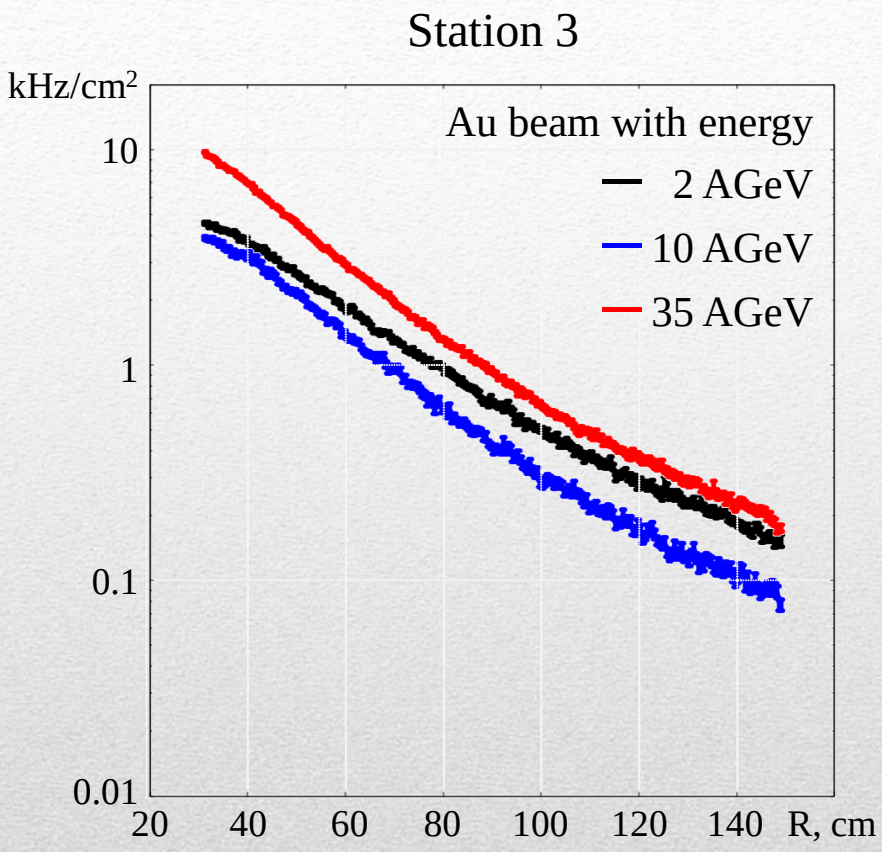
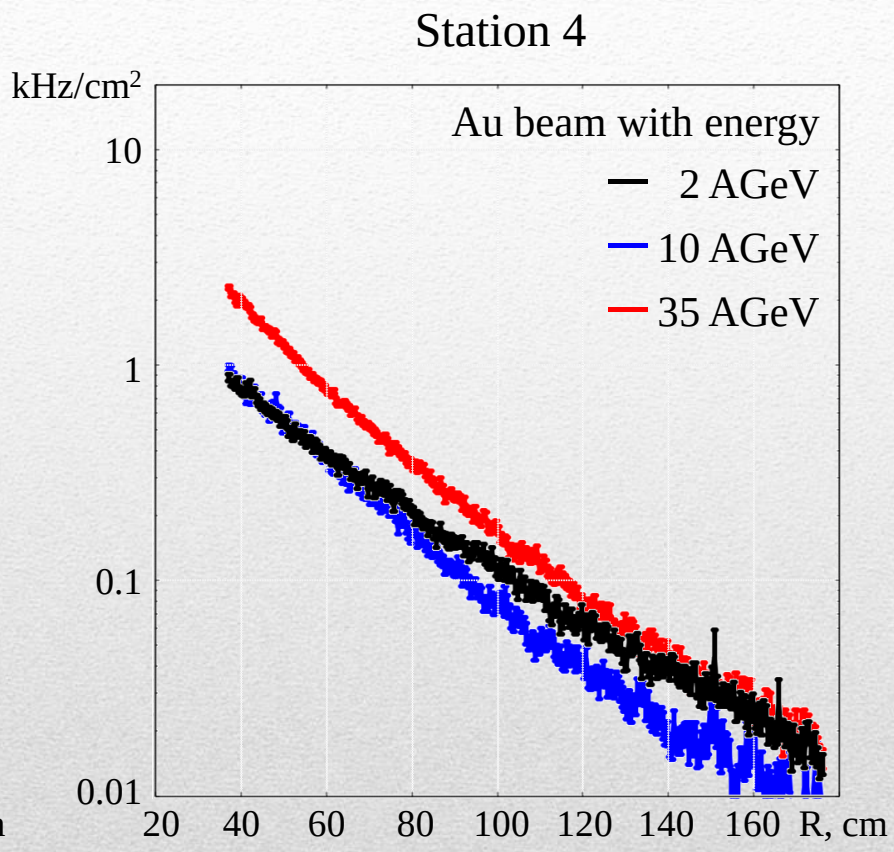
Detector studies for stations 3 and 4

Anna Senger

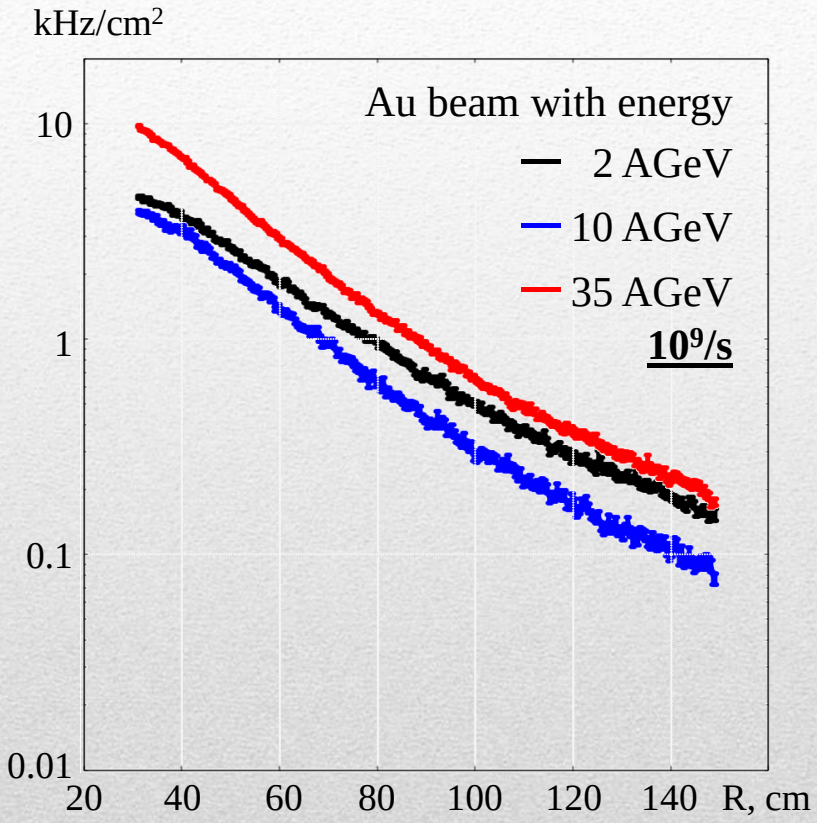


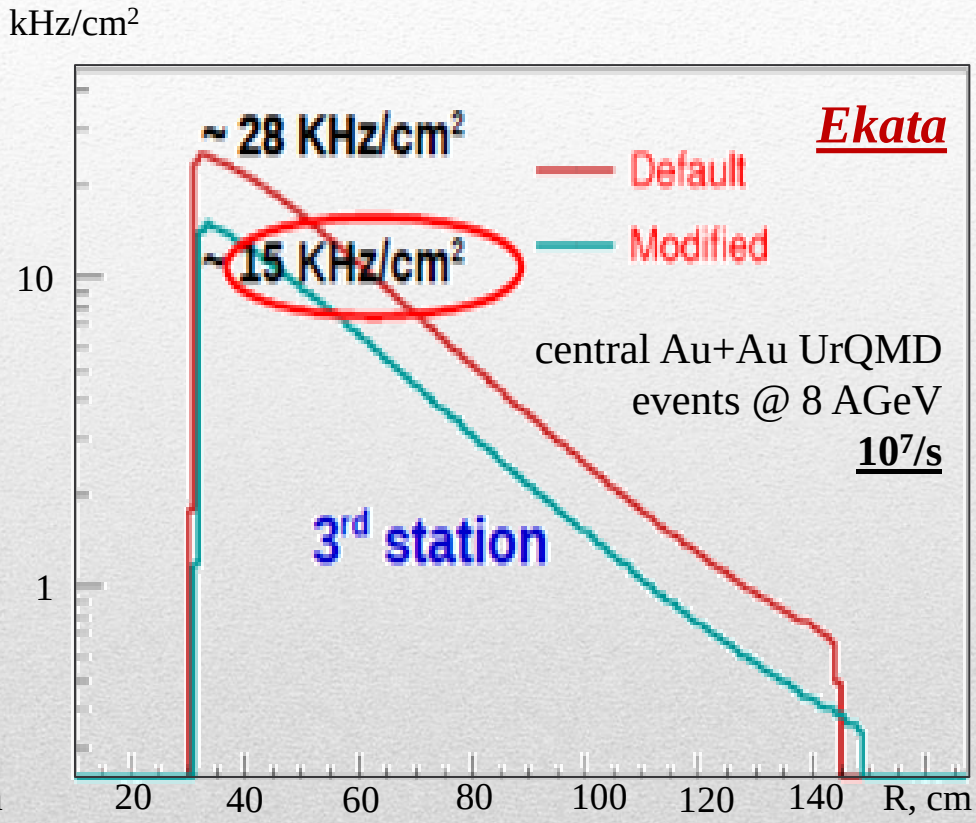


Au beam intensity 10^9/s

Particle rates (FLUKA)

Station 3



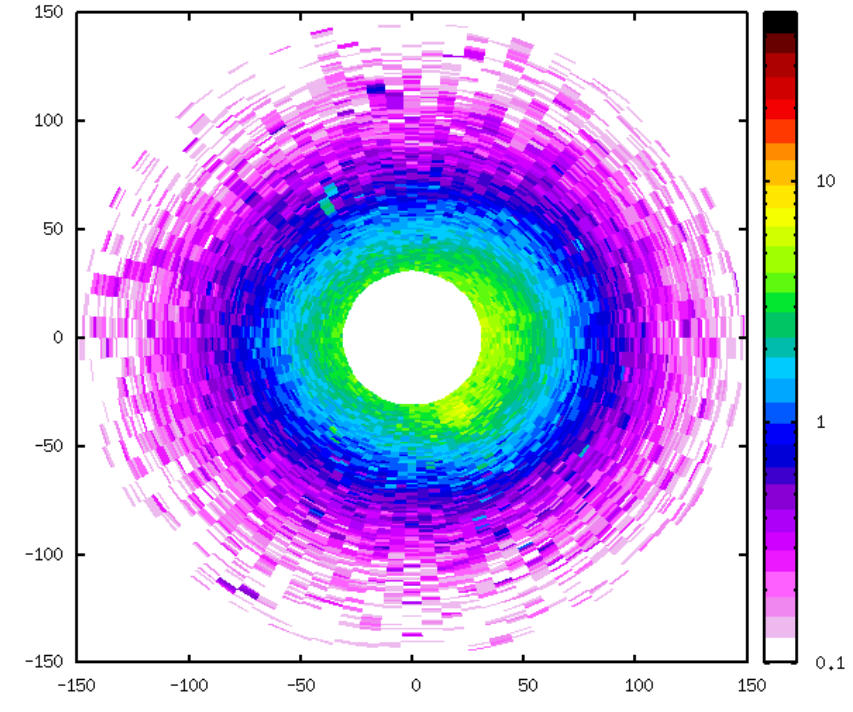


FLUKA vs CBMROOT

Station 3

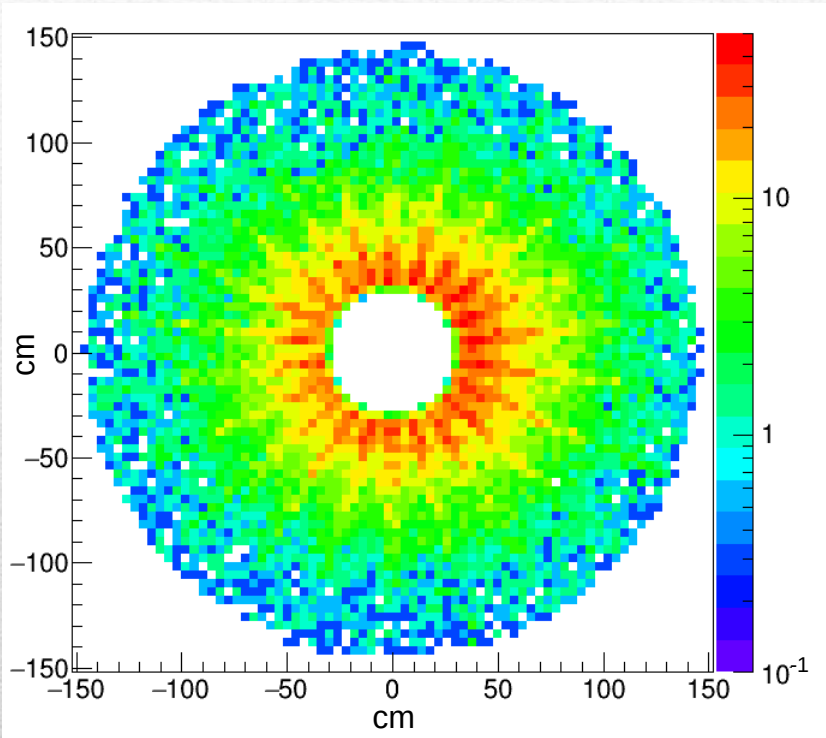
10^9 Au ions @ 10 AGeV per s
+ 1% Au target

kHz/cm^2



10^7 central Au+Au UrQMD
events @ 8 AGeV per s

kHz/cm^2



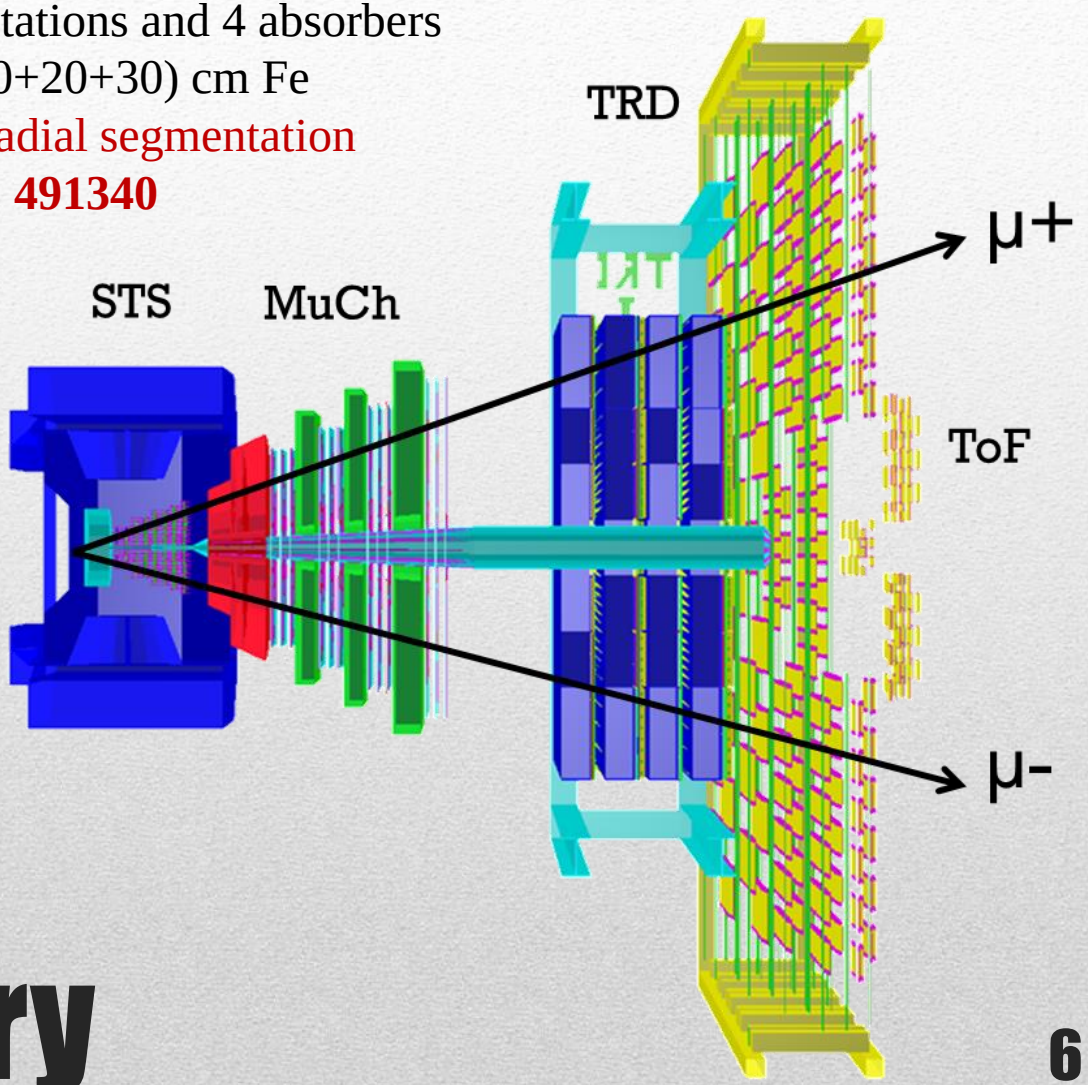
FLUKA vs CBMROOT

Detector characteristics for stations 3 and 4:

- Detector segmentation
- Detector efficiency

Outline

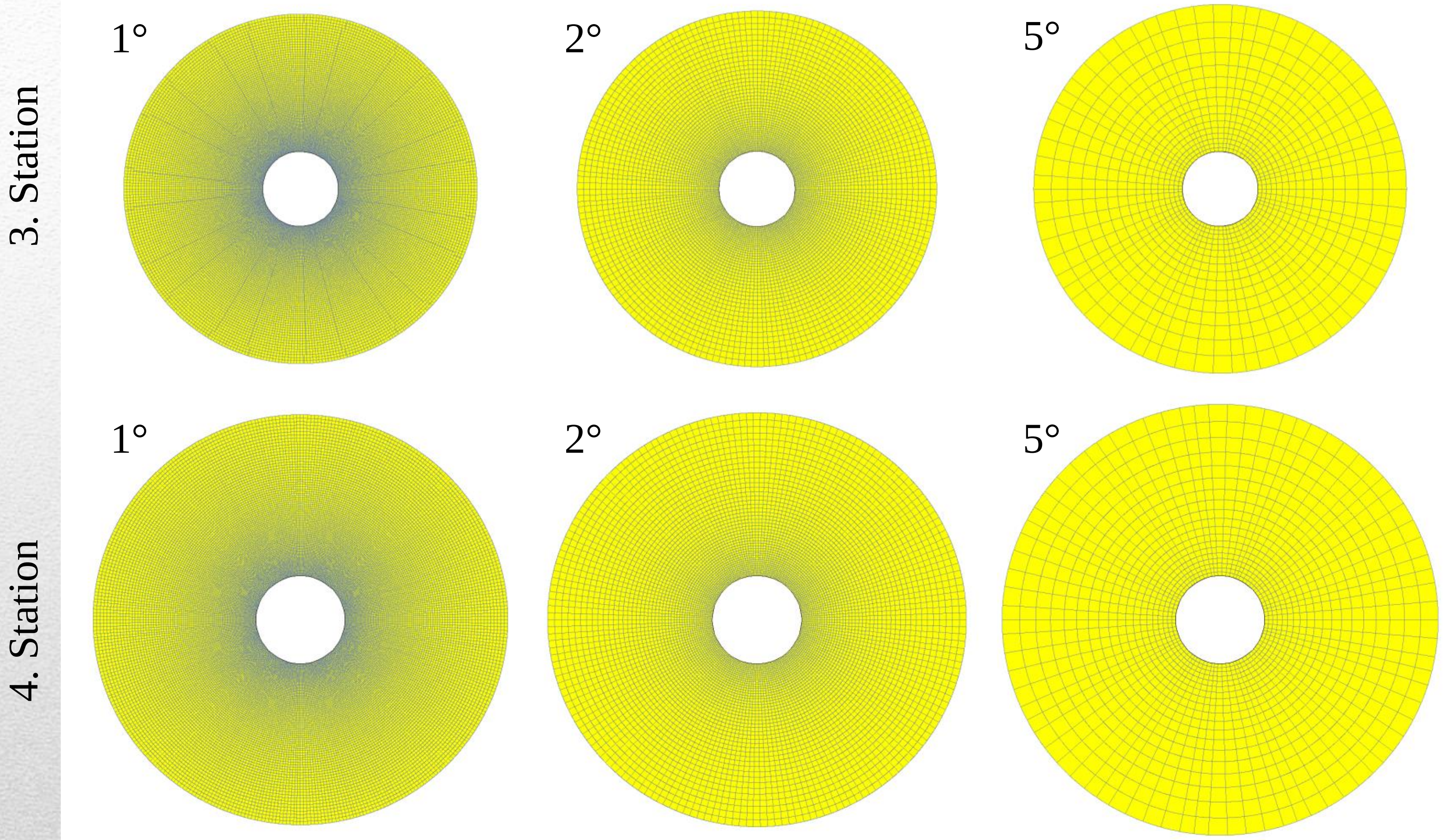
Present muon system: 4 stations and 4 absorbers
Absorbers: 60 cm C + (20+20+30) cm Fe
4 GEM stations with 1° radial segmentation
total number of channels: **491340**



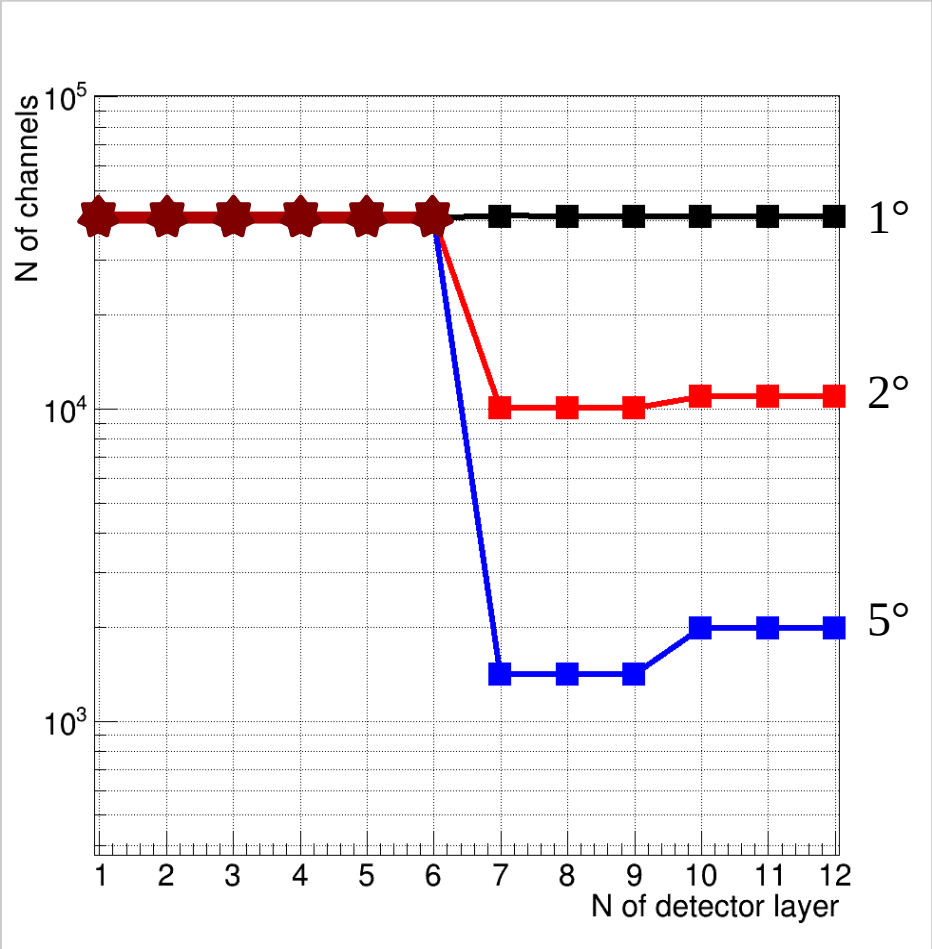
Geometry

DETECTOR SEGMENTATION

in stations 3 and 4



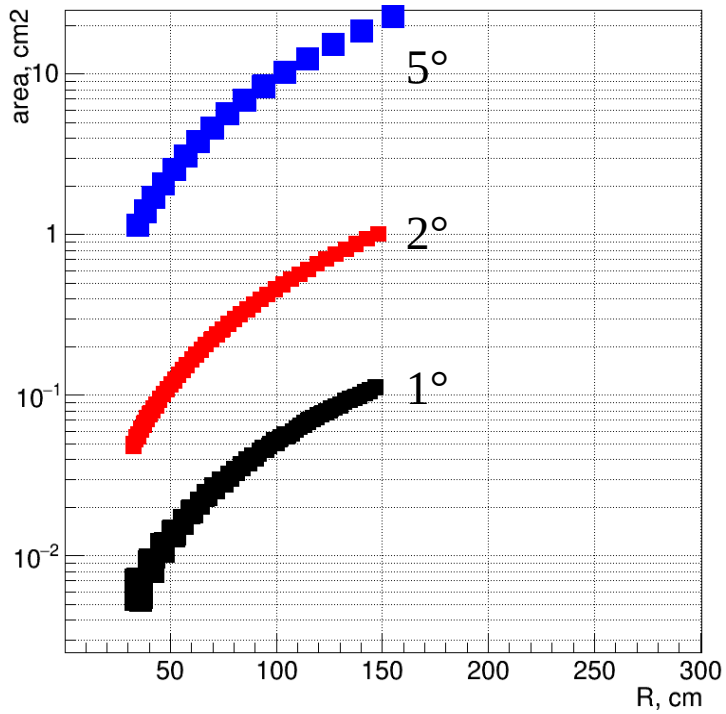
Detector segmentations



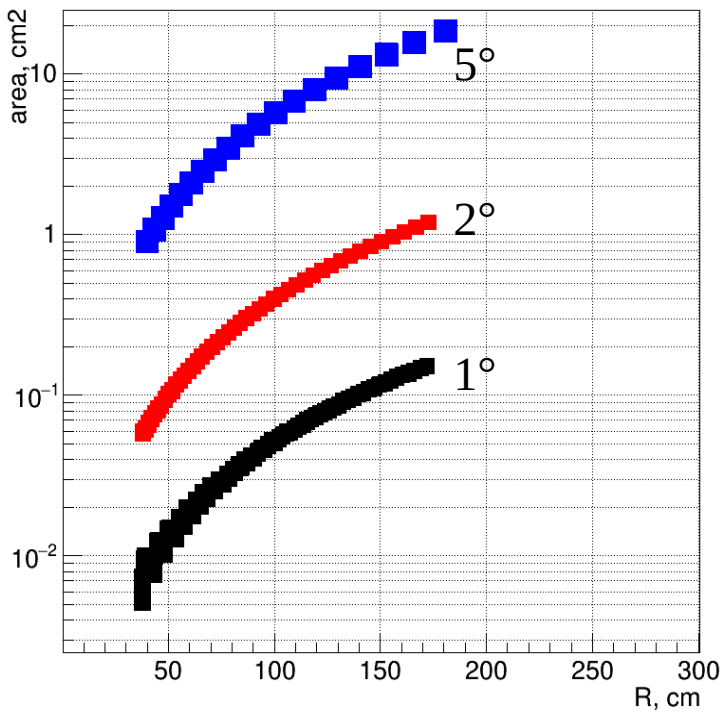
Stations 1, 2	Station 3	Station 4	Total
243396	124080	123864	491340
243396	29964	32760	306120
243396	4224	5928	253548

Number of channels

station 3

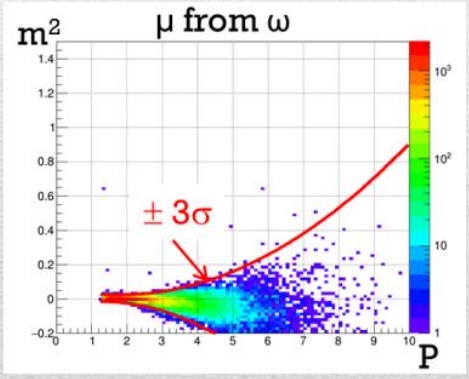


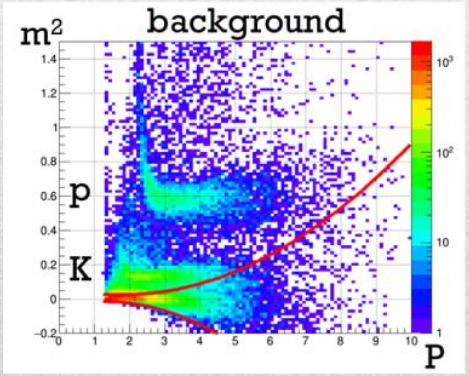
station 4



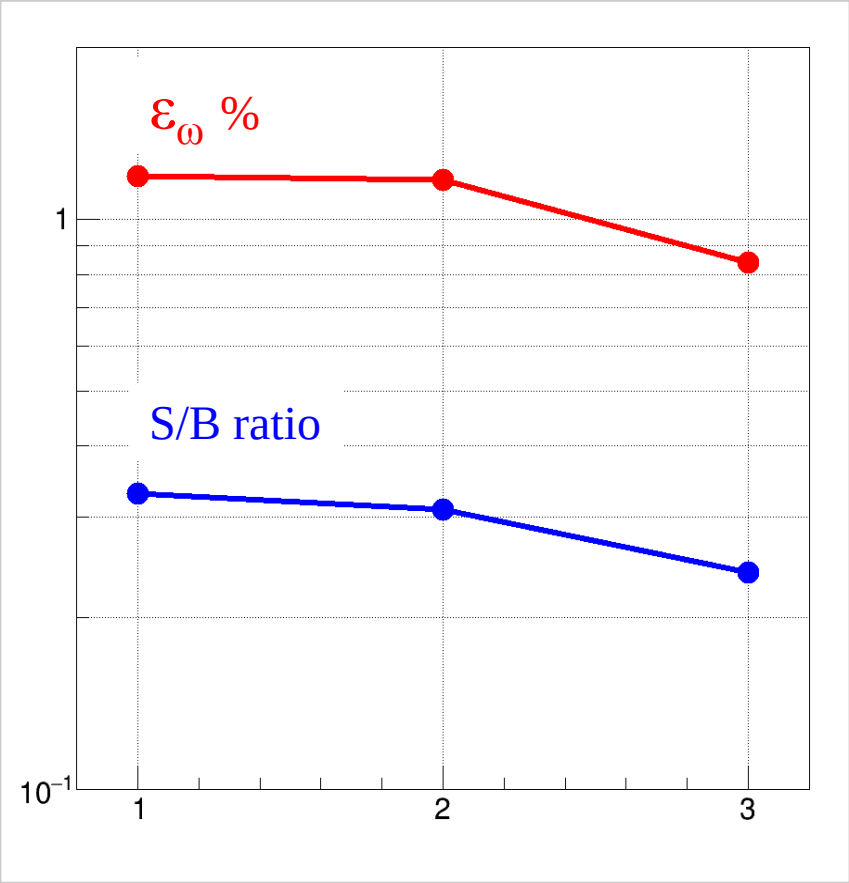
Pad size

- Primary tracks ($\chi^2_{vertex} < 2$)
- Track quality in STS
  - long tracks: at least 7 STS hits
  - $\chi^2_{STS} < 2$
- Track quality in MuCh
  - long tracks
  - $\chi^2_{MuCh} < 1.5$
- Particle ID in ToF





Track selection criteria



Stations 1 and 2:

3 layers per station with 1° segmentation

Stations 3 and 4:

1 → 3 layers per station with 1° segmentation

2 → 3 layers per station with 2° segmentation

3 → 3 layers per station with 5° segmentation

Results

N of MuCh hits > 10

DETECTOR INEFFICIENCY

in stations 3 and 4

Stations 3 and 4:				
Detector selmentation	2°		5°	
Detector efficiency	100%	80%	100%	80%
ω efficiency	**1.07**	**0.77**	**0.82**	**0.59**
ω/background ratio	**0.38**	**0.41**	**0.29**	**0.33**

Stations 1 and 2:

3 layers per station with 1° segmentation and with 100% efficiency

Results

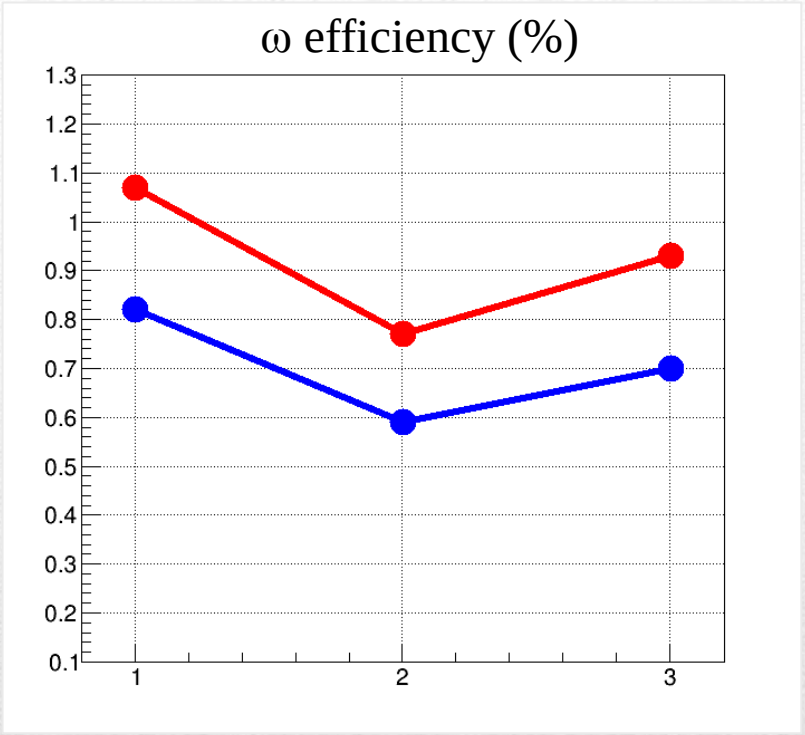
N of MuCh hits > 9, last hit in station 4

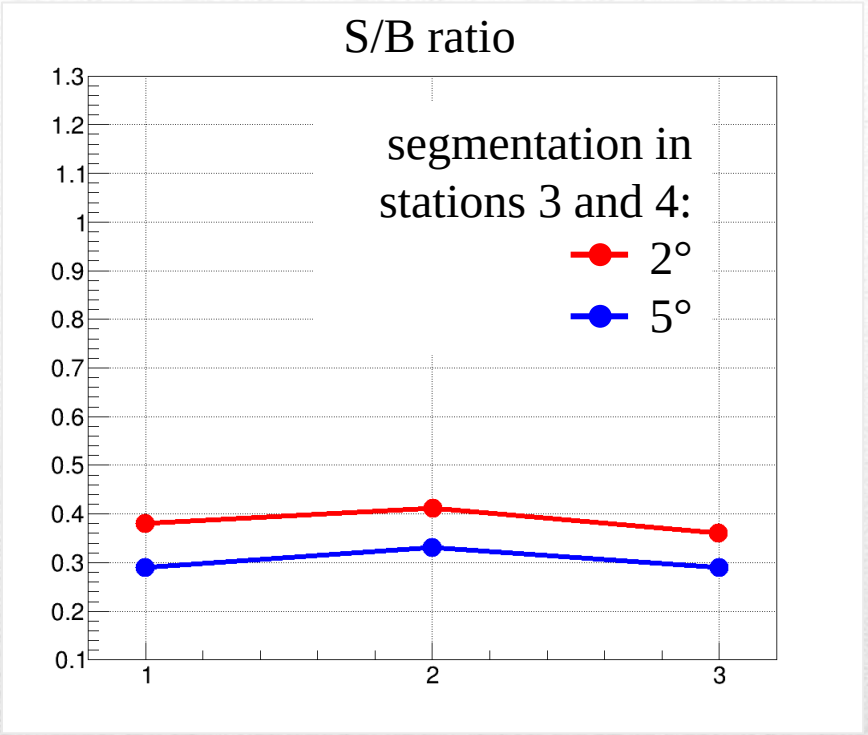
- increase number of detector layers in low-efficiency stations
- use different clustering procedure

Possibility to increase reconstruction efficiency

Detector segmentation	2°		5°	
№ of detector layers per station	3	4	3	4
Number of channels	**62724**	**83632**	**10152**	**13536**

Number of channels in stations 3 and 4





Stations 1 and 2:

3 layers per station with 1° segmentation and with 100% efficiency

Stations 3 and 4:

1 → 3 layers per station with 100% efficiency
2 → 3 layers per station with 80% efficiency
3 → 4 layers per station with 80% efficiency

Results

- Digis (pads) → cluster → hit

for detectors with 100% efficiency (station 1 and 2)

- Digi (pad) → hit

for detectors with 80% efficiency (station 3 and 4)

Clusterization

	ω efficiency		ω/background ratio	
	cluster → hit	digi → hit	cluster → hit	digi → hit
Type A	**0.77**	**0.89**	**0.41**	**0.36**
Type B	**0.59**	**0.78**	**0.33**	**0.32**

Station 1 and 2: 1° segmentation, 100% efficiency
Station 3 and 4: 2° segmentation, 80% efficiency (type A)
5° segmentation, 80% efficiency (type B)

Results

- Muon detector segmentation: the ω reconstruction efficiency and the signal-to-background ratio decreases by 10% (40%) when increasing the segmentation of detector stations 3 and 4 such that the number of channels is reduced by a factor of 4 (25). The total number of channels (stations 1-4) is reduced by a factor of 1.6 (2).

- Low efficiency detectors: the ω reconstruction efficiency is reduced by 20% for detectors with low (80%) efficiency, but could be compensated with increasing of detector layers inside absorber gap. Other solution to compensate the efficiency losses is a modification of the hit producer for low-efficiency stations.

Conclusions

Backup