

# Simulation Studies on SciTil Geometries

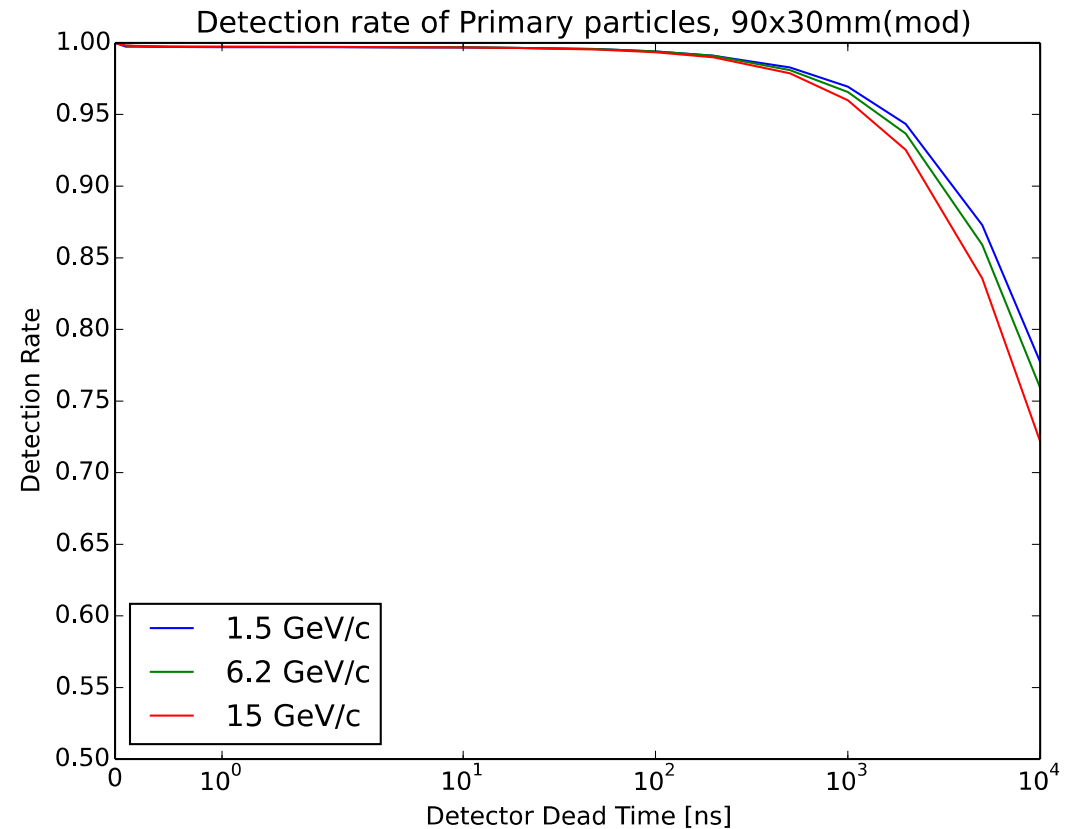
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Bochum, 1.3.2016

# Outline

- Summary from Vienna Meeting
  - Results of simulation studies on the single tile multi hit probability
- Properties of the compared geometries
- Simulation studies on the efficiency with realistic particle distribution
- Summary

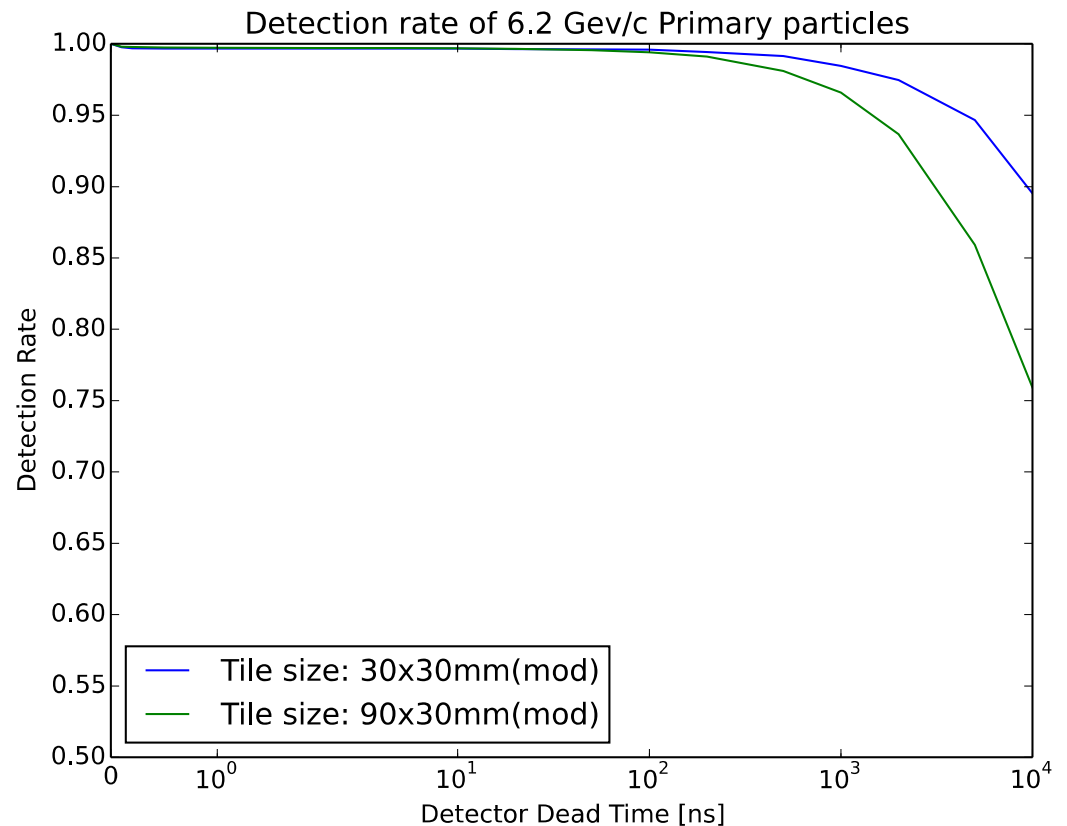
# Single tile multi hit probability

- Simulation parameters
  - DPM generator
  - $N_{\text{avg}} = 20 \text{ MHz}$
  - $10^5$  events simulated
- Perfect geometrical fill factor assumed
- Efficiency for Primaries  
(90 x 30 x 5 mm)
  - 100 ns Dead Time: 99.3 – 99.4 %
  - 1000 ns Dead Time: 96.0 – 96.9 %



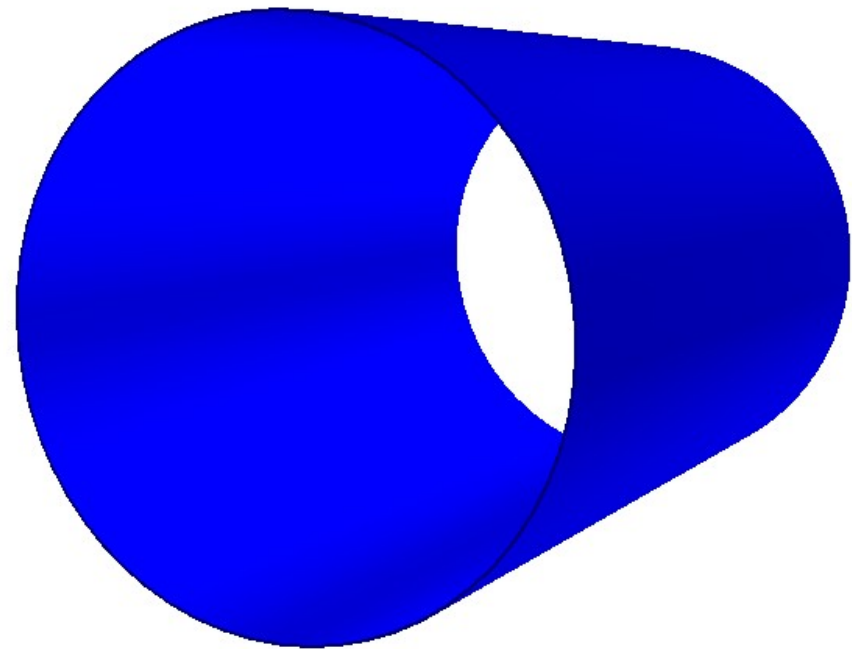
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# Properties of the Geometries

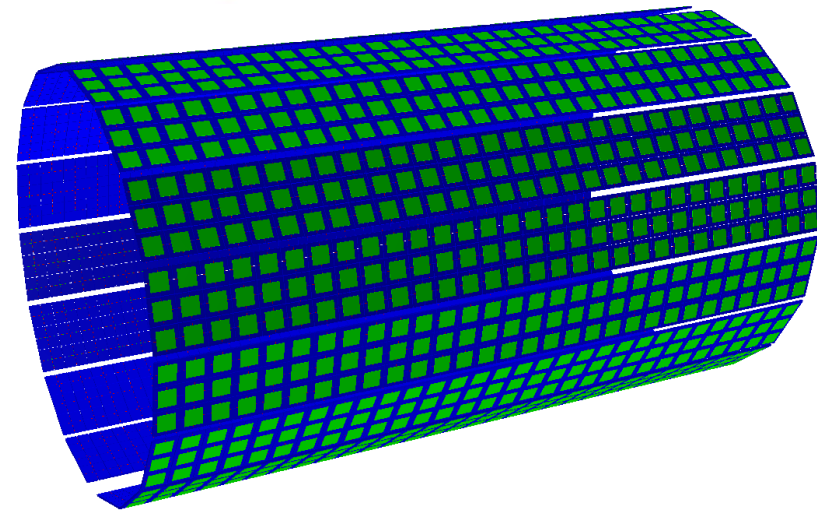
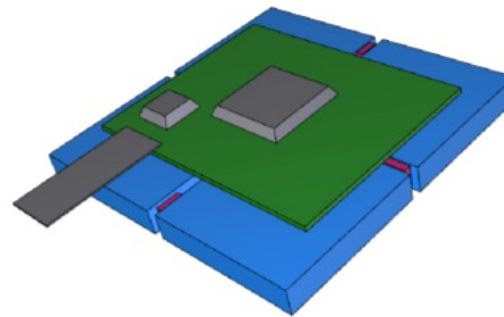
- Perfect Geometry
  - Used as reference
  - No gaps
  - Inner radius = 503 mm
  - 1800 mm length
  - $\sim 5.7 \text{ m}^2$  active area



# Properties of the Geometries

- Proposal Geometry

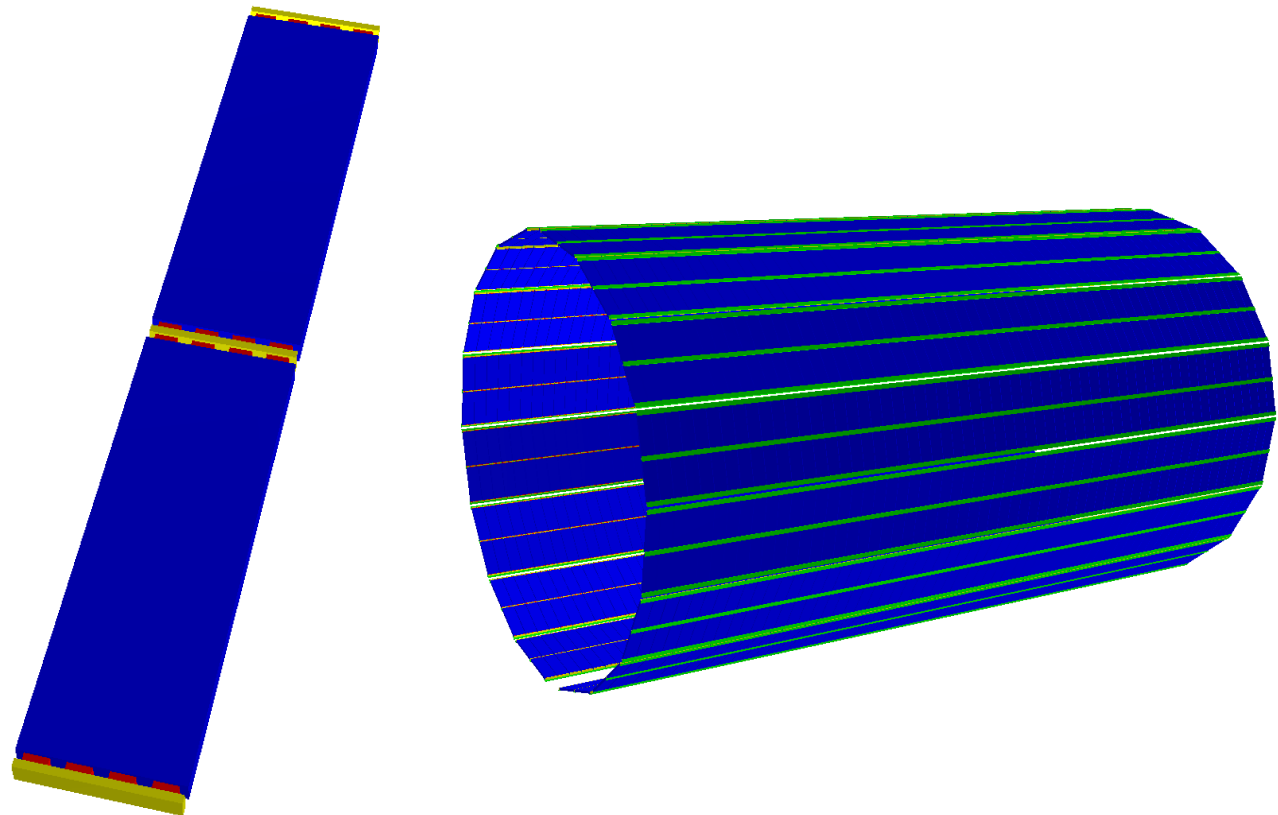
- 5760 tiles
- 28.5 x 28.5 x 5 mm scintillator
- ~4.7 m<sup>2</sup> active area
- **Fillfactor: ~ 82 %**
- **Unrealistic due to missing space for**
  - **wrapping**
  - **SiPM connectors (PCB cards)**



# Properties of the Geometries

- Current Geometry

- 1920 tiles
- 86.95 x 29.4 x 5 mm scintillator
- Small gaps in  $\varphi$  direction
- Larger gaps in  $z$  due to PCB cards and double sided SiPMs
- $\sim 4.9 \text{ m}^2$  active area
- **Fillfactor:  $\sim 86\%$**
- **Realistic**



# Properties of the Geometries

	# Tiles	Tile size	Active area	Fill factor
Reference	-	-	5.7 m <sup>2</sup>	100 %
Proposal	5760	28.5 x 28.5 mm	4.7 m <sup>2</sup>	82 %
Current	1920	86.95 x 29.4 mm	4.9 m <sup>2</sup>	86 %



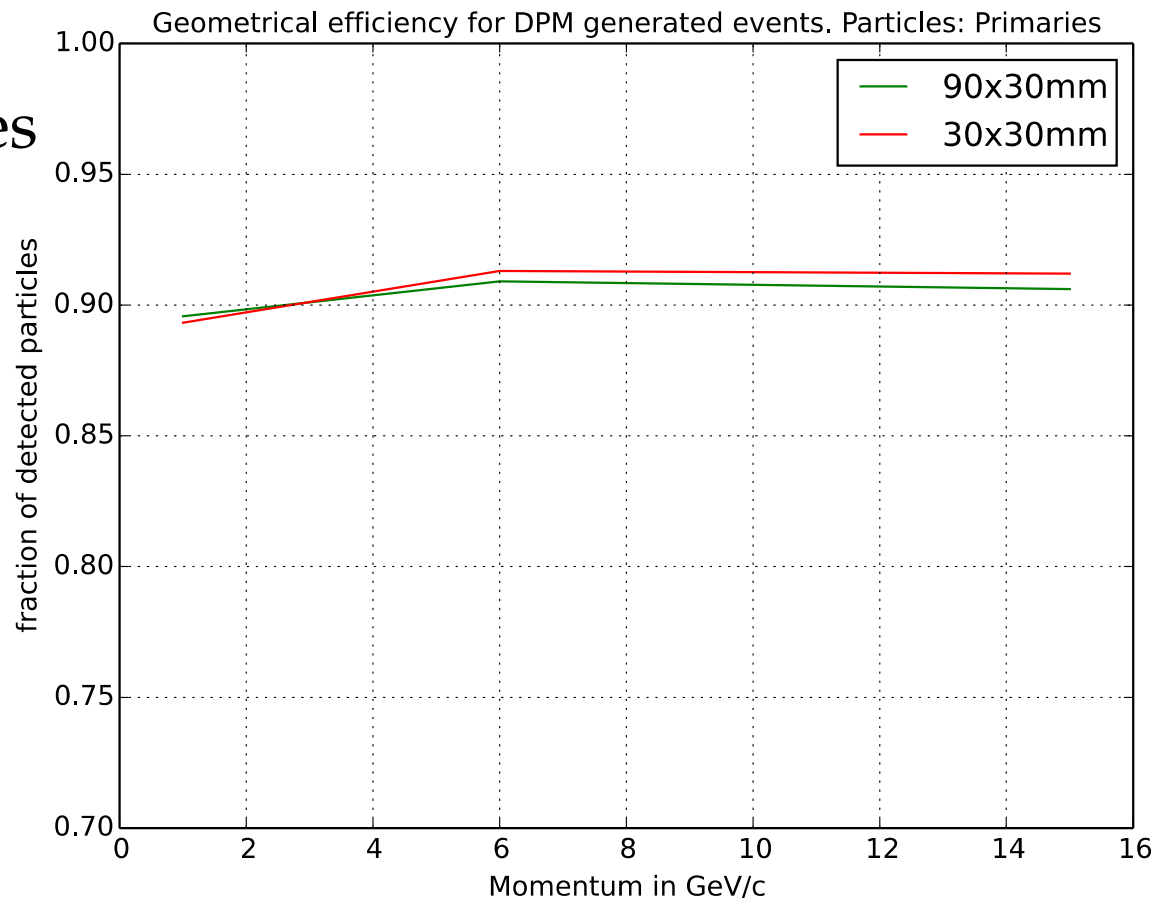
# Efficiency studies

- Simulation parameters
  - DPM generator at 1.5 , 6 , 15 GeV/c
  - Activated detectors : MVD, STT, Dirc, SciTil
  - Fixed RND generator seed
- Counts of Hits in SciTil
  - Counts in perfect geometry as reference value
  - Detector dead time not taken into account

- $$E_{Geo} = \frac{Hits}{Hits_{Geo_{perfect}}}$$

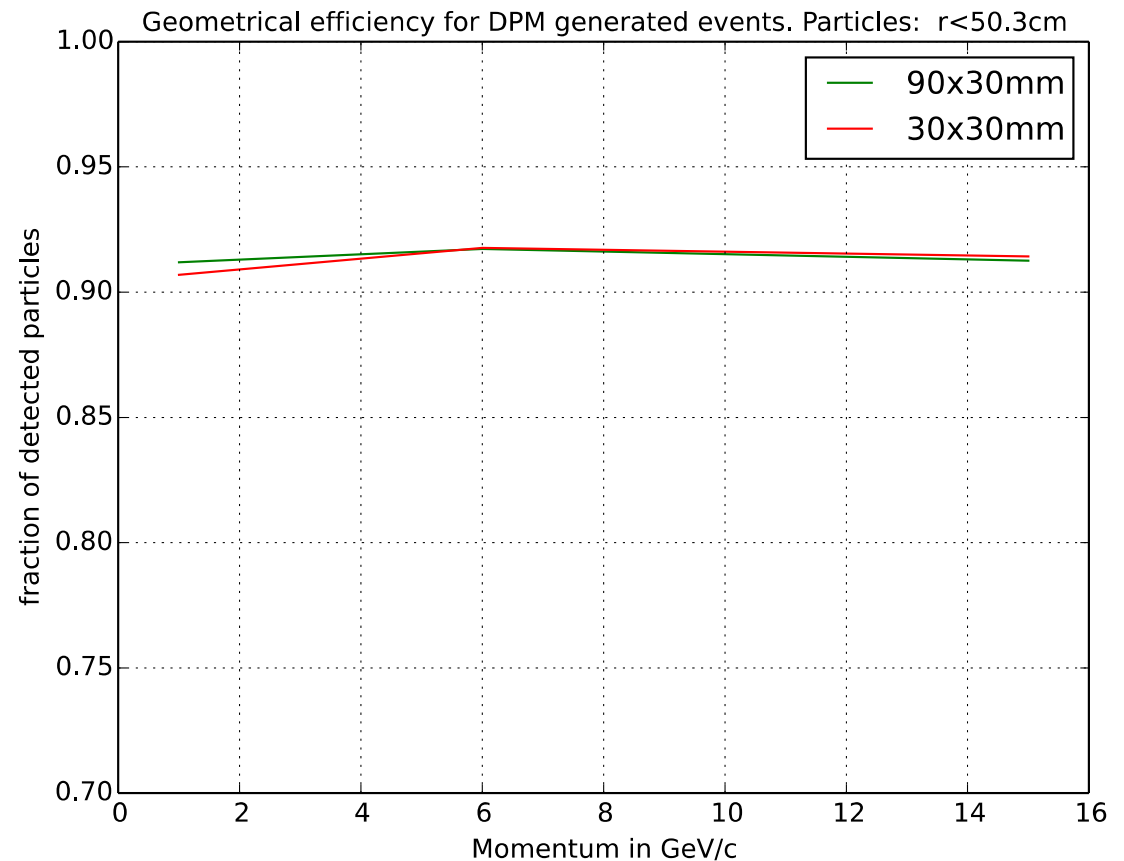
# Efficiency studies

- Efficiency for primaries
  - Proposal Geometry
    - (ideal)
    - 89.3 – 91.3 %
  - Current Geometry
    - 89.6 - 90.9 %



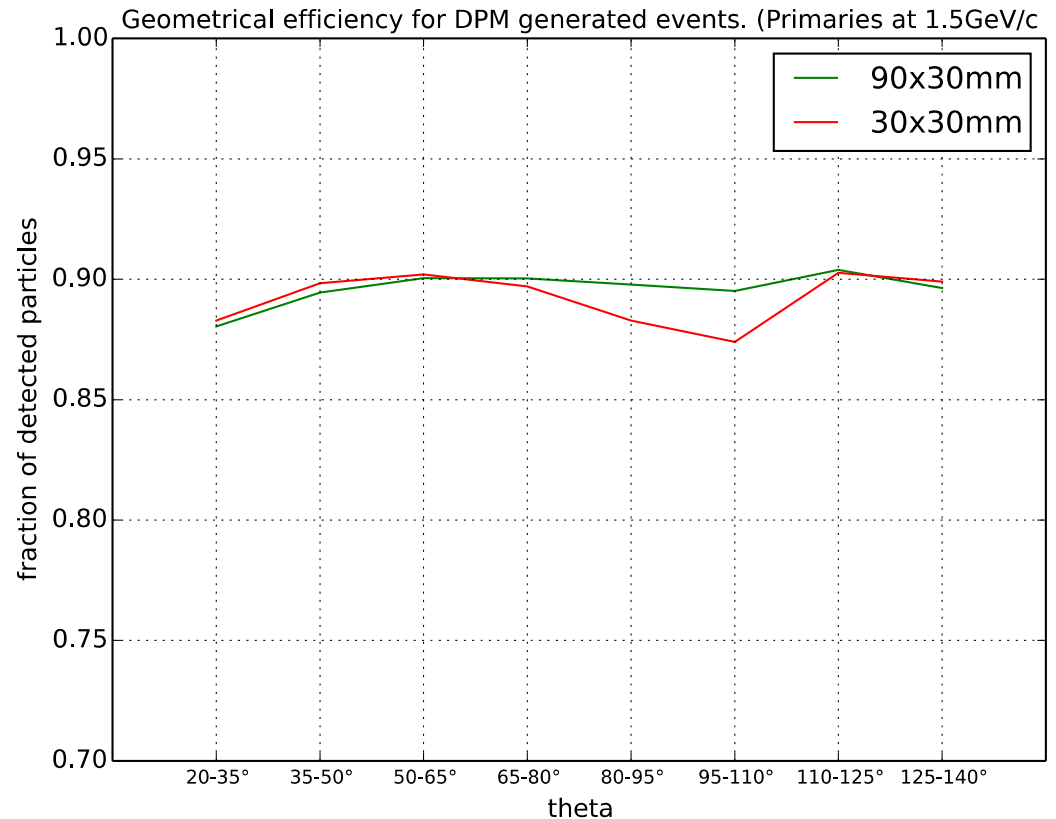
# Efficiency studies

- Efficiency  
(inc. secondaries)
  - Proposal Geometry
    - (ideal)
    - 90.6 – 91.8 %
  - Current Geometry
    - 91.2 - 91.7 %



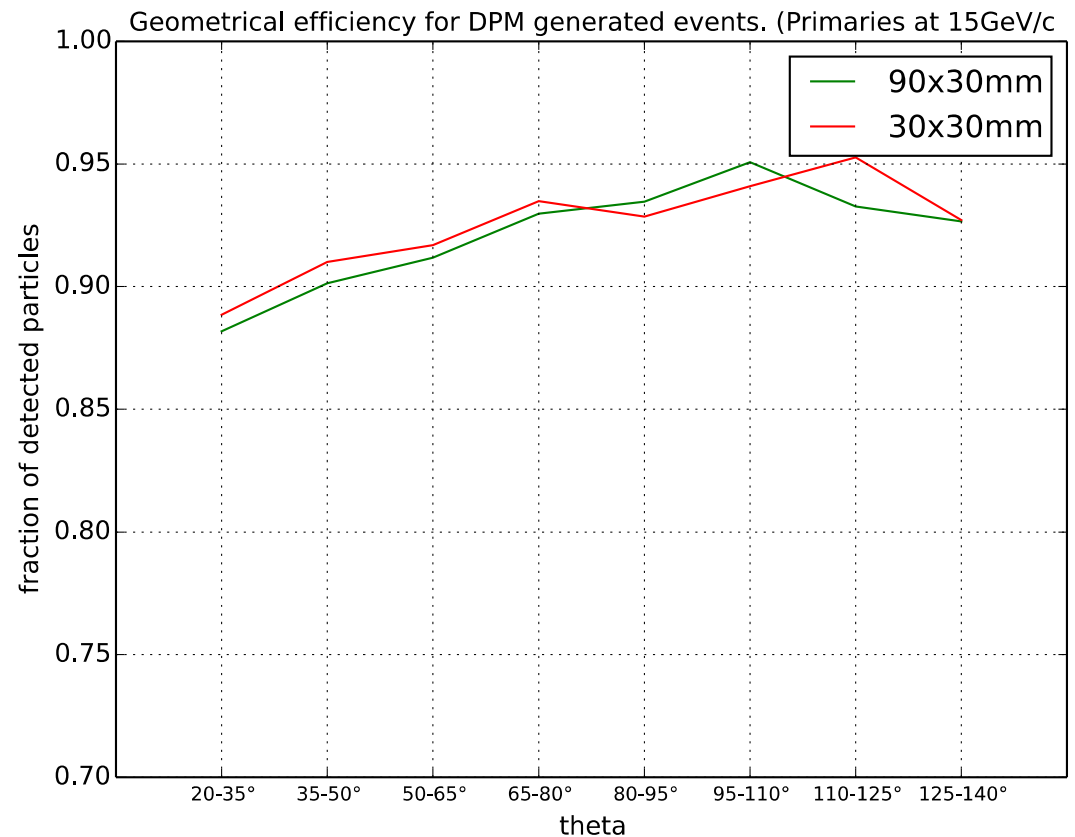
# Efficiency studies

- Efficiency for different production angles
  - Primaries at 1.5 GeV/c
- Noticeable effect of smaller gap size in  $\varphi$  direction
  - Although (back-) forward boosted particles not strongly influenced



# Efficiency studies

- Efficiency for different production angles
  - Primaries at 15 GeV/c
- Increased efficiency for backward boosted particles
  - Not completely understood at the moment



# Summary

	# Tiles	Tile size	active area	Fill factor	Efficiency for primaries (DPM)	Multi hit efficiency (primaries, 20 MHz)
Reference	-	-	5.7 m <sup>2</sup>	100 %		
Proposal	5760	28.5 x 28.5 mm	4.7 m <sup>2</sup>	82 %	89.3 – 91.3 %	98.4 – 99.6 %
Current	1920	86.95 x 29.4 mm	4.9 m <sup>2</sup>	86 %	89.6 – 90.9 %	96.0 – 99.4 %

- Current geometry has similar efficiency compared to the proposal
- Proposal geometry is still idealized
  - Current geometry efficiency may be above the realistic proposal one

Thank you for the attentions

# Backup slides

## Detection efficiency

