

Design Studies using MC Simulations

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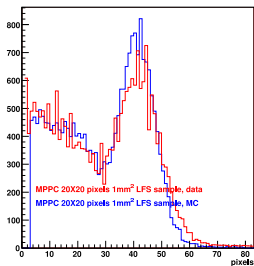
DESY Hamburg

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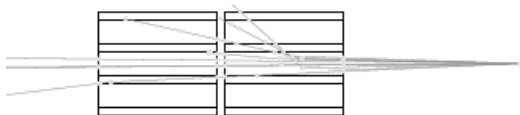
- 1 MC Tools
- 2 First Results
- 3 Summary and Conclusion

- **GEANT3** + extension for treatment of optical photons (Adel Terkulov)
 - Well understood, quite advanced digitisation and modelling of the MPPC
 - Reasonable agreement with measurements
- **GATE** - Geant4 Application for Emission Tomography (Martin Göttlich)
 - Developed, maintained and validated by the OpenGATE Collaboration
 - Widely-used in medical physics (see CERN Courier article, many publications)
 - Allows to define complex geometries very easily, sophisticated digitisation, timing/coincidence studies, moving detector, output in ROOT format
 - Packages for image reconstruction
 - Studies just started, implementation of a more detailed digitisation and modelling of the MPPC

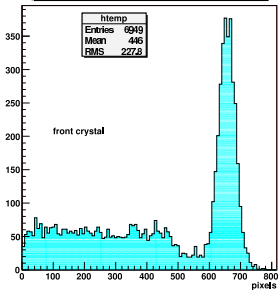
First results: GEANT3 + extensions (Adel Terkulov)



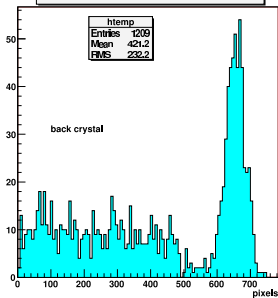
Matrix w/ two layers of crystals:



γ 511 keV, 3x3x15 mm³ LFS, MPPC 3x3 mm² 3600 pixels



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Studies ongoing ...

- LSO energy resolution 8% FWHM
- Implement digitisation such that detector response and readout is well modelled for a system consisting of a single crystal + MPPC + DAQ.
- Build matrix out of crystals (two layers), optimize crystal length.
- Construct ring out of matrices.
- Study properties of the PET system: spacial resolution, energy resolution, time resolution, efficiencies, image reconstruction. Quantify the improvement.
- GATE is well suited to these studies.

- GEANT3 + extension packages and GATE proven to be reliable tools
- Cross check results of both approaches
- Refine simulation, deepen design studies