AI for Particle Physics in UK

Blueprint Workshop:
Towards a National-Scale AI Collaboration in HEP

18 May 2026

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A brief overview of HEP funding in the UK

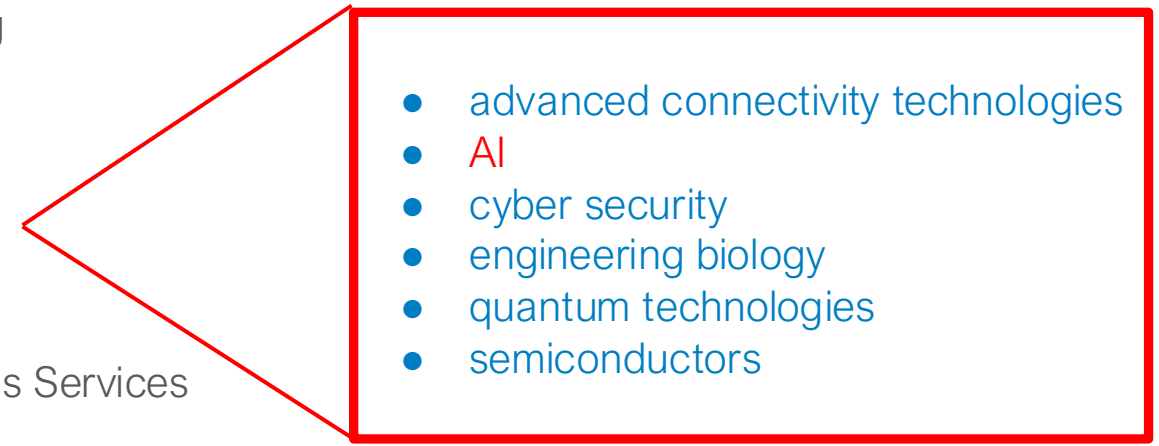
Department for Science, Innovation and Technology (DSIT)

Particle Physics, Astronomy, Nuclear (PPAN)

- New funding model based on 4 “buckets”
  1. Curiosity driven research
  2. Strategic government and societal priorities
  3. Support innovative companies
  4. Enabling and strengthening UK R&D
- Most HEP funding via STFC
  - Bucket 1 funding
  - Shape of buckets 2&3 evolving
  - Occasional cross-cutting initiatives funded higher up
- PPAN funding prioritisation under review

UK Government Priorities

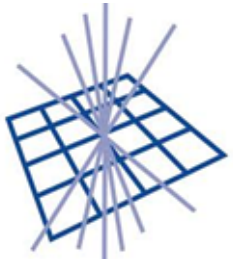
- UK Government Strategy focusing towards industrial return. Key driver for UKRI
- Focus around eight sectors (IS8)
  - Advanced Manufacturing
  - Clean Energy Industries
  - Creative Industries
  - Defence
  - Digital and Technologies
  - Financial Services
  - Life Sciences
  - Professional and Business Services



- UKRI strategy towards IS8 (Industrial Strategy) and in particular AI is evolving
- How STFC will engage with IS8 is evolving. Scope to influence how this works.
- AI funding will largely be organized in a cross council way, following UKRI strategic priorities and thematic programmes, and will not follow the model of current Particle Physics funding which is handled by STFC.
- Scope for strategic influence and collaboration to emerge from this workshop

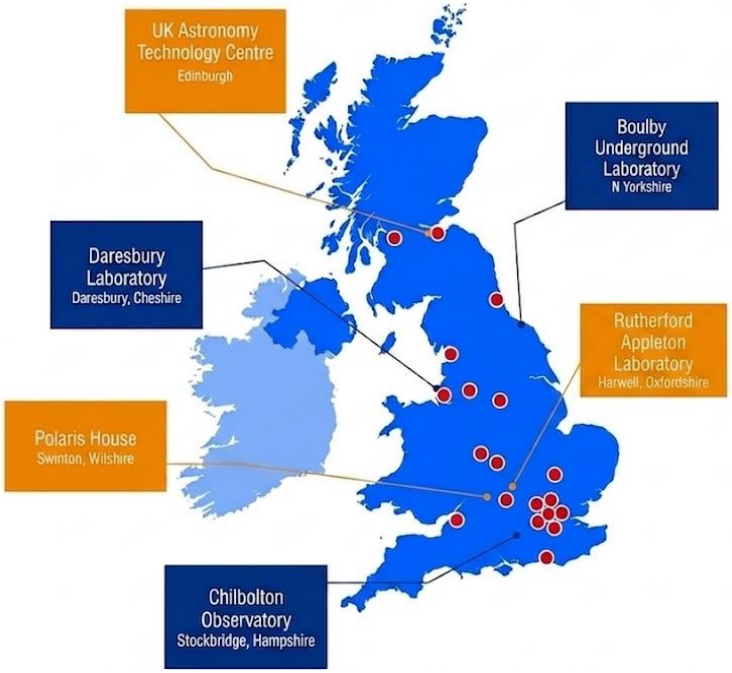
Funding for HEP software and infrastucture

- HEP software initiative:
  - SWIFT-HEP, 2020-25, STFC funded
- And other smaller cross-cutting initiatives (UKRI funded)
  - E.g. ExaTEPP (part of ExCALIBUR), CCP-TEPP (part of CoSeC), ShareING, …
- Physical compute infrastructure
  - GridPP (LHC, part of WLCG)
  - DiRAC (theory, lattice, cosmology, etc)
  - IRIS (smaller experiments, astro, etc)
- No Exascale HPC facility exists (yet)
  - Some AI dedicated facilities exist
  - Plans to expand them



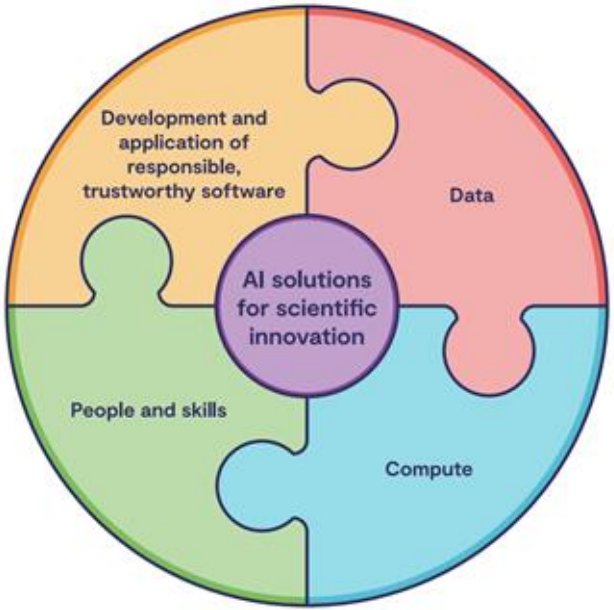
DiRAC

STFC funded National Laboratories & University Departments



The AI strategy documents

- Government AI for Science Strategy (link) with 3 pillars
  - Data, Compute, People and Culture
  - Priority areas aligned with the government industrial strategy
- STFC AI strategy (link)
  - Strategic goal 1: Using AI to productively advance STFC's science, technology, engineering and innovation, maintaining our status and influence as a world-leading R&I organisation and simultaneously driving AI innovation
  - Strategic goal 2: Securing the health of the AI ecosystem in collaboration across UKRI and the wider R&I ecosystem
  - Strategic goal 3: Enabling organisations across the UK to harness the potential of AI to solve real-world challenges
- HEP strategy needs to fit within this framework
  - The importance of HEP science is emphasized



AI4HEP Community initiative

- Three workshops on AI for HEP (2 were sponsored by SWIFT-HEP)
  - Oct 2024 at UCL (link) → Short document written as a summary (link)
  - Sep 2025 in Liverpool (link) → Led to a short-term funded project
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- Summary document written at the first workshop in CDS
  Findings (9) and recommendations (17)

  1. UK must adopt a strategic approach to AI for HEP, including sustained funding, skills development, talent retention, knowledge transfer, industry collaboration, and participation in global AI-initiatives.

  3. Establish a regular forum for discussing common barriers, challenges, and opportunities in AI across the HEP field.

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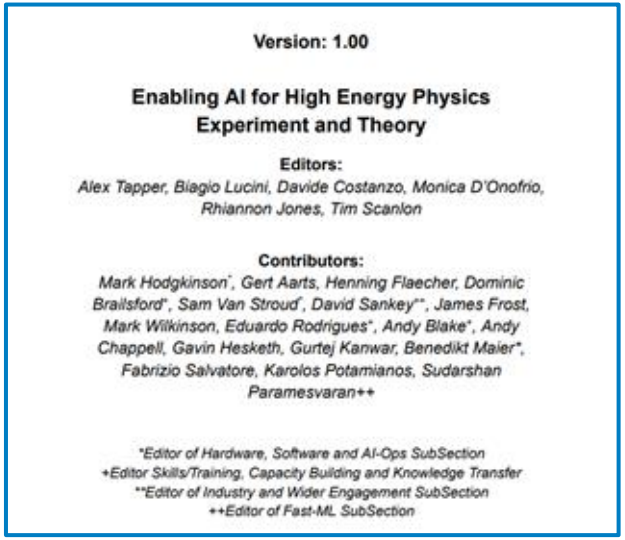
- Highlight the importance of a community driven approach



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Enabling AI for High Energy Physics Experiment and Theory

Editors:

Alex Tapper, Biagio Lucini, Davide Costanzo, Monica D'Onofrio, Rhiannon Jones, Tim Scanlon

Contributors:

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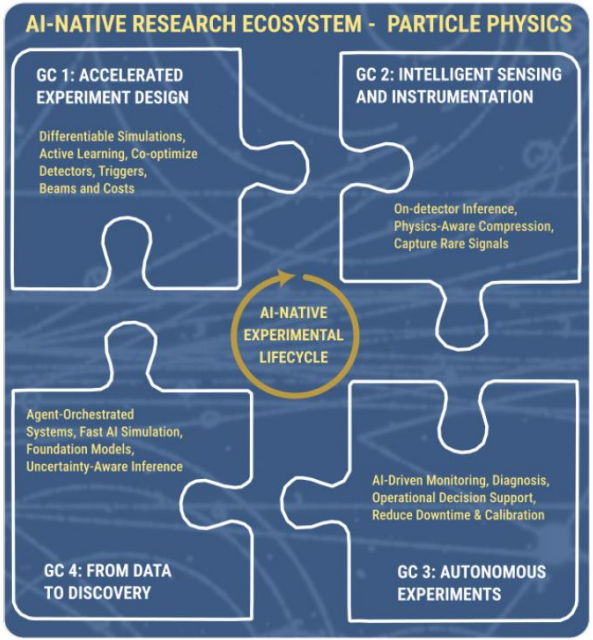
- Preparing **Evidence Note and Delivery Plan** from latest workshop

Span of UK AI topical activities

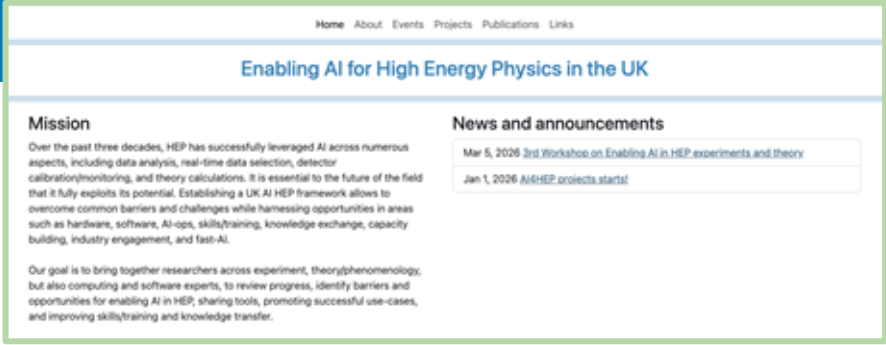
- UK Particle Physics AI activities in ATLAS, CMS, LHCb and DUNE
- Broad areas of experiment activity:
  - physics object reconstruction
  - identification and calibration
  - real-time event selection
  - pattern recognition for event classification
  - uncertainty evaluation
  - event selection
  - background modelling
- Theory (Lattice QCD) & Phenomenology
- Much of this fits nicely into the vision in “Building an AI-native Research Ecosystem for Experimental Particle Physics: A Community Vision” whitepaper.



AI4HEP Initiative, scoping projects

- Short term “scoping” project funded in FY2025-26 (7 mini-projects funded 17 submitted)
  - *Cross-experimental Tools and Open-source Datasets* Jackson Barr (UCL) link
  - *AI Inference as a Service deployment at a WLCG Tier-2* Bruno Borbely (Glasgow) link
  - *Smart Monitoring: AI-Driven Analysis of Distributed Systems* Robert Fay (Liverpool) link
  - *FastML tools, studies and plans* Lauri Laatu (Imperial) link
  - *PHAZE-1: Validating Early Predictive Sufficiency for Low-Latency Foundation Models* - Pratik Javahar (Manchester) link
  - *Pandora Deep Learning for Interaction Vertex Reconstruction in LAr neutrino detectors* - Alex Moor (Sheffield) link
  - *AI-enhanced 2D to 3D pattern recognition in LArTPCs* Isobel Mawby (Lancaster) link

Where do we go from here?



- Community initiative is well underway
  - 3 community workshops, plus a follow-up
  - Website and mailing list for communication
  - Sharing of tools and ideas across experiments
- The UKRI programme manager:
  - AI funding calls should be coming soon via **discipline agnostic** calls
- We need
  - Sustained postdoctoral support
  - Shared Research Software Engineering expertise to transform HEP-developed pipelines to UKRI priority applications
  - Computing infrastructure that works for experiments
- Most importantly, we need to make the case for AI use in HEP and the impact it can generate
  - **We can certainly learn from the USA experience along others**

Summary

- UK people working on AI mostly in LHC and neutrino experiments
- The UK community is organizing through AI4HEP
- UKRI Funding structure and strategic approach is evolving. Opportunity

- Strategic discussions at this workshop of great interest
- Potential collaborations

- UK people here Davide Costanzo and Claire Shepherd-Themistocleous (leave Thursday). Online Monica D'Onofrio.

Backup

What can particle physics do for AI?

Referring to the UKRI pillars:

1. Technology development
   Decades of expertise processing, filtering and analysing large datasets.
1. Sustainable and efficient AI
   Sustainable (white papers, HECAP+ link). Efficient AI (is that a trigger?) .
1. AI for research (AI for science)
   Unique very large-scale well curated datasets for AI development, training and testing (beyond what is being done on language models)
2. Innovation and adoption
   Several example of how using AI/ML tools improved physics performance well beyond expectation (e.g. Flavour Tagging, testing of fundamental AI scaling laws using jet data at LHC)
1. Responsible AI
   Physics requires **rigorous uncertainty quantification**, making the HEP community a vital testing ground for "Responsible AI".
1. Skills and talent
   Excellent track-record of skills training in this area and talent-pipelines seeding many areas
   Incredibly successful Centres for Doctoral Training (UCL, Liverpool, …) spanning from HEP to Accelerator Science and Astro. Extends beyond AI4HEP. And **collaboration with industry**

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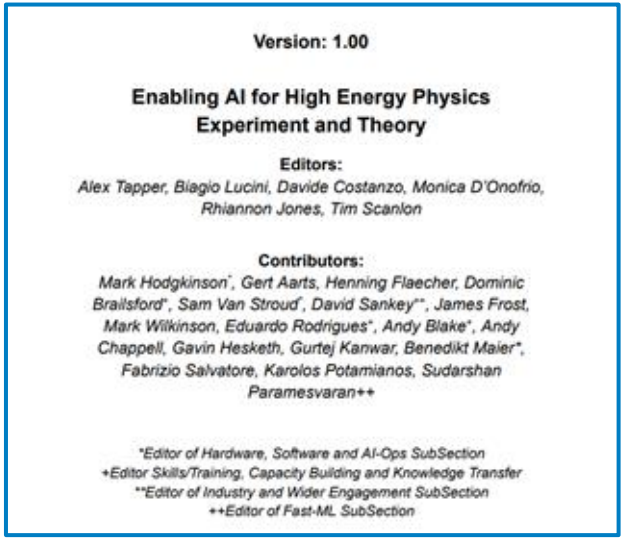

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