Contribution ID: **45** Type: **not specified**

Towards real-time cosmic-ray identification with the LOw Frequency ARay

Friday 15 June 2018 11:30 (20 minutes)

poster:

When a cosmic ray interacts with the Earth's atmosphere, it produces a cascade of secondary particles, known as Extensive Air Showers (EAS). Associated with the cascade, a radio signal is emitted through Geomagnetic and Askaryan mechanisms, which can be used for reconstructing the properties of the primary particle.
The LOw Frequency ARay (LOFAR) observatory is a multipurpose radio antenna array aimed to detect radio signals in the frequency range 10-240 MHz. Radio antennas are clustered into over 50 stations, and are spread along central and northern Europe, with a higher density in the northern Netherlands. The LOFAR core, where the density of stations is highest, has been used since 2011 for detecting radio signals from cosmic-ray air showers in the energy range 10^16 - 10^18 eV, in association with the LOfar Radboud air shower Array (LORA).
One of the biggest challenges for assessing the Radio detection as a valuable technique for cosmic-ray observation is to have a real-time recognition system for the very short radio pulses induced by the secondary particles cascades over the overwhelming background noise. A study for developing a real-time cosmic-ray detection system has been carried out in the last years on the LOFAR Low Band Antenna, which are sensitive between 10 and 90 MHz. The latest results of this study are here presented.

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Session Classification: Future and perspectives