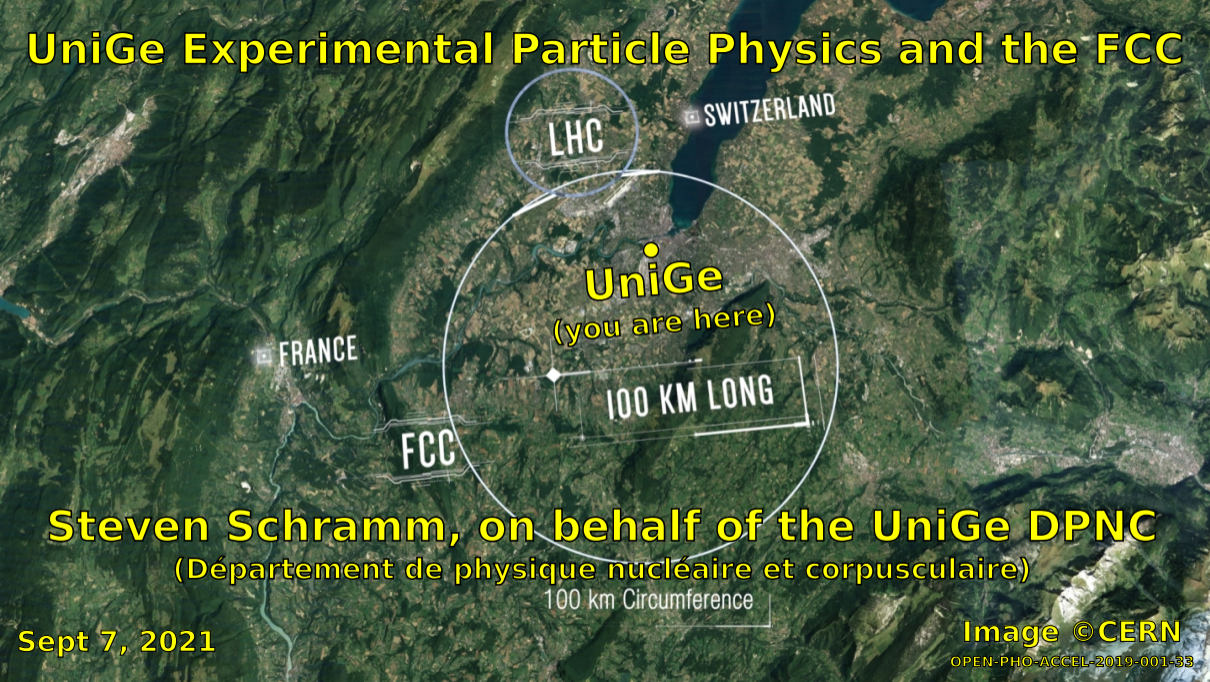


UniGe Experimental Particle Physics and the FCC



LHC

SWITZERLAND

UniGe

(you are here)

FRANCE

FCC

100 KM LONG

Steven Schramm, on behalf of the UniGe DPNC

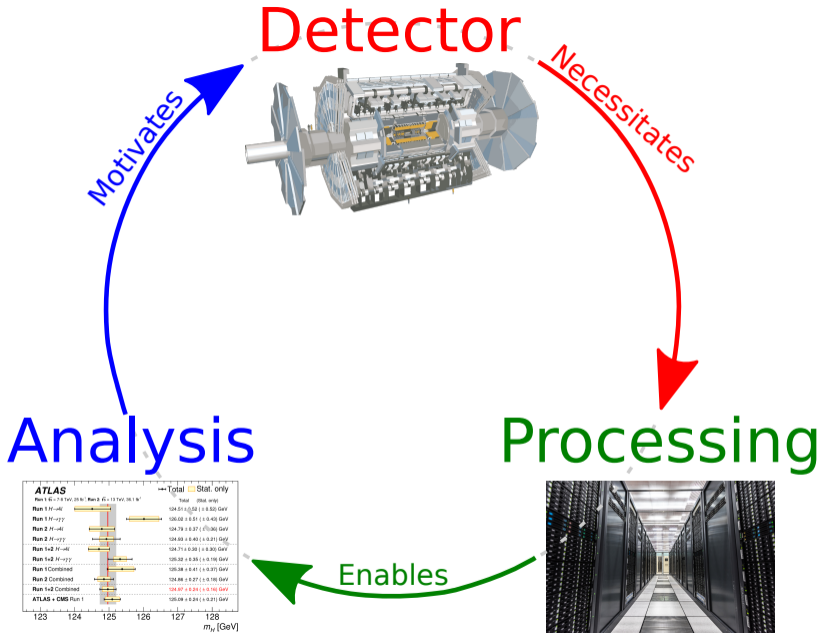
(Département de physique nucléaire et corpusculaire)

100 km Circumference

Sept 7, 2021

Image © CERN

OPEN-PHO-ACCEL-2019-001-33



The UniGe DPNC ATLAS Group

- Group priority remains LHC/HL-LHC for many years
- Initially envision FCC-related contributions in areas that **complement existing research lines**
- Investigating potential synergies between HL-LHC objectives and FCC objectives/possibilities



Giuseppe Iacobucci

Full professor

- Timing and tracking detector design
- Hadronic physics analyses/searches
- FASER pre-shower design



Tobias Golling

Associate professor

- Machine learning for various uses (simulation, object identification, ...)
- Tracking detector operation



Anna Sfyra

Associate professor

- Triggering and data acquisition
- Hadronic physics analyses/searches
- FASER triggering and readout



Lorenzo Paolozzi

Assistant professor

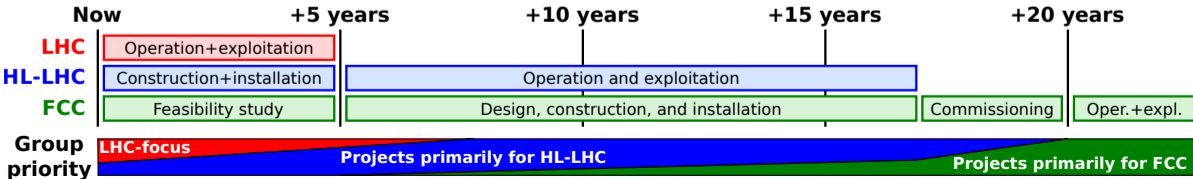
- Timing and tracking detector development and characterization
- Joint position+project with CERN



Steven Schramm

Assistant professor

- Hadronic triggering, reconstruction, characterization, and searches
- Machine learning for data analysis



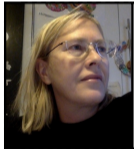
Other groups and expertise at the DPNC

- The DPNC has several key competencies beyond the LHC-dedicated groups
 - Some of these other groups do have LHC links, but their main priorities lie elsewhere
- These groups are generally not planning for any short-term involvement in FCC-related activities
 - However, they may participate in activities which are transversal throughout the department



Federico Sanchez, full professor
Accelerator-based neutrino physics

- T2K international spokesperson; Hyper-K
- Experience in TPC and SiPM systems
- Director of the UniGe DPNC



Teresa Montaruli, full professor
Ground-based astroparticle physics

- IceCube and CTA
- Focus on gamma rays, neutrinos, and cosmic rays beyond the GeV scale



Xin Wu, full professor
Space-based astroparticle physics

- Tracking, silicon, and SiPM detectors
- Triggering, electronics, and simulation
- Space instrumentation



Domenico Della Volpe, associate professor
Ground-based astroparticle physics

- Gas detectors and SiPM
- Data acquisition and triggering
- System engineering and design

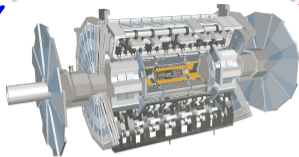


Andrii Tykhonov, assistant professor
Space-based astroparticle physics

- Data reconstruction and machine learning
- Geant; high-energy hadronic simulation
- Position-sensitive and imaging detectors

Three **potential** areas for synergies between ongoing research lines and FCC objectives [examples, not exhaustive]

Detector



Silicon timing detectors:

- G. Iacobucci
- L. Paolozzi
- X. Wu

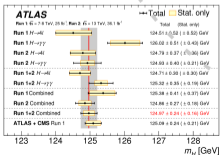
Necessitates

Motivates

Analysis

Machine learning:

- T. Golling
- F. Sanchez
- S. Schramm
- A. Sfyrla
- A. Tykhonov



Processing



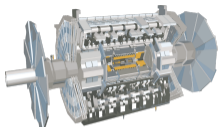
Heterogeneous computing:

- F. Sanchez
- S. Schramm
- A. Sfyrla

Enables

Potential synergies towards FCC-relevant research

Detector



Silicon timing detectors

- Significant current focus for G. Iacobucci and L. Paolozzi
 - Current work supported by MONOLITH ERC Advanced Grant
- Transversal area of interest for A. Sfyrla and X. Wu
- **Potential relevance to FCC:** precision particle timing detectors, which can enable new types of physics searches and measurements

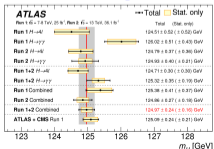
Processing



Heterogeneous computing

- Area of growing expertise at the DPNC, in a variety of different contexts
- Of interest to F. Sanchez, S. Schramm, and A. Sfyrla
- Of key relevance already to the HL-LHC programme
- **Potential relevance to FCC:** triggerless data processing and general usage in speeding up increasingly complex computations/simulations/etc

Analysis



Machine learning

- Significant current focus for T. Golling, supported by SNSF Sinergia Grant
- Also a focus for S. Schramm, supported by ERC StG and SNSF Eccellenza
- Transversal interest for many others: F. Sanchez, A. Sfyrla, A. Tykhonov, ...
- **Potential relevance to FCC:** triggering, reconstruction, simulation, data analysis, and general exploitation of large multi-dimensional datasets

Summary of short-term DPNC involvement in the FCC

- Clearly, if the FCC is built, the DPNC plans to be involved: we will be inside the FCC ring!
- In anticipation of the FCC feasibility study, we have identified active areas of relevance
 - **Silicon timing detectors**, which may be of great use for FCC physics objectives
 - **Heterogeneous computing**, which may be needed to accelerate processing of FCC data
 - **Machine learning**, which is increasingly important as data size and complexity grow
- These are only three examples; many other areas for DPNC involvement if FCC is built
 - FCC would be of great interest to detector, processing, and analysis efforts
 - Potential for further collaborations with the UniGe department of theoretical physics (DPT)
- Group priorities remain LHC/HL-LHC until the FCC is more clearly established
 - Preparatory studies underway by A. Sfyrla: studying the nature of HNLs at the FCCee

