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Detection of MeV electrons using a charge integrating hybrid pixel detector

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Electrons are emerging as a strong complement to X-rays for diffraction based studies. In this paper we investigate the performance of a JUNGFRÄU [1] detector with 320 μm thick silicon sensor at a pulsed electron source [2]. Originally developed for X-ray detection at free electron lasers, JUNGFRÄU features a dynamic range of 120 MeV/pixel (implemented with in-pixel gain switching) which translated to about 1200 incident electrons per pixel and frame in the MeV region.

We present basic characteristics such as energy deposited per incident particle (Figure 1), resulting cluster size and spatial resolution along with dynamic (intensity) range scans. Measurements were performed at 4, 10 and 20 MeV/c. We compare the measurements with GEANT4 [3] based simulations and extrapolate the results to different sensor thicknesses using these simulations.

- [1] A. Mozzanica et al., Characterization results of the JUNGFRÄU full scale readout ASIC JINST 11 (2016)
- [2] D. Angal-Kalinin et al, Design, specifications, and first beam measurements of the compact linear accelerator for research and applications front end, Phys. Rev. Accel. Beams 23, (2020)
- [3] S. Agostinelli et al, Geant4—a simulation toolkit NIMA 506 (2003)

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