Polarization results

special polar. meeting
17.08.12

Some handy #'s we haven't seen:

- dP/dt significance
- stat. uncert. P
- relative P loss
- $\sigma(P')$ vs. $\sigma(P_0)$, for error analysis

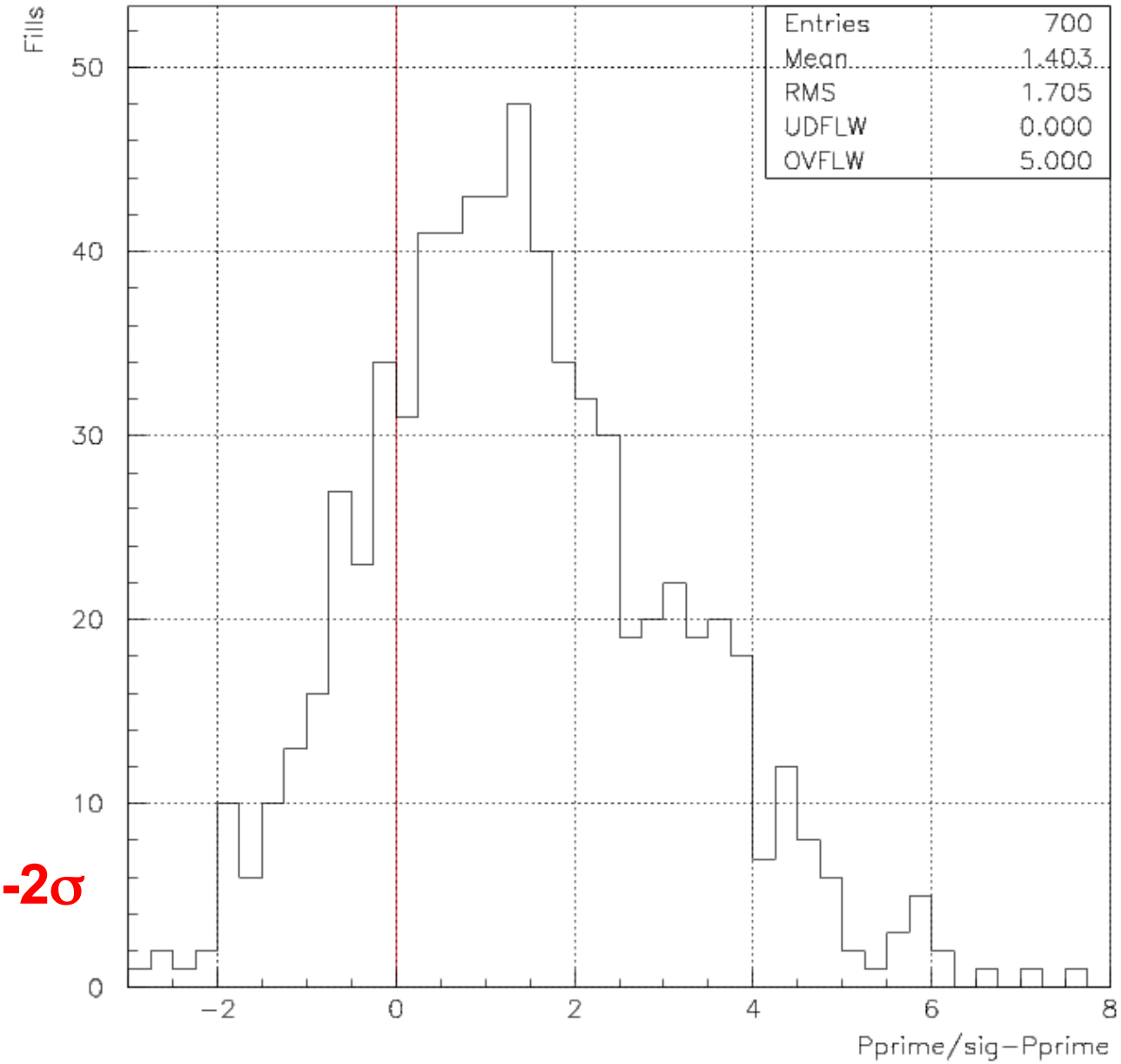
New:

- Check of profile correction % syst. uncert.
  → more checks needed

Summary of uncertainties

Significance of P'=-dp/dt

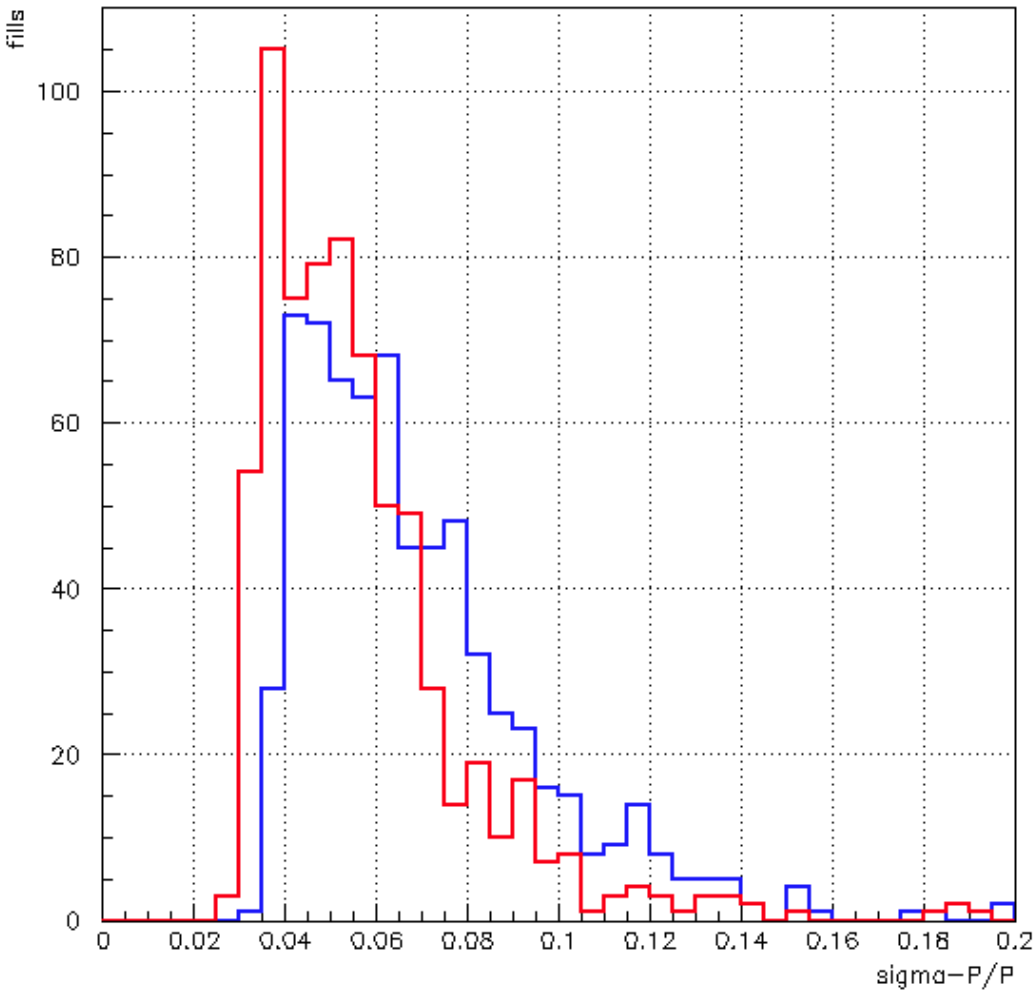
- Histogram P'/σ(P'), all fill Runs 9-12:



no fills <-2σ

Stat. uncert. P per fill

- Histogram stat. $\sigma(P)/P$, all fills Runs 9-12:

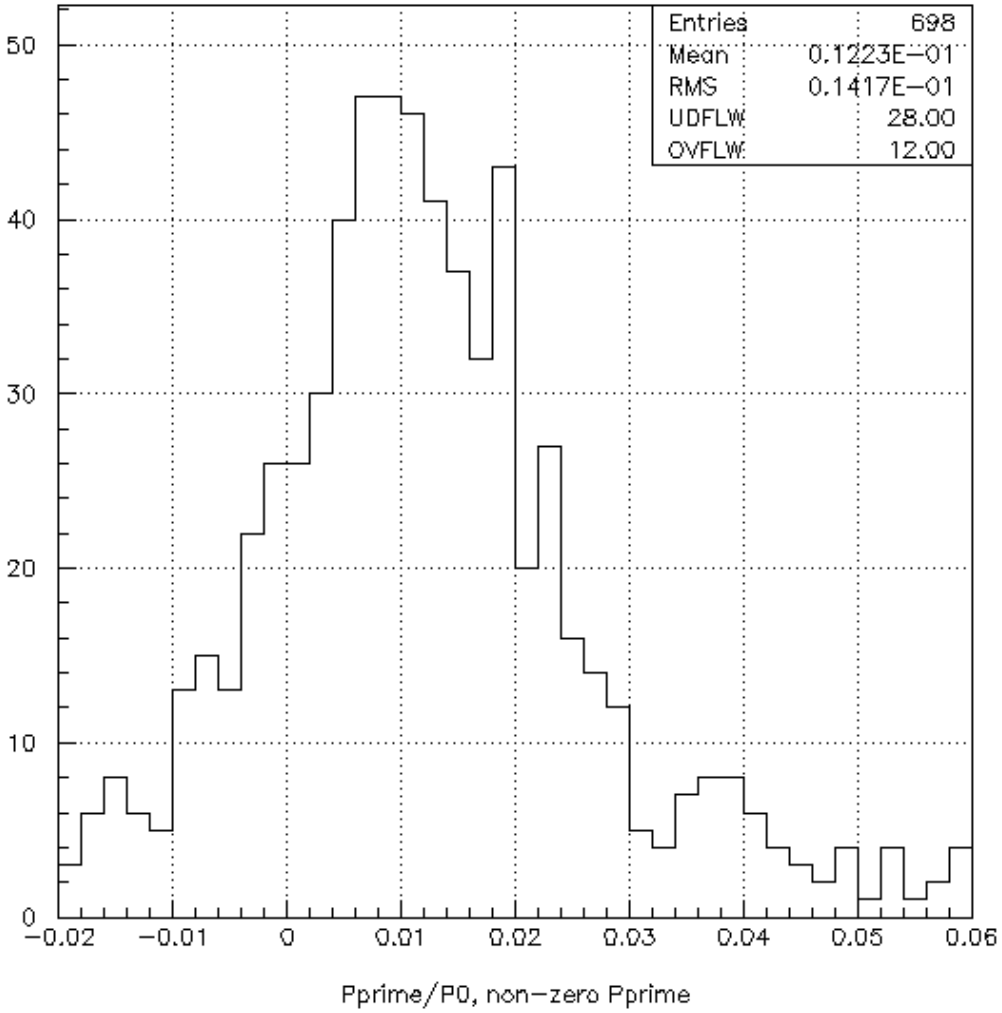


$\sigma(P_{Avrg})/P_{Avrg} \approx 4\text{-}8\%$

$\sigma(P_0)/P_0 \approx 4\text{-}6\%$

Relative rate of P loss: P'/P_0

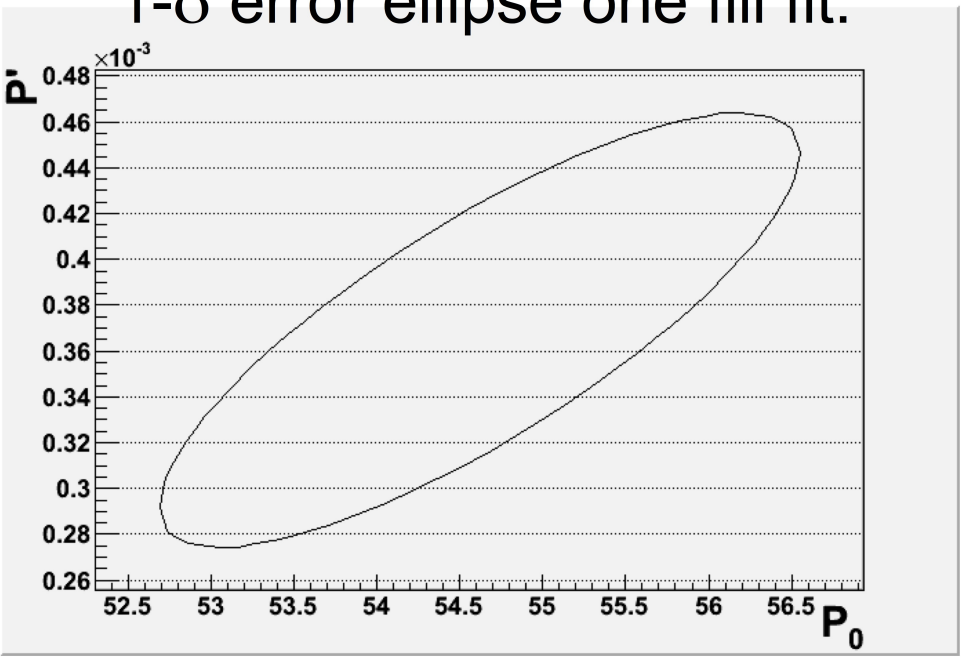
- Histogram P'/P_0, all fills Runs 9-12:
- ~1% / hour (relative)
- ~5% correction $P_0 \rightarrow \langle P \rangle$ over 10 hour fill

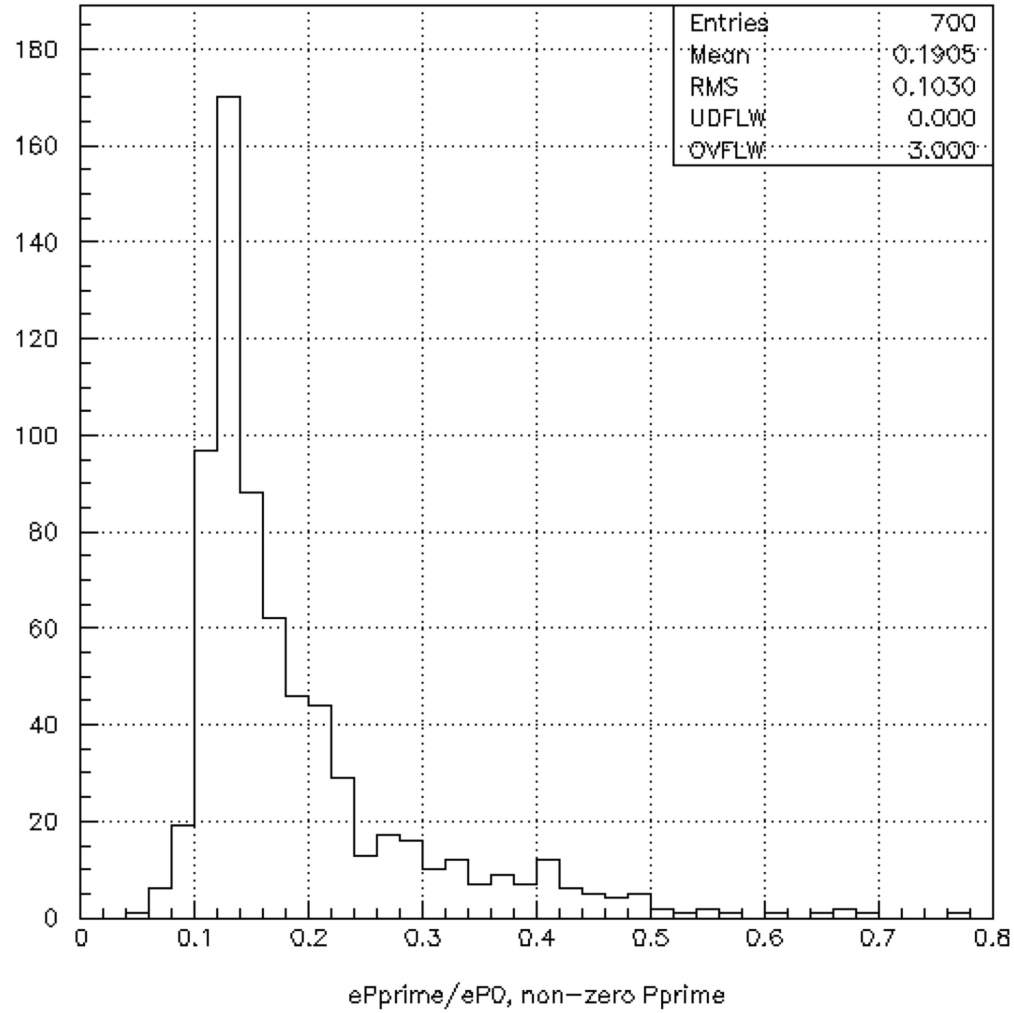


$\sigma(P')$ vs. $\sigma(P_0)$

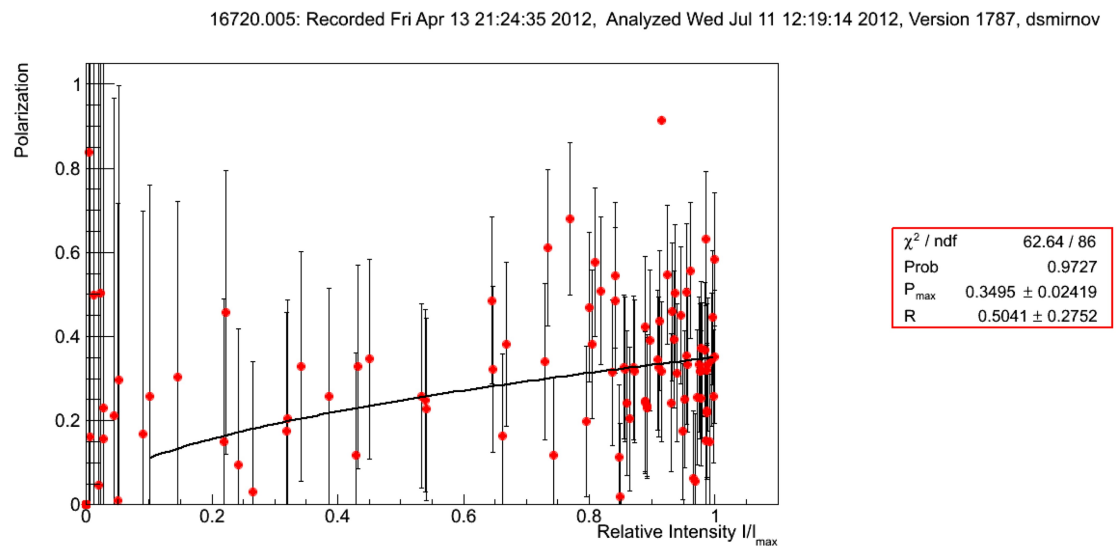
- Histogram $\sigma(P')/\sigma(P_0)$, all fills Runs 9-12:
- $\sigma(P')/\sigma(P_0)$<~ 0.2
- Uncert. on P for a fill
  fill length T hours:
  $\sigma(P) \approx \sigma(P_0) \oplus ½T\cdot\sigma(P')$
  $= \sigma(P_0) \cdot (1 \oplus ½T\cdot\sigma(P')/\sigma(P_0))$
- T~10 hours, both terms
  significant
- Correlator $\langle P_0 \cdot P' \rangle$ significant?

1-σ error ellipse one fill fit:





Check of profile (R) correction



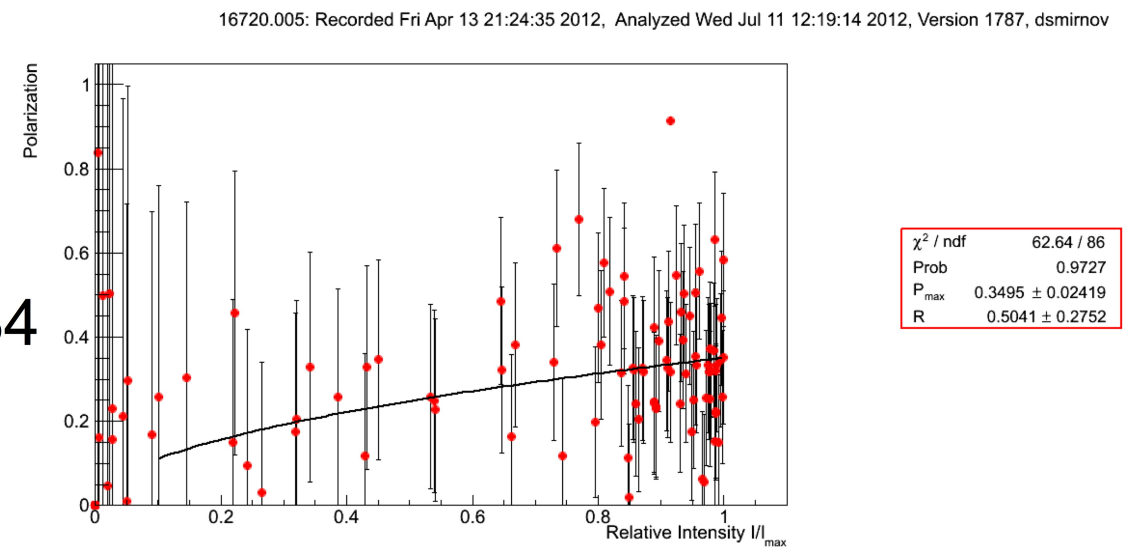
- Measure R from P vs. Intensity:
  $P(I) = P_{max} \cdot (I/I_{max})^{R}$
- In terms the (fit) parameters
  P_{max} & R , mean of sweep is:
  $\langle P \rangle_{fit} = P_{max}/\sqrt{(1+R)} \approx P_{max} \cdot (1-\frac{1}{2}R)$
- Very similar to SSA profile correction:
  $P_{SSA} \approx \langle P \rangle \cdot (1+\frac{1}{2}R)$

- We measure directly (& use for results) sweep mean $\langle P \rangle_{sweep}$
- Comparing $\langle P \rangle_{fit}$ & $\langle P \rangle_{sweep}$ sheds light on precision of SSA correction

P scale difference

- So far histos I use for P(I) must have a preliminary scale applied to P; e.g. for:

  Fit gives P_{max} = 0.3495

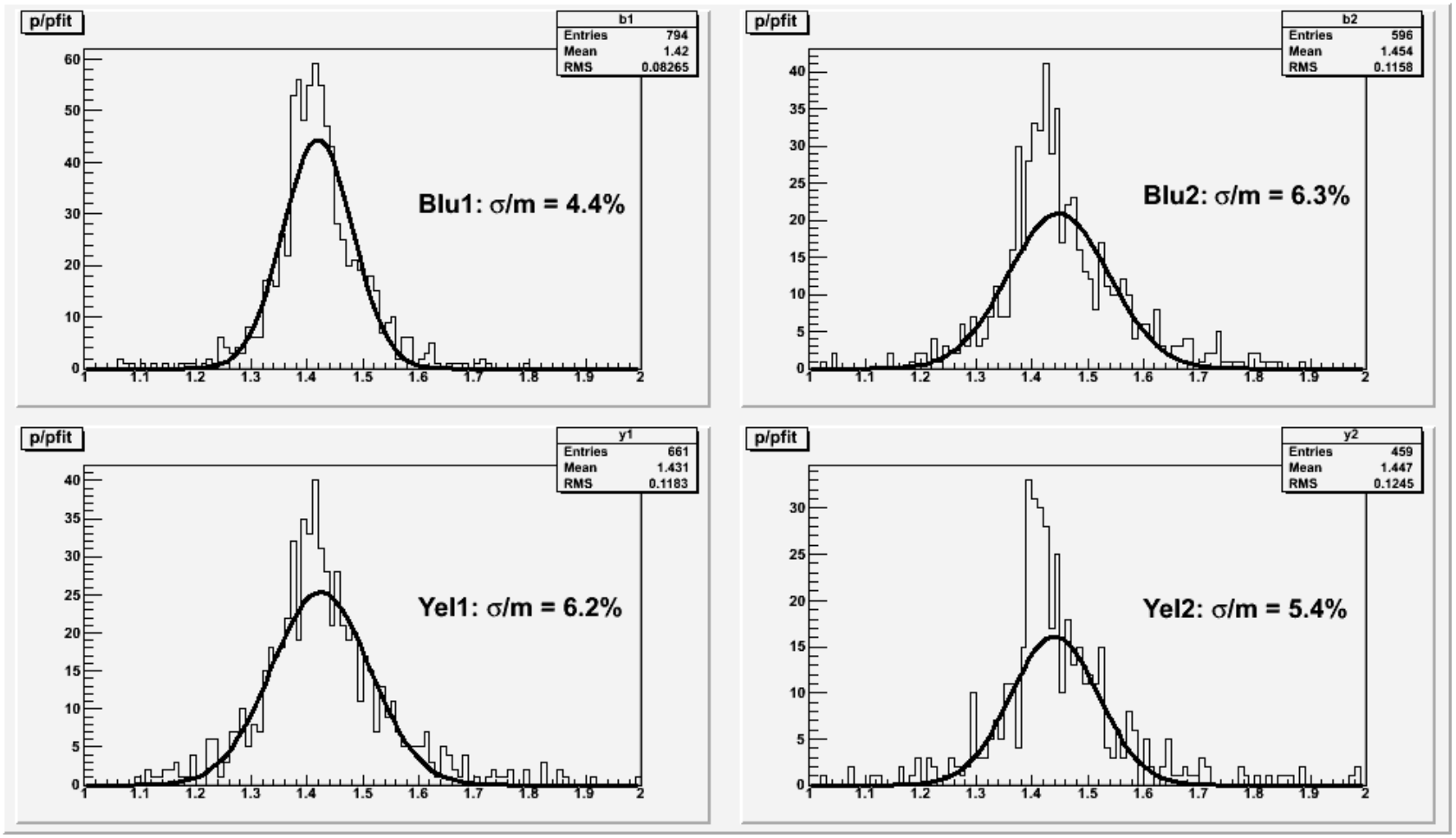


- In data base results: $\langle P \rangle$ = 0.434
- But should have: $\langle P \rangle < P_{max}$
- Scale difference in info I'm using; preliminary A_N apllied to P(I) histo?
- Would be good to sort out, or compare raw asymmetries...
- For now: look fill-by-fill at ($\langle P \rangle_{fit}/\langle P \rangle_{sweep}$),

  RMS of distribution ∝ instability of algorithm
- Later, sort out scale: mean of ($\langle P \rangle_{fit}/\langle P \rangle_{sweep}$) ∝ bias in algorithm

Check of profile (R) correction

- RMS/mean of ($\langle P \rangle_{fit} / \langle P \rangle_{sweep}$) distributions:



- RMS/mean ~ 4.5-6.5%
- Mean values ~1.4, 40% P-scale difference? Or bias?

REALLY SHOULD CHECK THIS...

Profile correction uncertainty

- This is uncertainty per sweep measurement in one direction:
  $\langle P \rangle_{fit} \approx P_{max} \cdot (1 - \frac{1}{2} R)$
- Sweep→SSA correction is ~average two independent measurements:
  $P_{SSA} \approx \langle P \rangle \cdot (1 + \frac{1}{4}(R_V + RH))$
- ⇒ scale uncert. × $1/\sqrt{2}$
- Each fill has typically ~3 sweep measurements
- ⇒ scale uncert. × $1/\sqrt{3}$
- Scale result previous slide: $\sigma_{prof\text{-}corr}$ = 1.8-2.6%, call it 2.2%
- **⇒ fill-to-fill $\sigma_{prof\text{-}corr}$ = 2.2%**

Summary: uncertainties

Scale

- H-jet scale: 2% (H_2 contamination)
- H-jet background: ???%
- pC A_N: 1.2% (H-jet/pC ratios, stat&syst.)

Fill-to-Fill

- Statistical: 5-9% ($\sigma(P_0)$, $\sigma(P')$)
- Scale systematic: 0-3% (P(upstream)/P(downstream))
- Profile correction: 2% (P(I) fits vs. P-sweep)

Sets of fills

- Fill-to-fill stat. & scale syst. uncert. already in pC A_N uncert.:

  scale by $(1-M/N)^{1/2}$ for M fills in data set

  N fills for H-jet/pC normalization
- Profile correction scales by $1/\sqrt{M}$

  unless there is a bias, should check...