

Chapter 5: Leapfrogging into the future

Messages transmitted

- Open questions in particle & fundamental physics in the post-LHC landscape. The chapter discusses the deeper questions that we face today along with theoretical and experimental evidence for the existence of new physics beyond the Standard Model.
- Answering the big open questions about our Universe calls for synergies with other fields beyond HEP including astrophysics and cosmology. It also demonstrates how progress in particle physics could have tremendous impact on the other fields contributing to understanding about the origin as well as the future of our Universe.
- Acknowledges the involvement of three distinct communities -theorists, experimentalists, engineers/technicians working in instrumentation - who collaborate in the development of new scientific tools that could keep us in the path of discovery. Progress in science calls for unity among the different communities.
- Underlines the physics motivation for designing a post-LHC large-scale research infrastructures. The chapter focuses on the FCCs as a facility that offers the most diverse research programme in particle physics over the 21st century.
- The challenges and opportunities during the development of Conceptual Design Report and a **feasibility study**. Lessons from the first phase of the FCC CDR and the ongoing feasibility study can be useful for other Big Science facilities envisions in other fields.:
 - Technological Developments [here we need/can add references to Chapter 4]
 - Derives on a number of lessons derived during the first phase of the FCC study that led to the publication of the CDR and the mandate of the recent update of the EPPSU for preparing a feasibility study. Key message behind this is the need to establish an open and diverse collaboration, a balance between traditional and new players as well as the involvement of industry and academia from an early stage in the lifetime of such long-term projects.
 - Address the broader socio-economic impact of such large public investments. This should also be addressed from an early stage in the design phase of a future Big Science facility. The chapter will discuss lessons from a Cost-Benefit Analysis (CBA) performed for LHC/HL-LHC and guidelines for designing a CBA for FCC

Chapter 5: Summary Status

- Our estimate of current level of completion: 90%
- The following additions/revisions will be completed by July 31st
 - Revision of lessons and opportunities to ensure that they can apply beyond the context of FCC.
 - Possibly elaborate on the socio-economic impact lesson.
 - Briefly (& more clearly) mention the role of EU H2020 projects that supported the work of the FCC collaboration including EASIttrain, EuroCirCol, RI-PATHS, ARIES a.o
 - Adapt to further comments from the reviewers