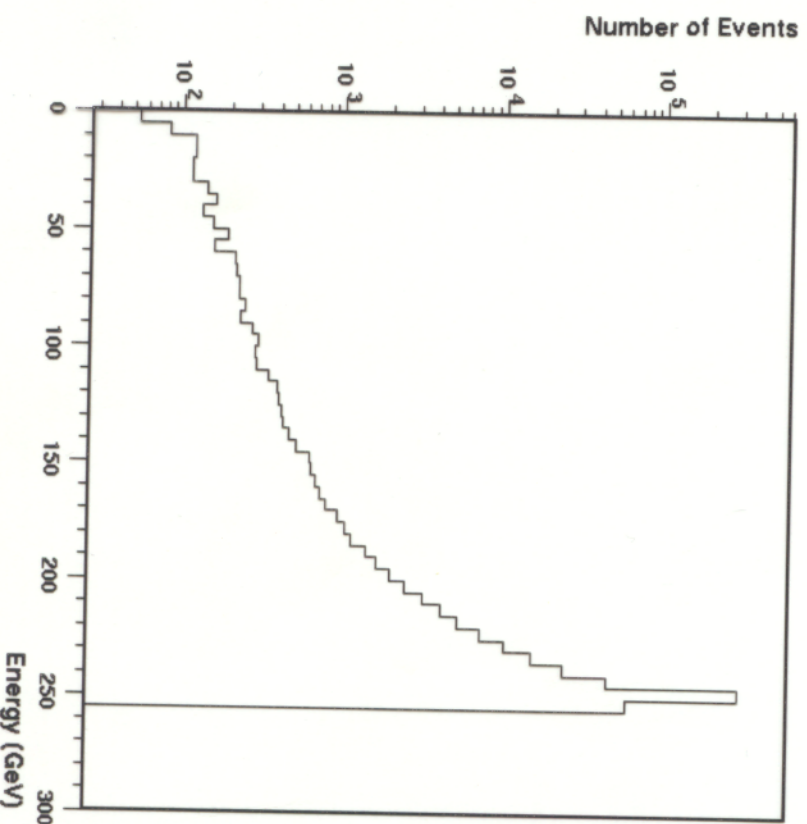


# Introduction



Goal: Check if the true luminosity spectrum can be obtained from Bhabha processes using the forward calorimetry by the employment of unfolding techniques.

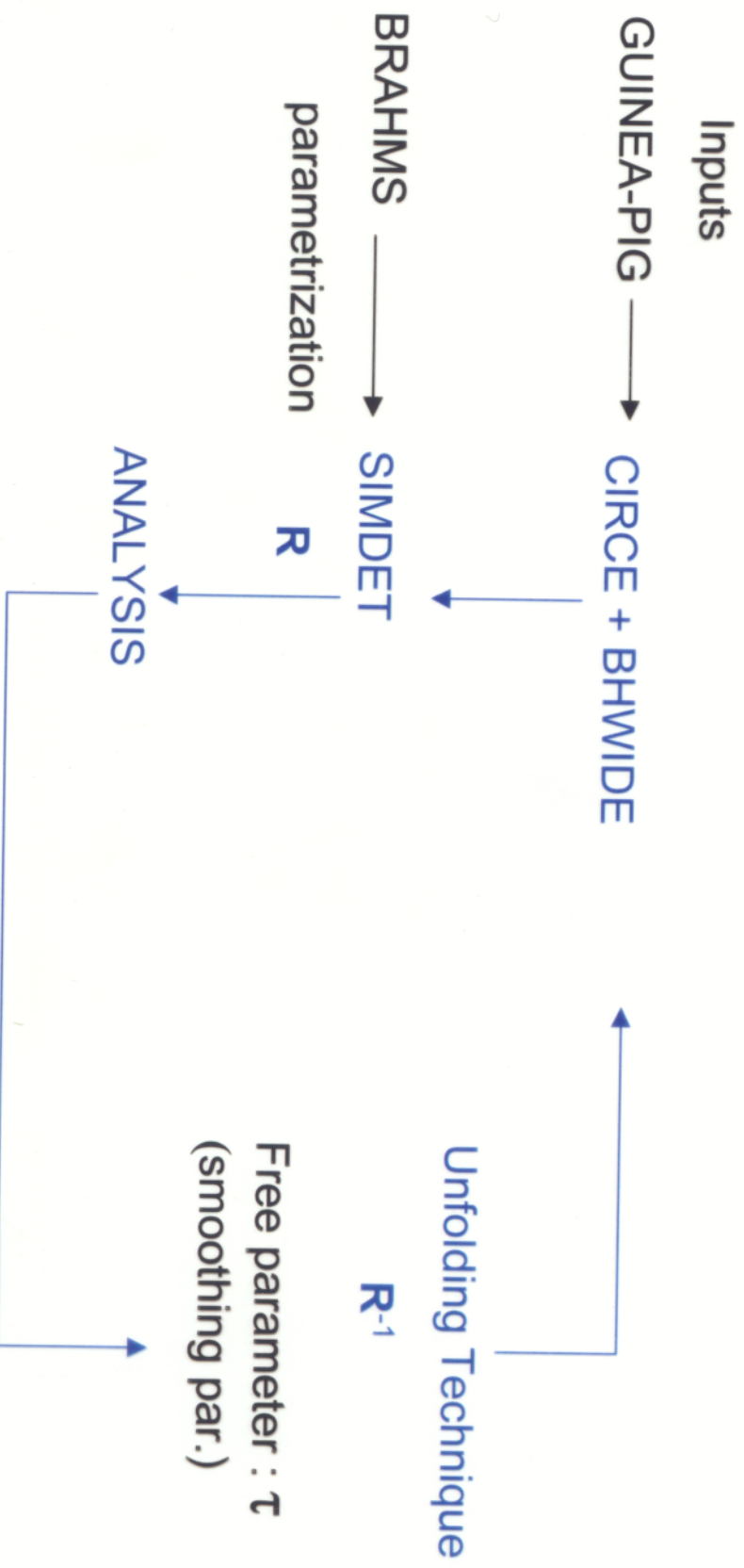


$$\sigma_{e^+e^-}(5.4 \text{ mrad} < \theta < 83.1 \text{ mrad}) \approx 160\,000 \text{ pb}$$

for  $\sqrt{S} = 500 \text{ GeV}$

# Technique

Unfolding techniques using the transformation matrix of a detector for associated variables (Energies, angles,...) can be used. There are some packages such as GURU/ RUN.





# Need of This Technique

Response matrix of a detector which requires precise parameterization.

For forward calorimetry(LCAL/LAT) parametrization is under way (W. Lohmann *et al.*) with and without background and is being included in SIMDET.

Energy resolution of calorimeter described as quadratic addition:

$$\frac{\sigma_E}{E} = \sqrt{\left(\frac{a}{\sqrt{E}}\right)^2 + b^2}$$

a: stochastic term

b: constant term

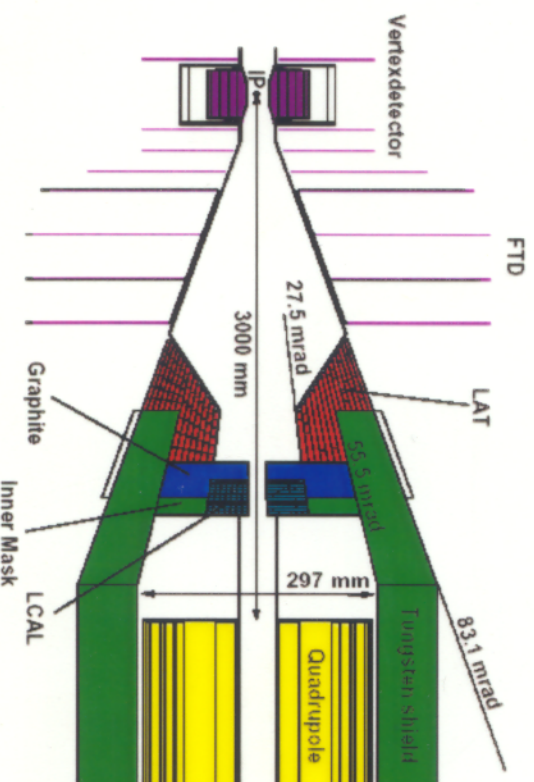
**LAT** (from TDR updated)

a=0.1

b=0.01

$\theta_{\min} = 27.5 \text{ mrad}$

$\theta_{\max} = 83.1 \text{ mrad}$



← 220 cm →

**LCAL** (updated to paramet.)

A and b as in the following slide, dependant on  $\theta$

$\theta_{\min} = 5.4 \text{ mrad}$

$\theta_{\max} = 30 \text{ mrad}$

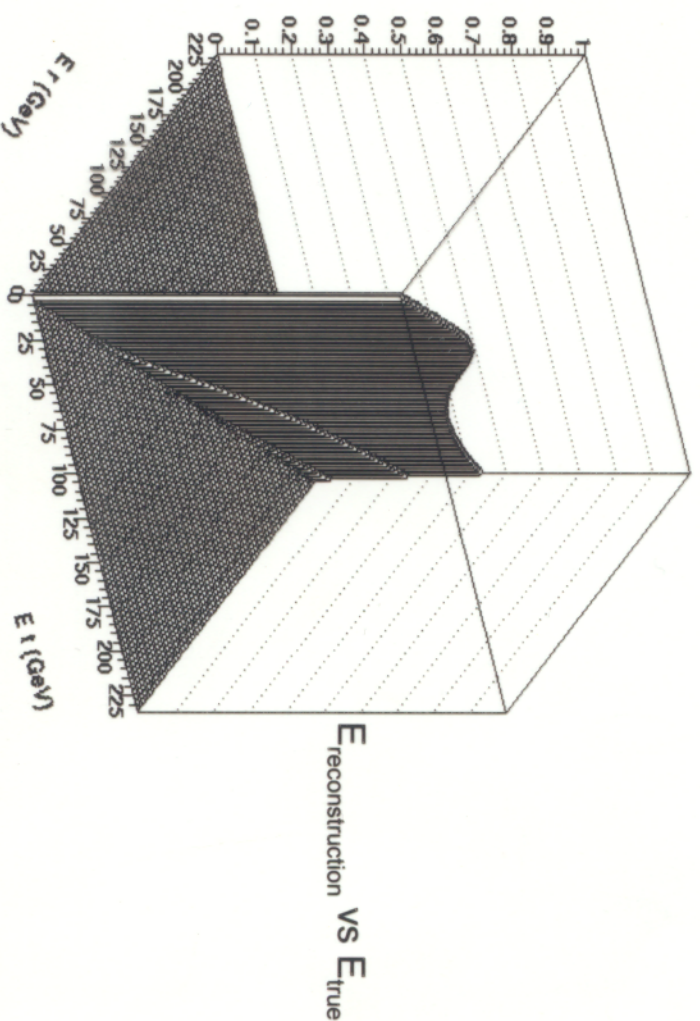
# Parametrization & Matrix

2 examples for unfolding:

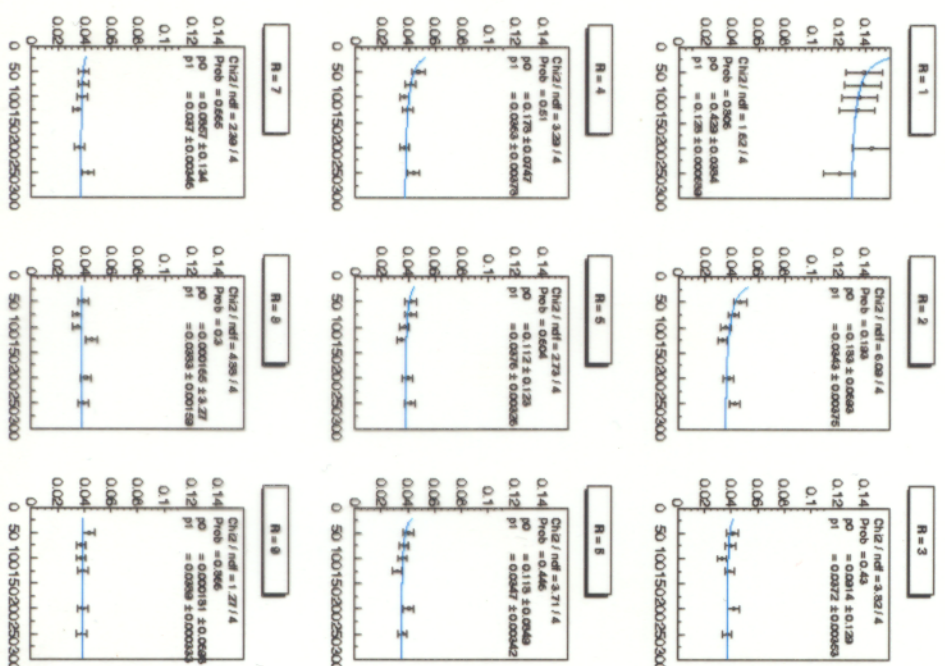
LCAL Parametrization of energy (preliminary),

LAT Matrix of considered variables

LAT matrix (R) from TDR



LCAL parameterization (k. kuznetsova)





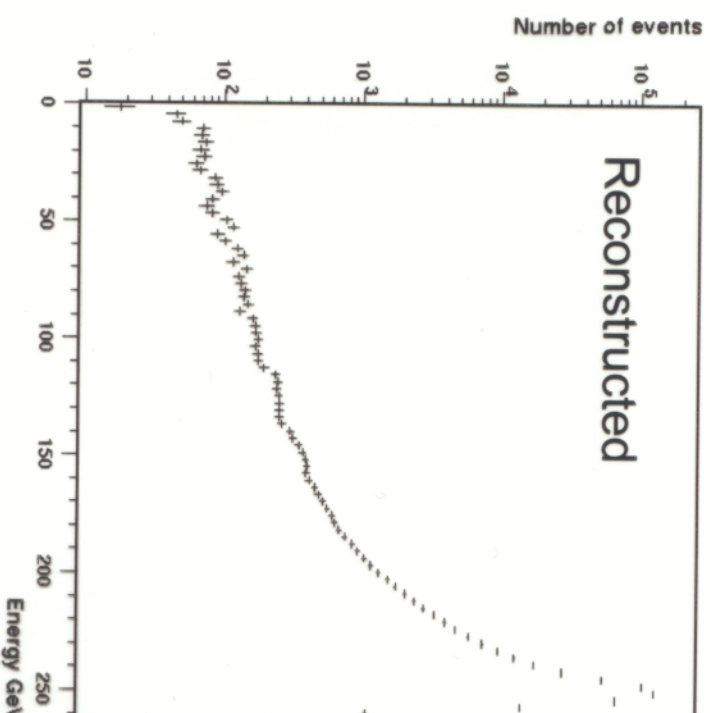
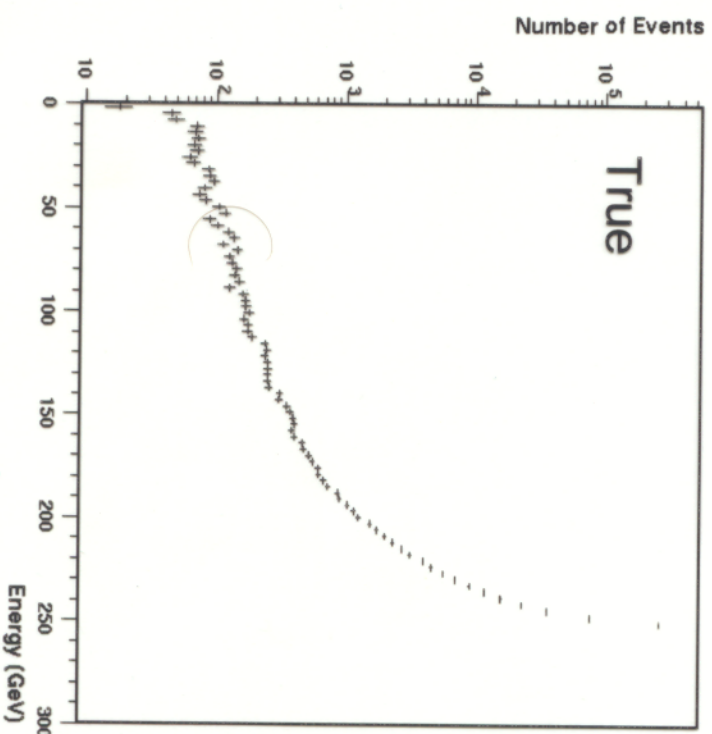
# Unfolding with LAT

Lower statistic than LCal (30 times),  
Better resolution,  
Less background.

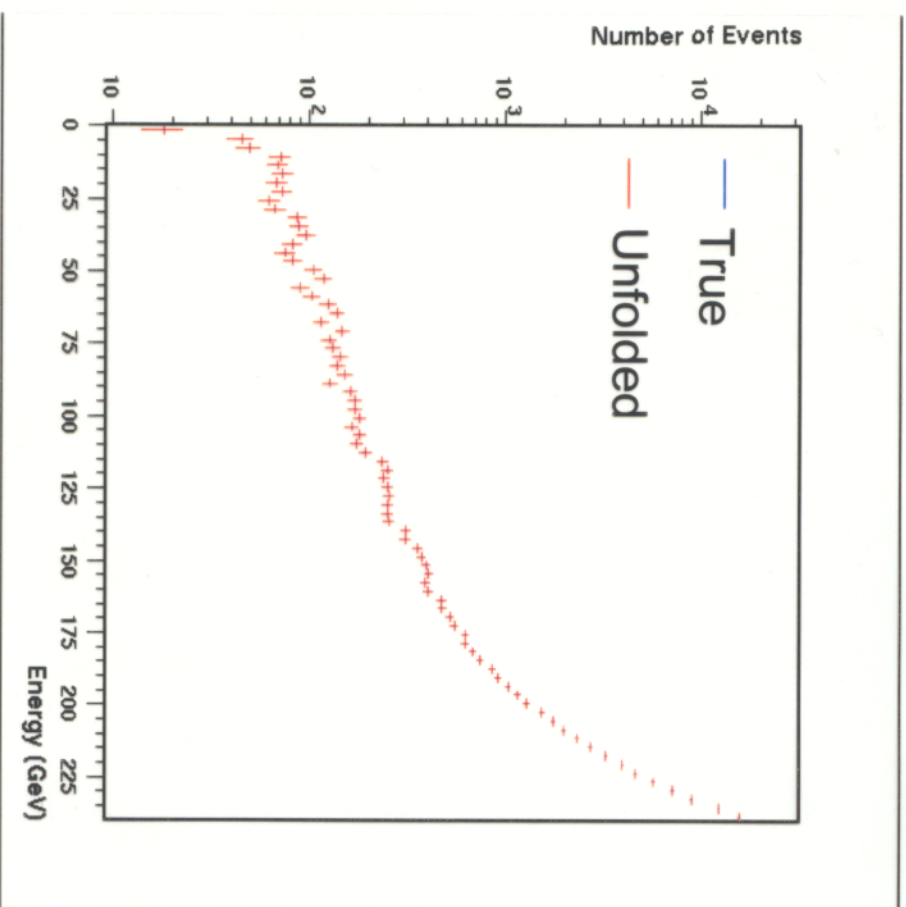
Integrated luminosity:  $2.5 \text{ fb}^{-1}$  at  $\sqrt{s} = 500 \text{ GeV}$

True distribution from CIRCE 1.0  
+ BHWIDE 1.04

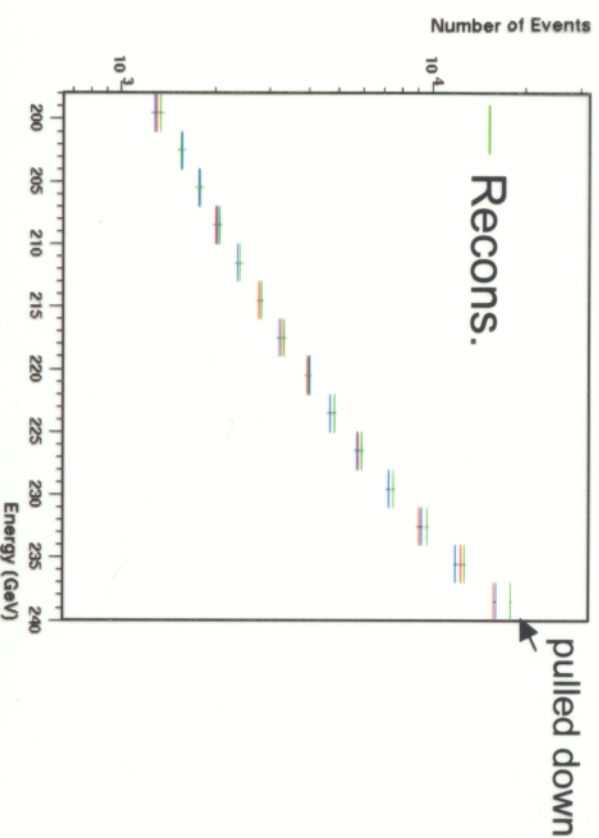
Beamstrahlung + ISR included



# Unfolding (cont'd)



*GLRLL*



Works if we constrain our study up to 240 GeV:

$$\chi^2 = 0.135 \text{ for } \tau = 0.399 \cdot 10^{-6}$$

Unfolding does not work if we ask up to 250 GeV!!

$$\chi^2 = \sum_{i=\text{bin\#}} \frac{(x_{\text{unf}}^i - x_{\text{true}}^i)^2}{|x_{\text{true}}^i|}$$



# Future plan

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- Now loop is closed, need to extend the study:
- i.e. include Beamspread,
- a whole theta range (LCAL to LAT),
- Check this unfolding method helps to distinguish typical beams (with backgrounds),
- For this need to study constrain on the smoothing parameter ( $\tau$ ).