A SUMMARY ON POLARISATION IN RUN-15 FOR 100 GEV P+P

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PRESENTING THE WORK DONE
BY BILL, DIMA, GRANT AND OLEG

BROOKHAVEN NATIONAL LABORATORY
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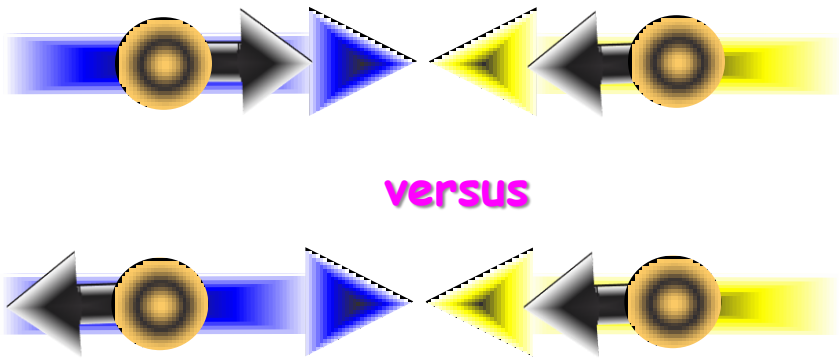
WHY IS POLARISATION CRITICAL



Double-spin helicity asymmetry:

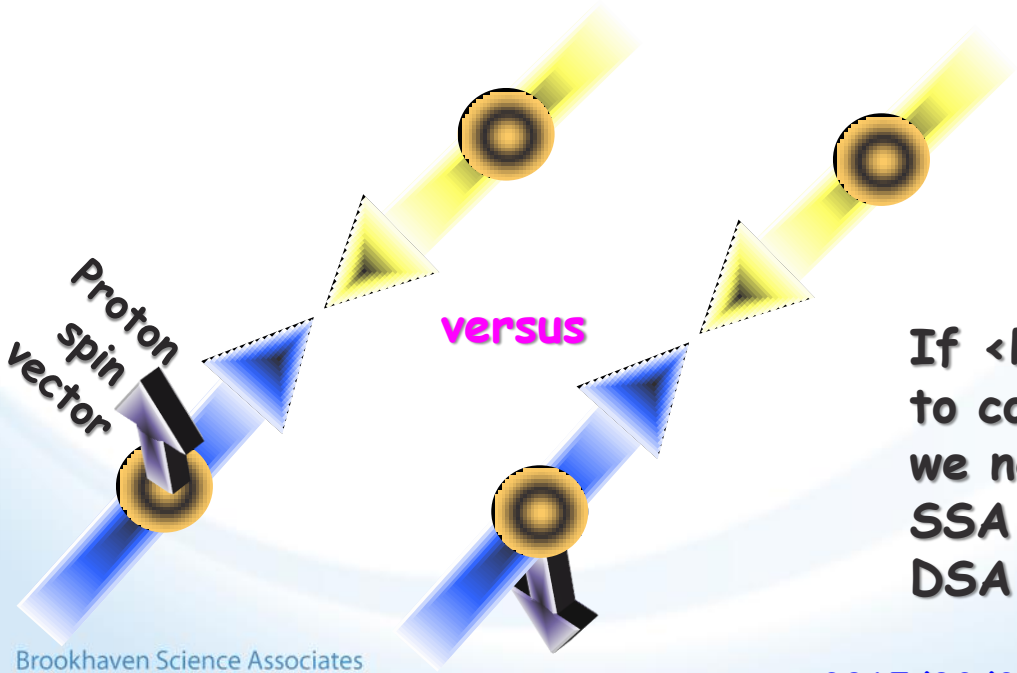
$$A_{LL} \equiv \frac{1}{P_1 P_2} \frac{N_{++}/\mathcal{L}_{++} - N_{+-}/\mathcal{L}_{+-}}{N_{++}/\mathcal{L}_{++} + N_{+-}/\mathcal{L}_{+-}}$$

$$\delta A_{LL/TT} \sim \frac{1}{\sqrt{P_1^2 P_2^2 \int L\,dt}} = \frac{1}{P_1 P_2 \sqrt{\int L\,dt}}$$

Single-spin asymmmetry:

$$A_N \equiv \frac{1}{P_1} \frac{N_\uparrow/\mathcal{L}_\uparrow - N_\downarrow/\mathcal{L}_\downarrow}{N_\uparrow/\mathcal{L}_\uparrow + N_\downarrow/\mathcal{L}_\downarrow}$$

$$\delta A_{L/T} \sim \frac{1}{\sqrt{P_1^2 \int L\,dt}} = \frac{1}{P_1 \sqrt{\int L\,dt}}$$

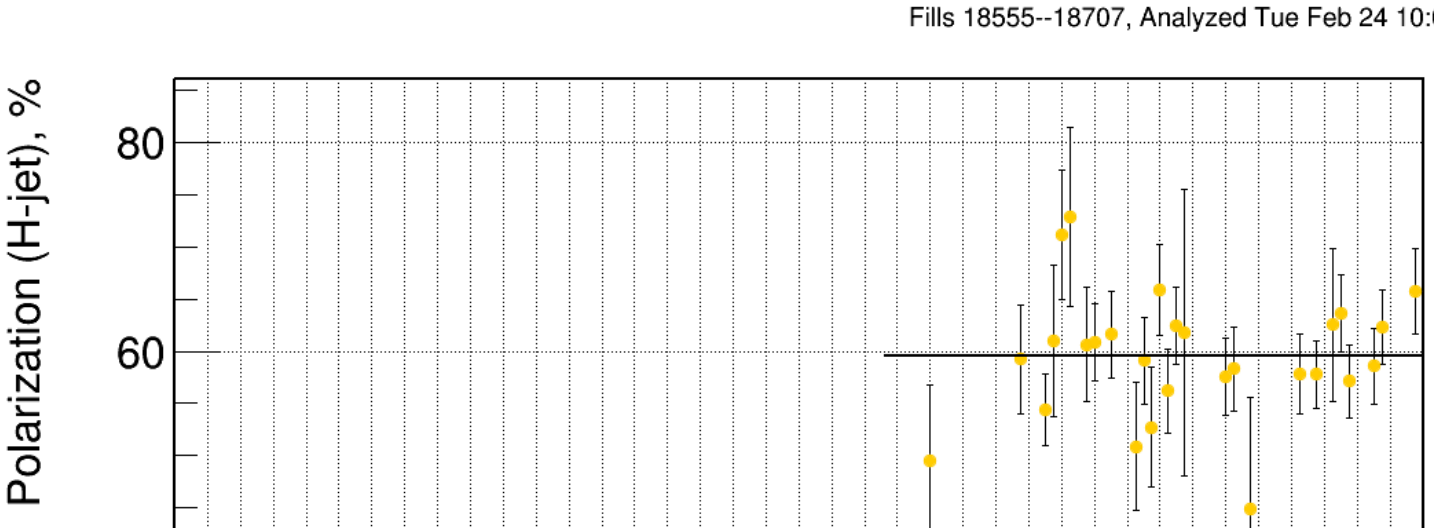


If $\langle P_{1/2} \rangle$ drops from 0.5 to 0.4 to compensate it with integrated lumi we need

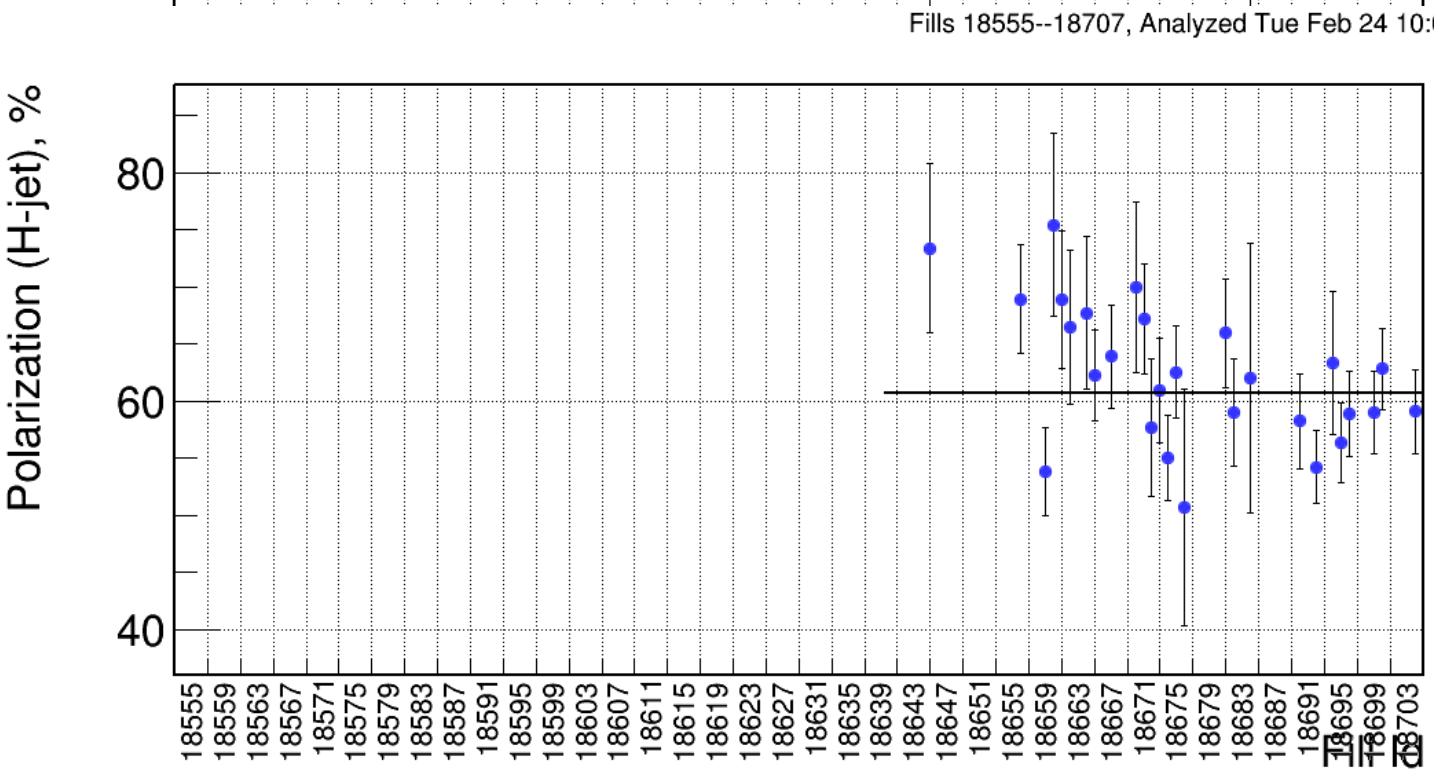
SSA: 1.5 x $\int L dt$

DSA: 2.5 x $\int L dt$

2015: H-JET RESULTS

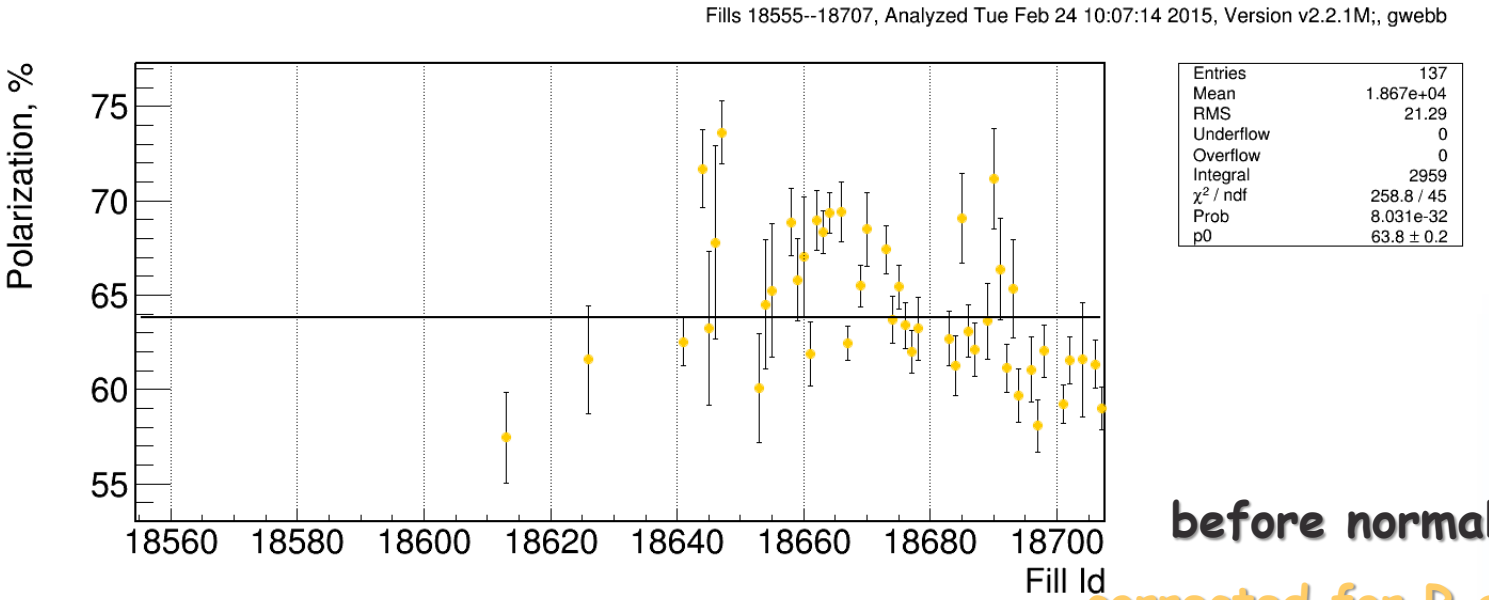


2012:
55.8 +/- 0.5



2012:
61.2 +/- 0.46

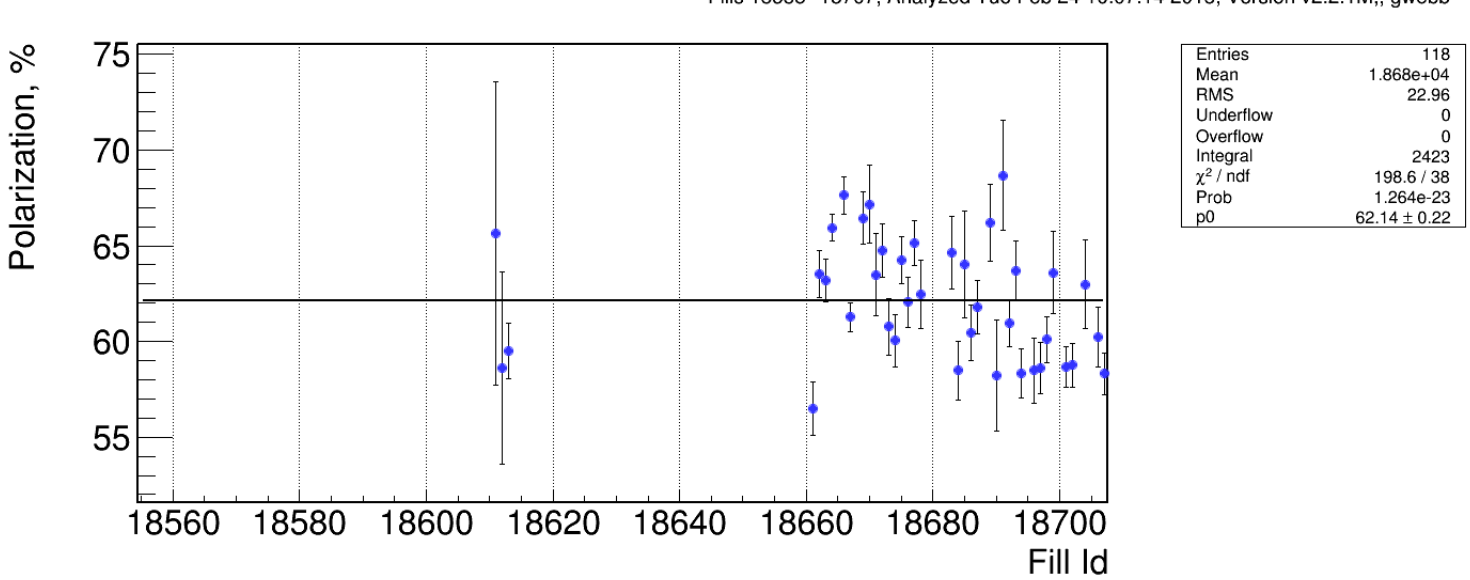
pC: POLARISATION RESULTS PER FILL



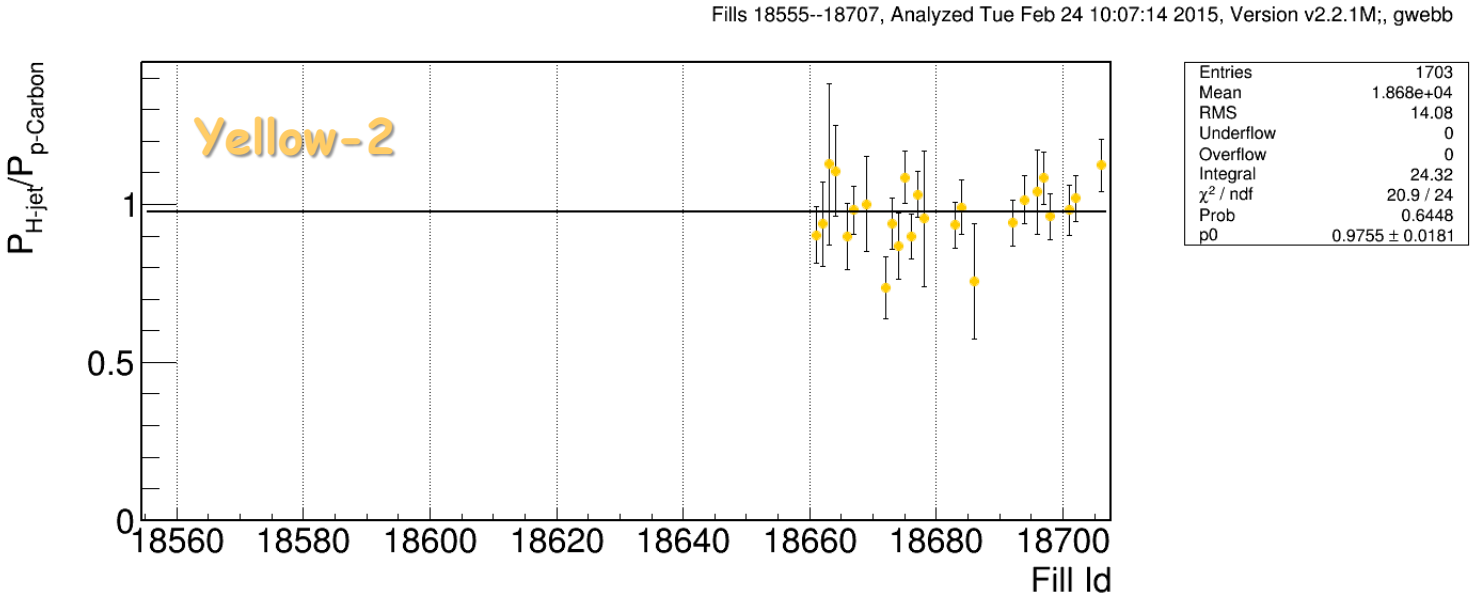
before normalizing to H-Jet

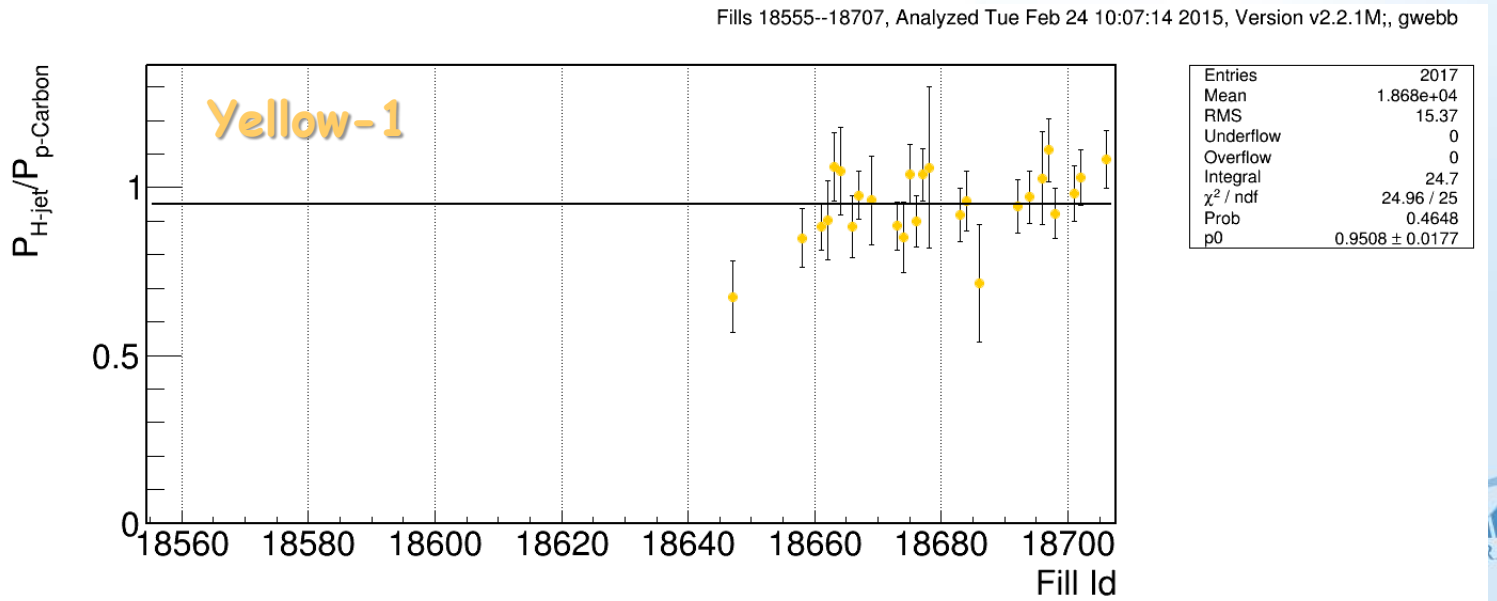
corrected for R and τ_p <p>=64.63

corrected for R and τ_p <p>=64.68

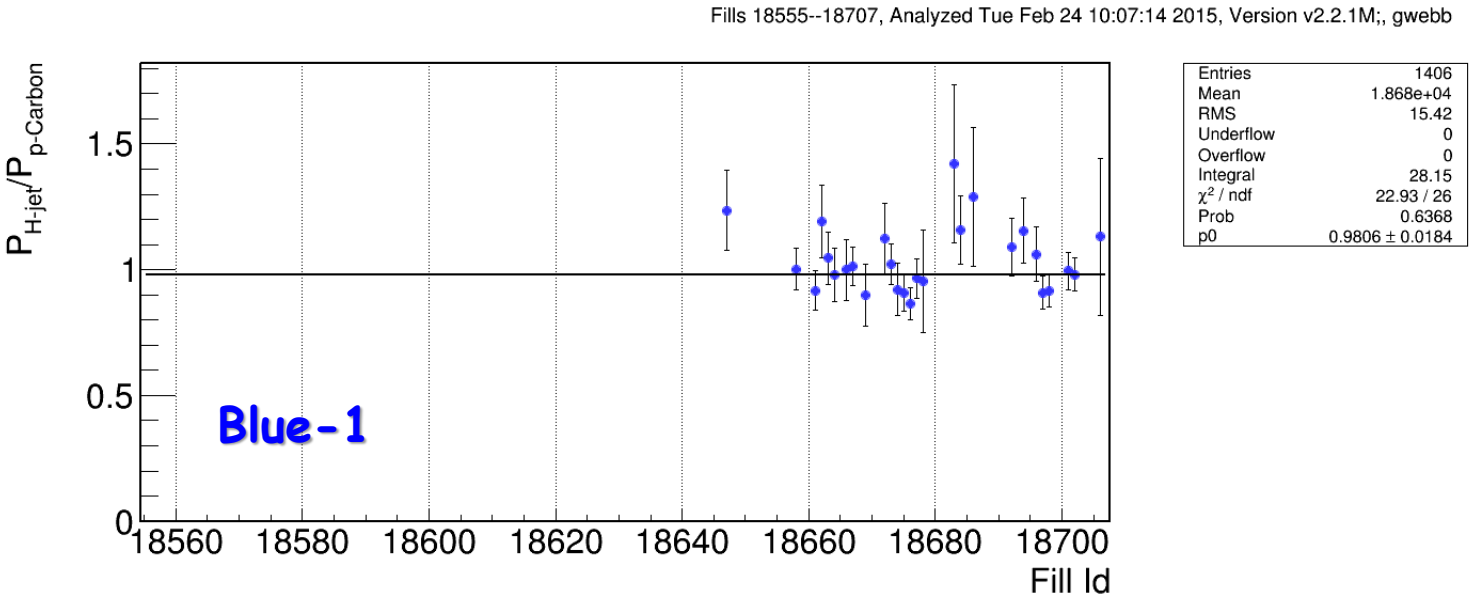


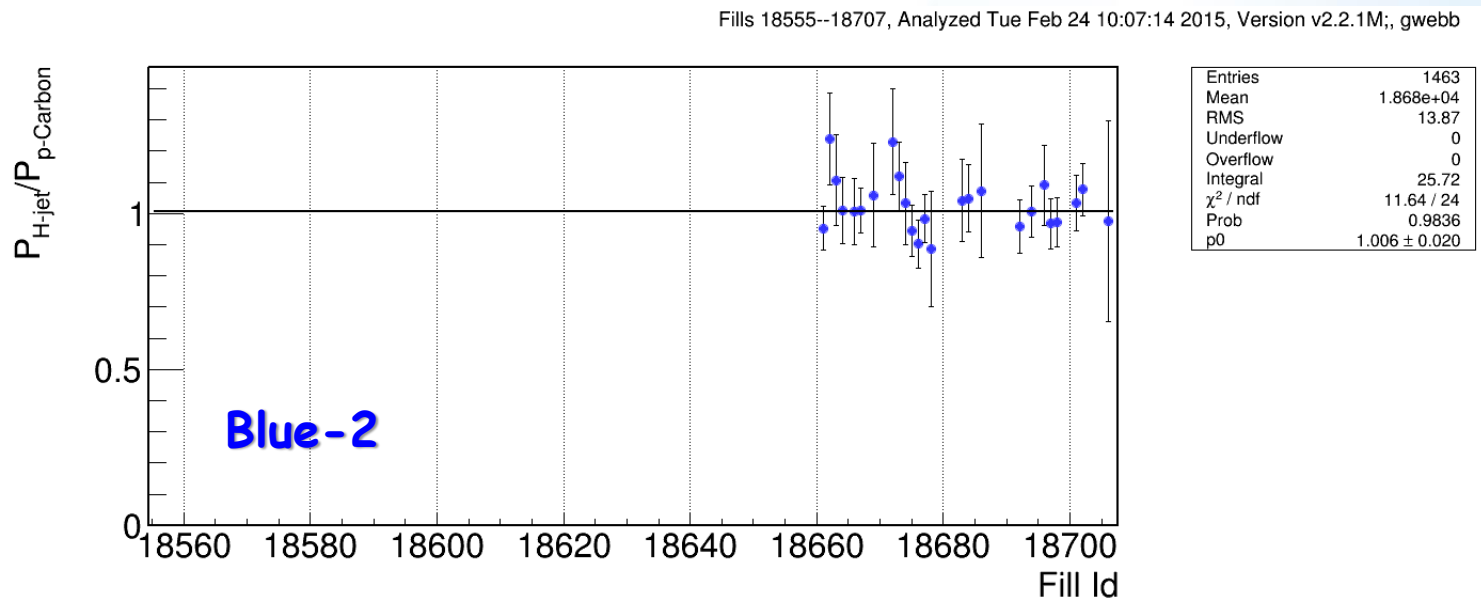
PC NORMALISATION FROM H-JET





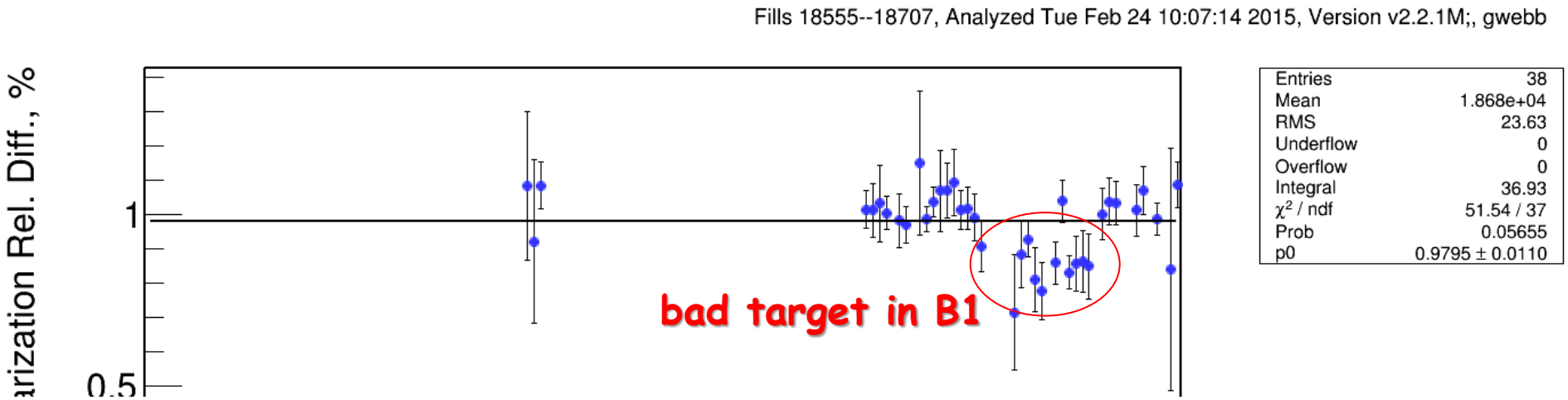
PC NORMALISATION FROM H-JET

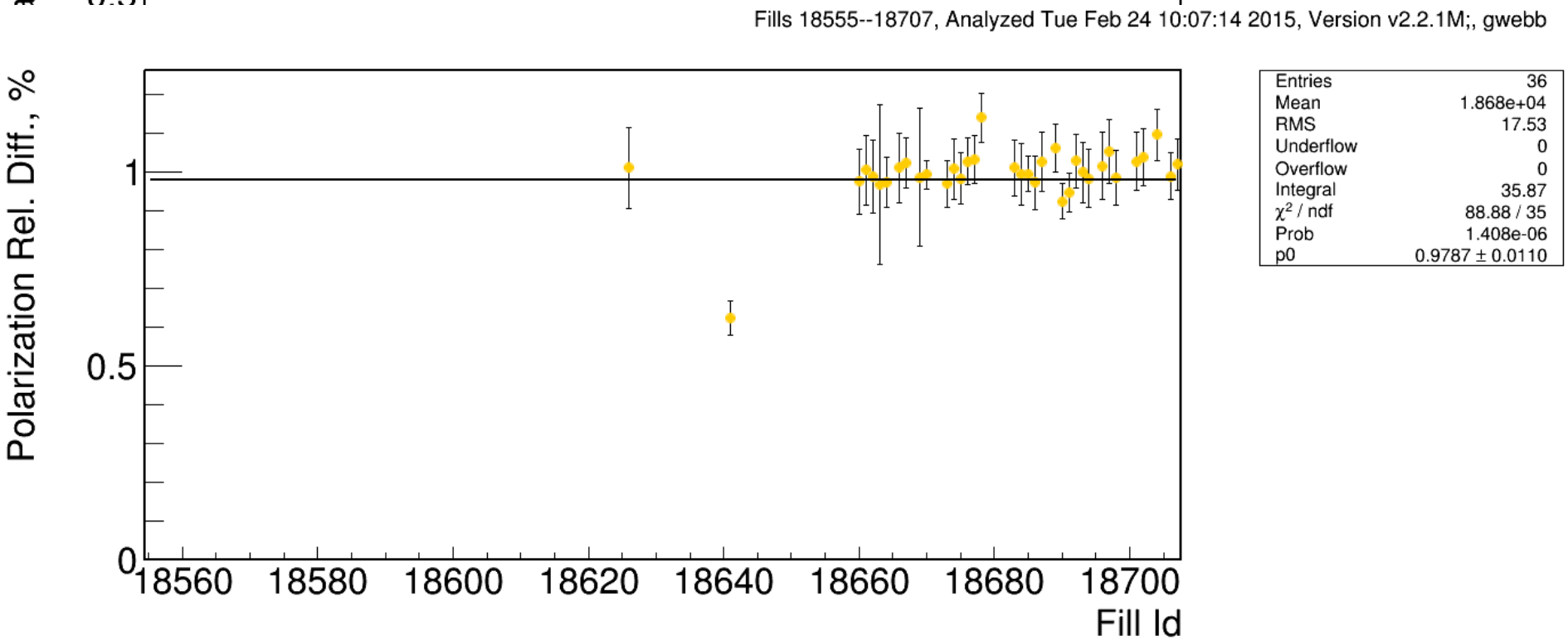




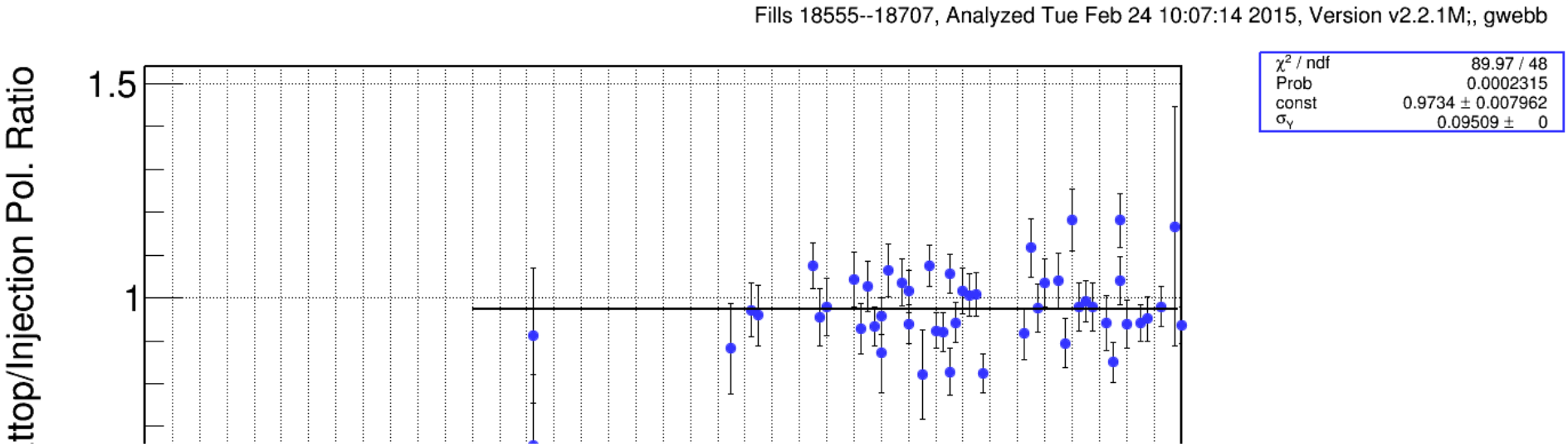
Y1-Y2 AND B1-B2 RATIO

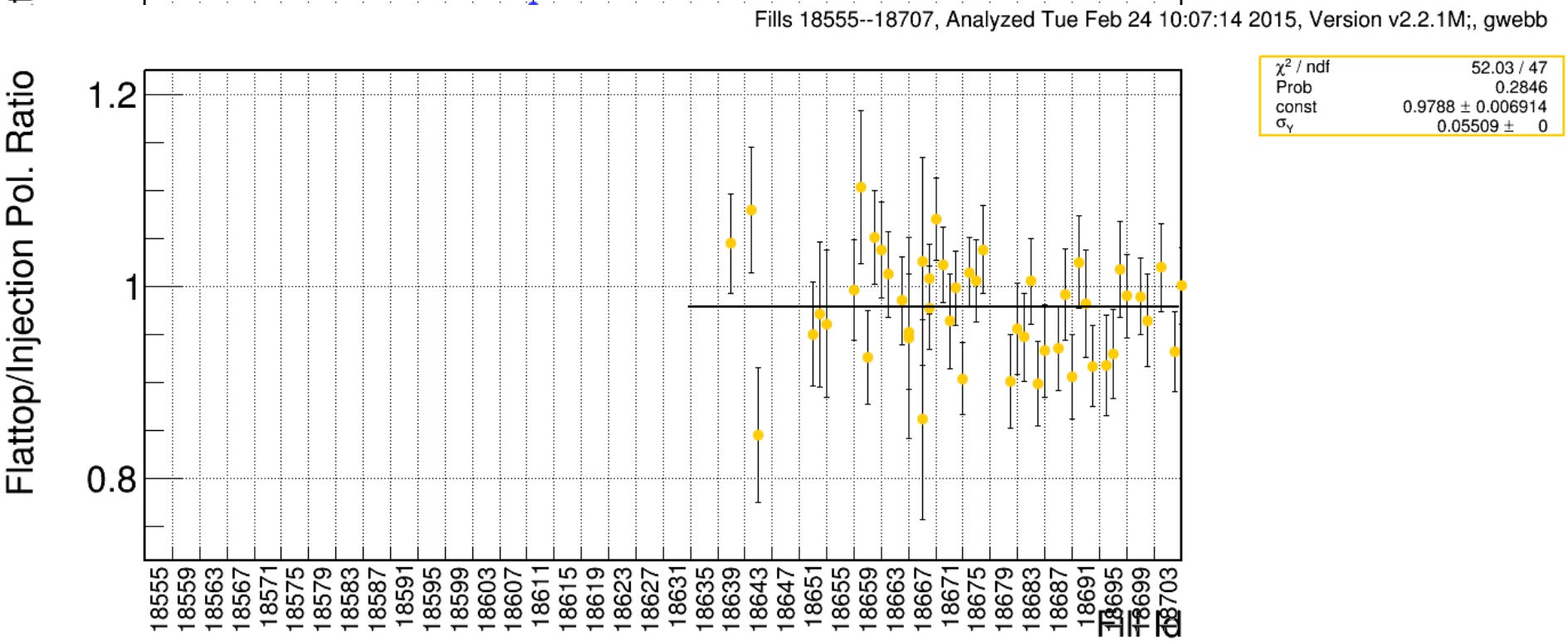
Ratio after scaling to H-Jet:



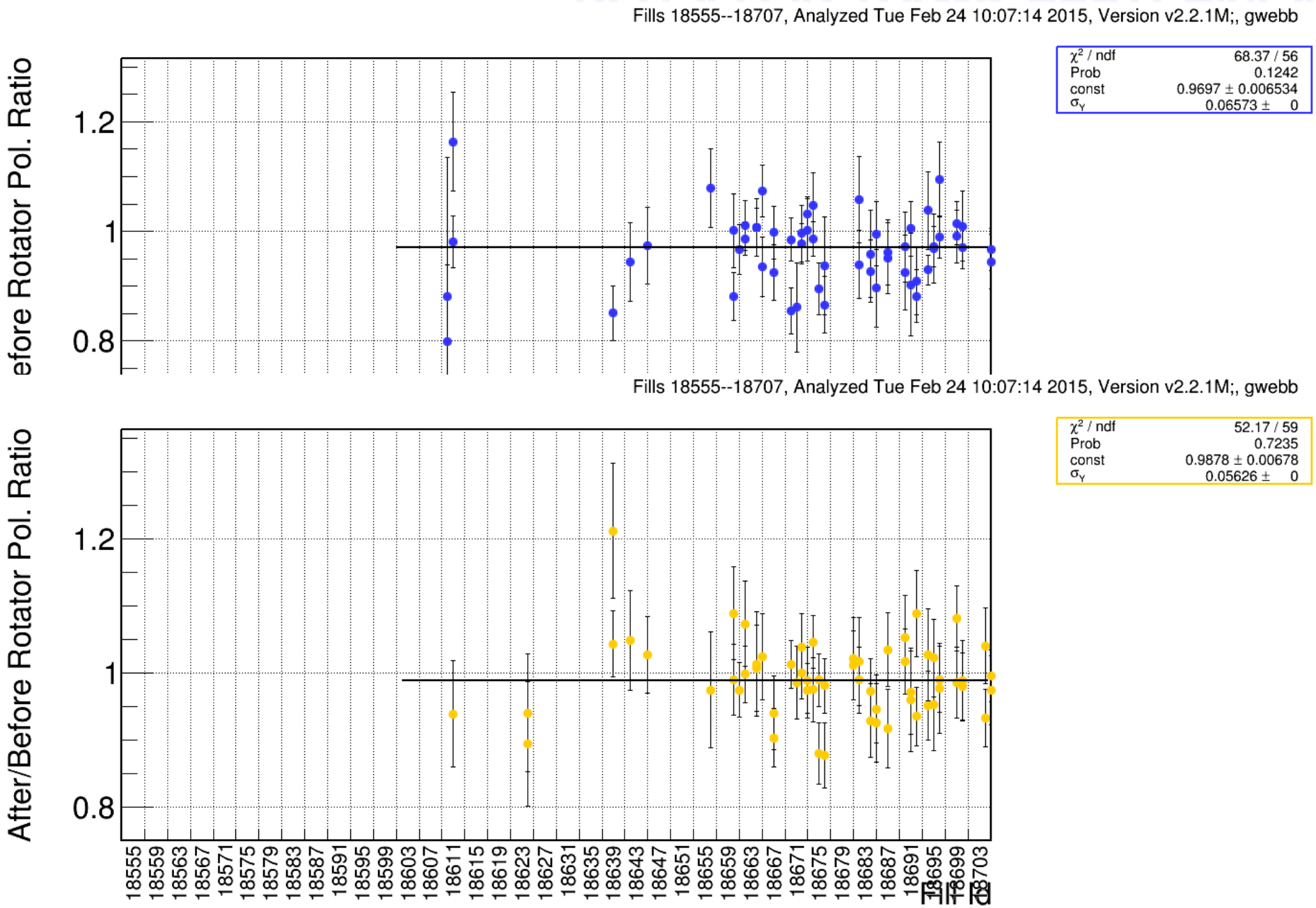


RAMP EFFICENCY



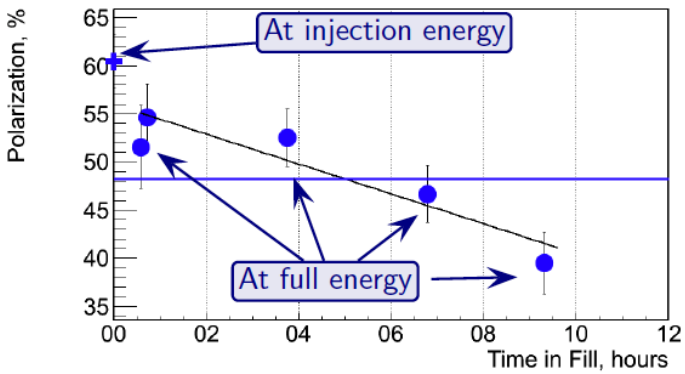


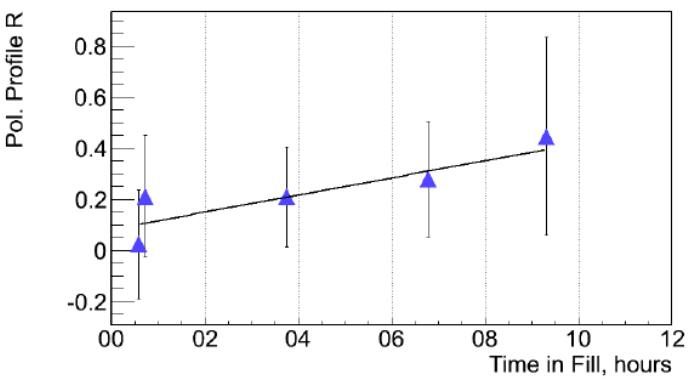
ROTATOR RAMP EFFICENCY



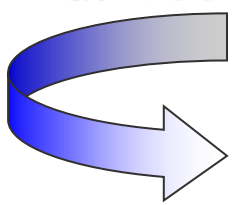
HADRON POLARISATION FOR EXPERIMENTS

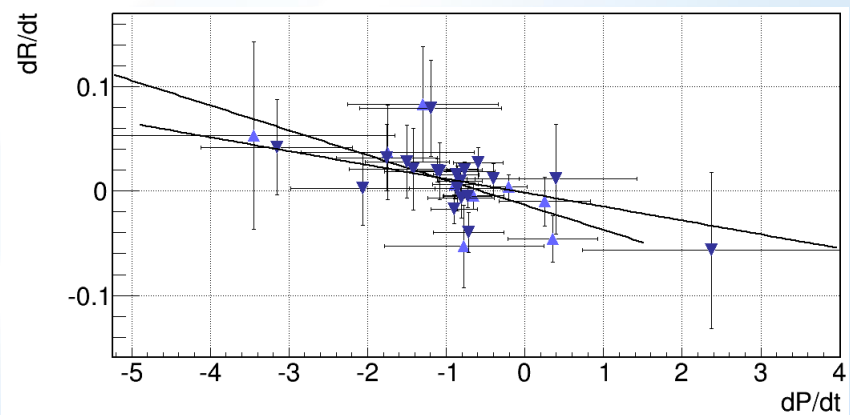
Account for
beam polarization decay through fill → $P(t)=P_0\exp(-t/\tau_p)$
growth of beam polarization profile R through fill





correlation of dP/dt to dR/dt for all 2013 fills at 100 GeV



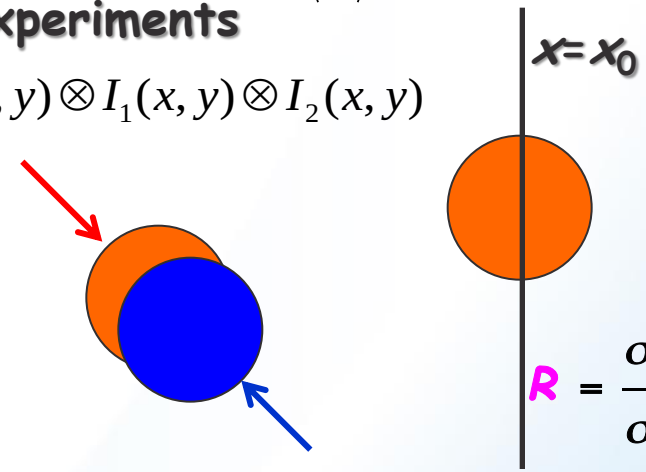


pCarbon polarimeter

$$\langle P_1 \rangle = P_1(x_0, y) \otimes I_1(x_0, y)$$

Collider Experiments

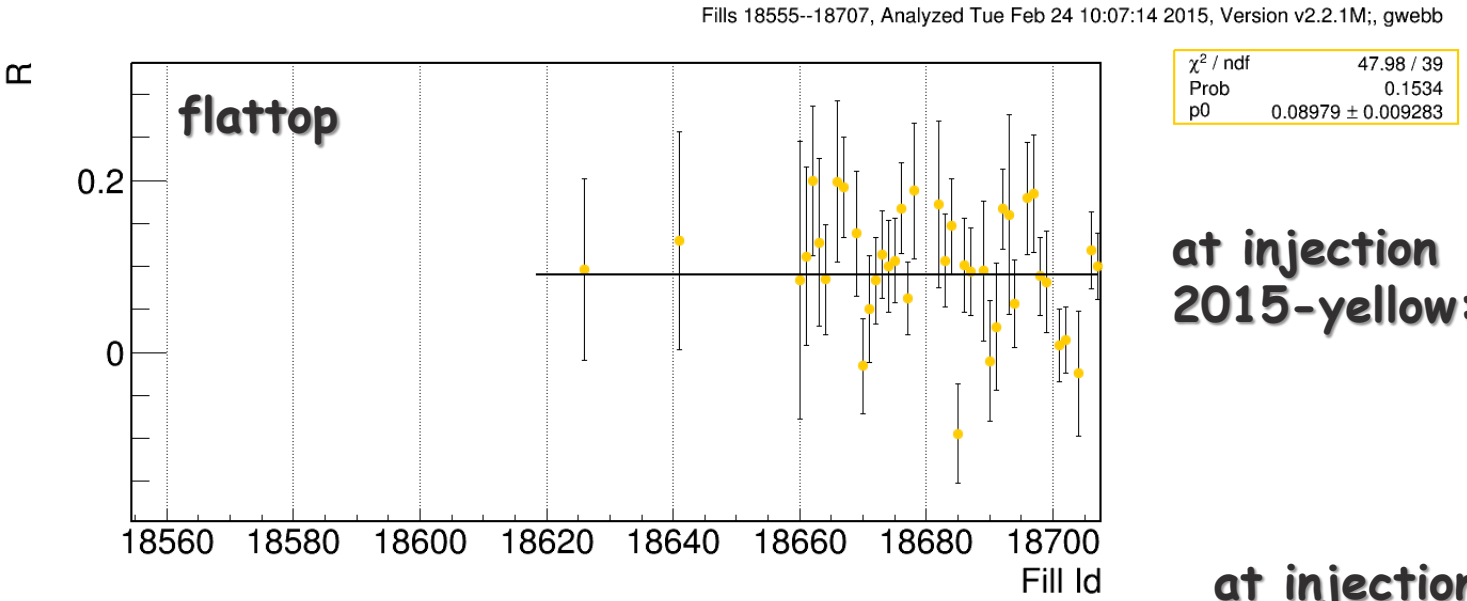
$$\langle P_1 \rangle = P_1(x, y) \otimes I_1(x, y) \otimes I_2(x, y)$$



$$R = \frac{\sigma_I^2}{\sigma_P^2}$$

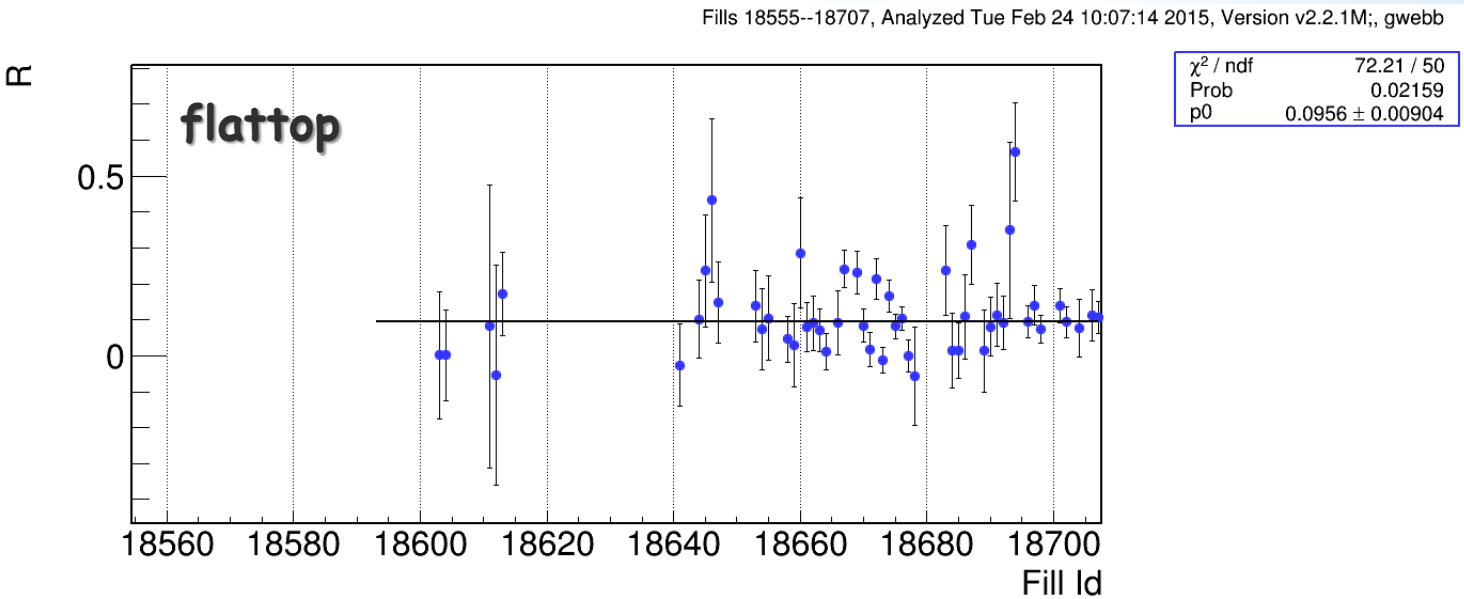
Polarization lifetime has consequences for physics analysis
→ different physics triggers mix over fill
→ different <P>

pC RESULTS: PROFILE R

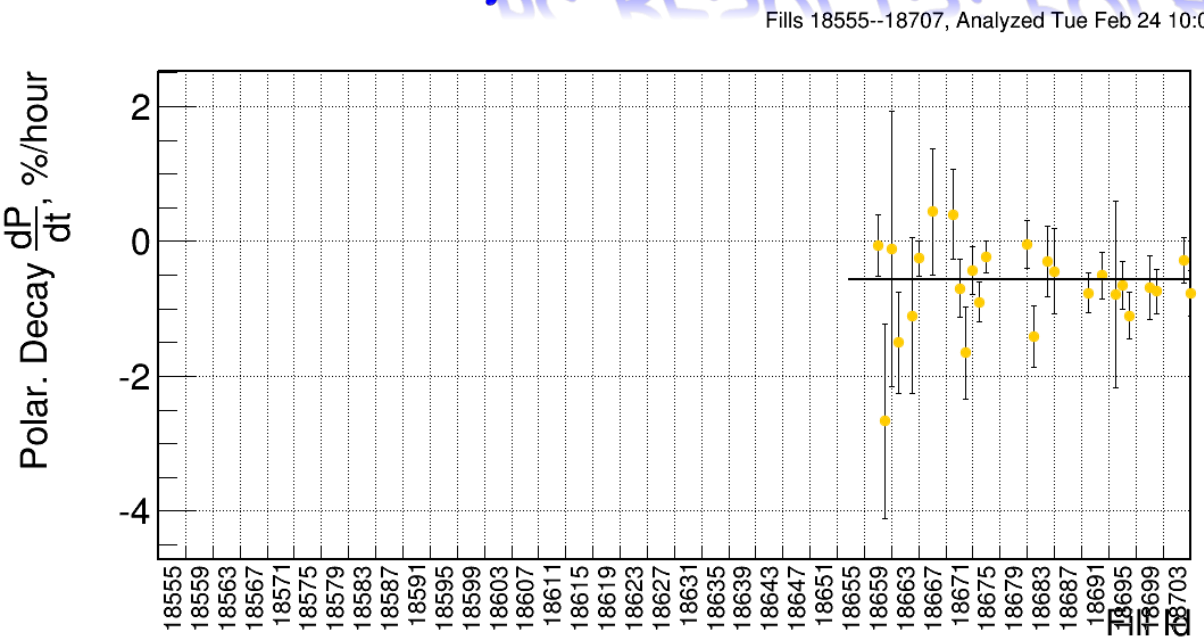


at injection
2015-yellow:0.048+/-0.01

at injection
2015-blue: 0.019+/-0.015

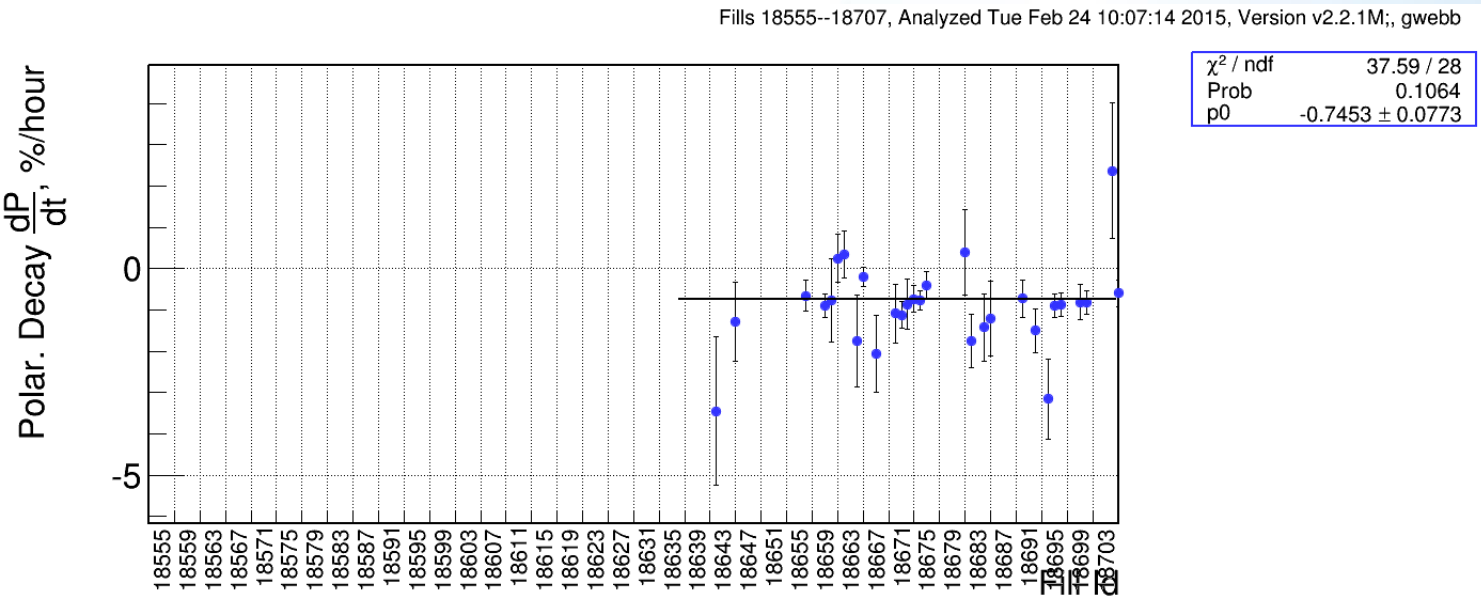


pC RESULTS: POLARISATION DECAY



2015-yellow: -0.56+/-0.08

2015-blue: -0.74+/-0.08



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SUMMARY

- Polarisation lifetime
  - blue and yellow dP/dt < 1% per hour
- Energy and Rotator Ramp efficiency
  - both look good
- Polarisation profile
  - currently similiar as in 2012
- targets:
  - behave okay