



**bmb**+f - Förderschwerpunkt

COMPASS

Großgeräte der physikalischen Grundlagenforschung



#### Linearity and Energy Resolution of Lead Glass Modules in the Electromagnetic Calorimeter of COMPASS



## Motivation



- COMPASS/CERN SPS, fixed target experiment
- Electromagnetic calorimeters equipped with lead glass modules
- Goal of the present study:
  - Investigate energy resolution and linearity
  - First study done end of 2007 at CERN T9 test beam with electrons and muons 1 - 15 GeV
  - Here: measurement at H2 test beam/CERN done for 15 - 90 GeV positron-beam



### COMPASS-Spectrometer



**COmmon Muon and** Proton Apparatus for Structure and **S**pectroscopy E/HCAL SM<sub>2</sub> E/HCA SM1 50m Liquide hydrogene target two stage spectrometer RICH with two T.K beam electromagnetic calorimeters



### **GAMS-module**



GAMS	
lead glass type	TF1
density [g/cm <sup>3</sup> ]	3.86
X <sub>0</sub> [cm]	2,74
Molière radius [cm]	3.8
refractive index	1,65
size [cm]	3.82 x 3.82
length [cm]	45
length [X <sub>0</sub> ]	16.42
critical energy [MeV]	16

**OMPA** 

 $^{\scriptscriptstyle \succ}$  Since few years in ECALs  $\rightarrow$  new calculation of linearity and energy resolution necessary

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## H2 test set-up





- Box equipped with 25 lead glass modules (TF1 called GAMS)
- Set-up as 5x5-matrix
- Hodoscope and beam counter in coincidence served as a trigger

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# Test procedure



- Irradiation of each module with 50 GeV (e<sup>+</sup> - beam)
  - 1) Pedestal determinate
  - 2) Determining of inter-calibration constants
- Irradiation of central module in matrix with 15 – 90 GeV
  - Global calibration
  - Linearity
  - Energy resolution



#### Individual pedestal for each module, of course!

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#### Note: high constants in one corner!

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# Summed energy spectrum



 Second part of the measurement

All single ADC
spectrum combined
to summed energy
spectrum

Were fitted with
Gaussian



Values serve for global calibration, linearity and energy resolution

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### Linearity



Linearity of 5x5-Cluster



Good linearity in wide energy range!

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### Residuals





#### → The relative differences from the linearity is below to 2%.

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# Energy resolution





#### →3 parameter better than 2 parameter fit.



# Conclusion & outlook



- Determine linearity and energy resolution of GAMS-modules at high energy
- Linearity is good in wide energy range
- Energy resolution good as expected
- Some module made problems  $\rightarrow$  electronic noise?
- Investigate of 3x3-Cluster without border modules