Impact assessment- collider GPDs

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Introduction

- Energy-frontier exploration at the (HL-)LHC with the ATLAS and CMS detectors represents a large part of the UK PP community (~500 physicists, engineers, technicians, admin staff + O(150) students).
- Funding comes through CG and project grants (ATLAS phase II upgrade, CMS phase II upgrade).
- International agreements are negotiated via MOUs (M&O) and deliverables reviewed on a regular basis.
- For a recent detailed discussion of our commitments, contributions, scientific impact and leadership see slides by Monica for the 2024 r-ECFA visit to the UK.
- **Coordinated responses by the projects to recent announcements are being discussed within the communities**- these slides will focus on over-arching considerations and avoid project-specific details.

High-level narrative

Delivering and exploiting the HL-LHC is the highest international priority for particle physics for the next two decades as highlighted in the recent 2026 ESPP process. The energy frontier programme at ATLAS and CMS provides a world-class training pipeline for UK researchers and drives innovation in instrumentation, computing and AI. Proposed reduction in the GPD programmes would compromise UK capacity to scientifically exploit these datasets, diminish our return on investment and undermine the UK's leadership and respected position in the international community. More existentially, UK contributions to ATLAS and CMS are critical for the success of the HL-LHC programme so reducing these contributions could put these international programmes at risk.

Impact assessment in a nutshell

Capability impact

- Reduce capacity to maximally exploit HL-LHC datasets when legacy results will be generated.
- Irreversible loss of skills and expertise.
- Detrimental effect on training and career pipeline for ECRs.
- Loss of innovation in data-analysis/AI/computing.

Strategic impact

- Undermine UK's position to influence future projects (e.g. FCC) and their industrial returns.

Reputational impact

- Loss of international leadership and influence.
- Failure to meet international commitments.

This narrative will evolve based on discussions today and further input from the community- thanks to all who have contributed so far!

Backup

Further details on impact assessment

•Weakening of UK's leading role and return on investment from current/future flagship global projects

•HL-LHC is the highest international priority for particle physics for the next two decades, stressed and reiterated by the ESPP2026. Failure to fully deliver and exploit HL-LHC undermines the UK's position in shaping future global projects (e.g. FCC or alternatives).

•The cumulative effect is a **long-term downgrading of the UK's role** from leader to marginal participant.

•Loss of international leadership and influence

•The UK has been consistently world-leading in ATLAS and CMS for decades, providing spokespersons, physics coordinators, collaboration board chairs, project leaders, and run coordinators.

•Funding-driven withdrawal or partial delivery of upgrade commitments will rapidly erode UK credibility as a reliable international partner, reducing the UK's influence over detector design, physics priorities, and governance.

•This loss of standing is particularly damaging at a time when the UK holds exceptional visibility at CERN, including leadership at the highest level.

•Failure to meet international commitments

•The HL-LHC upgrade programme is governed by binding international MoUs.

•Constrained funding will imply that the UK will be unable to meet some agreed commitments, in some cases jeopardising the entire HL-LHC (if not built, the experiment will not run!).

Further details on impact assessment

- **Irreversible loss of skills and expertise**
- UK particle physics relies on a **highly specialised workforce** of physicists, engineers, technicians, and software experts whose skills are not rapidly replaceable.
- Gaps in funding lead to **loss of expert personnel**, fragmentation of teams, and permanent exit from the field — effects that cannot be reversed on policy-relevant timescales.
- This is especially acute for detector experts and computing specialists central to HL-LHC operations.

- **Severe impact on training and early-career pipeline**
- The UK ATLAS and CMS programmes support **hundreds of PhD students and early-career researchers**, with upgrade and operations activities providing critical hands-on training.
- Reduced scope in upgrades and operations directly translates into **fewer PhD and PDRA opportunities**, weakening the national skills pipeline.

-> This risks a generational gap in expertise precisely when HL-LHC demands peak capability.

- **Loss of innovation in data, computing, and AI**
- UK groups are leaders in **ML, AI-driven reconstruction, trigger-level analysis, and advanced computing frameworks**, with applications extending well beyond particle physics.
- Contraction of the programme will stall innovation in **fast-ML, real-time inference, large-scale data processing, and AI-enabled detector operations**.

-> This undermines alignment with UK strategic priorities in AI, data science, and digital

- Current pressures risk a **narrowing of the HEP programme** as a whole, reducing resilience and the ability to respond to new discoveries or strategic opportunities.

-> Once lost, this breadth cannot be rapidly rebuilt.