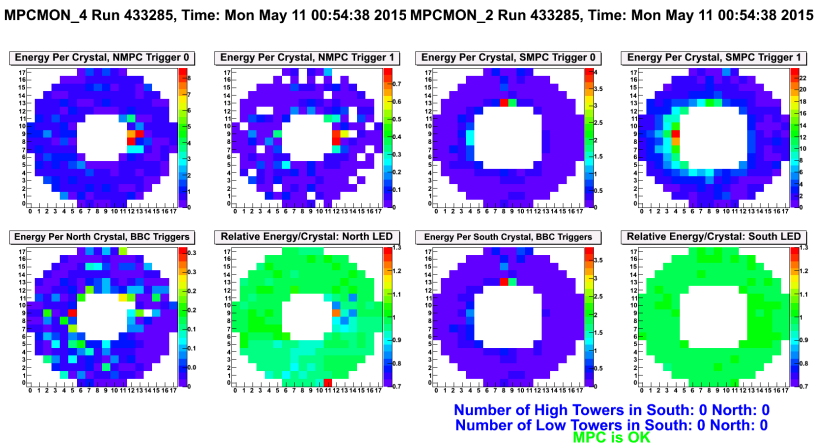
# MPC+MPC-Ex Event Display



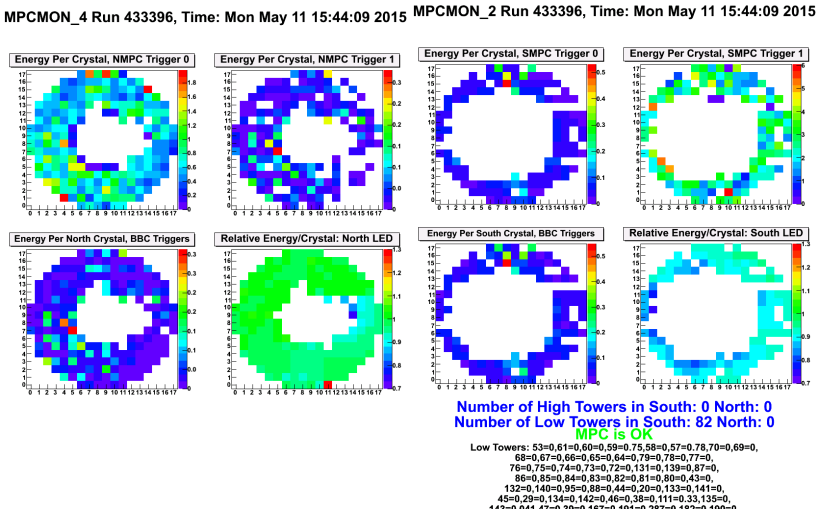

Two electromagnetic shower development can be seen.

# MPC-EX Status [Bad News]

- Monday at around 1am everything is fine in the MPC.

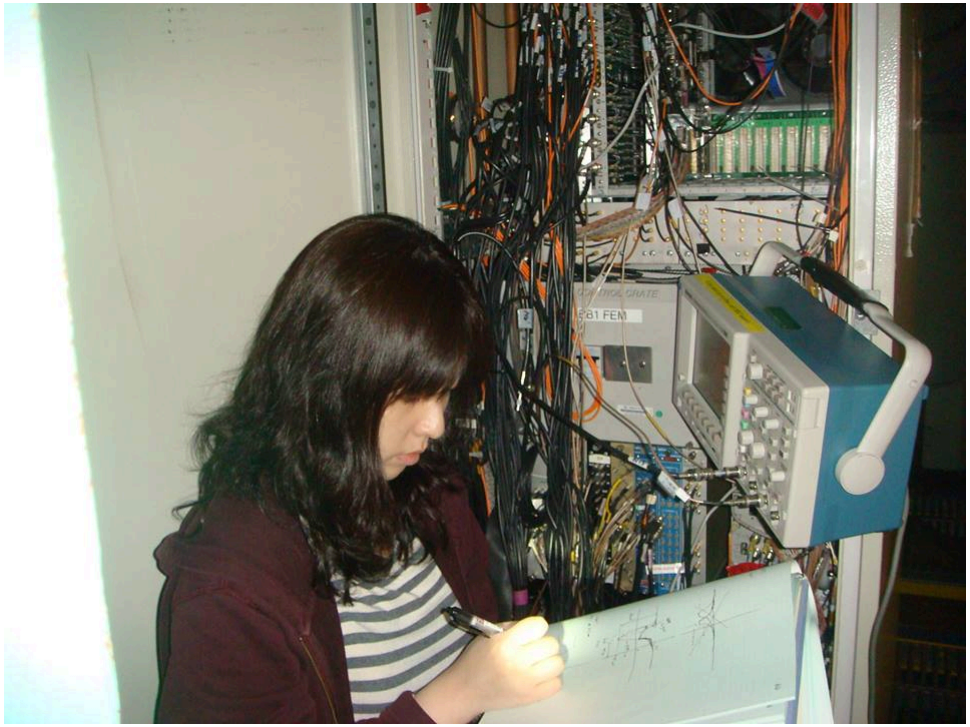



- By Monday at 3pm, there are significant losses in the MPC, especially in the South.



# Consequences

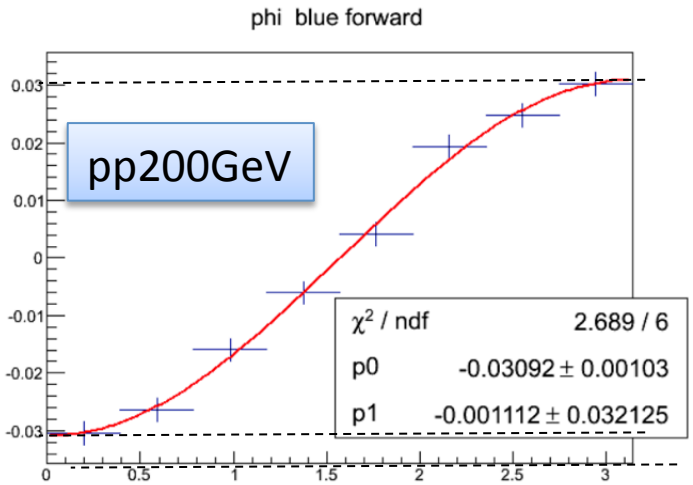
- North is still mostly OK, so direct photon physics for Au low-x is still feasible, but with some loss in acceptance.
- Polarized physics is still OK with the same loss in acceptance (since north is p-going direction).
- South is mostly lost, so high-x physics in Au is lost.

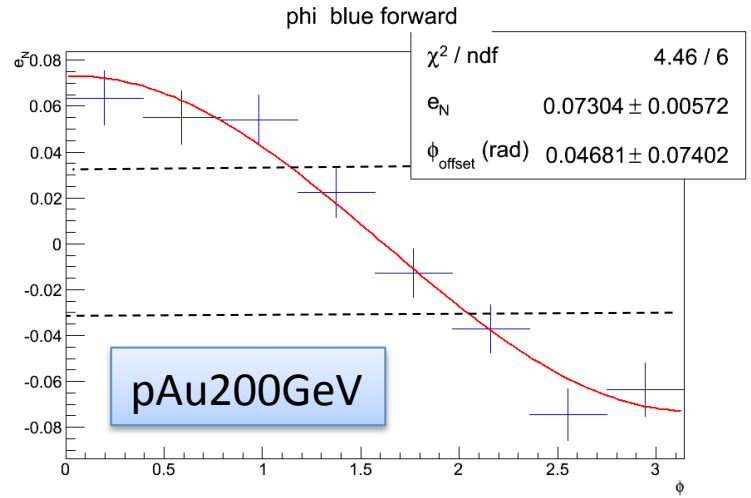


Minjung Kim

# LOCAL POLARIMETRY

# Local Polarimetry

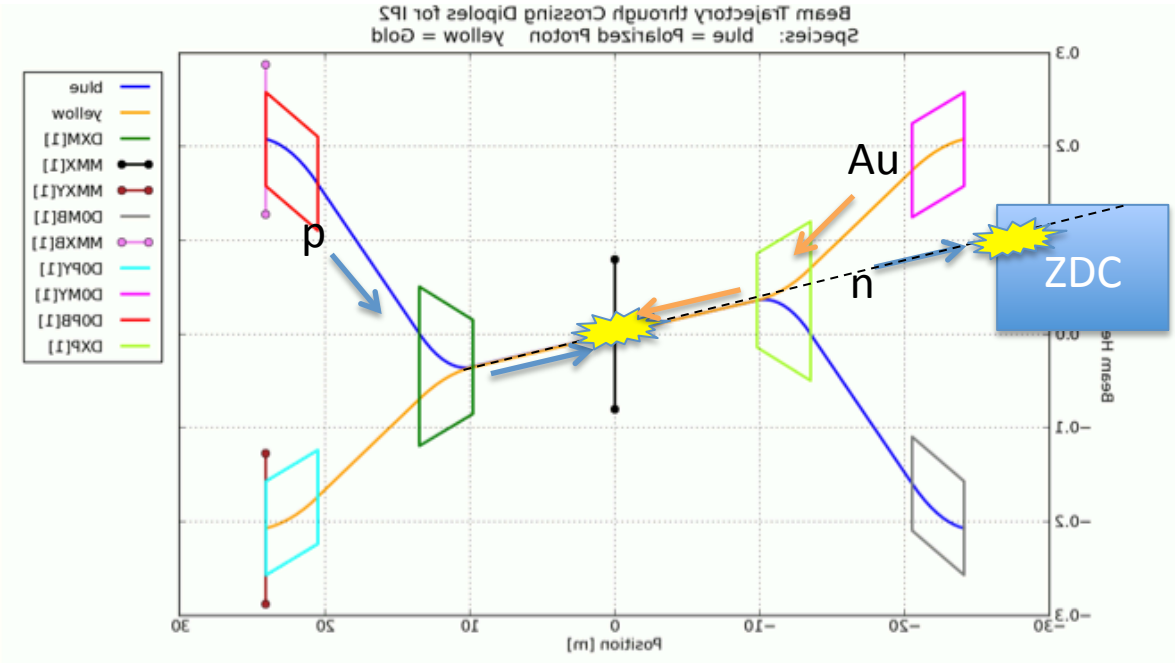


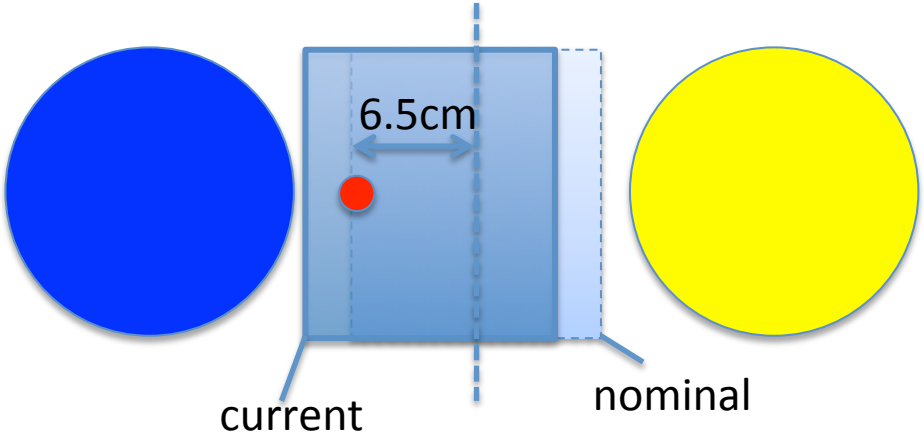

- One physics fill (19032)
- Polarization = 0.6384 ± 0.0557
- ZDCN trigger samples (1M triggers)
- Large and negative asymmetry is observed

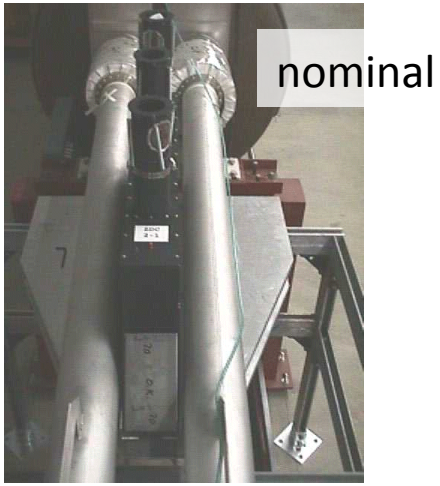
$$\varepsilon_N^{pAu} \sim -2\varepsilon_N^{pp}$$

# Caveat of Neutron Beam Position



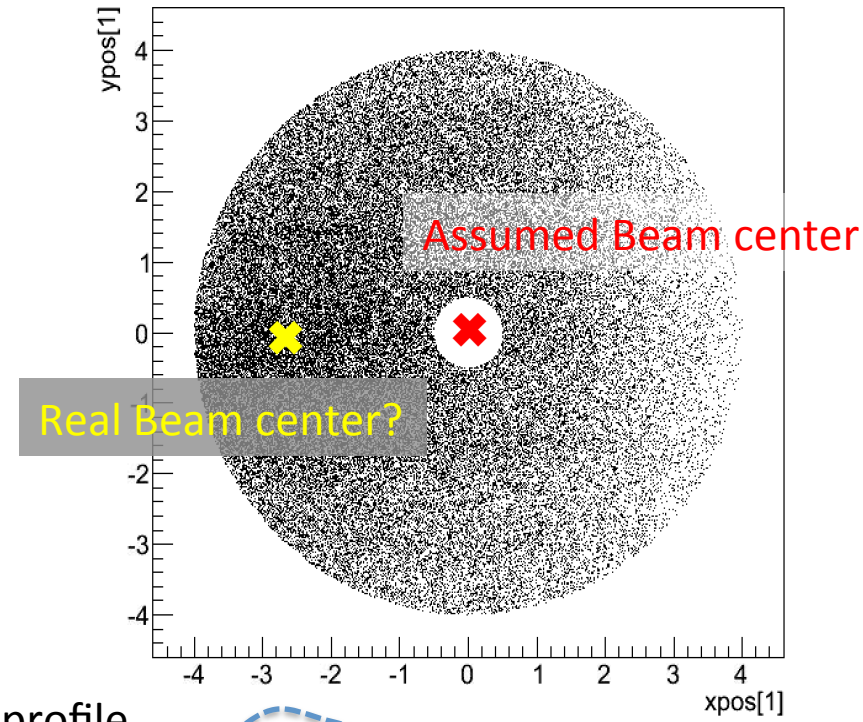
Beams are angled by 3.6mrad
-> ~ 6.5cm off centered at ZDC

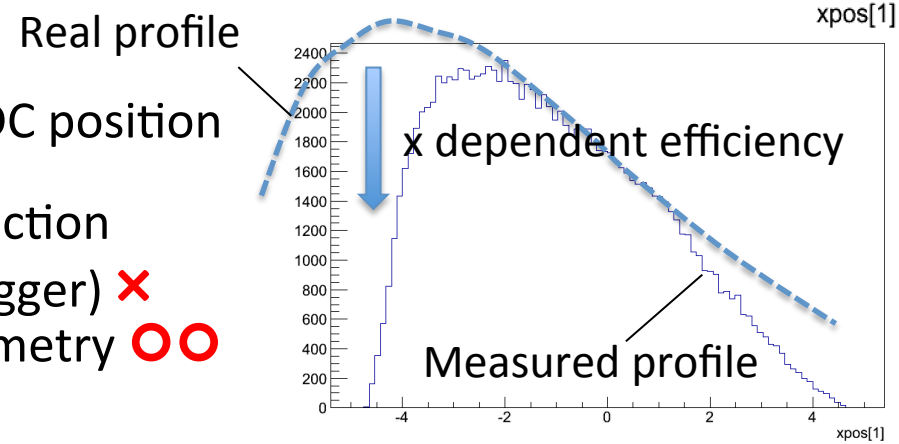


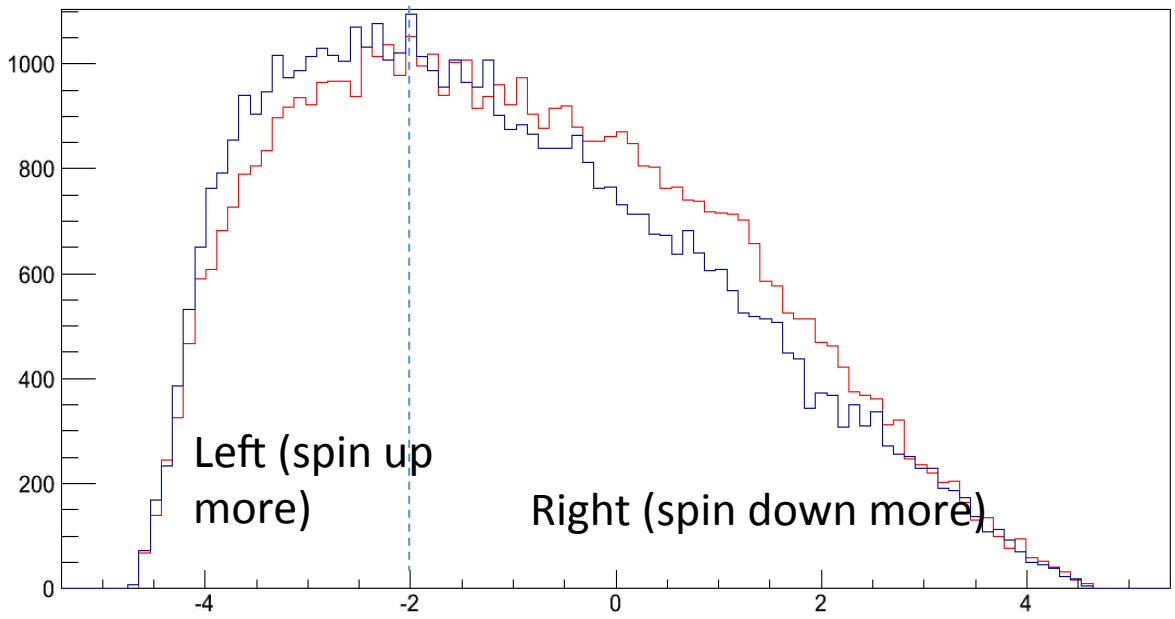
# Role of Beam Center in Asymmetry

- e_N is calculated assuming beam center as (0, 0)
- We know this is wild assumption. Beam is surely off centered.
- To measure $A_N$ in absolute scale, the beam center must be known.
- How do we know the beam center?
  - Calculation by beam angle + ZDC position survey ○
  - Peak of X profile (requires detection efficiency of SMD w.r.t. ZDC trigger) ×
  - Beam center dependent Asymmetry ○○



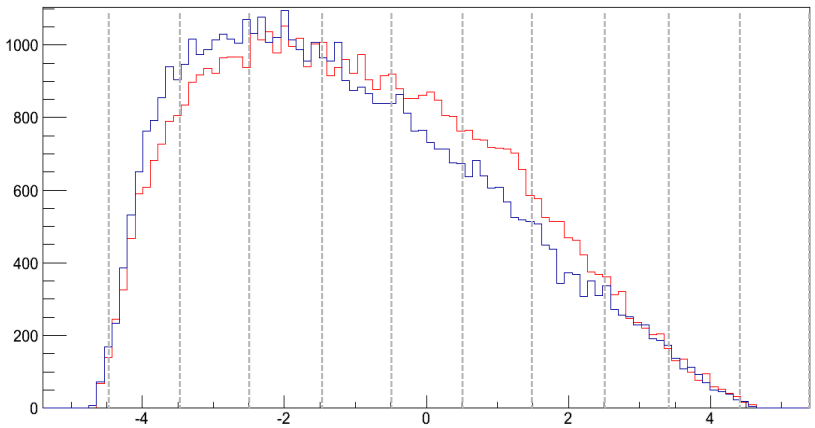



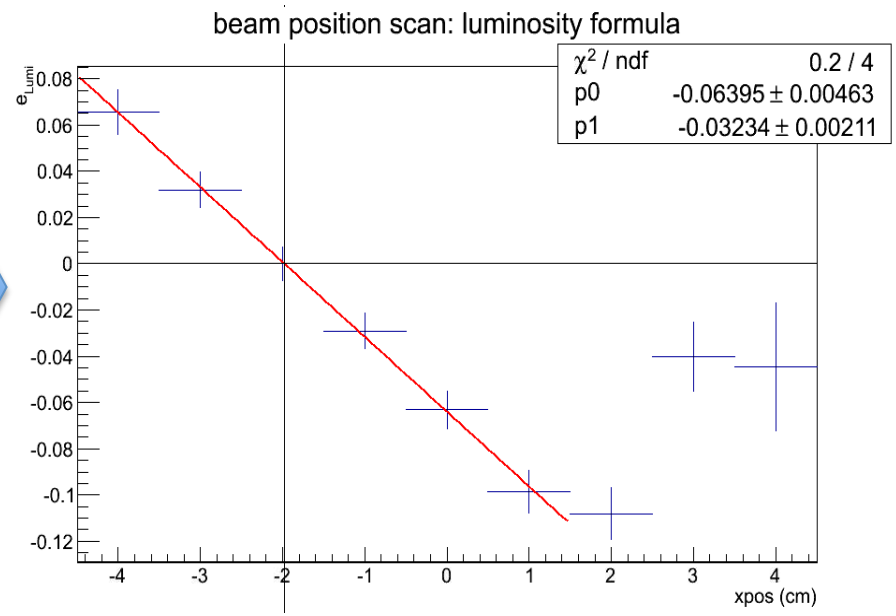
# Beam Center Determination via Asymmetries




- X distribution is shifted toward to left
- Blue: spin up
- Red: spin down
- Beam center can be around -2 cm from this plot

# Beam Position Scan using Luminosity formula




$$e_{Lumi} = \frac{N^{\uparrow}_{Area} - RN^{\downarrow}_{Area}}{N^{\uparrow}_{Area} + RN^{\downarrow}_{Area}}$$

A_N>0 means
e_Lumi =

- >0 at the left
- 0 at the beam center
- <0 at the right

X-axis: x position
Y-axis: e_Lumi

The beam position can be predicted to be -2.0 cm with clear definition of the error.

# Is this asymmetry publishable?

Consistency checks of beam center -2.0 cm is critical path to measure the absolute amplitude of $A_N$.

- Calculated beam center w/ the beam angle + ZDC position survey
- **Dedicated Local Pol run with different beam angle as close as possible to ZDC center for 1 hour.**
  - Reduce systematic errors from multiple stores. (gain)
  - Change only proton angle causes significant luminosity loss (pay)

| Trigger rate (ZDCN) | 10kH | 1 kH (O(10) times luminosity drop example) |
|---|---|---|
| Total trig | 36M | 3.6 M |

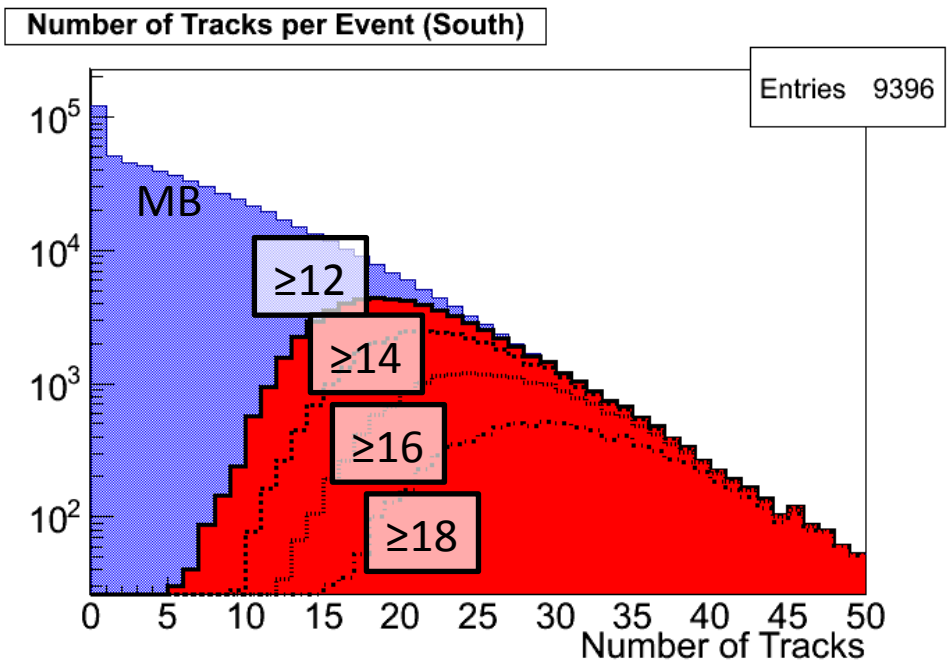
ZDCN (+ZDCN&&BBC ?)
ZDCN raw rate = O(10k) Hz
Max: 10 kH

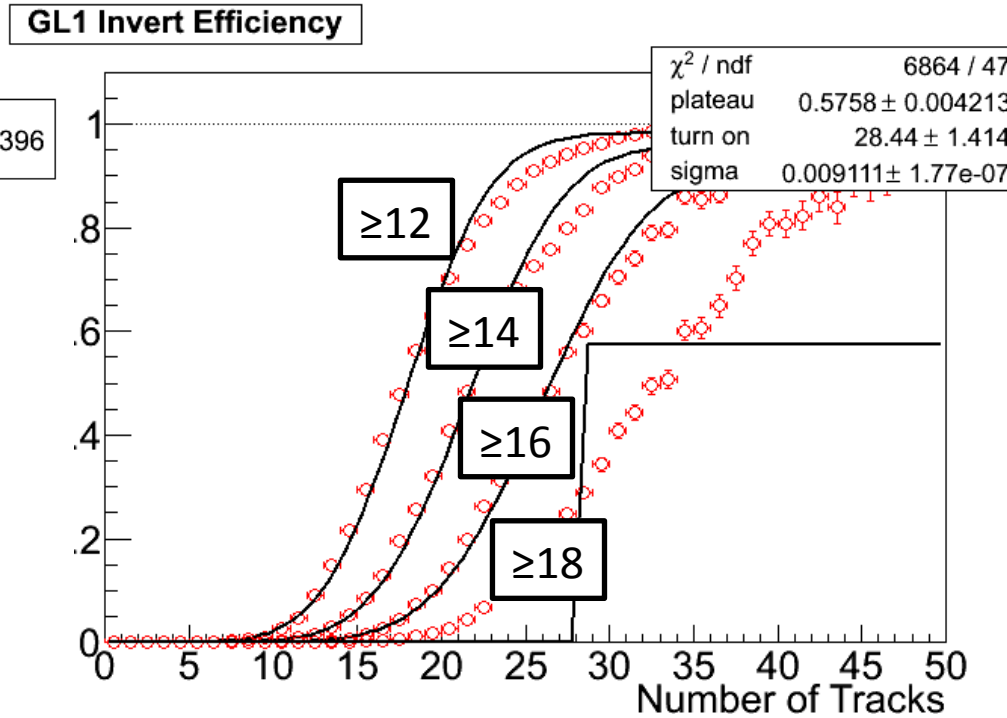
Expected precision

| Total trig | 28M (BBCLL1&& ZDCN\|\|S, pp) | 1M trigger (ZDCN, pA) |
|---|---|---|
| e_N | -0.03 +- 0.001 (3% precision) | 0.07 +- 0.006 (8% precision) |

# FVTX HIGH MULTIPLICITY TRIGGER

# FVTX Trig Threshold Dependence
## (South Au-going)

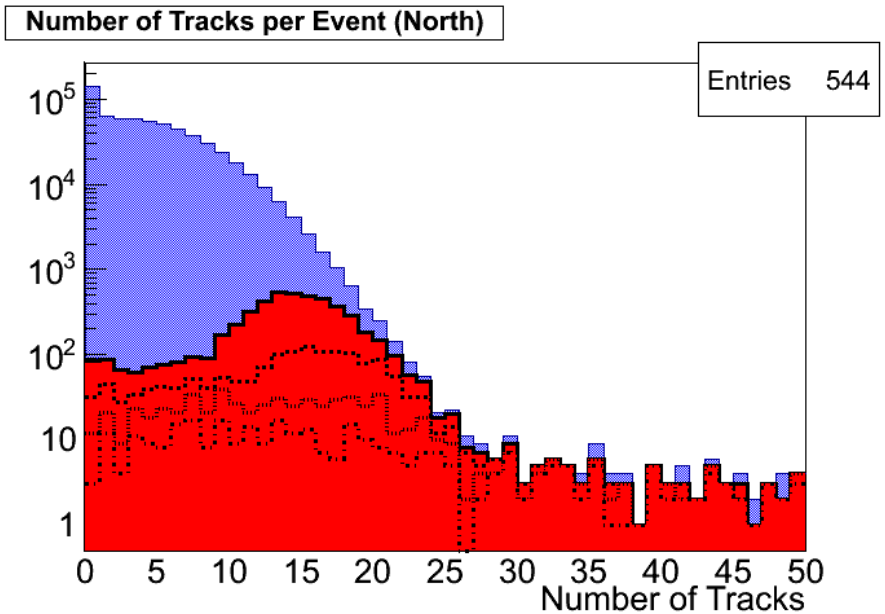


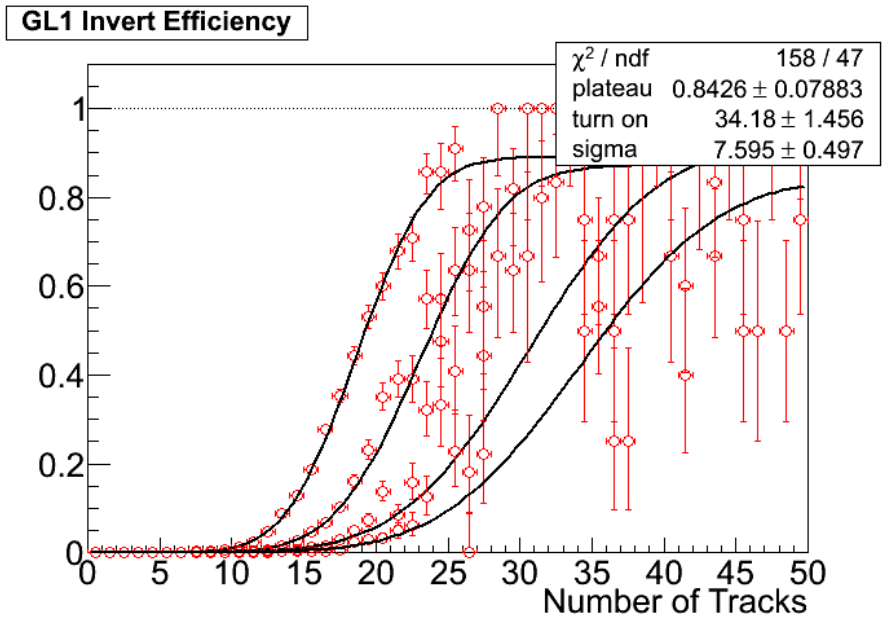




| #track Threshold | 12 | 14 | 16 | 18 |
|---|---|---|---|---|
| Rates [kHz] | 60 | 32 | 18 | 8.6 |
| Purity >=25 | 0.31 | 0.46 | 0.65 | 0.79 |

The trigger performance of Au-going direction is much better than pp case.
We are running at threshold ≥18 which provides about 80% purity.

# FVTX Trig Threshold Dependence
## (North p-going)




| Threshold | 12 | 14 | 16 | 18 |
|---|---|---|---|---|
| Rates [kHz] | 27 | 9.2 | 4.5 | 2.7 |
| Purity >=20 | 0.124 | 0.22 | 0.225 | 0.215 |
| Purity >=25 | 0.025 | 0.06 | 0.112 | 0.147 |

Similar purity achieved in pp run. Not as good performance as Au-going performance.

# High Multiplicity Trigger

| Trigger | Allocated Rates | Total Expected Trigger |
|---|---|---|
| BBC Centrarity | 500 ~ 2 kHz | 500~2000 Mevents |
| FVTX South HighMult | 100~200 Hz | 100~200 Mevents |
| FVTX North HighMult | 100~200 Hz | 100~200 Mevents |

- The main triggers will be Au-going side trigger.
- South FVTX High multiplicity trigger will have 100Mevents whose purity is about 80%. Thus we will have 80M real high multiplicity events on data.
- Signal is expected to be smaller than dAu. 80M x 2~3 will be a good goal to be set.

# BACKUP

# Started Data Taking from May 7th

Run Summary

www.phenix.bnl.gov/WWW/run/daq/runcontrol/RunSummary.php?RunNumber=433743

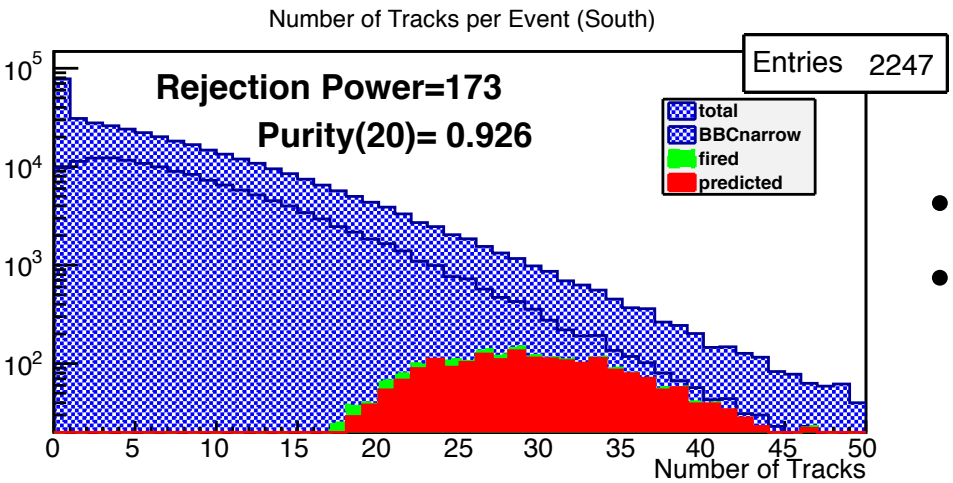
Indico Run PHENIX goo 辞書 Yahoo! JAPAN ニュース 理研電話帳 アップル tmp Google マップ 関数電卓 ガーミンコネクト ONE TOKYO

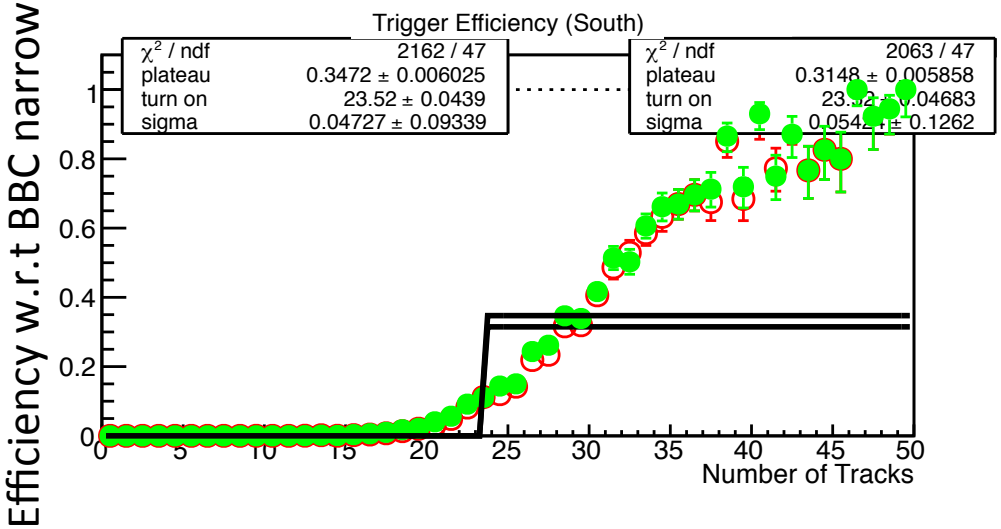
Blue Jeans Network | Video Collaboration in the Cloud | RHIC Broadcast | Run Summary

| Name | Bit Mask | Scale Down | State | Raw Trigger Count | Raw Trigger Rate | Live Trigger Count | Live Trigger Rate | Scaled Trigger Count | Scaled Trigger Rate | Livetime |
|---|---|---|---|---|---|---|---|---|---|---|
| BBCLL1(>0 tubes) | 0x00000001 | 2605 | Enabled | 1272317443 | 239607.80 | 1207078700 | 227321.79 | 463192 | 87.23 | 0.95 |
| BBCLL1(>0 tubes) novertex | 0x00000002 | 4949 | Enabled | 2557650492 | 481666.76 | 2426610223 | 456988.74 | 490224 | 92.32 | 0.95 |
| ZDCLL1wide | 0x00000004 | 244 | Enabled | 65244803 | 12287.16 | 61590169 | 11598.90 | 251389 | 47.34 | 0.94 |
| BBCLL1(>0 tubes)_central35_narrowvtx | 0x00000008 | 2 | Enabled | 21714954 | 4089.45 | 20594017 | 3878.35 | 6864672 | 1292.78 | 0.95 |
| BBCLL1(>0 tubes) narrowvtx | 0x00000010 | 180 | Enabled | 492752904 | 92797.16 | 467469535 | 88035.69 | 2582704 | 486.38 | 0.95 |
| ZDCNS | 0x00000020 | 244 | Enabled | 69709154 | 13127.90 | 66146402 | 12456.95 | 269985 | 50.84 | 0.95 |
| ERT_4x4b | 0x00000040 | 0 | Enabled | 270324 | 50.91 | 252261 | 47.51 | 252261 | 47.51 | 0.93 |
| ERT_4x4a&BBCLL1 | 0x00000080 | 0 | Enabled | 771308 | 145.26 | 734423 | 138.31 | 734423 | 138.31 | 0.95 |
| ERT_4x4c&BBCLL1(narrow) | 0x00000100 | 0 | Enabled | 1145928 | 215.81 | 1092166 | 205.68 | 1092166 | 205.68 | 0.95 |
| ERTLL1_E&BBCLL1(narrow) | 0x00000200 | 0 | Enabled | 507831 | 95.64 | 483536 | 91.06 | 483536 | 91.06 | 0.95 |
| FVTX_HighMult_N&BBCLL1(narrow) | 0x00000400 | 0 | Enabled | 1022334 | 192.53 | 972518 | 183.15 | 972518 | 183.15 | 0.95 |
| FVTX_HighMult_S&BBCLL1(narrow) | 0x00000800 | 6 | Enabled | 8547546 | 1609.71 | 8138453 | 1532.67 | 1162636 | 218.95 | 0.95 |
| MPC_N_A | 0x00001000 | 0 | Enabled | 11216106 | 2112.26 | 10266829 | 1933.49 | 10266829 | 1933.49 | 0.92 |
| MPC_S_A | 0x00002000 | 9999999 | Enabled | 2684129 | 505.49 | 2546390 | 479.55 | 0 | 0.00 | 0.95 |
| MPC_S_C&ERTLL1_2x2 | 0x00004000 | 9999999 | Enabled | 37913 | 7.14 | 36107 | 6.80 | 0 | 0.00 | 0.95 |
| ZDCN | 0x00008000 | 380 | Enabled | 184962486 | 34832.86 | 176274801 | 33196.76 | 462663 | 87.13 | 0.95 |
| CLOCK | 0x00010000 | 196077 | Enabled | 49814793868 | 9381317.11 | 47413413933 | 8929079.84 | 241809 | 45.54 | 0.95 |
| MPC_N_B | 0x00020000 | 0 | Enabled | 3455235 | 650.70 | 3136801 | 590.73 | 3136801 | 590.73 | 0.91 |
| MPC_N_C&ERTLL1_2x2 | 0x00040000 | 0 | Enabled | 42847 | 8.07 | 39645 | 7.47 | 39645 | 7.47 | 0.93 |
| ZDCS | 0x00080000 | 8250 | Enabled | 3681983196 | 693405.50 | 3485689494 | 656438.70 | 422457 | 79.56 | 0.95 |
| MUIDLL1_N2D&BBCLL1narrow | 0x00100000 | 0 | Enabled | 223432 | 42.08 | 211443 | 39.82 | 211443 | 39.82 | 0.95 |
| MUIDLL1_S2D&BBCLL1narrow | 0x00200000 | 0 | Enabled | 100259 | 18.88 | 94785 | 17.85 | 94785 | 17.85 | 0.95 |
| MUIDLL1_N1D&BBCLL1narrow | 0x00400000 | 3 | Enabled | 1581393 | 297.81 | 1501580 | 282.78 | 375395 | 70.70 | 0.95 |
| MUIDLL1_S1D&BBCLL1narrow | 0x00800000 | 5 | Enabled | 3626997 | 683.05 | 3450431 | 649.80 | 575072 | 108.30 | 0.95 |

So far coincidence with BBCLL1 narrow

# Running Condition



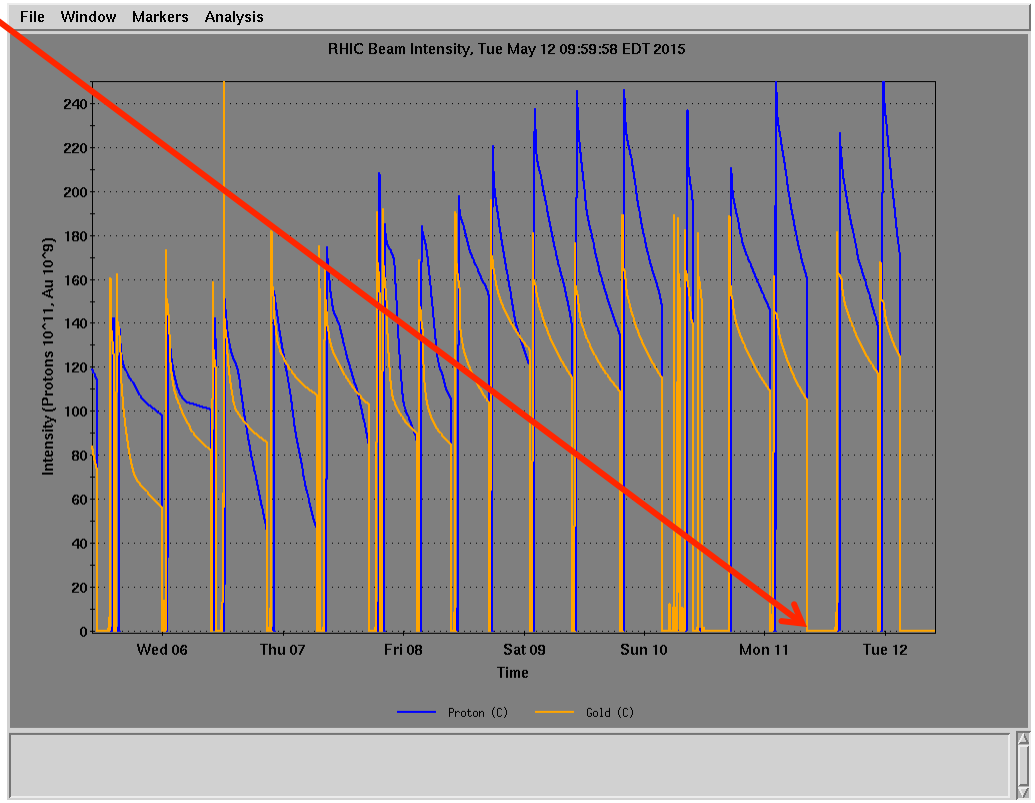




- Trigger threshold>=18/arm
- Good

GL1 matching efficiency > 95%

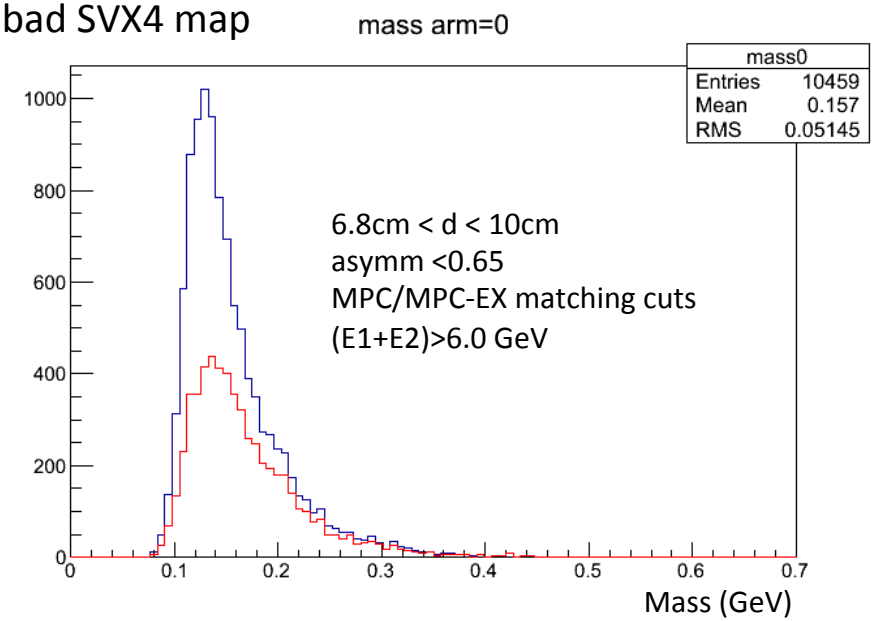
# Pre-fire

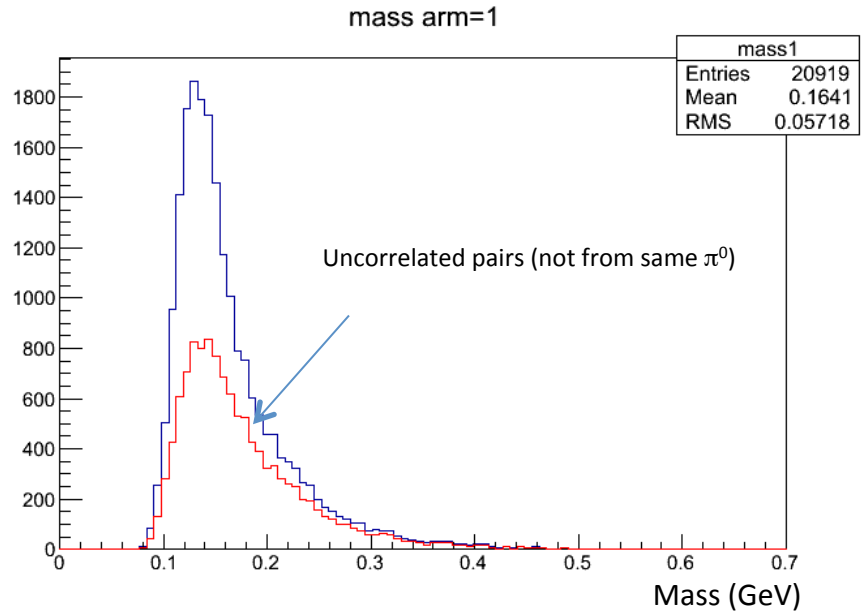
- There was a abort kicker pre-fire at 8:28am Monday morning

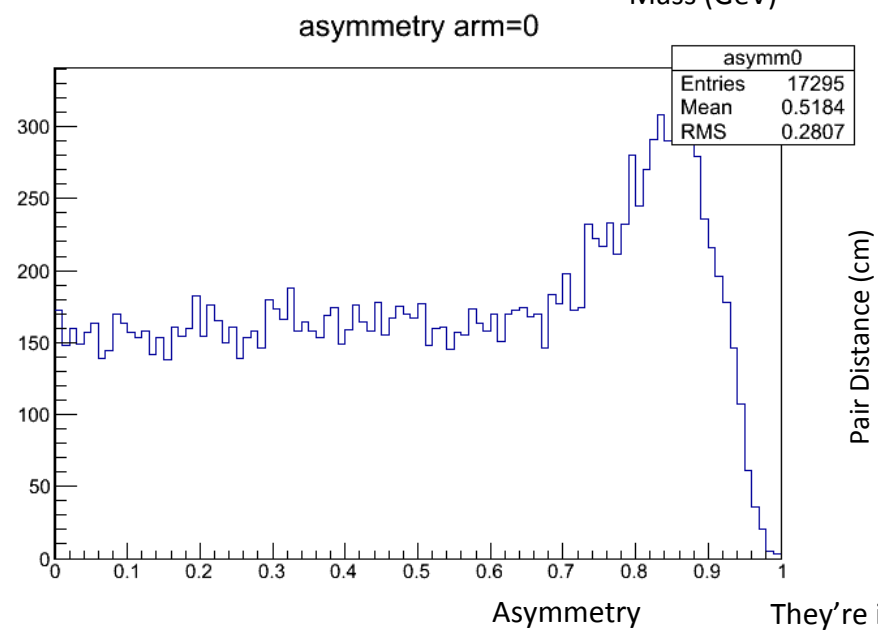


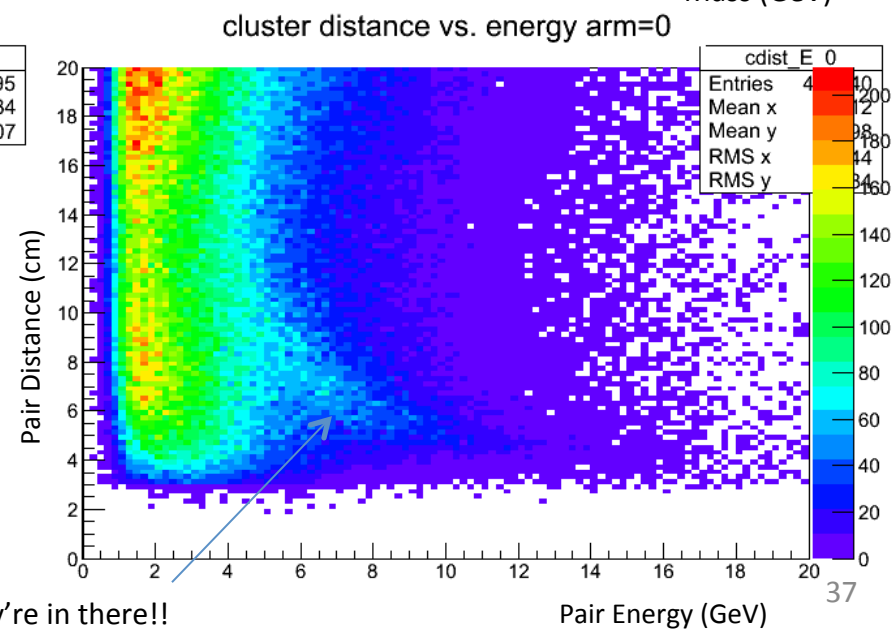
# $\pi^0$'s in Simulation

Pythia minbias
with bad SVX4 map

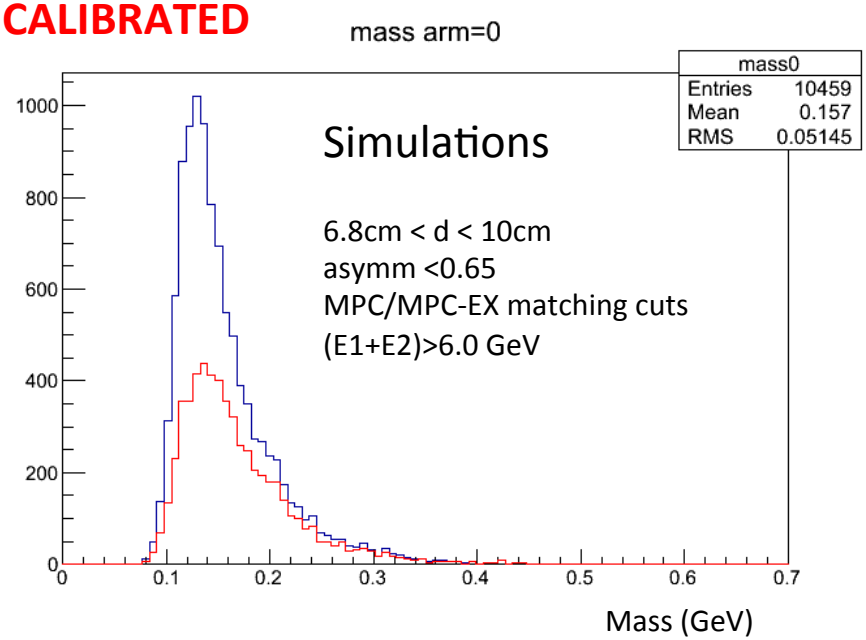
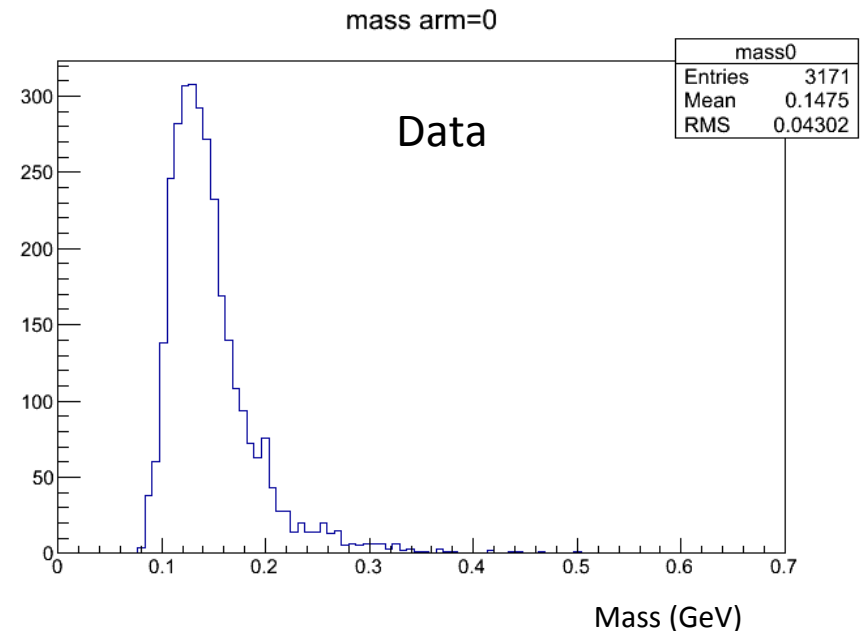
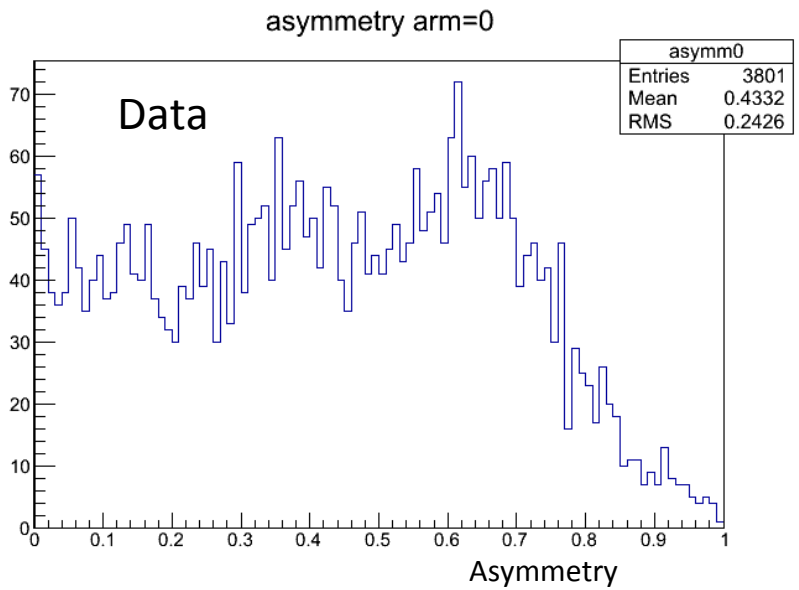
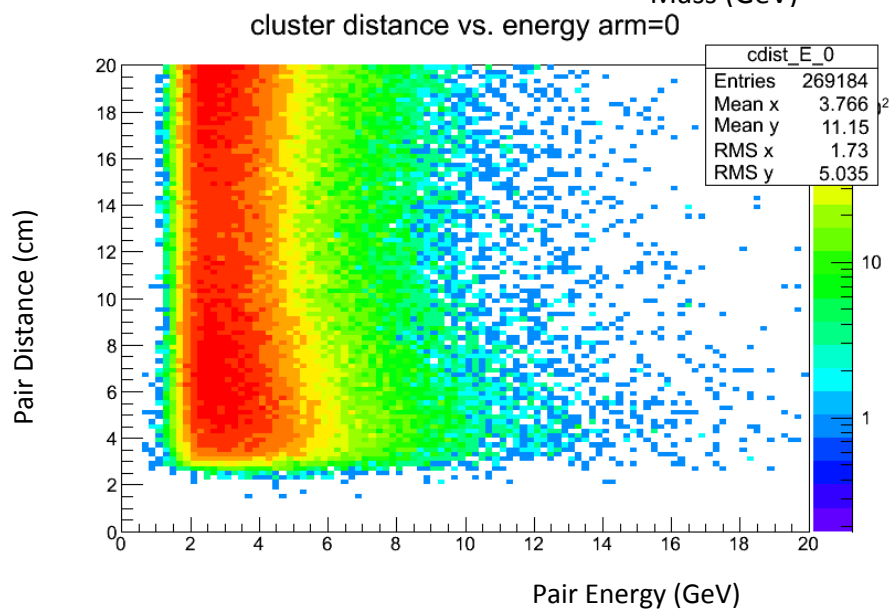



They're in there!!

**Both MPC and MPC-EX are UNCALIBRATED**

# $\pi^0$'s in Data (p+p)