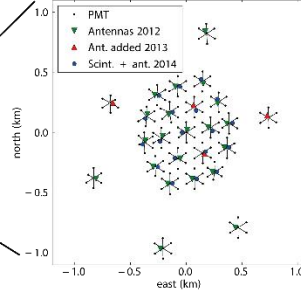


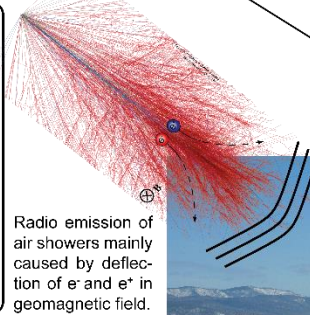
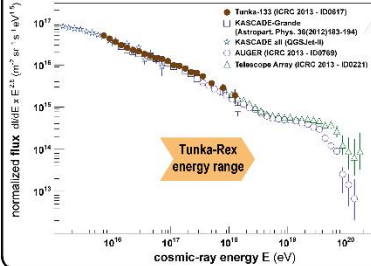
Take home message

- Cross-calibration of air-Cherenkov and radio measurements of the same air showers
- Both have similar energy precision: ~ 15%
- 24/7 operation possible due to trigger by new scintillator extension Tunka-Grande

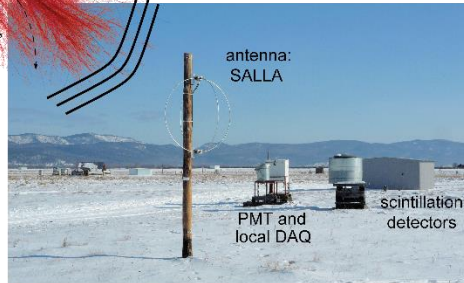


Map of the Tunka experiments:
Tunka-133 (air-Cherenkov), Tunka-Grande (particles), Tunka-Rex (radio)

Cosmic-Ray energy range



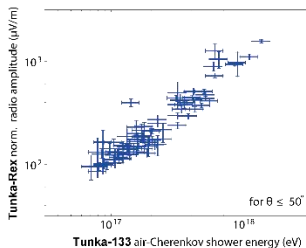
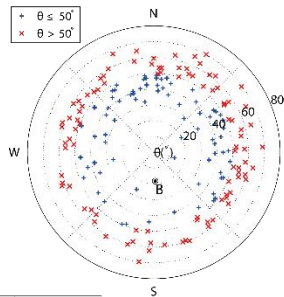
Radio emission of air showers mainly caused by deflection of e^- and e^+ in geomagnetic field.



First results

Sky map of events of first season (2012/2013):

- North-South asymmetry due to dominant geomagnetic effect
- In contrast to air-Cherenkov method, radio more efficient for inclined events



Energy correlation:

Radio amplitude at 100 meter distance from shower axis, normalized for geomagnetic effect vs. air-shower energy obtained from Tunka-133 air-Cherenkov measurement

Technical data

- Trigger and DAQ: by PMTs and scintillators
- Effective freq. band: 35-76 MHz
- Antenna type: SALLA (2 channels)
- Alignment: 45° and 135° (like LOFAR)
- Array size: 44 antennas on approx. 3 km²
- Approx. cost: ~ 400 € per antenna
- Event rate: approx. one event per hour

Blind strategy for cross-calibration

- Develop methods for reconstruction of Tunka-Rex radio measurements by cross-calibration to the Tunka-133 air-Cherenkov data of 2012/13
- Test of the **precision for energy and composition** by comparison with yet blind Tunka-133 data of 2013/14



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Tunka-Rex Collaboration

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www.ikp.kit.edu/tunka-rex

Tunka-Rex

- Cost-effective antenna array at Tunka experiment for cosmic rays in Siberia
- Cross-calibration of Radio and air-Cherenkov signal

