

01/10/2024



NUCLÉAIRE
& PARTICULES

Entretien annuel projet (EAP) 2024

FCC-PED

Responsable scientifique : Gregorio Bernardi

+Giovanni Marchiori (APC) Fares Djama (CPPM), Nicolas Morange (IJCLab), Suzanne Gascon-Shotkin (IP2I), Ziad El Bitar (IPHC), Marco Delmastro (LAPP), Vincent Boudry (LLR), Stéphane Monteil (LPC), Luc Poggioli (LPNHE), Jean-Baptiste De Vivie (LPSC), Catherine Biscarat (L2IT)



Activités après le FCC Feasibility Study Mid-Term report

The goal of the FCC FS mid-term review is to assess the progress of the Study towards the final report.

Deliverables approved by the Council in September 2022:

https://indico.cern.ch/event/1197445/contributions/5034859/attachments/2510649/4315140/spc-e-1183-Rev2-c-e-3654-Rev2_FCC_Mid_Term_Review.pdf


Deliverables:

- D1 : Definition of the baseline scenario
- D2 : Civil engineering
- D3 : Processes and implementation studies with the Host States
- D4 : Technical infrastructure
- D5 : FCC-ee accelerator
- D6: FCC-hh accelerator
- D7: Project cost and financial feasibility
- D8: Physics, experiments and detectors

Future Circular Collider Midterm Report

February 2024

Edited by:
B. Auchmann, W. Bartmann, M. Benedikt, J.P. Burnet, P. Craievich,
M. Giovannozzi, C. Grojoss, J. Gutleber, K. Hanke, P. Janot, M. Mangano,
J. Osborne, J. Poole, T. Raubenheimer, T. Watson, F. Zimmermann

 This project has received funding under the European Union's Horizon 2020 research and innovation programme under grant agreement No 951754.

This document has been produced by the organisations participating in the FCC feasibility study. The studies and technical concepts presented here do not represent an agreement or commitment of any of CERN's Member States or of the European Union for the construction and operation of an extension to CERN's existing research infrastructures. The midterm report of the FCC Feasibility Study reflects work in progress and should therefore not be propagated to people who do not have direct access to this document.

Full Report

- 8 Chapters/Deliverables
- ~ 700pp document
- ~ 16 editors
- ~ 500 contributors

Many thanks to the SAC, CRP, SPC, FC and the Council for the very useful reviews!

Documents:

- Mid-term report (all deliverables except D7)
- Executive Summary of mid-term report
- Updated cost assessment (D7)
- Funding model (D7)

Review process:

- Oct 2023: Scientific Advisory Committee (scientific and technical aspects) and Cost Review Panel (ad hoc committee; cost and financial aspects)
- Nov 2023: SPC and FC
- 2 Feb 2024: Council

All deliverables met, no technical showstoppers

→70-80 recommendations

Objectifs Principaux pour 2024-mi 2025

- **Completion of technical work for Feasibility Study until end 2024**
 - Implementation of recommendations of the mid-term review
 - Focus on “feasibility items” and items with important impact on cost/performance
 - Develop a risk register
 - Update cost estimate to reach cat 3 level on cost uncertainty (-20% / +30%).
 - Further develop the funding model based on discussions with CERN Council
- **Complete FS by March 2025 as input for ESPP update.**
- **In parallel, continue work with host states on project definition and responsibilities, authorization procedures, excavation material strategy and regional implementation development.**

Structure: 3 Volumes

- *Vol. 1: Physics, Experiments and Detectors (~200 pages)*
- *Vol. 2: Accelerators, Technical Infrastructures, Safety Concepts (~370 pages)*
- *Vol. 3: Civil Engineering, Implementation & Sustainability (~200 pages)*

Input for Update of European Strategy for Particle Physics

to be prepared with Overleaf & published by EPJ (Springer-Nature) – FCCIS members



In addition documentation on Cost Estimate – Funding Models

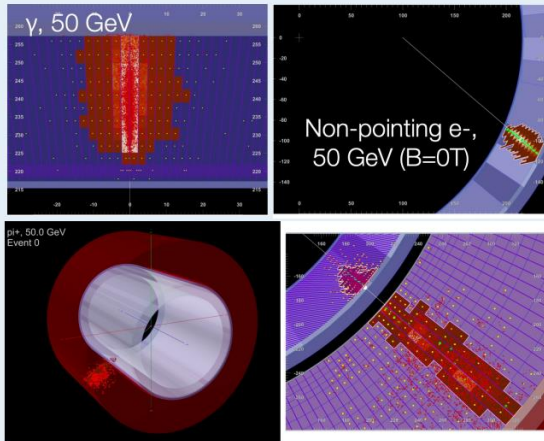
Objectifs de FCC-PED (overall et IN2P3)

- Contribute to the Final version of the FCC Feasibility study, in order to contribute to the ESPPU, towards the recommendation of moving forward with FCC
- Contribute to DRD's, and produce EoI's for FCC subdetectors.
- Join EoI's for FCC Detector concepts (not proto-collaborations)
- Contribute to the ECFA report of future e+e- colliders
- Contribute to the National Strategy, and to National FCC EoI's

FAITS MARQUANTS 2024: APC

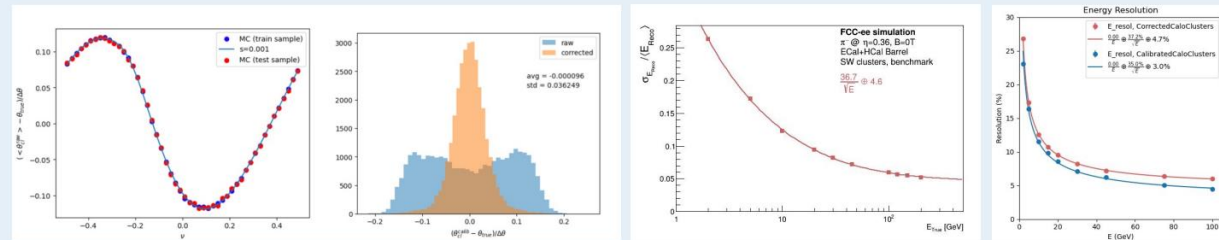
Clustering performance

- Topo and sliding-window clustering algorithms re-designed based on the new calorimeter segmentation
- Nice event display tool was developed
- Enabled clustering with ECal + HCal combination

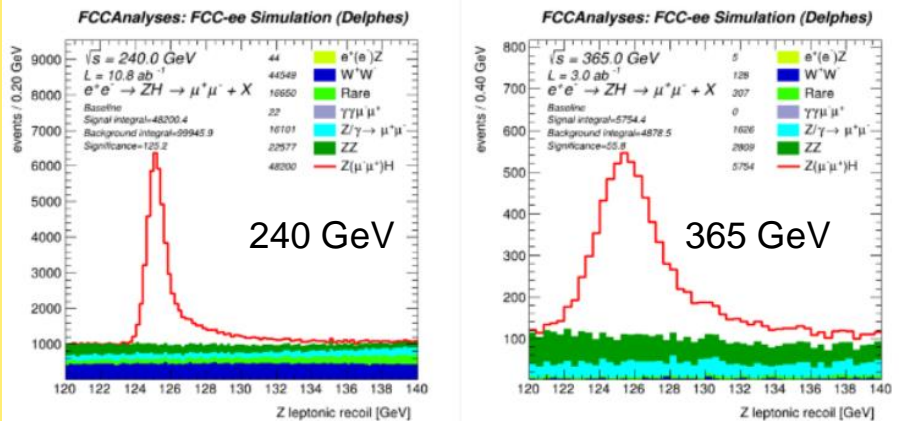


Resolution correction and calibration

- S-curve is observed in θ resolution due to the finite cell size that will lead to a bias of measurement to the center of cell
- A “common” detector effect:
 - We have observed that curve before in the ATLAS detector
 - Corrected by re-defining the barycenter calculation
 - Use log E_{cell} weights:
- Energy resolution to single pion with combined reconstruction in ECal and HCal barrels, calibration with benchmark method in red, with MVA in blue

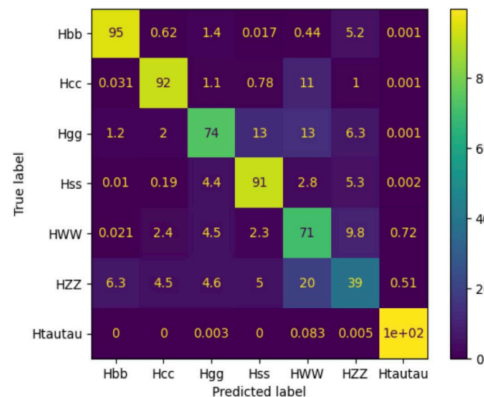


Recoil Mass



σ_{ZH} is measured in a model independent way with 0.6% accuracy at 240 GeV, 1.5% at 365 GeV opening the way to precise Higgs couplings measurements

Hadronic Higgs decays @ FCC-ee (quark Yukawa and gluon coupling)



PRELIMINARY

Final state	$\delta\sigma\text{BR}/\sigma\text{BR}$ Z(l)H(jj) %	$\delta\sigma\text{BR}/\sigma\text{BR}$ Z(vv)H(jj) %	$\delta\sigma\text{BR}/\sigma\text{BR}$ Z(qq)H(jj) %	BR(SM)
H→bb	0.7	0.4	0.3	58 %
H→cc	4.1	2.2	3.3	2.9 %
H→gg	2.2	1.1	3.1	8.6 %
H→ss	230	150	440	0.024 %
H→WW→had	1.8	1.1	8.7	10 %

10.8/ab at $\sqrt{s}=240$ GeV : $\delta\sigma\text{BR}/\sigma\text{BR} = 0.22\%$ (bb), 1.7% (cc), 0.9% (gg), 120% (ss), 1.1% (WW)
3/ab at $\sqrt{s}=365$ GeV : expect reduction of $\delta\text{BR}/\text{BR}$ by ~10% in combination with 240 GeV

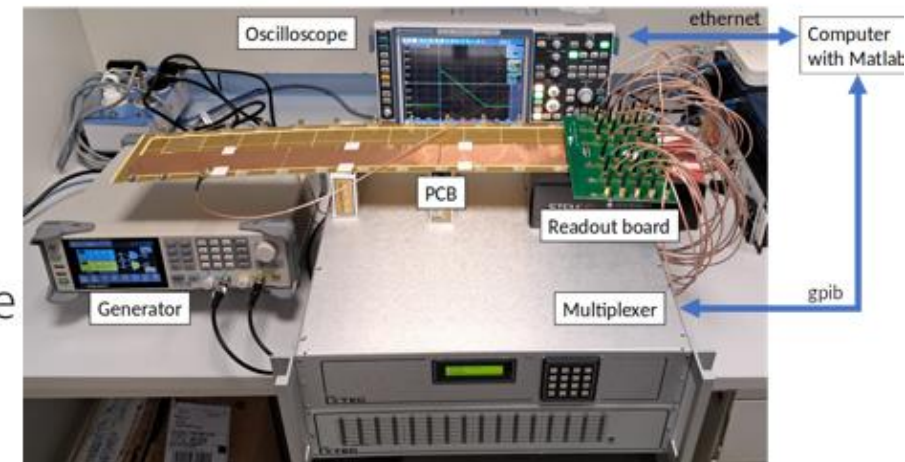
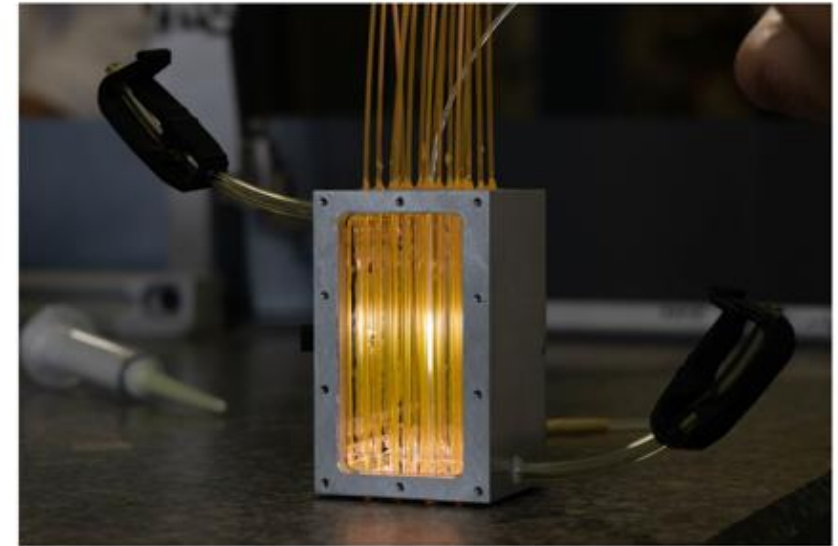
FAITS MARQUANTS 2024: IJC Lab

GRAiNITA

- Publication JINST
- Testbeam (en parasite d'un TB LHCb Upgrade)
 - Prise de données réussie ! Mesure d'efficacités et uniformité
- Dépôt d'ANR. Malheureusement rejeté en 2nde phase

Allegro Ecal

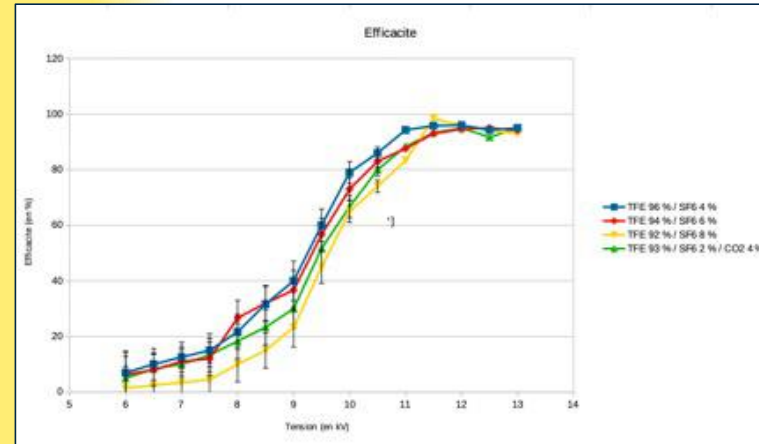
- Design des électrodes
 - Nouveau prototype 3 tours 15 cellules/tour
 - Mesures et compréhension d'effets fins
 - Travail conjoint avec CERN pour choix d'optimisation de design
- Simulation
 - Travail en collaboration avec APC (photon-ID)
- Coordination Allegro



FAITS MARQUANTS 2024 : IP2I Lyon

• T-SDHCAL & T-MRPC:

- Construction des RPC à 4 'gaps' (1m²) aux 'fishing lines', nouvelle technique de montage à l'aide d'entretoises, $\epsilon > 95\%$

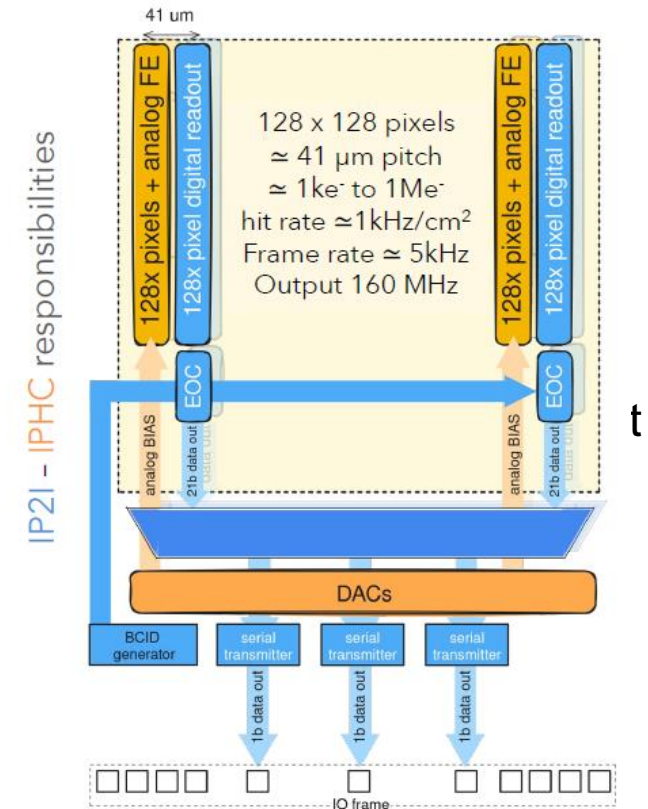


- Inclusion officielle dans le software key4hep d'un processeur "Marlin" capable de tourner SDHCAL Calibration/PandoraPFA APRIL PFA.

• CMOS monolithiques/GRAM: 1er circuit 'DoTIIX' (IP2I+IPHC),

technologie TJ180nm pour mesure des ions, soumission en

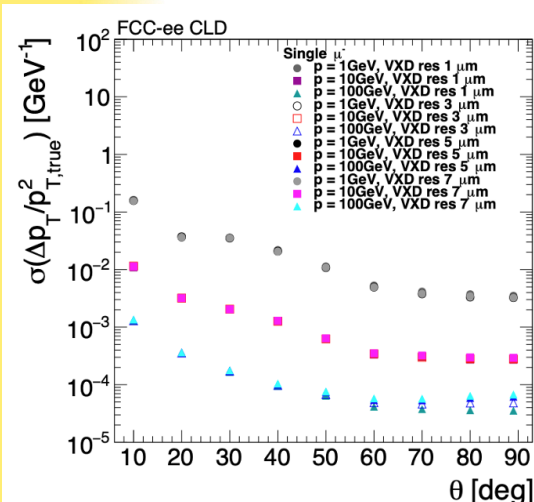
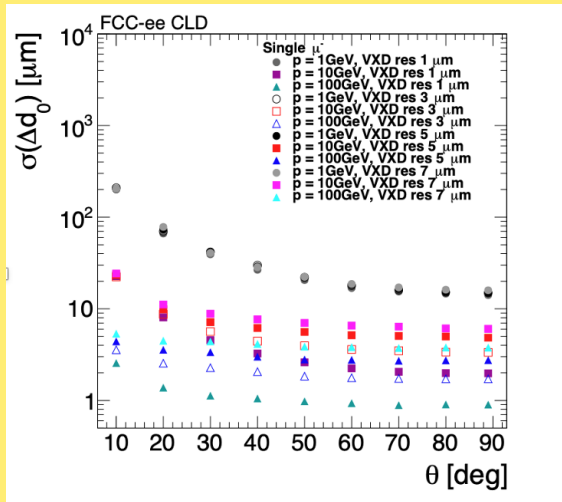
fonderie prévue avant fin 2024, évolution vers TPSCo 65nm en 2025



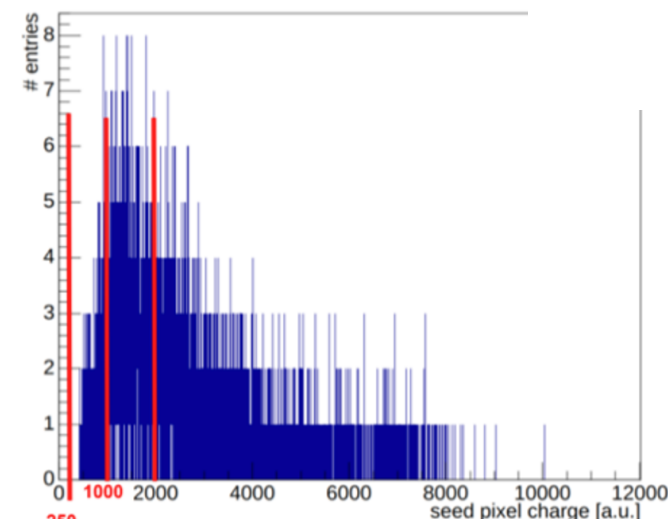
FAITS MARQUANTS 2024 : IPHC,

Vertex Detector Performances at CLD : FullSim

- Relation entre résolution des hits et des traces:

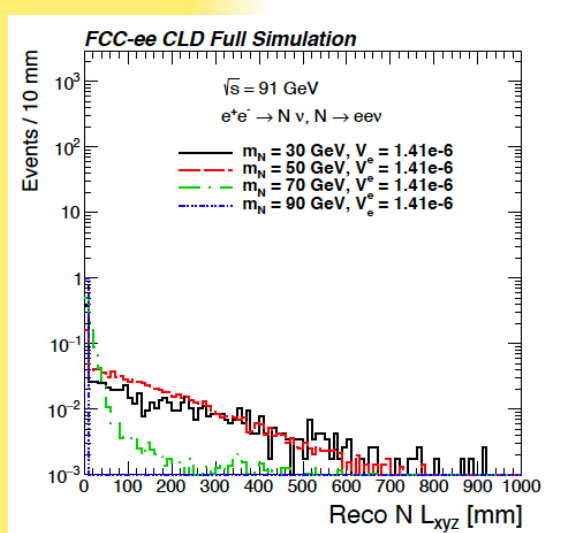


- Digitisation du signal des capteurs (CMOS)

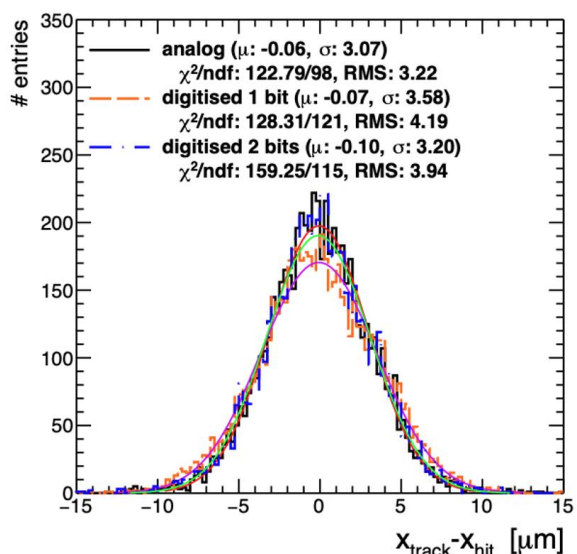
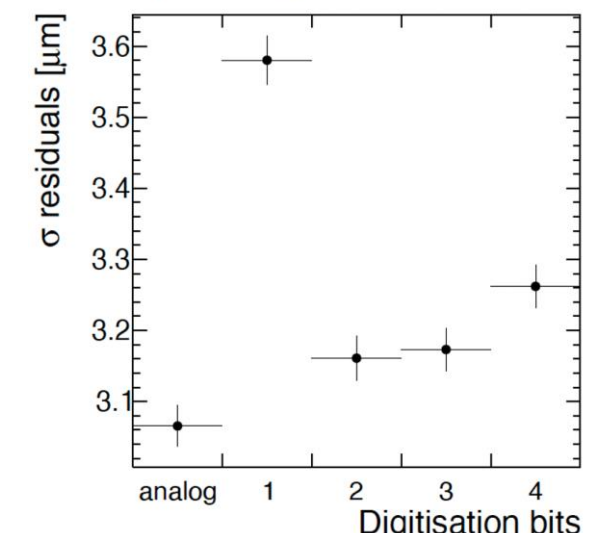


HNL and ALPs :

- Phéno,
- Génération,
- FullSim
- Reconstruction



Sigma vs Digitisation (residualsX)



FAITS MARQUANTS 2024 : LAPP

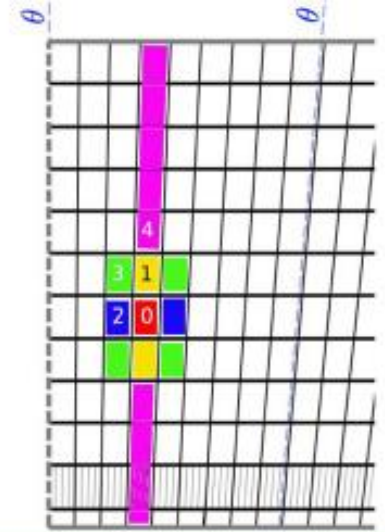
En cours

- ✓ **Simulation détecteur ALLEGRO (Zhibo Wu, Marco Delmastro)**
 - Simulation cross-talk et bruit ECAL
 - Optimization des geometries des electrodes ALLEGRO pour reconstruction optimale gerbes electromagnetique et identification particules
 - *Talk @ ICHEP 2024: Z. WU, "R&D studies of the noble liquid calorimeter for ALLEGRO FCC-ee detector concept"*
- ✓ **Physique du Higgs au FCC-ee (Marco Delmastro, Olivier Arneaz, Hind Taibi)**
 - Mesure de $VH/H \rightarrow ZZ^*$ dans les canaux $4l+w$ et $4l+jj$, pour la mesure de la largeur du Higgs

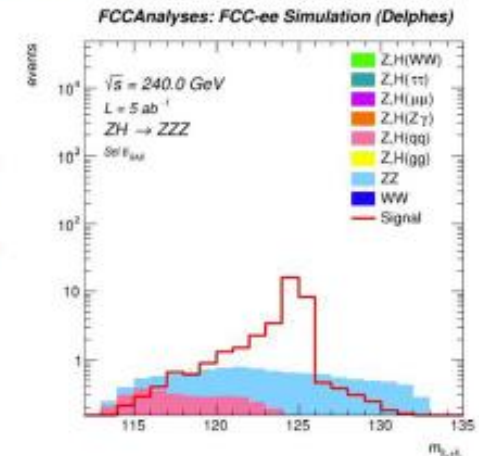
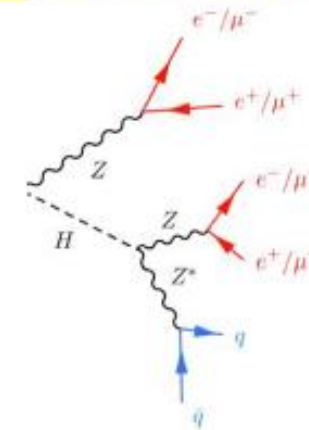
À venir (2025)

- ✓ **Simulation détecteur ALLEGRO (ZW, MD)**
 - R&T calorimétrie; EoI ALLEGRO ECAL
- ✓ **Contributions au FS et au rapport ECFA (MD, OA, stagiaire M1)**
 - Physique du Higgs au FCC-ee

Variable discriminant dans l'analyse $VH/H \rightarrow ZZ^* \rightarrow 4lljj$

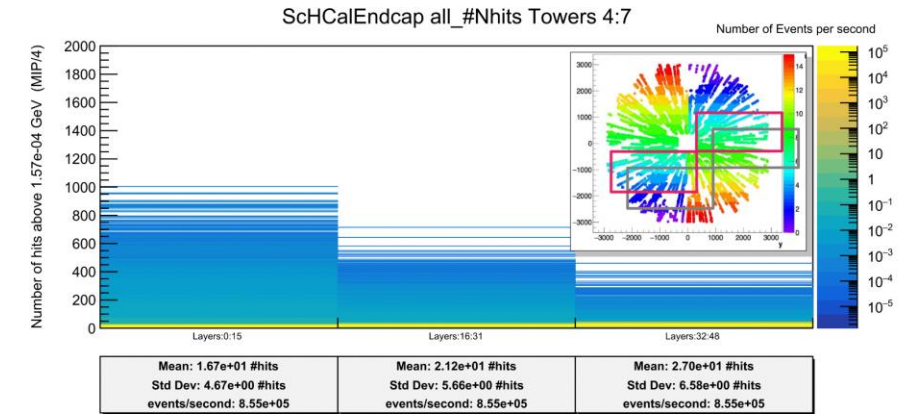


Des mesures du cross-talk sur le prototype d'electrode à l'emulation dans la simulation



FAITS MARQUANTS 2024 : LLR

- Outil d'évaluation des taux de donnée, d'occupation et de dissipation de chaleur dans les calorimètres (stage X-international : K. Hassouna + sup. VB) : → JINST ✓
 - à partir de simulations détaillées d'évènements minimum-bias et de bruit de fond machine. Résultats → Meeting ECFA
- Préparation de ILD-CC : SiW-ECAL au FCC (cooling)
 - contribs ESPPu : FCC, ILD-CC ; SiW-ECAL
- Évaluation de la sensibilité au couplage triple du Higgs au HL-LHC et FCC-hh (stage M2 : Bastien Voirin, sup. C. Charlot).
- Le budget 2025 mission couvre les réunions et ateliers FCC et symposium de la ESPPU.
- + 2 stages de M1/M2 sur les études de physiques (C. Charlot/J.C. Brient).
- ↔ MP DRD6 SiW-ECAL ; ANRs timing in calorimeters : T-Calo / Calo5D

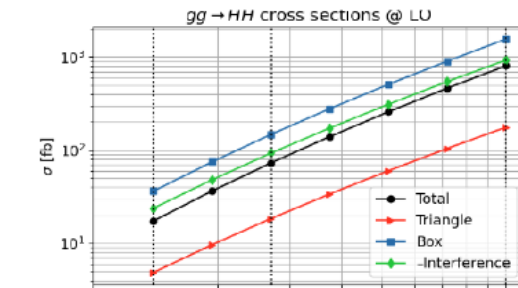


Average	14E+6 hits/s	18E+6 hits/s	23E+6 hits/s
MaxNhits	1000 Nhits/event	600 Nhits/event	400 Nhits/event
for 6B/hits	86E+6 B/s	109E+6 B/s	139E+6 B/s
Est. Ncells	278 756	278 756	278 756
Occupancy/BX	1,0E-06	1,3E-06	1,7E-06
cell size	30		

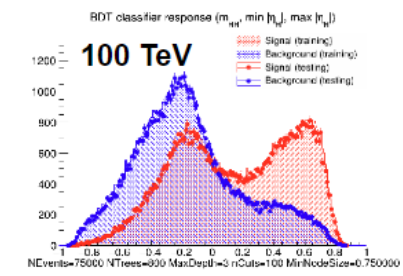
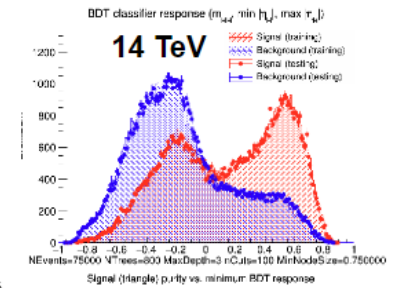
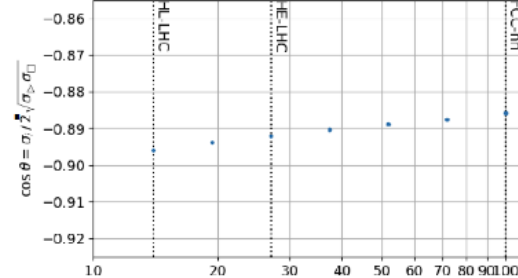
Note 1 : Very preliminary

Note 2 : Rates for all tower 4:7 modules → /4 per module, /16 per layer

LO cross sections vs. center-of-mass energy \sqrt{s}

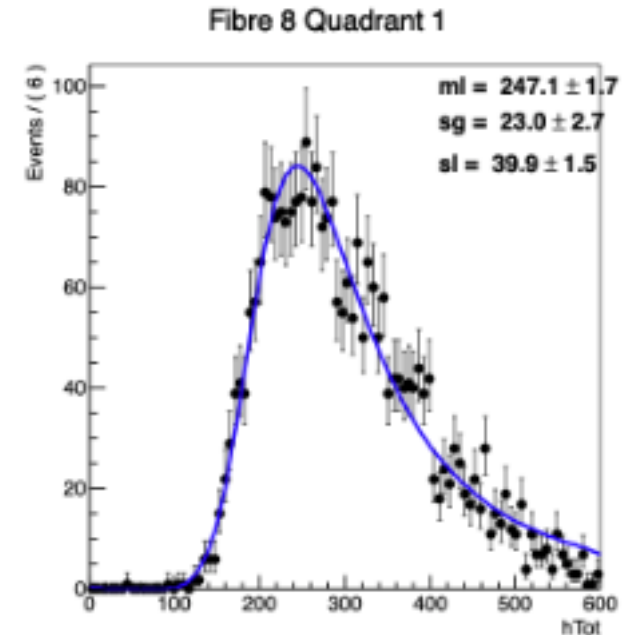
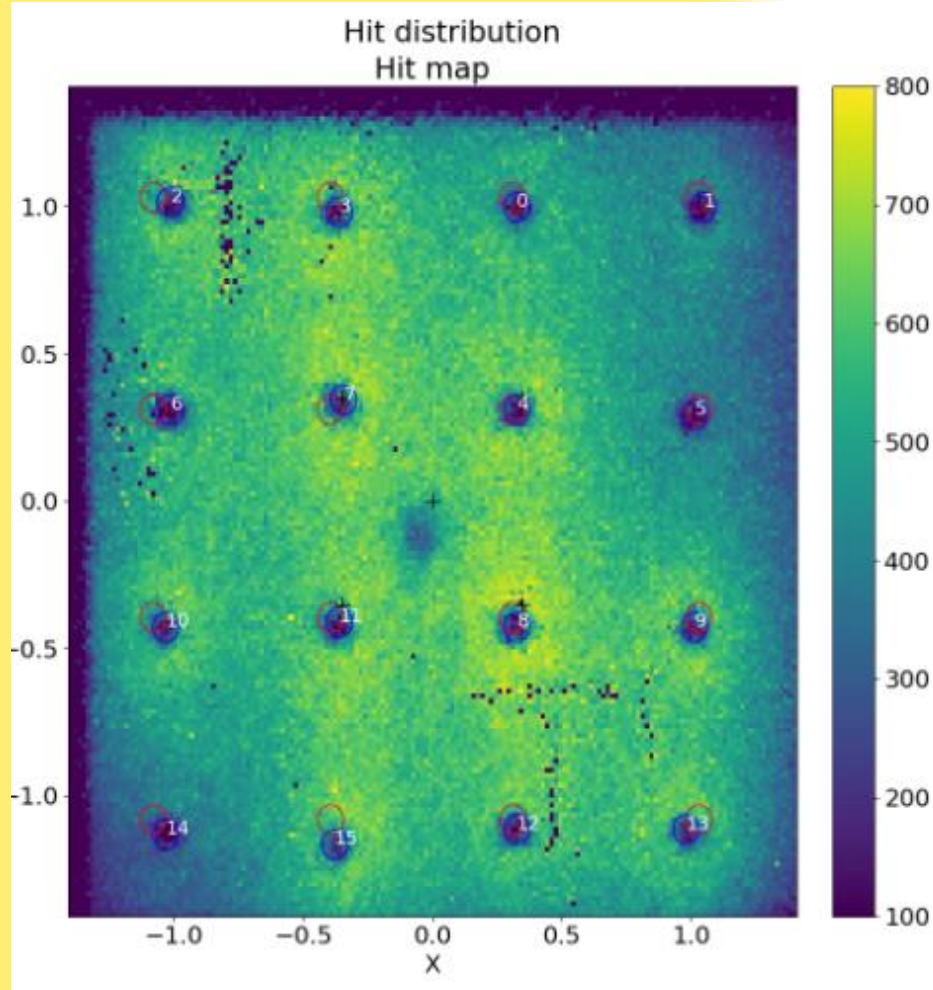


Interference angle between box and triangle amplitudes



FAITS MARQUANTS 2024 : LPC

Campagne de faisceaux tests au CERN (muons et pions) pour GRAiNITA (juin 2024)



Confirmation d'un terme stochastique possible de l'ordre de $1\% / \sqrt{E}$.
L'analyse est en cours.

FAITS MARQUANTS 2024 : CPPM, LPNHE, LPSC

Activités au CPPM

- Calorimétrie à liquide noble, dans le detector-concept Allegro:
 - Mécanique (P. K., E. M., F. Dj.)
 - Simulation, optimisation, performance (F. Dj.) (2025)
- Pixels
 - Développement de DMAPS (M. Barbero, M. Menouni)

LPNHE

- Implication dans physique/performances
 - **Etudes QCD (α_s , Lund Jet Plane)**
 - **But**
 - Sensibilité potentielle à α_s au FCC-ee
 - Implications sur le design du détecteur (eg calorimètre)
 - **Etudes**
 - Historiquement autour de l'étude de la multiplicité en #jets
 - Maintenant centré autour du Lund Jet Plane (synergie avec les études dans ATLAS)
- Suivi des développements R&D pour futurs détecteurs

Participation LPSC en 2024:

- Uniquement veille scientifique pour le moment (JBdV < 5%, FM ?)
- Dans le passé, FM + stagiaire M1, asymétrie avant-arrière dans avec jets b (A_{FB}^b)

APC:

- 1) ALLEGRO contribution to the Feasibility study, work in progress
- 2) FCC software contribution to the FS, work in progress
- 2) ZH cross section from Z-Leptonic decays / contribution to FS / work in progress
- 3) Hadronic Higgs decay / contribution to FS / work in progress

IPHC:

- 1) G. Sadowski et al., Search for HNL at FCCee, and comparisons between Fast and Full Sim, proposal F.S., work in progress.
- 2) M.Meena et al., Search for Axion-Like Particles decaying into a pair of gluons at FCC-ee, proposal to FS work in progress.
- 3) G.Sadowski et al, Tracking Resolution Studies with CLD Detector, proposal to the feasibility study

IP2I:

- 1) Recherches de nouveaux (pseudo-) scalaires légers contributions FCC FS/ECFA/ESPPU en préparation
- 2) Mesure du couplage HWW dans le canal $ee \rightarrow H\nu\nu$, $H \rightarrow WW$ hadronique (contributions FCC FS/ECFA/ESPPU en préparation
- 3) Etudes théoriques: tests de physique électrofaible de précision, physique du quark top, couplages et largeur du boson de Higgs, extensions au secteur scalaire, physique du saveur, particules composites, baryogenèse (contribution ESPPU en préparation, FCC FS/ECFA?)

IJCLab:

- 1) ALLEGRO contribution to the Feasibility study, work in progress
- 2) First characterization of a novel grain calorimeter: the GRAiNITA prototype, JINST, Volume 19, April 2024, GRAiNITA team

LAPP:

- 1) ALLEGRO contribution to the Feasibility study, work in progress
- 2) ZH/H \rightarrow ZZ* cross section from 4l+X final states (Higgs width measurement) / contribution to FS / work in progress

LPC:

- 1) [First characterization of a novel grain calorimeter: the GRAiNITA prototype](#), S. Barsuk et al., JINST 19 (2024) 04, P04008
- 2) Study of the feasibility of the observation of B_0 to $K^*(892) \tau^+\tau^-$ at FCC-eeT Miralles et al., doi 10.17181/d772d-egz40
- 3) Measuring A_{FB}^b and R_b with exclusive b-hadron decays at FCC-ee, doi 10.17181/yax2s-mvc83

LLR:

- 1) K. Hassouna, V. Boudry, "CaloFlux: A Tool to Estimate Fluxes in Calorimeters at Colliders", accepted at JINST as tech. report.

PRODUCTION SCIENTIFIQUE: Conférences (non exhaustif)

APC

- **Talk** ICHEP 2024: G. Marchiori, “Higgs physics program at FCC”
- **Talk** ICHEP 2024: G. Bernardi, “ZH total xsection and Higgs mass at FCC-ee”
- **Talk** Higgs 2023: G. Marchiori, “R&D towards future Higgs factories”

LAPP

- **Talk** ICHEP 2024: Z. WU, “R&D studies of the noble liquid calorimeter for ALLEGRO FCC-ee detector concept”

LPC

- **Talk** FCC-week à Annecy et à San Francisco et au WS ECFA à Paestum [Miralles (1), Monteil (2), Roehrig (4)]
- **Talk** à I3EE 2023 [Chanal] et poster TWEPP 2024 [Magne]

CPPM

- **Talk** "R&D on Noble Liquid Calorimeter for Future Collider Exp". F. Djama, 3rd ECFA workshop on future e+e- Colliders, 2024

IPHC

- **Talk/Procs** : G. Sadowski et al., Tracking Performance Studies for Future Circular Collider (FCCee) with CLD Detector, LCWS 2024.
- **Talk**: Z, ElBitar, Status of the Key4HEP Ecosystem, FCC/DRD France Workshop, 11/23,
- **Talk**: G.Sadowski, Detailed simulation for Tracking, FCC/DRD France Workshop, 11/23,
- **Talk**: J.Andrea, Top quark generation, full simulation and reconstruction with the CLD detector. FCC/DRD France Workshop, 11/23,
- **Talk**: G.Sadowski, Towards CLD Tracker optimization, 7th FCC Physics Workshop, Annecy, 01/23

IP2I

- **Talk**: FCC Week San Francisco Juin 2024: D. Contardo, "ECFA highlights and DRD collaboration progress“
- **Talk**: 2nd ECFA workshop Paestum, 2024: G. Cacciapaglia " Searching for light scalars and ALPs from Z decays “

Soutenance de thèse : 2023 Ang Li (APC), 2024 Lars Roehrig (LPC) Tristan Miralles (LPC)

3 soutenances prévues en 2025

Contributions aux ECFA panels: HET factory study

Web page: <https://ecfa.web.cern.ch/ecfa-study-higgs-ew-top-factories>

□ Charge:

□ Based on the recommendations of the [ESPP Update], ECFA is organising a series of workshops on physics studies, experiment design and detector technologies towards a future electron-positron Higgs/EW/Top factory.

□ *The aim is to bring together the efforts of various e+e- projects, to share challenges and expertise, to explore synergies and to respond coherently to this high-priority strategy item.*

□ Current goal: update contribution sent to Snowmass exercise; write up in an ECFA White Paper (or CERN Yellow Report) for Dec 2025.

□ Editors: A. Robson and C. Leonidopoulos

□ HET Factory Workshops:

• First: 2022 @ DESY (GE);

• Second: 2023 @ Paestum (IT);

• Third: 2024 @ Paris, October 9-11

□ Task for RECFA:

□ Impact on HET Factory study (its conclusion) and schedule of next EUSPP:

Since ECFA study has to feed/inform ESPP process, it should be ready in early Spring 2025.

3rd ECFA workshop on e⁺e⁻ Higgs, Top & ElectroWeak Factories

9–11 October 2024

Sorbonne Université, Campus des Cordeliers, Paris



International Advisory Committee

- Patricia Coude Duval (IST/LP)
- Delia Comans (IMZPS)
- Mogens Dam (Copenhagen NBI)
- Arnoud Ferrari (Stockholm)
- Juan Foster (Wiscad)
- Eliott Gross (Tel Aviv)
- Jürgen D'Onofri (VU Brussel)
- Christophe Grosjean (DESY)
- Patrick Janot (CERN)
- Matt Khan (Liverpool)
- Christos Leontiadopoulos (Edinburgh)
- Celia Martinez Rivera (Madrid)
- Joachim Nacht (CERN)
- Alexandro Nisati (ROME 6)
- Adam Robinson (Glasgow)
- Frank Sjöström (KIT)
- Paris Sphariss (Athens, CERN, Chai)
- Stefan Storz (CERN)
- Roberto Tenchini (Pisa)
- Guy Wilkinson (Oxford)
- Andreas Wulzer (Lausanne)

Local Organizing Committee

- Gregorio Bernardi (CNRS/IN2P3, Chai)
- Catherine Baccant (L2IT Toulouse)
- Guillaume Boudoul (IP2I Lyon, ACP)
- Vincent Bouček (ILR Palaiseau)
- Paul Colas (IRFU, CEA/Saclay)
- Maria Delmastro (IAPP Anecy)
- Jean-Baptiste De Vivie (IPSC Grenoble)
- François Dyrna (CFPM, Marseille)
- Ziad El Bina (PhC Strasbourg)
- Giovanni Marchionni (APC Paris, co-Chair)
- Stephane Nooral (LPC Clermont-Ferrand)
- Nicolas Morange (JULab Dijon, co-Chair)
- Luc Poggiani (LPNHE Paris)
- Suzanne Gossez-Sharkas (IP2I Lyon)
- Maxim Tlou (IRFU, CEA/Saclay)

<https://indico.in2p3.fr/e/ecfa2024>



Science et Société: le projet FCC, le Futur Collisionneur Circulaire de particules élémentaires du CERN

8 octobre 2024
Campus des Cordeliers, Paris, Metro Odeon
Fuseau horaire Europe/Paris

Entrer le texte à rechercher

Accueil

Ordre du jour

Inscription

Contact

✉ gregorio.bernardi@in2p...

Séminaire d'information sur la faisabilité du FCC, le Futur Collisionneur Circulaire au CERN.

Lors de la dernière stratégie européenne pour le futur de la physique des particules élémentaires, le CERN a reçu le mandat, par ses États membres, d'étudier la faisabilité d'un Futur collisionneur circulaire ou FCC. Le FCC serait un collisionneur de particules de nouvelle génération installé dans un tunnel souterrain de 91 km qui serait creusé en profondeur sous les départements de l'Ain et de la Haute-Savoie en France, ainsi que le canton de Genève, en Suisse. Le FCC succéderait au Grand Collisionneur de Hadrons (LHC) dont le programme de recherche s'achèvera au début des années 2040.

+ ECR workshop on 8/1 (afternoon)

205 inscrites

Extracts of the agenda (1st and 3rd day)

Wednesday 9/10

	Registration		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
			08:30 - 09:00
09:00	News from the local organizers		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
		<i>G. Bernardi et al.</i>	09:00 - 09:10
	Welcome from IN2P3 and IRFU		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
		<i>Dr Christelle Roy</i>	09:10 - 09:25
	ESPPU process and timeline; goals of the workshop		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
		<i>Paris Sphicas</i>	09:30 - 09:40
10:00	The need for a Higgs, Electroweak, and Top factory		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
		<i>Margarete Mühlleitner</i>	09:45 - 10:10
	Software for future colliders		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
		<i>Juraj Smiesko</i>	10:15 - 10:30
	coffee break		
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>		
			10:30 - 11:00
11:00	Overview on low mass sc...	Measurement of hadronic ...	Reimagining Electron-Pos...
	<i>Tania Robens</i>	<i>Alexis Malaizel</i>	<i>Graham Wils...</i>
	Search for additional Higg...	Strange tagging with ILD f...	CMOS R&D targeting a ver...
	<i>Anne-Marie ...</i>	<i>Dr Taikan Su...</i>	<i>auguste bes...</i>
	Search for invisible decay...	Detector impact on flavou...	Precision studies of quan...
	<i>Aman Desai</i>	<i>Andrea Scia...</i>	<i>Juan Alcara...</i>
		Probing New Physics at fu...	Large area low-power Mo...
		<i>Redamy Per...</i>	<i>Yanyan Gao</i>

Friday 11/10

09:00	Generators and Theory developments needed for HET physics	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		09:00 - 09:25
	Towards detectors for HET factories / tracking and vertexing systems	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		09:30 - 09:50
10:00	Towards detectors for HET factories / calorimeter and PID systems	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		09:55 - 10:15
	Towards detectors for HET factories / electronics, mechanics, integration	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		10:20 - 10:40
	coffee break	
11:00	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		10:45 - 11:15
	WG1 (physics potential):Subgroup-1 report/plans	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		11:15 - 11:25
	WG1 (physics potential):Subgroup-2 report/plans	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		11:30 - 11:40
	WG1 (physics potential):Subgroup-3 report/plans	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		11:45 - 11:55
12:00	WG1 (physics potential):Subgroup-4 report/plans	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		12:00 - 12:10
	WG1 (physics potential):Subgroup-5 report/plans	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		12:15 - 12:25
	Poster prizes and 10min talks by two winning posters	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		12:30 - 12:55
13:00	lunch break	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
	ECFA Report: plans from WG3; discussion	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		15:05 - 15:20
	Next steps and timelines for ECFA Report; approval process	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		15:25 - 15:35
	Discussion: what is missing; how to engage in ESPPU process	
	<i>Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon</i>	
		15:35 - 15:50

FCC: FRANCE – ITALIE 4-6 novembre, Venise

2ND "FCC ITALY & FRANCE WORKSHOP"

VENICE, PALAZZO FRANCHETTI - NOVEMBER 4 - 6, 2024

2nd FCC Italy & France Workshop

Nov 4 – 6, 2024
Venice
Europe/Rome timezone

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- Overview
- Registration
- Organizing Committees
- Organization for FCC Project in Italy and France & contacts
- Scientific Program
- (Preliminary) Agenda Skeleton
- Travelling to Venice
- Accommodation in Venice
- FCC POSTER

The second joint FCC-France&Italy workshop on Higgs, Top, EW, HF and SM physics will take place at Palazzo Franchetti, in Venice from 4-6th of November 2024.

In 2020 CERN started a feasibility study for the construction of a Future Circular Collider (FCC) in the Geneva region with a circumference of about 100 km. An e+e- collider (FCC-ee), covering the energy range from the Z pole up to the top pair production threshold is the first step to collect incredible statistics of the heaviest particles of the SM. The FCC integrated project, that includes the hadron collider FCC-hh, offers an incredible discovery potential with a careful mixture of precision measurements sensitive to very weak couplings or to very heavy objects, and very high energies where the new heavy particle could be directly produced.

During this 5 year process, toward the preparation of a document for the next European Strategy for Particle Physics, it is important to perform all the studies needed to design detector concepts able to satisfy the needs of the extensive physics program and this workshop happens at a crucial time in the process. In this workshop, the current status of the most recent advances in the R&D for the accelerator and detectors, will be presented. In addition, there will be sessions dedicated to the experimental and theoretical developments for the various physics topics, from Higgs and electroweak precision measurements to flavour physics (including top) and BSM sensitivities. Plenary sessions will be devoted to overall summaries of the current status of the various aspects, while the parallel sessions will focus on specific areas.

The workshop aims at intensifying French and Italian collaboration and participation to the FCC feasibility study through detailed studies on physics possibilities and the constraints that these entail on the detectors, and through accelerator and detector concepts studies and R&D. The workshop will happen at a crucial time towards the preparation of the final document to be provided as input to the next European Strategy in Spring 2025 so we look forward to new inputs and contributions from the community at large.

FCC Contact

[FCC Italy_France conta...](#)

Scientific Program

Physics Studies (theory and experiment)

- Higgs
- Electroweak
- Flavour
- Top
- Beyond Standard Model

Detector

- Vertex
- Tracking systems
- Electromagnetic Calorimeter
- Hadronic Calorimeter
- Muon
- PID
- Timing
- MDI

Accelerator

- MDI and Interaction Region
- Main Rings
- Collective effects
- Injector
- Booster

ECR Discussion

- Common IT-FR thesis proposals
- Researcher mobility between IT-FR
- How to combine work for LHC experiment and FCC?

Ressources Humaines

APC

- Gregorio Bernardi : DR (0.7* ETP).
- Marco Bomben : MCF (0.1 ETP).
- Giovanni Marchiori: DR (0.4* ETP).
- Alexis Maloizel : PhD (0.5 ETP).
- Tong Li : post-doc mixte ATLAS-FCC
(0.5 ETP) **FIN 12/2024**
- **TOTAL : 2.2 FTE**

LPNHE

- 3 permanents :
 - **Luc Poggioli** (Em, ATLAS/FCC, 80%), **Alain Blondel** (Em, FCC/T2K, 40%), **Bogdan Malaescu** (CR, ATLAS/FCC/g-2, 30%)
- 1 doctorant :
 - **Line Delagrang** 2/3 ATLAS, 1/3 FCC
 - soutenance en 2025 (Mesure de α_s dans ATLAS & études d'optimisation QCD au FCC)
- 1 postdoc :
 - **Lata Panwar** (postdoc ANR-LEAP 07/2022-07/2025) 2/3 ATLAS, 1/3 FCC
 - Etude du Lund Jet Plane dans ATLAS. Utilisation dans FCC-ee et optimisation des paramètres des détecteurs

TOTAL : 2.5 FTE

RH : IJCLAB

Nom	Activité	ETP 2024	ETP 2025
Nicolas Morange	Allegro ; Physique	0.30	0.30
Daniel Fournier	Allegro	0.10	0.10
Ronic Chiche (IT)	Allegro	0.10	0.10
Laurent Serin	DRD	0.10	0.10
Marie-Hélène Schune	Grainita	0.15	0.15
Jacques Lefrançois	Grainita	0.35	0.35
Giulia Hull (IT)	Grainita	0.40	0.40
Ianina Boyarintseva	Grainita	0.30	0.30
Yasmine Amhis	Physique	0.10	0.10
Zuchen Huang (CDD, 01/12/2024)	Allegro	0.05	0.50
Sergey Barsuk	Grainita	0.05	0.05
Dominique Breton (IT)	Grainita	0.05	0.05
Jihane Maalmi (IT)	Grainita	0.05	0.05
Carlos Dominguez-Goncalves (IT)	Grainita	0.25	0.25

TOTAL : 2.35 FTE

2.80 FTE

Statut	Nom	FCC-PED	GRAM	AIDAINNOVA / T-CALO	T-MRPC	Total Futurs Collision.
Permanent	G. Boudoul	40%, 55%	1%, 5%			40%, 60%
	D. Contardo	20%, 20%	15%, 15%			35%, 35%
	S. Gascon	25%, 25%				25%, 25%
	M. Gouzevitch	5%, 5%				15%, 0%
	G. Grenier	10%, 10%		30%, 30%	5%, 5%	45%, 45%
	I. Laktineh	10%, 10%		15%, 15%	15%, 15%	35%, 35%
	L. Mirabito	10%, 10%		5%, 5%	15%, 15%	25%, 25%
	G. Cacciapaglia	25%, 0%				25%, 0%
	A. Deandrea	20%, 20%				20%, 20%
	L. Darmé	10%, 10%				10%, 10%
	N. Mahmoudi	15%, 15%				15%, 15%
	F. Nortier	0%, 40%				0%, 40%
Postdoc/ CDD	J. Xiao	10%, 10%				10%, 10%
	NN ('mixte')	5%, 30%				5%, 30%
Doctorant	E. Jourd'huy (D3)	10%, 0%				10%, 0%
	T. Pasquier (D2)	10%, 10%		65%, 0%	10%, 75%	85%, 85%
	W. Vaginy (D1)	20%, 85%				20%, 85%
	C. Verollet (D1)	5%, 30%				5%, 30%
	Total Project (FTE)	2.40, 3.80	0.15, 0.20	1.10, 0.45	0.40, 1.05	4.20, 5.45

RH : IPHC

- Jeremy Andrea : DR (0.2 ETP).
- Auguste Besson : MCF (0.1 ETP).
- Ziad El Bitar: DR (0.2 ETP).
- Emmanuel Medernach : IR (0.5 ETP).
- Meena Meena : post-doc mixte CMS-FCC (démarrage activité ~full time FCC en juillet 2024).
- Gaëlle Sadowski: PhD (1 ETP).
- +1 Eric Chabert (0.2 ETP) starting in fall 2024

TOTAL : 3.0 FTE

RH : CPPM

Nom	Statut	FTE 2024	FTE 2025
Marlon Barbero	Enseignant-Chercheur	0.10	0.10
Farès Djama	Ingénieur-Chercheur	0.35	0.35
Lorenzo Feligioni	Chercheur	0.10	0.00
Emmanuel Monnier	Chercheur	0.05	0.05
Pierre Karst	Ingénieur	0.20	0.20

TOTAL : 0.8 FTE

0.7 FTE

- Marco Delmastro (DR2, Coordinateur LAPP FCC-PED)
 - ✓ 10% en 2024, même en 2025
- Olivier Arnez (CPJ USMB)
 - ✓ 5% en 2024, même en 2025
- Zhibo Wu (postdoc IN2P3 2024-2026)
 - ✓ 50% FCC en 2024 (50% ATLAS), même en 2025
- Hind Taibi (stagiaire M1)
 - ✓ 30% en 2024 (100% mai-aout 2024)
- Stage M1 à pourvoir en 2025
 - ✓ ~4 mois, physique Higgs FCC-ee pour FS et rapport ECFA

TOTAL : 1.2 FTEÉvolution 2025: **LPSC**

- Contributions simulation + analyses à discuter avec le recrutement CPJ
(JBdV , CPJ ~ 2×10% + en principe augmentation progressive, FM ~ 5% ?)

- Intérêts contributions techniques :

→ Service mécanique (SERM): participation DRD6 (et 7, 8)

Structures mécaniques (D. Grondin)

« Thermal integration » (J. Giraud)

« micro-cooling » (P. Delebecque)

→ Service électronique: plus générique que FCC

WADPAT (F. Rarbi, FM)

TOTAL : 0.4 FTE (tbc)

RH:

LPC

LLR

Statut	LPC
Permanent	Hervé Chanal (MCF) Romain Madar (CR) Stéphane Monteil (Prof) Magali Magne (IE) David Picard (IE)
Postdoc/CDD	Yingrui Hou (CNRS) Mike Yeresko (ATER)
Doctorant	Tristan Miralles (MESRI) Lars Roehrig (DFG)

LLR	2024 / 2025
R. Salerno (DR)	10 % / 5 %
V. Boudry (CR)	40 % / 40 %
C. Charlot (DR)	10 % / 10 %
U. Bassler (DR)	15 % / 50 %
J.C. Brient (em)	15 % / 15 %
H. Videau (em)	10 % / 10 %
ANR T-Calo	5 % / 30 %
ANR Calo5D	5 % / 30 %

TOTAL : 1.1 / 1.8 FTE

DEMANDE RESSOURCES FINANCIERES IN2P3 EN 2025

COUT VOYAGE	CERN (3nights) Phys wkshop	Austria FCC-week	FCC-France	FCC-meet CERN	open symposium	TOTAL (k€) TOT	dont FCC-FR	TOTAL rounded
		800	1800	500	400	1500		
APC+FCC-FR	3200	5400	2000	3200	3000	21,8	5000	22
CPPM	800	0	1000	400	1500	3,7		4
IJC Lab	2400	3600	1500	400	1500	9,4		9
IPHC	1600	3600	1000	4000	1500	11,7		12
IP2I	5600	9000	6000	1000	1500	23,1		23
LAPP	400	3600	1000	400	1500	6,9		7
LLR	1600	1800	1500	400	1500	6,8		7
LPC	2400	1800	1000	1600	1500	8,3		8
LPNHE	2400	1800	1500	1200	1500	8,4		8
LPSC	800	1800	2000	1600	1500	7,7		8
L2IT	300	0	1500	0	0	1,8		2
TOTAL-2024	21500	32400	20000	14200	16500	109,6	5000	110

DEMANDE RESSOURCES HUMAINES IN2P3 EN 2025

Laboratoire	Permanents	Postdocs	Doctorants
APC	CR : ATLAS/FCC (Higgs/ALLEGRO)		PhD: ATLAS/FCC (Higgs/Allegro)
LPCA		PD: LHCb / FCC	
CPPM		PD: ATLAS / FCC	PhD: ALLEGRO (technique)
IJCLab			
IP2I			
....			

Faire figurer les demandes qui sont dans les priorités du labo (DIALOG), éventuellement inter-classer entre labos. Les autres demandes (non-remontées par le labo) peuvent être affichées en gris Préciser en 2/3 mots le sujet

Doctorant : préciser bourse entière ou demi-bourse (avec qui ?)

• Classement: **CR / APC**

PD / LPCA

PhD / CPPM

Les prochaines années

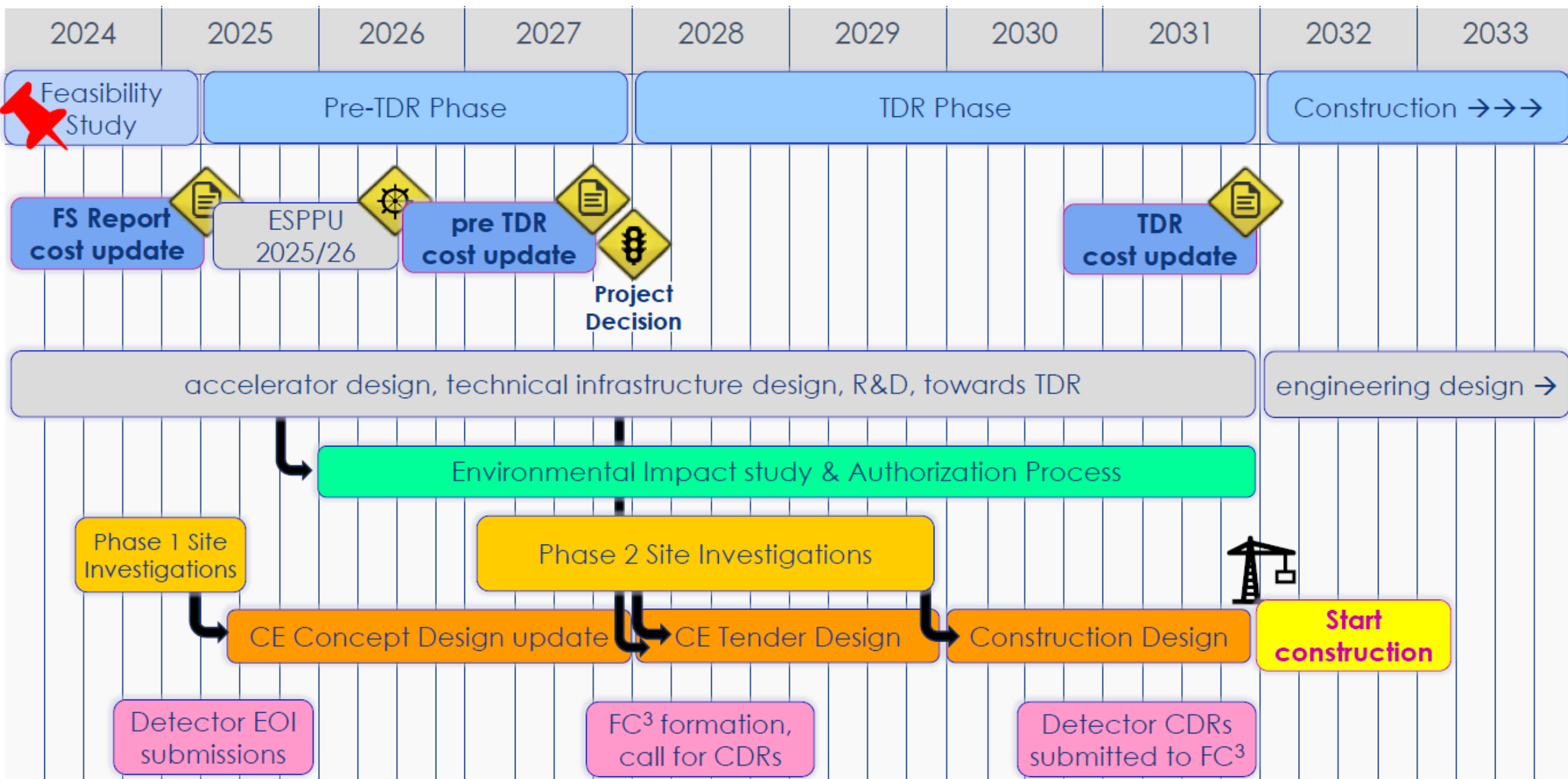


Pre-TDR phase from April 2025 until end 2027

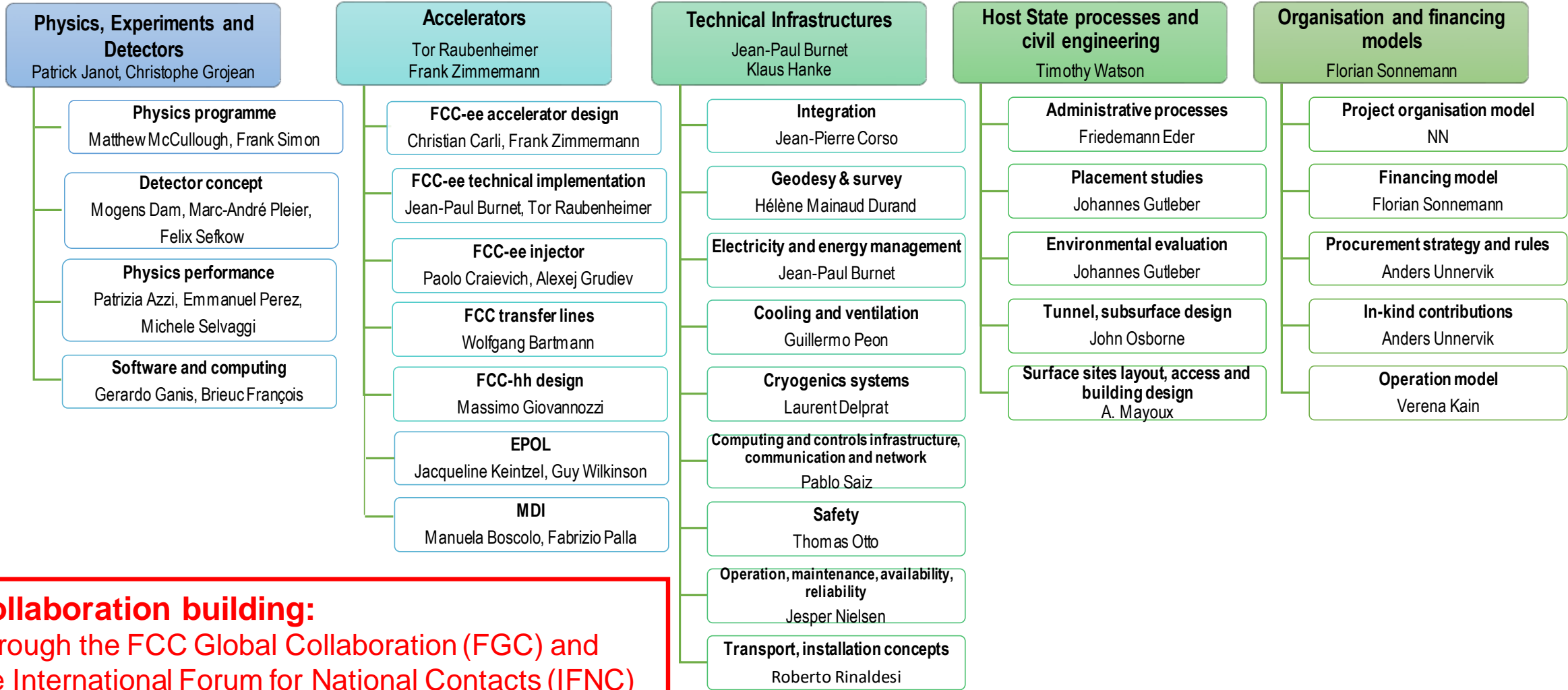
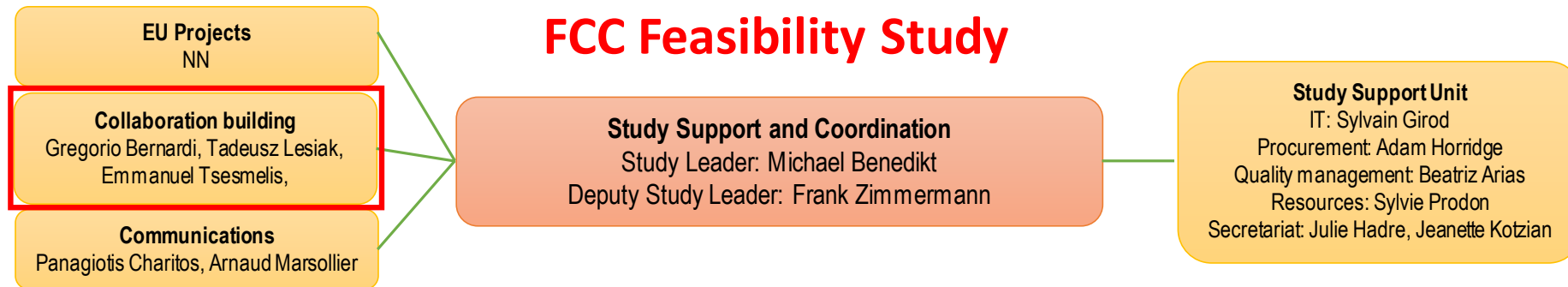
Main goal is to provide all information to Council to allow taking a decision on the project **by end of 2027 or early 2028**

- Further develop the civil engineering and the technical design of all major systems and components, so as to provide a **more detailed cost estimate** with reduced uncertainties
 - Continuation of **technical R&D activities**
 - Work with host states on **regional implementation development and authorization process definition to enable launch of environmental impact study in 2026**
 - Continuation of site investigations and perform an **overall integration study to specify requirements of technical infrastructure, accelerators and detectors**
 - **Provision of input for civil engineering design if the project goes ahead.**
- Work with international partners to define roles and work packages

Expected time line till start of construction



FCC Feasibility Study



Collaboration building:
Through the FCC Global Collaboration (FGC) and the International Forum for National Contacts (IFNC)

Next 5 years / HEP Collaborations building

- **EOI for subdetectors and proto-detector concepts to be submitted by March 2025**
- **National/Regional EOI in support of FCC for subdetectors to be submitted by March 2025 ?**
- **Set-up process for proto-collaborations formation in 2028-2029**

The Cost Review Panel recommends to work with the scientific community, institutes, laboratories and funding agencies to ensure support and resources for **four experiments**, facilitating the exploitation of the full scientific potential offered by the large investment in the FCC-ee facility

- Completing list of tasks of the Institutes in the IFNC
- Iterate with National Contacts to gather latest information of possible funding of the HEP teams.
- Explore how the countries/institutes position themselves on the current/future proto-detector concepts

A possible strategy for building HEP collaborations in the next five years:

- Start with EOI for subdetectors and proto-detector concepts in 2025, and their development in the following two years.
- Assuming positive recommendation to push forward by end of 2027 by the CERN council:
 - Setting up FCCC and proto-collaborations (following call for CDR); probably around proposed proto-detector concepts,
 - Learn from observing the current setting up of the DRD collaborations.
 - Find a scheme to reduce the number of proto-collaborations (merging) if more than 4 proposals
 - **Process could converge by 2030-2031**

Examples of FCC-useful input to the ESPP, in a given country:

- FCC Feasibility Study
- National Strategy document (all fields, not only colliders)
- EoI's for FCC subdetectors
- EoI's for FCC detector concepts
- EoI's/Notes on National (or Regional) FCC Scope and Activities

• Eol's for FCC subdetectors

PED will soon call for Eol's by institute or consortia of institutes to pursue the development of sub-detectors (e.g. calorimeter, tracker) for FCC experiments

Activities should be well connected to R&D pursued in the DRD collaborations and complement these with a focus on system integrations aspects at the subdetector level but also on its integration in one or several global detector concept.

R&D should be supported with detailed simulation and system performance optimisation

These Eol's should be compact documents (2-4 pages, possibly with references to more detailed notes), including:

- The scope of planned activities for the pre-TDR phase (next 3-5 years)
- The partners and their expertise
- The connection with DRD activities
- The engineering and simulation connections with detector concept groups

• Eol's for FCC detector concepts

These Eol's should also be compact documents (4-6 pages) including

- The description of the possible subdetector configurations
- The partners and their expertise
- Performance obtained in such concepts
- ...

Eol's/Notes on National (or Regional) FCC Activities

Goal: give an overview of scope or activities related to future e+e- colliders in the country/region:

Can be presented as compact notes (3-6 pages) along the line:

Assuming FCC moves forward, we would continue/start to contribute in these fields:

- List of Detector/R&D scope and activities
- List of Software/Analysis scope and activities
- List of Theory scope and activities
- List of any other scope and activities within PED

with references to Feasibility study, Eol's, ECFA or other notes.

We can refer to results obtained in local workshops (and list them)

We list institutions participating, detailing in which field they contribute.

Rappel de nos conclusions en 2023

Strasbourg 11/2023: first conclusions on detectors Eol's / DRAFT

- We have seen numerous commitments to the ALLEGRO concept
- We would like to be in an expression of interest for a microvertex concept, and check which labs are interested to join.
- We could try to collaborate with Italian Labs on tracking (microvertex + drift chamber)
- We hope ILD will indeed make a proposal 'ILD' for FCC, and we need to identify somebody in France in charge of pushing this effort locally, which includes Calice calorimetry, and TPC if it can work.
- We have other collaborative proposals: Crystal calorimetry or Grainita, which could go into a separate detector concept dedicated to heavy flavour physics

QUESTIONS ?

ECFA Panels: HET Factory Study (III)

□ HET Factory study; focus topics in [ArXiv report](#).

1	HtoSS — $e^+e^- \rightarrow Zh: h \rightarrow s\bar{s}$ ($\sqrt{s} = 240/250$ GeV)
2	ZHang — Zh angular distributions and CP studies
3	Hself — Determination of the Higgs self-coupling
4	Wmass — Mass and width of the W boson from the pair-production threshold cross section lineshape and from decay kinematics
5	WWdiff — Full studies of WW and $e\nu W$
6	TTthres — Top threshold: Detector-level simulation studies of $e^+e^- \rightarrow t\bar{t}$ and threshold scan optimisation
7	LUMI — Precision luminosity measurement
8	EXscalar — New exotic scalars
9	LLPs — Long-lived particles
10	EXtt — Exotic top decays
11	CKMWW — CKM matrix elements from W decays
12	BKtautau — $B^0 \rightarrow K^{0*}\tau^+\tau^-$
13	TwoF — EW precision: 2-fermion final states ($\sqrt{s} = M_Z$ and beyond)
14	BCfrag and Gsplit — Heavy quark fragmentation and hadronisation, gluon splitting and quark-gluon separation

- In these last three years, the IFNC has grown to include national contacts from all European countries, and has reached out to all large countries outside Europe, with dedicated information/collaboration meetings
- With Japan, there have been discussions but no contact has been confirmed yet given the ILC revived initiative.
- With China since there is direct competition, only general discussions have taken place, showing however that Chinese physicists would like to collaborate if FCC would move forward and not CEPC.
- To reach further consensus, inside each country, contacts for institutes eager to collaborate in FCC have been identified (>45 in the US, 15-20 in each of UK, Italy and France, 10 in Germany but growing and so on),
 - detailed picture of the FCC support is now identified, and is now showing a clear majority supporting FCC-ee.
- The minority is divided into
 - 1) those supporting a muon collider: many physicists of this community accept now that the muon collider is a second generation machine, hence feel less in competition with the FCC project.
 - 2) those supporting a linear option (mostly ILC-like) based on arguments which are sometimes contradictory (e.g. duration and cost when considering the necessary upgrades)
 - 3) those who would like to go directly to a FCC-hh, especially if CEPC would be built, even at lower energy than in the nominal hh project, however penalizing is such a plan in terms of cost and starting time delay.
- The FCC-ee IFNC has identified these physicists and participates in workshops in which scientific arguments are exchanged with them, and some physicists of the minority get convinced and eventually support FCC, but this is a slow process.
- The on-going strategy process in many European countries is also playing a positive role to further unite the community.