Run12, 11, …: results, systematics

special polar. mtg.
06.07.12

- Plan for results for experiments: P(t) etc.
- Where are we: Dima's web pages, ...
- Some systematics

The Plan was...

Include time dependence of polarization in results:

- Determine sweep pol. $P(t) = P_0 (1 - t/\tau_P)$
- For collision polarization include profile R: $P_{SSA} \approx (1 + \frac{1}{2} R)P$

  $$P_{SSA}(t) = P_{0,SSA}(1 - t/\tau_{P,SSA})$$
- Provide to experiments: $P_{0,SSA}$, $\tau_{P,SSA}$, and definition of t_0

Procedure in terms of pC & jet measurements:

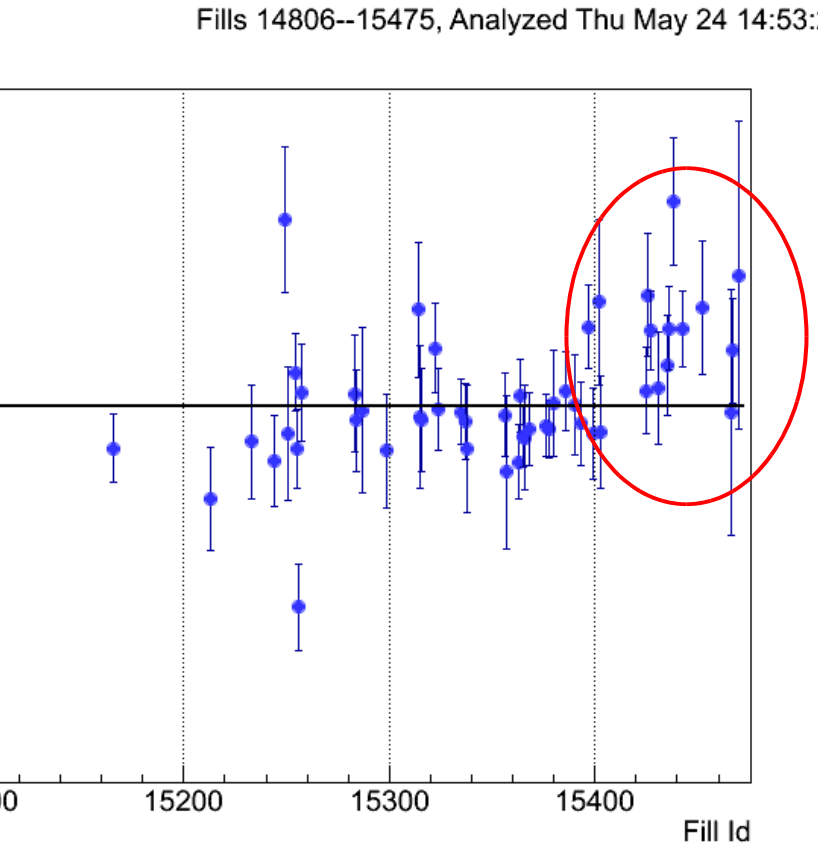
- From pC determine each fill: P^{pC}_0, τ_P, $P^{pC}_{0,SSA}$, $\tau_{P,SSA}$
- Jet measures over fill: $\langle P^{jet} \rangle = (\int_0^T I(t)P(t)dt) / (\int_0^T I(t)dt)$

  determine P^{jet}_0; e.g. for exp. I(t),P(t): $\langle P^{jet} \rangle \approx P^{jet}_0 (1 - \frac{1}{2} T/\tau_P)$
- From all fill determine pC/jet scale: $s = \langle P^{pC}_0 / P^{jet}_0 \rangle_{fills}$

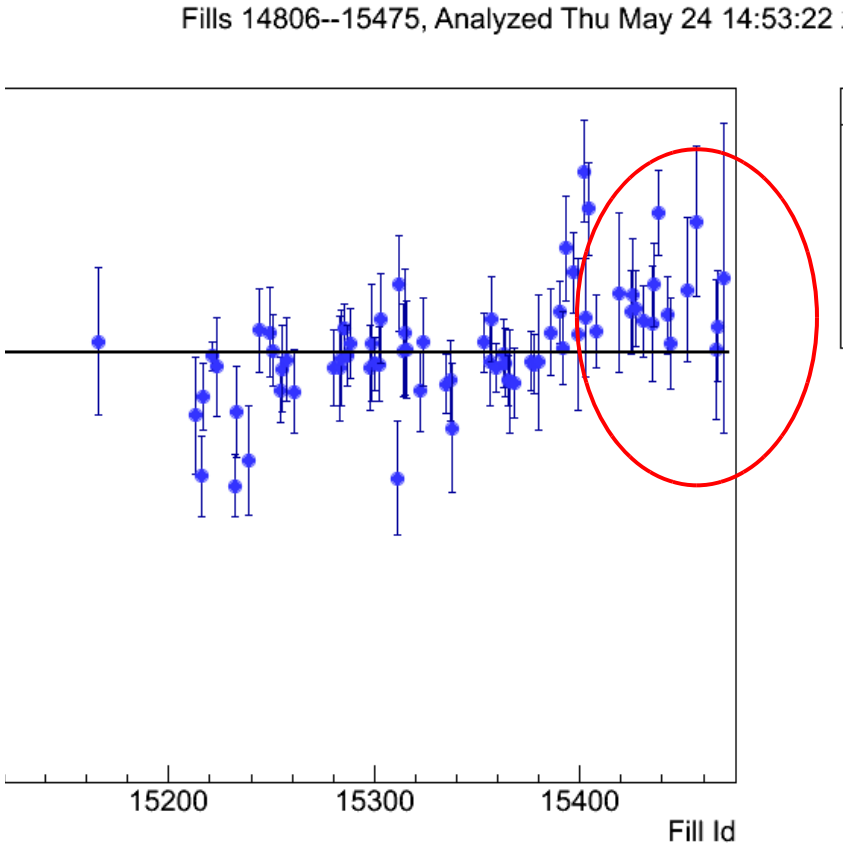
  & apply same factor to pC SSA results: $P_{0,SSA} = (1/s) P^{pC}_{0,SSA}$

Run11 B2D 4x target?

- Decided to do norm. to Hjet separately
- Done?
- Seems not reflected in Hjet/B2D, B1U/B2D ratios:



hNormJCVsFill_B2D_250	
Entries	2295
Mean	1.536e+04
RMS	74.07
χ^2 / ndf	83.39 / 50
Prob	0.002122
p0	1.093 ± 0.019



Syst. Uncert.: Hjet scale

Jet target polarization scale

- From H_2 contamination in B-R pol. meas.: 2%
- No new info; 2% overall scale uncert. on P

Backgrounds, e.g. inelastic

- Do these affect the key relation: $P_{beam} = \epsilon_{beam}/\epsilon_{tgt}\ P_{tgt}$
  i.e. different A_N for beam, tgt. polarized?
- If fill-to-fill variations not apparent, this is a scale uncert.
  can use entire data set to investigate

Syst. Uncert.: pC scale

- We measure with pC: $P = \epsilon^{pC}/A_N^{pC}$
- Each pC polar. A_N^{pC} taken as a constant for a running period

  $\Rightarrow$ scale uncert. on pC measurements from uncert. on A_N^{pC}
- Measured as mean all fills in period: $A_N^{pC} = \epsilon^{pC}/P^{Hjet}$
- The mean of A_N^{pC} has stat. uncert. (dominated by Hjet stat.)
- Variations of A_N^{pC} from constant $\Rightarrow$ syst. uncert.

  estimate syst.:

  increase (stat.$\oplus$syst.) until constant fit χ^2/NDOF=1
- Reevaluate mean, uncert. on A_N^{pC} using (stat.$\oplus$syst.)

  $\Rightarrow$ this is the overall scale uncert. each pC polarim.

Uncert. on A_N^{pC}

- Relative syst. uncert. on ratio needed to give χ^2/NDOF=1:

Rel. Syst. Uncert. on Hjet/pC				
(%)	B1U	B2D	Y2U	Y1D
Run12-255	2.3	5.9	0.9	0.8
Run12-100	0.	0.	5.6	0.
Run11-250	0.	11.1	2.8	3.6

- Many small <1%; Hjet stat. dominates measurement

- Overall relative uncert. on A_N^{pC}:

Rel. Uncert. on A_N^{pC}				
(%)	B1U	B2D	Y2U	Y1D
Run12-255	1.3	3.0	1.8	1.5
Run12-100	1.2	2.1	2.1	1.6
Run11-250	1.3	2.6	1.4	1.8

Uncert. on A_N^{pC}

This uncert. on A_N^{pC} includes:

- All Hjet uncertainties (other than the scale)
  - statistical
  - fill-to-fill systematics (background, ...)
- All pC uncertainties
  - statistical
  - fill-to-fill systematics

It provides uncert. for pC measurements:

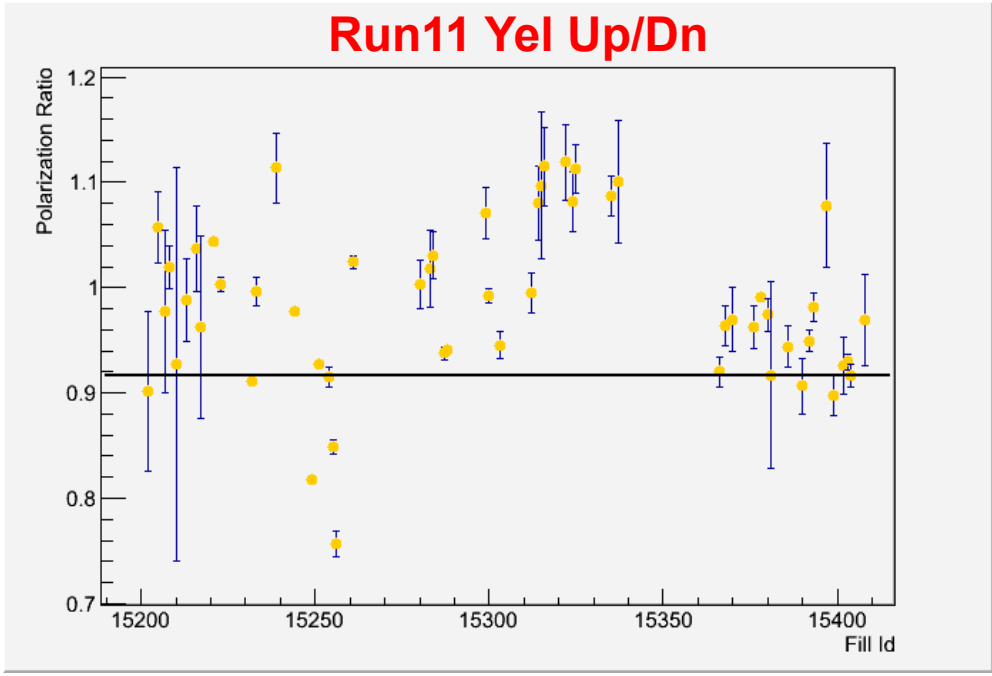
- All Hjet fill-to-fill uncertainties incorporated, done ✓
- For P for entire run period, all pC uncert. incorporated
  - Then just have $\sigma(P)/P = \sigma(\text{Hjet scale}) \oplus \sigma(A_N^{pC})$
- For subsets of entire run period
  - need a fill-to-fill systematic for pC measurements (next slide ↘)
  - need to subtract out part of this already in A_N^{pC}, inflating the final uncert. on P
  - not sure yet how to do this...

Fill-to-fill pC syst.

- Fill-by-fill have pC ratios P(upstream)/P(downstream):

- Can do the χ^2/NDOF=1 thang and get a fill-to-fill systematic on Up/Dn:

Rel. Syst. Uncert. on Up/Dn		
(%)	Blu	Yel
Run12-255	9.8	8.0
Run12-100	8.5	9.5
Run11-250	12.9	7.8



- Could just take these values × 1/√2 as each pC fill-to-fill syst.
- But know Up/Dn can be different, e.g. Blu2 always worse
- Needs more thought...

Further systematics

- These arguments have covered the scale and fill-to-fill of our pC sweep measurements
- But we also have profile R used for colliding P
- Dominated by large stat. uncert., need syst. uncert. estimate
- Sasha/Dima have mentioned comparing sweep means with results of $P(I) \propto I^R$ fits
- Could also help:
  now clear that intensity (pC rate) I is not exactly related to actual pC scattering rate, position across beam
- Needs more work...

Extras

Attempt: untangled systematics

- Relative systematics estimated from ratios
  (the χ^2/NDOF=1 thang) give:
  - σ(Hjet/Up) = σ(Hjet) $\oplus$ σ(Up)
  - σ(Hjet/Dn) = σ(Hjet) $\oplus$ σ(Dn)
  - σ(Up/Dn) = σ(Up) $\oplus$ σ(Dn)
- Then in principle:
  - from estimated σ(Hjet/Up) , σ(Hjet/Dn) , σ(Up/Dn)
  - determine σ(Up) , σ(Dn) , σ(Hjet)
    (3 equations for 3 unknowns)
- But in reality:
  - equations are really e.g. $\sigma(\text{Hjet/Up})^2 = \sigma(\text{Hjet})^2 + \sigma(\text{Up})^2$
  - always get a negative $\sigma(\text{Hjet})^2$
- Needs more thought...