

Fast algorithm for 3D online spectrum and hit position reconstruction in segmented semiconductor detectors based on analytical model of charge collection dynamics

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The pixelated semiconductor tracking detectors became standard tool in experiments of high energy physics. An increasing demand for high resolution data requires highly granular detectors. Small pixels size and low noise electronics allows more data to be recorded for each event (cluster of pixels). Every pixel of modern detectors (e.g. Timepix3/4) can record deposited energy and time of interaction.

The ionizing particle interacting with sensor creates a charge cloud which is directed by the electric field to the pixel electrodes. In this work we show invertible model of signal formation (charge collection dynamics). Its inversion applied to measured data calculates interaction parameters: 3d coordinates with subpixel resolution (6-10x), deposited energy (corrected for charge losses) and time (corrected for drift). Very fast algorithm have been developed and tested. It uses technique similar to convolutional neural networks and can be hardwired into the electronics.

Alternate track

1. Computing, AI and Data Handling

I read the instructions above

Yes

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Session Classification: Poster Session 2

Track Classification: 13. Detectors for Future Facilities, R&D, Novel Techniques