



Universität Hamburg  
DER FORSCHUNG | DER LEHRE | DER BILDUNG

TUHH

Fachbereich  
Physik



**Detector development group at the Inst. of Experimental physics**

## **Bachelor / Master Student Project**

### **Title: Spectral CT imaging using the CMS pixel detector**

**Task:** At the Institute of Experimental Physics, a mini-CT system has been developed that consist of a cone like geometry including a flat panel detector (CMS/LHC pixel phase I detector module) [1]. When assuming parallel beam geometry for reconstruction, geometric distortions appear in the reconstructed images. In the Bachelor thesis, reconstruction algorithms will be implemented that remove theses geometric distortions. In a first step, a fan-beam geometry will be assumed and a filtered back-projection will be adapted to take this into account. In the second step, the true cone beam geometry will be considered and the so-called FDK algorithm is to be implemented. For a master thesis the reconstruction algorithm can be extended to include the energy measured for each single photon in the image equation (spectral CT).

The candidate will work on key developments of a spectral-CT imager:

- phantom design
- detector calibration
- imaging of phantoms
- 3D (bachelor) / 4D (master) – image reconstruction
- image reconstruction
- cone beam correction

### **Literature:**

[1] Severin Diederichs bachelor thesis, "[From High Energy Physics to Medical Application: CT-Scanning with a CMS Pixel Detector](#)", Dec 2016

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