

PPAP Roadmap input: FCC

October 2020

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The recent update of the European Strategy for Particle Physics (ESPPU) identified an electron-positron Higgs factory as the highest-priority next collider and recognised the importance of R&D towards a future hadron collider of the highest achievable energy [1]. The FCC project encompasses both these goals, and indeed the ESPPU states: “*Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage. Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update.*”

We, as representatives of the UK experimental and theoretical High Energy Physics groups, and accelerator community, are writing to signal our enthusiasm for the FCC [2] and to indicate the possibilities for UK engagement in the areas of detector development, phenomenology and accelerator contributions. This brief document is expanded on in three parallel submissions, focused on the electron-positron (FCC-ee) [3], hadron collider (FCC-hh) [4] and electron-proton (FCC-eh) [5] opportunities.

The exact nature of the FCC programme will depend on our evolving understanding of the physics landscape, and also has a dependency on developments on other high-energy collider projects outside Europe, such as the ILC in Japan. The immediate priority of elucidating the nature of the Higgs boson in an e^+e^- collider can be realised at either the ILC or the FCC-ee, which necessitates a programme of detector R&D with requirements that are largely common between the two projects. The European goal of a 100 TeV proton collider at CERN requires its own detector and accelerator studies that must begin now, and also presents opportunities for engagement with the machine challenges which should be seriously considered by UK institutes and industry. Aside from the Higgs studies, the FCC-ee also offers the exciting possibility of ultra-precise measurements of the properties of the Z and W bosons, as well as in flavour physics, that does not exist at the ILC. Finally, the option exists, with the FCC-eh, to study electron-proton collisions at 3.5 TeV concurrently with FCC-hh operation. All of these projects will greatly benefit from the committed involvement of the UK theory community.

[1] 2020 update of the European Strategy for Particle Physics, [CERN-ESU-013](#).

[2] FCC Conceptual Design Report, vols 1-3, [EPJC 79 \(2019\) 79](#), [EPJC 228 \(2019\) 261](#), [EPJC 228 \(2019\) 755](#).

[3] PPAP Roadmap Input: FCC-ee.

[4] PPAP Roadmap Input: FCC-hh.

[5] PPAP Roadmap Input: FCC-eh – Electron Hadron Scattering at the Energy Frontier

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