

# **IFNC Round table**

# Questions to the National Contact

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

Relations between PED and the Accelerator community working on FCC ?

How is the FCC vs. other ee-colliders situation evolving in your country ?

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

What are the initiatives to recruit new people and to connect to other groups internationally ?

**IN WHICH DOMAIN THE ADDITIONAL PERSONPOWER WILL ENGAGE ?**

Do you plan a National (or Regional ) FCC workshops in 2022?

Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ?

Can you list the persons involved at 15% FTE or more in PED activities in your country, **NOW OR IN THE NEXT TWO YEARS**

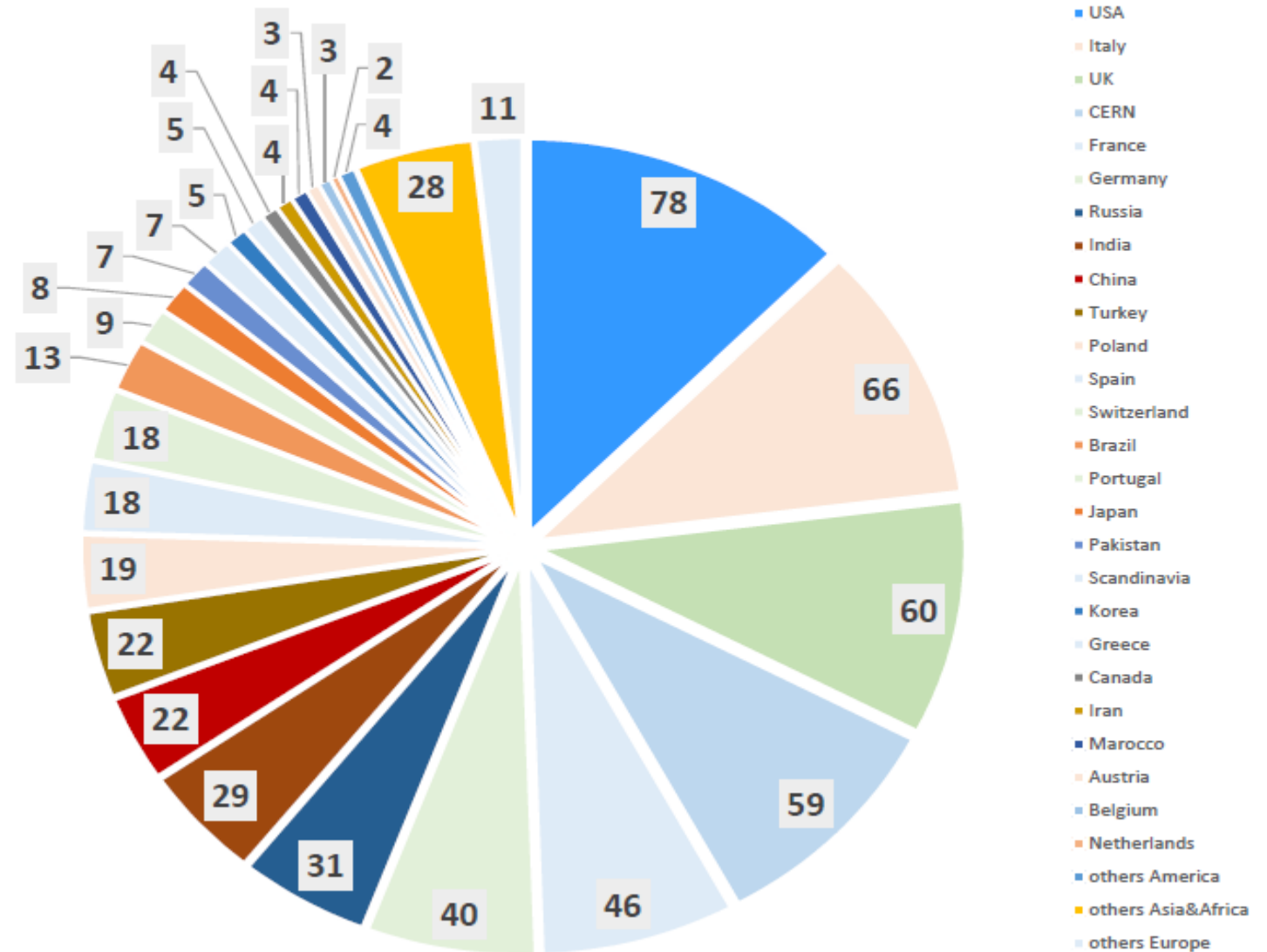
## Slides

+	USA	78
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+	Portugal	9
	Japan	8
o	Pakistan	7
+++	Scandinavia	7
+	Korea	5
o	Greece	5
	Canada	4
	Iran	4
	Marocco	4
+	Austria	3
+	Belgium	3
	Netherlands	2
	others America	4
	others Asia&Africa	28
+	others Europe	11
	unidentified	17
	sum	625
	grand total	642

### other Europe:

	Ireland	1
o	Israel	1
o	Slovenia	1
+	Czech	2
	Estonia	1
	Croatia	1
+	Serbia	1
	Bulgaria	1
	Belarus	1
	Romania	1

Participants to 5th FCC PW per institution country (as of 2022/02/10)



# Answers without Slides (1)

There is still no dedicated activity towards FCC in **Norway**.

Sincerely yours, Alex Read (Norway)

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In **Bulgaria** there is no activity for FCC at the moment.

Best! Plamen Iaydjiev

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There is no dedicated activity for FCC in **Israel** at the moment.

Done detector R&D but not within a dedicated FCC activity

Eilam Gross

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No dedicated FCC activity to report from **Slovenia** for 2020/21.

There is some detector RD towards FCC-hh, beyond that all resources are allocated to (HL-)LHC and Belle2.

Best, Marko Mirkuz

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We (**Pakistan**) have nothing new to report.

Best regards — Hafeez Hoorani

# Answers without Slides (2)

For **Hungary**, Daniel Barna reported his group's intense R&D activities related to FCC.

1. His group is working on the Sushi septum magnet (the prototype will be tested in September in Sweeden).
2. A collaboration was started on CCT magnets with **Hungarian** contribution.

We are not working directly on FCC Detectors.

Best Regard, Peter Levai (director of Wigner RCP)

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At the moment there is still no official activity in **Cyprus** on the FCC .

Best regards, Panos Razis

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As at the time of the previous status report, **Greece** has no dedicated FCC activity yet.

While there is interest, resources are stretched with the current physics program (LHC+HL-LHC).

Best, Paris Sphicas

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# Korea (1)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

A) We were quite active as follows.

- Form Korea Future Collider Consortium (KFCC): more than 50 physicists have joined
- 4 dedicated workshops under KFCC organization were held with domestic and international invited speakers
  1. kick-off workshop (Feb. 25, 2021): overview of FCC project, physics, and detector
  2. Summer workshop (Aug. 26-27, 2021): discuss local activities & funding idea, interesting topics etc.
  3. Fall workshop (Nov. 12 – 14, 2021): strategic discussion for future roadmap
  4. Winter workshop (Jan. 6– 8, 2022): discuss overview & interesting physics topics for FCC projects
- Development on dual-readout calorimeter R&D under IDEA detector concept
  - ⇒ building prototype detector with various R&D and engineering points
  - ⇒ 5-year secured national funding: total \$2M (2020 – 2024)
- It's difficult to estimate FTE for our activities but at least for the dual-readout calorimeter R&D approximately
  - 3 faculties (0.9 FTE), 3 postdocs (1.2 FTE), 10 graduate students (3.0 FTE), 5 undergraduate internship (1.0 FTE)

# Korea (2)

What is the situation with the MOU and Addenda for your country ?

A) 5 institutions since 2016: Gangneung-Wonju National University, KAIST, KIAS, Korea University (Seoul, Sejong)

We had an informal meeting with CERN FCC management team at Sep. 3, 2021 (<https://indico.cern.ch/event/1065948/>) and more institutions with MOU and Addendum are under discussion

Are there commitments related to PED ?

A) Gangneung-Wonju National University, KAIST, KIAS, Korea University (Seoul)

Relations between PED and the Accelerator community working on FCC ?

A) We are discussing with accelerator community in Korea to collaborate on FCC

How is the FCC vs. other ee-colliders situation evolving in your country ?

A) Activities are pretty concentrated on the FCC project. For CEPC, physics & detector R&D are quite similar, so we are working with same direction. For ILC, Korean community's contributions have been quite huge by middle of 2010, but they are not so active now.

# Korea (3)

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- A) Not easy to estimate at the moment but at least the dual-readout calorimeter R&D activity is secured in 2022
- \$400k (totally \$2M for 5 years by end of 2024)
  - 3 faculties (0.9 FTE), 3 postdocs (1.2 FTE), 10 graduate students (3.0 FTE), 5 undergraduate internship (1.0 FTE)
  - More people have a plan to join this activity

What are the initiatives to recruit new people and to connect to other groups internationally ?

- A) We are already quite active as described in our achievements. Moreover we are major team in various international collaboration, for example, in dual-readout calorimeter R&D team (EU, USA, Korea)

For recruiting, we consider two directions:

1. Extension of local community: accelerator community, civil engineering community
2. Extension of international community: consider to form Asian consortium for FCC activity

Do you plan a National (or Regional ) FCC workshops in 2022? Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ?

- A) Yes, we have several national/regional FCC workshops in this year (but the plan is not finalized yet)

- B) Yes we consider with Japan, Taiwan, China, etc., but it needs to discuss carefully in KFCC first then with other countries

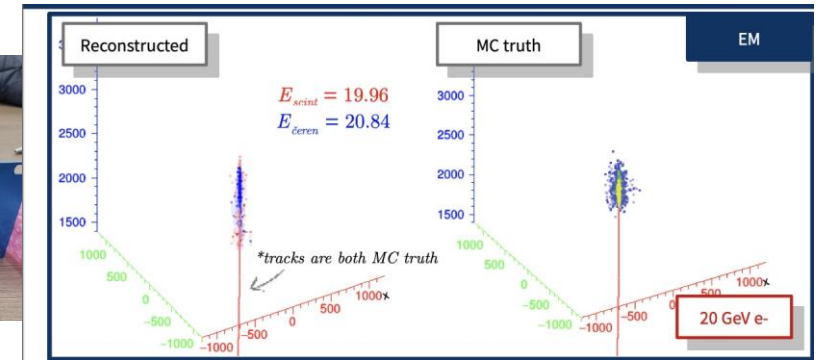
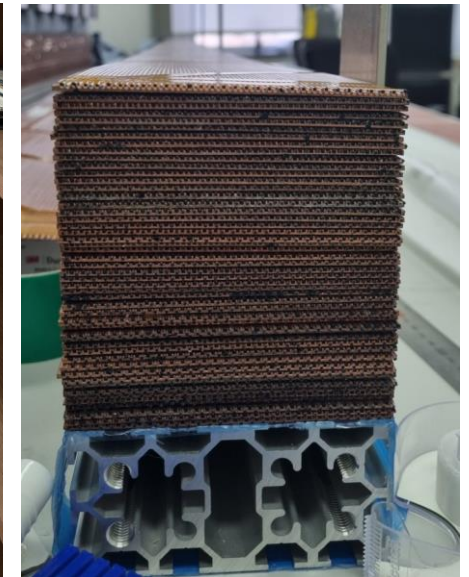
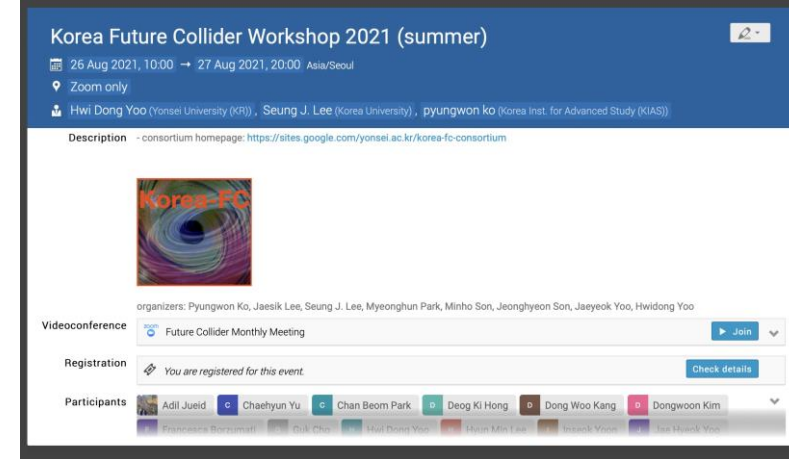
Can you list the persons involved at 15% FTE or more in PED activities in your country

- A) Prof. Hwidong Yoo (Yonsei University), Prof. Sehwook Lee (Kyungpook National University), Prof. Jason Lee (University of Seoul) and their teams for the dual-readout calorimeter R&D



# Korea (4)

- Pyungwon Ko (KIAS), Hwidong Yoo (Yonsei University)
- Korea Future Collider Consortium activities: 4 local workshops have been organized in 2021
  - Kick-off (overview), summer (wide topics), fall (strategic), and winter (phenomenology)
  - More than 50 physicists have participated in the workshops
  - Informal meeting with CERN management (Sep. 3): many institutes are interested in MOU and addendum
  - Start a discussion for national-wide funding and activity: initiate with NRF and Science Ministry of Science
- Detector R&D: dual-readout calorimeter
  - Two modules are being built for test-beam 2022 (expect at June)
  - New electronics readout and assembly systems are produced
  - 3D metal printing based copper forming is successful
  - Various simulation performance study has been done



# United States of America (1)

Joel Butler,  
Dmitri Denisov,  
Sarah Eno

- The US is in the middle of the “Snowmass” process, which provides input for the “P5” committee to determine future US funding priorities. Until this process is over, US activity on future is constrained. Many of us spending up to 25% of our time on Snowmass activities, while there is no funding provided.
- Group of ~20 US faculty (or lab equivalents) are working with our European colleagues to produce a 50 page FCC document for Snowmass. As the process continues, more will be recruited. We expect that completion of P5 process by late 2023 will enable active funding and increased participation.
- Due to the Snowmass process, we do not foresee an FCC workshop in the US this year. There will be a workshop at Brown University where FCC and other colliders are discussed (<https://indico.fnal.gov/event/52465/>) and in Seattle (<https://indico.fnal.gov/event/22303/>) Sometime in 2023 FCC specific workshop can occur in US.

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

\* Activities related to Snowmass and interactions with European colleagues working on FCC, estimate about 20 people (not FTEs).

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

\* US is signing initial MoUs with CERN on FCC (tunneling, magnets, etc.).

Relations between PED and the Accelerator community working on FCC ?

\* Close cooperation.

# United States of America (2)

Joel Butler,  
Dmitri Denisov,  
Sarah Eno

How is the FCC vs. other ee-colliders situation evolving in your country ?

- FCC is among other actively discussed options most notable ILC, muon collider and C3.

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- \* No substantial FCC related funding before end of Snowmass/P5 process late 2023 is expected.

What are the initiatives to recruit new people and to connect to other groups internationally ?

- Snowmass meetings and discussions creating excellent opportunities.

Do you plan a National (or Regional ) FCC workshops in 2022? Are you building or planning to join a Regional FCC “cluster” with neighboring nations ?

- Not at this moment, while see potential in 2023 / Not at this moment.

Can you list the persons involved at 15% FTE or more in PED activities in your country

- \* Sarah Eno, others are at lower levels for now.

# Turkey (1)

1- What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?:

- Particle Accelerators and Detectors Local Infrastructure and R&D Workshop, 27 Nov 2021- 28 Nov 2021.
- CERN ATLAS Experiment National Workshop, 25-26 June, 2021, Bilgi University, Istanbul.

2- What is the situation with the MOU and Addenda for your country ?

Previously signed Addendum by 4 universities (BAIB Uni, Ankara Uni, Giresun Uni, IUE Uni.) and MoU signed by 14 Univ. (BAIB Uni, Akdeniz Uni, Ankara Uni, Ege Uni, Giresun Uni, Isik Uni, Istanbul Aydin Uni, Istanbul Uni, IUE Uni, IYTE, Okan Uni, PRU, TOBB ETU and Uludag Uni.

Are there commitments related to PED?

Following a national project which will be launched in the near future, this will be clear.

3- Relations between PED and the Accelerator community working on FCC ?

(3 Accelerator PhD thesis, 1 detector PhD thesis, 1 Physics PhD, 7 PED MS thesis) (Thesis supervisor from accelerator and PED communities)

4- How is the FCC vs. other ee-colliders situation evolving in your country ?

Turkish scientist have been contributing to the FCC project since 2014. In this regard, the following were organized in Turkey.

Internationally participated workshops have been organized in 2016 and 2019.

FCC Physics, Detector And Accelerator Workshop @ Istanbul, 11-12 March, 2016 (<https://indico.cern.ch/event/405973/>)

FCC Physics, Detector And Accelerator @Antalya, 9-11 September, Antalya, 2019 (<http://aknam.akdeniz.edu.tr/fcc-workshop/>)

# Turkey (2)

5- Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

Recent national project funded by TAEK (new name TENMAK) has been completed in 2022. A new project with a larger team is planned about FCC PED in 2022 and 2023.

6- What are the initiatives to recruit new people and to connect to other groups internationally ?

New people is expected to participate in the planned project which can contact other group internationally.

7- Do you plan a National (or Regional ) FCC workshops in 2022?

Yes, we plan national workshop in 2022.

8- Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ?

Not at this moment, but we able to plan to built regional FCC cluster similar to structure of the LHC experiments in the near future. We will discuss it.

9- Can you list the persons involved at 15% FTE or more in PED activities in your country?

A few people has been involved in Accelerator and Detector studies, but more involved in Physics.

**Our activities in FCC in 2021 were entirely in materials physics part.**

- We have signed the MoU with FCC study. It includes FCC-hh and FCC-ee colliders and their detectors.
- Currently the activity is centered around the group led by Prof. Djurabekova, and is focused on development of the superconducting RF accelerating cavities. The same group is an active partner in large international collaboration on development of RF accelerating structures for CLIC accelerators.
- Contributions to PED are in planning, but not yet in practice. We contribute around 70 k€ annually to the activities related to FCC SRF cavities
- The group collaborates with the group at CERN and are open to broaden the collaboration within the topic related to materials research problem.
- We are a part of FCC Nordic initiative
- Nobody involved at 15% FTE or more in PED. With accelerators we have 1 PhD student (Milad Ghaemi) and 0.5 postdoctoral researcher (Dr. Alvaro Lopez Casalilla). Prof Djurabekova is at 10% FTE, Dr. Eryang Lu at 5%

# Sweden

- **Uppsala**: continues FCC-ee LLP work
  - Master thesis: Rohini Sengupta (June 2021), Uppsala University. Co-supervised with Suchita Kulkarni “[Towards Vertexing Studies of Heavy Neutral Leptons with the Future Circular Collider at CERN](#)”
  - Project: Lovisa Ryagaard and Nils Eriksson (January 2022) Uppsala University. Co-supervised with Suchita Kulkarni and Juliette Alimena – “[Simulation of long-lived Heavy Neutral Leptons and Axion-Like Particles at the FCC-ee](#)”
  - **Master thesis ongoing**: Lovisa Ryagaard, Uppsala University. Co-supervised with Suchita Kulkarni and Juliette Alimena
- MOU signed by Sweden already: **Unclear about the Addenda**
- **Accelerator community of Sweden expressed interest in following up on FCC back in 2020, not followed up**
- Not much discussion on FCC vs. other ee-colliders in Sweden, **most visible effort at the moment: FCC-ee**
- Resources (human and funds) that the labs in Sweden plan to commit for FCC PED in 2022 and 2023
  - Unclear, depending on funding
- 1/3 funding proposals submitted in 2021 mentioning FCC approved
  - **One open postdoc position in Uppsala, with particle FCC description**
- Nordic FCC workshops in mind, but no advances after the first Nordic day in 2021
- **Clear interest in a Nordic Cluster, second Nordic day soon could be a good idea**

# Denmark

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- Definition of and Coordinating role for Detector Concepts activity (0.3 FTE)

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- MoU being signed, Addendum to be formulated

Relations between PED and the Accelerator community working on FCC ?

- No accelerator community in DK

How is the FCC vs. other ee-colliders situation evolving in your country ?

- In 2021, two FCC-ee MSc projects. No other ee activity in DK

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- As previous years

Do you plan a National (or Regional ) FCC workshops in 2022? ?

Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ? - N/A

Can you list the persons involved at 15% FTE or more in PED activities in your country

- Mogens Dam, Jørgen Beck Hansen (supervision of MSc project)



# Poland (1)

Marcin Chrzaszcz,  
Tadeusz Lesiak

⇒ What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- Scintillator detectors.
- Forward Calo, Lumi meters.

⇒ What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- Signed MOU and addendum.

⇒ Relations between PED and the Accelerator community working on FCC ?

- Started. New Uni joining accelerator R&D.

⇒ How is the FCC vs. other ee-colliders situation evolving in your country ?

- FCC becomes dominant. CLIC activities still remain.

# Poland (2)

Marcin Chrzaszcz,  
Tadeusz Lesiak

⇒ Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- 5-7 FFTE. 2 Grants dedicated to FCC. More applications waiting for results.

⇒ What are the initiatives to recruit new people and to connect to other groups internationally ?

- 2 more Uni. Msc Students.

⇒ Do you plan a National (or Regional ) FCC workshops in 2022?

- We have weekly catchups.
- If Covid behaves we might have a 1-2 day retreat.

⇒ Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries)?

- Planning to.

⇒ Can you list the persons involved at 15

- Academic: 7, 3 researchers, 1 Msc Student.

# Czechia

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- Group at CUNI (Charles University) is working on calorimeter (noble liquid technology) for FCC-ee. The work accounts ~1.0 FTE in 2021.

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- CUNI signed the MOU and Addenda. Our commitments are related to calorimetry

How is the FCC vs. other ee-colliders situation evolving in your country ?

- Our main interest is FCC. Czechia is not active in any other ee-collider studies.

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022/23 ?

- We plan ~ 1.0 FTE in 2022 and 2023. We have funds for the salaries.

What are the initiatives to recruit new people and to connect to other groups internationally ?

- We do not plan to recruit new people (lack of fundings) in 2022. We have a strong collaboration with CERN and IJC lab.

Do you plan a National (or Regional ) FCC workshops in 2022? Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ?

- No

Can you list the persons involved at 15% FTE or more in PED activities in your country

- Jana Faltova, Juraj Smiesko

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- None

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- (a) Under consideration if we need a new MoU, since we signed one few years ago. (b) While we are committed to FCC, not much has been done. but we plan to built on our experience with ATLAS, CMS and work on HL-LHC, including accelerator development

Relations between PED and the Accelerator community working on FCC ?

- None on FCC, some relations with respect to HL-LHC.

How is the FCC vs. other ee-colliders situation evolving in your country ?

- There is some activity related to linear colliders now

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022/23 ?

- Current groups are small and committed to current projects which include LHC and HL-LHC. However, within these projects, we have a PhD student working on a project related to future tracking detectors, applicable to FCC. In addition, we plan to request funding for FCC.

What are the initiatives to recruit new people and to connect to other groups internationally ?

- We do not plan to recruit new people (lack of fundings) in 2022. We have a strong collaboration with CERN and IJC lab.

Do you plan a National (or Regional ) FCC workshops in 2022? Are you building or planning to join a Regional FCC “cluster”?

→ No, not at the moment

Can you list the persons involved at 15% FTE or more in PED activities in your country - None

# Germany (1)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- Contributions to physics studies at a small number of institutes; involvement in PED coordination and in setting up of detector concept pillar. FTEs hard to estimate, but relatively small (lower single digits). Interest present, but (still) mostly passive. Analysis activities at DESY, KIT, MPP; others expected to join (with students / postdocs at larger FTE-fractions); also pheno projects / theory involvement at several places.
- Significant detector R&D activities, which often are generic, but are applicable also to FCC PED.

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- No complete overview, but there are several institutes that have signed the MOU, and are contributing to PED.

Relations between PED and the Accelerator community working on FCC ?

- At this point no formalized interactions – but opportunities for exchange within FCForum meetings, and within institutes participating in both pillars.

How is the FCC vs. other ee-colliders situation evolving in your country ?

- Interest in FCC-ee is increasing relative to other e+e- colliders. In a recent survey conducted by me, FCC-ee was mentioned most often as the context of PED-relevant work, more than ILC or CLIC.

# Germany (2)

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- No concrete estimate, but the trend is positive. New groups starting to become active. No BMBF funding available at this point, activities supported through individual grants; DESY and MPG resources; informal contributions at universities

What are the initiatives to recruit new people and to connect to other groups internationally ?

- Discussions in KET (German Committee for Particle Physics), community engagement.

Do you plan a National (or Regional ) FCC workshops in 2022?

- Yes, a FCForum meeting is planned for later in 2022 (pending evolution of pandemic). Not clear yet if this will be branded as FCC workshop, or rather more generic, with FCC focus.

Can you list the persons involved at 15% FTE or more in PED activities in your country

- Hard to do – Coordination roles: Christophe Grojean, Clement Helsen, Markus Klute, Felix Sefkow, Frank Simon (not all reaching 15%) – expect in particular students / postdocs to reach higher fractions of their time.

# Austria (1)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

Austrian wide Workshop to ramp up activities

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

HEPHY signed the MoU, the side letter with the commitments is under discussion

Relations between PED and the Accelerator community working on FCC ?

common workshop in 2022, but no collaboration or common efforts

How is the FCC vs. other ee-colliders situation evolving in your country ?

mainly FCCee related activities, some generic ee related efforts

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ? no number available yet

What are the initiatives to recruit new people and to connect to other groups internationally ?

start discussions with collaborators from other projects

Do you plan a National (or Regional ) FCC workshops in 2022?

yes

Are you building or planning to join a Regional FCC “cluster” with neighboring nations

we started to think about it

# FCC related news from Austria

- HEPHY signed the FCC MoU
  - R. Schöfbeck coordinates the HEPHY FCC efforts
  - detailed discussions about FCC contributions ongoing
  - participation in physics and detector studies planed
  
- FCC related theoretical investigations at the University of Vienna and the University of Graz are ongoing





# Belgium

*Development of flavour tagging methods for FCC-ee and exploring the physics potential they unlock.*

Flavour tagging depends, amongst others on the detector technology, and much less on the accelerator geometry

Status: presentation at this FCC week

[https://indico.cern.ch/event/1066234/contributions/4710424/attachments/2386869/4079308/S-Tagging\\_CNN\\_FCCPhysicsWorkshop.pdf](https://indico.cern.ch/event/1066234/contributions/4710424/attachments/2386869/4079308/S-Tagging_CNN_FCCPhysicsWorkshop.pdf)

The MoU is signed by the Vrije Universiteit Brussel (VUB)

At this stage, we have a budget for two PhD students (4y each) and an adequate running budget for them

A project-specific connection between VUB (D'Hondt), DESY (Blekman) and UZurich (Canelli) for the two PhD students

No national FCC (or future collider) forum at this stage, but intentions to explore the options to cluster BE & NL

# U.K. (1)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- Generic detector R&D in many institutes for silicon-vertex/trackers, calorimetry. There is additional interest in DAQ and electronics for FCC.
- Physics studies for ee, eh, and hh. New interest shown recently in joining such efforts.
- Wilkinson and Leonidopoulos members of PED Coordination Group, who have also been active in preparing EPJC articles and organisation of FCC Physics Workshop.

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- Few institutes have signed the MoU yet.

Relations between PED and the Accelerator community working on FCC ?

- Close collaboration through Cockcroft and John Adams Institutes, and Daresbury and the Rutherford lab.

# U.K. (2)

How is the FCC vs. other ee-colliders situation evolving in your country ?

- UK has an established linear collider community involved in ILC as well as CLIC. Majority of physicists and institutes would be happy to see either FCC-ee or ILC move forward and have a positive opinion towards both facilities. Agreement between FCC-ee and ILC communities, and reflected in recent UK roadmap, that joint detector R&D support should be sought for both initiatives.
- The FCC-hh and FCC-eh communities naturally focus on developing the physics/detector cases for FCC.

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- It is likely that physicists from many institutes will become active in PED-related activities, and existing detector studies will continue.
- It is unlikely, however, that dedicated FCC funding at a significant level will become available during this period. We have submitted a case for improved funding for FCC-related activities to the STFC PPTAP recently, to try to improve the situation

What are the initiatives to recruit new people and to connect to other groups internationally ?

- We will continue to stimulate activity in the UK institutes through workshops. This will include some training in how to run software for physics studies, to reduce barriers for new collaborators.
- The UK recently restructured its activities in FCC, with clearly defined coordinators for FCC-ee (G.Wilkinson), FCC-hh (A.Pilkington) and FCC-eh (U.Klein). Pilkington acts as the overall FCC-UK national contact. The purpose of this is develop activities in each area

# U.K. (3)

Do you plan a National (or Regional ) FCC workshops in 2022?

- We had a national FCC-UK workshop in December 2021 and another one is likely in 2022.
- We plan to have other workshops focused on specific activities (see answer to previous question).

Are you building or planning to join a Regional FCC “cluster” with neighboring nations ?

We do not plan for this currently. We focus instead on building the UK community.

Can you list the persons involved at 15% FTE or more in PED activities in your country

We estimate that most institutes have at least one physicist who will contribute to PED activities at the 15% FTE level, or higher.

# Portugal (1)

- Just started!
  - MoU signed in Nov. 2021 by LIP – Lab. for Instrumentation and Particles
- Starting small:
  - Started from core of people who contributed to FCC CDR, from LHC experiments & pheno.
  - 4 academics from different universities; 3 researchers from LIP; 1 PhD student from ATLAS
  - 1 very small funded project: 2 MSc grants and some travel money
- ...but aim to grow with recruiting:
  - Colleagues from other groups, especially theory
  - LIP colleagues working on detector R&D
  - MSc or PhD students – advantage in having academics from 3 universities
- Activity already initiated or planned for 2021:
  - Theory: virtual photon scattering in FCC-ee; precision  $\alpha_s$  measurements in FCC-ee; jet substructure
  - Experiment: development of rad-hard plastic scintillators together with polymer research group focusing on FCC-hh; calorimetry simulation for FCC-ee

Can you list the persons involved at 15% FTE or more in PED activities in your country

Theory: 1 academic, 2 researchers;      Experiment: 3 academics, 3 researchers, 1 PhD student

# Portugal (2)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

In Portugal we have just started this activity. Generic investigation of new rad-hard scintillator materials started. Planned work on phenomenology to start later this year.

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

MoU signed (5/11/2021). Addendum will take a few months to define.

Relations between PED and the Accelerator community working on FCC ?

No accelerator activity apart from wakefield acceleration in plasmas group. Initial contact made but no results so far.

How is the FCC vs. other ee-colliders situation evolving in your country ?

No other specific work on future accelerators.

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

About 1.5 FFTE may be expected on average, but small fractions of several people.

What are the initiatives to recruit new people and to connect to other groups internationally ?

Expect 2 MSc students in the next year. Also plan to reach out to colleagues in other groups.

Do you plan a National (or Regional ) FCC workshops in 2022? Are you building or planning to join a Regional FCC “cluster”

Most likely will happen only in 2023. Not yet... just started

# Spain (1)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

Minimal, due to pandemics and the aim to get the next meeting of the Spanish Future Collider Network in “in person” mode

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

For the moment only the existing groups signing the previous MoU, and involved in technological activities (CIEMAT, CELLS/ALBA, ...) stay involved. Addendas have to be discussed. New groups were contacted too, but without positive answer for the moment. There is some reluctance from their administration to get involved early in what is perceived as a “formal commitment” (even if it is only on a best effort basis) while getting involved only in PED activities, which look as secondary activities in the context of the FCC feasibility study.

Relations between PED and the Accelerator community working on FCC ?

These aspects are really well embedded in the Spanish Future Collider Network and discussions are global (also with industry). In cases like CIEMAT, communications occur in the same center and are fluid. However their objectives are a bit disconnected for the moment (development superconducting magnets for FCC versus FCC-ee PED activities, for instance).

How is the FCC vs. other ee-colliders situation evolving in your country ?

The Spanish community has been and is still strongly involved in linear collider activities. Despite that, FCC activities and, in particular common ee activities in the context of the ECFA PED initiative are being developed in an almost agnostic way regarding the collider choice. IFIC and CIEMAT groups have also prepared a coordinated project that covers all future ee collider activities (it includes ongoing FCC, ILC and ECFA PED activities).

# Spain (2)

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

Unclear. We have prepared requests that will be evaluated during this year 2022, but we do not expect strong support compared with other, more urgent, matters (LHC upgrades, for instance)

What are the initiatives to recruit new people and to connect to other groups internationally ?

We are mostly relying on existing manpower working in other projects (LHC) and on new students (master thesis works, ...). We are connecting to other international groups via existing FCC structures and the new ECFA PED initiative. It is unclear for the moment how much we will be able to profit from the new FC unit at CERN.

Do you plan a National (or Regional ) FCC workshops in 2022?

Yes, but not FCC-only workshops for the moment. No dates have been fixed yet, because we aim for meetings in person

Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ?

No. At least for the moment.

Can you list the persons involved at 15% FTE or more in PED activities in your country

Regarding FCC PED: Strictly speaking (i.e. existing project paying for that activity for  $\geq 15\%$  of the time), nobody.



# Italy (1)

What were the Physics-Expts and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

Current activities are organized by work packages. Below is the list:

## 1. Physics studies, Simulation & Software development

### Full Simulation

- Drift Chamber (BA,LE)
- DR Calo (PV,Sussex)
- ECAL (MI)
- Muon detector(BO,FE)

### Tools development

- EDM4HEP interface (TO)
- Tau ID with DNN (RM1)
- DR clustering with DNN (Sussex)
- PID with ClusterCounting in DCH(LE,BA)
- Displaced tracks in Delphes(PI)

### Case studies

- Flavor: Bs->DsK (FE)
- EWK Physics: Afb(bb, cc) (UD)
- Higgs mass with recoil (BO)

## 2. Machine Detector Interface studies

## 3. Silicon Detectors (Vertex and trackers) R&D

## 4. Drift Chamber R&D

## 5. MPGD for muon chambers and pre-shower

## 6. Dual Readout Calorimetry R&D

Number of researchers/Engineers involved in 2021 is 91 people for 15.7 FTE

Relations between PED and the Accelerator community working on FCC ?

Good interaction on MDI and background studies through MDI work Package

# Italy (2)

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

A list of Italian institutions with a signed MoU follows. Only INFN is clearly committed to PED, but has not yet submitted addenda.

CNR-SPIN	Commitment to PED?	NO (Superconducting materials)
CSIL	Commitment to PED?	NO (Economics)
INFN	Commitment to PED?	YES
UNIROMA1	Commitment to PED?	~YES (Accelerator / MDI)
UNIGENOA	Commitment to PED?	NO (Superconducting materials with CNR-SPIN)
UNIMI	Commitment to PED?	NO (Economics)
UNIROMA3	Commitment to PED?	NO (Economics)

How is the FCC vs. other ee-colliders situation evolving in your country ?

Main interest is FCCee (CEPC as a backup option). No major involvement in CLIC or ILC.

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

Funding scale for 2022 is 600-700 k€ with about 120 people involved. Expect growth in 2023.

# Italy (3)

What are the initiatives to recruit new people and to connect to other groups internationally ?

First FCC-Italy workshop on March 21-22 – CERN simifellows program now open also for FCC -  
Participation in FCCee meetings and workshop organization – R&D activities within Work Packages –  
Involvement in EU programs (e.g. AidaInnova)

Do you plan a National (or Regional ) FCC workshops in 2022?

Yes. First FCC-Italy workshop on March 21-22

Are you building or planning to join a Regional FCC “cluster” with neighboring nations (cf. Nordic countries) ?

Not at the moment although we are preparing an ITN EU grant request that could help in this context

Can you list the persons involved at 15% FTE or more in PED activities in your country

yes, but it's a list of 32 people in 2022. I can provide the names if needed.

# France (1)

Roy Aleksan  
Gregorio Bernardi

What were the Physics-Experiments and Detectors (PED) Activities in 2021 in your country (type and FTE) ?

- Contributions to physics studies at 12 institutes; involvement in PED case studies (Higgs, QCD, Heavy Flavour, Electroweak, BSM) (40 persons / 9 FTE)
- Detector R&D activities ) (microvertex, TPC, ToF, Calorimetry, RPC, wireless connections) , often developed initially for ILC, but now moving towards FCC.
- Phenomenology and theory projects, ee and hh / theory involvement at several places (5 persons / 2FTE)

What is the situation with the MOU and Addenda for your country ? Are there commitments related to PED ?

- 4 MOU's signed by IN2P3 and CEA Saclay for accelerators mostly in 2014,2015 . 4 MOU's also for enterprises working on the accelerator (2017-2019). New MOU's and Addenda for PED being prepared, related to collaboration board evolution.

Relations between PED and the Accelerator community working on FCC ?

- Exchanges during the FCC-France workshops, where a full accelerator session is reserved

How is the FCC vs. other ee-colliders situation evolving in your country ?

- FCC-ee priority is evolving positively relative to other e+e- colliders. ILC-France community is participating to FCC France workshops.

# France (2)

Roy Aleksan  
Gregorio Bernardi

Estimate of the resources (human and funds) that the labs in your country or your national institute plan to commit for FCC PED in 2022 and 2023 ?

- Number is slowly but steadily growing. 2 Postdocs and 2 Ph.D Student are starting on FCC in 2022 + many 3-4 months trainee (~12) presenting their work in an annual Jamboree. New members are also joining/increasing their commitment

What are the initiatives to recruit new people and to connect to other groups internationally ?

- European/French ANR grants are being submitted in 2022 (Calorimetry, Microvertex) to get funds and person-power.

Do you plan a National (or Regional ) FCC workshops in 2022?

- Yes, a 4<sup>th</sup> FCC-France meeting (jointly with other ee colliders) is planned for November 2022 in Lyon (funding obtained). The 3<sup>rd</sup> took place in Annecy in 2021 in Hybrid mode with 50 on-site, > 80 off-site. In 2023 we could envisage a joint FCC-regional meeting, for instance with Italy with whom we are already sharing some activities

Can you list the persons involved at 15% FTE or more in PED activities in your country

- Between 1 and 4 persons in each of the 12 IN2P3 and IRFU labs

# Switzerland

- Host country
  - Strong support and leading involvement from the beginning
  - From bottom-up roadmap effort and "political" level

With the HL-LHC, new physics will be fully probed up to an energy scale of at least  $\sim 1$  TeV in the near future. The next step has to include decisive studies of the properties of the Higgs and the top quark. This should then be followed by the exploration of an energy scale that is an order of magnitude higher than what can be reached with the LHC in the years to come.

For this reason, the Swiss community considers the FCC to be the most promising project for the next high-energy frontier machine at CERN. The FCC would start as an  $e^+e^-$  collider. It is a challenging project that requires R&D, but does not need the

Swiss roadmap for particle and astroparticle physics, 2020

- CHART: accelerator R&D stimulus program (HTS, beam dynamics, injector, geology)
- ETHZ, EPFL, PSI, UniBE, UniGE, UniZH long history of particle detector R&D
  - Main priority on collider physics is for now the HL-LHC
  - FCC as obvious continuation
  - UniZH and UniGE have dedicated efforts. Physics studies and HW; at UniZH also in collaboration with VUB
- Had one general workshop in Sept 2021. Next workshop in Spring 2022 and interactions with funding agency to find strategy for more concrete involvements.

# CERN

What were the Physics-Expts and Detectors (PED) Activities in 2021 ?

Pretty much all areas of PED are covered at CERN, including overall coordination

Estimate of the resources (human and funds) that the lab plan to commit for FCC PED in 2022 and 2023

About 8-10 FTEs, distributed over more than 15 members of staff, fellows and scientific associates

What are the initiatives to recruit new people and to connect to other groups internationally

We expect to hire two postdocs on FCC PED in 2022, and have submitted 4 FCC projects to the selection committee for CERN's Summer Student programme. Our resources for the Scientific Associate (SASS) programme allowed us so far to secure a SASS dedicated to FCC starting in March '22 (P.Azzi).

Persons involved at 15% FTE or more in PED activities

EP:

Patrick Janot  
David D'Enterria  
Emmanuel Perez  
Martin Aleksa  
Michele Selvaggi  
Loukas Gouskos  
Anna Gaborowska  
Philip Roloff  
Andreas Salzburger  
Werner Riegler  
Patrizia Azzi (SASS)  
+ 2 fellows to be hired

TH:

Michelangelo Mangano  
Matthew Mc Cullough  
Johann Usovitsch  
+ several who occasionally write papers  
- typically BSM - of relevance to FCC

EP/SoftWare:

Gerri Ganis