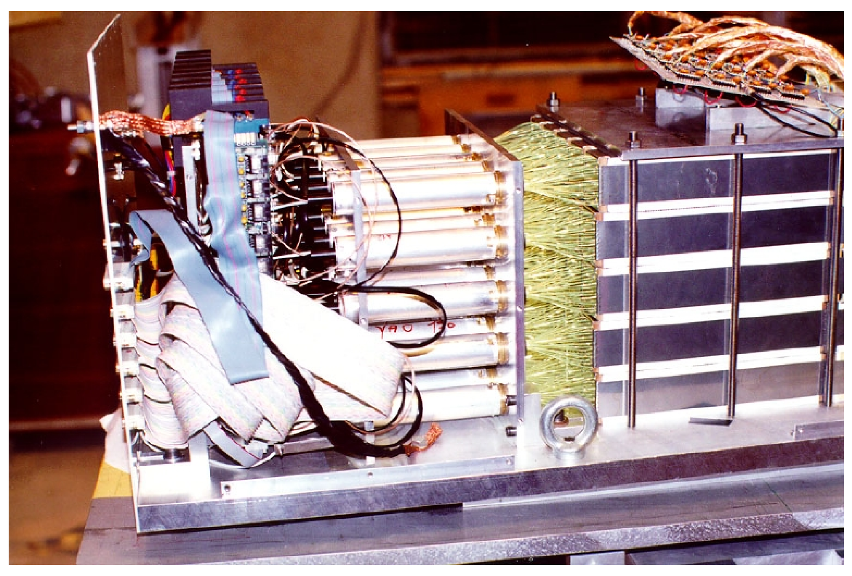
# CALEIDO[a]: A Shashlik e.m. Calorimeter with Longitudinal Segmentation



## Requests for Calorimetry at Linear Collider:

- High granularity
- Good energy resolution ($\sim \frac{10\%}{\sqrt{E}} \oplus 1\%$)
- Read-out in high magnetic field ($3-4\ T$)
- Longitudinal segmentation: **$e/\pi$ separation, $\gamma$ direction reconstruction**

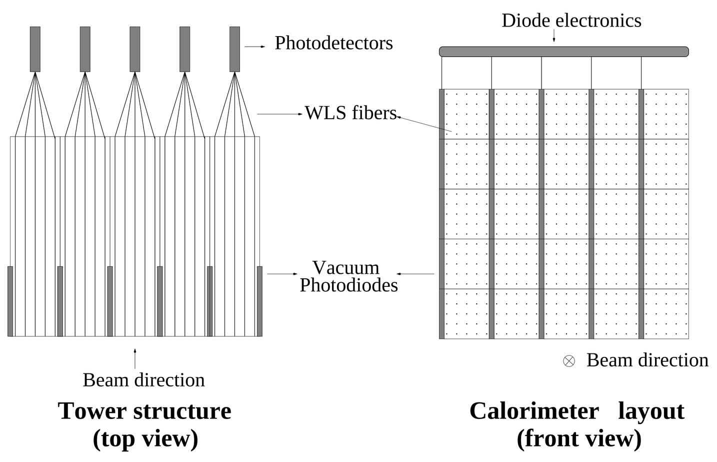
$\Longrightarrow$ **Shashlik Calorimeters:**

- Scintillation light collected by optical WLS fibers
- Compact, modular, easy to operate
- No dead zones

## Longitudinal Segmentation, 2 solutions:

### CALEIDO 1

Insertion of Vacuum Photodiodes in the first 8 $X_0$



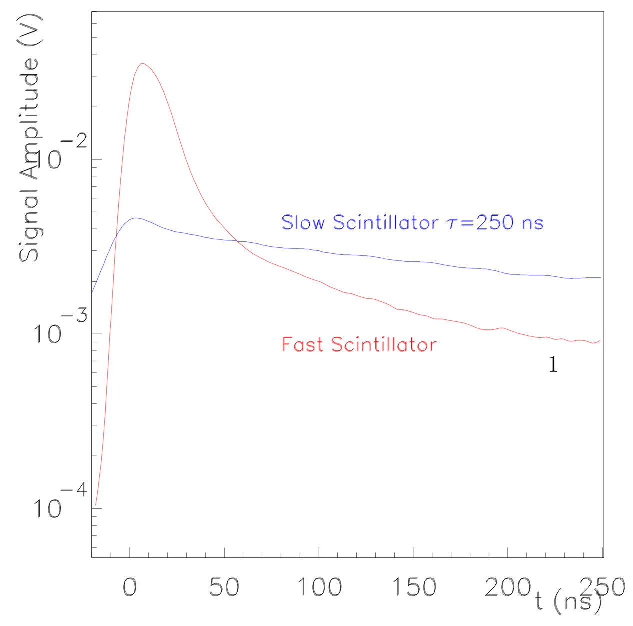

25 towers, 1 mm Pb + 1 mm scintillator sampling ($5 \times 5 \times 36\ cm^3 \sim 25 X_0$)

Back side read-out: Hamamatsu Phototetrodes/APD

Top side read-out: EMI/Hamamatsu Photodiodes

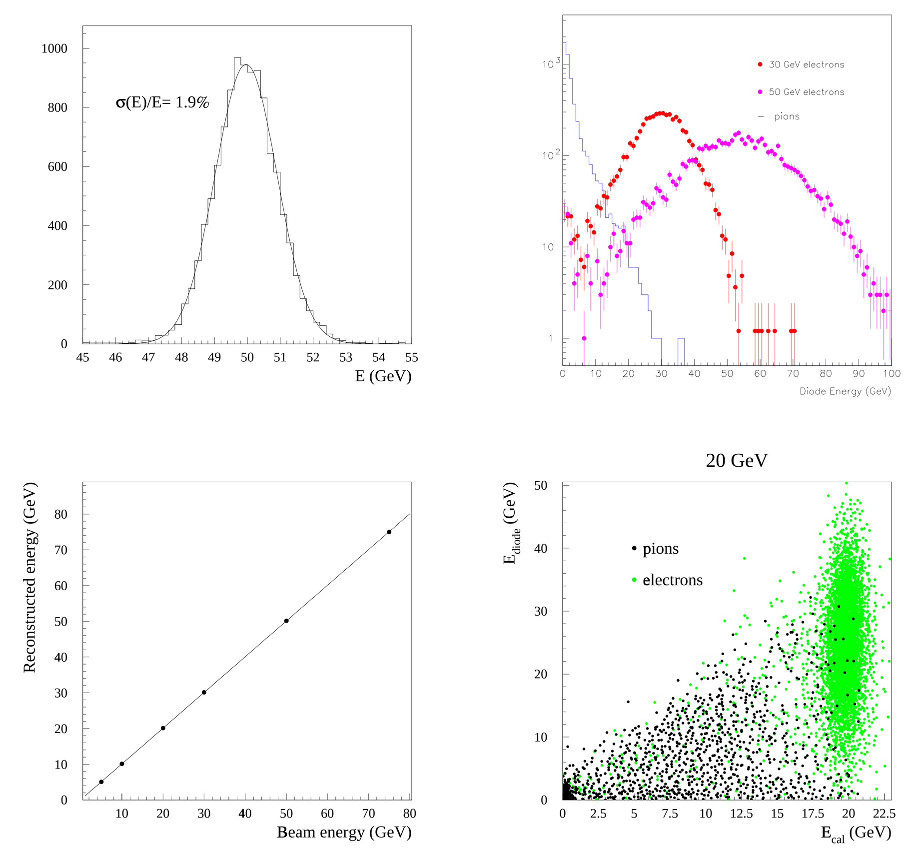
### CALEIDO 2 (preliminary)

Use 2 Scintillators with different time response



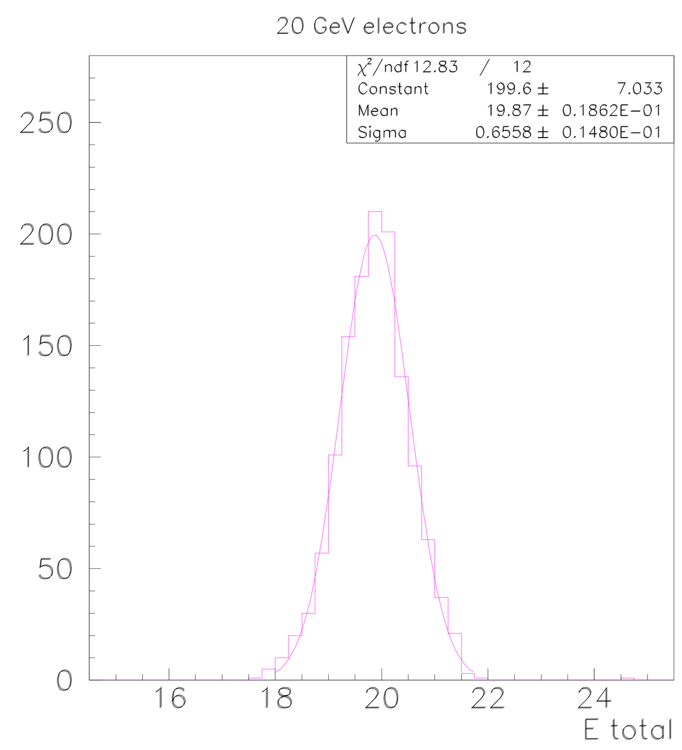

Slow Scintillator BC-444 ($\tau \sim 250\ ns$) in the first 5.2 $X_0$. Signal sampled with 2 different gates (NARROW = 55 $ns$, WIDE = 600 $ns$). Light Yields Ratio $\frac{Q_{FAST}}{Q_{SLOW}} \sim 2$ to be optimized.

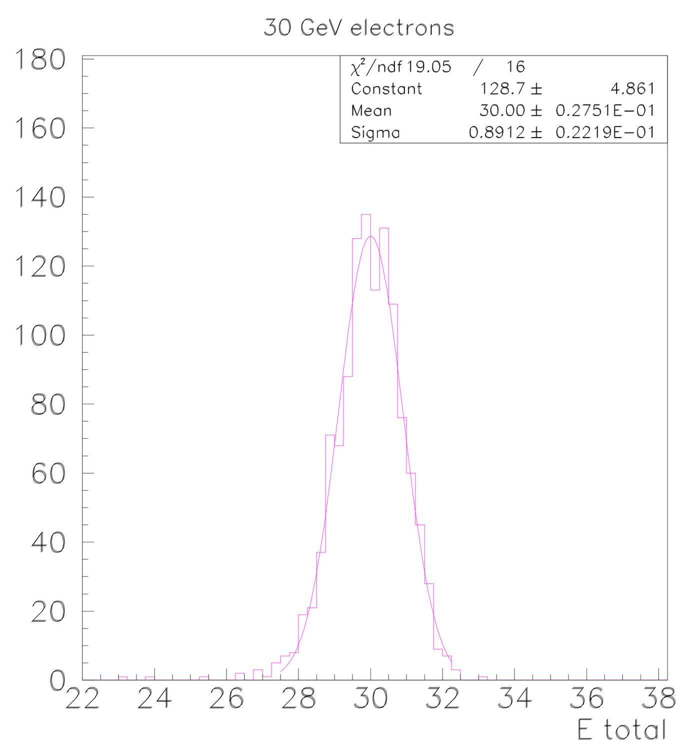
### CALEIDO 1




$$\frac{\sigma(E)}{E} = \sqrt{\left(\frac{9.6\%}{\sqrt{E}} + 0.5\%\right)^2 + \left(\frac{0.130}{E}\right)^2}$$

### CALEIDO 2




## $e/\pi$ Separation (CALEIDO 2) :

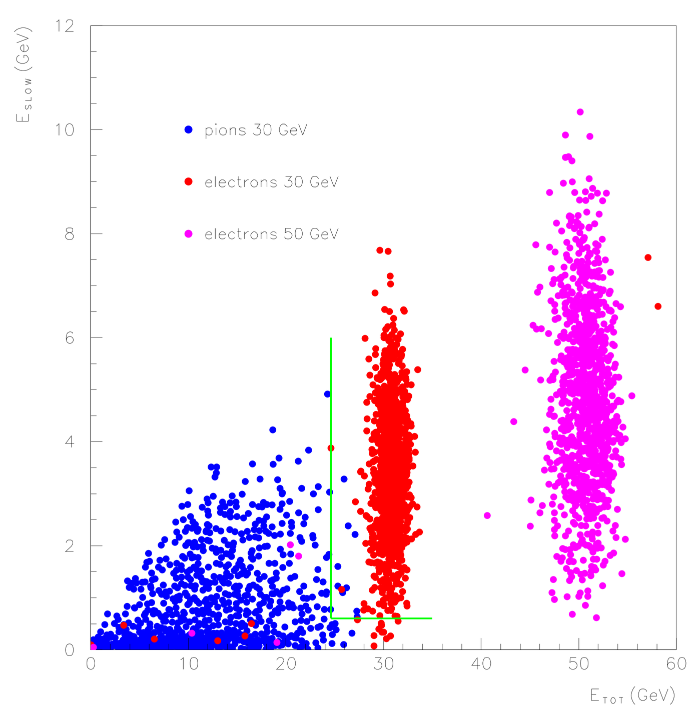
**$e/\pi$ Separation exploiting:**

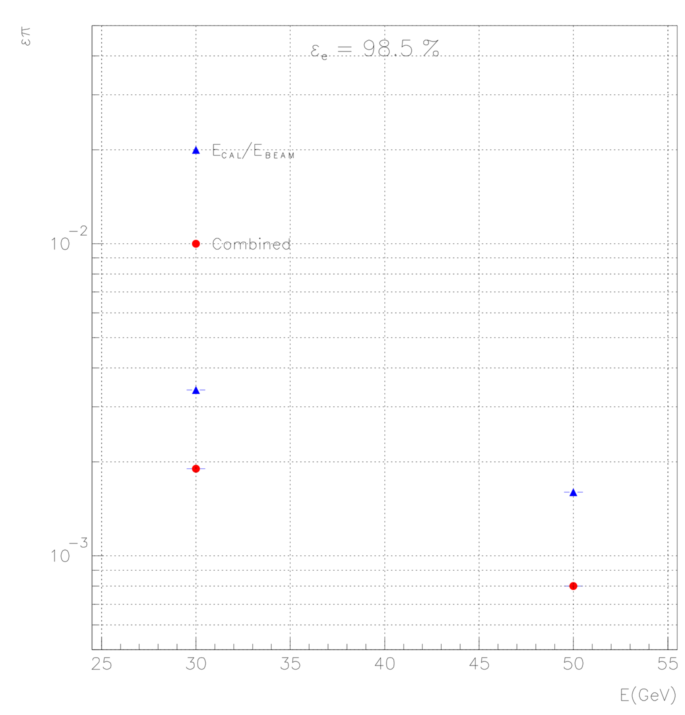
- E/p
- Fast/Slow Scintillator Responses

$\Longrightarrow$ **Separation better of factor $\sim 2$ w.r.t. E/p**

$\epsilon_\pi = 8 \times 10^{-4}$ **for** $\epsilon_e = 98.5\%$

$\epsilon_\pi < 5.6 \times 10^{-4}$ ($95\%\ C.L.$) **for** $\epsilon_e = 95\%$




**Pion Efficiency**

[a]CERN, Lund, Milano, Padova, Protvino