Machine Learning for Wave Structure Interaction Training

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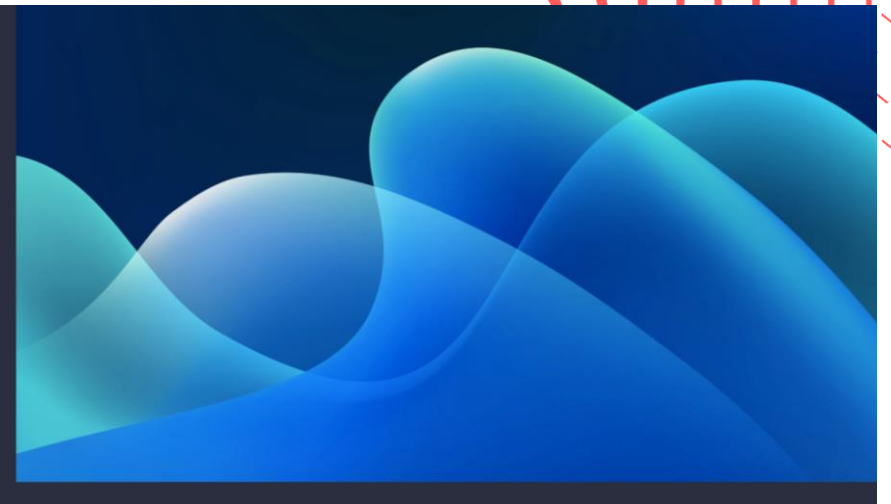
Introduction to STFC

Welcome to Daresbury Laboratory

- One of STFC's 6 UK locations
- One of 2 of the UK's national laboratories
- Home to some of STFC's large facilities and associated activities:
  - Computational Science
  - Supercomputing
  - Particle accelerators
  - Engineering for Science
  - Business Incubation

UK Astronomy Technology Centre
Edinburgh, Scotland

Boulby Underground Laboratory
North Yorkshire

Polaris House
Swindon, Wiltshire

Daresbury Laboratory
Sci-Tech Daresbury Warrington, Cheshire

Chilbolton Observatory
Stockbridge, Hampshire

Rutherford Appleton Laboratory
Harwell Didcot, Oxfordshire

UK RI

Science and Technology Facilities Council

Scientific Computing

Logistics

- You can get access to the materials of this training from the following repository
https://github.com/jonycastagna/CCp-WSI-ML-workshop

- There is no fire alarm expected on either day, so if you do hear one then please exit the building immediately

- If you would like to order a taxi then please book it by the number
    - Apec – 01928 57 57 57
    - Abba – 01925 44 44 44
    - Uber – through your smart phone

- Recommendations of where to get an evening meal:
    - Ring O'Bells – Chester Road
    - The Red Lion – Moore
    - Evenwood Farm – Evenwood Close
    - Stockton Heath/Warrington Town Centre has a number of restaurants

If you need to leave the room at any point, please make sure you take an access card with you (and then bring it back!)

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CCP-WSI+

- **C**ollaborative **C**omputational **P**roject on **W**ave **S**tructure **I**nteraction
- Chaired by Plymouth University
- Founded in 2016 and funded by EPSRC until September 2025
- Community building around computational methods and related software to solve problems related to WSI
- Directly supported by the STFC CoSeC programme to:
  - Deliver training
  - Implement, release and support software
  - Develop new computational modelling and simulation methods

HEC-WSI

HEC-WSI
a High End Computing Consortium
for Wave Structure Interaction

- **H**igh **E**nd **C**onsortia on **W**ave **S**tructure **I**nteraction
- New EPSRC funded community running until December 2026
- Chaired by Plymouth University with the same working group as CCP-WSI
- Provides a simple and single point of entry for UK national supercomputing resources for UKRI funded work related to WSI
- Supported by CoSeC around application performance engineering and training
- Visit the HEC website to apply for access to the ARCHER2 service

Access Modes

Porting and Benchmarking

Code Development

Project Access

Early career researchers

HEC-WSI
A High End Computing consortium in Wave Structure Interaction

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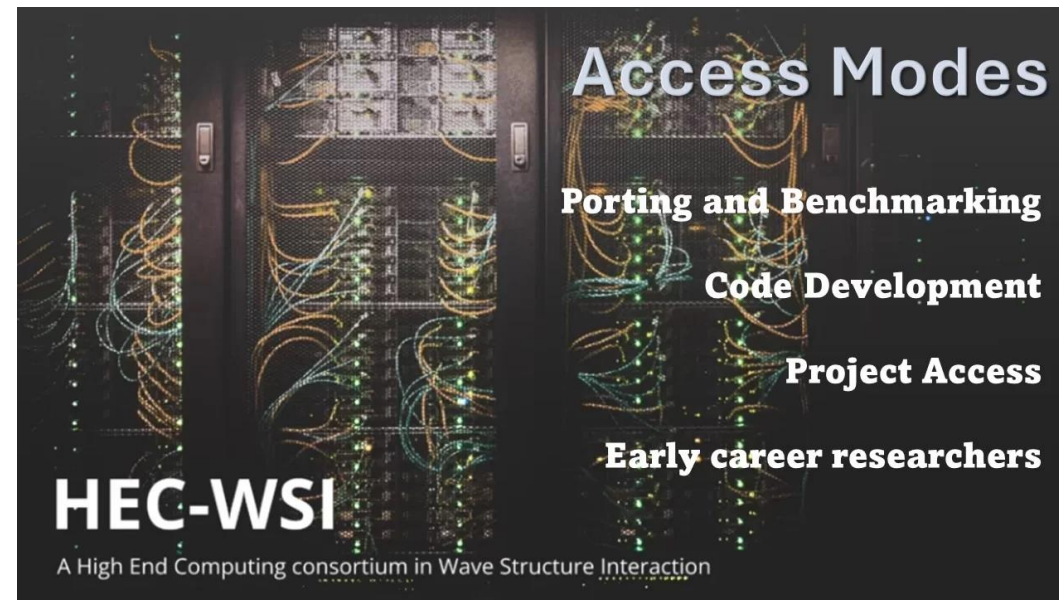
CoSeC

- The **C**omputational **S**cience **Ce**ntre for Research **C**ommunities
- CoSeC is a national Centre
- Across UKRI it provides an interface and point of co-ordination for CCP activity and a bridge for HECs and related DRI components
- A large, stable and diverse team of Research Technical Professionals
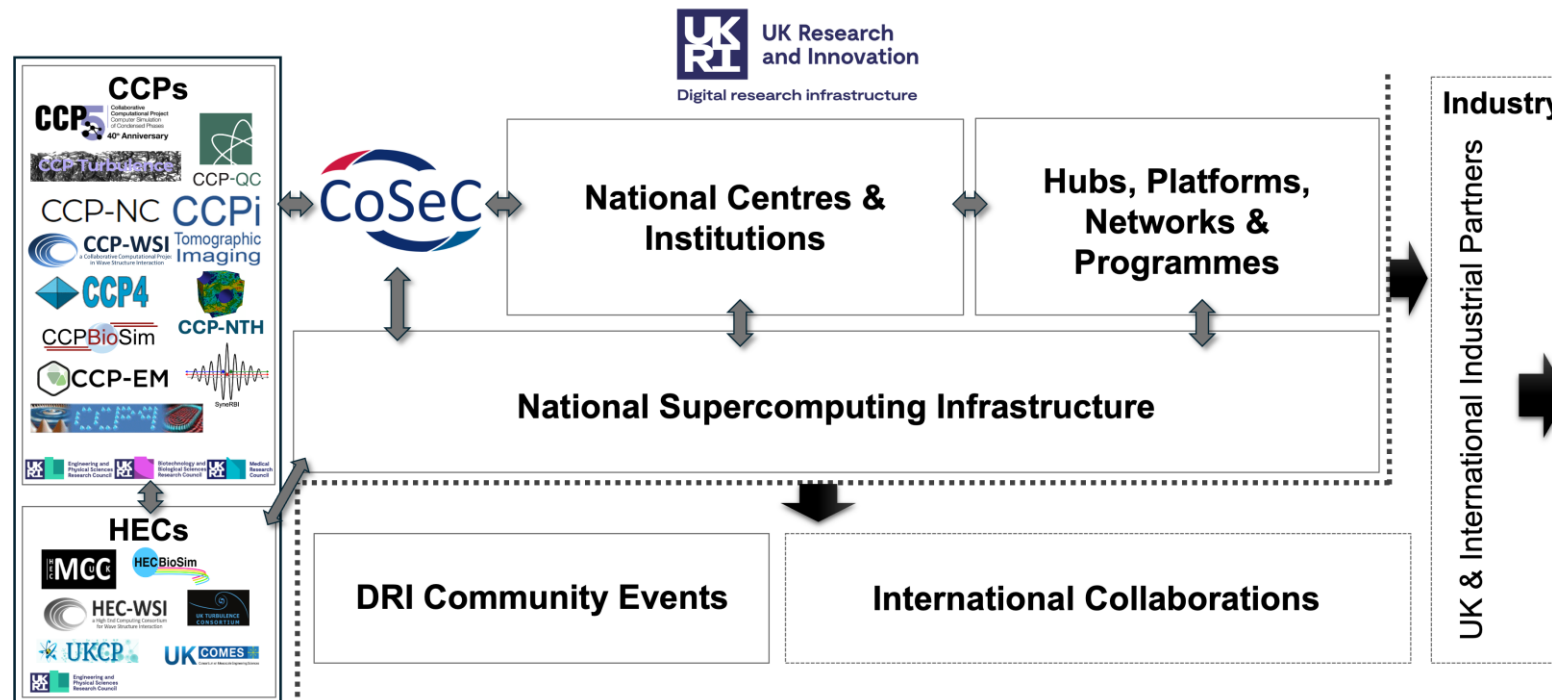
Machine Learning for WSI

- The aim of this course is to give an introduction to machine learning (deep learning) and an overview of how different techniques can be applied to CFD problems.

- Through hands-on exercises in computer vision and natural language processing, you'll train deep learning models from scratch, learning tools and tricks to achieve highly accurate results. You'll also see how to leverage freely available, state-of-the-art pre-trained models to save time and get your deep learning application up and running quickly.

Agenda

Day 1

12:00 – 12:50	Lunch
12:50 – 13:00	Welcome & Introduction
13:00 – 14:00	Introduction to Deep Learning (NVidia Deep Learning Institute)
14:00 – 15:00	How a Neural Network Trains
15:00 – 15:30	Coffee break
15:30 – 16:30	Convolutional Neural Networks
16:30 – 17:30	Data Augmentation and Deployment

Day 2

09:00 – 09:45	Pre-trained Model
09:45 – 10:30	Advanced Architectures
10:30 – 11:00	Coffee Break
11:00 – 12:30	Some Literature overview on Deep Learning for Turbulence
12:30 – 13:30	Lunch break
13:30 – 15:00	Test case: StyleGAN as deconvolution operator for LES in BOUT++

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