γ E Scale - Run 6 Results

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Outline

- Processing and selection of $\pi^0$ and $\mu\mu\gamma$ data
- $\gamma$ energy scale, $\theta$, $E$ dependence in run 6
- EMC response in run 6, $\mu\mu\gamma$ and $\pi^0$ data
- Summary
Introduction

Data processing and selection – $\pi^0$

Goal: select symmetric $\pi^0$ candidates in data and MC.

- **Datasets:**
  - run 6 R22d-V01: runs 69604 – 74349  (21.1.07 – 2.7.07)
  - MC generic B (R22d), no selection corresponding to the run range in data!

- **Selection:**
  - BGF multihadron events with $R2 > 0.8$
  - $\gamma$ cluster with LAT < 0.6 and $N_{digi} > 1$
  - no tracks within a distance of 30 cm on the EMC surface

- **Signal processing:**
  - subtract combinatorial background using $\gamma$ cluster of different events
  - fit Novosibirsk func. around the peak of the distr. to extract $<m_{\gamma\gamma}>$

Data processing and selection – $\mu\mu\gamma$

- **Datasets for $\mu\mu\gamma$ calibration:**
  - run 6 R22d-V01: runs 69604 – 74349  (21.1.07 – 2.7.07) (46.6 fb$^{-1}$)
  - MC SP3981 (R22d), no selection corresponding to the run range in data!

- **Use exactly the same selection as for the previous $\mu\mu\gamma$ calibration.**
γ Energy Scale Parametrizations

θ dependence of the γ energy scale in μμγ data

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E dependence of the $\gamma$ energy scale in $\mu\mu\gamma$ and $\pi^0$ data

\[ \ln E_{\gamma} \]

- $\pi^0$ MC
- $\mu\mu\gamma$ MC

$\gamma$ scale (MC)

$\gamma$ scale (Data)

Run 5

$\pi^0$ data
$\mu\mu\gamma$ data

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E dependence of the $\gamma$ energy scale in $\mu\mu\gamma$ and $\pi^0$ data

$E$ dependence of the $\gamma$ energy scale in $\mu\mu\gamma$ and $\pi^0$ data

$\pi^0$ MC
$\mu\mu\gamma$ MC

$\pi^0$ data
$\mu\mu\gamma$ data
E dependence of the $\gamma$ energy scale in $\mu\mu\gamma$ and $\pi^0$ data

- Run 6
- Run 5

$\gamma$ scale

$\ln(E)$

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EMC Response in Data and MC
EMC response to $\pi^0$ data

Apply the parametrizations to $\pi^0$'s and measure data/mc before and after calibration.

Data/MC

$\ln E_\gamma / \text{GeV}$

EMC$_{\text{barrel}}$

$\pm$ 1 %

Larger constants in $\theta$ at lower $E_\gamma$ preferred

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EMC response to $\pi^0$ data - Energy dependence

Apply the parametrizations to $\pi^0$'s and measure the response before and after calibration.

$EMC_{\text{barrel}}$

$\ln E_{\gamma}/\text{GeV}$

$mc_{\gamma \gamma} [\text{MeV}]$

MC raw

Data raw

MC calibrated

Data calibrated

2 MeV

2 MeV

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**EMC response to $\pi^0$ data - $\theta$ dependence run 1 - 6**

Apply the parametrizations to $\pi^0$'s and measure the response before and after calibration.
EMC response to $\pi^0$ data - asymmetric case

Apply the parametrizations to asymmetric $\pi^0$'s and measure data/mc after calibration.

Data/MC

$E_{MC_{\text{barrel}}}$

$\ln E_{\gamma}$ / GeV

$\theta$

1 %
**EMC response to $\pi^0$ data**

- Good description of the data by MC after calibration.
- Strong $\theta$ dependence in the raw data of run 5 and 6.
- Even for run 1 the description of the data by MC is ok.
EMC response to \( \mu\mu\gamma \) data

Apply parametrizations to \( \mu\mu\gamma \) datasets and measure data / mc signal ratio.

Data/MC

\( \ln \left( E_\gamma / \text{GeV} \right) \)

\( I_\theta \)
Remarks on the run 7 $\gamma$ energy scale calibration

In first order the overall scale is fixed by source / bhabha calibration and we can keep the dependencies as is from the previous run. But due to the large amount of hardware work we need to extract the run 6 calibration as soon as possible.

What do we need to derive a run 7 calibration?

- Determination of the angular dependence
  - $\mu\mu\gamma$ data from about 25 fb$^{-1}$ of data taking (similar amount as for run 1) and the corresponding MC data (SP3981)

- Determination of the energy dependence
  - $\mu\mu\gamma$ data and "BGF multihadron" data and MC datasets SP3981 and SP1237.

- Time for processing and analysis about 10 days.
Summary

- Parametrizations for run 6 in E, θ of the γ energy scale are derived in the energy range of 70 MeV – 6 GeV using π⁰ and μμγ data processed in R22d.
- The energy scales derived from the π⁰ and μμγ datasets agree within the errors.
- Comparing the response of the calorimeter to π⁰ and μμγ events in the different run periods shows a good description of the data by Monte Carlo.
- An amount of about 25 fb⁻¹ data and the corresponding MC datasets are needed to perform a full run 7 calibration.