

Observing Ultra-High Energy Cosmic Rays EAS Core using CMOS Camera Image Sensors

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Idea of Observation

Observing the air shower core of ultra-high energy cosmic rays with a CMOS camera image sensor.

Secondary particles
(charged particles)

EAS CORE

Charged Particles

Tracks

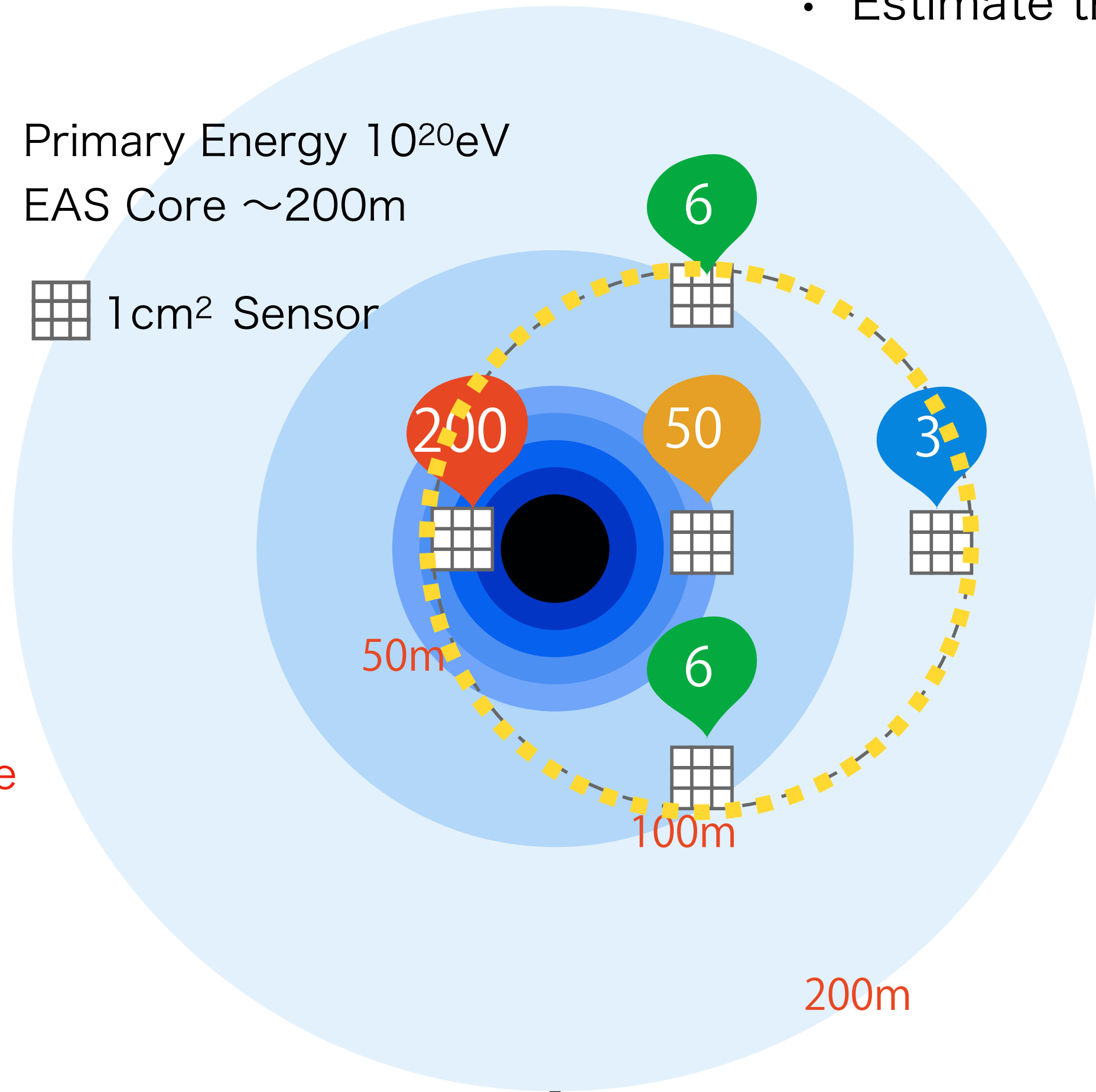
CMOS sensor

CMOS sensor array

- Measure density changes
- Investigate angle distribution
- Analyze tracks

Detection Method

- Measure the density changes of the core and estimate the energy of the primary particle.
- Estimate the arrival direction of primary particle from angle distributions.

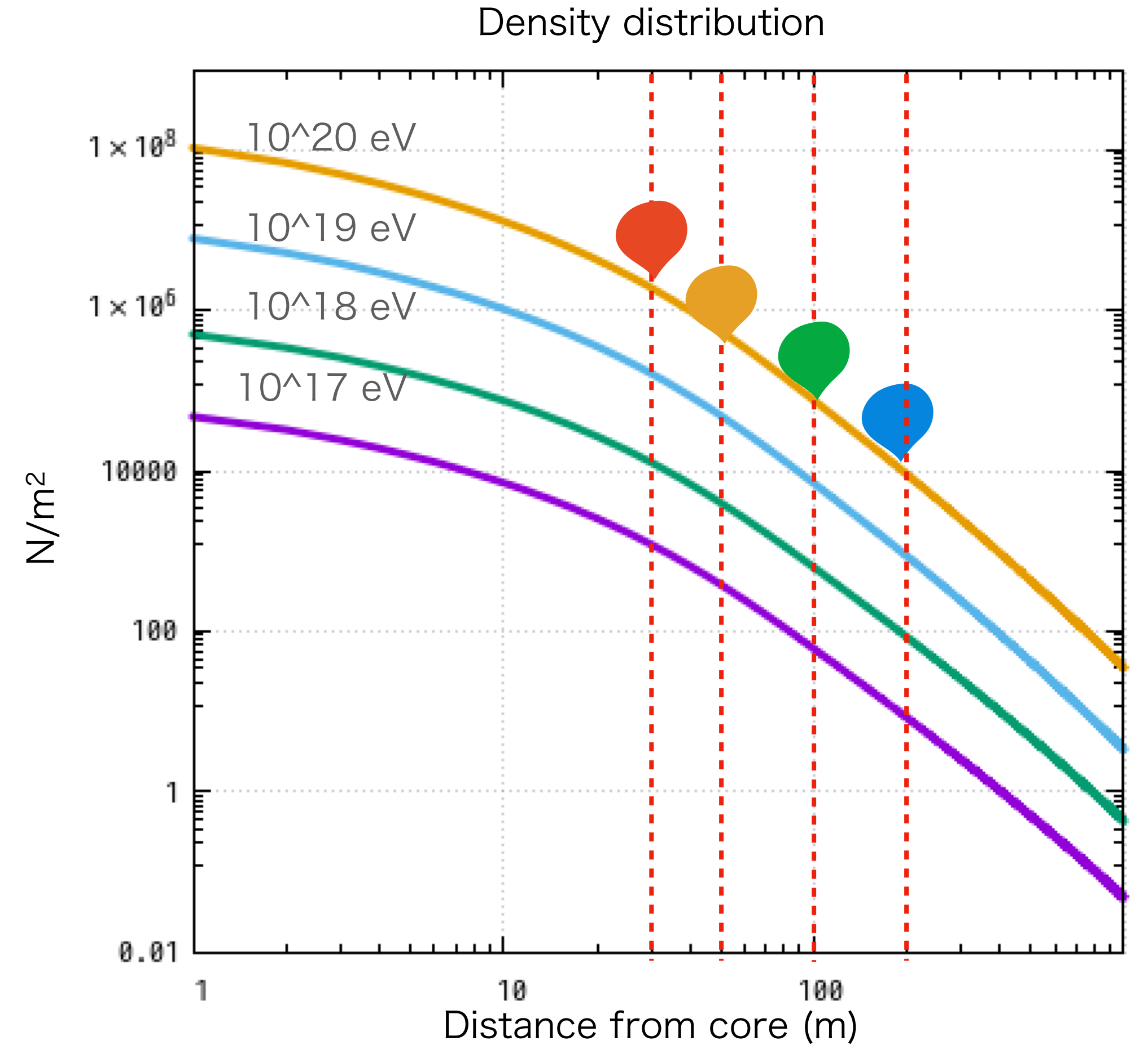


Primary Energy = 10^{20} eV

Flux
 10^{-8} particles m⁻² year⁻¹

Effective Area
31400 m²

Number of Arrays
 $\sim 3,200$

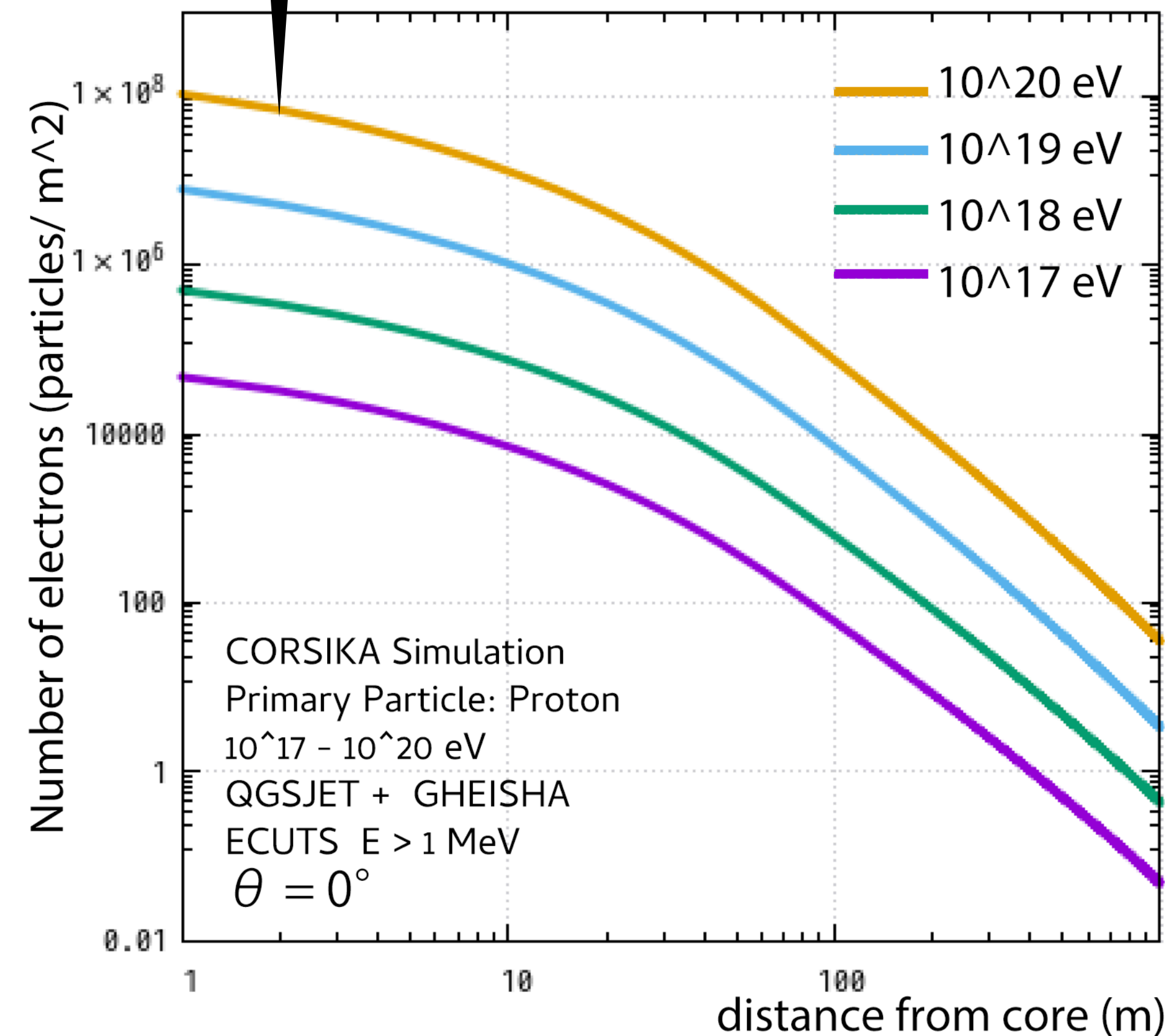


Number of particles hitting a sensor

Charged particles in the EAS Core

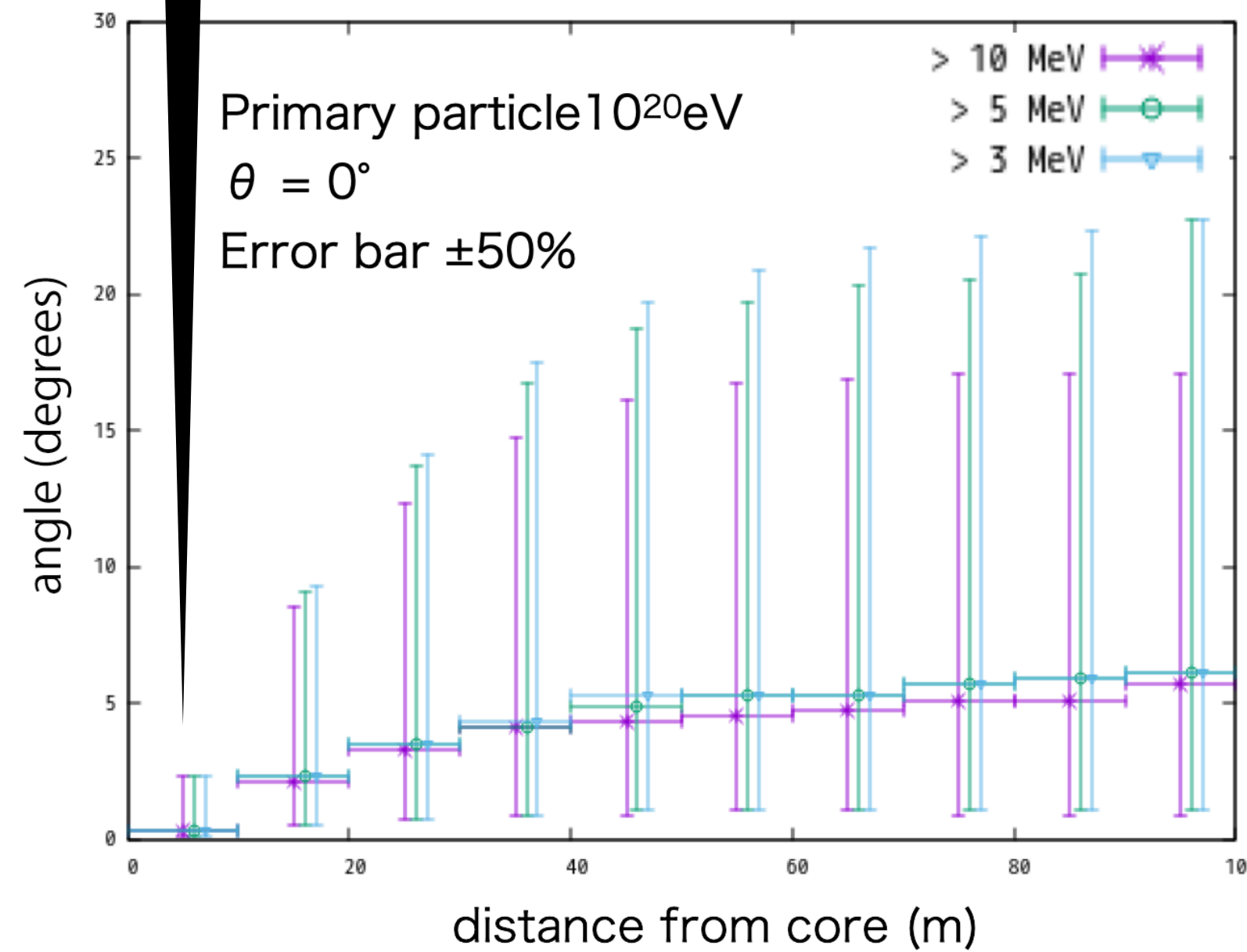
1,000 particles hit an 1 cm² sensor at one time

Density Distribution



Median is less than 1 degree at 10m from the core

Angle Distribution



Corsika Simulation

Interaction Model QGSGET + gheisha

Primary Particle: Proton

Energy Range : 10²⁰eV

Range of Zenith angle : 0

Energy distribution

