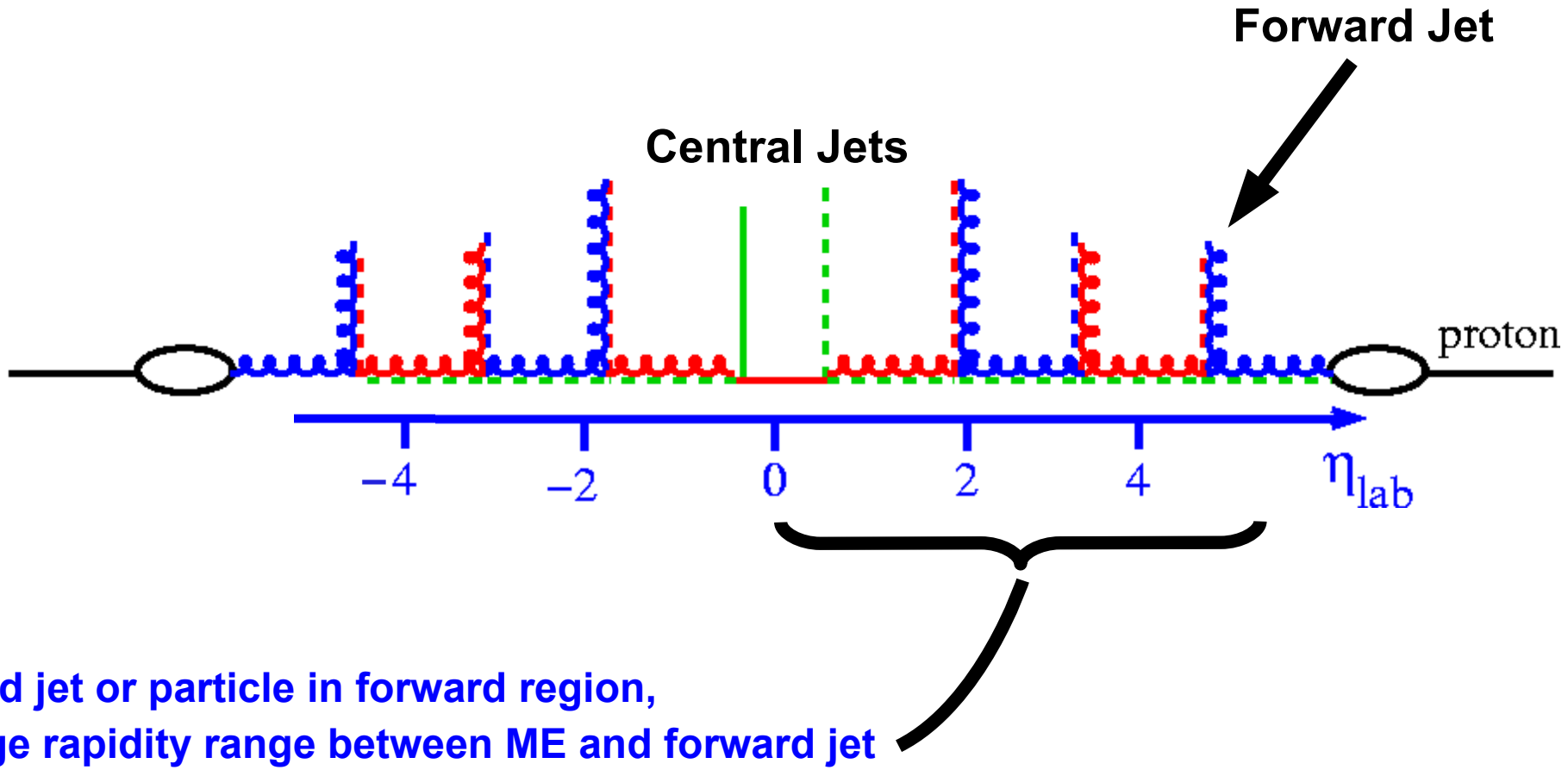
Forward Jets in CASTOR

Status report of MC studies

SMIX meeting DESY 9/5-2008

Albert Knutsson

Reminder



Hard jet or particle in forward region,
large rapidity range between ME and forward jet

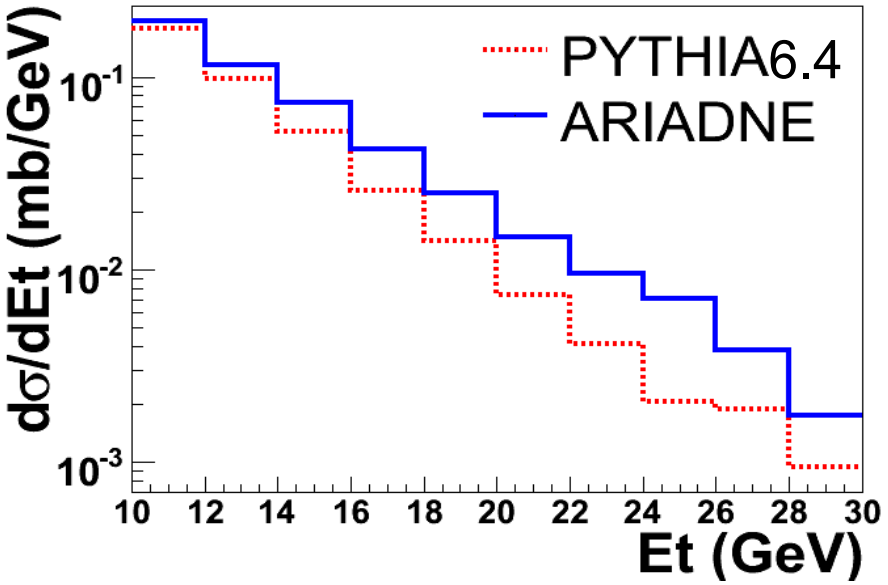
- **Opens up phase space for emissions, higher order reactions**
- **Small x physics**
- **Gain information of the full evolution**

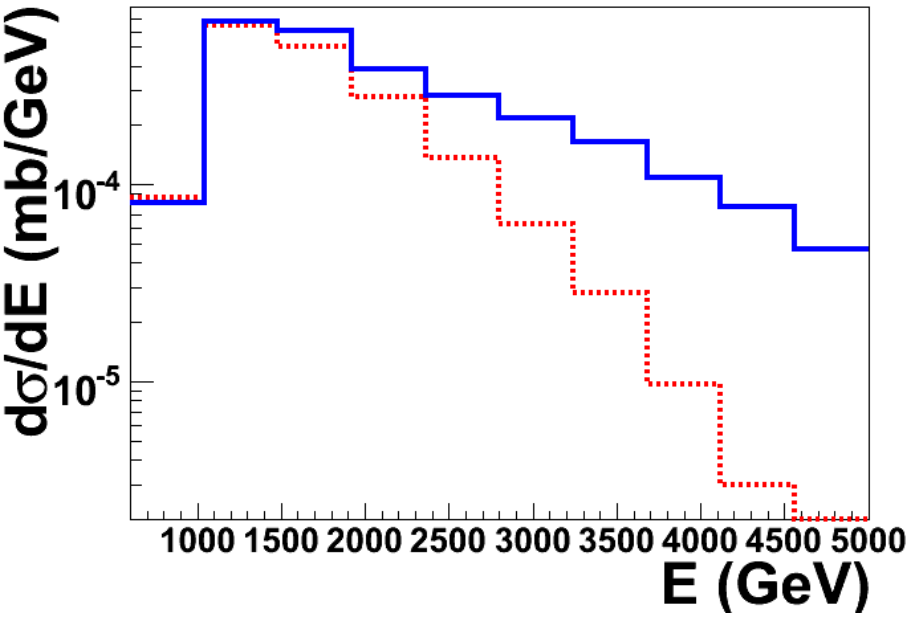
Tool to study higher order QCD reactions

Forward Jets in CASTOR

Selection: 2 central jets, 1 jet in CASTOR region $(5.2 < \eta < 6.6)$
with $E_t > 10$ GeV

Hadron level



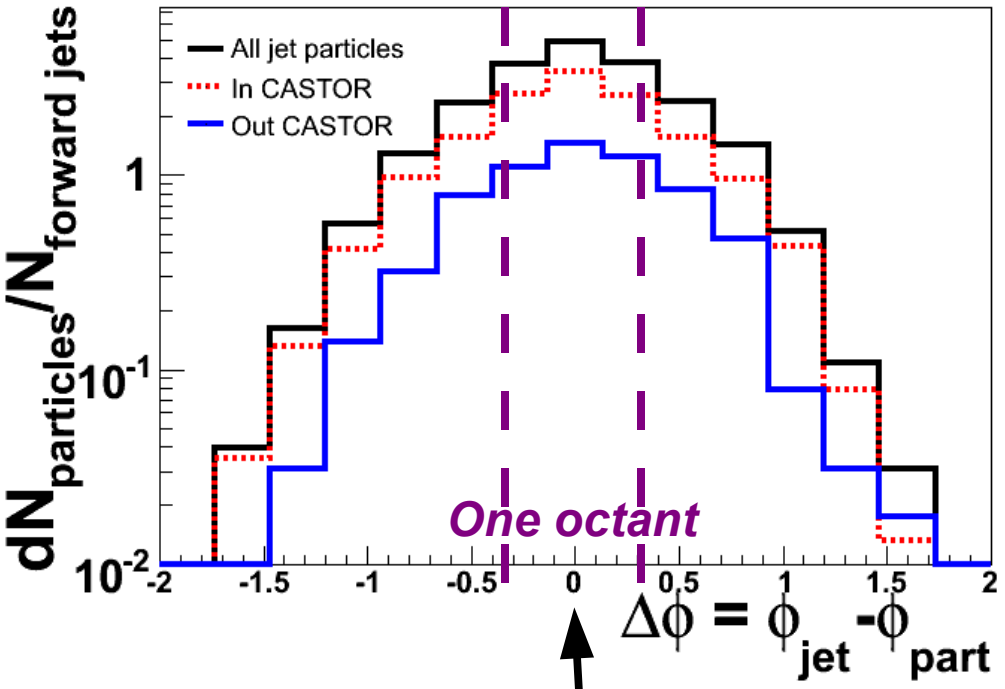


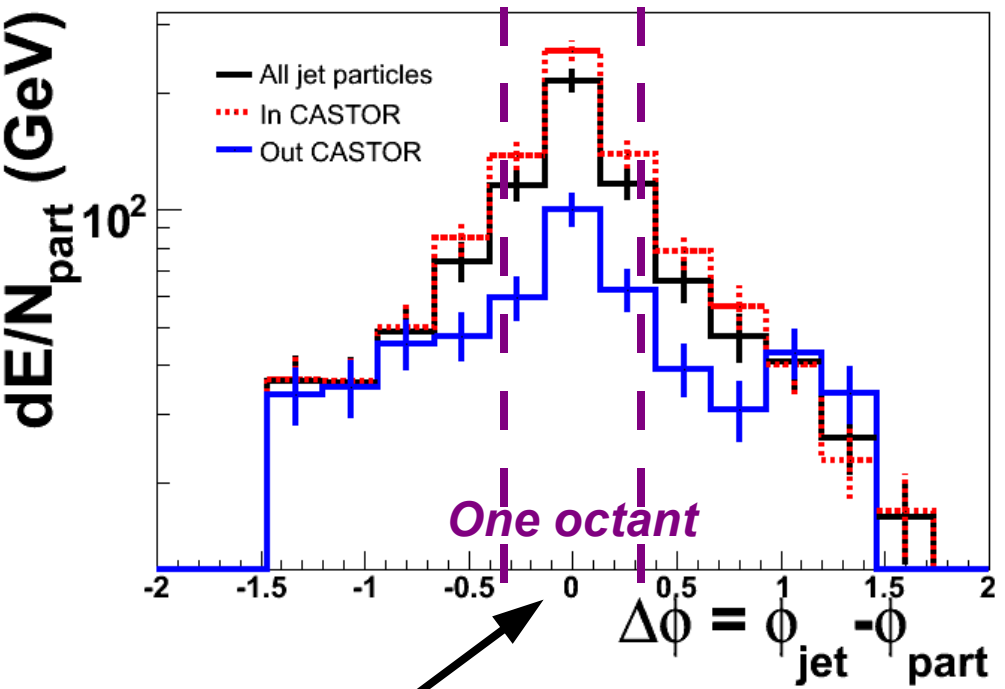
ARIADNE with the Color Dipole Model – giving a more BFKL like final state – with partons unordered in kt – predicts more hard jets in the CASTOR region.

Forward Jets in CASTOR

Forward jet events: How much activity can we expect in CASTOR?

"JET PROFILES"





- On event average ~ 10 particles/most active octant
- On average 100 GeV/particle in octant around jet axis

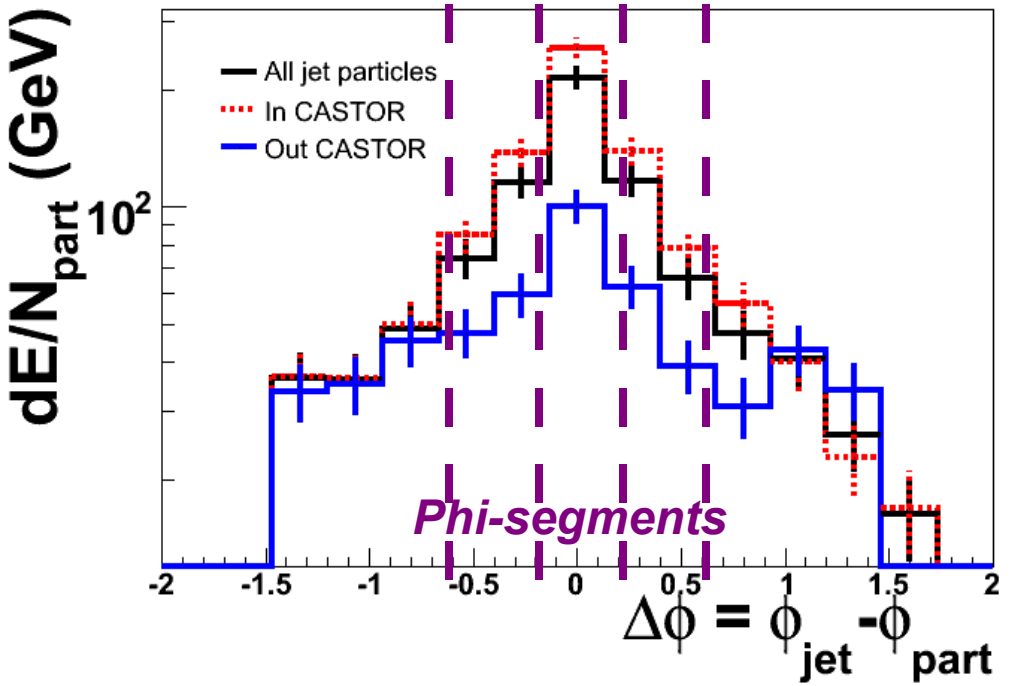
In order to run a jet algorithm we need to resolve θ, ϕ and Energy for 5-10 particles within a Phi-segment.

To much activity to resolve particles and run jet algorithm!?

Jet Energy – CASTOR energy correlation

Measure deposit energy in CASTOR.

- **Total energy deposit in CASTOR**
- **Energy in most active Phi-segment**
- **Energy in most active Phi-segment + Energy in two neighbouring Phi-segments**
- **?**



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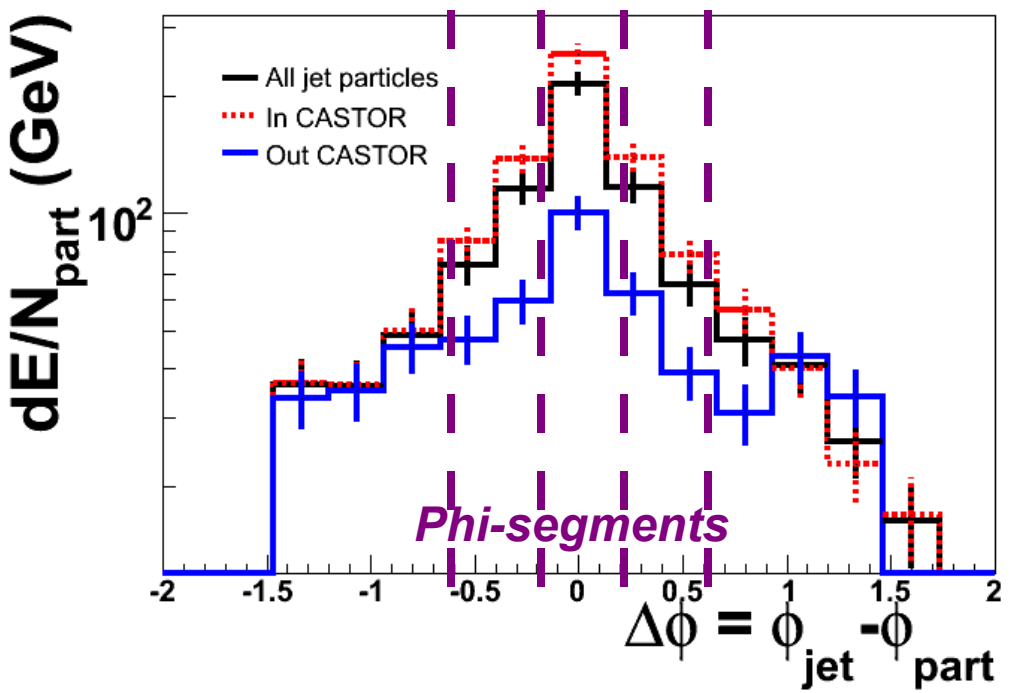

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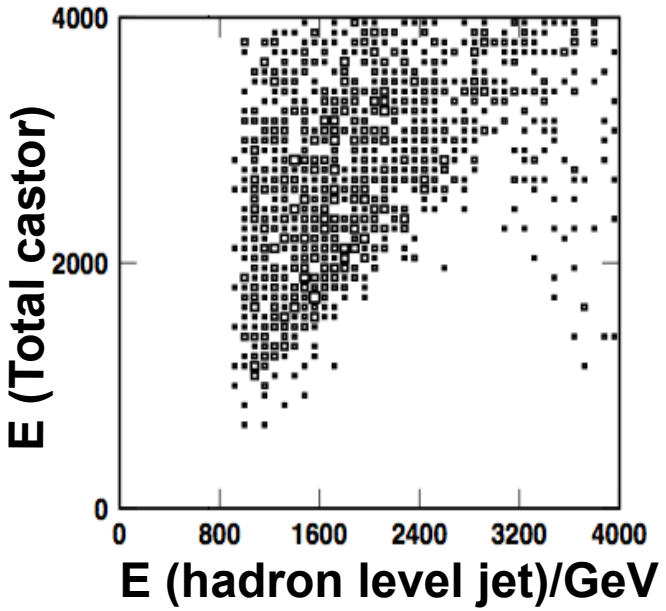

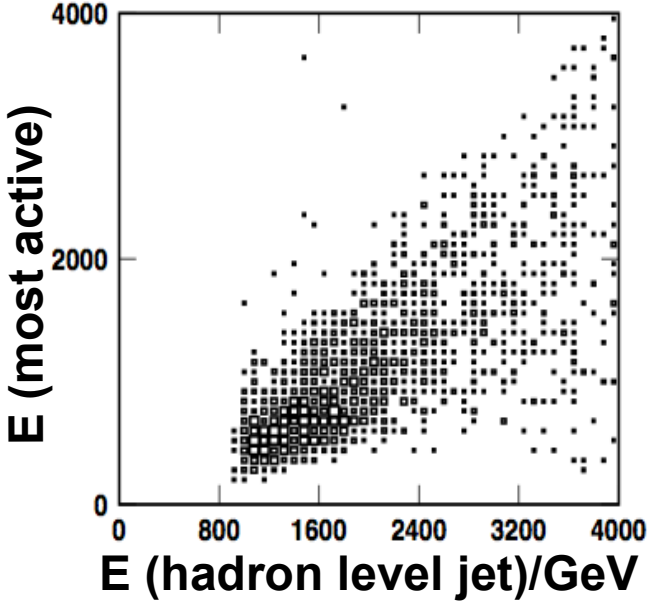

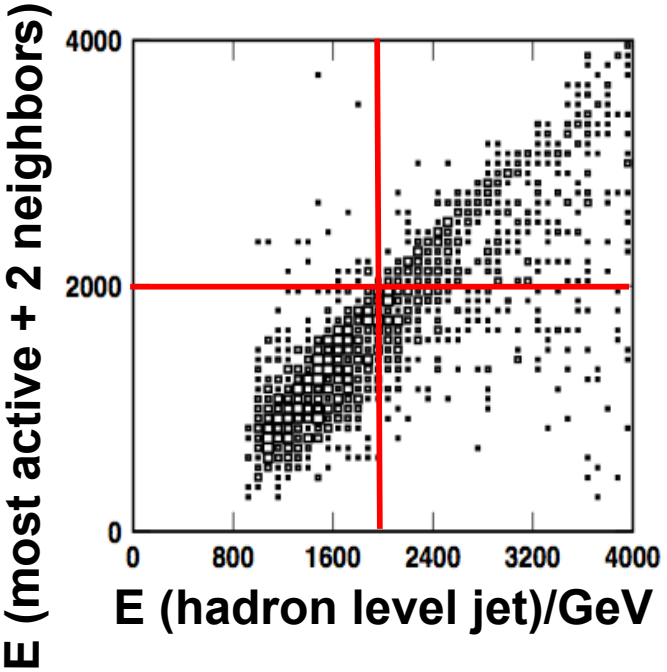

E (hadron level jet) > 10 GeV

Jet Energy – CASTOR energy correlation

Measure deposit energy in CASTOR.

- **Total energy deposit in CASTOR**
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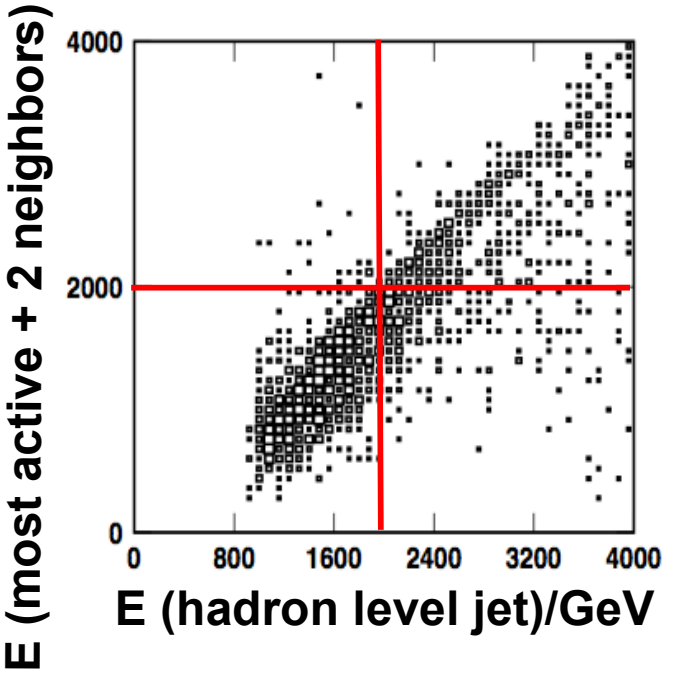
- **Energy in most active Phi-segment + Energy in two neighbouring Phi-segments**
- **?**

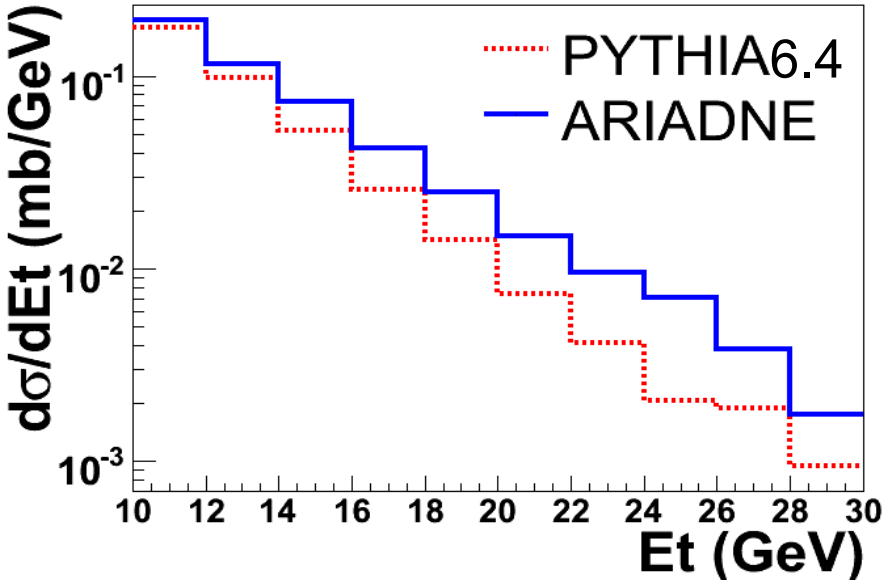
On hadron level in Monte Carlo:

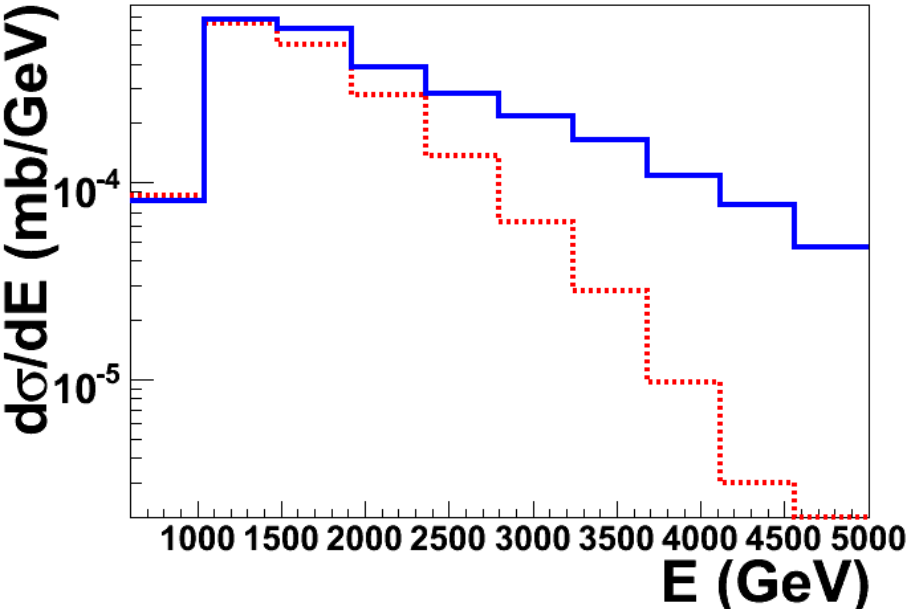
1. **Divide forward region into 16 Phi-regions.**
2. **For each region sum energy of all stable particles.**
3. **Find segment with highest energy.**
4. **Add energy from 2 neighbouring cells.**



MC comparison

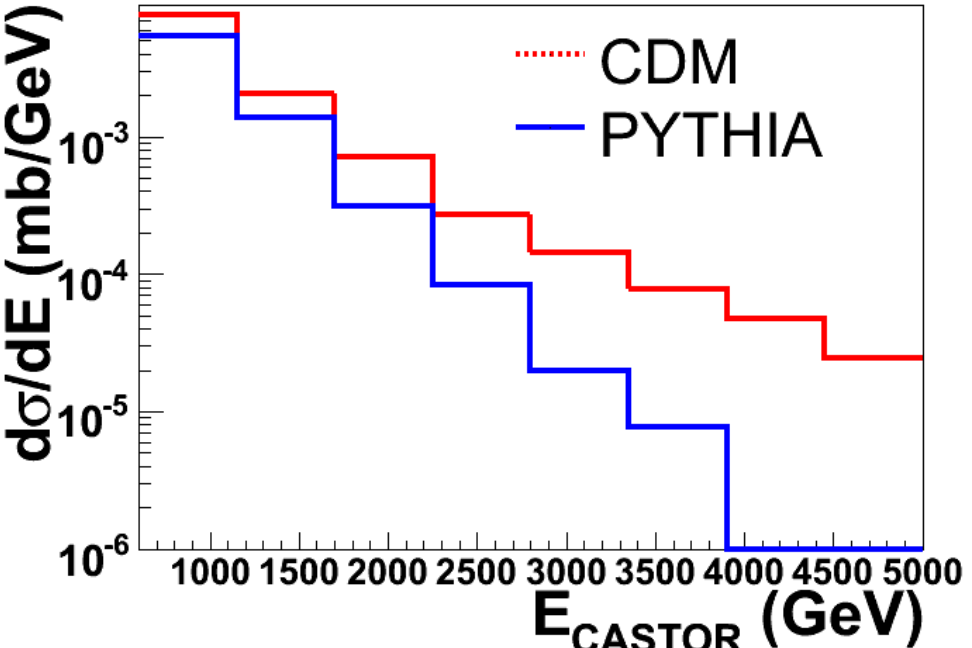
Before, forward jets hadron level:





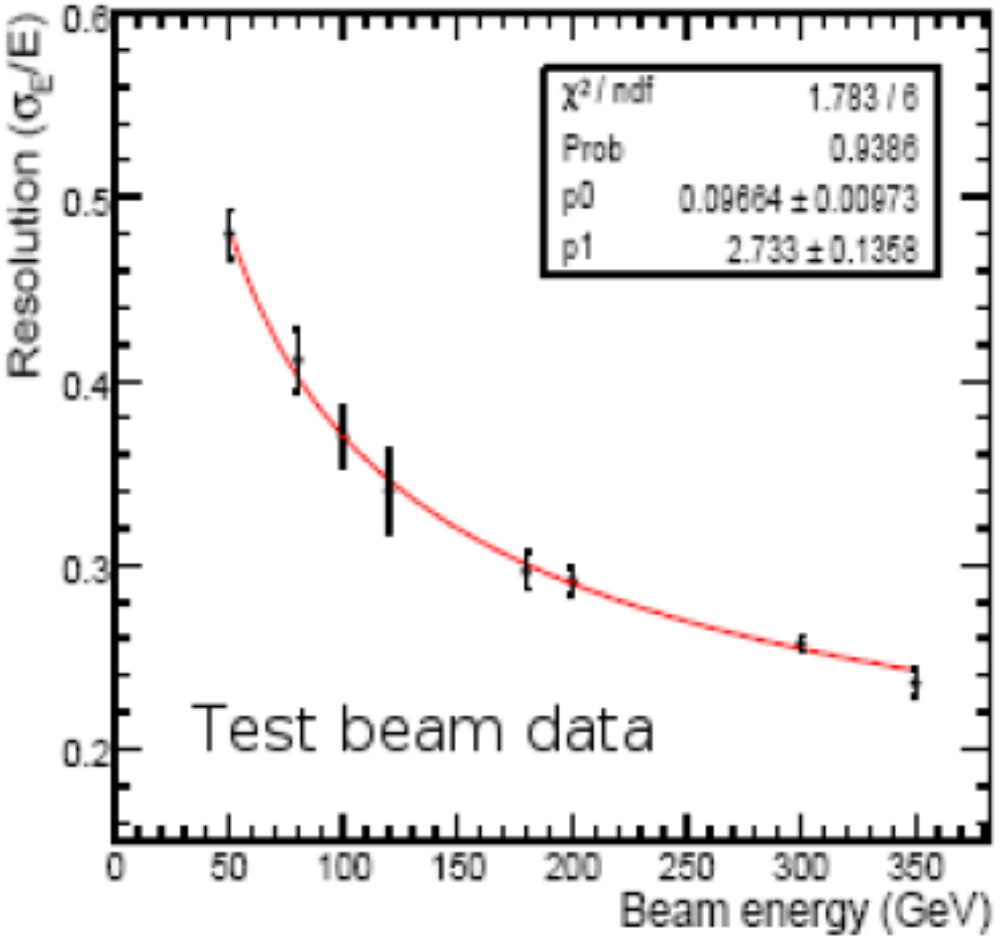
Now, segments in CASTOR:

Signal seems to still there



Detector effects

Energy resolution



Smear **all particles** used particles accordning to:

$$\frac{\sigma}{E} = p_0 + \frac{p1}{\sqrt{E}}$$

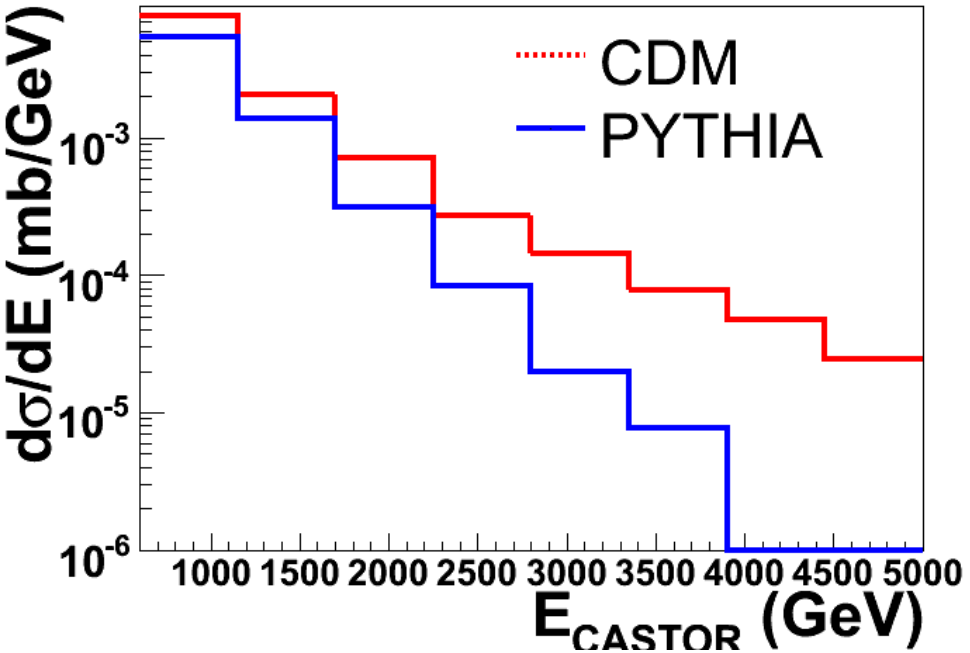
where

$$p_{0,hadrons} = 0.09664$$
$$p_{1,hadrons} = 2.733$$

$$p_{0,EM} = 0.063$$
$$p_{1,EM} = 0.886$$

MC comparison

Before energy smearing:



After energy smearing:

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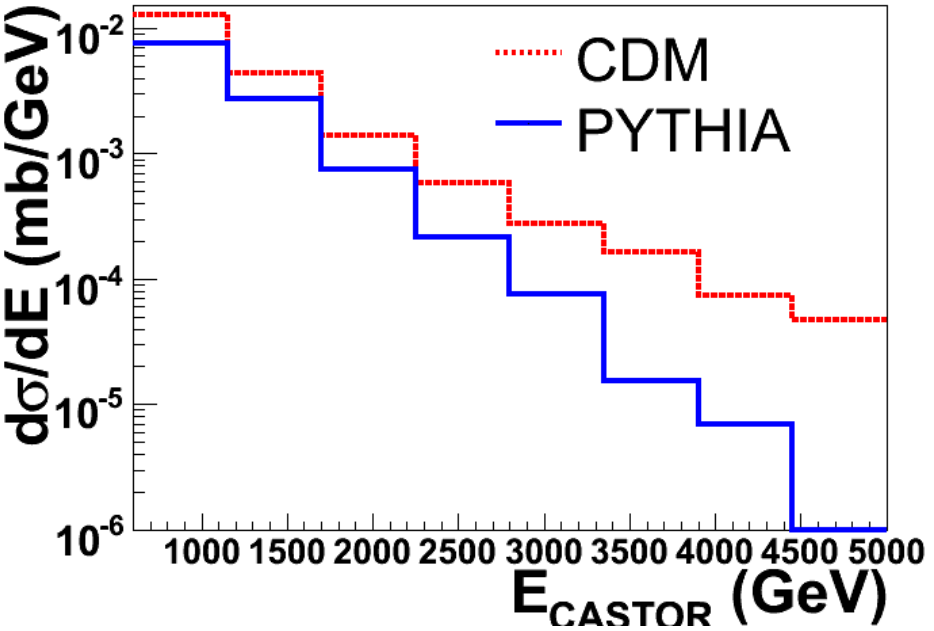
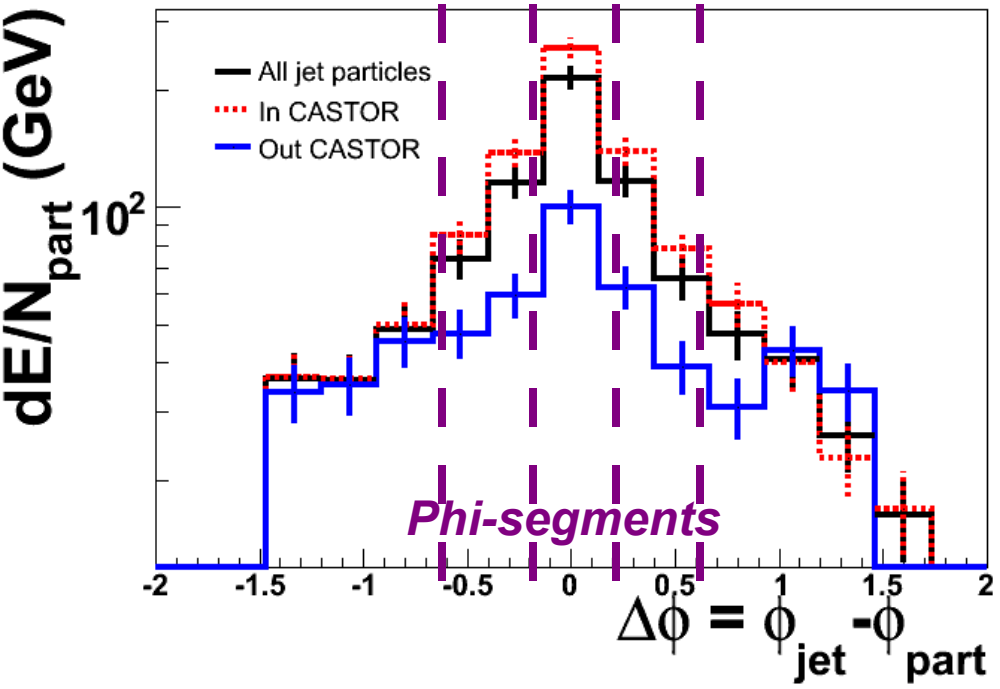
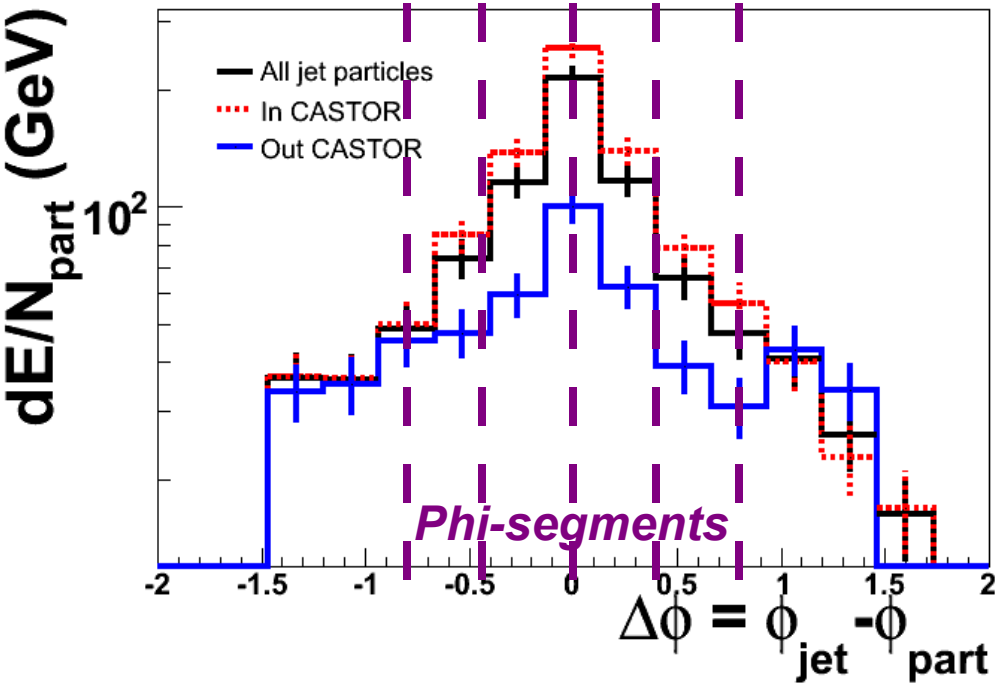


Improvements...

What I assumed:



What I should also consider:



2+Forward Jet Statistics

2 central jets, 1 jet in CASTOR region $(5.2 < \eta < 6.6)$

All 3 jets with $E_t > 10\ \mathrm{GeV}$

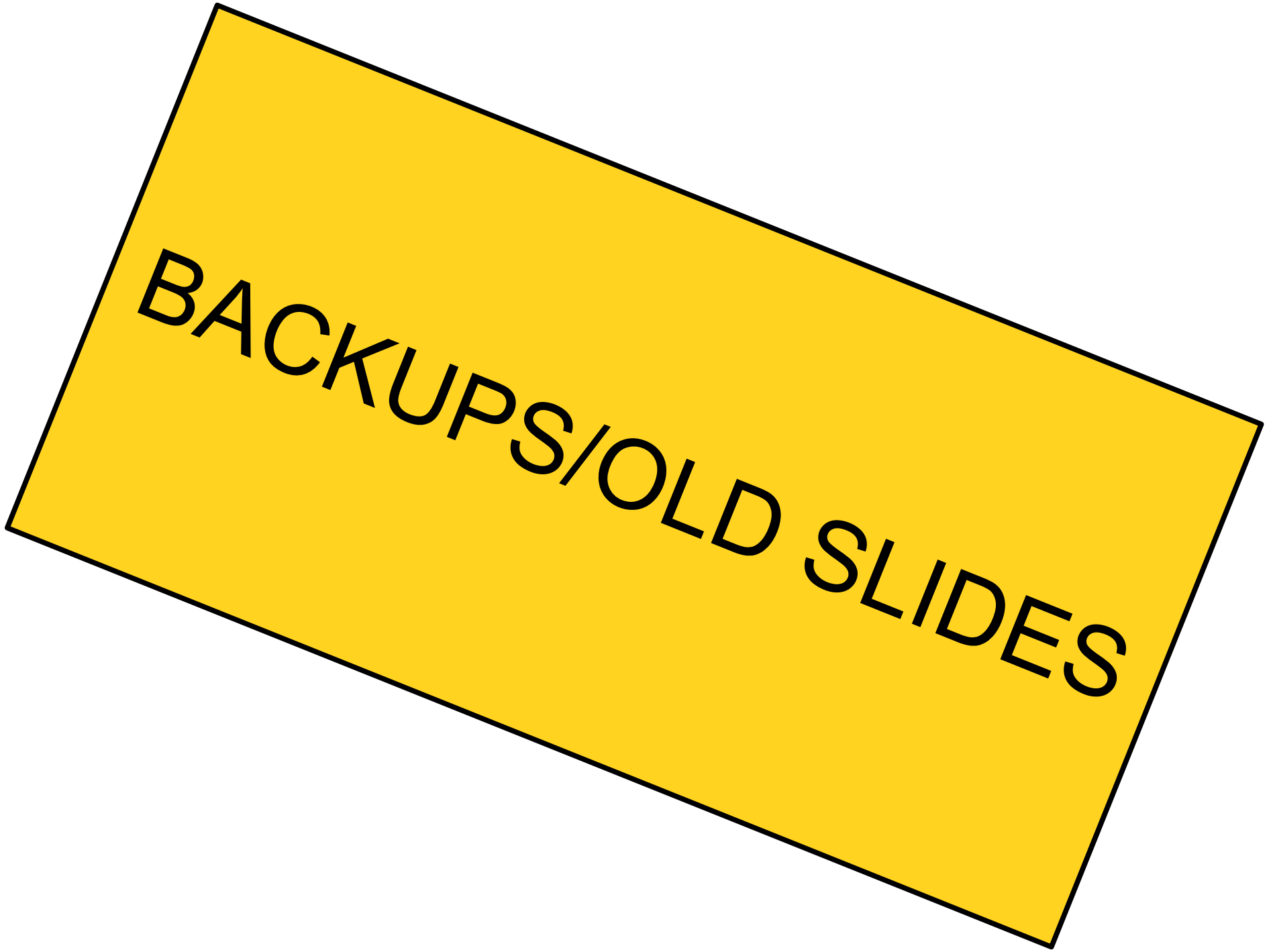
Gives (ARIADNE) $\sigma_{2+\mathrm{Forward\ jet}} \approx 1.5mb$

For luminosity

$$dL = 10^{32} cm^{-2} s^{-1} = 10^{5} mb^{-1} s^{-1} \qquad (1b = 10^{-24} cm^{2})$$

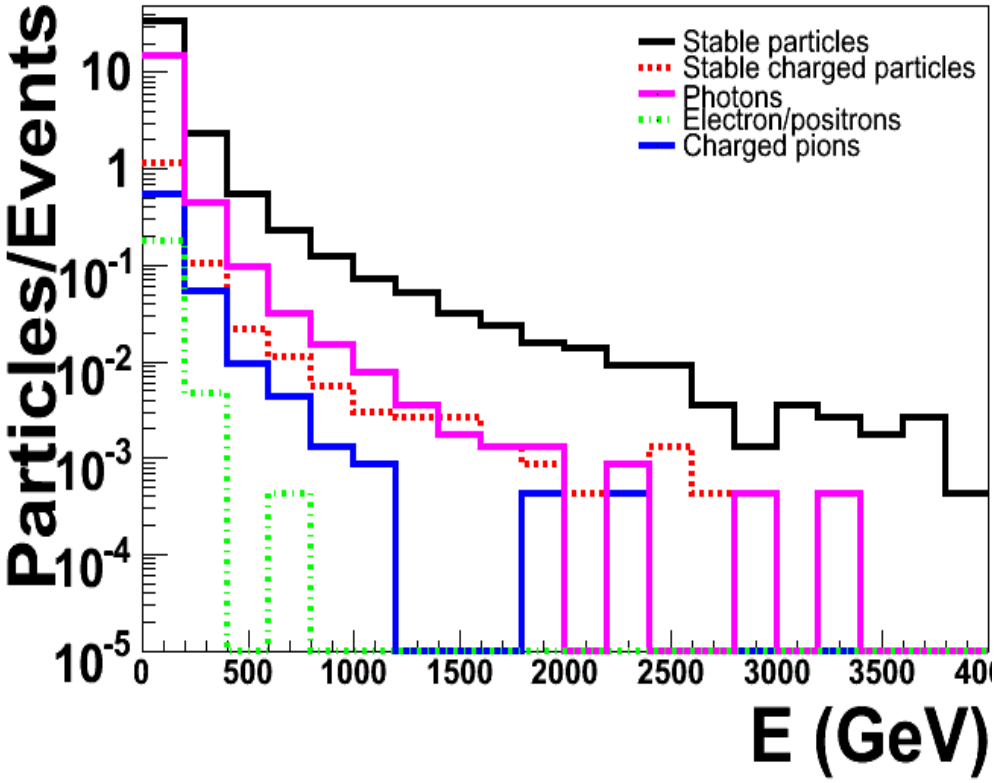
We get $1.5 \cdot 10^{5}$ **2+Forward jet events/second...**

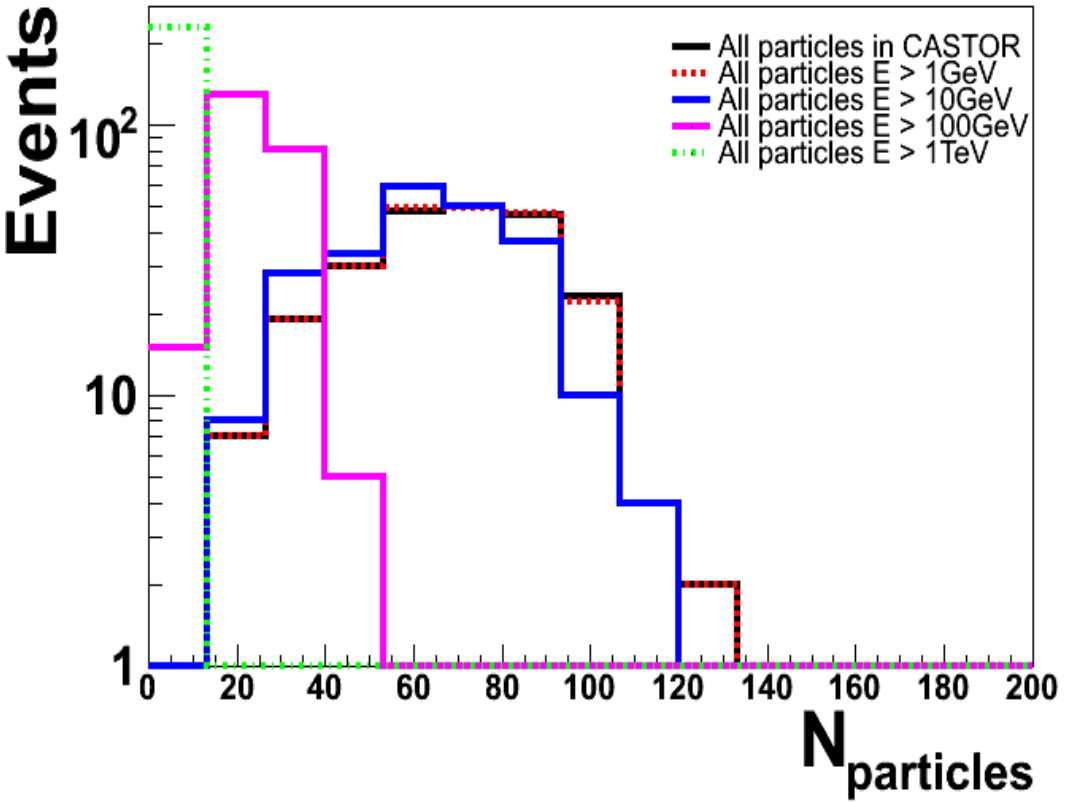
We have the statistics... Do we have the resolution?


BACKUPS/OLD SLIDES

Forward Jets - Activity in CASTOR

Forward jet events: How much activity can we expect in CASTOR?





- ~1% of forward jet events have particle(s) with E > 1 TeV in CASTOR
- 20-40 particles/event with E > 100 GeV

(Integrated over all Phi-octants)

-All predictions made with ARIADNE (CDM) with MI switched on