Second UK meeting on Enabling AI in HEP experiments and theory

University of Liverpool – September 2025

Minutes put together by Monica D'Onofrio with the help of an AI assistant using meeting caption notes from ZOOM and information on agenda.

This second workshop on Artificial Intelligence (AI)/Machine Learning (ML) and emerging technologies in particle physics, sponsored by SWIFT-HEP, built on the success of the first meeting at UCL in 2024. The goal was to bring together researchers across experiment, theory and also computing experts to review progress, identify barriers and opportunities for enabling AI in HEP, and plan how the community should position itself in relation to UK and European strategies. The workshop also aimed to connect with the recommendations of the community document *"Enabling AI for High Energy Physics Experiment and Theory."*

Morning Session: Strategy and Infrastructure

The meeting opened with **Monica D'Onofrio**, who recapped progress since 2024 and outlined the aims of the day, followed by **Davide Costanzo** reporting on progress and challenges since the last meeting. **Monica** and **Caterina Doglioni** reported from EUCAIF and the European Strategy update, stressing that the UK must remain visible in European AI/HEP discussions. Coordinated participation in ECFA's AI activities and the EUCAIF forum will be crucial to ensure the UK's role is recognised in future planning.

Mark Wilkinson and **Valerie Farr** presented on and discussed the **STFC AI strategy** and the current status of AI initiatives within STFC. He noted the UKRI's broader AI strategy, upcoming cross-council programmes, and highlighted the need for physics to present a clear, distinctive narrative on where AI adds value. **Katherine Rooke** (UKRI) reinforced that AI is one of the government's highest R&D priorities, and encouraged the community to make strong, evidence-backed cases for funding, with well-developed use cases, impact pathways, and industry links.

David Britton introduced **ICEFLOE**, a proposed UK-wide initiative to coordinate AI and computing for HEP. ICEFLOE would complement existing infrastructure such as GridPP and IRIS, but focus specifically on emerging challenges: AI/ML operations, integration with HPC, sustainability, and connections to quantum computing. This proposal generated discussion about the importance of not treating AI in isolation but embedding it within a broader UK computing strategy.

The morning closed with an open discussion on the **opportunity and funding landscape**, covering STFC/UKRI schemes, cross-council initiatives (AI, exascale computing, sustainability), and potential international collaborations. The need for community-wide coordination and proactive engagement with these opportunities was emphasised. Participants discussed the idea of having a clear **delivery plan for AI in HEP** (as suggested by STFC/UKRI representatives) so that funders and policymakers can clearly see the UK community's ambitions and requirements. This was widely agreed as a good outcome (see below). The ICEFLOE idea generated consensus although details should be further discussed within the community i.e. through PPAP - it was noted that a presentation on it at the CAP meeting in November is planned and it might be beneficial having a position document alongside the presentation at that time.

Afternoon Session: Use Cases, Sustainability, and Wider Engagement

The afternoon turned to physics-driven use cases and broader perspectives.

- **Alex Tapper** presented collider applications, focusing, among other things, on physics analysis improvements, ML for operations and FastML and related efforts. AI has shown significant potential in real-time triggering, event reconstruction, and analysis acceleration. These were highlighted as **strong candidates for flagship use cases** that could demonstrate UK leadership. In

the same session, **Joe Egan** presented **chATLAS,** *an AI Assistant for the ATLAS Collaboration* at CERN. The idea of chATLAS is to provide ATLAS collaborators with a quick and comprehensive access to the large amount of diverse documentation and info from ATLAS. It uses vector embeddings to fetch relevant documents and then runs LLM to generate responses. A demo version was launched in 2023 and more work is in progress to add more data sources and deal with issues and current limitations. A second version already shows considerable improvements. Pros and cons of using these tools in HEP have been discussed.

- **Andrew Chappell** described **neutrino physics applications**, where AI is helping to tackle reconstruction challenges and enable real-time processing. The neutrino community is already making progress but requires greater cross-talk with collider and theory groups to share methods.
- **Kirstin Lohwasser** and **Caterina Doglioni** led a session on **sustainability**, drawing attention to the growing energy footprint of HEP computing and the need for greener practices. They referenced initiatives such as Green Algorithms and the Software Sustainability Institute, and called for the HEP community to actively contribute to energy efficiency goals and carbon reduction.
- **Gurtej Kanwar** provided the **theory perspective**, focusing on generative models, surrogate simulations, and the opportunities AI offers for lattice calculations and theoretical modelling. He argued for stronger bridges between theory and experiment, so that methodological advances can be shared more effectively.
- **Gabriel Facini** discussed **industry engagement, training, and knowledge exchange**. He stressed that researchers with advanced AI skills are highly sought after outside academia, and without clear career pathways many leave the field permanently. This talent drain was seen as both a challenge and a motivator for building better industry links, knowledge-exchange pathways, and training opportunities that serve both HEP and wider society.

Wrap-Up Discussion

In the final discussion, participants reflected on the scope and aims of the AI HEP UK group. Several recurring themes emerged:

- The need for setting up a **delivery plan** for AI in HEP was strongly encouraged by STFC/UKRI and was broadly agreed to be essential, to align the community's priorities with funding agencies, UK government and European strategies. This should include clear flagship projects and demonstrators.
- **Infrastructure coordination** through initiatives like ICEFLOE is crucial to integrate AI, Grid, HPC, quantum, and sustainability into a coherent national framework. **Sustainability** must be addressed head-on, not only in hardware and data centres but also in software engineering and ML-Ops practices.
- **Skills and training** remain a pressing challenge: supporting early-career researchers in fellowship applications, expanding AI-focused doctoral and CPD opportunities, and ensuring staff capacity for reviewing and mentoring.
- **Industry engagement** is a priority, both for knowledge exchange and for career development of young researchers.
- Finally, there was consensus that **community cohesion** is vital. Collider, neutrino, and theory groups — as well as computing specialists — must coordinate more effectively, while also maintaining strong ties to international initiatives such as FastML, COST Actions, and EUCAIF.

Key Outcomes and Actions

1. Draft a **delivery plan for AI in HEP**, aligned with UKRI and European strategies, to be circulated before upcoming advisory panels.
2. Support development of **ICEFLOE** as a coordinating structure embedding in some way the UK AI/computing in HEP. Details should be further discussed within the community i.e. through PPAP.

The preparation of a position document alongside the presentation foreseen for CAP meeting in November should be discussed in the short-term.

3. On the short-term, assign as a task (i.e. to a team of representatives from various communities) to create an **easy-accessible documentation about available resources and examples of how to (successfully) request resources.**
4. Identify and develop **flagship use cases** (e.g. AI for triggers, real-time experiment operations) as demonstrators for funders and stakeholders.
5. Contribute to **green computing initiatives** and embed sustainability practices in HEP AI development.
6. Expand **skills and training provision**, with targeted support for ECRs applying for fellowships, and new training opportunities linked to industry needs.
7. Build **stronger partnerships with industry** for knowledge exchange, co-development of tools, and alternative career pathways.
8. Improve **intra-UK communication** between HEP subfields and computing groups, and encourage UK participation in international networking efforts such as COST Actions.

The workshop closed with agreement that coordinated action, sustained follow-up, and effective communication of the UK's ambitions in AI for HEP are essential. The community is well placed to influence national and international strategies but must speak with one voice and demonstrate impact through concrete projects and partnerships.