DATA CAPTURE AND CORRECTION FOR JUNGFRAU 9M

ACKNOWLEDGEMENTS

JF9M CHALLENGE

- 9M detector @ 2kHz / 16 bit readout - 36GB / s

- Data need to be corrected for per-pixel / per gain mode pedestal and gain

- Data need to be shuffled and compressed (~6:1) then saved to disk

- Process needs to be steady state i.e. run continuously (data veto needed)

Image kindly provided by Aldo Mozzanica
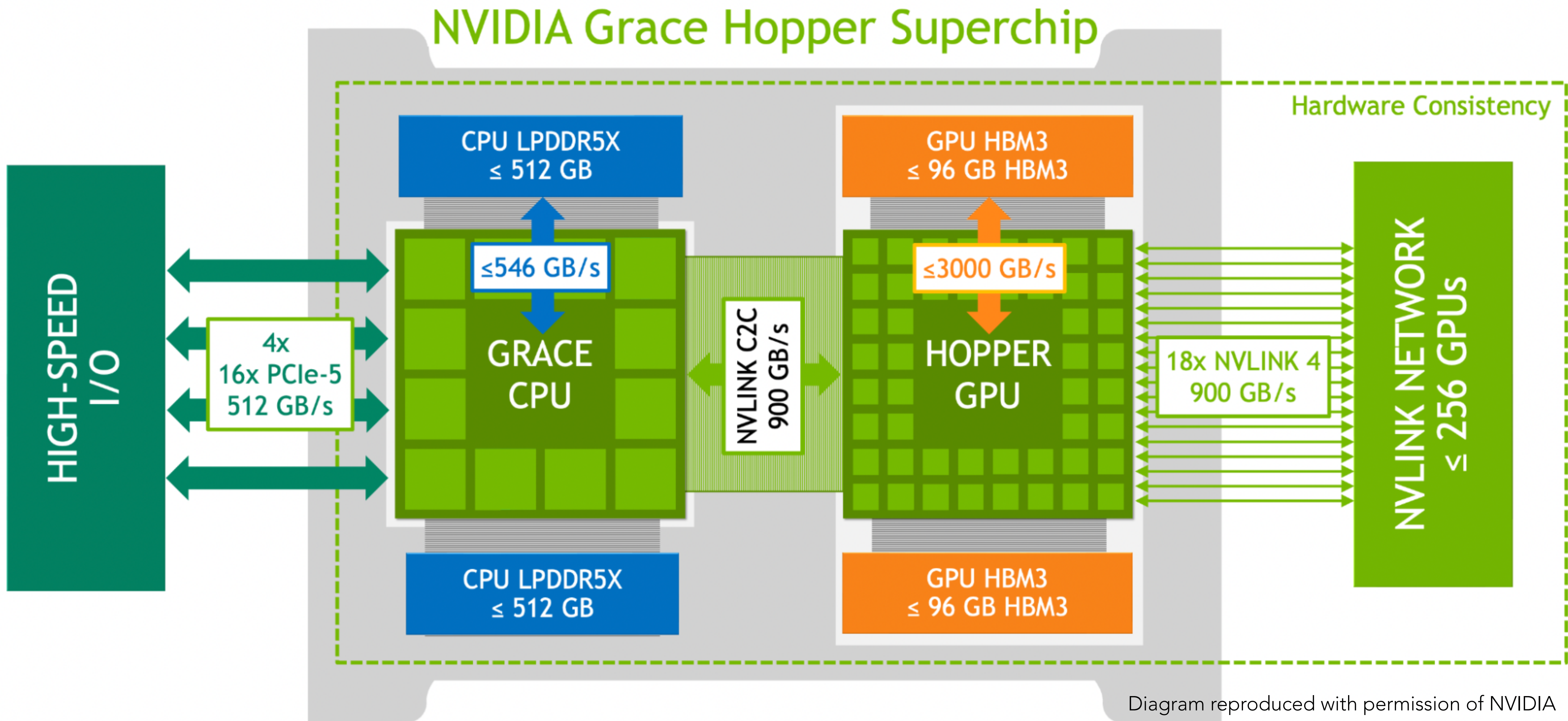(PSI detector group)

PSI SOLUTION

- JUNGFRAUJOCH - certain Filip will have described

- Limiting factors: memory bandwidth, real-time requirement

- FPGA HLS is an interesting technology but time consuming to implement and slow to debug

NVIDIA GRACE HOPPER

NVIDIA Grace Hopper Superchip

Hardware Consistency

HIGH-SPEED I/O

4x
16x PCIe-5
512 GB/s

CPU LPDDR5X
≤ 512 GB

GRACE CPU

≤546 GB/s

NVLINK C2C
900 GB/s

GPU HBM3
≤ 96 GB HBM3

HOPPER GPU

≤3000 GB/s

18x NVLINK 4
900 GB/s

NVLINK NETWORK
≤ 256 GPUs

CPU LPDDR5X
≤ 512 GB

GPU HBM3
≤ 96 GB HBM3

Diagram reproduced with permission of NVIDIA

DIAMOND SOLUTION

- SLS detector to receive packets from detector, form images

- Push data to GPU: perform correction in there, shuffling, maybe compression, maybe initial analysis

- *Keeping the data streams from half-modules separated*

- Save data to 36 x HDF5 stacks

COMMENTARY

- Compression: bslz4 uses 8kB chunks: splitting into modules does not reduce efficiency

- 36 half-modules can be reconstructed into one image using HDF5 VDS

- Never bringing data together can aid parallelism in analysis
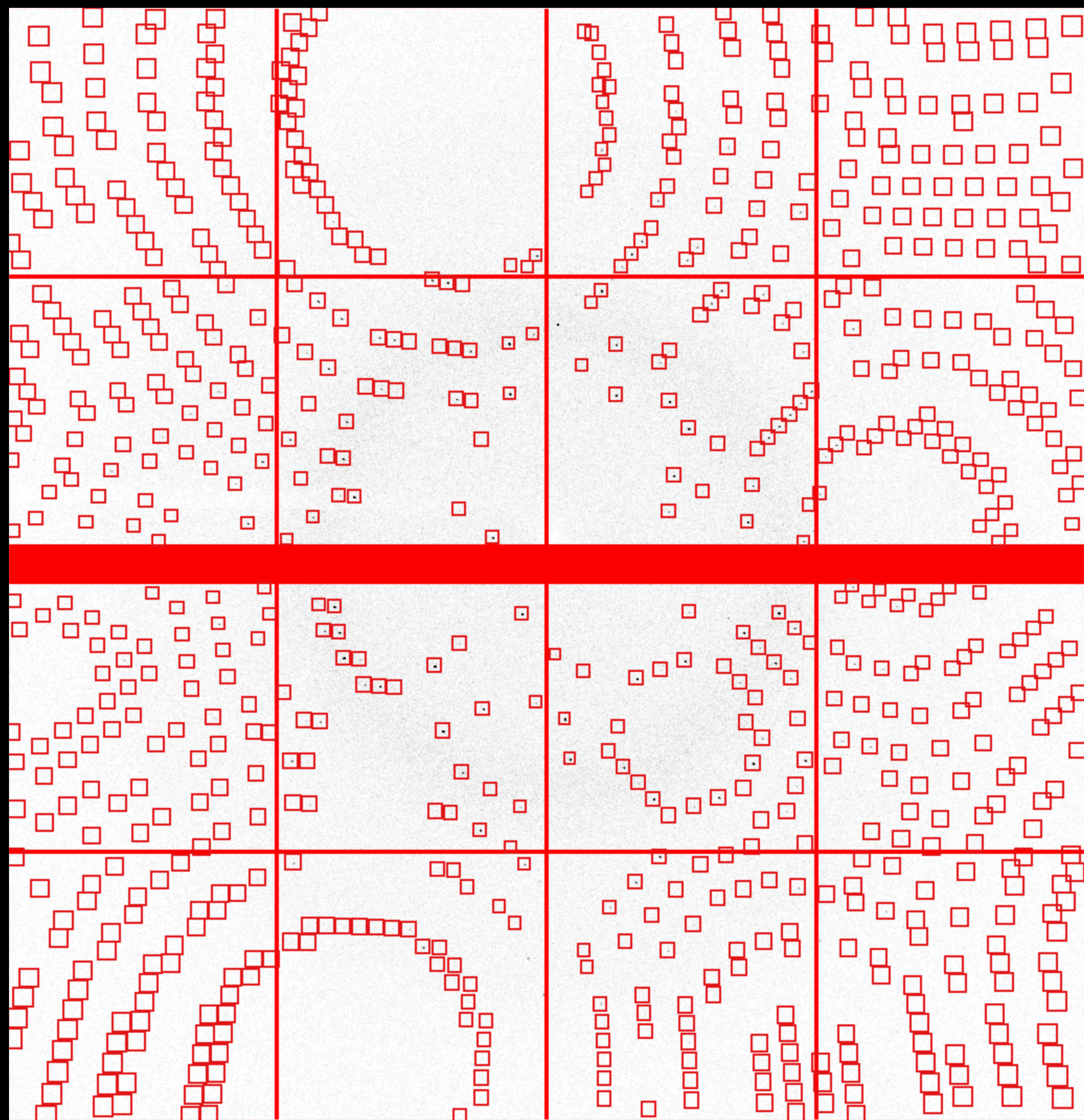
SIMULATION ENVIRONMENT

- 5 servers with 40GbE network - 1 x single port, 4 x dual port

- 18 x virtual jungfrauDetectorServer (lightly hacked to send real data)

- SN2100 network switch (needed for final detector)

- Very long slsDetector configuration file 🙃

CURRENT WORK

- Optimisation: removing the zeroMQ connection between slsReceiver / MORGUL

- Tuning the simulation environment: sending UDP packets at close to line speed for an hour at a time requires reliability

- Tuning the implementation

FUTURE WORK

- Optimise analysis around use of VDS (works in DIALS, not in XDS / DURIN)

- Example data from 1M: https://zenodo.org/records/15017658

- Exploring other applications of Grace Hopper