

A.D. 1308

unipg

DIPARTIMENTO
DI FISICA E GEOLOGIA

DIPARTIMENTO DI ECCELLENZA
MUR 2023/2027



Activity report

FCC contributes from the acronyms Belle2, CMS, LHCb,
and NA62

Maria Elena Ascioti and Stefano Moneta



Present activities

FCC:

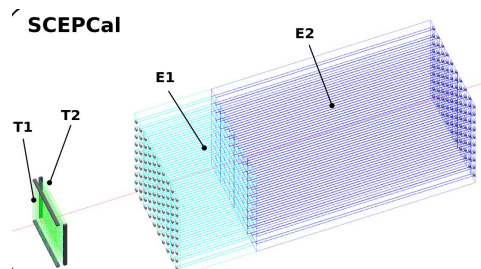
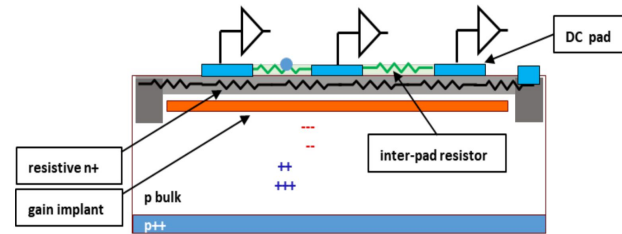
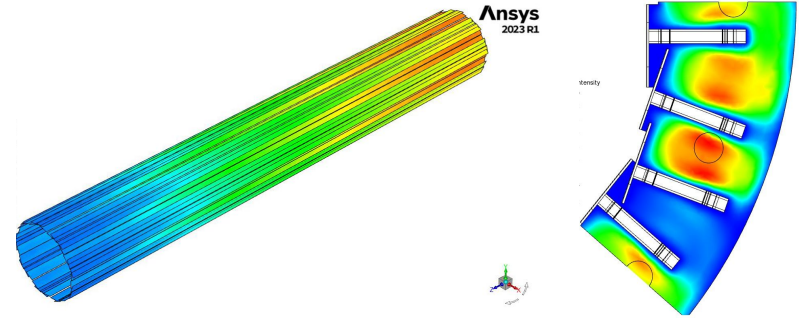
- Starting officially the FCC activities at Perugia
- Scouting among local groups on R&D and software activities most directly connected to FCC-INFN activities, primarily where:
 - Ongoing **R&D activities** projectable towards FCC (AIDAINNOVA, DRD)
 - CMS phase2 vertex upgrade
 - Belle II calorimeter R&D
 - Studies related to **physics performance**, and **phenomenology**
- There is a specific interest in investigating the preparation of FCC-ee

EIC:

- Theoretical and phenomenological studies on the partonic structure of nucleons and light-nuclei. (Matteo Rinaldi and Filippo Fornetti (Phd))

On-going R&D

- **Mechanics/Cooling** (WP2)
 - study of vertex detector cooling and MDI
- Timing sensors **LGAD** (WP3)
 - design for TOF, characterization and radiation hardness
- **Calorimetry** (WP5)
 - dual readout studies on single crystals



Software and Phenomenology

- **Software and simulation** (WP1): tracking, beam bkg studies, PID and PFA
- **Phenomenology:** heavy neutral leptons search (Sofia Giappichini's master thesis, 100% on FCC-ee)

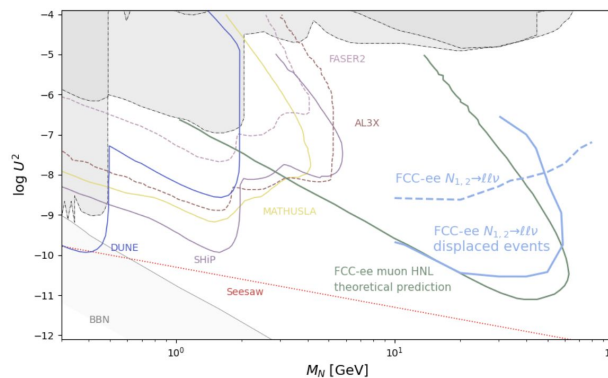
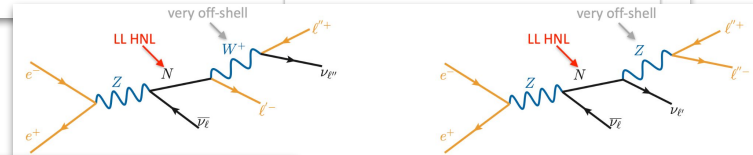
- The study highlighted how FCC-ee is able to identify HNLs events in the available parameter for a realistic see-saw scenario
- The work is complete and under review from FCC collaboration, and we are going to publish a preprint on the Arxiv soon

- **Studi fondo macchina:** background derivante dall'interazione e^+e^-
 - Non ci sono stime al momento sull'impatto che ha sulla fisica, atteso non trascurabile
- **Tracking:** tracker di IDEA è costituito da inner tracker (pixel silicio) + camera a drift + wrapper silicio esterno => occorre sviluppare algoritmo in key4hep per fare tracciamento
- **PiD e Energy Flow**

Attività non ancora concreta:

Studio del framework software FCC (workshop e tutorial)

L'idea è di partire con un contributo concreto allo sviluppo del tracking in IDEA (geometria, simulazione, ricostruzione...)



Heavy Neutral Leptons Search in a Realistic Neutrino Oscillation Model at FCC-ee

S. Ajmal^a, P. Azzi^b, S. Giappichini^{c,1}, M. Klute^c, O. Panella^a, M. Presilla^c and X. Zuo^c

^aINFN Sezione di Perugia, Via A. Pascoli, I-06123, Perugia, Italy

^bINFN Sezione di Padova, Via Marzolo 8, I-35100, Padova, Italy

^cInstitute for Experimental Particle Physics (ETP), Karlsruhe Institute of Technology (KIT), Wolfgang-Gaede-Straße 1, 76131 Karlsruhe, Germany

ABSTRACT: This paper explores the type I seesaw mechanism at the Future Circular Collider (FCC) in its e^+e^- stage at the Z pole, considering an integrated luminosity of 204 ab^{-1} . The study examines two generations of heavy neutral leptons (HNLs) produced in association with Standard Model (SM) neutrinos and decaying to a purely leptonic final state. The theoretical framework analyzed can explain neutrino oscillations and other open questions of the SM. This offers a broader perspective that is often overlooked in experimental searches. The analysis focuses on displaced vertices and other reconstructed variables as indications of HNL interactions using the IDEA detector as a reference. We obtain exclusion limits from a selection of kinematical variables aimed at reducing the

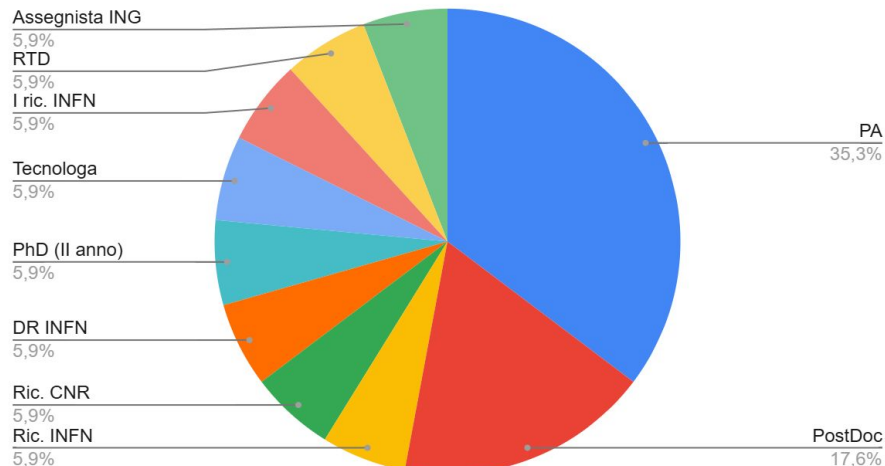
FCC Person power (2.7 FTE)

RD_FCC Perugia

Nome	% FTE	Qualifica (2023)	sigla principale
Alessandro Rossi	10	PA	CMS
Attilio Santocchia	20	PA	CMS
Claudia Cecchi	10	PA	BELLE2
Cristiano Turrioni	10	PostDoc	Fase2
Daniele Passeri	10	PA	Fase2
Elisa Manoni	10	Ric. INFN	BELLE2
Francesco Moscatelli	10	Ric. CNR	Fase2
Gabriele Martelli	30	PostDoc	LHCb
Gian Mario Bilei	10	DR INFN	CMS
Giorgio Baldinelli	20	PA	Fase2
Livio Fanò	10	PA	Fase2
Maria Elena Ascioti (*)	20	PhD (II anno)	CMS
Arianna Morozzi	10	Tecnologa	GR5
Orlando Panella	10	I ric. INFN	GR4
Stefano Moneta	10	PostDoc	BELLE2
Valentina Mariani	20	RTD	CMS
Giulia Pascoletti	50	Assegnista ING	CMS
Totale FTE	2,7		

(*) regola del dottorando/a al 100%, solo considerando le attività affini

Conteggio di Qualifica (2023)



More people involved in the activities (also from LHCb and NA62 groups) among them some ECR (Alessandro Fondacci, Costanza Carrivale, Sehar Ajmal, Lisa Fantini, Tommaso Tedeschi, Luca della Penna) Francesco Brizioli(*), Mauro Piccini, Matteo Presilla(**), Monica Pepe, Patrizia Cenci, Pisana Placidi, Viacheslav Duk

(*) congedo al CERN
(**) al momento a KIT



Final considerations

- Perugia INFN is getting involved in FCC-ee across different WPs
 - WP1, WP2, WP3, WP5
 - also involvement phenomenology
- The FCC activities brought people from different experiments to collaborate and share different expertise
 - CMS (+phase2), LHCb, Na62, Belle II
- ECR is about the 30% among the present person power
 - potentially can increase including young researchers already interested

Backup



The work of the RD_FCC is organized in several Work Packages:

WP1

WP1 – PHYSICS AND SOFTWARE

Conveners: Patrizia Azzi (INFN-PD), Nicola De Filippis (BA)

WP2

WP2 – ACCELERATORS

Conveners: Manuela Boscolo (LNF)

WP3

WP3 – SILICON VERTEX DETECTOR

Conveners: Attilio Andreazza (UniMI), Fabrizio Palla (INFN-PI)

WP4

WP4 – DRIFT CHAMBER

Convener: Franco Grancagnolo (INFN-LE)

WP5

WP5 – DUAL READOUT CALORIMETER

Convener: Roberto Ferrari (INFN-PV)

WP6

WP6 – MUON DETECTORS (MICRO-RWELL)

Convener: Marco Poli Lener (LNF)