Normalization studies for Hall A DVCS experiments

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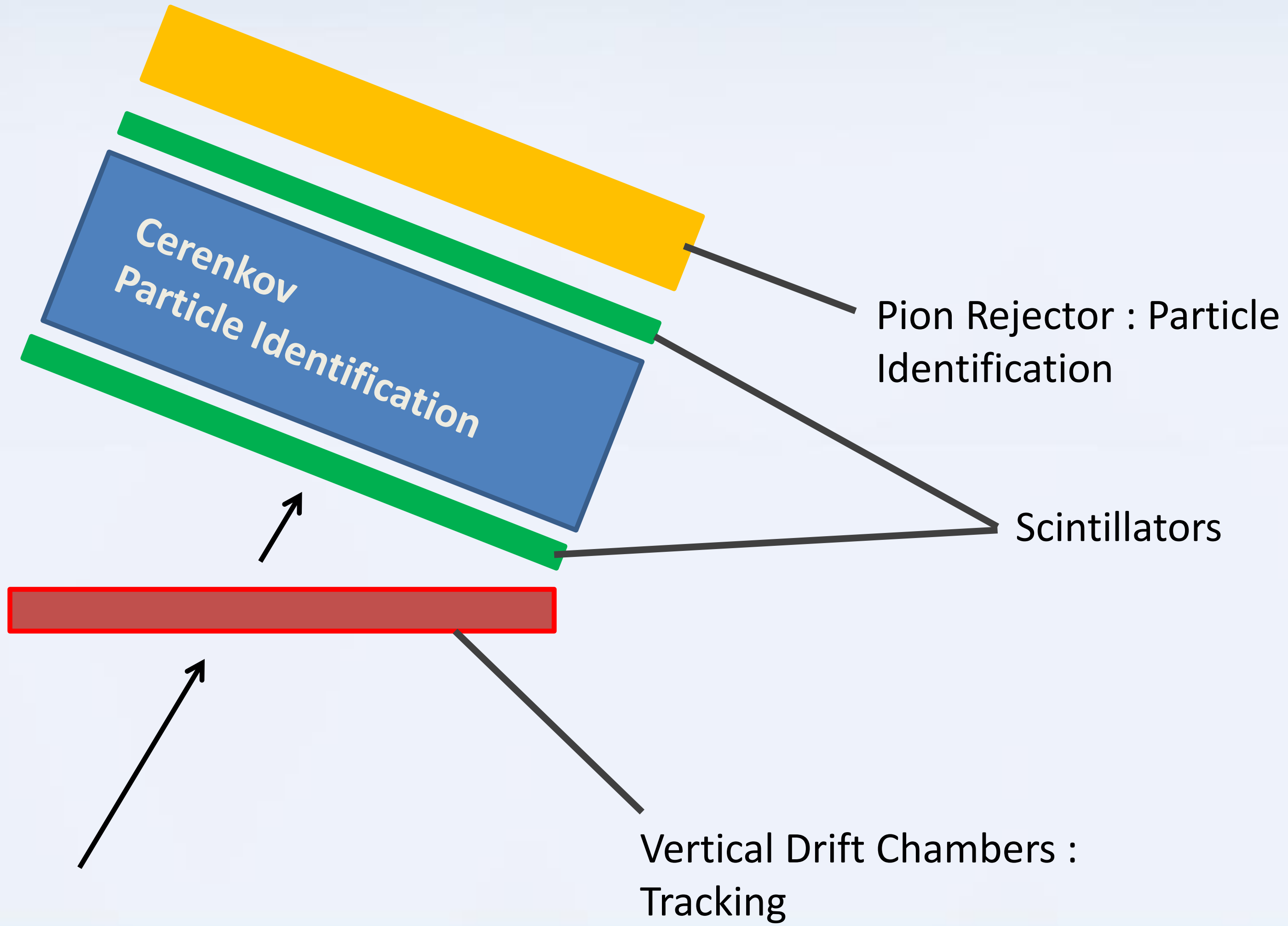
Plan

- Experimental Setup
- Introduction – Motivation
- Multitrack correction
- HRS Acceptance
- Results and Discussion/Conclusion

Experimental Setup: Detector Hut



Introduction / Motivation

- DVCS experiment from October to December 2010.

    $x=0.36$;
    $Q^2=1.5$, 1.75, 2; } At two beam energies

- During almost all the experiment,

    Trigger = S2 + Cerenkov

- Detect **ALL** electrons going through the spectrometer.

Introduction / Motivation

- Able to extract the well-known Deep Inelastic scattering cross section.

- Two interests:
  - Check the normalization (Charge, deadtime, acceptance,…) and evaluate some systematical errors.

  - Quality analysis

DIS cross section

- Compute expected DIS cross section thanks to Monte Carlo simulation and parametrization of structure function F2 [1].

- Extract DIS cross section from data.

$$\frac{d\sigma}{d\Omega dE} = \frac{N_{events}}{\mathrm{Lumi} \times \mathrm{Eff} \times \mathrm{livetime} \times \mathrm{Acc} \times \Delta\Omega\Delta\mathrm{E}}$$

[1] Ingo Schienbein, Voica A. Radescu, G.P. Zeller, M. Eric Christy, C.E. Keppel, et al. A Review of Target Mass Corrections. *J.Phys.*, G35:053101, 2008.

DIS cross section : Event selection

- Select only single track event

  - Failure to reconstruct track if more than one track.

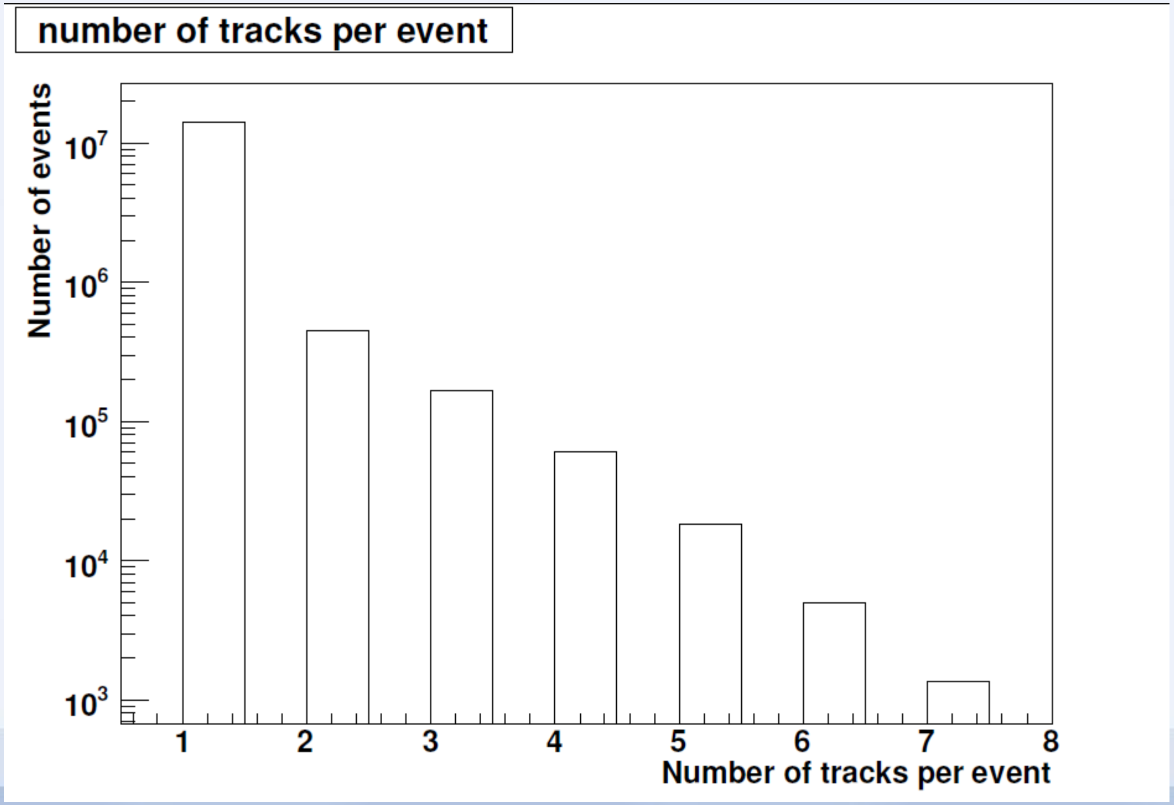
- Cut in the center of HRS acceptance (phase space).

- Cut on the pion rejector energy deposit

  - Remove δ-ray contribution.

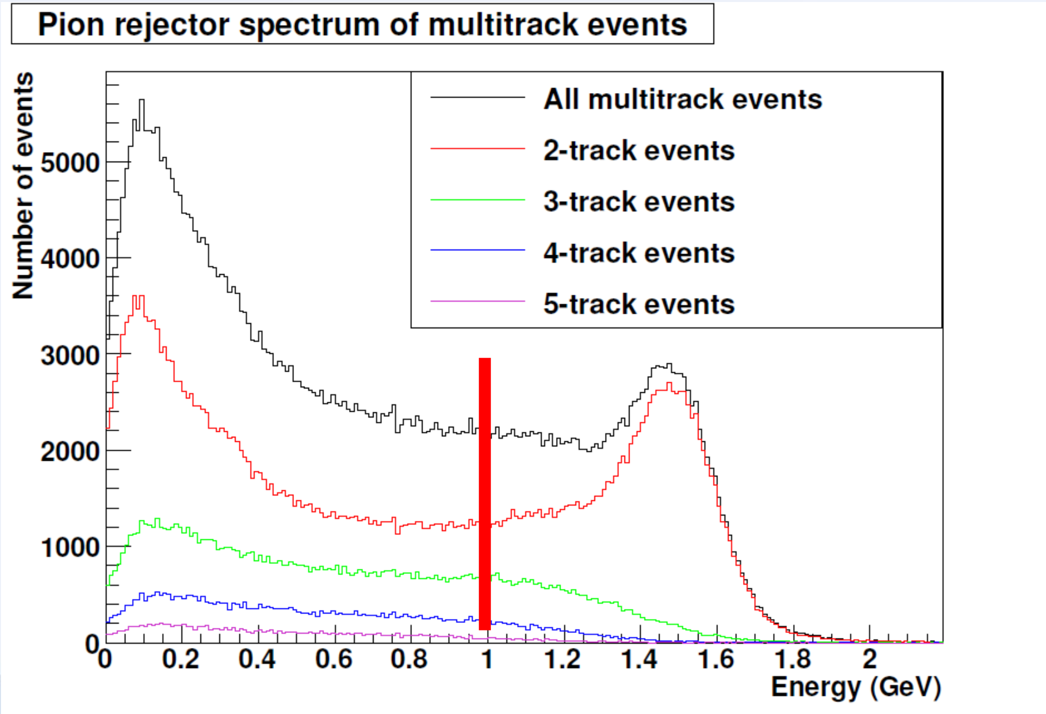
Multitrack correction

- If n-track events are n particles in coincidence:
  -> r = probability for 2 particles in coincidence
  -> then r^n for n particles in coincidence



Multitrack correction

- Removing good events by selecting 1-track events.
- By looking at the Pion Rejector:

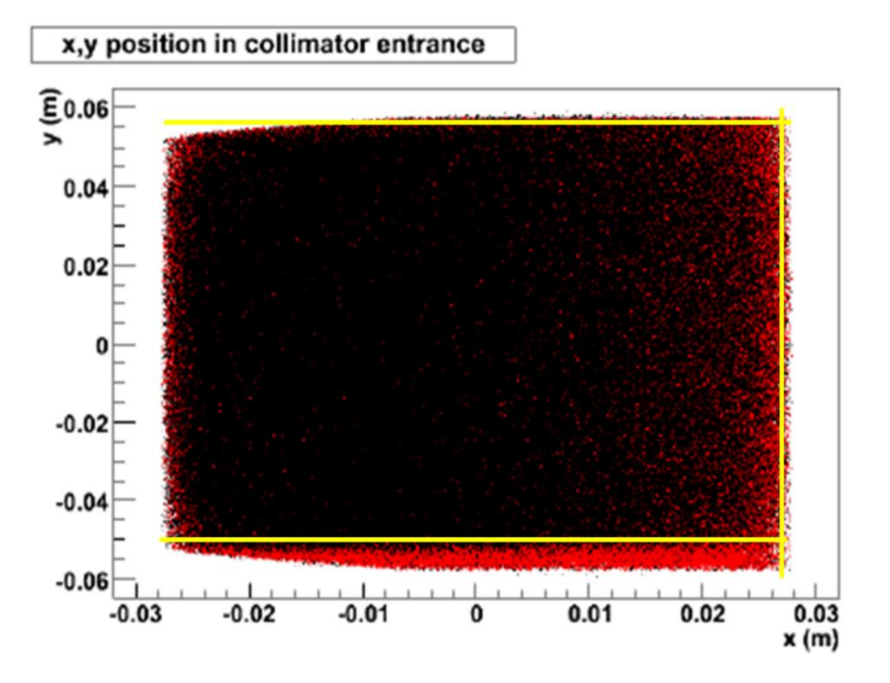


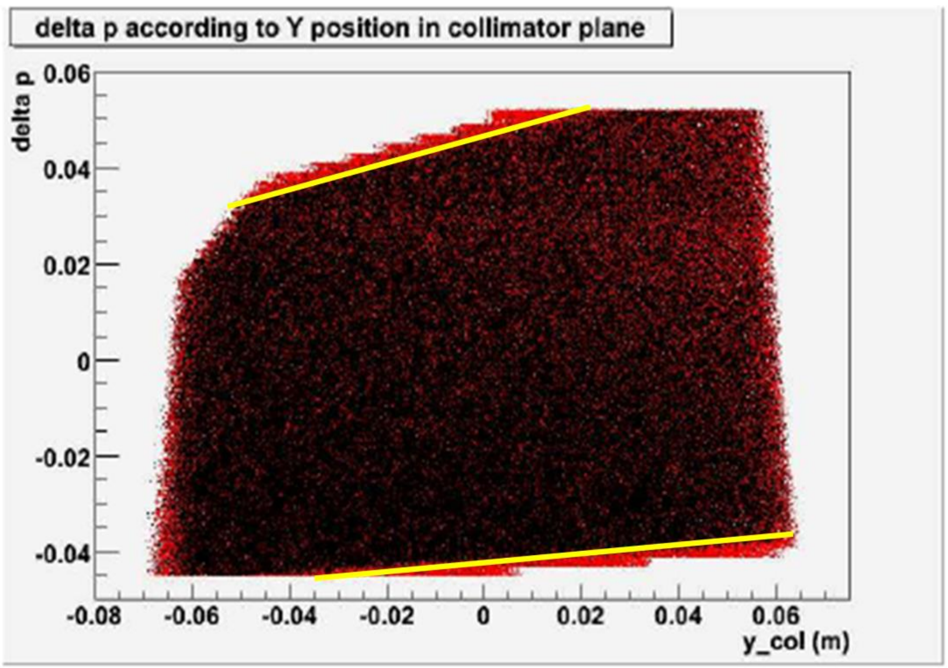
Mostly δ-rays in the vdc

Between 1-2% correction,
Same values found for kin2 and kin3 2004 DVCS experiment

HRS acceptance

- There were two problems:
  - Mislocated collimator (left)
  - Mismatch between data and Rfunction

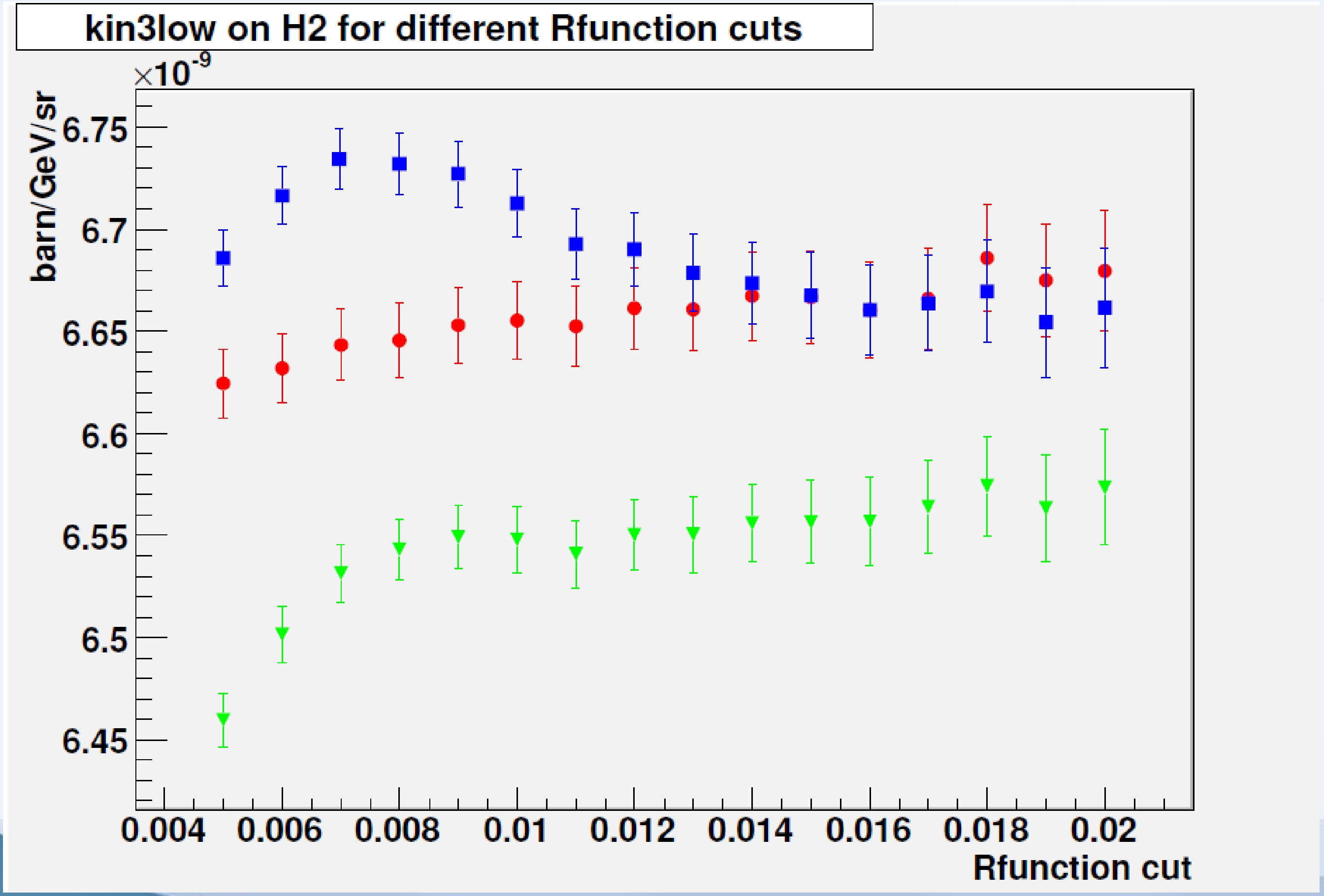




- We cut into the collimator and remove the bands in Rfunction.

HRS acceptance

- Kin3low was running without collimator:
  -> Test of the software collimator



Rval>0.005+(dp/p:y)

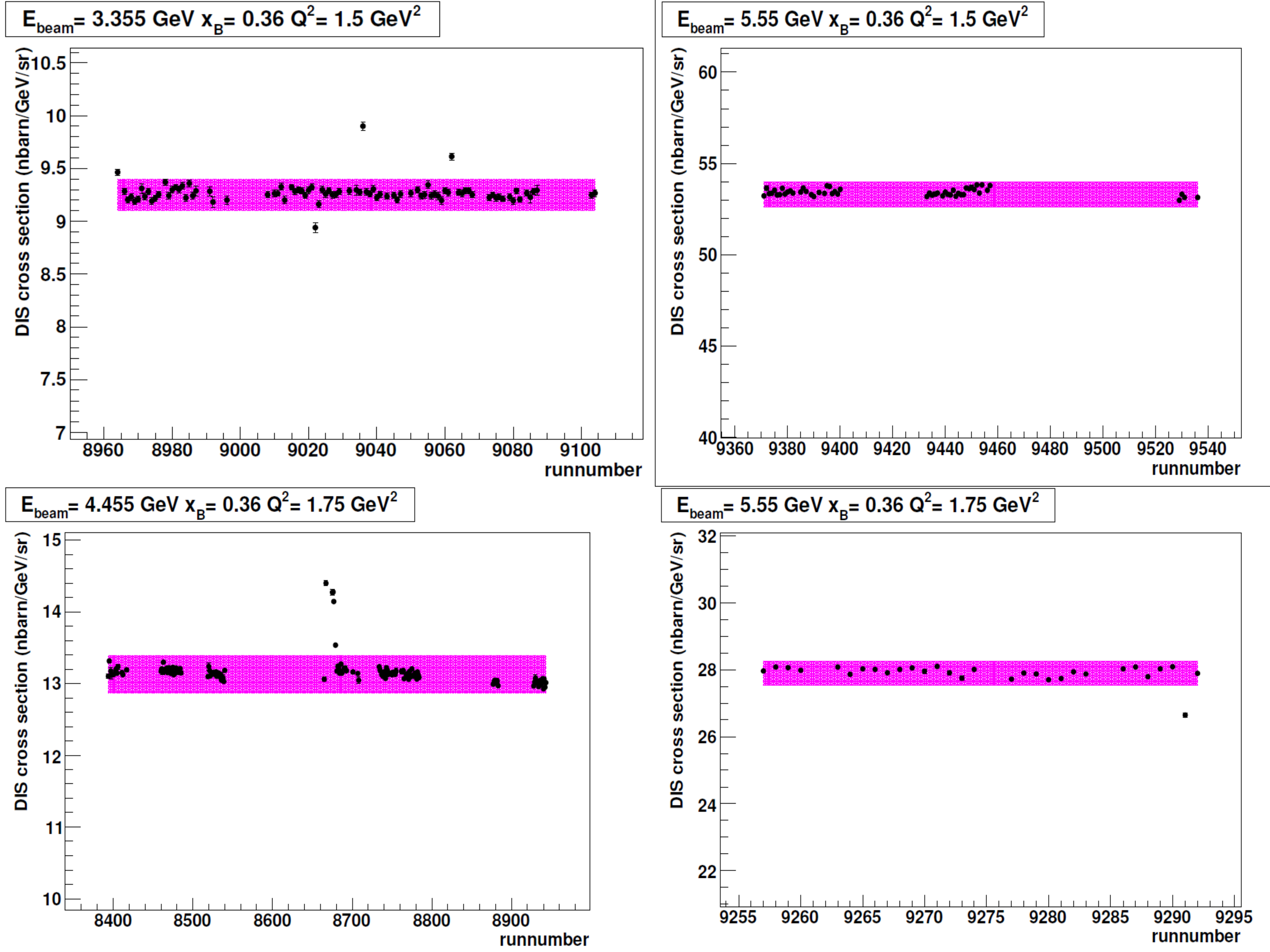
Rval>0.005+(dp/p:y) +software collimator

Rval>0.005

Systematic on HRS acceptance: 1%

Summary of the results

Kinematics	Experimental Cross section	Theoretical Cross section	Relative difference	Stability
Ebeam=3.355 GeV Q^2=1.5 GeV^2	9.26	9	+2.8%	1.6%
Ebeam=5.55 GeV Q^2=1.5 GeV^2	53.3	55.2	-3.4%	1.3%
Ebeam=4.455 GeV Q^2=1.75 GeV^2	13.14	13.14	0	2%
Ebeam=5.55 GeV Q^2=1.75 GeV^2	27.9	28.93	-3.4%	1.3%
Ebeam=4.455 GeV Q^2=2 GeV^2	6.9	6.6	+4.5%	4%
Ebeam=5.55 GeV Q^2=2 GeV^2	15.26	15.93	-4%	2.2%



E_beam= 3.355 GeV x_B= 0.36 Q^2= 1.5 GeV^2
DIS cross section (nbarn/GeV/sr)
runnumber
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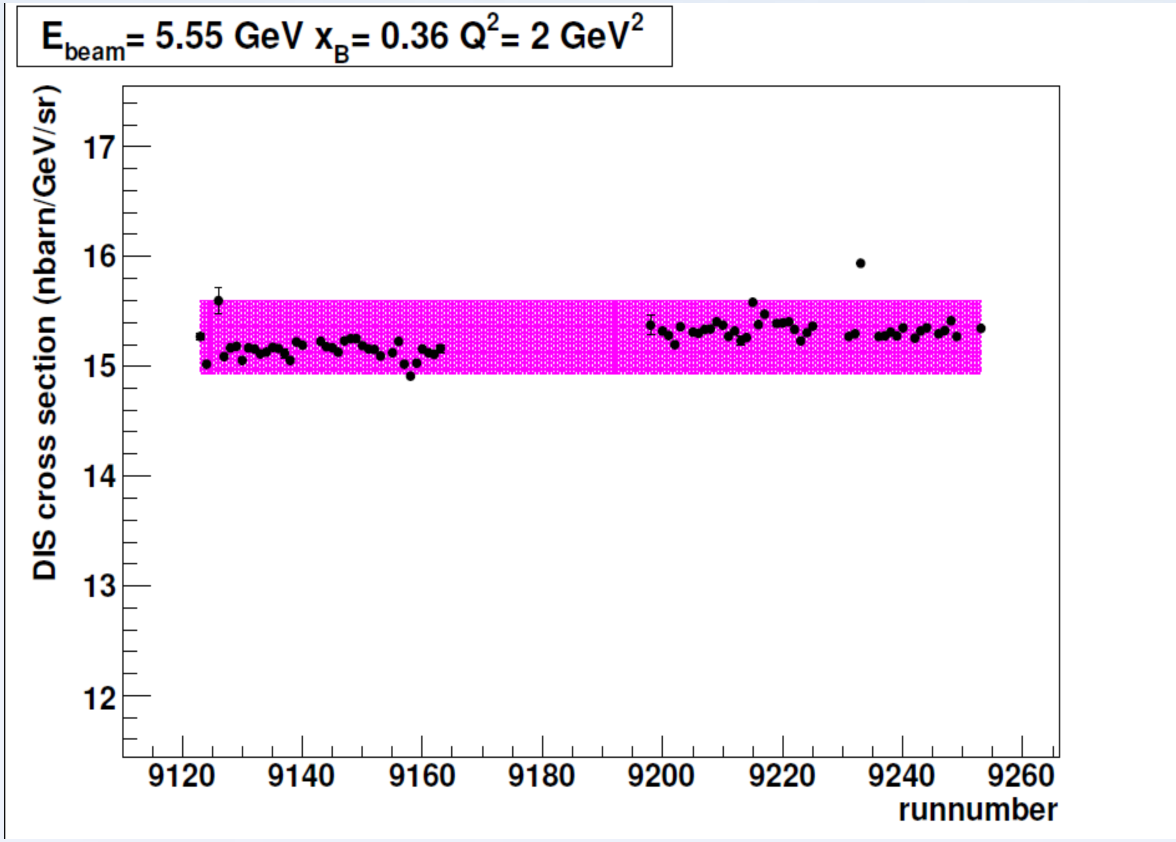
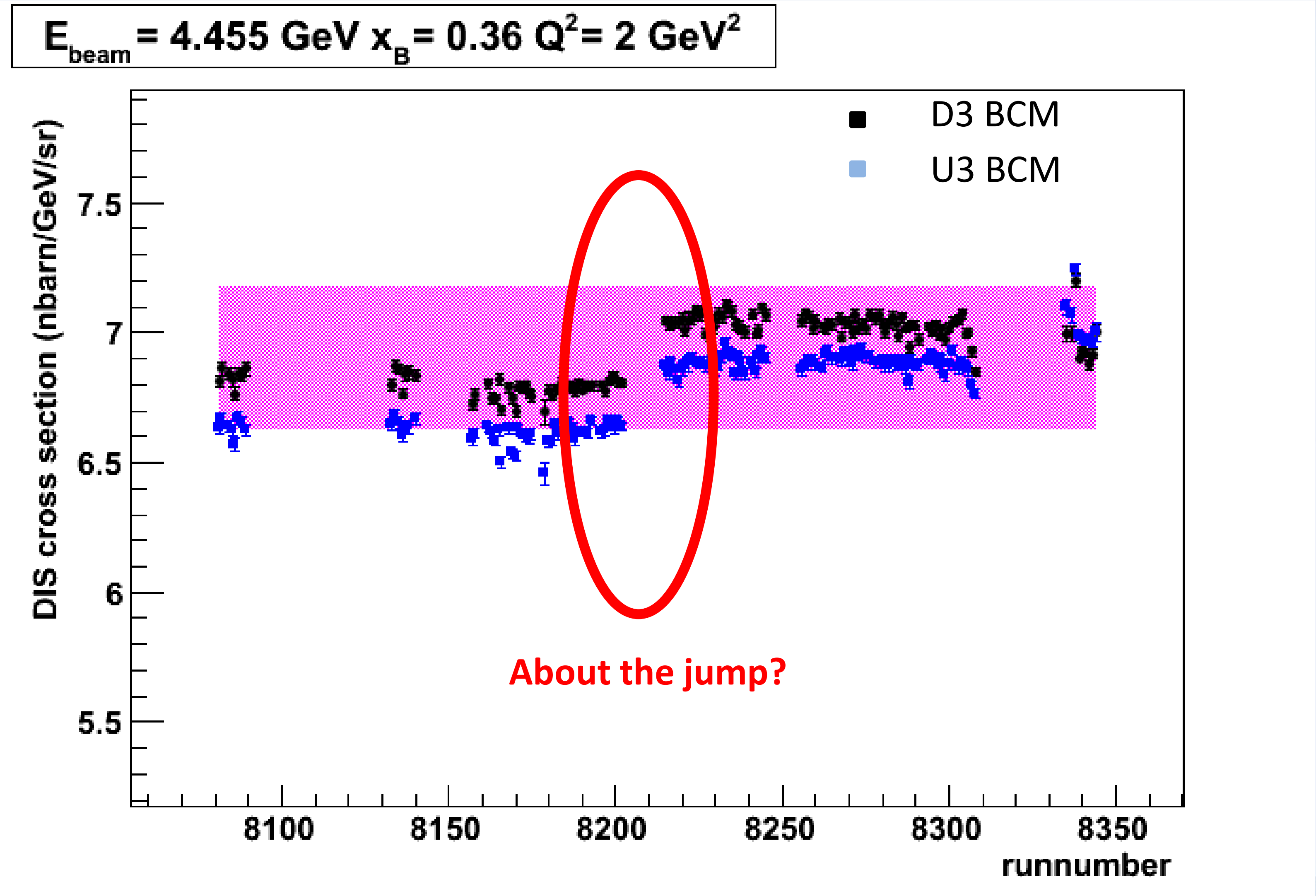


E_beam= 5.55 GeV x_B= 0.36 Q^2= 2 GeV^2
DIS cross section (nbarn/GeV/sr)
17
16
15
14
13
12
9120
9140
9160
9180
9200
9220
9240
9260
runnumber

Discussion: Which BCM do we use?

- Downstream BCM had some jump in gain.
- Upstream BCM calibration is not perfect (jump in the cross section before and after calibration).
- Problem:
  2% difference between them for kin3low.
  -> Systematic on charge???

Kin3low: About BCM??



Conclusion

- Except for the kin3low, very good stability of the cross section over the different kinematics.
- Experimental results are in good agreement with the parameterization.
- Sytematic on deadtime?
- Expect very good DVCS and pi^0 electroproduction cross section!

$$\int_{\Gamma_{DIS}} \frac{d\sigma}{d\Omega dE}(E^i, Q^2, x_B) d\Omega dE = \alpha \times \frac{d\sigma}{d\Omega dE}(E^{beam}, Q^2_{nom}, x_{B_{nom}}) \times \Gamma_{DIS} \quad (19)$$

Then one straightforwardly gets:

$$\alpha = \frac{1}{N_{sel} \times \frac{d\sigma}{d\Omega dE}(E^{beam}, Q^2_{nom}, x_{B_{nom}})} \sum_{k=1}^{N_{sel}} \frac{d\sigma}{d\Omega dE}(E^i_k, Q^2_k, x_{Bk}) \quad (20)$$