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 50x50x75 DEPFET pixel cell, see also talk by R. Richter for more details.



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



Belle II Photon Simulations



Only ~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)	~290	~200
Bulk Doping (in 10^{12} cm ⁻³)	0.85	10
Backplane Voltage (in V)	-180	-26
Drift Border Length (in μ m)	3	7 / 15
Clear Border Length (in μ m)	3	7
Source Border Length (in μ m)	3	3

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