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PLATON: An Unsegmented Active Target Particle Tracking Detector Concept

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High-resolution accelerator neutrino detection requires massive active material and fine-grained 3D tracking capability.
Organic scintillators can offer both, combined with sub-nanosecond time resolution.
A millimeter, or even sub-millimeter, particle tracking resolution would be desirable to resolve those nuclear effects that are known to introduce a bias in the reconstruction of the neutrino energy.
On the other hand, the required very fine granularity of the active volume would imply additional complexity in the detector construction.
Moreover, traditional photosensor systems would lead to a very large number of readout channels.

As a solution, we propose a novel readout system, applying 3D imaging techniques to neutrino interactions in an unsegmented monolithic volume of organic scintillator, capable of high-resolution particle tracking.
This is achieved by combining the concept of plenoptic imaging with a Single-Photon Avalanche Diode (SPAD) array imaging sensor.

The report will include the operation of the first plenoptic camera based on a SPAD array, as well as the resolution achievable by this detector concept, using image post-processing based on artificial intelligence.
Our work highlights the potential of such a novel system for high-precision detection of neutrino interactions.

Working Group

WG 6: Detectors

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