

## Task 2.2 Hardware Prototypes: Status and Next Steps

Dr. Eray Inanc

28.08.2023, CoE RAISE 2<sup>nd</sup> All-Hands Meeting, Iceland

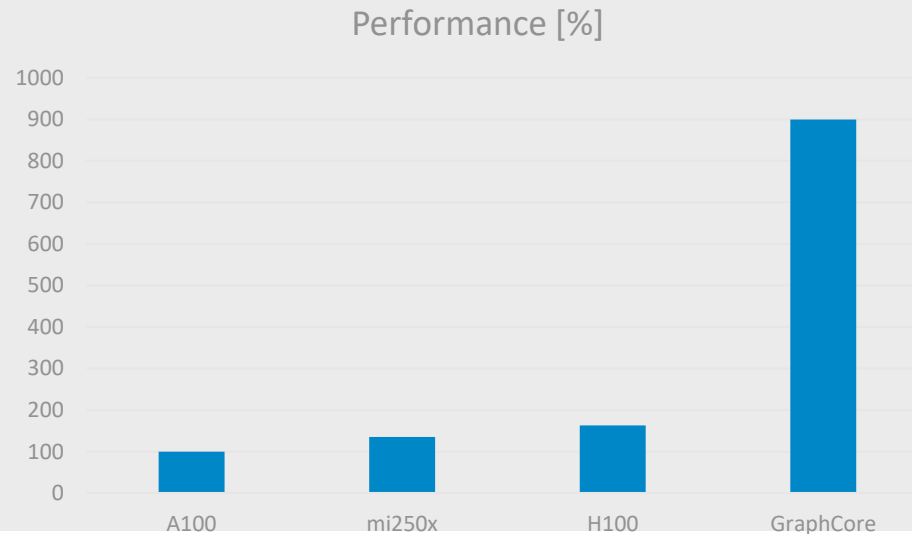
# Overview: Prototype Systems in RAISE

Location	System name	CPU	Accelerators
FZJ	DEEP-EST	147 Intel Xeon	75 NVIDIA V100
FZJ	JUAWEI	11 ARM HiSilicon	
BSC	CTE-AMD	33 AMD EPYC	66 AMD MI150
BSC	CTE-ARM	192 ARM A64FX	
BSC	HUAWEI	16 ARM Kunpeng 920	
<b>FZJ</b>	<b>JURECA-EPO</b>	<b>2 AMD + Intel Xeon</b>	<b>4 H100 + 8 MI250 + GraphCore</b>

# JURECA – Evaluation Platform Overview (EPO)



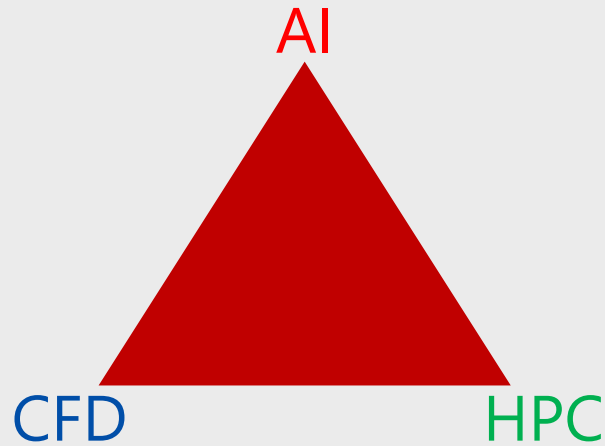
	<b>NVIDIA A100**</b>	<b>AMD MI250</b>	<b>NVIDIA H100</b>	<b>GraphCore* IPU</b>
System	JURECA-DC	JURECA-EPO	JURECA-EPO	JURECA-EPO
Epoch time [s]	54**	40	33	6
Performance [%]	100**	135	163	900



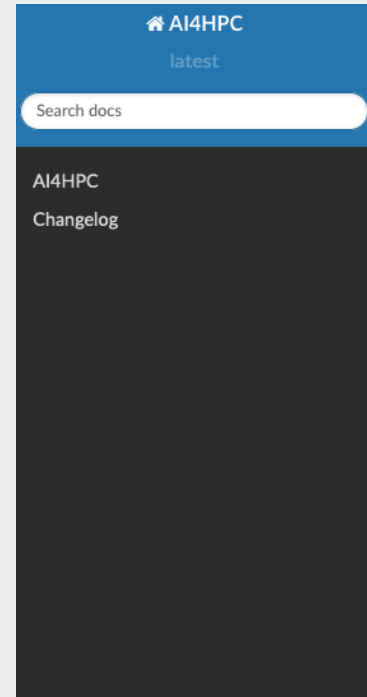
\*<https://www.graphcore.ai>

\*\*Base case

# AI4HPC part of UAIF (T2.4)



Is an open-source library to train **AI** models with **CFD** datasets on **HPC** systems



🏠 / Welcome to AI4HPC!

[View page source](#)

## Welcome to AI4HPC!

**AI4HPC**, part of **CoE RAISE**, is an open-source library to train AI models with CFD datasets on HPC systems.

In CoE RAISE, innovative AI methods on heterogeneous HPC architectures capable of scaling towards Exascale are developed and generalized for selected representative simulation codes and data-driven workflows.

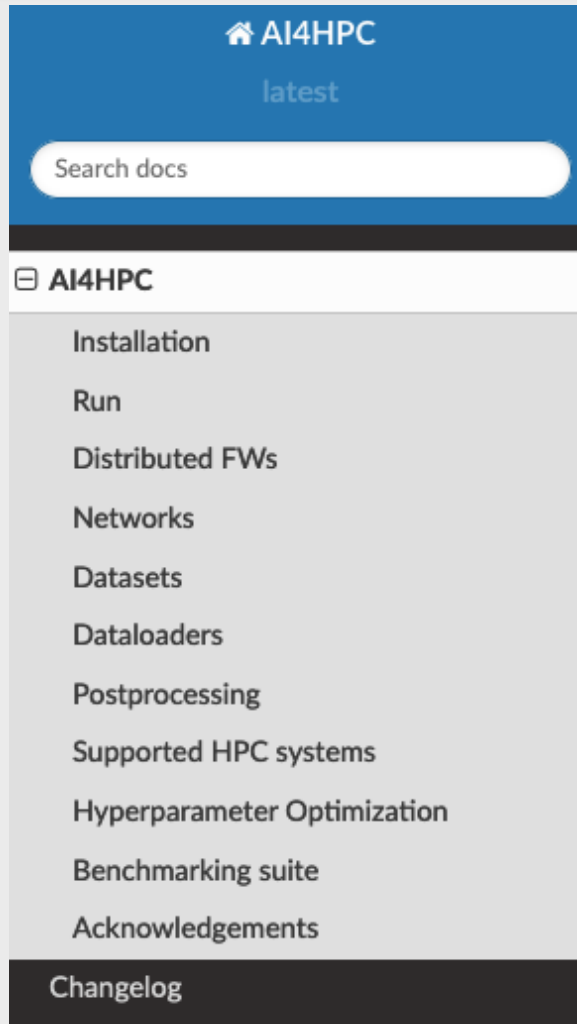
**AI4HPC** consists of data manipulation routines tuned to handle CFD datasets, ML models useful for CFD analyses, and optimizations for HPC systems. **AI4HPC** also includes a benchmarking suite to test the limits of any system with CPUs and GPUs towards Exascale and a HyperParameter Optimization (HPO) suite for scalable HPO tasks.

The source code can be found [here](#) !



[ai4hpc.readthedocs.io](https://ai4hpc.readthedocs.io)

# What AI4HPC offers



AI4HPC latest

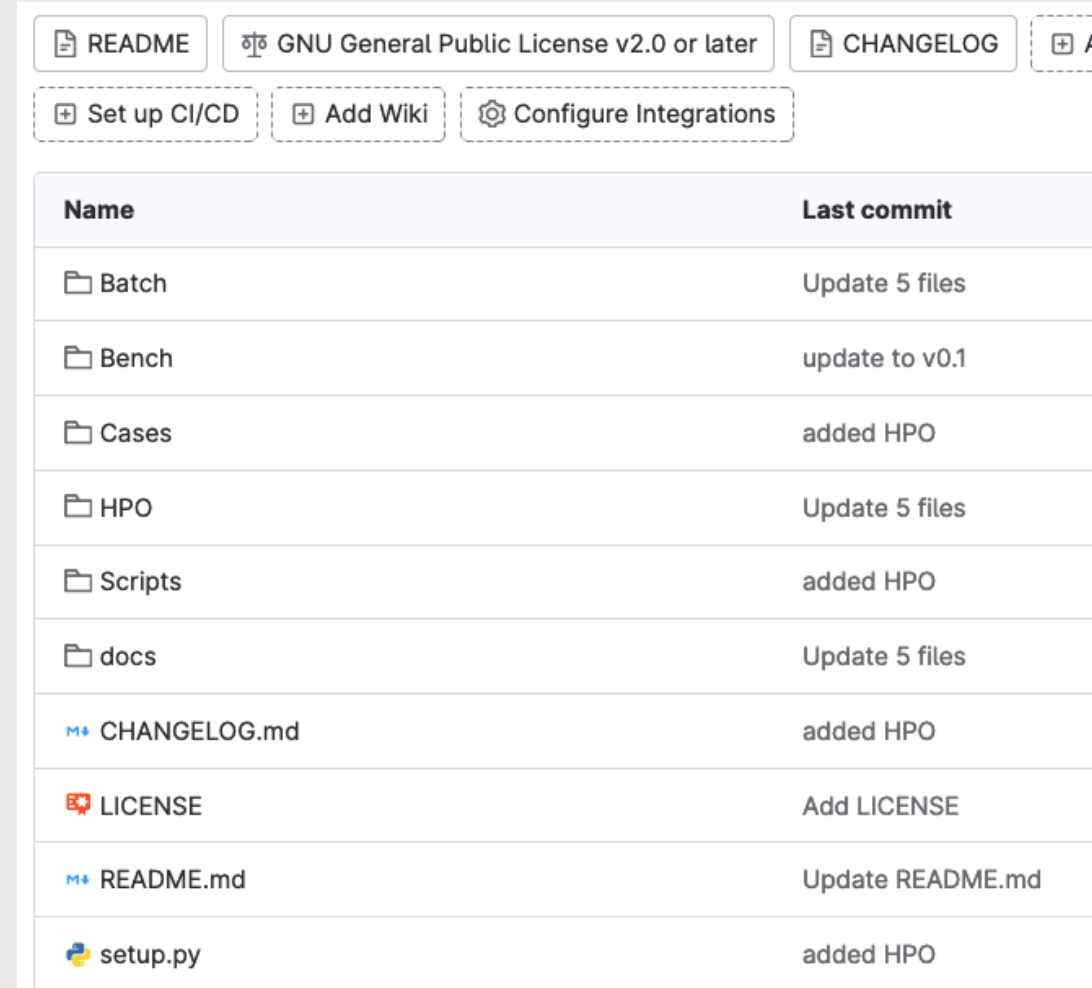
Search docs

AI4HPC

- Installation
- Run
- Distributed FWs
- Networks
- Datasets
- Dataloaders
- Postprocessing
- Supported HPC systems
- Hyperparameter Optimization
- Benchmarking suite
- Acknowledgements

Changelog

- Pre-processing routines
- ML models for CFD
- HPC optimizations
- Post-processing routines
- Benchmarking suite
- HPO suite



README GNU General Public License v2.0 or later CHANGELOG

Set up CI/CD Add Wiki Configure Integrations

Name	Last commit
Batch	Update 5 files
Bench	update to v0.1
Cases	added HPO
HPO	Update 5 files
Scripts	added HPO
docs	Update 5 files
CHANGELOG.md	added HPO
LICENSE	Add LICENSE
README.md	Update README.md
setup.py	added HPO

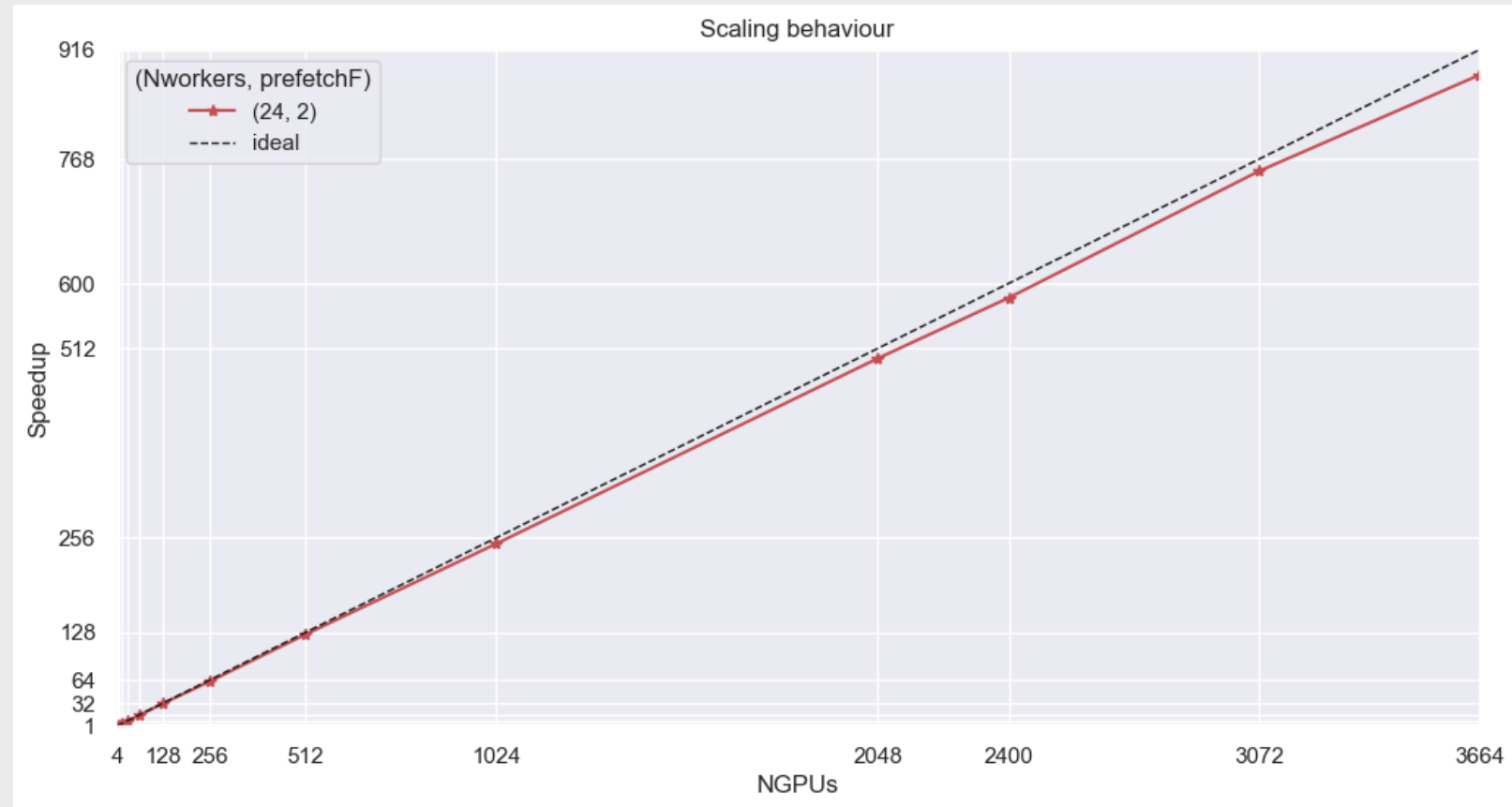
Source code: [gitlab.jsc.fz-juelich.de/CoE-RAISE/FZJ/ai4hpc](https://gitlab.jsc.fz-juelich.de/CoE-RAISE/FZJ/ai4hpc)

## Super scaling

- Test on JUWELS-BOOSTER
- Up to 3,664 GPUs
- $E > 0.93$

## Details:

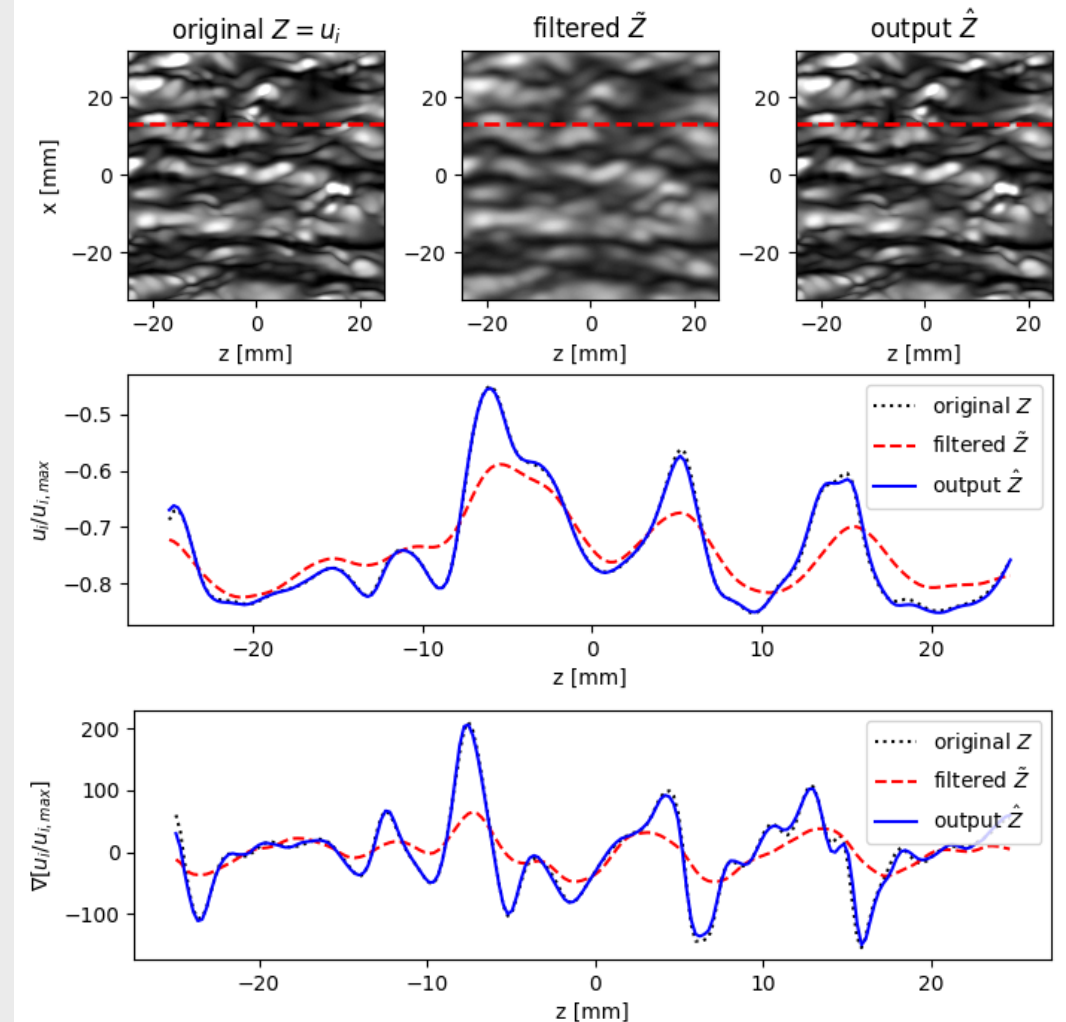
- Data-distributed training
  - PyTorch<sup>2</sup> w/ Horovod<sup>3</sup>
- I/O disabled – synthetic data



AI4HPC benchmarking suite tested on JUWELS-BOOSTER\*  
\*<https://www.fz-juelich.de/en/ias/jsc/systems/supercomputers/juwels>

# Results of T3.1 using AI4HPC

- Motivation: Super-resolution
- Aim: recover 5 times coarse grid
- Model: Convolutional Defiltering (CDM)
- System: 32 GPUs on JURECA-DC
- Shown: Streamvise velocity results
  - Black line -> fine grid
  - Red line -> 5x coarse grid
  - Blue line -> super-resolution



# Remarks

- AI4HPC is part of UAIF (T2.4)
- Continuous support to WP2-4

*Thank you for your attention*



# drive. enable. innovate.



The CoE RAISE project have received funding from the European Union's Horizon 2020 – Research and Innovation Framework Programme H2020-INFRAEDI-2019-1 under grant agreement no. 951733

Follow us:



R<sup>G</sup>