Graduation Project proposal

Company:
Supervisor(s) at company (name + e-mail addresses):
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University
Supervisor(s) at university (name + e-mail addresses; TU/e will look for suitable supervisors if left blank):

Project title (or topic):
Virtual X-ray Imaging: Acceleration of Projection Generation

Short project description:
X-ray imaging systems are routinely used in medical diagnosis and interventional procedures to produce a “projection view” of the human body. The physical processes of X-ray radiation interaction with objects are well understood but still there is an increasing demand on a virtual modeling and simulation of the imaging process. The current ongoing project intends to transfer existing simulation software to the business unit for routine use in research and development. For this purpose, an existing simulation framework needs to be reviewed and the imaging algorithmic needs to speed up to meet demands on timely availability of simulated X-ray images. The challenge to solve splits up into two related sub-topics:
First, the existing algorithm needs to be optimized and/or be replaced by new concepts of efficient object raytracing. Second, an algorithmic concept needs to be implemented on dedicated acceleration hardware (like e.g. graphic cards) to further optimize simulation speed.

Technical assignment:
An ideal candidate would have background and experience in the following disciplines:
- Programming with C, C++ (preferred) or a related object oriented language,
- Optimization of algorithms and a basic understanding of processor hardware,
- Programming of graphic cards or similar multi-processor architectures.

We expect the candidate to work on optimizing the existing algorithm implementation to reduce execution time. Ideally this will also include an investigation on execution time reduction using novel hardware architectures. Knowledge about (e.g. X-ray imaging) physics is not required to fulfill the task, as well there is no pre-knowledge required on 3D-models of imaged objects. The candidate can benefit from a close cooperation with experienced supervisors and technical experts.

Figure 1. An interventional X-ray System for which simulation of modelled X-ray imaging must be speed up.