K_s^0 production study at high Q^2

Cracow meeting 22-23/10/2007

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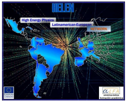
Cinvestav Mérida

HELEN Program

ALFA-EC funds



Motivation

What can we learn?

- Strangeness production: fragmentation? hadronization?
- Suppression factor: λ_s=0.3? , 0.25? , 0.22? , 0.2?
- Meson/Barion ratio.
- Product of other particles decay.
- Exotic Barions.
- F2 strange.

- HERA II provides more statistics to study high Q^2 particle production.

Data selection DIS NC

General cuts

- Central vertex
- $|\text{VtxZ}| < 35$ cm
- $100 < Q^2 < 20000$
- $0 < Y_e < 0.6$
- -0.15 $< Y_h - Y_e$
- -0.75 $< \frac{Y_h - Y_e}{Y_h}$
- $35 < E - P_z < 70$ GeV

Electron's cuts

- Trigger = 67
- Electron detected in LAr
- $E_e > 11$ GeV
- $10^\circ < \theta_e < 150^\circ$
- $Z_{impact} >$ -180 cm

Data selection $K_s^0 \to \pi^+\pi^-$

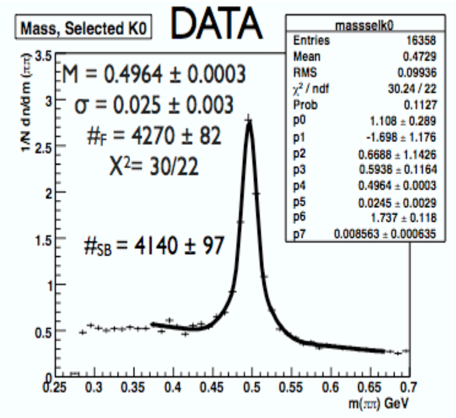
Pion's Cuts

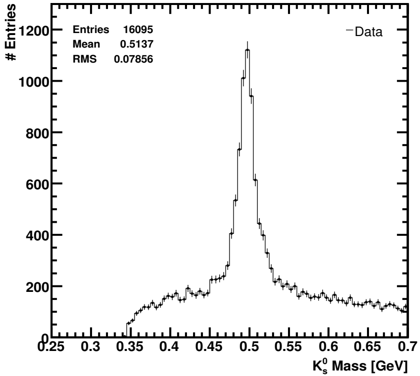
- Number of central tracks > 1
- Existence of 2 tracks with different charge
- They come from a secondary vertex
- Radial length $>$ 10 cm
- Number of hits (CJC) $>$ 10
- p$_t$ $>$ 0.12
- $|\eta| < 1.5$
- $20^\circ < \theta_\pi < 160^\circ$

K_s^0 identification

- Number of K_s^0 >0
- Daughters particles $=$ 2
- Decay length $>$ 2 cm
- $20^\circ < \theta_{K_s^0} <160^\circ$
- $|\eta| <1.5$
- p$_t$ $>$ 0.4
- M$(p\pi^-)$ $>$ 1.125 GeV
- M(e^+e^-) $>$ 0.05 GeV
- $\Delta dca >0.5$

K_s^0 invariant mass distribution 2000





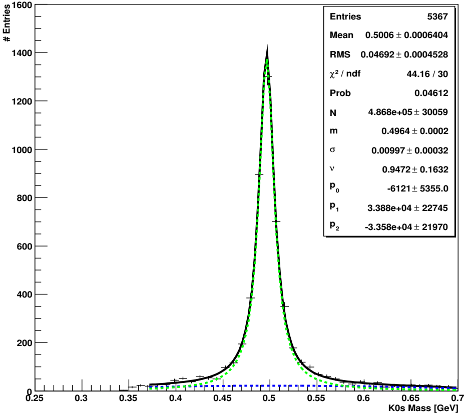
D.Traynor's Analysis (h1oo).

This analysis (H1Lt).

$\#_{SB} = 4218 \pm 94$

Control plots were ok.

K_s^0 invariant mass distribution 2000

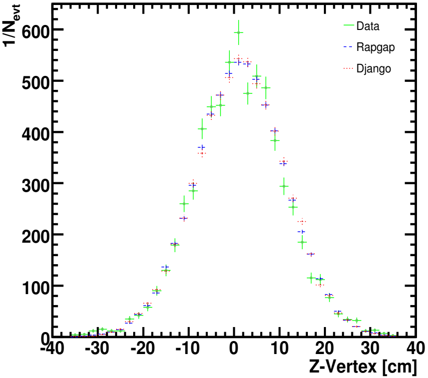


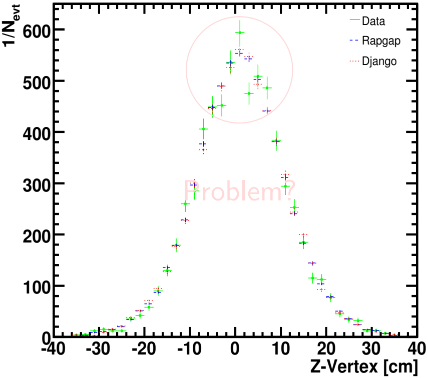
LESS BACKGROUND and NARROW WIDTH

K_s^0 candidates(after SB)$= 3962 \pm 66$

2006 data analysis

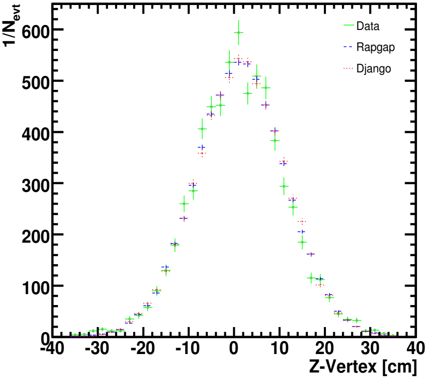
Kinematics Control Plots 2006 I

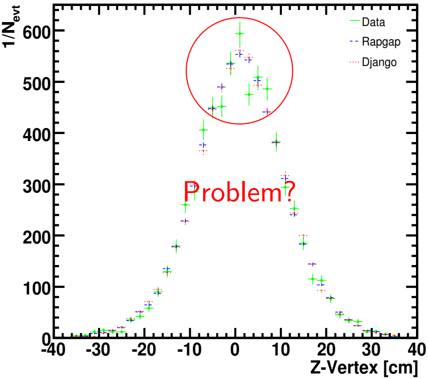




after the Z vertex reweighting

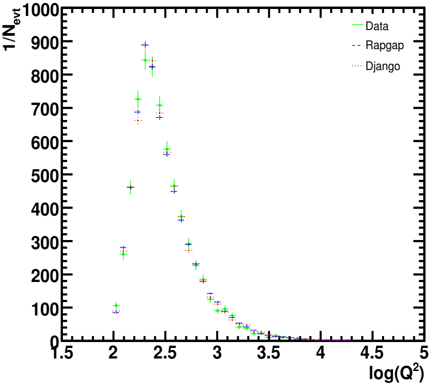
Kinematics Control Plots 2006 I

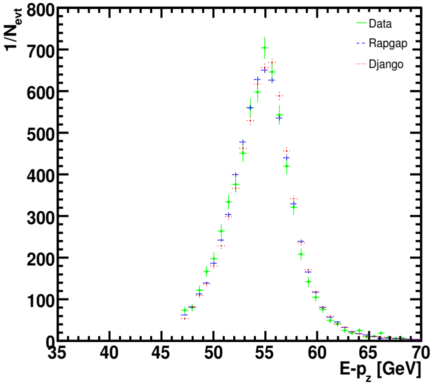




after the Z vertex reweighting

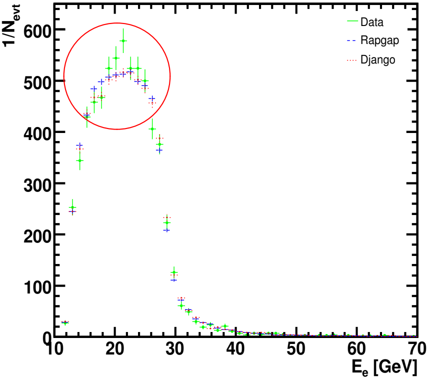
Kinematics Control Plots 2006 II

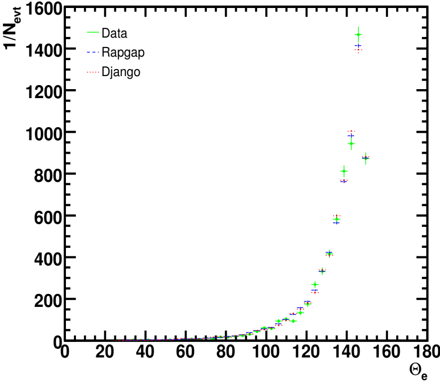




Good behavior

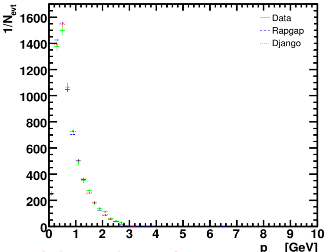
DIS-electron Control Plots

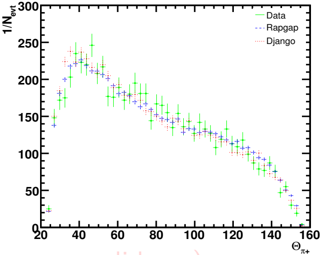




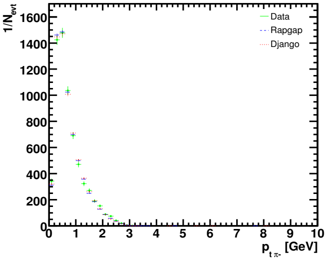
E_e Reweighting?

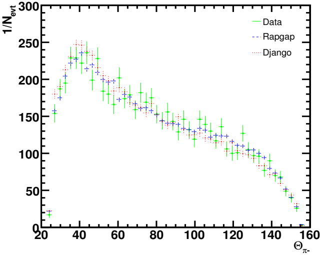
Pions's Control Plots



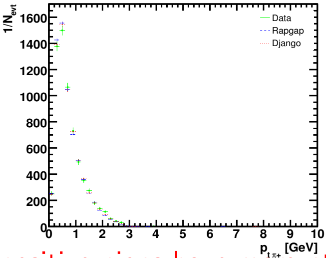


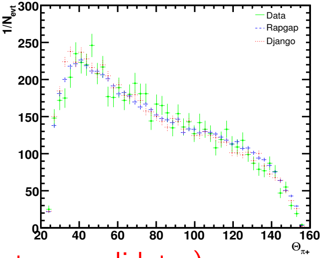
- positive pions have more pt (proton candidates).
- more pions in the "forward" region





Pions's Control Plots





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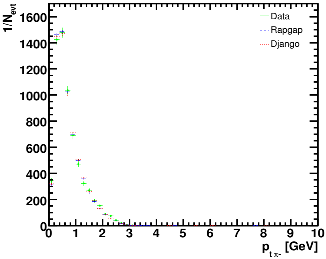
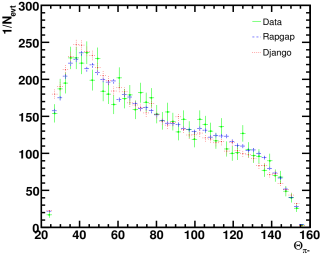
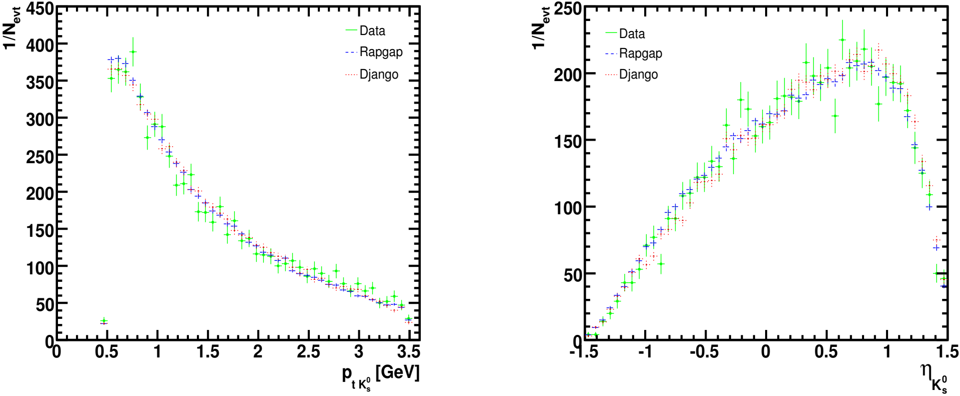


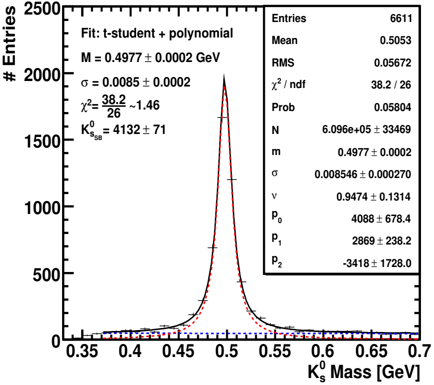


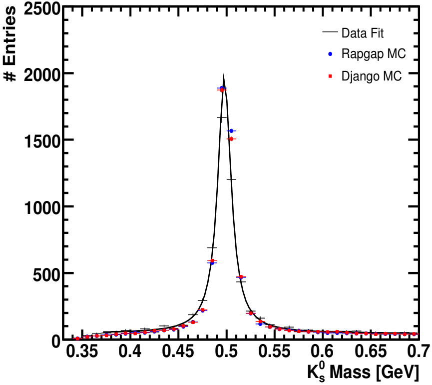
K_s^0 Control Plots



more K_s^0 produced in "forward" region
consistence with $\theta_{\pi^\pm}$ distribution.

Fit and Monte Carlo comparison

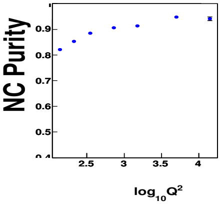


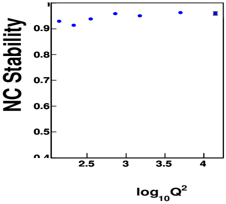


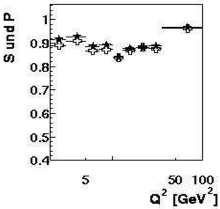
K_s^0 mass PDG: 497.672 $\pm$ 0.031 MeV.

Good K_s^0 signal! - Good fit! - Good Monte Carlo comparison!

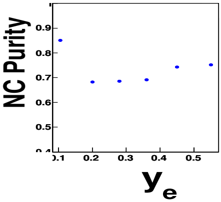
Purity and Stability for log(Q^2)- Risler thesis comparison

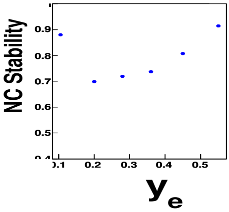


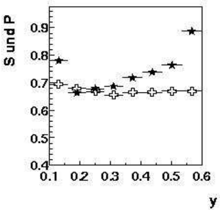




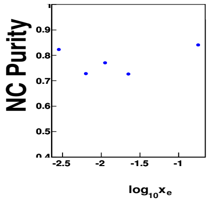
Purity and Stability for y_e - Risler thesis comparison

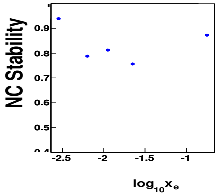


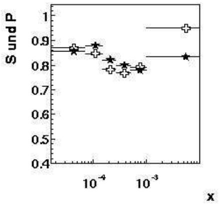




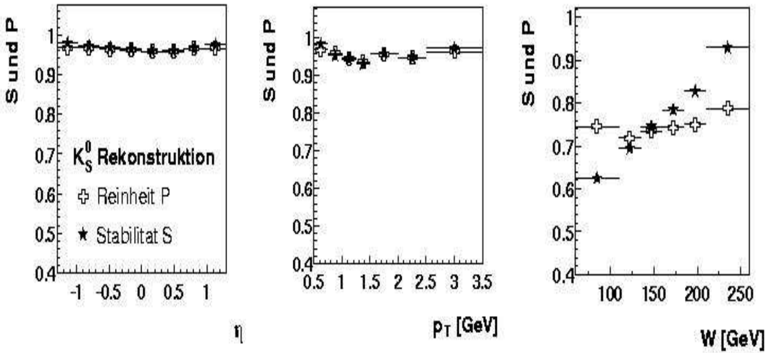
Purity and Stability for log(x_e) - Risler thesis comparison







Purity and Stability for other variables in Risler thesis



I am working on it...

Diferential Cross Section

$$\sigma = \frac{\#K^0_{s\,data}}{BR(K^0_s \to \pi^+\pi^-) * L_{data} * \varepsilon * \Delta Y}$$

where:

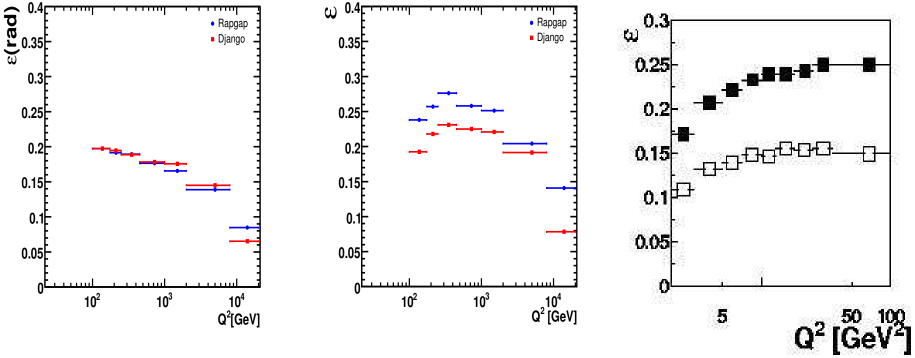
$L_{data} = 56.16\ pb^{-1}$
$L_{django} = 655.044\ pb^{-1}$
$L_{rapgap} = 776.19\ pb^{-1}$
ΔY = width of the bin
$BR(K^0_s \to \pi^+\pi^-) = 69.2\,\%$

and efficienty:

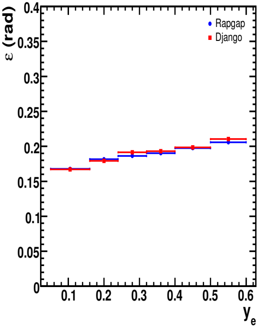
$$\varepsilon(rad) = \frac{K^{0\,QED}_{s\,recMC}}{K^{0\,QED}_{s\,genMC}}$$

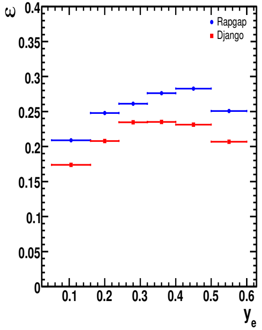
$$\varepsilon = \frac{\varepsilon(rad)}{QED_{correction}} = \frac{\#K^{0\,QED}_{s\,recMC}}{\#K^{0\,QED}_{s\,genMC}} \cdot \frac{\#K^{0\,QED}_{s\,genMC}}{\#K^{0}_{s\,genMC}} = \frac{\#K^{0\,QED}_{s\,recMC}}{\#K^{0}_{s\,genMC}}$$

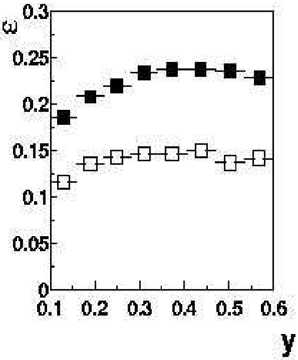
$\varepsilon(rad)$ and ε for Q^2



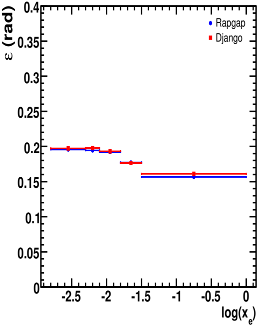
$\varepsilon(rad)$ and ε for y_e

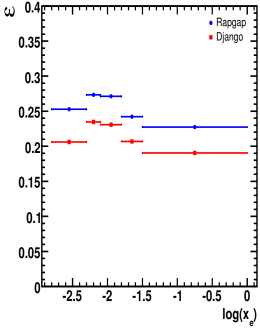


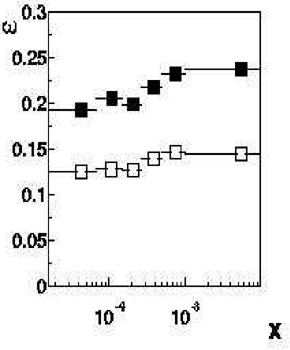




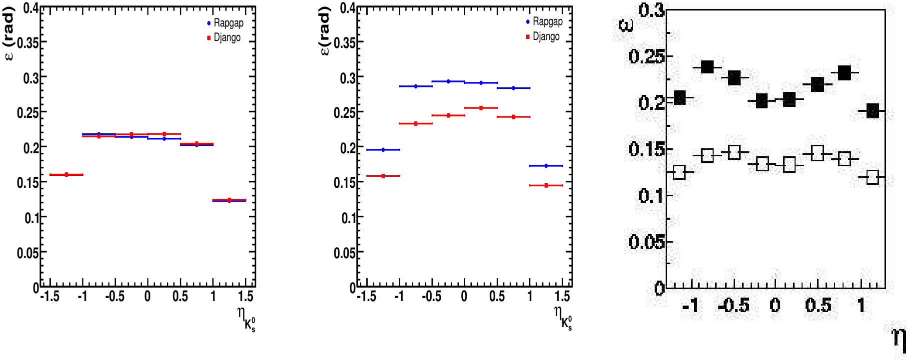
$\varepsilon(rad)$ and ε for x_e



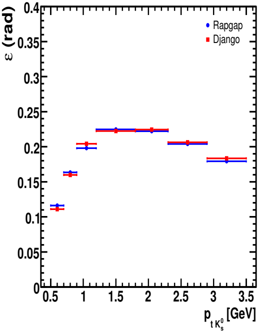


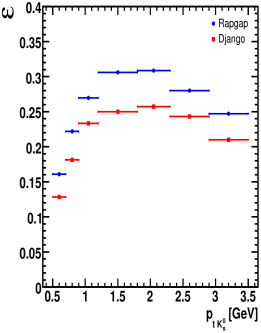


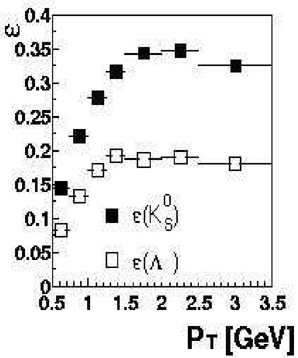
$\varepsilon(rad)$ and ε for $\eta_{k_s^0}$



$\varepsilon(rad)$ and ε for $p_{tK_s^0}$







σ(rad) & σ values

with $\varepsilon(rad)$:

$$\sigma_{Total} = 539.53\ pb^{-1}\ \text{(Django)}.$$
$$\sigma_{Total} = 534.989\ pb^{-1}\ \text{(Rapgap)}.$$

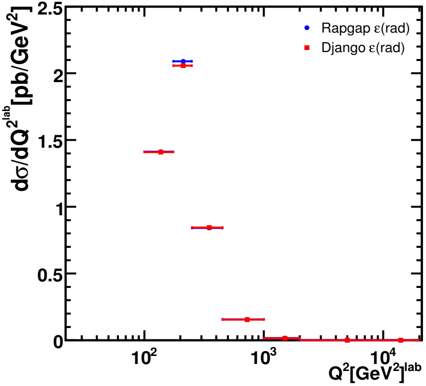
Good agreement in the values.

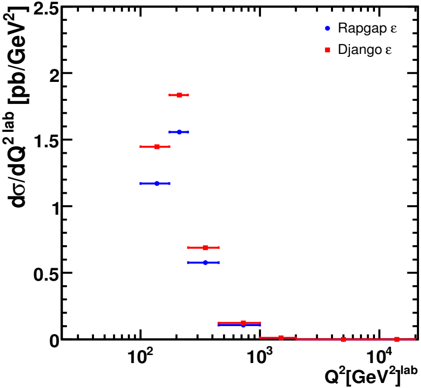
with ε:

$$\sigma_{Total} = 393.595\ pb^{-1}\ \text{(Django)}.$$
$$\sigma_{Total} = 467.865\ pb^{-1}\ \text{(Rapgap)}.$$

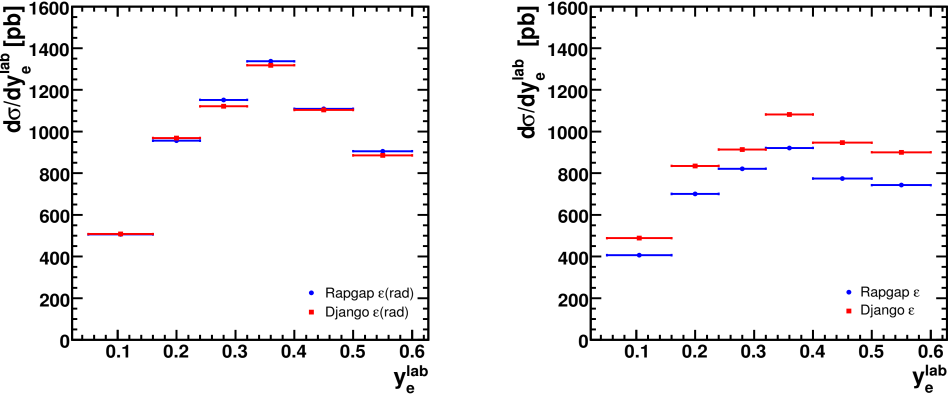
"Big" difference in the values.

$\sigma(rad)$ and σ distribution for Q^2

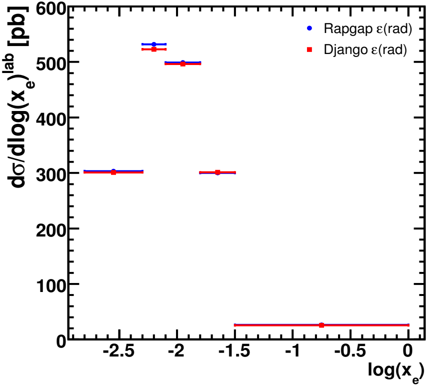


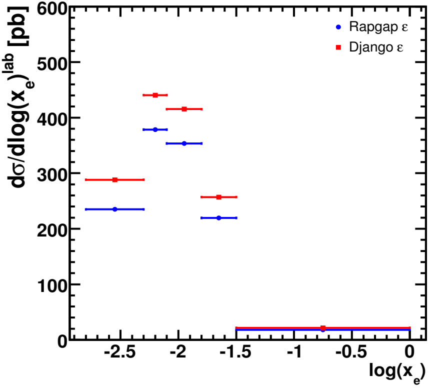


$\sigma(rad)$ and σ distribution for y_e

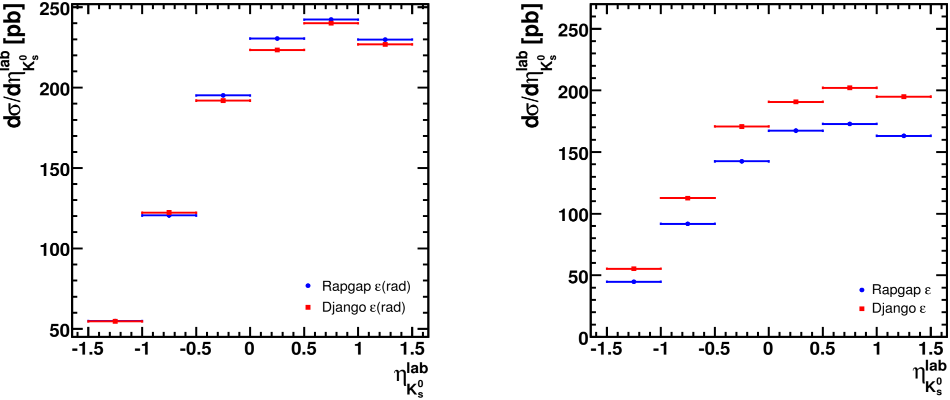


$\sigma(rad)$ and σ distribution for x_e

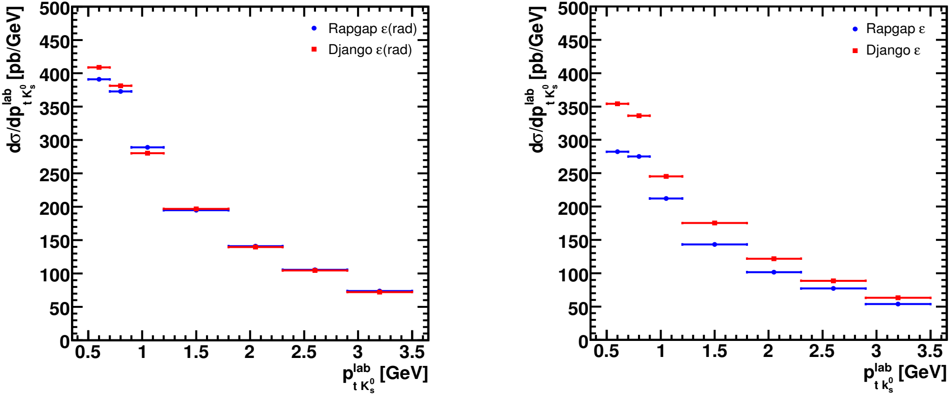




$\sigma(rad)$ and σ distribution for $eta_{K_s^0}$



$\sigma(rad)$ and σ distribution for $p_{tK_s^0}$



Summary

- Good K_s^0 identification.
- Good Purity and Stability values.
- Does the E_e reweighting is necessary?.
- Other reweighting?.
- Investigate why the ε values are different between Django and Rapgap?.
  - Monte Carlos problems at non radiative generator level?.

comments? suggestions? questions?

Complementary slides

Purity and Stability

definitions

$$Purity = \frac{N_{stay}}{N_{rec}}$$
$$Stability = \frac{N_{stay}}{N_{gen}}$$

where:

$N_{rec} = N_{stay} + N_{smear\ \ in}$
$N_{rec} = N_{stay} + N_{smear\ \ out}$
N_{stay} =The number of events which have the same Gen and Rec bin number (i).
$N_{smear-in}$ = The number of events which smeared into a Rec bin (j).
$N_{smear-out}$ = The number of events which smeared out of a Gen bin (i).