

i-PROGRESS - Internship Program for Junior Research Scientists

- The Helmholtz Alliance for Astroparticle Physics (HAP) offers support for German-Russian and Russian-German exchanges.
- Open to master students and young scientists (< 31 years) at HAP related institutions and projects in Germany and Russia.
- The exchange period is up to 2 months for undergraduates and up to 1 month for junior scientists.
- HAP provides travel cost and monthly allowance.
- Added value for German-Russian collaborations and joint projects in Astroparticle Physics.



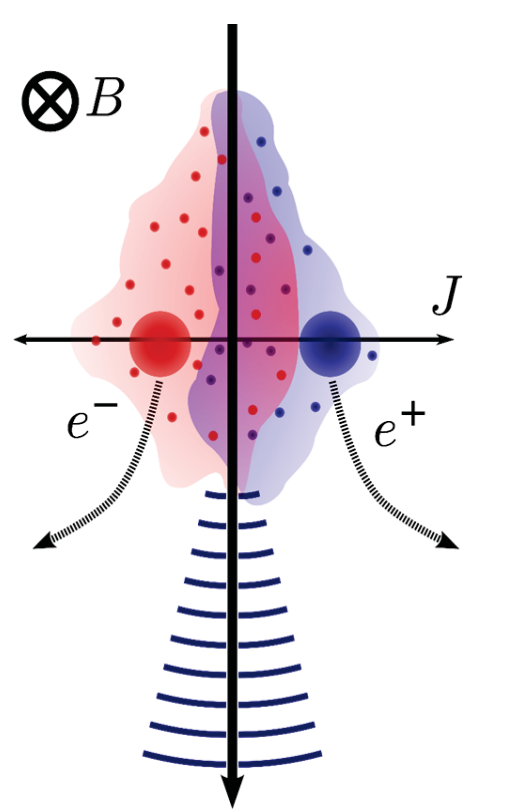
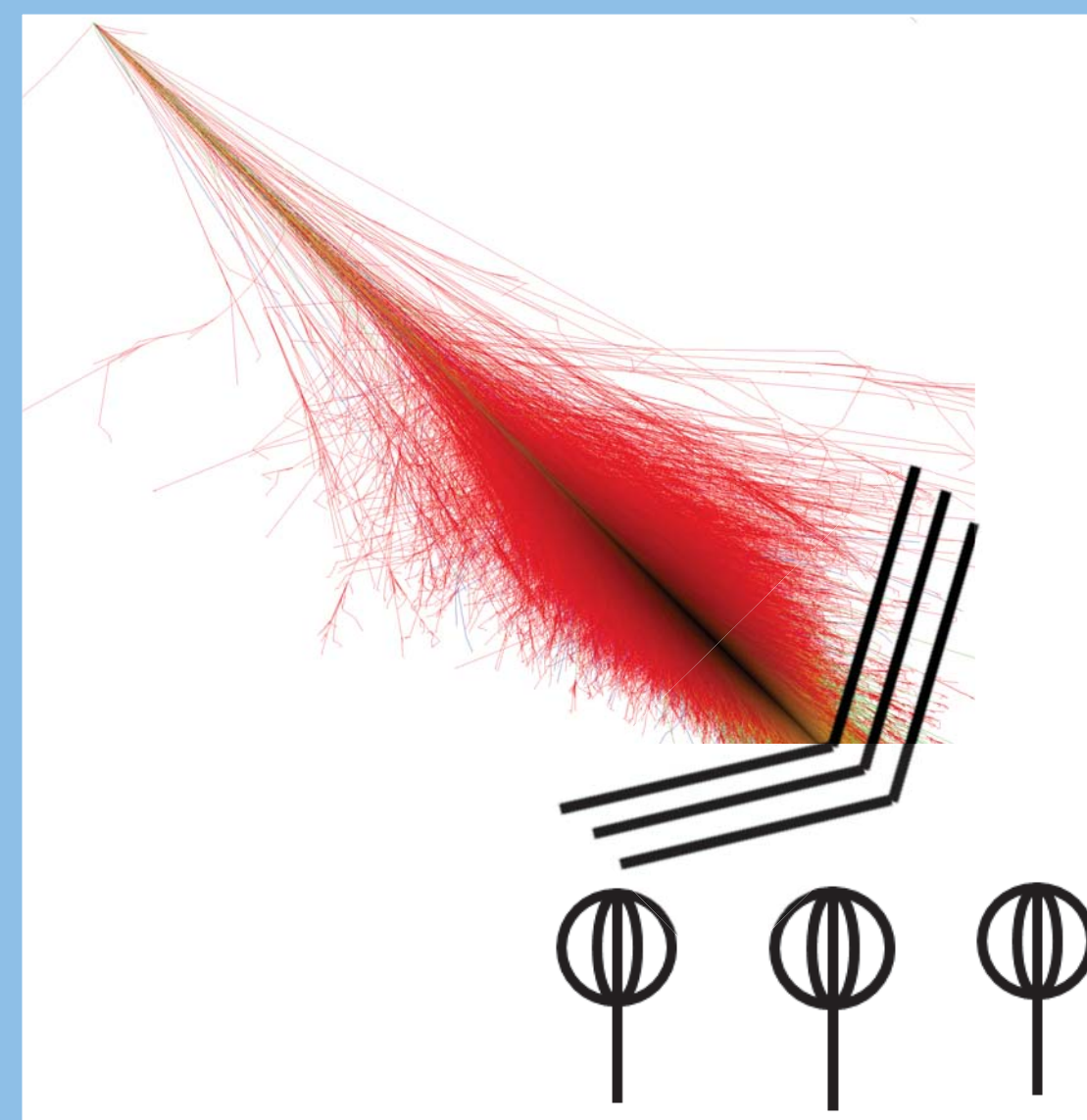
Example: Exchange of Y. Kazarina from Irkutsk to Karlsruhe for the Tunka-Rex project

Cosmic ray air showers

- High energy particles from space
- Unknown origin at energies $> 10^{17}$ eV
- Above 10^{14} eV flux too low for direct measurements
- Measurement of extensive air showers at ground
- Reconstruction of the primary particle type challenging

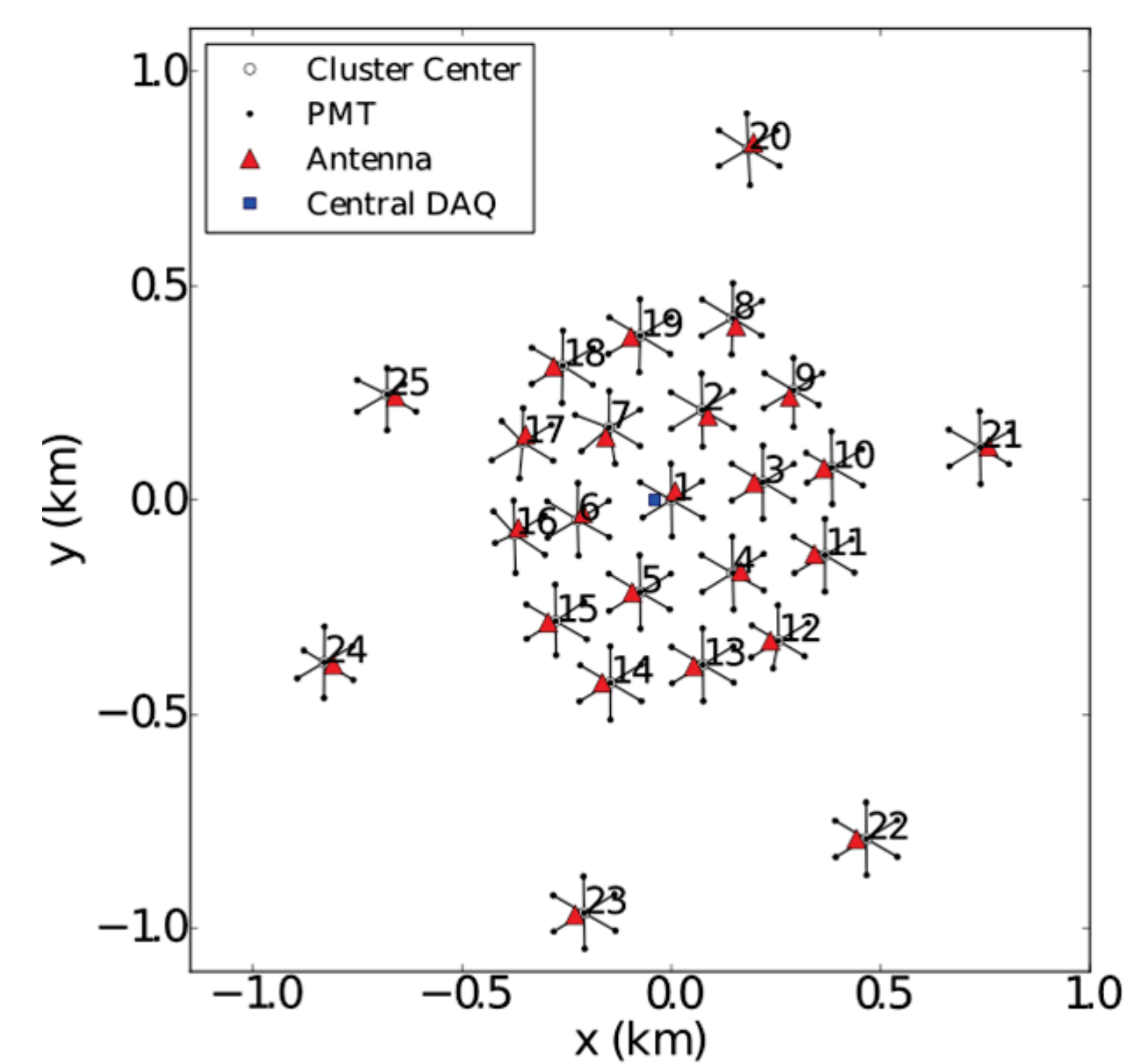
Radio emission from air showers

- Geomagnetic deflection of charged particles in shower front causes radio emission
- Frequencies up to ~ 100 MHz
- Operating almost 24 h/day (except during thunderstorms)
- Sensitive to shower development and therefore also to primary mass



Tunka-Rex

- Radio extension of Tunka-133 air-Cherenkov detector
- Hybrid measurements of air showers with 10^{17} - 10^{18} eV
- Started 2012
- 25 antenna stations
- 30-80 MHz



Tunka-Rex antenna station

Goals of Tunka-Rex

- Cross-calibration of Radio and air-Cherenkov signal
- Determine achievable precision of the radio technique
- Increase total statistics and accuracy of Tunka at the highest energies

Correlation between the energy of the air-Cherenkov measurements and the radio field strength of Tunka-Rex

