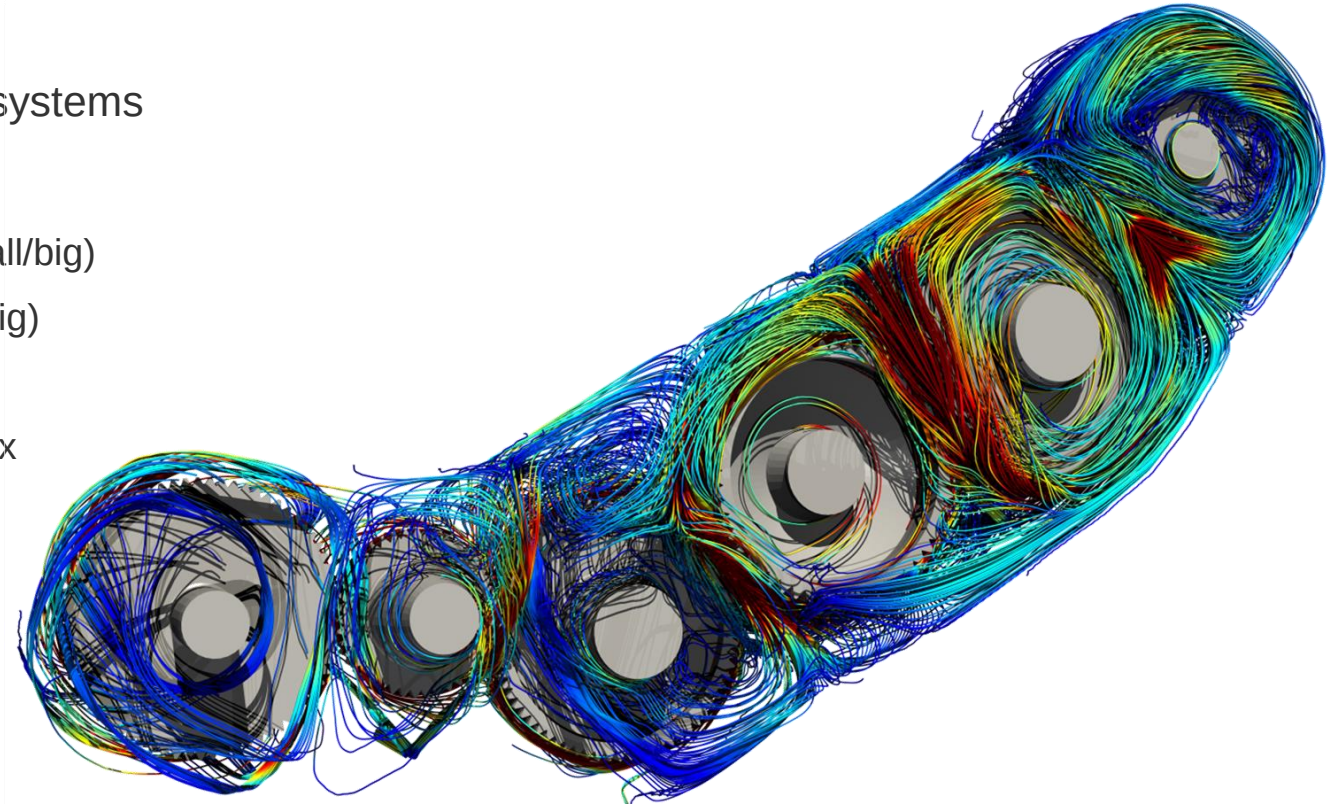
Altair nanoFluidX™

OUTLINE

Description of used systems

Performance data

- Minimal Cube (small/big)
- Dambreak (small/big)
- Altair E-Gearbox
- Aerospace Gearbox



DESCRIPTION OF USED SYSTEMS

DGX-1:

- 8x NVIDIA V100 (16 GB), 2x Intel Xeon E5-2698 v4, 512 GB RAM
  DGX OS 5.0.5, NVIDIA Driver 450.119.04

RTX A6000:

GWS-i9/4G （デスクサイド静音モデル)

- CPU: Intel Core ™i9 10940X, 3.3GHz
- GPU: 2x NVIDIA RTX A6000, 48GB
- RAM: 128GB

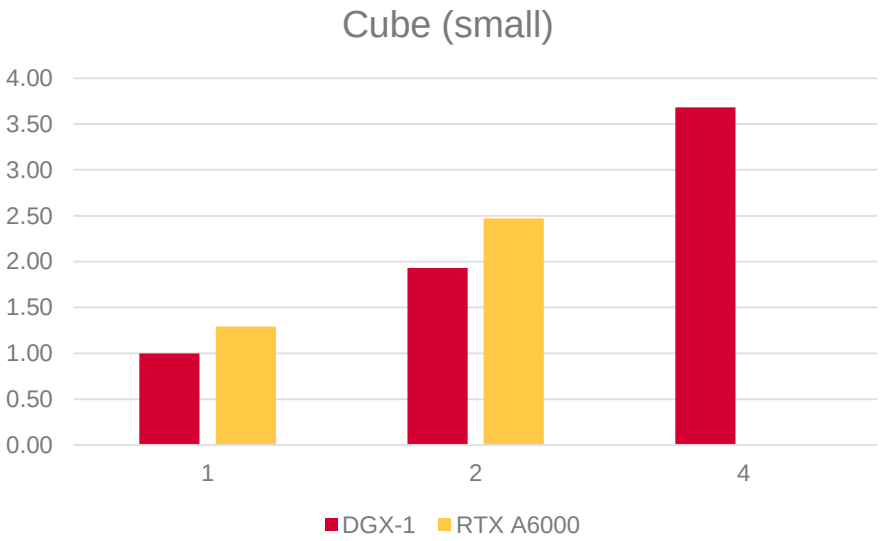
nanoFluidX software stack:

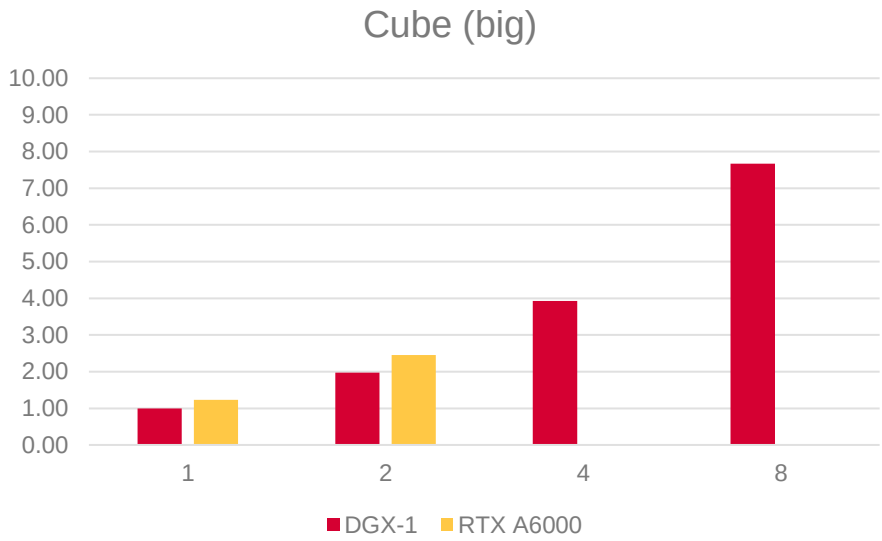
- nanoFluidX 2021.2 with single-precision floating point arithmetics
- CUDA 11.1.1
- Open MPI 4.0.6 (with CUDA support)

MINIMAL CUBE

- Simple cube of of static Fluid particles in rest
- Minimal Case to estimate raw performance of solver core
- 2 Different sizes:
  - Small: ~7m Fluid particles (size of relatively small production case, slightly smaller than what we usually recommend for 4 GPUs)
  - Big: ~57m Fluid particles (size of a bigger production case)
- All runs cover 1000 timesteps

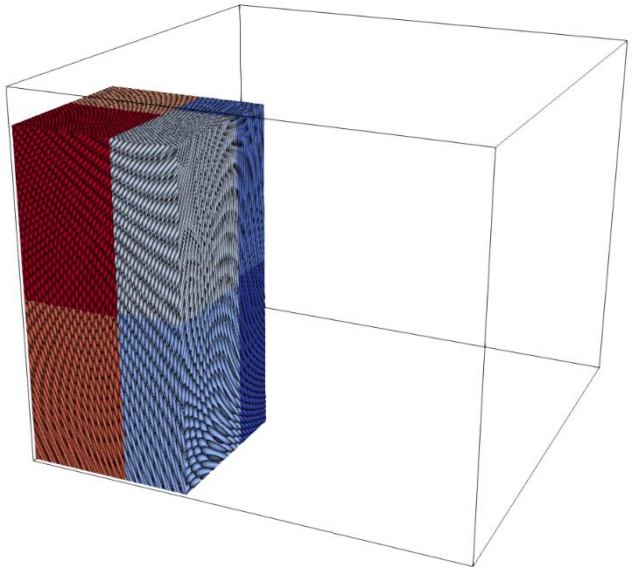
MINIMAL CUBE (RESULTS)



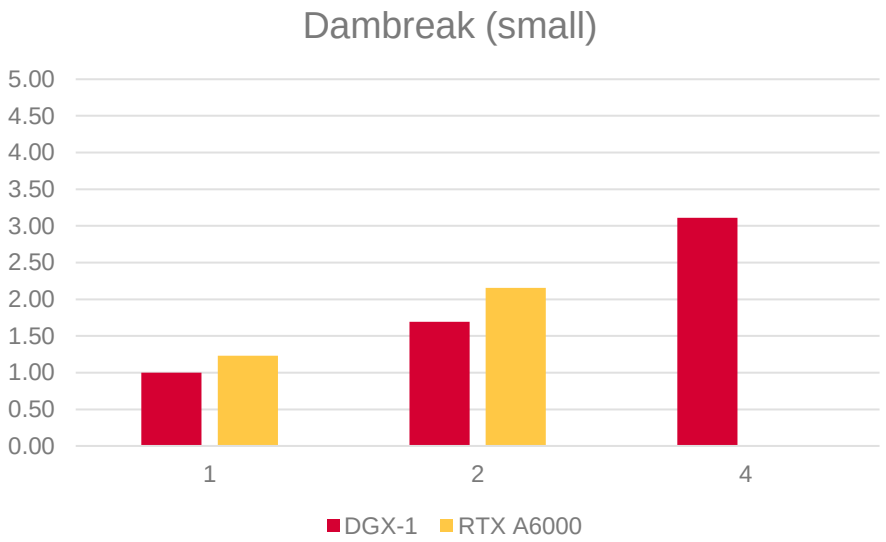


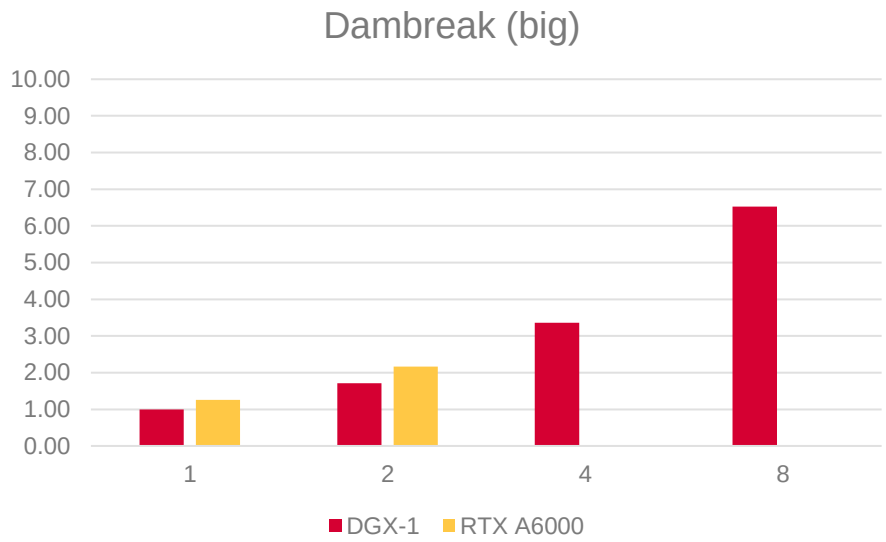
DAMBREAK

- Collapsing water column under gravity in domain (indicated by lines)
- Good case to evaluate performance for tricky particle distributions
- Therefore indicator whether load-balancing works
- 2 Different sizes:
  - Small: ~7m Fluid particles (~9m total), (size of relatively, slightly smaller than what we usually recommend for 4 GPUs)
  - Big: ~54m Fluid particles (~64m total), size of a bigger production case
- All runs cover 10000 timesteps



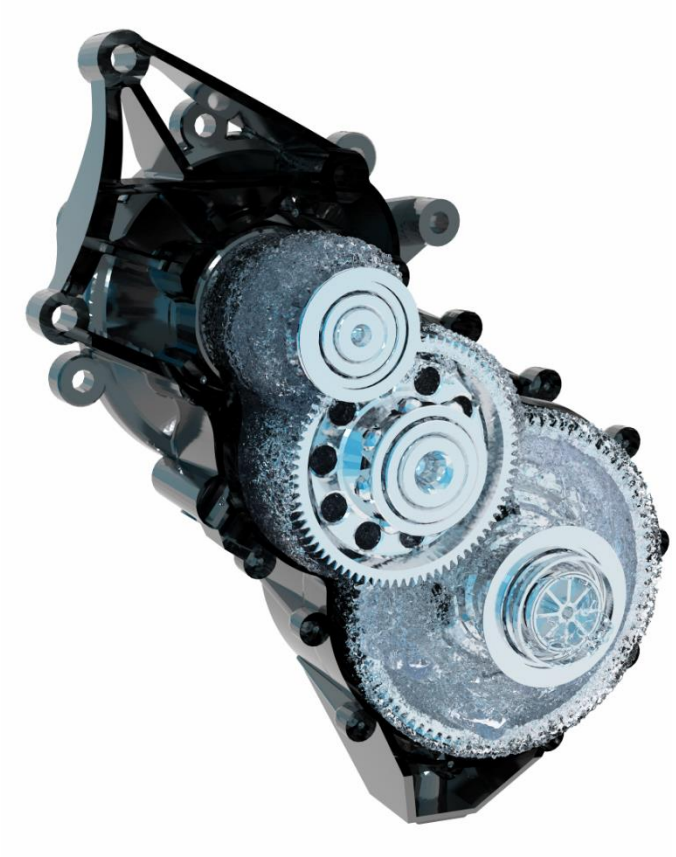
DAMBREAK (RESULTS)



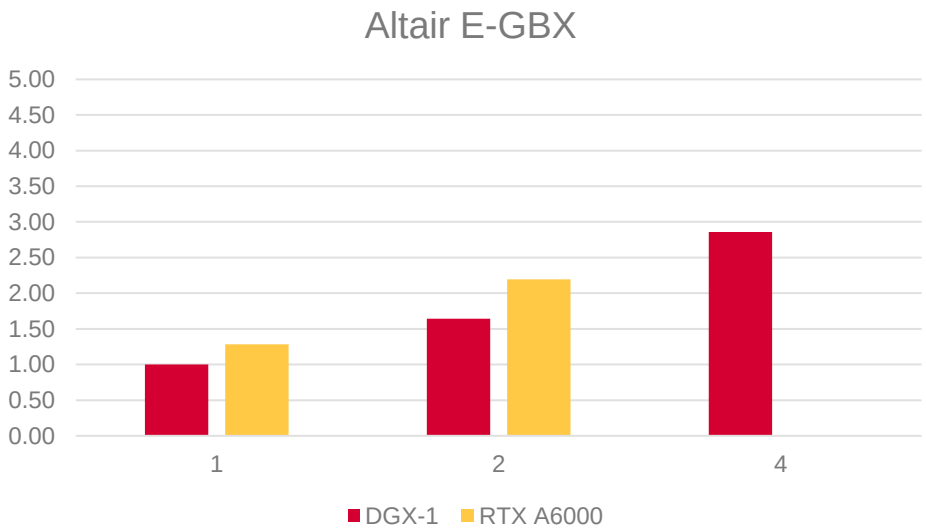


ALTAIR E-GEARBOX

- Showcase by Altair for E-Mobility application
- Size: ~6.5m Fluid particles (~12m total, slightly smaller than what we usually recommend for 4 GPUs)
- Run covers 10000 timesteps

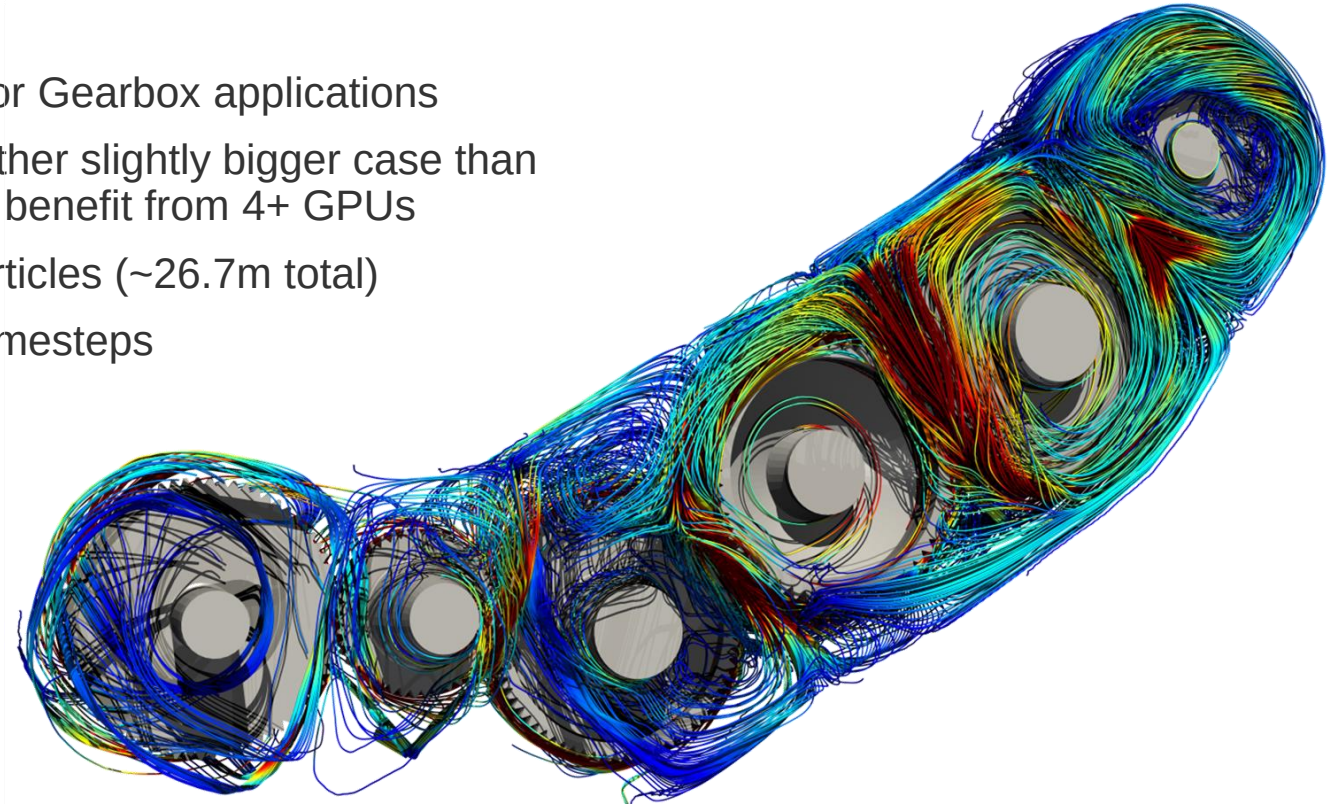


ALTAIR E-GEARBOX (RESULTS)

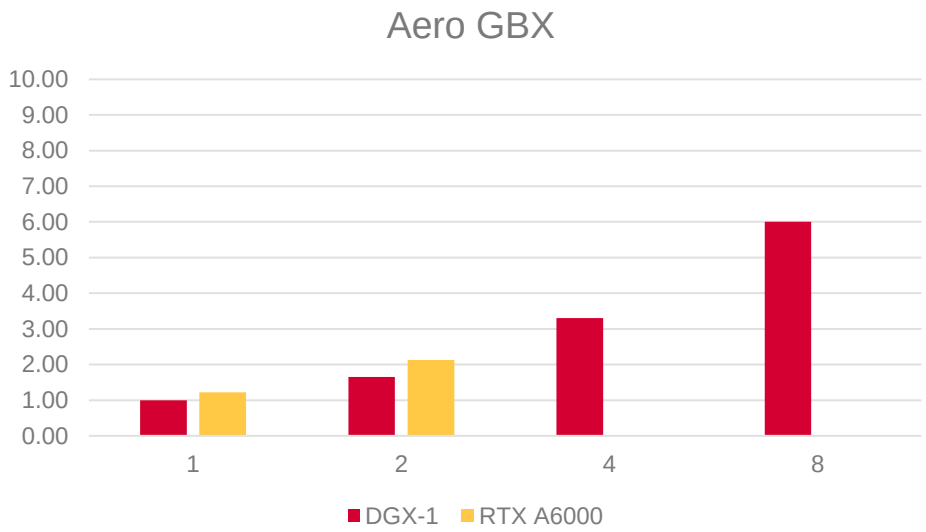


AEROSPACE GEARBOX

- Another showcase for Gearbox applications
- Chosen to have another slightly bigger case than previous one to fully benefit from 4+ GPUs
- Size: ~21m Fluid particles (~26.7m total)
- Run covers 10000 timesteps



AEROSPACE GEARBOX (RESULTS)



ADDITIONAL NOTES

- Performance data in the graphs always relative to 1 V100 on the DGX-1
- All cases with „WEIGHTED“ interaction scheme.
- All solver output has been deactivated to focus on solver performance, but generally this doesn‘t change the results significantly.
- Scalability between 1 and 2 GPUs is usually slightly impaired because in single-GPU runs some parts related to multi-GPU may be skipped entirely

Altair