

News - Physics Performance, Sep 25, 2023

P. Azzi (INFN – PD), E. Perez (CERN)

Mid-term review report

1st draft of the PED chapter delivered to the scientific advisory committee (SAC) about two weeks ago

- also to the conveners of the working groups
- earlier draft of the detector requirements section had also been sent early August to the authors of notes that we use in the report; not much has changed since then
- About 75 pages w/o the bibliography
- Positive feedback from the SAC – well written, progress made.

Our section is to be frozen tomorrow evening !

- Most remaining updates have been done in the last days
- Delivery of the complete report (all chapters) to the SAC on Oct 5

Many thanks to everyone who has been involved !

Plan is to make this report publicly available at some point, e.g. in CDS.

PED chapter: table of contents

◆ Table of content of the mid-term PED chapter (60 pages expected, 73+27(refs)+2(toc) delivered)

1	Overview	4	32	4 Detector requirements	39
2	1.1 FCC-ee: A great Higgs factory, and so much more	5	33	4.1 Introduction	39
3	1.2 FCC-hh: The energy-frontier collider with the broadest exploration potential	11	34	4.2 Machine-detector interface	40
4				4.3 The current detector concepts	41
5	2 Specificities of the FCC physics case	12	35	4.3.1 The IDEA detector concept	41
6	2.1 Characterisation of the Higgs boson: role of EW measurements and of FCC-hh	13	36	4.3.2 The CLD detector concept	41
7	2.1.1 Impact of Z-pole measurements in Higgs couplings determination	15	37	4.3.3 A third concept with a noble liquid electromagnetic calorimeter	42
8	2.1.2 Impact of diboson measurements in Higgs couplings determination	16	38	4.4 Measurement of the tracks of charged particles	42
9	2.1.3 Complementarity and synergy between FCC-ee and FCC-hh	17	39	4.5 Requirements on the vertex detector	46
10	2.2 Discovery landscape	19	40	4.6 Requirements on charged hadron particle identification	52
11	2.2.1 BSM discovery potential	19	40	4.7 Requirements on electromagnetic calorimetry	56
12	2.2.2 Dark Sectors	21	43	4.8 Requirements on the hadronic calorimeter	63
13	2.2.3 Search for Heavy Neutral Leptons	23	46	4.9 Requirements on the muon detector	65
14	2.2.4 Complementarity and synergy between FCC-ee and FCC-hh	24	47	4.10 Precise timing measurements	66
15	2.3 Flavour advancement	25	48	4.10.1 Time-of-flight measurements	67
16	2.4 FCC-hh specificities compared to lepton colliders	27	50	4.10.2 Time measurements very close to the IP	67
17	2.4.1 Generalities	28	51	4.10.3 Time measurements in the calorimeters	68
18	2.4.2 Resonance searches	28	51		
19	2.4.3 Pair production of new particles	30	52		
20					
21	3 Theoretical calculations	31		5 Outlook and further steps	68
22	3.1 Electroweak corrections	32	53	5.1 Software and Computing	70
23	3.2 QCD precision calculations	33	54	5.2 Physics Performance	71
24	3.2.1 QCD studies in $Z/\gamma^* \rightarrow$ jets	34	55	5.3 Detector Concepts	72
25	3.2.2 QCD aspects of Higgs physics	35	56	5.4 Centre-of-mass energy calibration, polarisation, monochromatisation (EPOL)	73
26	3.2.3 QCD modelling of the top-quark threshold	36	57	5.5 Machine-Detector Interface (MDI)	74
27	3.3 Monte Carlo event generators	36	58	5.6 Physics Programme	74
28	3.3.1 QCD aspects	36	59	5.7 FCC-hh	77
29	3.3.2 QED aspects	37			
30	3.4 Organization and support of future activities to improve theoretical precision	38			

FCC notes

FCC notes that serve as complementary material to the report: have been submitted to the (new) CDS system.

- So far, the notes are available to the PED coordination group and to the SAC.
- Will become public to the FCC community

CDS will be used to collect documentation on our studies beyond the mid-term report. Instructions to submit a FCC note to CDS:

https://docs.google.com/document/d/17pZmNR3ny3yHospsMrQLYkPO6l89Y_zF-SS6OhC-wtl/edit

CDS team is happy to get feedback to help improve the system. Have been very reactive in fixing the issues that we reported

- FCC is the first 'user' of the new-CDS system !

Next meetings and (some) events of interest

- Detector concept meeting on Oct 9
- Higgs WG meeting also on Oct 9
- Future Colliders for Early-Career Researchers (ECFA ECR panel), Sep 27
 - <https://indico.cern.ch/event/1293507/>
 - Hybrid CERN/zoom, poster session
- 2nd Higgs/EW/Top factory ECFA workshop, October 11-13, Paestum (Italy)
 - <https://agenda.infn.it/event/34841/>
 - Especially young people are encouraged to attend (low fees).
- 8th FCC Physics workshop, Annecy (France), Jan 29 – Feb 2
 - Plan is to have parallel sessions.
- ECFA seminars / workshops of interest :
 - List collected here <https://indico.cern.ch/category/14055/>

Today's agenda and next meetings

14:00 → 14:10 **News**

Speakers: Emmanuel Francois Perez (CERN), Patrizia Azzi (INFN Padova (IT))

14:10 → 14:30 **PID studies in Bs -> Ds K**

Speakers: Andrea Coccaro (INFN Genova (IT)), Fabrizio Parodi (Università degli Studi e INFN Genova (IT))

14:30 → 14:50 **Updates to the HNL -> mujj analysis**

Speakers: Giacomo Polesello (INFN, Sezione di Pavia (IT)), Nicolo Valle (INFN Sezione di Pavia (IT))

Next Physics Performance meeting : October 16 or 23, t.b.c.