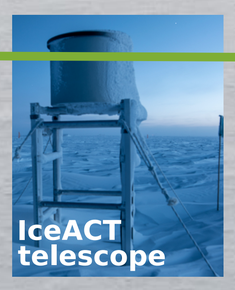
IceCube
South Pole Neutrino Observatory

UNIVERSITEIT GENT


Two scintillator panels


Radio antenna


Two IceTop tanks


IceACT telescope

The IceCube Neutrino Observatory is the world's largest neutrino detector, located at the geographic South Pole, close to the Amundsen-Scott South Pole Station.

IceCube consists of 5160 optical sensors deployed deep in the Antarctic Ice, covering a volume of 1 km³.
On top of this, 81 **IceTop** detector stations spread over 1 km² are located on the Antarctic plateau.

IceCube @ UGent

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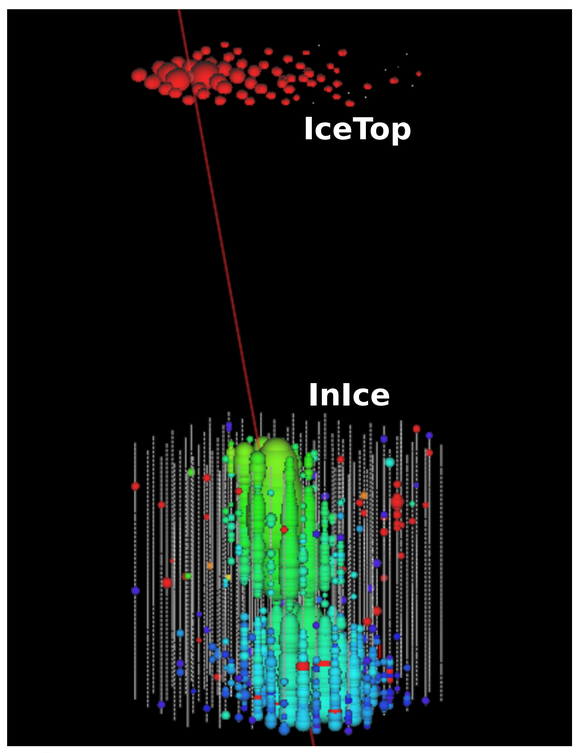
Cosmic rays

Cosmic ray air shower detection with energies from (1 - 1000) x 10^6 GeV

Hybrid detection technique:
- Ultra relativistic cosmic ray interacts with atmosphere → secondary particles
- Energy reconstruction using particle density distribution seen by IceTop
- Many relativistic muons can reach the detector simultaneously → muon bundle
- Mass sensitivity from high-energy muon bundle through IceCube
- Multiple hadronic interaction models used in air showers are inconsistent

Thesis subjects

- **IceTop + InIce:** influence of hadronic interaction models used in air shower simulations on mass composition analyses
- **IceTop:** Calibration of the absolute energy scale of the IceTop detector.



Cosmic ray event

early — Time scale — late

IceCube Gen 2

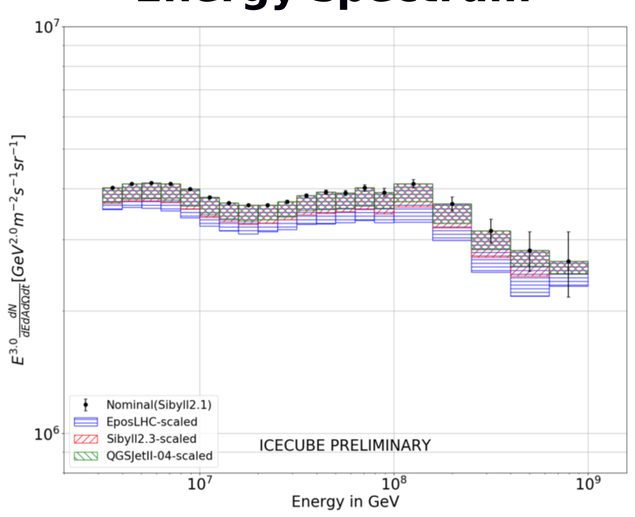
Increased InIce volume
- 1 km^3 → 10 km^3

Additional new surface detectors:
- Scintillators above snowed-in IceTop tanks → measure ionization losses from charged particles
- Imaging Air-Cherenkov Telescopes → measure Cherenkov radiation of air shower
- Radio antennas → measure radio waves from air showers

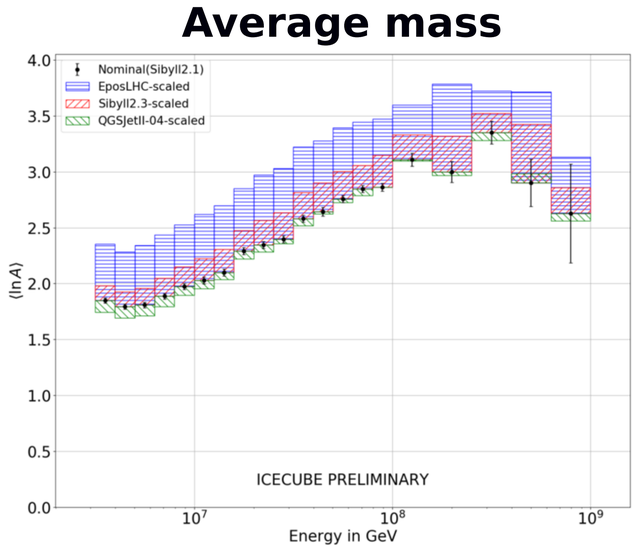
Thesis subjects

- **IceTop + Scintillators:** analysis on the muon component in hadronic interaction models with very inclined showers
- **IceTop + IceACT + Radio Antennas:** analysis on the electromagnetic component ($e^{\pm}$ + γ) in hadronic interaction models with multiple detectors

Energy spectrum



Average mass



Multi-experiment spectrum