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Realtime processing of LOFAR data for the detection of particles with the Moon

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The low flux of the ultra-high energy cosmic rays (UHECR) at the highest energies provides a challenge to answer the long standing question about their origin and nature. Even lower fluxes of neutrinos with energies above 10ˆ22 eV are predicted in certain Grand-Unifying-Theories (GUTs) and e.g. models for super-heavy dark matter (SHDM). The significant increase in detector volume required to detect these particles can be achieved by searching for the nano-second radio pulses that are emitted when a particle interacts in Earth's moon with current and future radio telescopes.

In this contribution we present the design of an online analysis and trigger pipeline for the detection of nano-second pulses with the LOFAR radio telescope. The most important steps of the processing pipeline are digital focusing of the antennas towards the Moon, correction of the signal for ionospheric dispersion, and synthesis of the time-domain signal from the polyphased-filtered signal in frequency domain. The implementation of the pipeline on a GPU/CPU cluster will be discussed together with the computing performance of the prototype.

Tertiary Keyword (Optional)

Data processing workflows and frameworks/pipelines

Secondary Keyword (Optional)

High performance computing

Primary Keyword (Mandatory)

Trigger

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