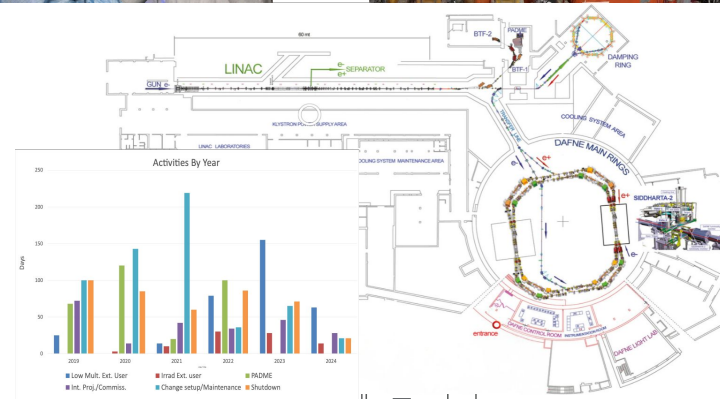


Group B: Take home lessons

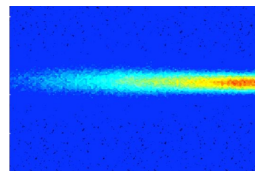
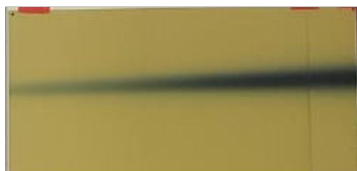
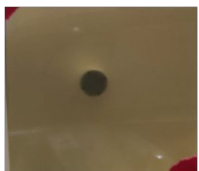
Advanced Training School on Operation of Accelerators
M. Coman, E. Diociaiuti, A. Fomin, C. Lehmann, A.G. Stoica, P. Schoch

- PhD 2020: “Study of the Mu2e sensitivity to $\mu^- \rightarrow e^-$ conversion process” + 3 year on post-doc on the same topic
- **September 2023 switched to accelerators working @ the Beam Test Facility of LNF**
 - provides external user e-/e+ beam from 1 particle/bunch up to $1e^{10}$ particles/bunches with energy from 25 MeV up to 700 (e-) and 500 MeV (e+)
 - ~35 week/year with external/internal users



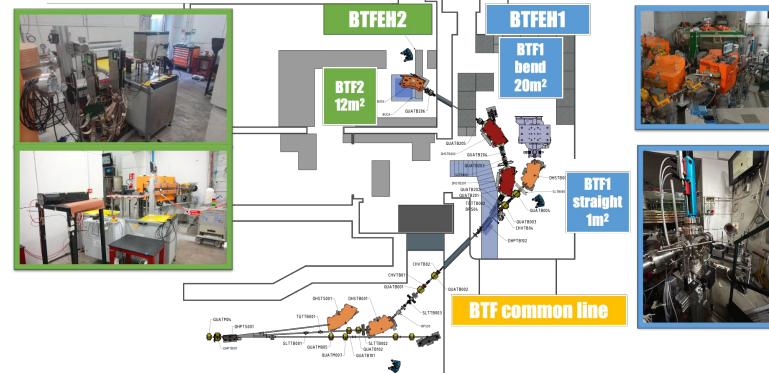
FLASH VHEE scientific Needs explored in BTF this year

- Control Imaging Systems
- Certified dosimetry in FLASH regime
- New beam fluorescence measurement in air



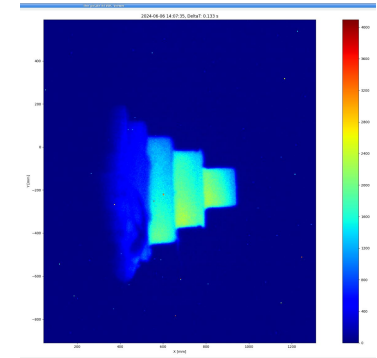
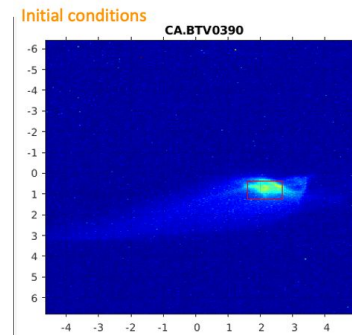
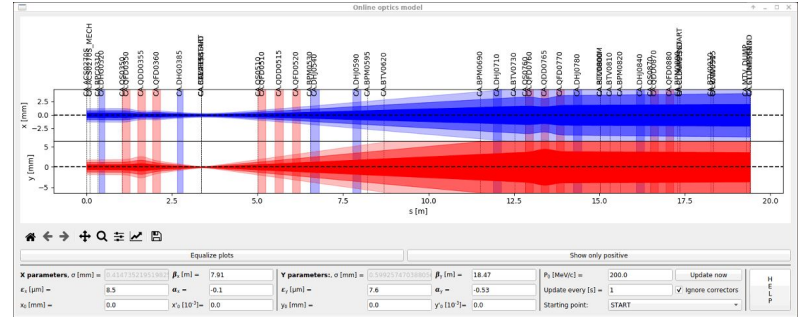
510 MeV, $1e^{10}$ particles/bunch

150MeV 1k particle/bunch



A lot of new concepts learned! Thanks

- Being relatively new to the accelerator field the entire week was extremely helpful for me - both “theory” and hands-ond
- Because of the similarities with my day-by-day activity CLEAR hands-on was super precious
 - Possibility to run the accelerator starting from scratch
 - optimization of electron beam dimensions
 - model of the optics to check the focus position
 - FLASH studies





DESY - Philipp Schoch

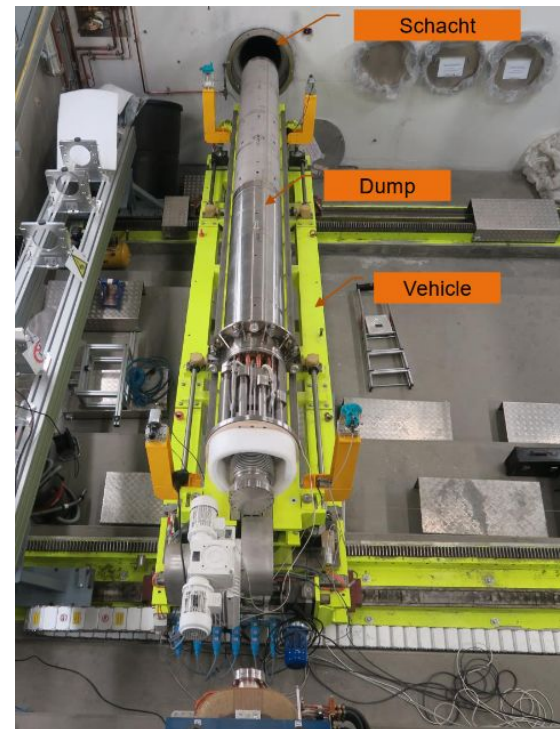
Education, Expertise, and Role:

- **Electrical Engineering (Automation & Robotics)**
 - PLCs, Microcontrollers, GUI Development
 - Radioactive Protection, SQL for Quality Reports
- **XFEL Dump Team: Overheat prevention, instrument/PLC maintenance, Operate FLASH Accelerator**
- **Side Projects: Kicker Powersupply GUI, Dump Sweeper Monitor, Kathode polishing machine, OP-ShiftBoard**



DESY, Hamburg, Germany:

- **PETRA III: 2.3 km, 6 GeV, Synchrotron radiation source.**
- **FLASH: 315 m, Up to 1.25 GeV, Free-electron laser.**
- **European XFEL: 3.4 km, 17.5 GeV, Ultra-short X-ray flashes.**



How this school helps me to be a better FLASH Operator

Running FLASH LINAC:

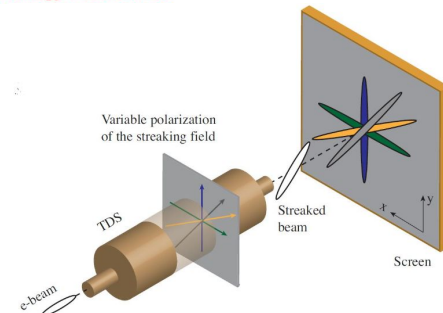
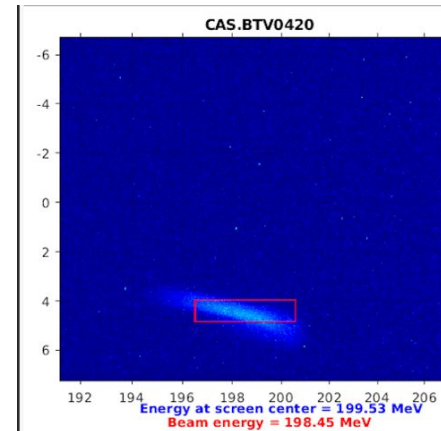
- I often operate the FLASH accelerator, but we haven't a structured school for this.

CLEAR is Smaller:

- Similar to FLASH, but about 10 times smaller.
- Seeing everything at a smaller scale helped me understand the basics better.
- Working with CLEAR gave me a deeper understanding of FLASH

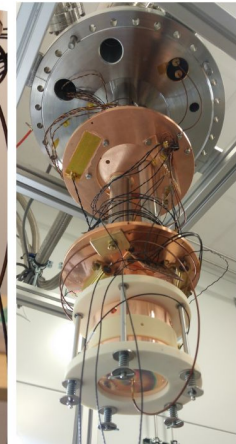
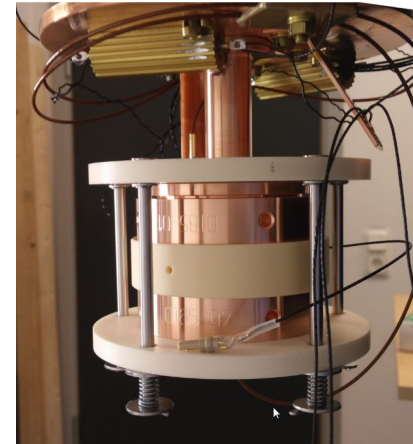
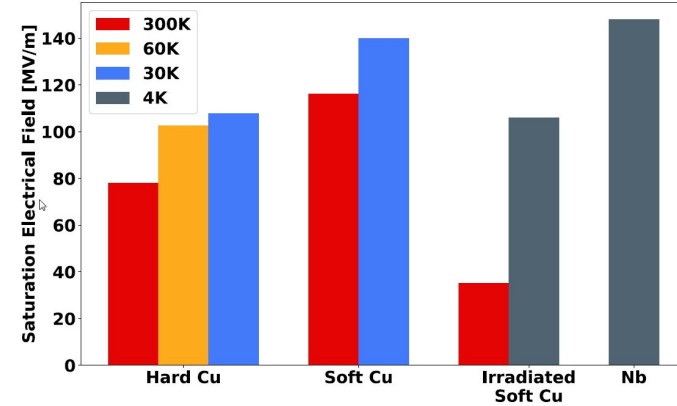
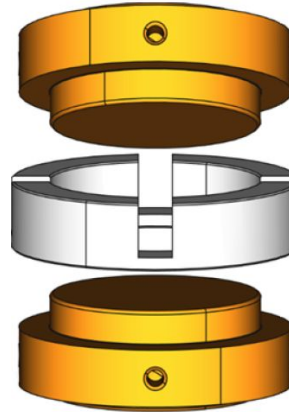
RF Deflecting Structure:

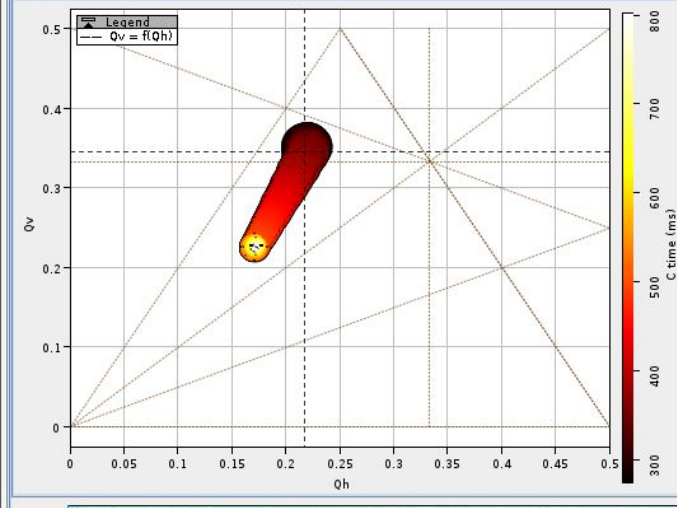
- Measures bunch length.
- Helps with phase space diagnostics.



Mircea Coman - My Background

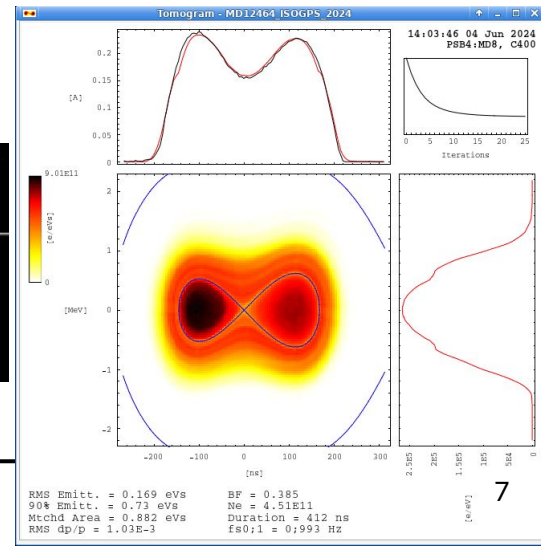
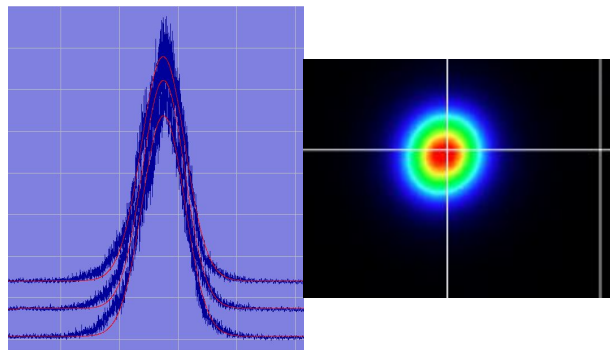
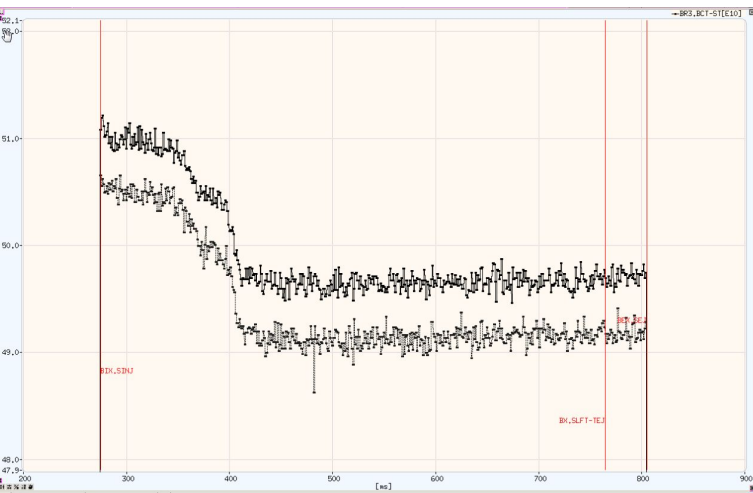
- PhD student in Uppsala, FREIA laboratory
- Vacuum arc breakdowns studies: Theory predicts strong dependence on temperature → cryogenic experiments
- Field emission and vacuum arcs limit the maximum achievable accelerating field
- At FREIA laboratory, different aspects of surface conditioning are studied in a cryogenic, DC system for different materials (Cu, Nb, Ti, so far)
- Surface resistivity **RF** measurements in **cryogenic conditions** to track down changes in crystallographic defect density underneath the metal surface





Mircea Coman - My takeaways

- Even if I did not work so far directly with accelerators, it was an interesting experience to see how they are operated
- Connect theory with hands on practice
 - Beam profile measurements
 - Setting and measuring the tune
 - The effects of a resonance on the beam
 - RF gymnastics

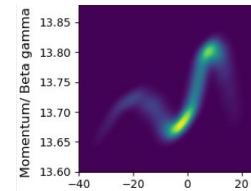
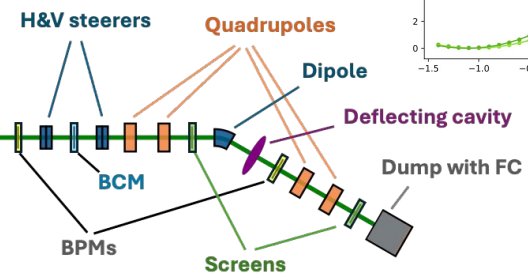
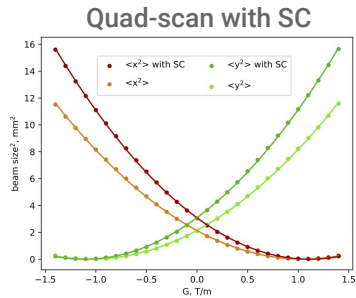
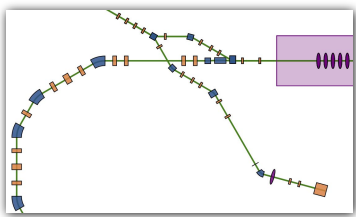
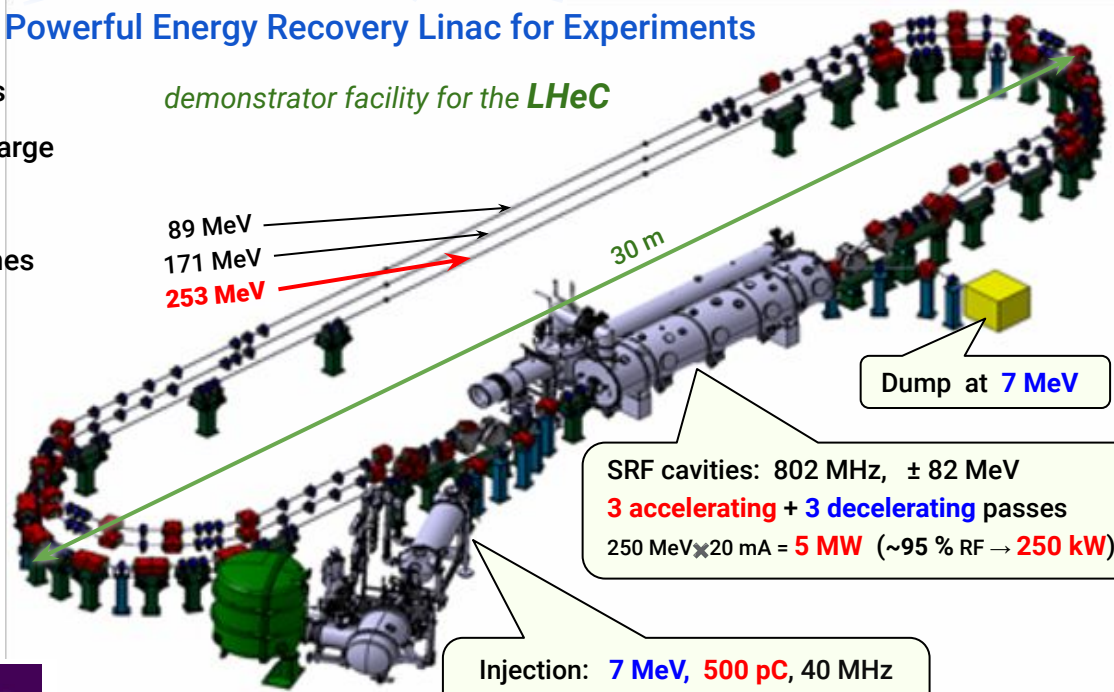


Alex Fomin PERLE at IJCLab (Orsay, France)

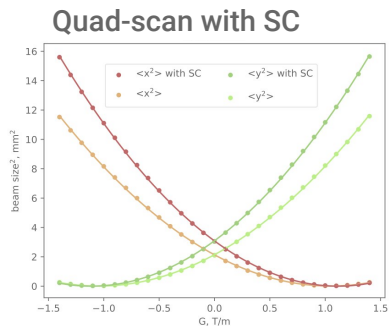
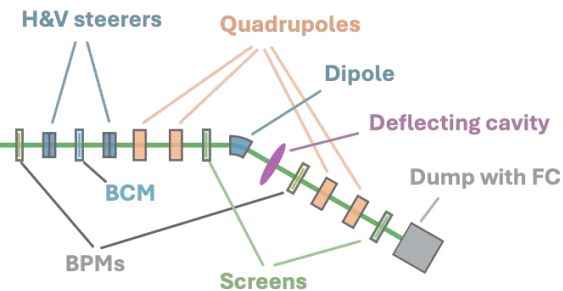
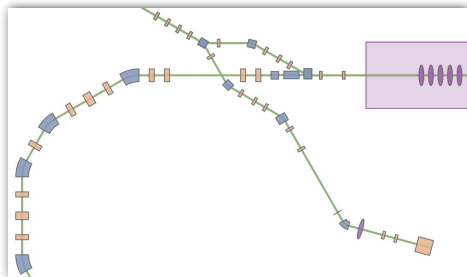
Powerful Energy Recovery Linac for Experiments

demonstrator facility for the **LHeC**

- lattice design of “Single Turn” & “250 MeV” versions
- optics matching: 2 low- β IPs, $M56=0$ and space-charge
- beam dynamics studies: space-charge and CSR
- beam diagnostics, tolerances and correction schemes

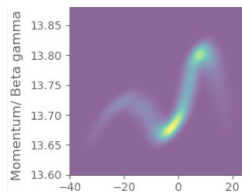


PERLE layout: merger & diag.

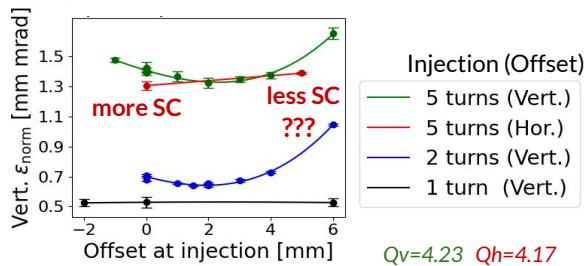
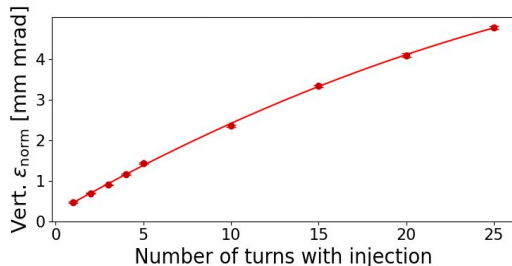


Alex Fomin Take home lessons:

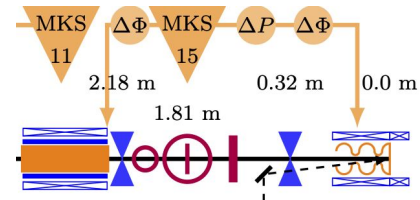
- shorter merger \rightarrow less space charge
(vs better diagnostics & control)
- saw “in flesh” and played with the diagnostic line similar to one we design for PERLE (but without SC)



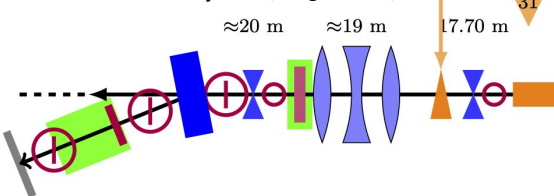
- Measurements with Space Charge effect at PS Booster



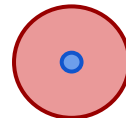
CLEAR layout (< 4.5 MeV part)



CLEAR layout (diagnostics)



more SC in Vert.



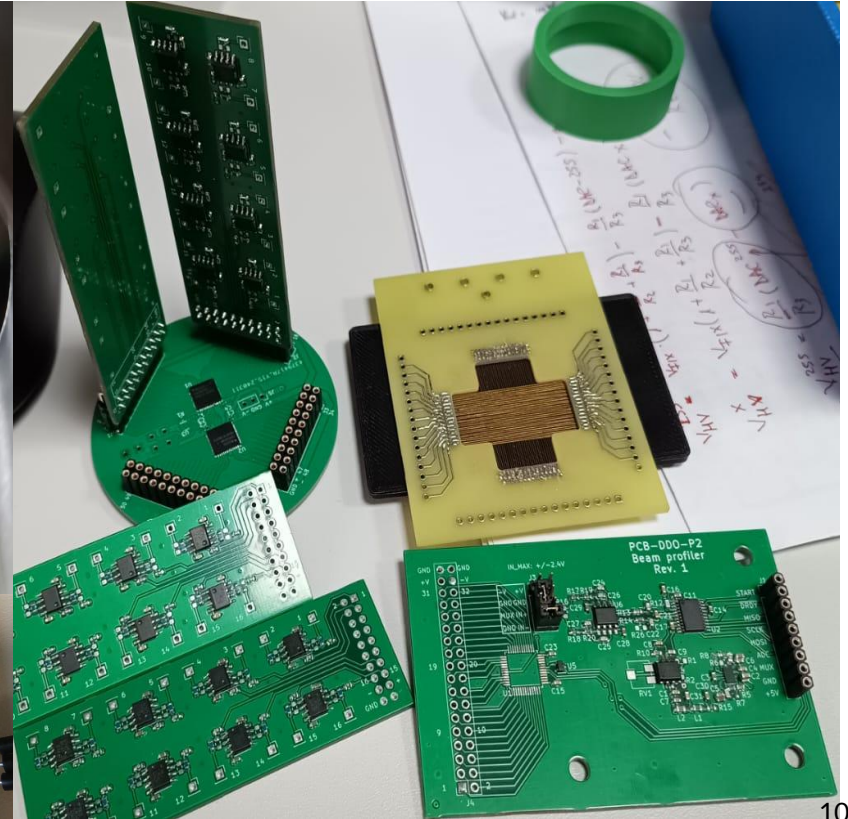
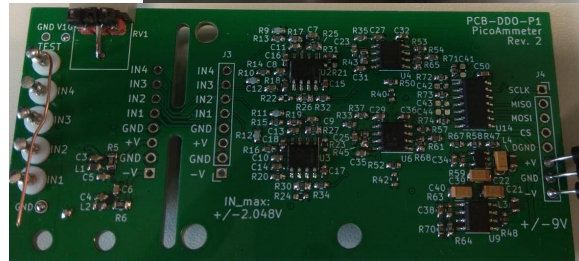
less SC in Vert.



not enough painting ???

Alexandru-Gabriel Stoica

- PhD student and research assistant at IFIN-HH/Electronics Lab
- SiPM detector development
- Ion beam simulation with SIMION
- I operate the TANDEM@9MeV when pulsed beam is needed

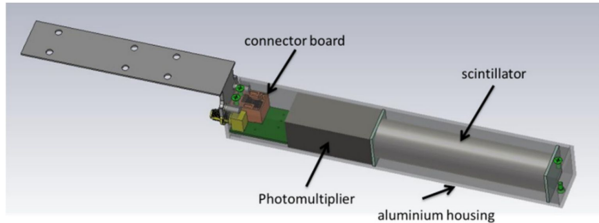


New knowledge and ideas

- from PSB: working principle, resonances, diagnostics
- from CLIC: - medical applications
 - how to obtain an evenly distributed dose
 - bunch length measurements using RF field
 - optic fiber to locate the losses

Corey Lehmann

- Currently studying a DPhil at University of Oxford in **Accelerator Physics** within JAI
- Researching within the Diagnostics group at **Diamond Light Source**
- Designing automatic fault detection using **Beam Loss Monitors** and **Machine Learning** techniques



My Takeaways

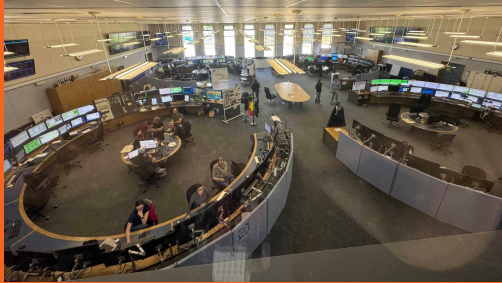
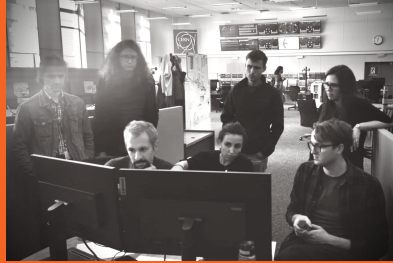
- I've studied multiple courses in accelerator physics theory. This was my first time seeing most of these phenomena in reality!
- Highly recommend for anyone who have studied a course in accelerator physics.

PSB:

- Measuring tunes
- Measuring chromaticity
- Measuring emittance
- Crossing resonances
- Mismatched injections

CLEAR:

- Beam steering
- Improving beam uniformity
- Quadrupole scan for twiss parameters
- RF tuning



Thanks to everyone who helped organise this school!

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