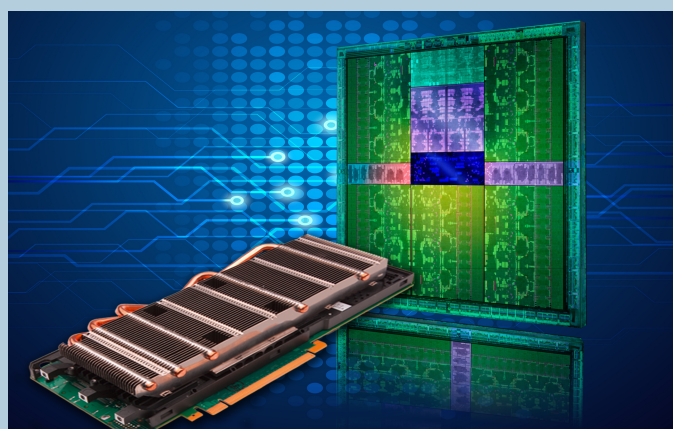


NVIDIA Application Lab at Jülich

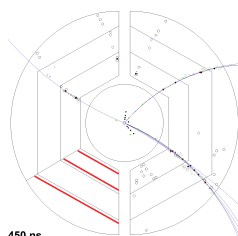


Collaboration between JSC and NVIDIA to

- Enable scientific applications for GPU-based architectures
- Provide support for their optimization
- Investigate performance and scaling

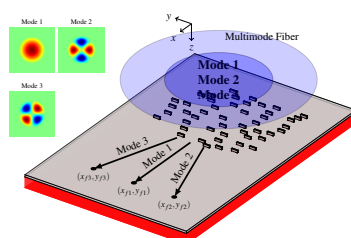
Application requirements analysis

- Support for a broad range of applications
- Investigation of computational needs depending on problem size
- Analysis of mapping to the hardware characteristics of various current and future GPU-based architectures



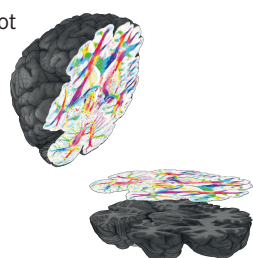
Application: PANDA

- Set of applications developed at Forschungszentrum Jülich (IKP) to explore solutions for triggerless particle track reconstruction in future high-energy physics experiments
- Challenge: Process data coming out of experiment at rate of 200 GByte/s
- Possible solution: Triplet finder algorithm on high-end GPUs



Application: B-CALM

- 3D Finite Difference Time Domain (FDTD) simulator developed at Vrije Universiteit Brussel to study electro-magnetic effects in thin metal layers
- Challenge: Simulations using large lattices which do not fit into GPU memory
- Solution: Efficient parallelisation over dozens of GPUs



Parallelization on many GPUs

- Exploration of different parallelization strategies
- Computing resource: JURECA cluster with 75 nodes with 2 K80 each

Hardware architecture and CUDA feature analysis

- Analysis of usability of new features introduced with each new generation of hardware and software
- Analysis of architectural limitations for application portfolio

Application: JuBrain

- Application developed at Forschungszentrum Jülich (INM-1) to construct 3-d brain model from 2-d brain slice images
- Challenge: Registration of high-resolution, i.e. large, images
- Solution: Parallelisation of mutual information metric calculation

Application: Regional Flood Model

- Application of GeoForschungsZentrum (GFZ) Potsdam to perform large-scale simulations of models for flood risk assessment.
- Challenge: Solve Saint-Venant equations in 2 dimensions efficiently
- Solution: Optimizations including host-device data transfer aggregation and kernel merging

Training

- Organisation of workshops and training events
- Aim to improve skills of application developers