

# Run-6 $pC$ polarimetry analysis

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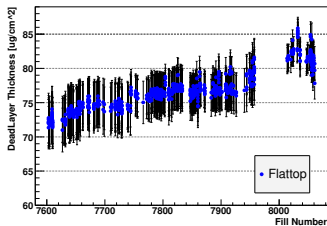
# Outline

1. QA analysis
2. Scan measurements: luminosity/polarization profile
3. Preliminary results from  $pC$
4. Comparison with Jet-preliminary
5. Summary

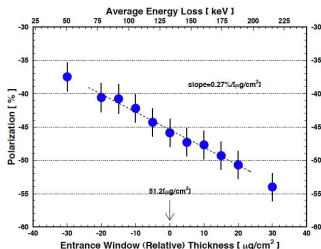
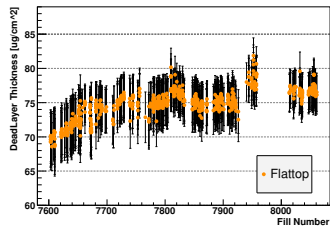
# Dead-layer history

Silicon strip dead-layer: obtained by fitting ToF vs. Energy

DeadLayer History (Blue)



DeadLayer History (Yellow)



**Goal:**

$10 \mu\text{g}/\text{cm}^2$  strip-by-strip stability  $\Rightarrow$   
 $\approx 3\%$  systematic error in  $\mathcal{P}$  (due to DL)

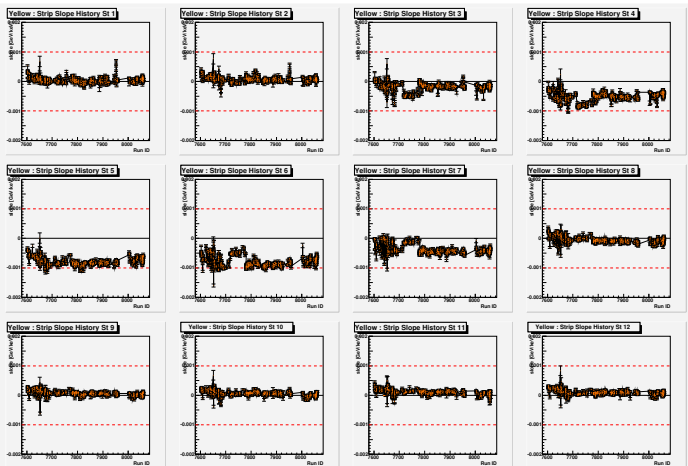
# Strip anomaly checks

- ▶  $C$  mass–energy correlation
- ▶  $C$  mass position
- ▶  $C$  mass width
- ▶ Number of events in banana

## Strip anomalies

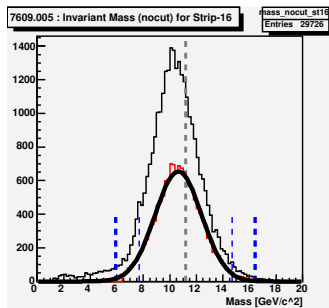
 $C$  mass–energy correlation

- ▶ 0.001 GeV/keV limit  $\Rightarrow \approx 3\text{-}4\%$   $E$  resolution  $\Rightarrow \approx 3\%$  syst. in  $\mathcal{P}$
- ▶ Removed strips  $\gg 0.001$  GeV/keV: very few (2–3 strips in 3–4 runs)



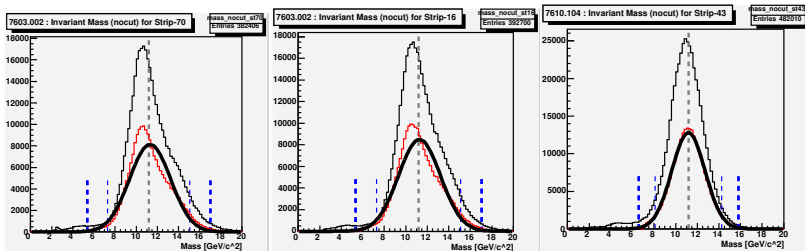
## C mass position error

- ▶ 0.5 GeV deviation  $\Rightarrow \Delta\text{ToF}=1 \sim 1.25$  ns and  $\Rightarrow \approx 3\%$  in  $\mathcal{P}$
- ▶ Removed strips with deviations 0.5 GeV (only 9 runs affected)



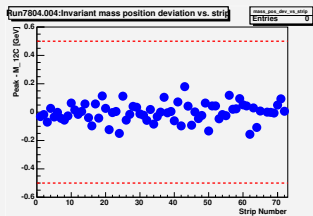
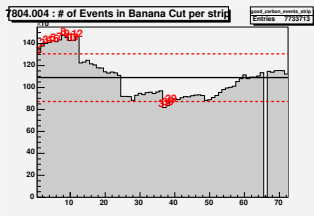
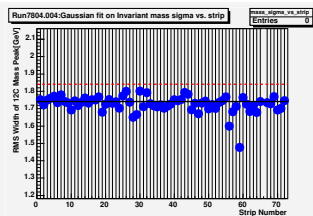
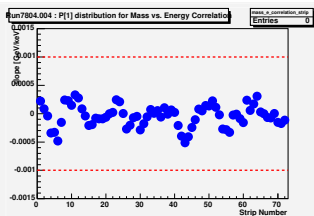
## C mass width error

- ▶ “Double peak” due to electronics jitter
- ▶ Very small effect in  $\mathcal{P}$ : 1% from 2- $\sigma$  to 3- $\sigma$  cut
- ▶ No strips disabled due to this error  
(backgrounds are low and only a few strips show this problem)



## Number of events in banana

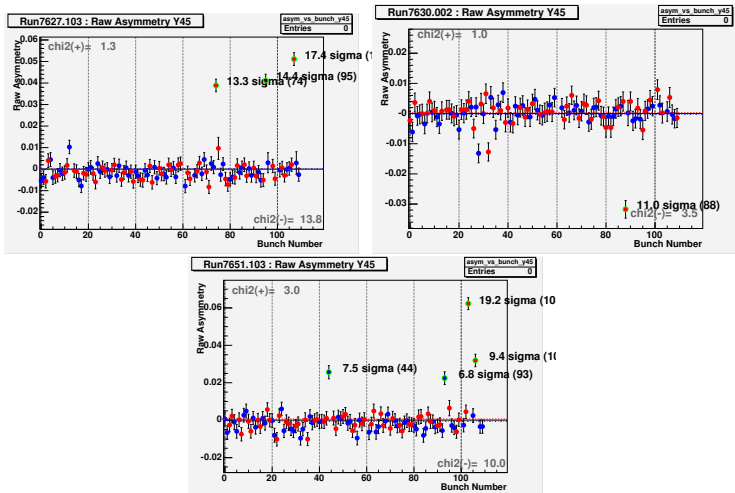
- ▶ Limit set at  $\pm 20\%$  of the average
- ▶ Some strange cases found (4 runs, eg. below), not understood  
⇒ runs removed



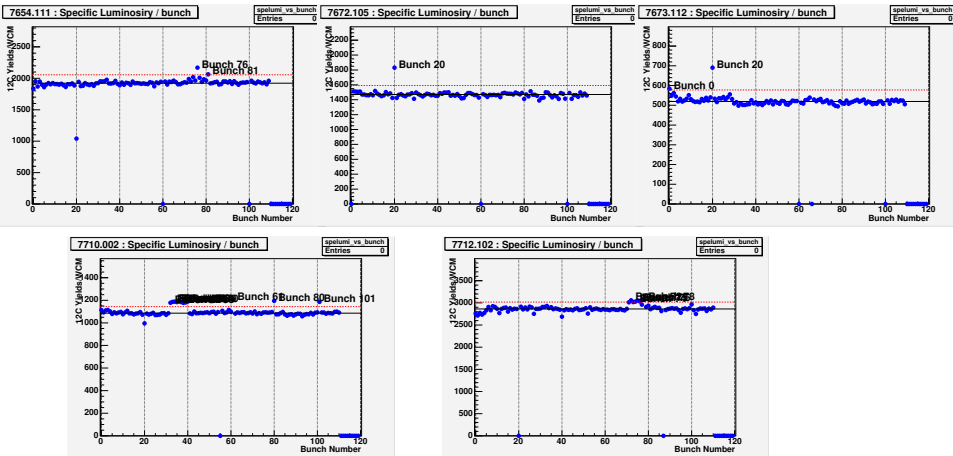


# Bad bunch asymmetries

Only seen in 3 runs removed: associated with  $pC$  DAQ problem



# Hot bunches

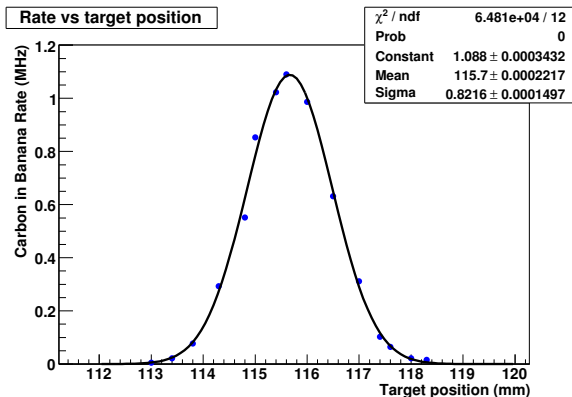


Seen in around 30 fills:

- ▶ Disabled very hot bunches (like bunch 20)
- ▶ Bunches slightly above average considered OK

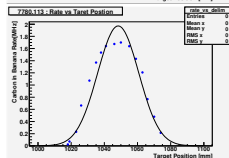
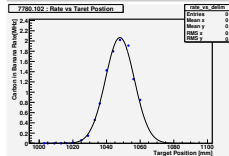
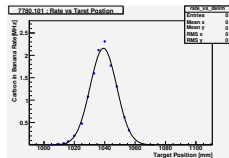
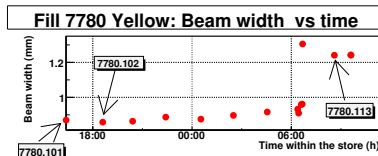
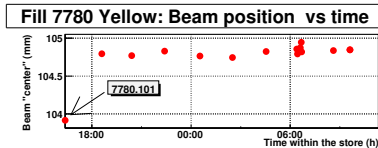
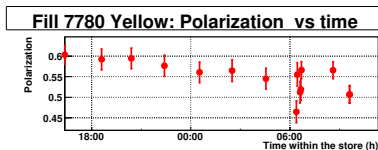
# An example: run 7654.005

## Horizontal scan (vertical target)



Horizontal width  $\sim 0.8$  mm

# Changes in beam position/width within a fill: 7780-Yellow



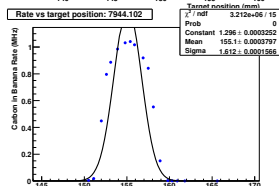
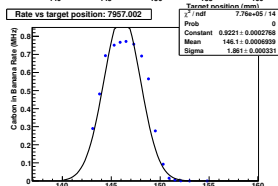
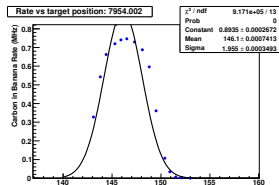
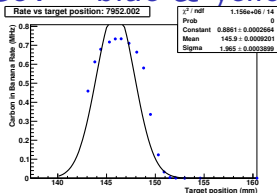
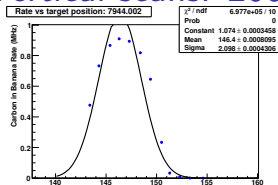
IPM emittance check (by Haixin) showed this is not real  $\Rightarrow$   
**target position problem**

## Vertical profile: fill summary

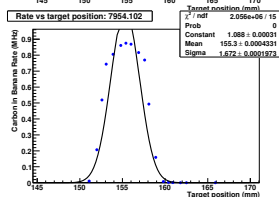
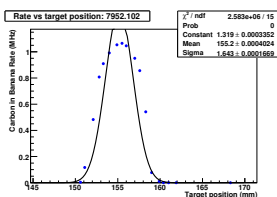
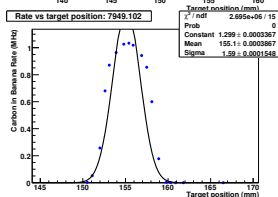
Horizontal scan		Vertical scan		← TOTAL
Blue	Yellow	Blue	Yellow	
133	144	15	6	
		7940	7940	200 GeV (long)
		7944	7944	
		7949	7949	
		7952	7952	
		7954	7954	
		7957	7957	
		8036		62 GeV (trans)
		8047		
		8049		
		8052		
		8054		
		8055		
		8056		
		8058		
		8059		
		8061		

Vertical scans

## Vertical scans: 200 GeV – blue &amp; yellow

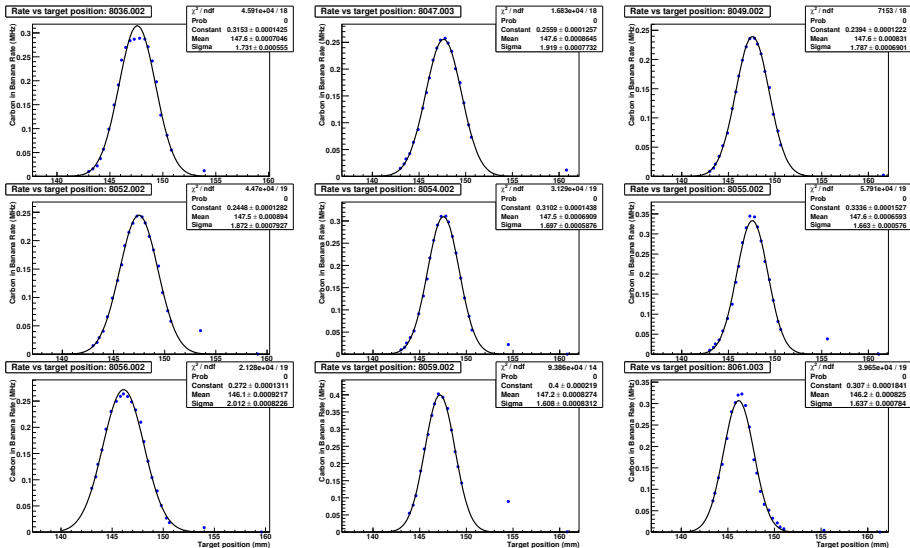


Again,  
target position problem



## Vertical scans

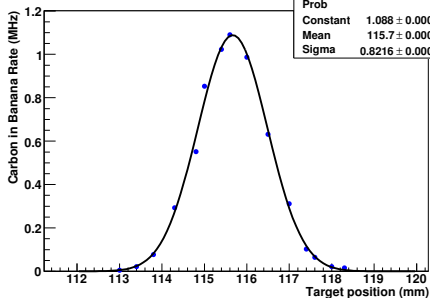
## Vertical scans: 62 GeV – blue



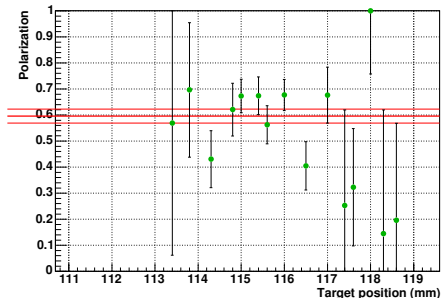
# An example: run 7654.005 (200 GeV)

## Horizontal scan (vertical target)

Rate vs target position



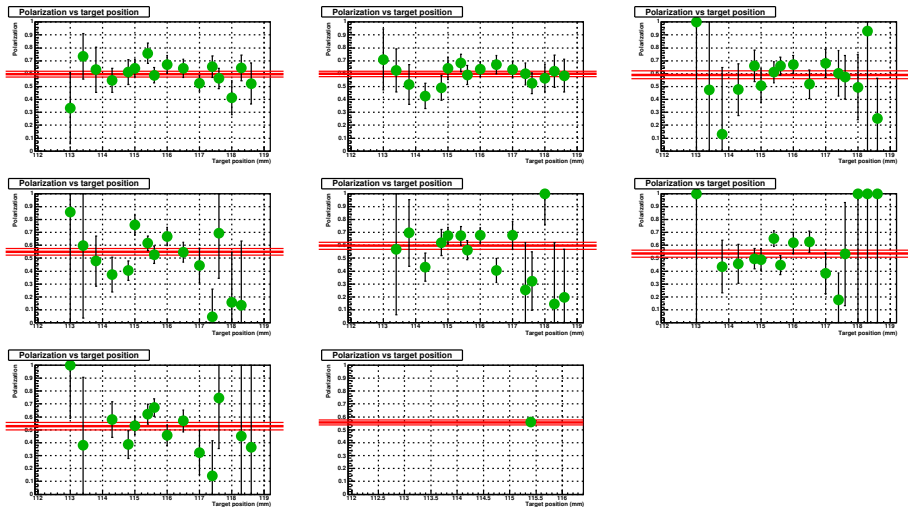
Polarization vs target position





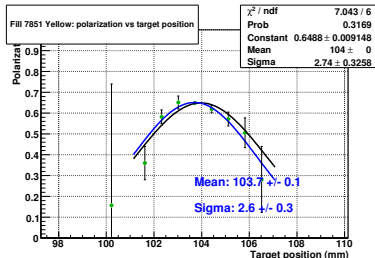
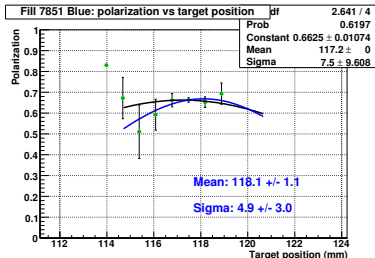
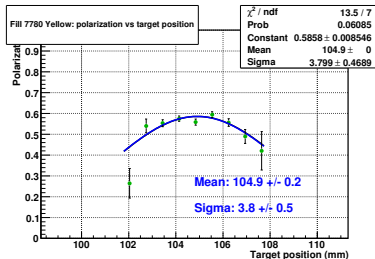
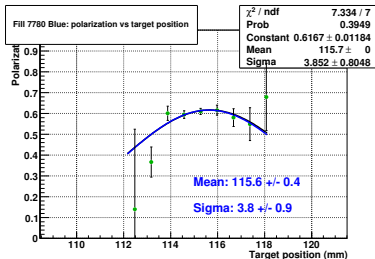
## Polarization profile

## A whole fill: polarization vs. target position



## Polarization profile

## Polarization vs. target position: some combined fills



## Polarization vs. rate fit

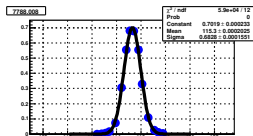
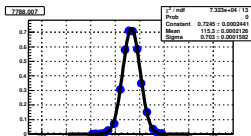
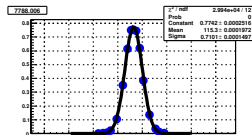
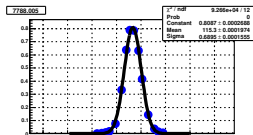
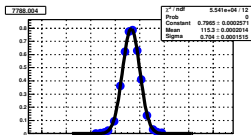
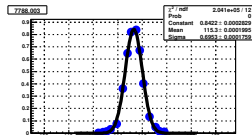
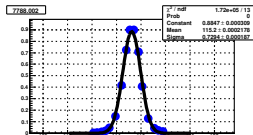
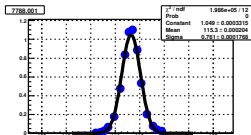
Fit polarization vs. rate to extract  $r = (\sigma_L/\sigma_P)^2$

$$\left. \begin{aligned} L &= L_{max} \cdot e^{\frac{-x^2}{2\sigma_L^2}} \\ P &= P_{max} \cdot e^{\frac{-x^2}{2\sigma_P^2}} \end{aligned} \right\} \Rightarrow P = P_{max} \cdot (L/L_{max}) \left(\frac{\sigma_L}{\sigma_P}\right)^2$$

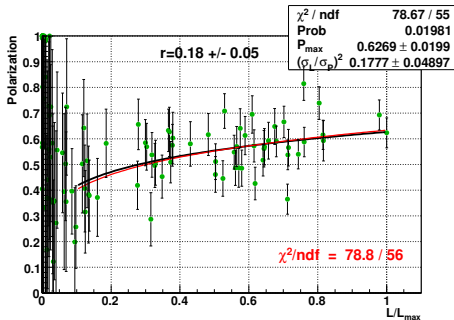
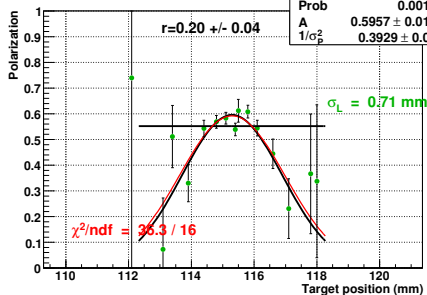
- ▶ Fit of  $P$  vs  $L/L_{max}$
- ▶  $P_{max}$  and  $r = (\sigma_L/\sigma_P)^2$  are the 2 free parameters of the fit
- ▶ **Only  $r$  is needed** for correcting for polarization profile (no need of  $\sigma_L$  and  $\sigma_P$  separately):
  - ▶ Correction peak-to-average for Jet:  $\sqrt{1+r}$
  - ▶ Correction peak-to-average for experiments:  $1/\sqrt{1+r/2}$

# Fill 7788 – blue: luminosity profile

Fill showing *good* (gaussian) luminosity profile



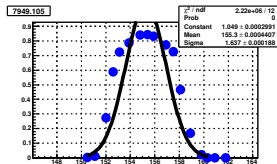
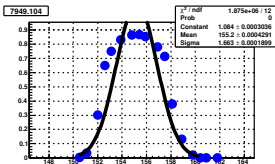
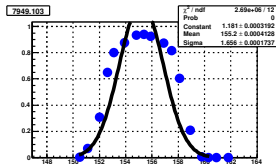
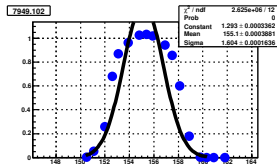
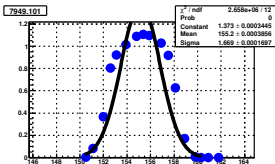
# Fill 7788 – blue: comparison of two methods

**Fill 7788 Blue: pol vs tgt pos**


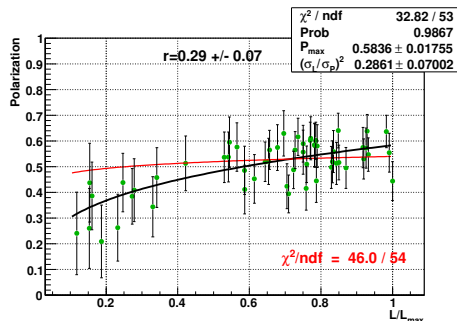
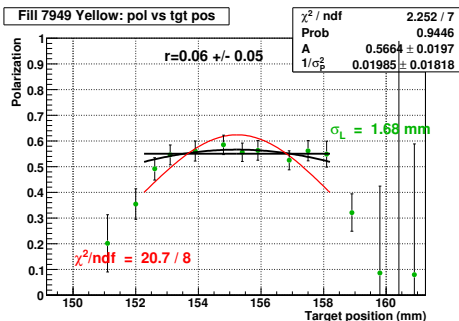
Both methods ( $\mathcal{P}$  vs tgt.-pos. &  $\mathcal{P}$  vs rate) are consistent

# Fill 7949 – yellow: luminosity profile

Fill showing “weird” luminosity/intensity profile



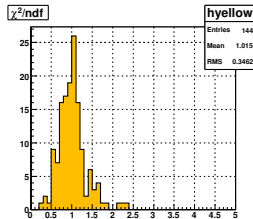
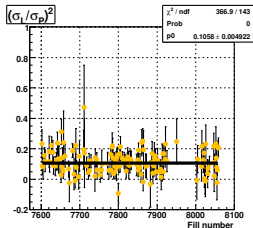
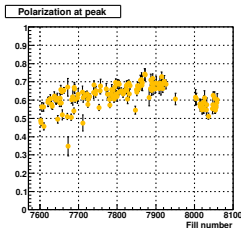
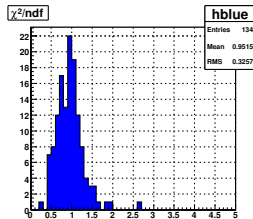
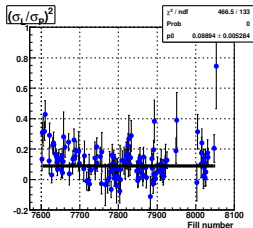
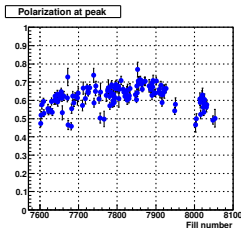
# Fill 7949 – yellow: comparison of two methods



$\mathcal{P}$  vs tgt.-pos. &  $\mathcal{P}$  vs rate yield different result  
 $\Rightarrow \mathcal{P}$  vs rate method used for analysis

# Preliminary results: horizontal scans

- $(\sigma_L/\sigma_P)^2 \sim 0.1$  for both blue & yellow (horizontal)

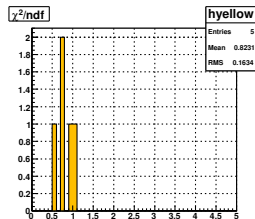
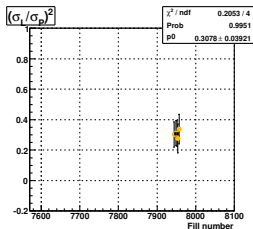
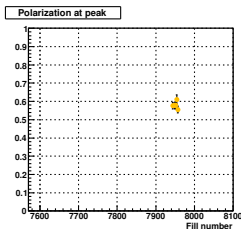
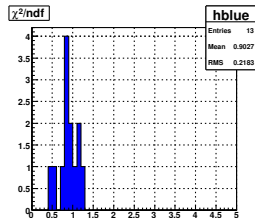
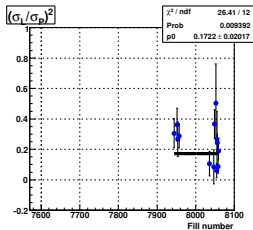
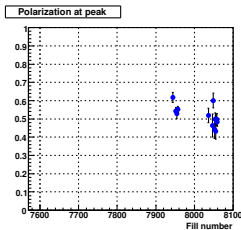




## Vertical scans

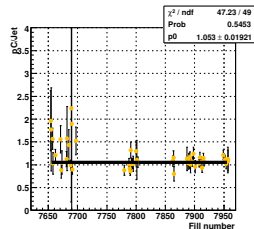
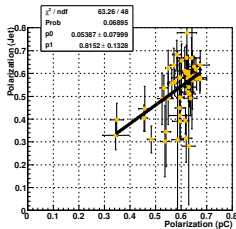
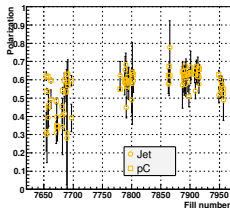
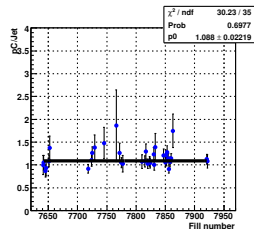
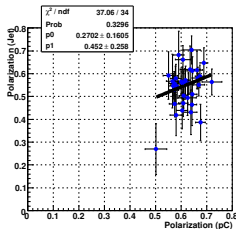
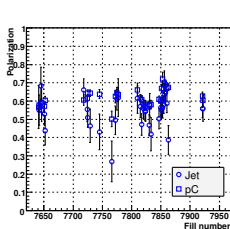
## Preliminary results: vertical scans

- ▶  $(\sigma_L/\sigma_P)^2 \sim 0.2 - 0.3$ : much larger than horizontal
- ▶ Only very few measurements



# Comparison with Jet preliminary results (200 GeV)

- ▶  $pC/_{\text{Jet}} = 1.09$  for blue and  $1.05$  for yellow



# Summary

1. Problems with target motion/positioning
2. Both horizontal and vertical polarization profile:
  - ▶ Still biggest source of systematic error in Run-6
  - ▶ Need to monitor both horizontal & vertical profiles in the future
3. Results still preliminary (further checks on systematics), but close to final. . .