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# Impact of Bhabha scattering on the BeamCal performances

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## Motivation

Benchmark geometry of the BeamCal:

$5 \text{ mrad} \leq \theta \leq 28 \text{ mrad}$ , where  $5 \text{ mrad} \leq \theta_{\text{BeamPipe}} \leq 5.45 \text{ mrad}$

Bhabha scattering  $e^- e^+ \rightarrow e^- e^+$  (ny)

$\sigma \sim 1/\theta^3 \Rightarrow$  very high probability at very small angles

When one or several particle from such event are found but event is not identified like Bhabha, it becomes severe background for other physic processes.

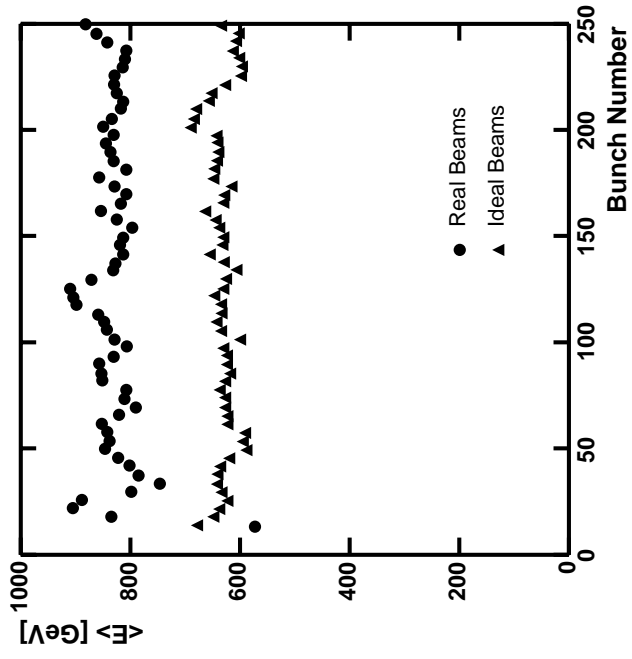
Why some events cannot be fully reconstructed and identified:

- some particles are lost
- pure energy resolution

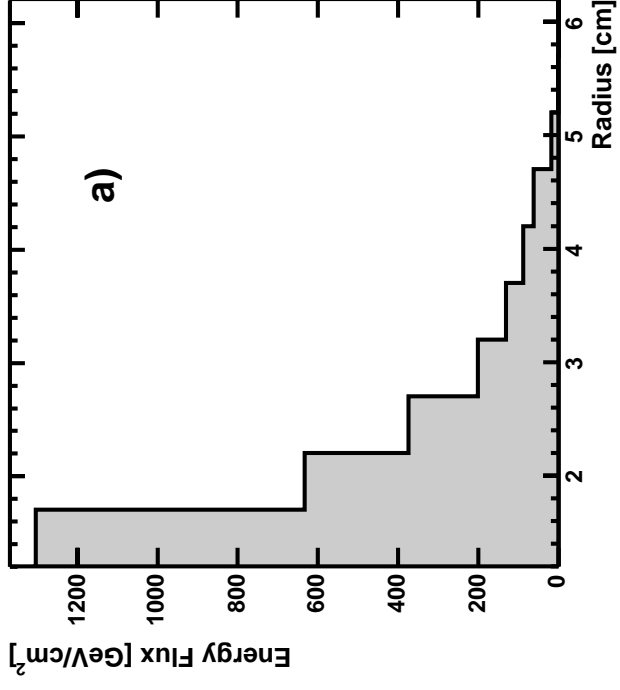
Why particles can be lost:

- reconstruction problem due to beamstrahlung background;
- kinematics -  $\gamma$ -radiation deflect particles.

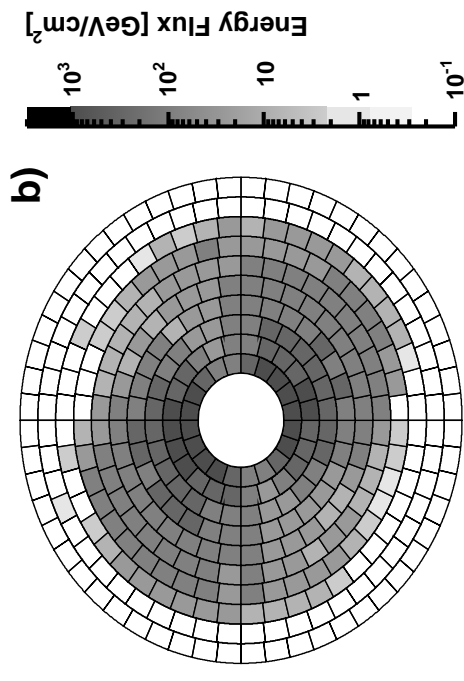
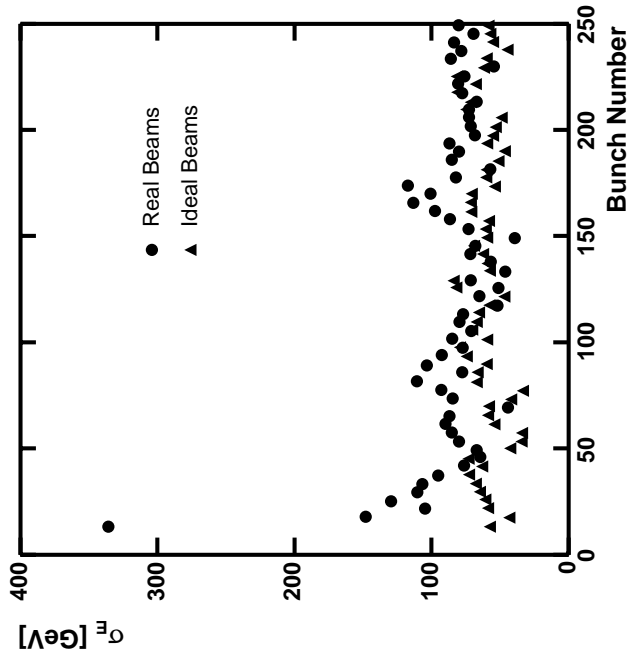
# Beamstrahlung Background



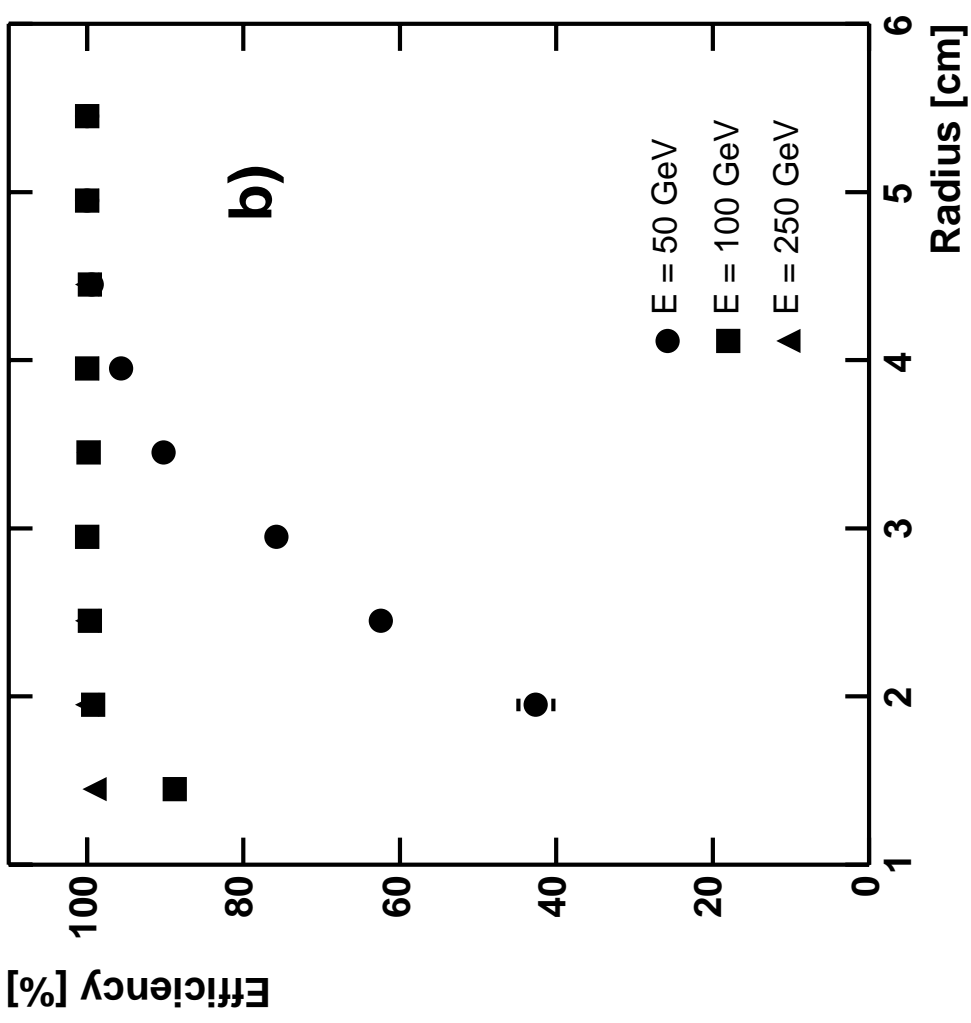
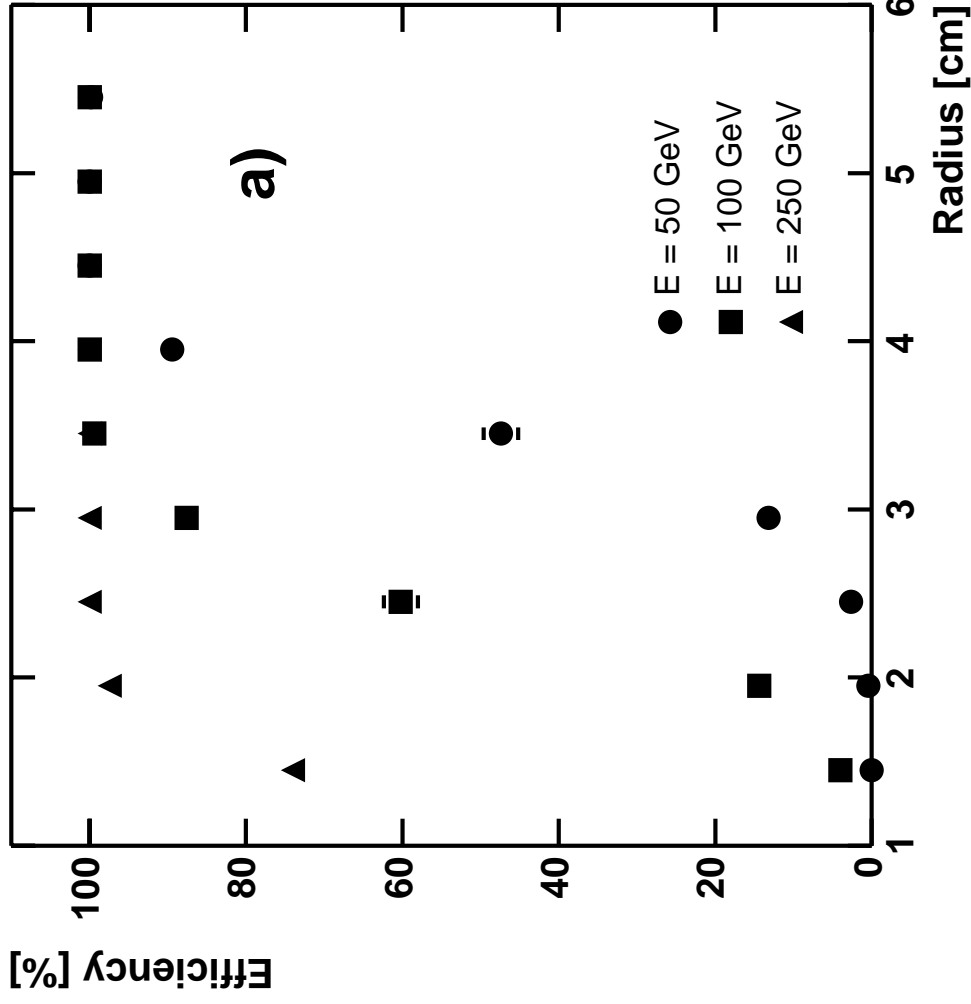
Energy flux through particular cell. Train dynamics.



R- $\phi$  distribution of energy flux for particular BX.



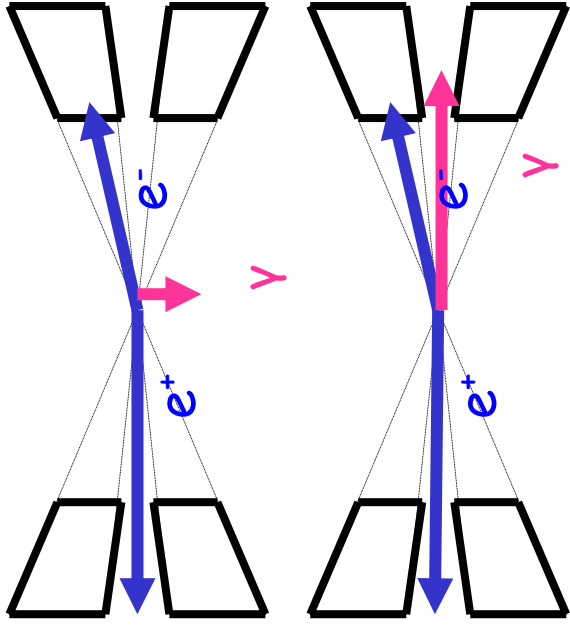
# Single Electron Reconstruction Efficiency



a) and b) represents different  $\varphi$  angles

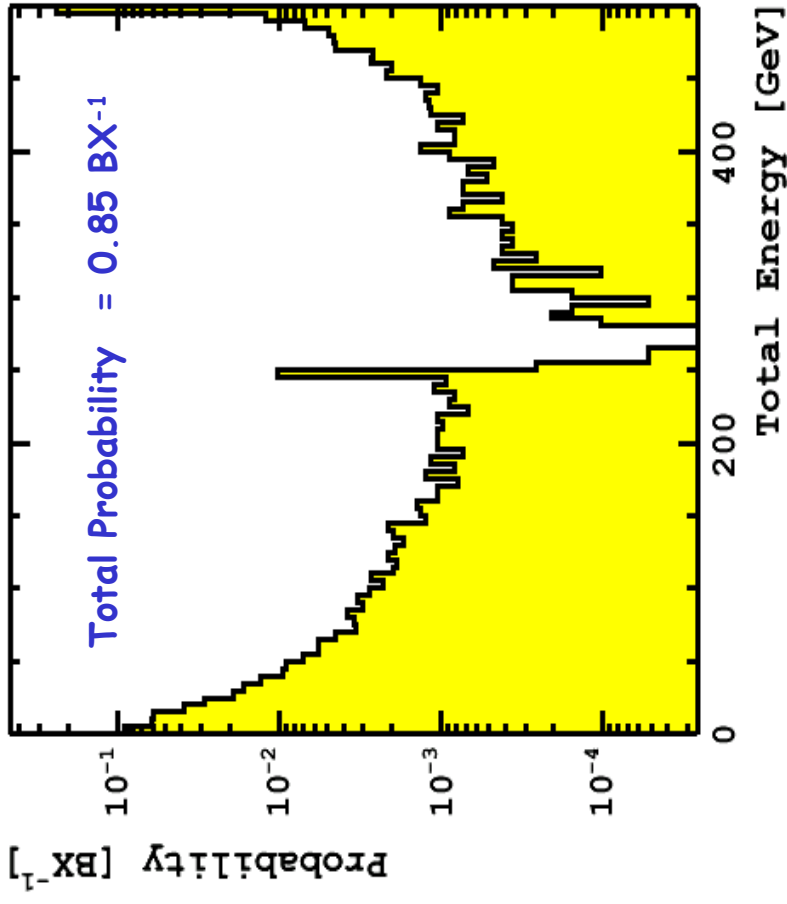
# Bhabha kinematics

Examples



Only 1 electron hits detector

BHLUMI generator  
 $\Theta_{\min} = 0.3 \text{ mrad}$



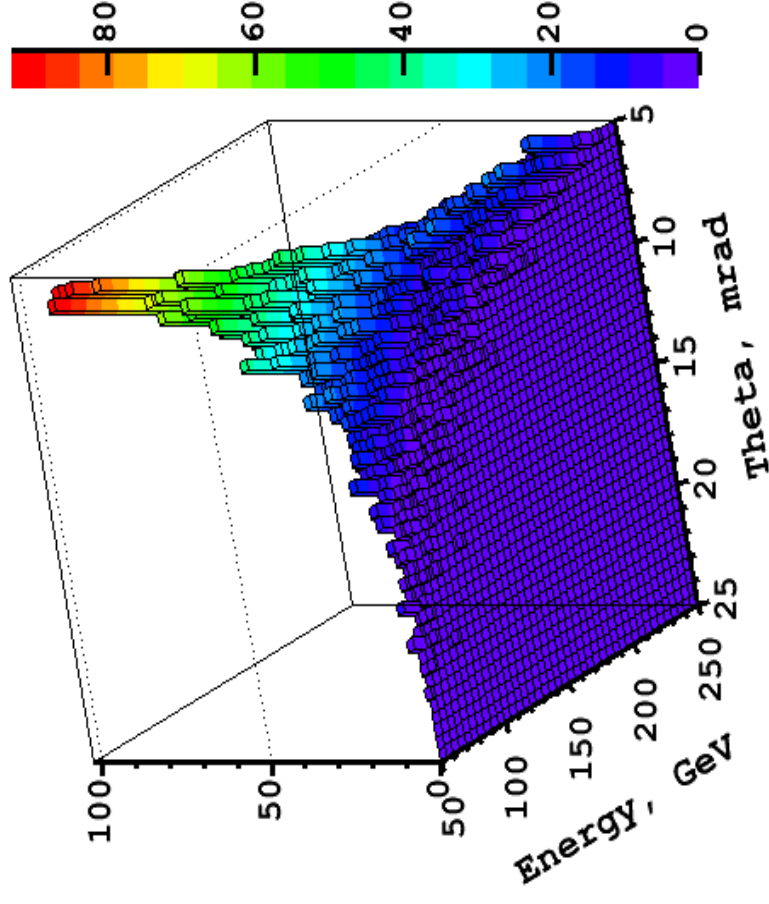
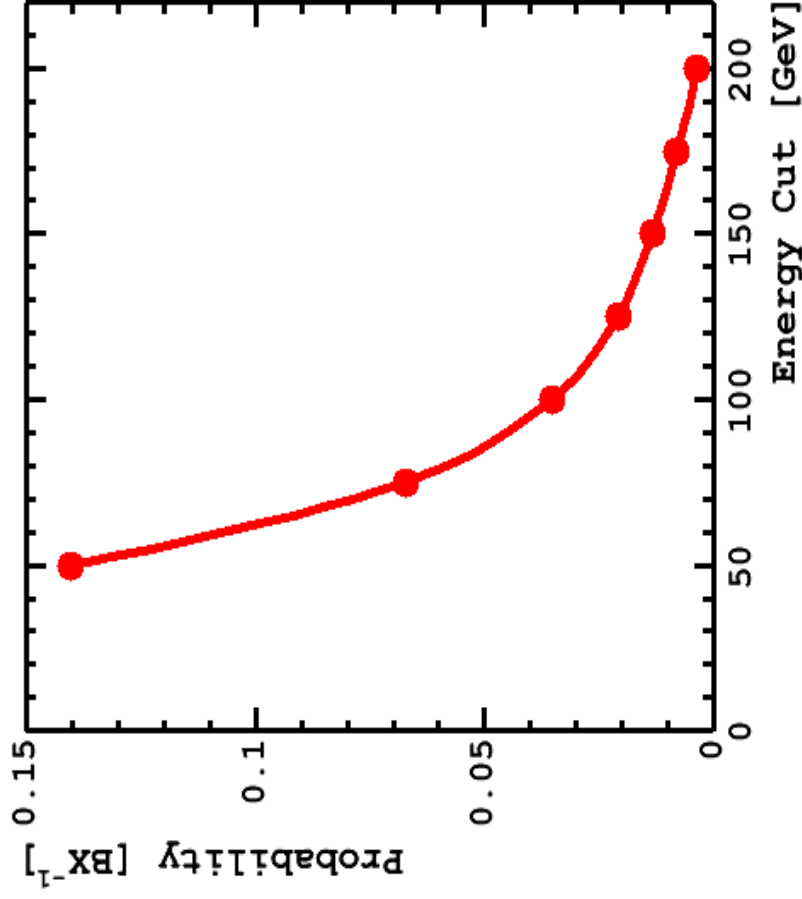
How correct it works  
at such small angles?

# TEEGG generator

Generate process  $e^- e^+ \rightarrow e^- e^+ \gamma(\gamma)$

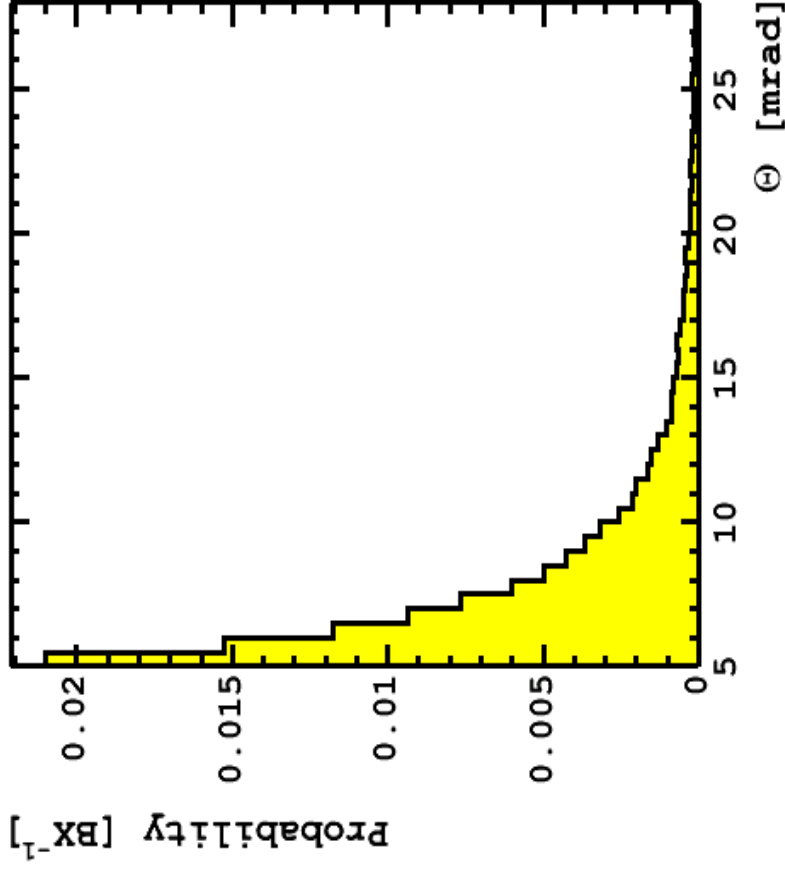
Options:

- only 1  $e^-$  or  $e^+$  in detector
- only  $\gamma$  in detector



# Reconstruction

First step is to simulate and reconstruct  $e^- e^+ \rightarrow e^- e^+$  process

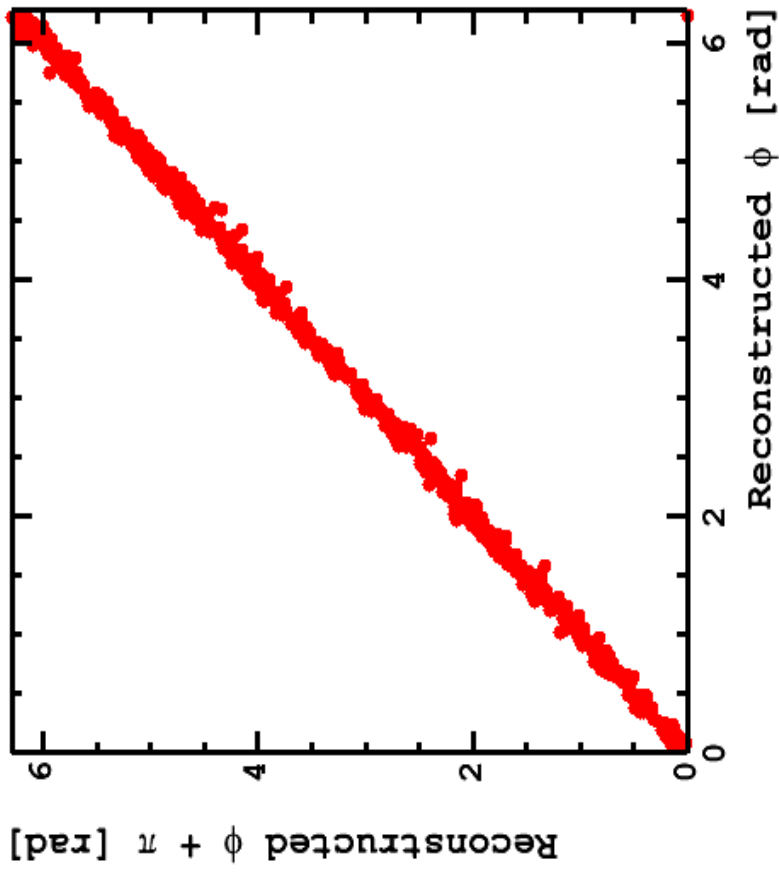
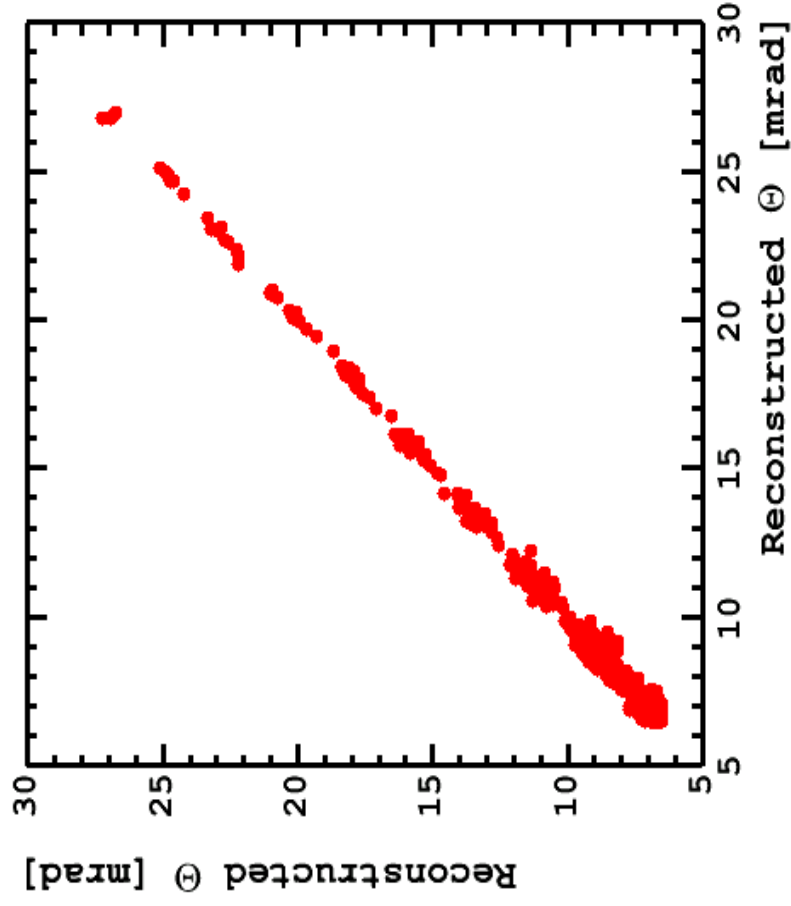


BHLUMI generator

Total Probability =  $0.11 \text{ BX}^{-1}$   
Hit BP 11.5%

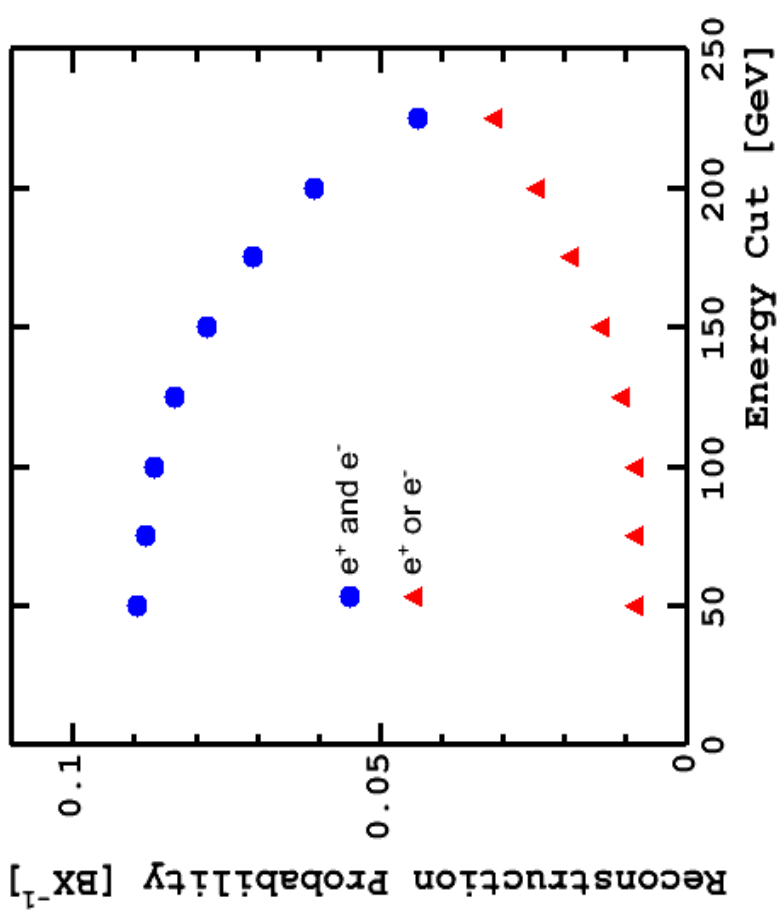
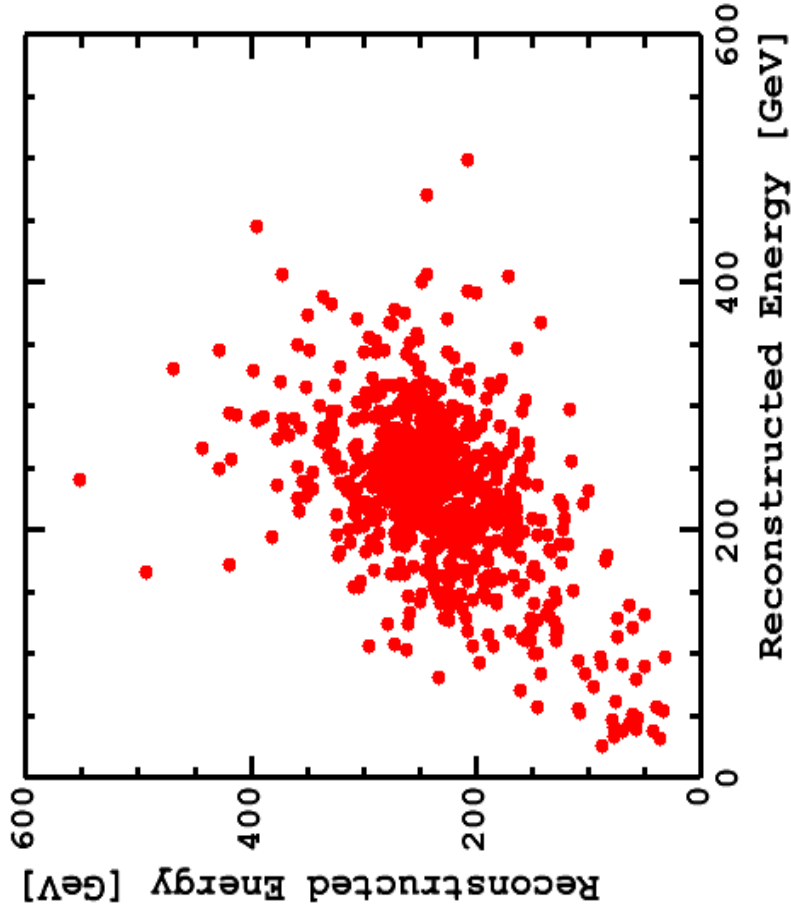
1000 event were tracked by  
BRAHMS and then  
reconstructed:  
- 10.5% -  $0 e^\pm$  - leakage  
- 6.7% -  $1 e^\pm$  - leakage +  
reconstruction imperfection  
- 82.2% -  $2 e^\pm$

# Reconstruction. Angular resolution.





# Reconstruction. Energy resolution and cuts



## Outlook

A lot of work is to be done:

Compare BHLUMI and TEEGG at small angles

Analysing full Bhabha events

Find out identification criteria

Finally:

Find out reconstruction rate

Find out veto rate