

# MC tuning for the identification in argon run

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#### Recap

• Sketch of used detectors with their status



# Sketch of used detectors with their status

#### Good result :)



1200 1000 800

600

400

1 1.2 1.4 1.6 1.8 2 p. GeV/c D

data

**TOF400Point in MC** 

**CSC** – absent in MC

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#### Content

- Three tracking algorithms and their problems
- Si+GEM+CSC+Extend features
- Si+GEM+CSC+Extend for MC, GEM residuals bug
- GEM residuals bug has fixed
- MC target geometry is improved
- Back Si strips shift fixed
- Si Z position bug fixed
- GEM geometry check for Data and MC

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#### Content

- Plane 1 TOF400 hit production bug
- TOF400 geometry is improved
- CSC geometry is improved
- CSC difference for Data and MC
- MC TOF400 efficiency



Tr1, y pi+

hypiptr1 tries 25767 an 2.487

data

data

Tr1, p pi+

25786

hppipt Entries

Mean 1.338 Std Dev 0.3567

0.3222

1200

1000

800

600

400

200

500

400

300

200

100

#### Three tracking algorithms and their problems UrQMD, 2MEv, without eff, pi+ hypip 81809 Entries 81809 Mean 2.162 Std Dev 0.4213

- **GEM+CSC** 
  - **Problem:** Significantly less particles in low part of p<sub>full</sub> spectrum for Data than for MC



Si+GEM+CSC+Extend **Problem:** The same as for

**GEM+CSC** tracking

0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 p, GeV/c Si+GEM+CSC

2.5

**Problem:** 3-4 times less identified particles than for **GEM+CSC** tracking

0.4 0.6 0.8

1.5

v MC

UrQMD, 2MEv, without eff, pi+

hppig

Mean Std Der

MC

1.6 1.8

1 1.2 1.4



<u>ל200</u>⊢

2000

1800

1600

1400 1200

800

600

400

200

1800

1600

1200

1000 800

600

400

200

0.2

### Si+GEM+CSC+Extend features



- Short tracks are reconstructed using hits from last four GEMs
- Short tracks are extrapolated upstream and refitted with matched hits from first two GEMs and Silicones
- Tracks are extrapolated downstream and refitted with matched hits from CSC

#### **BM@N Si+GEM+CSC+Extend** for MC, GEM residuals bug



• Residuals (dX) for interpolated tracks and corresponding hits.  $\alpha_x$  is  $\alpha_x$  the angle between track's to XZ plane projection and the Z axis

### GEM residuals bug has fixed

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dX



 Bug reason: mixed up signs for Lorentz shifts in the digitizer

### MC target geometry is improved

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• **Result:** low part of MC p<sub>full</sub> spectrum decrease by ~20%



### Back Si strips shift fixed



- **point** StsPoint from MCTrack (simulated)
- hit reconstructed hit
- **Before fixing:** 2 peaks with mean  $\approx \pm 2.3$  mm
- After fixing: 1 peak with mean < 20 µm

### Si Z position bug fixed



- **point** StsPoint from MCTrack (simulated)
- hit reconstructed hit

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- Before fixing: shift  $\approx$  73 µm
- After fixing: shift < 1 µm



# GEM geometry check for Data and MC

N <sub>GEM</sub> / dx	μ <sub>X+</sub> /σ <sub>X+</sub> , μm/μm	μ <sub>X-</sub> /σ <sub>X-</sub> , μm/μm	N <sub>GEM</sub> / dy	μ <sub>x+</sub> /σ <sub>x+</sub> , μm/μm	μ <sub>x-</sub> /σ <sub>x-</sub> , μm/μm
1	13/81	-41/141	1	27/235	21/213
2	-7/78	32/130	2	-21/219	-18/193
3	-2/72	23/107	3	-12/215	-12/179
4	1/72	-21/98	4	12/223	8/182
5	-1/68	19/92	5	-11/227	-11/177
6	-3/72		6	8/220	

- Data and MC geometries practically equal
- Differences can be explained by the  $Z_{\text{effective}}$  shift relative to  $Z_{\text{GemHit}}$

### Plane 1 TOF400 hit production bug



Hit<sub>x</sub>, cm

• **Problem:** strips do not rotated around Z

### TOF400 geometry is improved



• Data • MC

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Hit<sub>x</sub>, cm

TOF400 for MC aligned as for Data

### TOF400 geometry is improved



TOF400 for MC aligned as for Data

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• TOF400Hit is used in identification



### CSC geometry is improved



- X shift ~ 6 mm
- Y shift ~ 6.3 cm
- Strip's slope shift ~ 0.05° (~0.5 mm difference at 60 cm distance)
- CSCHit is used in identification

### <sup>в</sup>M<sup>@</sup>N CSC difference for Data and MC



- Qtot is a cluster's signal
- Cut for Data qtot>50
- Left side part from the peak for Data is recorded
- Need to know peak's position for Data

- NofDigis is number of digits in the cluster
- NofDigis<3 is a noises mostly</li>
- NofDigis peak for Data around 4





#### MC TOF400 efficiency



-  $\text{Eff}_{\text{MC}}$  with CSC almost independent of  $p_{\text{Full}}$ 



#### Outlook

- To conform Si, Gem and CSC the cluster sizes and the amplitudes in MC and Data
- To get MC efficiencies of Si, GEM, CSC, TOF400
- To get Data efficiencies of Si, GEM, CSC, TOF400
- In the MC, to add efficiencies from the Data normalized to the efficiencies from the MC
- To compare identification results for  $\pi^{}_{}$  and K^{}\_{} for the Data and MC



## Thank you!



## Backup

# First result of MC v2 identification in comparison with Data



- Normalization on Integral
- Data slightly shifted to right for  $\pi^{\scriptscriptstyle +}$
- Spectra pretty similar for K+

# First result of MC v2 identification in comparison with Data



- Normalization on Integral
- Number of low y Data tracks slightly less than MC tracks for  $\pi^{\scriptscriptstyle +}$
- Spectra pretty similar for K+

# **EMON** First result of MC v2 identification in comparison with Data



Normalization on Integral

# First result of MC v2 identification in comparison with Data



- Normalization on  $\pi^+$  on the left
- Normalization on K+ on the right

# **EMON** First result of MC v2 identification in comparison with Data



No light nuclei for UrQMD

# First result of MC v2 identification in comparison with Data



No light nuclei for UrQMD



- X shift < 1  $\mu$ m
- Y shift < 20  $\mu$ m
- Strip's slope shift < 0.0001° (< 2 μm difference at 60 cm distance)

### Si difference for Data and MC



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- Qtot is a cluster's signal
- Qtot shapes for Data and MC are different

- NofDigis is number of digits in the cluster
- Mean for the Data 1.6 times higher than for the MC