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Image optimization techniques in a PET diamond location system

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Abstract content
 (Max 300 words)

Mineral PET is a project to locate diamonds within Kimberlite by first irradiating the rock to induce beta decay in carbon atoms, then imaging the resultant positron emission signals. The presence of homogeneously distributed carbon forces us to go beyond simple counting techniques and rather create a 3D image of hotspots. The resolution of the image obtained is critically important for the location of small diamonds (of the order of 1mm). If the resolution is improved, less activation and/or fewer detectors are required to differentiate the diamond signal from the background.

While in theory the position and orientation of the detectors is known, each detector will differ slightly from the ideal values due to small misalignments, calibration differences etc. We therefore present attempts to improve position readouts inspired by techniques developed at CERN, specifically in the ATLAS detector of the LHC. Detector alignment at ATLAS uses a track-based algorithm that minimizes a χ^2 based on track-hit residuals. While the Mineral PET context is simplified by a vastly reduced number of detectors elements, it is complicated by the fact that we are not interested in the path of the gamma rays that are actually detected, but rather the path of the diamond through the detectors, which can only be reconstructed from the combination of several detected events.

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Yes

Level for award
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 PhD)?

PhD

Main supervisor (name and email)
and his / her institution

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Yes

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