

# News - Physics Performance, July 25, 2023

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FCC notes that serve as complementary material to the report: should be submitted to (the new) CDS system (and not to Zenodo as announced last time).

- Still making some tests
- Instructions will be sent soon
- Several stages of “restricted access” will be possible
- Updates can easily be uploaded

As soon as the system is ready and instructions are in place, please upload your 1st version of the note.

For the mid-term review report: we are drafting the detector requirements section based on the material that we have received. Plots / numbers will have to be updated to the latest luminosity numbers, before the report is sent to the SAC.

# 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  $\text{ab}^{-1}$  at 88 GeV, 125  $\text{ab}^{-1}$  at 91.2 GeV, and 40  $\text{ab}^{-1}$  at 94 GeV (5  $\text{ab}^{-1}$  at 157.5 GeV, and 5  $\text{ab}^{-1}$  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 ( $\text{ab}^{-1}$ )	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

- Detector concept meeting on July 31st
  - <https://indico.cern.ch/event/1308427/>
- Summer break... most FCC-ee meetings will resume in September

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

- 2<sup>nd</sup> 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).

- ECFA seminars / workshops of interest :
  - List collected here <https://indico.cern.ch/category/14055/>

## 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”
- EW: “Precision EW physics at FCC-ee”
- QCD: “High-precision QCD physics at FCC-ee”
- Poster on Detector :“Detector R&D studies for the FCC-ee”

Please contact the speaker’s buro at [FCC-PED-SpeakersBuro@cern.ch](mailto:FCC-PED-SpeakersBuro@cern.ch) if you volunteer or want to suggest someone.

## Today's agenda and next meetings

**15:00** → 15:10 **News**

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

**15:10** → 15:30 **AFB<sup>b</sup> status (jet charge)** ¶

**Speaker:** Leonardo Toffolin (Universita degli Studi di Udine (IT))

**15:30** → 15:50 **Exclusive b-tagger and hemisphere correlations**

**Speaker:** Lars Rohrig (Technische Universitaet Dortmund (DE))

**15:50** → 16:10 **Update on the sensitivity to B to K\* tau tau**

**Speaker:** Tristan Miralles (Université Clermont Auvergne (FR))

Next Physics Performance meeting : September 18

# 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