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Charge Carrier Propagation based on pre-calculated Lookup-Tables

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In the past few months CERN EP-R&D WP1.2 in collaboration with ALICE ITS3 adapted its Monte Carlo simulation methodology to support a lookup based propagation technique : In a first step the pixel is meshed and a fixed amount of electrons are injected in each node and propagated in the 'standard'way using TCAD generated electric field, the final state of these electrons is saved. In a second step, more realistic charge deposition is generated, and the previously generated look-up is used to simulate propagation. This leads to extremely fast simulation (for the moment giving access only to the amplitude of the signal without timing, a coarse timing information is under consideration).

Using this method in Garfield++ gave excellent matching with measurements for the iron spectrum of MAPS in a 65nm technology. A similar method is currently under development in Allpix-Squared via the modules MappedPropagation and PropagationMapWriter.

Garfield++ also allows loading mobility and lifetime directly from a file (e.g. generated by TCAD). This feature is also in development in Allpix-Squared. Ultimately, loading lifetime from TCAD also allows to include the effect of irradiation in the lifetime, enabling more complex models.

As a summary this contribution presents one of the MAPS simulation frameworks used at CERN and how part of it is currently implemented by Allpix-Squared developers.

Will the talk be given in person or remotely?

In person

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