CDF Luminosity studies

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Outline

- Look at COT currents and CLC luminosity VS time (run number).
- Look at W yields VS time (run number).
- Look for non linear effects at very high luminosity by comparing with offline measurement with particle counting method.

COT currents vs CDF - Idea

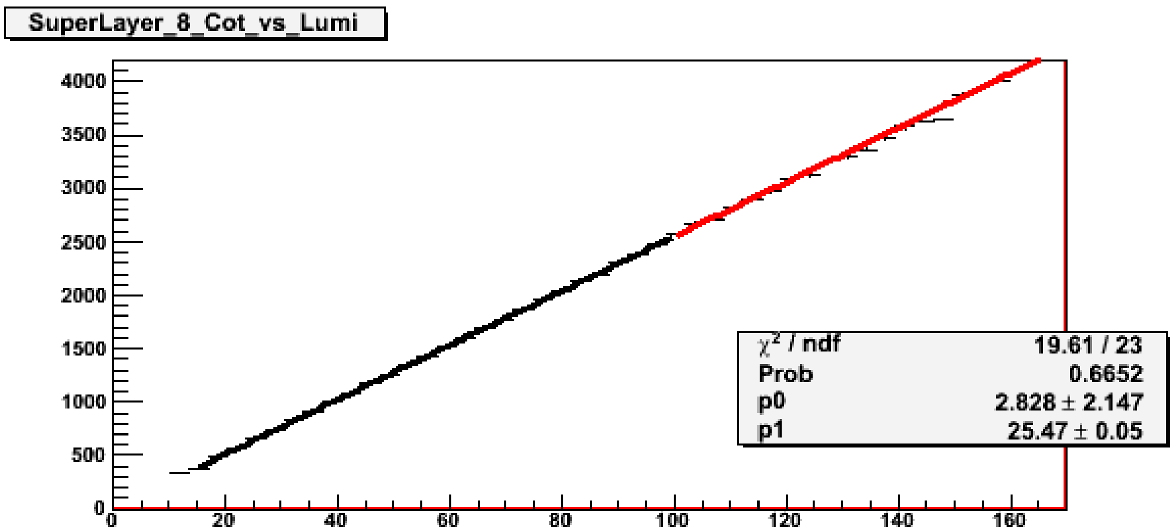
Central Outer Tracker (COT) in CDF is a drift chamber, with 8 superlayers, covering radii between 44cm and 132cm.

If there is no saturation on currents, we expect the currents to scale linearly with luminosity.

We checked the COT currents by comparing SL_i VS SL_j. Only first 2 SLs showed saturation effect (see backup slides if interested).

Results we are showing are based on SL_8. The outermost.

COT currents vs CDF - Results



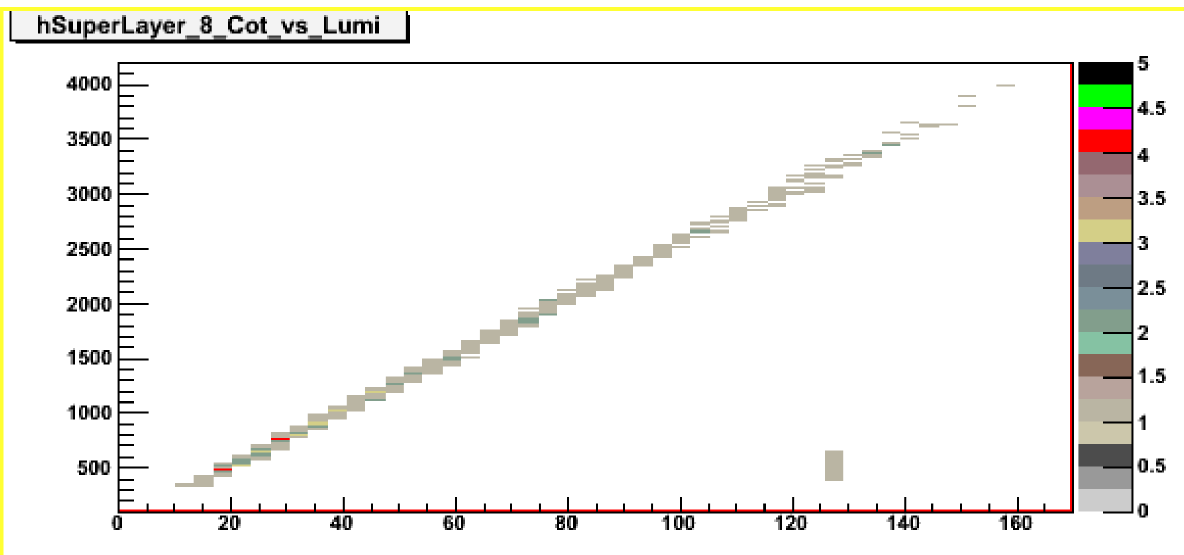
Here we plot:

SL8 VS B0lum

X axes -> Lum[E30cm^{-2}s^{-1}]

Y axes -> SL8 current

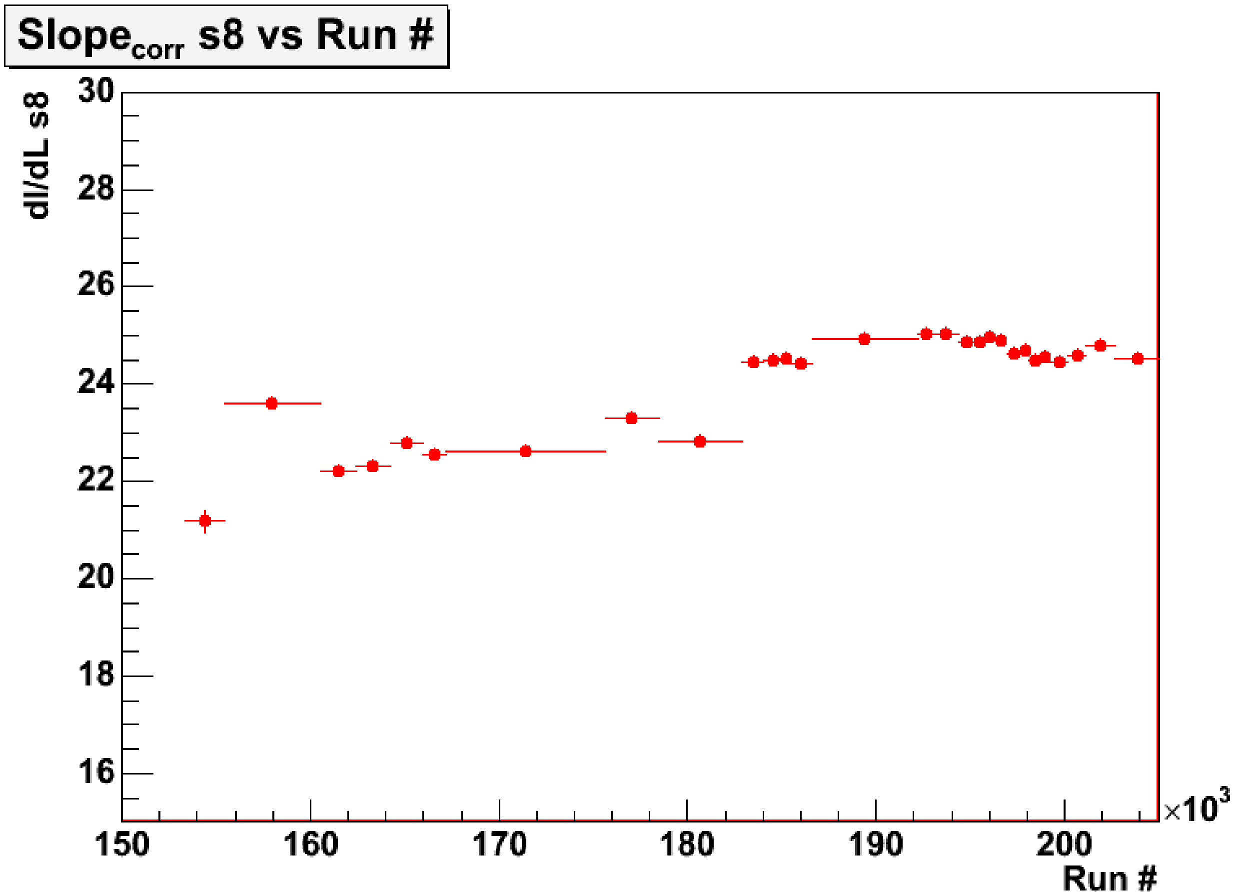
Fit up to 100E30. Extrapolated to guide the eye.



COT Superlayer 8 is the outermost layer. Less sensitive to current saturation.

Data collected from Oct 16 to Oct 31 2005

COT currents vs CDF - Results



Here we plot:

Slope of SL8_B0lum vs Run #

X axes -> Run Number(time)

each bin ~ 24 pb^{-1}

Y axes -> Slope of COT current vs B0Lum.

Slopes stable after shutdown at 2% level.

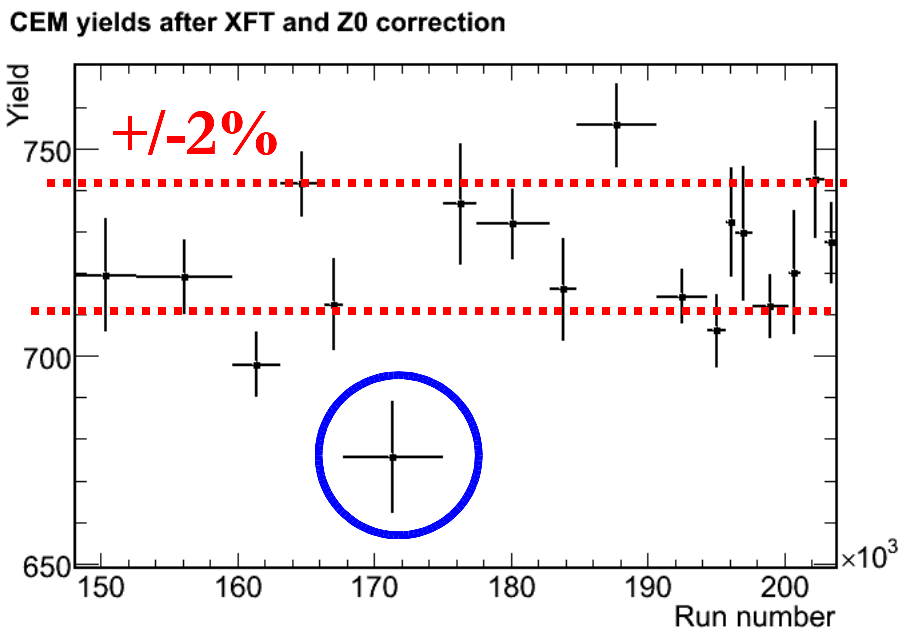
W Yields vs time

- **Trigger efficiency:**
  - ***Muons from J/psi study***
  - ***Electrons from WNOTRACK study***
- **Z-vertex cut efficiency**
- **Z-vertex dependent acceptance**
- **Apply no cuts on COT chi2 or number of superlayers**
  - ***Minimise difference between gen5 and gen6 reconstruction***
- **Apply to Central_Electron18, WNOTRACK and CMUP triggered W’s**
  - ***WNOTRACK does not get XFT efficiency correction***

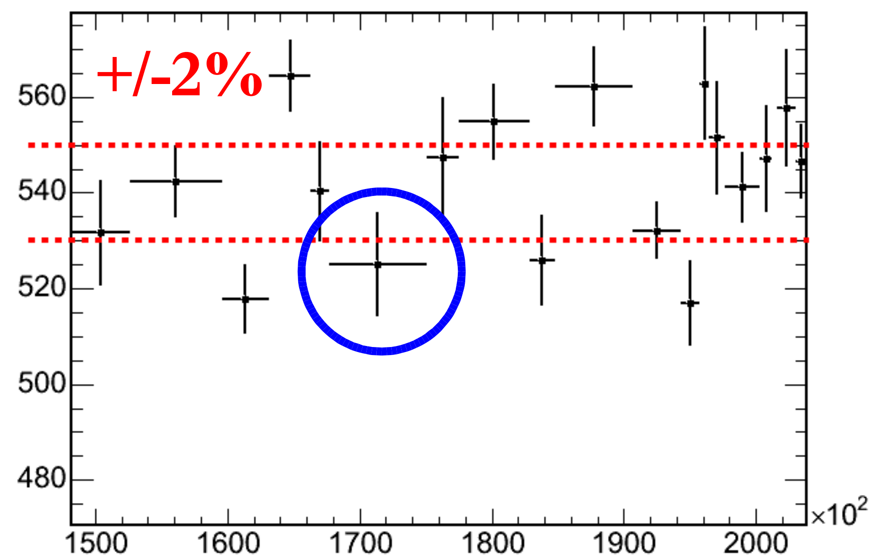
From talk by Beate Heinemann on CDF Joint Physics Group

W Yeilds vs time

CENTRAL_ELECTRON18



WNOTRACK



From talk by Beate Heinemann on CDF Joint Physics Group

Zero counting VS particle counting methods

Online. Zero counting method.

Offline. From zero bias data we collect on each store we can calculate luminosity offline using different methods.

Here we present the comparison between online and offline luminosity measurements with particle counting method.

Algorithm:

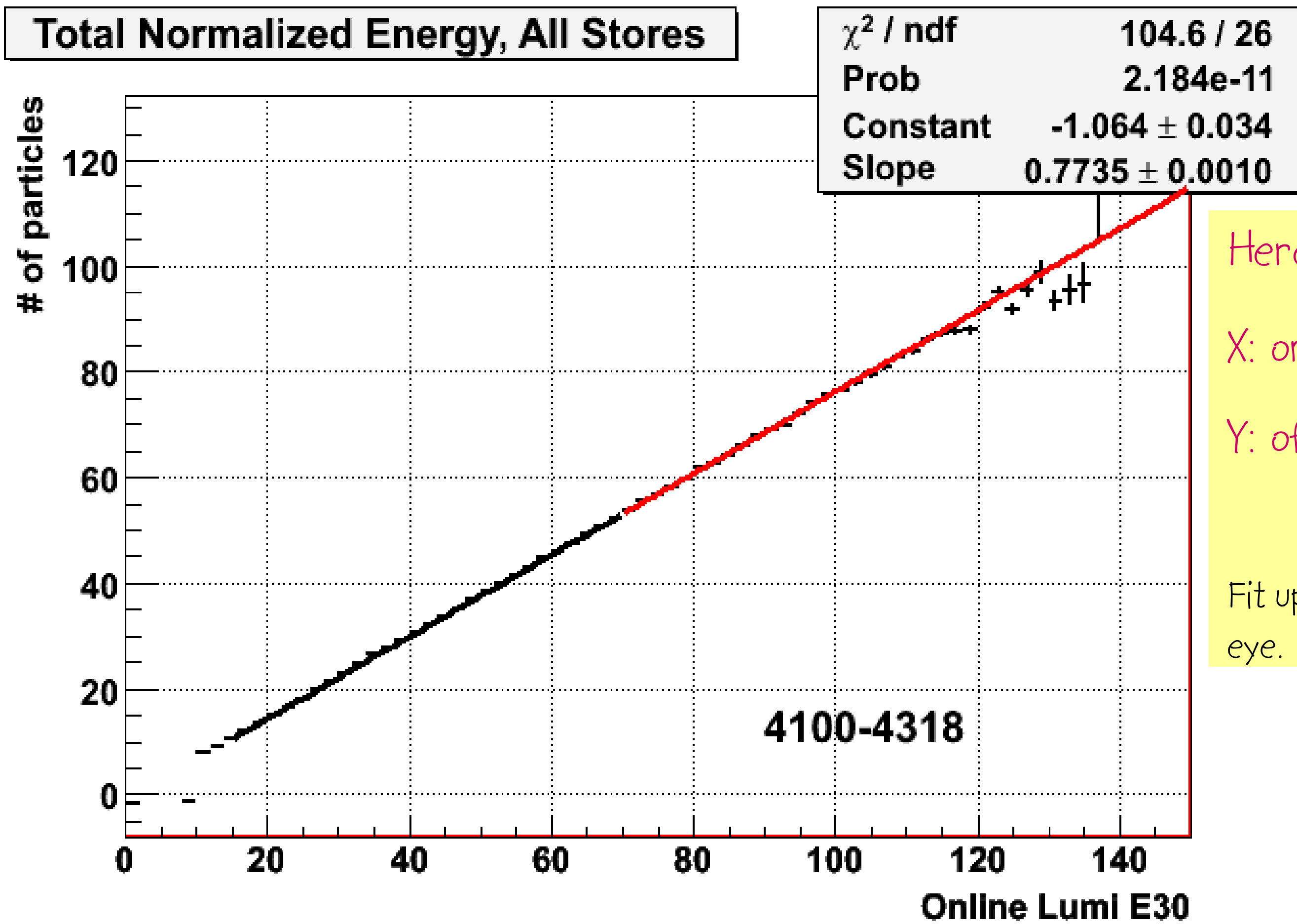
We calibrate the CLC for each store. We measure from data the Single Particle Peak (SPP) and pedestal (PED) for each channel. Dead channel are excluded.

On an event-by-event basis we calculate:

$$N_{particles} = \sum_{i \in channels} \frac{ADC_i - PED_i}{SPP_i}$$

We expect $N_{particles}$ to be **proportional** to instantaneous luminosity

Zero counting VS particle counting methods - Results



Here we plot:

X: online zero counting lumi[E30cm^{-2}s^{-1}]

Y: offline particle counting

Fit up to 70E30. Extrapolated to guide the eye.

Stores from 4100 to 4318. Data collected from April 20th to Aug 4th 2005

Very linear till ~120E30cm^{-2}s^{-1}. Above the statistics is limited.

Previously observed same behaviour when top luminosity was 100E30cm^{-2}s^{-1}.

Will process more data to extend interval of investigation. Be patient!

Conclusions and plans

- Slopes between CLC luminosity and COT currents are flat as a function of time after shutdown.
- W yields shows no run dependence.
  - Next step will be to plot W yields VS instantanuous luminosity.
- Zero counting method consistent with particle counting method
  - internal consistency check
- All checks indicate that our measurement is stable VS time/luminosity