

News - Physics Performance, June 27, 2023

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Reminder: timelines

A very tight schedule!

- **First draft is expected by June – around the FCC Week 2023**

- ◆ To allow for internal review and corrections over summer

- This is exactly ~~four~~ months away



- **Our mid-term deliverable will be covered in a ~60-page report (with flexibility)**

8. Physics & Experiments	C. Grojean, P. Janot, M. Mangano	8.1 Overview
		8.2. Documentation of the specificities of the FCC-ee and FCC-hh physics cases.
		8.3 Strategic plans for the improved theoretical calculations.
		8.4 FCC-ee Detector Requirements.
		+ Preliminary detector costing (tbc)

- ◆ The report will address the key question in a concise, albeit comprehensive way

- It will include links to supplementary material
 - Several FCC Notes to be written ahead of the report itself
 - Your plans towards these FCC notes is very much welcome (starting today)

Next:

- All deliverables available in **final form** to the SAC by end of Sep
- SAC report available to the SPC end of Oct

- Early drafts of the analysis notes were expected by end of April.
- Will be reviewed / approved, and ultimately submitted to arXiv or to a journal

Updated timeline

- A first complete draft of the PED chapter by the end of July
 - EP & PA edit the “Detector requirements” section
- FCC notes that serve as complementary material to the report ready and submitted to Zenodo by the end of June
 - 1st set of instructions here:
<https://twiki.cern.ch/twiki/bin/view/FCC/Zenodo>
 - Some clarifications to Panos have been asked (e.g. which “community”, etc) will send more details in a few days
 - Idea: people upload their note draft to Zenodo; the note remains restricted at that point; some review; once “approved” the note becomes public

Luminosities: revised numbers !

- **Luminosity / IP has decreased at all energies since the CDR**
 - ◆ The ring shrank from 100 km to 90.7 km
 - ~10% luminosity reduction
 - e.g, from 230 to ~210 $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ at the Z pole
 - ◆ The number of IPs moved from 2 to 4 in the baseline
 - Gu-estimated reduction factor of 0.85 at each IP (with respect to 2 IP)
 - e.g, from 210 to 180 $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ at the Z pole: almost 10^{13} Z and $2 \cdot 10^6$ ZH with 4 IP
 - ◆ These numbers were shown by Fabiola at the BNL P5 meeting
 - We had agreed with Michael and Tor to freeze these numbers for the mid-term review report
 - ◆ Instabilities were discovered (too short lifetime), and lattice was fixed for the FCC week
 - With 2 IP and 4 IP (more severe with 4 IP)
 - Reduction from 180 to 140 $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ at the Z pole (4 IP)
 - Reduction from 210 to 180 $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ at the Z pole (2 IP)
 - These numbers were shown to the SAC, and “approved” (in spite of the previous agreement)
 - ◆ For the sake of internal consistency, we must align for PED estimates in mid-term report

Luminosities: numbers to be used for the mid-term report

Table 1 The baseline FCC-ee operation model with four interaction points, showing the centre-of-mass energies, instantaneous luminosities for each IP, integrated luminosity per year summed over 4 IPs corresponding to 185 days of physics per year and 75% efficiency, in the order Z, WW, ZH, $t\bar{t}$. The luminosity is assumed to be half the design value for machine commissioning and optimisation during the first two years at the Z pole, the first two years at the WW threshold, and the first year at the $t\bar{t}$ threshold. (Should the order of the sequence be modified to either Z, ZH, WW, $t\bar{t}$ or ZH, WW, Z, $t\bar{t}$, the ZH stage would start with two years at half the design luminosity followed by two years at design luminosity, while the WW stage would run afterwards for only one year but at design luminosity.) The luminosity at the Z pole (the WW threshold) is distributed as follows: 40 ab^{-1} at 88 GeV, 125 ab^{-1} at 91.2 GeV, and 40 ab^{-1} at 94 GeV (5 ab^{-1} at 157.5 GeV, and 5 ab^{-1} at 162.5 GeV). The number of WW events include all \sqrt{s} values from 157.5 GeV up.

Working point	Z, years 1-2	Z, later	WW, years 1-2	WW, later	ZH	$t\bar{t}$	
\sqrt{s} (GeV)	88, 91, 94		157, 163		240	340–350	365
Lumi/IP ($10^{34} \text{ cm}^{-2} \text{ s}^{-1}$)	70	140	10	20	5.0	0.75	1.20
Lumi/year (ab^{-1})	34	68	4.8	9.6	2.4	0.36	0.58
Run time (year)	2	2	2	0	3	1	4
Number of events	$6 \cdot 10^{12}$ Z		$2.4 \cdot 10^8$ WW		$1.45 \cdot 10^6$ HZ + 45k WW \rightarrow H	$1.9 \cdot 10^6$ $t\bar{t}$ +330k HZ +80k WW \rightarrow H	

Next meetings and (some) events of interest

- Next Higgs performance meeting, July 3 :
 - <https://indico.cern.ch/event/1299294/>
- WG2 ECFA Reconstruction Workshop 11-12 July , at CERN
 - <https://indico.cern.ch/event/1283129/>
- General SW meetings have restarted. One yesterday, next July 31
- 2nd Higgs/EW/Top factory ECFA workshop, October 11-13, Paestum (Italy)
 - <https://agenda.infn.it/event/34841/>
- ECFA seminars / workshops of interest :
 - List collected here <https://indico.cern.ch/category/14055/>

Strongly encourage ALL physics groups to have regular working meetings where ongoing analyses should be discussed / reviewed !

Call for speakers

Several talks have been accepted for EPS, for which we look for a speaker:

- BSM: “Exploring the frontiers of fundamental physics at the FCC-ee”
- Higgs: “Higgs physics opportunities at FCC”
- EW: “Precision EW physics at FCC-ee”
- QCD: “High-precision QCD physics at FCC-ee”
- Detector :“Detector R&D studies for the FCC-ee”

Please contact the speaker's buro at FCC-PED-SpeakersBuro@cern.ch if you volunteer or want to suggest someone.

Today's agenda and next meetings

14:00 → 14:20 **Update on B to K* tau tau**

Speakers: Stephane Monteil (Université Clermont Auvergne (FR)), Tristan Miralles (Université Clermont Auvergne (FR))

14:20 → 14:30 **News**

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

14:30 → 14:50 **Tau reconstruction**

Speaker: Maria Cepeda (CIEMAT)

Next Physics Performance meeting :

- July 17 or 24 (t.b.c.)

Still work ahead to converge on the results that will be used for the mid-term report !

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