# Internship or Master Thesis: *High-speed communication module for ROFEX control system used to track dynamic structures in multiphase flows*

Gas–particle flow in fluidized beds is generally complex and difficult to observe, but exact information on voidage distribution and solid transport is required in many applications ranging from chemical processes, such as fluid catalytic cracking and polymerization, to drying, combustion, granulation, purification and coating. To study such flows, an ultrafast X-ray tomography system ROFEX is designed at TU Dresden. With the frame rates around 10,000 fps which are required to monitor fast processes, it becomes a challenge to perform analysis of the incoming images and control the scanner position according to movement of tracked structures along the height of a process space.

The data is acquired by 32 detector modules equipped with 1 GBit Ethernet interface each. The data streams are merged by a networking switch and are delivered to the control station over 40 Gbit network link using UDP protocol. GPUs are used to recognize and to follow structures in the liquid flow. To improve communication performance and to reduce control latencies, we plan to use FPGA to receive data from the network, build data sets, and deliver them to GPU for further analysis and control. The GPUDirect or/and DirectGMA technologies will be used to transfer data between FPGA and GPU directly on PCIe bus. Your goal is to develop IP cores to 1) receive data and 2) build the complete data sets from the received UDP packets. The developed IP cores have to be integrated with our FPGA/GPU communication framework. The latency of a complete data path from the detector to GPU should be measured and reported.
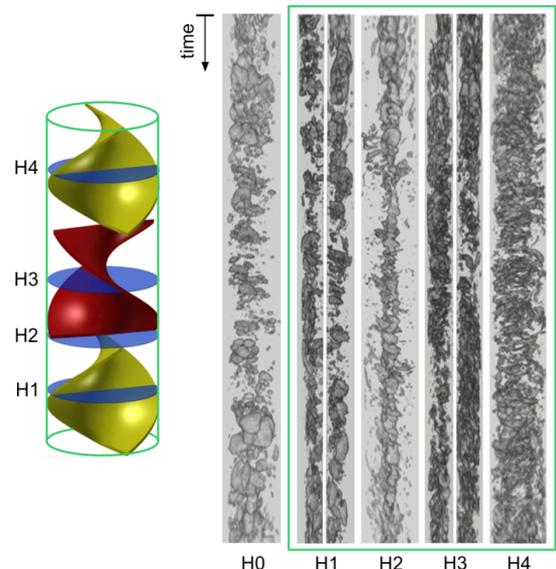
Sample bubble flow

Required Skills: FPGA fundamentals

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