## Photon Simulation in Belle II PXD

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## Outline

- Synchroton photons are part of the background in the PXD and increase the pixel occupancy.
- The simulation of photons in the PXD is split into 2 parts:
- Creation of signal electrons in Si mostly via Photo Effect and Compton Effect handled by Geant4 (save).
- Collection of signal electrons into internal gates taking into account drift, diffusion and Lorents shift ( $\rightarrow$ DEPFET Digitizer).
- Detailed device simulations available for Belle II prototype DEPFET designs from R. Richter.
- Define parameters for simplified(!) charge collection model useful for fast digitization.
- First results for photon cluster sizes in Belle II PXD.


## Belle II DEPFET Layout

Prototype layout for $50 \times 50 \times 75$ DEPFET pixel cell, see also talk by R. Richter for more details.


Pixel Border: Weak lateral drift fields and pixel charge sharing.


## 2D Potential Map in R-Ф Cut: Clear - Clear Gate - IG



## Vertical Charge Transport




Simple parabolic potential model works below the potential maximum and in Drift/Clear pixel borders.

## Lateral Charge Transport



Pixel Border
Clear
IG

## Belle II Photon Simulations


[Martin Ritter]

Only $\sim 50 \%$ of photon clusters consist of a single pixel. Cluster sizes up to of 4 pixels are possible.

## Summary

- Implementation of charge collection model based upon device simulations for Belle II prototype sensors.
- Already inside the BASF2 PXD Digitizer :)
- First results for photon cluster sizes in the BASF2 frameworks.
- Cluster size frequently > 1 pixel.
- To Do: Validation of photon simulations with thin PXD6 sensors (soon available).
- To Do: Reference manual for DEPFET Digitizer.

Thank You

## Backup Slides

## Parameter Summary Belle II DEPFETs

|  | PXD 5 (TB2009) | BelleII PXD |
| :--- | :---: | :---: |
| Noise (in ENC) | ${ }^{2} 290$ | ${ }^{2} 200$ |
| Bulk Doping (in $10^{12} \mathrm{~cm}^{-3}$ ) | 0.85 | 10 |
| Backplane Voltage (in V) | -180 | -26 |
| Drift Border Length (in $\mu \mathrm{m}$ ) | 3 | $7 / 15$ |
| Clear Border Length (in $\mu \mathrm{m}$ ) | 3 | 7 |
| Source Border Length (in $\mu \mathrm{m}$ ) | 3 | 3 |

Table 1: Listing of DEPFET digitizer parameters for TB and Belle II.

