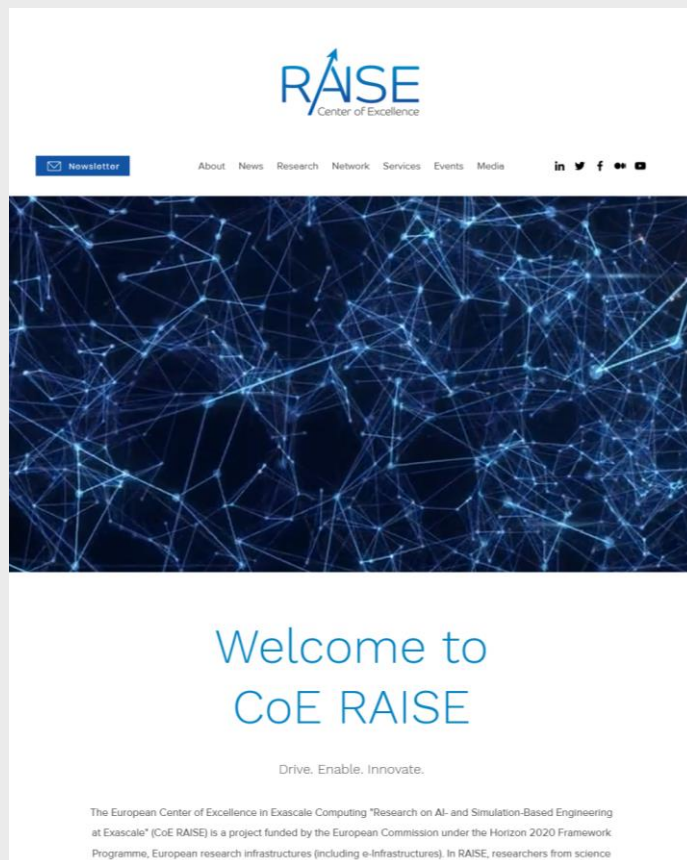


# 6.3 Dissemination and communication

All-Hands-Meeting  
28-30 August 2023  
Michael Bresser

# Website statistics and updates

# Website visitor numbers are “in need of improvement”



	M2-M12	M13-M24	M25-30	M31
Users	667	1556	212	101
Sessions	1370	3144	519	85
Page views	3809	6379	1430	507

Google Analytics  
GA4 (New Version)

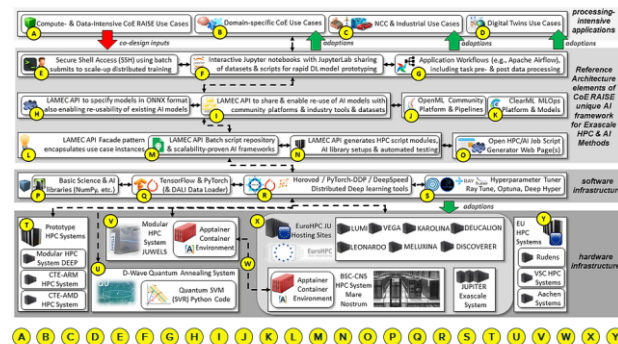
# New menu structure to better describe the Unique Artificial Intelligence Framework (UAIF)

## Unique AI Framework

- (UAIF) -

CoE RAISE follows the rules of open science and publishes its results open-access when they are ready for wider application. All developments of CoE RAISE are being integrated into the Unique AI Framework (UAIF), which will not only contain the trained models but also documentation on how to use them on current Petaflop and future Exascale HPC, prototype, and disruptive systems. The UAIF developed by CoE RAISE works with processing-intensive applications of a wide variety of scientific and engineering domains.

### UAIF in the context of the larger European Ecosystem of Projects and Initiatives



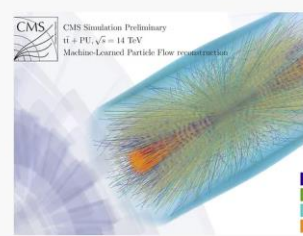
#### A - Compute- and Data-Intensive CoE RAISE Use Cases

Component (A) in Fig. 1 represents the co-design efforts of the UAIF based on compute- and data-intensive use cases. Fact Sheets for each use case have been produced and describe what novel AI methods correlate to available UAIF components. They foster general understanding of the contributions that have been added over time to the UAIF and include scalability and utility for Exascale aspects. Several tasks in WP2 contributed to benchmarking and proof of scalability of selected components of the UAIF on various production and prototype HPC systems in this context. Detailed co-design activities have been performed via the Interaction Room methodology and Murat Boards. During the project and especially in the last reporting period, a clear picture is provided on what components are relevant for the UAIF.

## Code Repositories

- (UAIF) -

CoE RAISE follows the rules of open science and publishes its results open-access when they are ready for wider application. All developments of CoE RAISE are being integrated into the Unique AI Framework (UAIF), which will not only contain the trained models but also documentation on how to use them on current Petaflop and future Exascale HPC, prototype, and disruptive systems. The developments toward the Unique AI Framework are continuously progressing. The present code base of the UAIF can be found below.

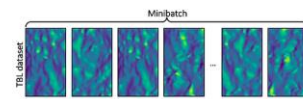


### Machine-Learned Particle-Flow (MLPF)

Machine-Learned Particle-Flow (MLPF) is an algorithm based on Graph Neural Networks (GNN) and is aimed at performing efficient, GPU-accelerated particle flow reconstruction at large particle detector experiments. It takes particle tracks and calorimeter clusters as input and gives higher-level physics objects, for instance electrons, hadrons and photons, as output. This repository contains the code necessary to train MLPF using single or multiple GPUs, to perform large-scale hyperparameter optimization (HPO) using multiple compute nodes on HPC systems, to evaluate the model performance as well as to export the model for later use in inference. The main model and training is implemented in TensorFlow while Ray Tune is used for HPO. A publicly available dataset is available at [1]. MLPF was first introduced in [2] and later versions appeared in [3,4].

[GIT Repository](#)

### AI for HPC



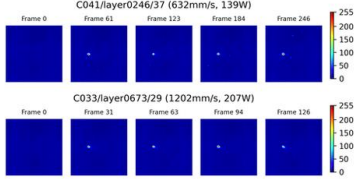
AI4HPC, part of CoE RAISE, is an open-source library to train AI models with CFD datasets on HPC systems. In CoE RAISE, innovative AI methods on heterogeneous HPC architectures capable of scaling towards Exascale are developed and generalized for selected representative simulation codes and

- General information
  - UAIF in the context of the larger European Ecosystem of Projects and Initiatives
- Code Repositories
  - Present code base of the UAIF with five database sets
    - Machine-Learned Particle-Flow
    - AI for HPC
    - AI4Sim Model Collection
    - PhyDLL
    - Earth Observation Data Workflows with Apache Airflow

# We continue to make our results visible

**The RAISE-LPBF-Laser benchmark**

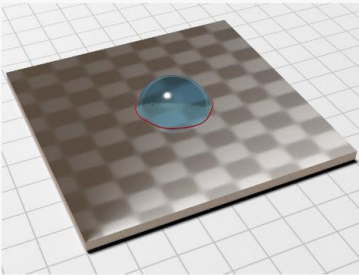
A large dataset on the effect of laser power and laser dot speed in powder bed fusion (LPBF) of 316L stainless steel bulk material.



[Read more](#)

**Wetting hydrodynamics**


Training Fourier neural operator (FNO) models to predict droplet dynamics



[Read more](#)

**Particle Flow Reconstruction**

This High-Energy Physics dataset contains terascale data on physics events with full GEANT4 simulation, suitable for Particle Flow (PF) reconstruction.



[Read more](#)

- The RAISE-LPBF-Laser benchmark
  - Own website: <https://makebench.eu/>
- Wetting hydrodynamics
- Particle Flow Reconstruction

# Service Portal was launched in February

The image displays two views of the RAISE Service Portal. The left view shows the main landing page with the RAISE logo, navigation menu, and a section for Jupyter-JSC. A red circle highlights a 'Connect' button, with a red arrow pointing to the right view. The right view is a detailed page for the 'Next-Generation Notebook Interface', featuring a background image of server racks and a central text box. The text box contains the following information:

- JUPYTERLAB**
- Next-Generation Notebook Interface**
- We are pleased to bring "Supercomputing in your browser".
- Jupyter-JSC gives access to JupyterLab, a web-based interactive development environment for Jupyter notebooks, code, and data. JupyterLab is flexible: configure and arrange the user interface to support a wide range of workflows in data science, scientific computing, and machine learning. JupyterLab is extensible and modular: write plugins that add new components and integrate with existing ones. [Read more.](#)

Below the text box, there are 'Login' and 'Register' buttons. The footer of the page lists various JSC resources: Jupyter-JSC, JUWELS, JURECA, JUSUF, DEEP, HDFML, and HDF-Cloud. It also includes contact information and a note about funding from the European Union's Horizon 2020 program.

# Another use case has emerged in the course of the project

## Bringing Personalized Medicine to Rhinology

### Using Computational Fluid Dynamics and Artificial Intelligence to Understand Pathologies and to Perform Surgery Planning

The nasal cavity is one of the most important organs of the human body. Its various functionalities are essential for the well-being of the individual person. It is responsible for the sense of smell, supports degustation, and filters, tempers, and moistens the inhaled air to provide optimal conditions for the lung. Diseases of the nasal cavity like chronic rhinosinusitis, septal deviation, or nasal polyps may lead to restrictions or complete loss of these functionalities [1, 2]. A decreased respiratory capability, the development of irritations and inflammations, and lung diseases can be the consequences.

The shape of the nasal cavity varies from person to person with stronger changes being present in pathological cases. A decent analysis on a per-patient basis is hence crucial to plan for a surgery with a successful outcome. Nowadays diagnostic methods rely on morphological analyses of the shape of the nasal cavity. They employ methods of medical imaging such as computed tomography (CT) or magnetic resonance imaging (MRI), and nasal endoscopy [3]. Such methods, however, do not cover the fluid mechanics of respiration, which are essential to understand the impact of a pathology on the quality of respiration, and to plan for a surgery. Only a meaningful and physics-based diagnosis can help to adequately understand the functional efficiency of the nasal cavity, to quantify the impact of different pathologies on respiration, and to support surgeons in decision making.

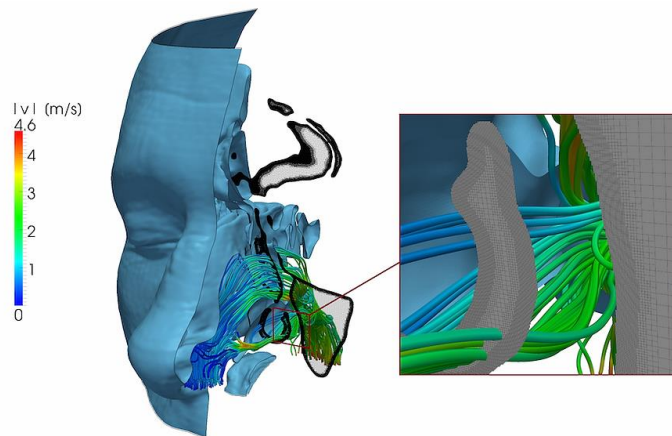
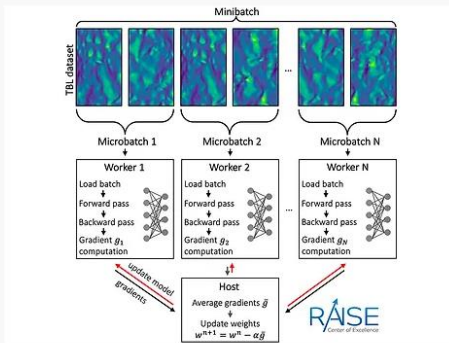


Figure 1: Visualization of the flow in the human nasal cavity. The streamlines are colored by the velocity magnitude  $|v|$ . The inset on the right shows a magnification highlighting the boundary-refined computational mesh.

- Partners from FZJ and BSC work closely together in this use case called “AI-assisted respiratory flow simulations”
- The goal is, using Computational Fluid Dynamics and AI to understand pathologies and to perform surgery planning

## Our latest news



WP2 news: Welcome to AI4HPC - the newest addition to the UAIF!

AI4HPC is an open-source library to train AI models for Computational Fluid Dynamics (CFD)-based applications on High-Performance Computing (HPC) systems. This library has been developed in the context of the CoE RAISE project and is part of the Unique AI Framework (UAIF).

[Read more](#)

June 2023



AI Insights Episode 2 – CoE RAISE Podcast

Today's guest is Morris Riedel, a full professor and head of Iceland's National Competence for High Performance Computing & Artificial Intelligence at the University of Iceland. On top of that, he is also the research group leader of the Federated Systems and Data Division at the Jülich Supercomputing Centre. In addition, he serves as a EuroHPC JU Governing Board member for Iceland as well being involved in many strategic decisions on HPC in Europe.

# 28 news articles

## Upcoming news:

- News article out of WP3 (July)
- CoE RAISE AHM at Iceland
  - Article or short video



# When the idea turns into practice

**CoE RAISE helps Treble Technologies improve acoustic response in virtual reality applications**

Treble Technologies is an Icelandic startup and SME specializing in acoustic simulations. They simulate the acoustical effects of proposed architectural designs and present these results in virtual reality. This lets Treble's clients experience the soundscape of a building or other environment so that they can identify and correct acoustic problems before construction begins.

In order to provide the most accurate presentation to their clients, however, Treble needs to know more than just the building's acoustics. They also need to know how the sound that reaches a listener's eardrums is affected by which way the listener is facing.

[www.treble.tech](http://www.treble.tech)

**Solution**

In order to collect training data for its AI modeling, CoE RAISE Task 4.4 (Sound Engineering) maintains a custom-built test apparatus in the Acoustic and Flexible Engineering (ACUTE) laboratory at the University of Iceland; this consists of a mannequin with interchangeable ear inserts and a loudspeaker located in an echo-free environment. The system is automated and measures the acoustic response from approximately 1000 different directions in order to obtain a complete picture of the acoustic effects.

In collaboration with researchers in CoE RAISE Task 4.4 and the Icelandic National Competence Center (NCC) for High-Performance Computing (HPC), Treble used these experimental facilities to measure the acoustic response of a human analogue. This provided the data necessary for Treble to include directional effects in their virtual reality presentations, allowing their clients to make more informed decisions.

**Impact**

Feedback arising from the collaboration between Treble and CoE RAISE has been invaluable to RAISE T4.4, as it identified several improvements to our processes that are currently being implemented. Treble's use of the data collected during this collaboration demonstrates both that the data being collected by RAISE T4.4 is useful in traditional acoustic applications and that a thorough understanding of these listener-directional effects can markedly improve the quality and accuracy of virtual reality applications. The research aim of RAISE Task 4.4 is to study these effects, and ultimately produce an AI model that will enable others, who don't have access to similar experimental facilities, to incorporate this information into their own applications.

Contact: [coe-raise.eu](mailto:coe-raise.eu) | [raise\\_info@juelich.de](mailto:raise_info@juelich.de) | Follow us:

**Accelerating Hyperparameter Optimization of Deep Learning Models Using Performance Prediction and Quantum Computing**

**Challenge**

In CoE RAISE, we have seen that ML can unlock new potential in fields such as high energy physics (HEP), remote sensing, seismic imaging, additive manufacturing, and acoustics. Training Deep Learning (DL) models, however, is no trivial task, especially if the models are large and have many tunable hyperparameters. To tackle this challenge, Hyperparameter Optimization (HPO) can be used to systematically explore the search space of possible hyperparameter configurations. This tends, however, to be a very computationally expensive process as training the target model with a lot of different configurations is usually required.

**Solution**

Making use of novel approaches for HPO based on performance prediction strategies have potential to drastically speed up the process of improving DL models. We studied the suitability of using such new strategies for MLPF, a neural network for particle flow reconstruction that is being developed in CoE RAISE WP4 in Task 4.1 "Event reconstruction and classification at the CERN HL-LHC". To do this, we made use of High Performance Computing (HPC) resources to generate a dataset of MLPF learning curves, where we could test the performance predictors. In addition to using classical Support Vector Regression (SVR), a model that has been successfully used for performance prediction tasks in other studies, we collaborated with our colleagues in WP2 to train the performance predictors using an annealing quantum computer, the D-Wave Advantage™ System JUPSI at the Jülich Supercomputing Center. We successfully designed strategies to overcome some of the current limitations of quantum technologies for the task of learning curve prediction in HPO acceleration.

**Impact**

We demonstrated the strong potential of using performance prediction techniques for HPO, leaving the door open for the use of this technique in later HPO cycles of MLPF. We also showed that, despite the current limitations of quantum computers, it is possible to train SVR models on a quantum annealer while achieving performances comparable to those obtained with classical SVR techniques. This encourages further studies in utilizing hybrid quantum/HPC workflows for HPO as well as in other use-cases.

Contact: [coe-raise.eu](mailto:coe-raise.eu) | [raise\\_info@juelich.de](mailto:raise_info@juelich.de) | Follow us:

## 2 success stories (Flyer)

### Out of the collaboration with treble and CERN

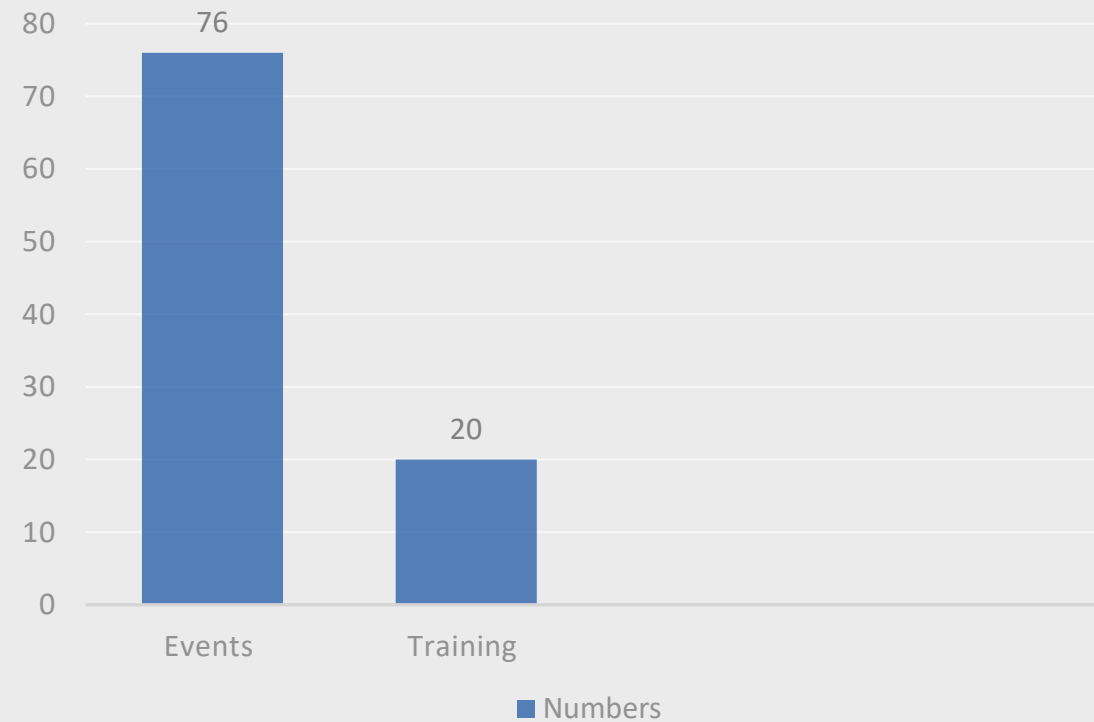
- Two good examples of how our work can be put into practice
  - Selectable on the website

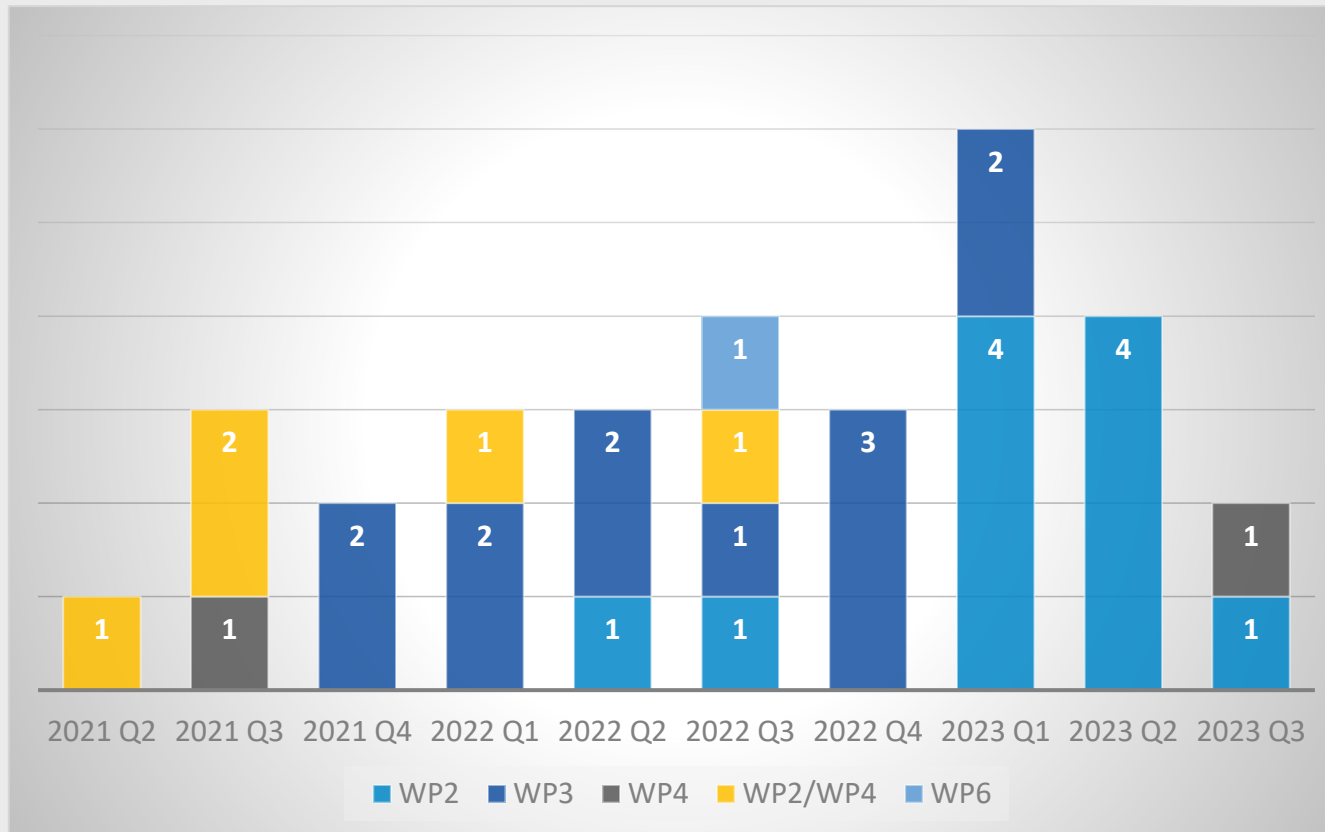
# Dissemination

# Events and training



Events and training numbers





## 34 publications

- 19 conference proceedings
- 15 journal articles

- ✓ Open access
- ✓ CoE RAISE acknowledgement

# All social media channels have a positive development this year as well



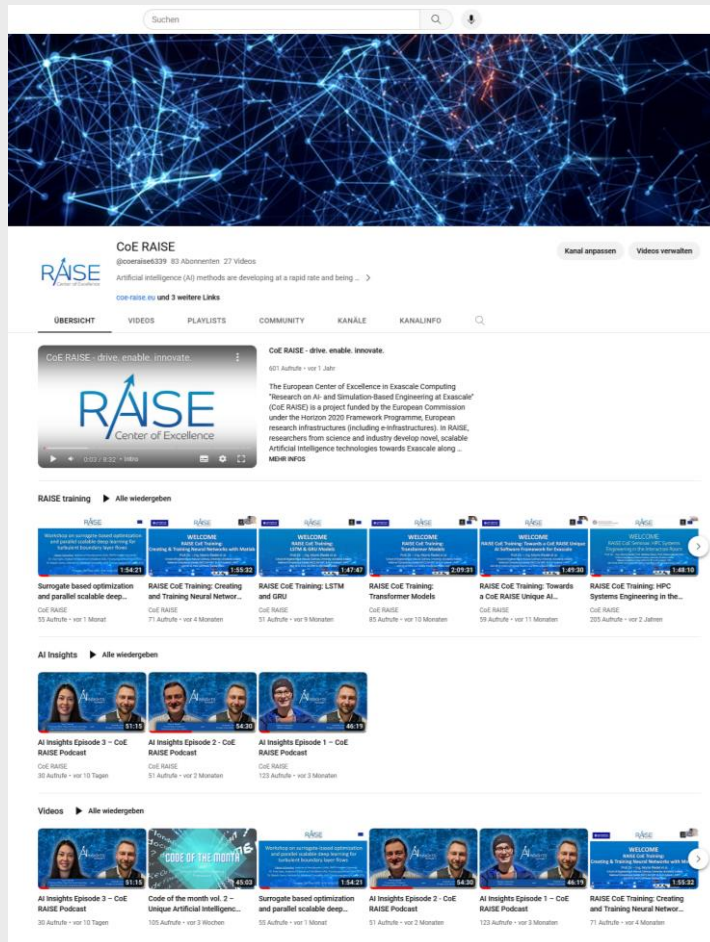
Social media	M1-M12	M1-M24	M1-31
LinkedIn	348 followers	611 followers	707 followers
Twitter	188 followers	299 followers	374 follower
Facebook	17 followers	51 followers	61 follower
YouTube	342 views	2522 views	3539 views
ResearchGate	824 reads	2623 reads	3035 reads
Medium	9 views	50 views	133 views

“My name is Andreas Lintermann and I’m the host of this show...”



3 episodes online  
1 episode in the making

# The RAISE video channel on YouTube now has...



26 videos | 83 Follower | ~3500 views

- The site is divided into the category Training and our podcast AI Insights
- Beside our own videos, EuroCC hosts the event series Code of the Month
  - We were part of the second volume and Morris gave an introduction to UAIF
- RAISE training with the topic "Accelerating ML with GraphCore" and our "Image Video" are the most clicked with over 600 views.
  - For this reason, the success story should be created, or even another training





# Key Performance Indicators

Key Performance Indicator	M 18 (mid-term report)	M 31 (All-Hands-Meeting)	Total target (by the end of the project)
Press mentions	30	42	40
Non-Scientific and non-peer reviewed publication	14	15	20
Project Fact Sheet	1	1	1
Website views	9,139 (M2 – M18)	12,125	12,000 total page views
Project presentations	52	75	70
Scientific publications	14	34	20
Employees Campaign	2	2	3

Next steps

# Keeping an eye on targets and turning the right screws

- Focusing on the results
  - UAIF
  - Open data
  - Success stories
- Better promote upcoming events
  - Send us the key data early
  - Possibly take a photo on site
  - Publish recordings on YouTube afterwards
- Possibly revise the structure of the website to make it cleaner and increase the number of visitors
  - Implementation of trainings and AI Insights videos

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