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Title: FCC physics studies

The HEP@VUB centre has been involved with the physics studies on the Future Circular Collider (FCC). This project uses a staged approach, in which a new, 100-km tunnel is first used for electron-positron collisions (FCC-ee), after which the complex is upgraded to collide hadrons (FCC-hh). The FCC-ee will offer the first chance to study the Higgs boson and top quark in a well-understood and very clean environment, with no pileup and no underlying event, as is the case in hadron colliders. It is of the utmost importance that the international community **undertakes studies that determine the sensitivity of the FCC-ee to the most relevant physics scenarios in as much detail as possible and projections to the detector and accelerator performance necessary to achieve this sensitivity.**

The measurement precision for processes involving Higgs bosons and top quarks at the FCC-ee will depend on the detector technology. **It is particularly relevant that these studies start utilizing the modern analysis techniques currently used at the LHC to evaluate the physics reach of the FCC-ee**, as most available FCC studies available now rely on reconstruction techniques that are effectively the same as the state-of-the-art at the end of the LEP era. Should a linear electron-positron collider be chosen in the future, the detector technology and physics simulations of this proposal could be adapted for another lepton collider project as well. The detailed studies will be essential to move the field of particle physics forward beyond the European Strategy and will givea Marie Curie Individual fellow a substantial influence and visibility to contribute the exciting choices that will be made in international particle physics in the coming years.

It is important that there is feedback between the detector R&D communities and the physics-measurement communities so that well-informed decisions can be made regarding the detector technology pursued at any electron positron collider. A successful Marie-Curie Individual Fellow will endeavor on further study of the Brout-Englert-Higgs mechanism at electron positron collider machines as the primary goal. The presence of a phenomenology group and strong CMS presence will be essential to achieve these studies successfully. The development of new analysis techniques to study Higgs bosons is will be an important facet when considering possible different detector technologies. The Higgs boson decays 58% to bottom-quark pairs and highly efficient identification of these particles is key. **There is substantial world-class expertise in this topic at the HEP@VUB research centre, and the secondary goal of this proposal is to translate the heavy flavor identification expertise at the VUB towards future colliders**.

Supervisor: Freya.Blekman@vub.be

Research Group: https://www.iihe.ac.be/

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