



FLASHForward▶▶

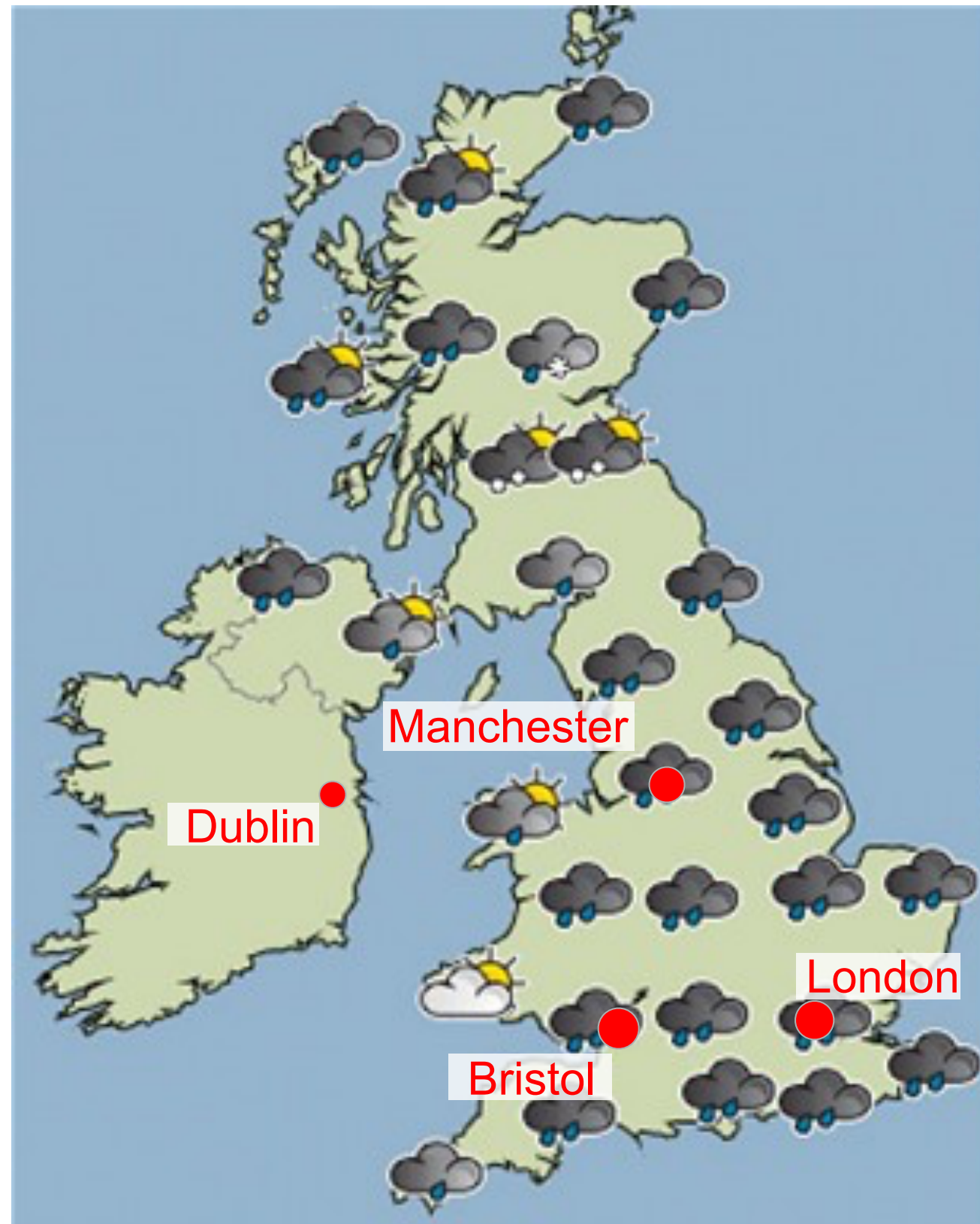
RESEARCHING NOVEL PARTICLE ACCELERATORS

Dr. Jimmy Garland

FLASHFORWARD▶▶ Research Fellow | Research Group for Plasma Wakefield Accelerators
Deutsches Elektronen-Synchrotron DESY, Particle Physics Division, Hamburg, Germany

My background

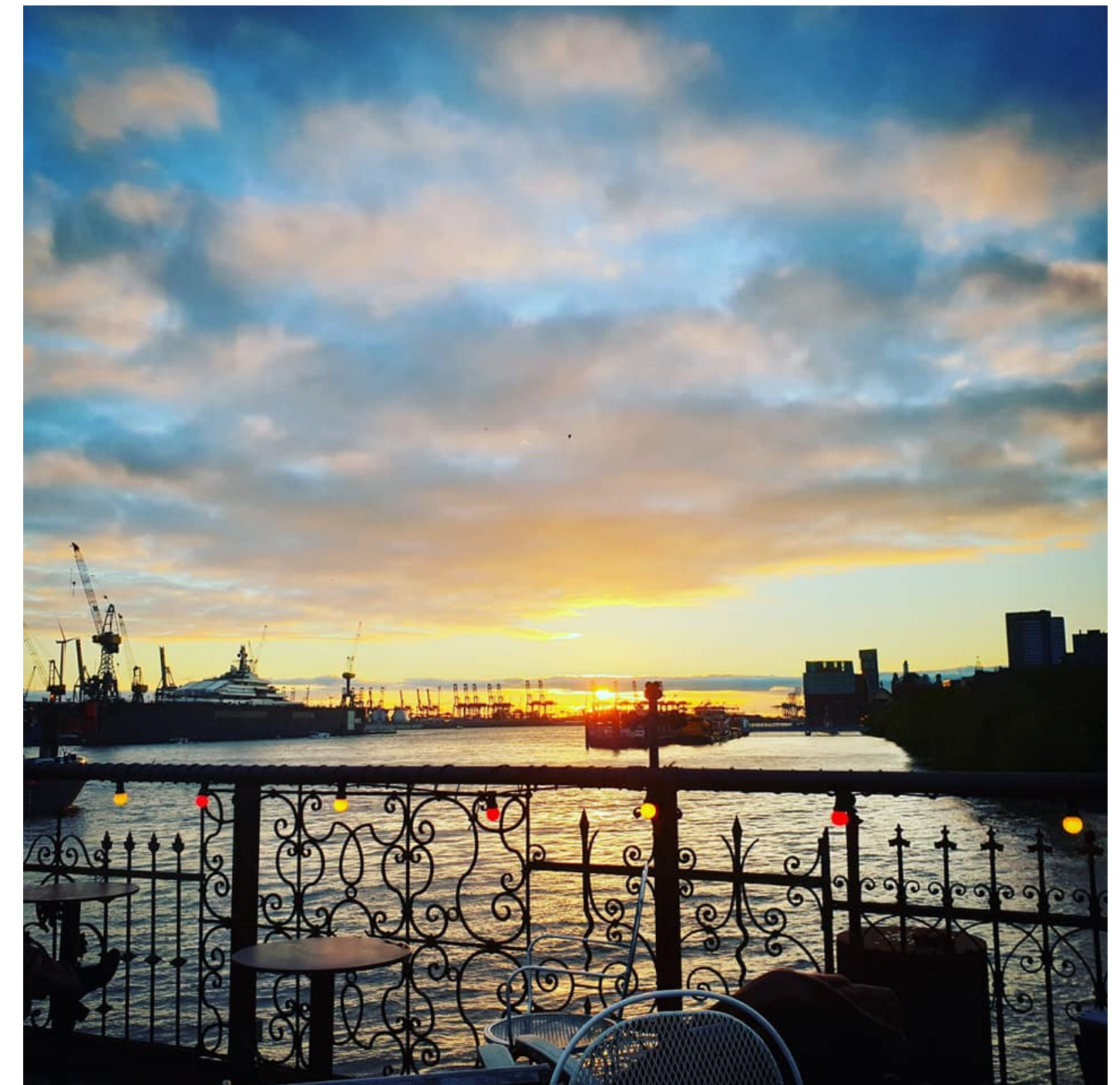
- > Originally from **Bristol** in the UK
- > But my farther's parents were Irish (this is my Brexit insurance)
- > Masters and PhD in **Manchester**...
- > First PostDoc also in Manchester =>12 yrs!



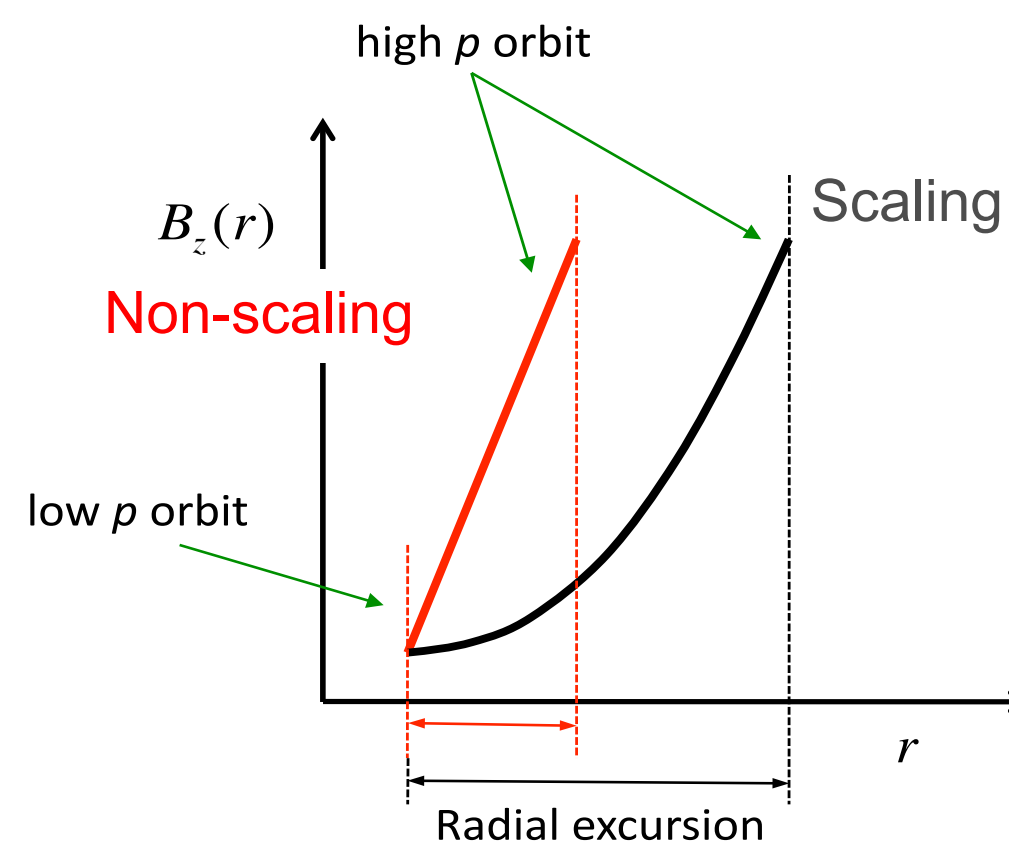
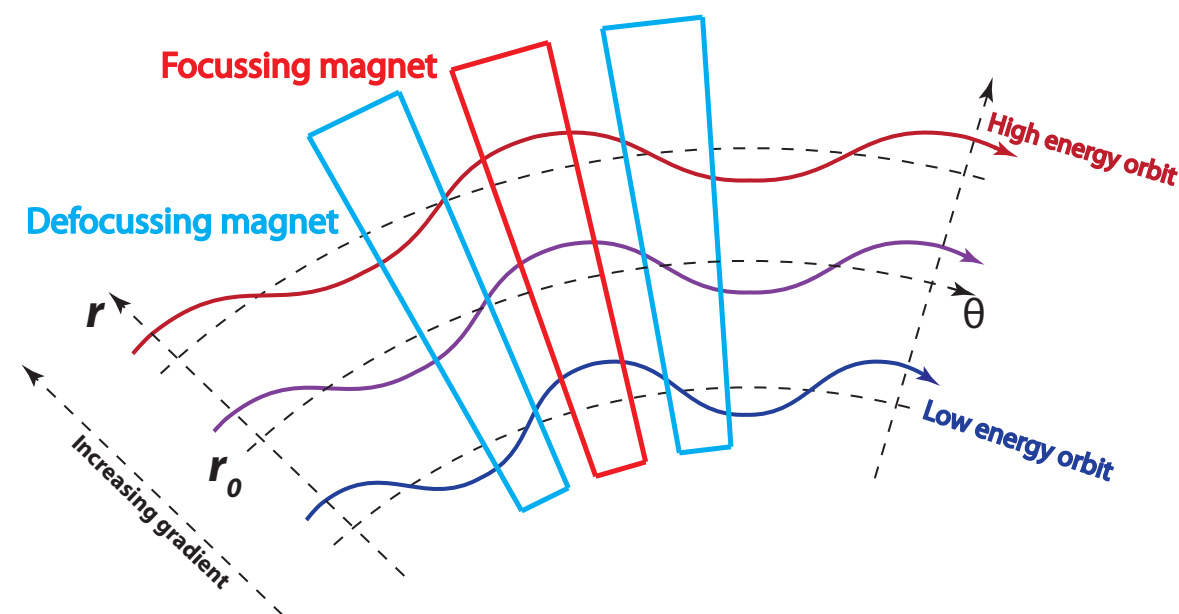
- > Moved to **Geneva** in 2015
- > Fellow at CERN
- > However, there were mountains...



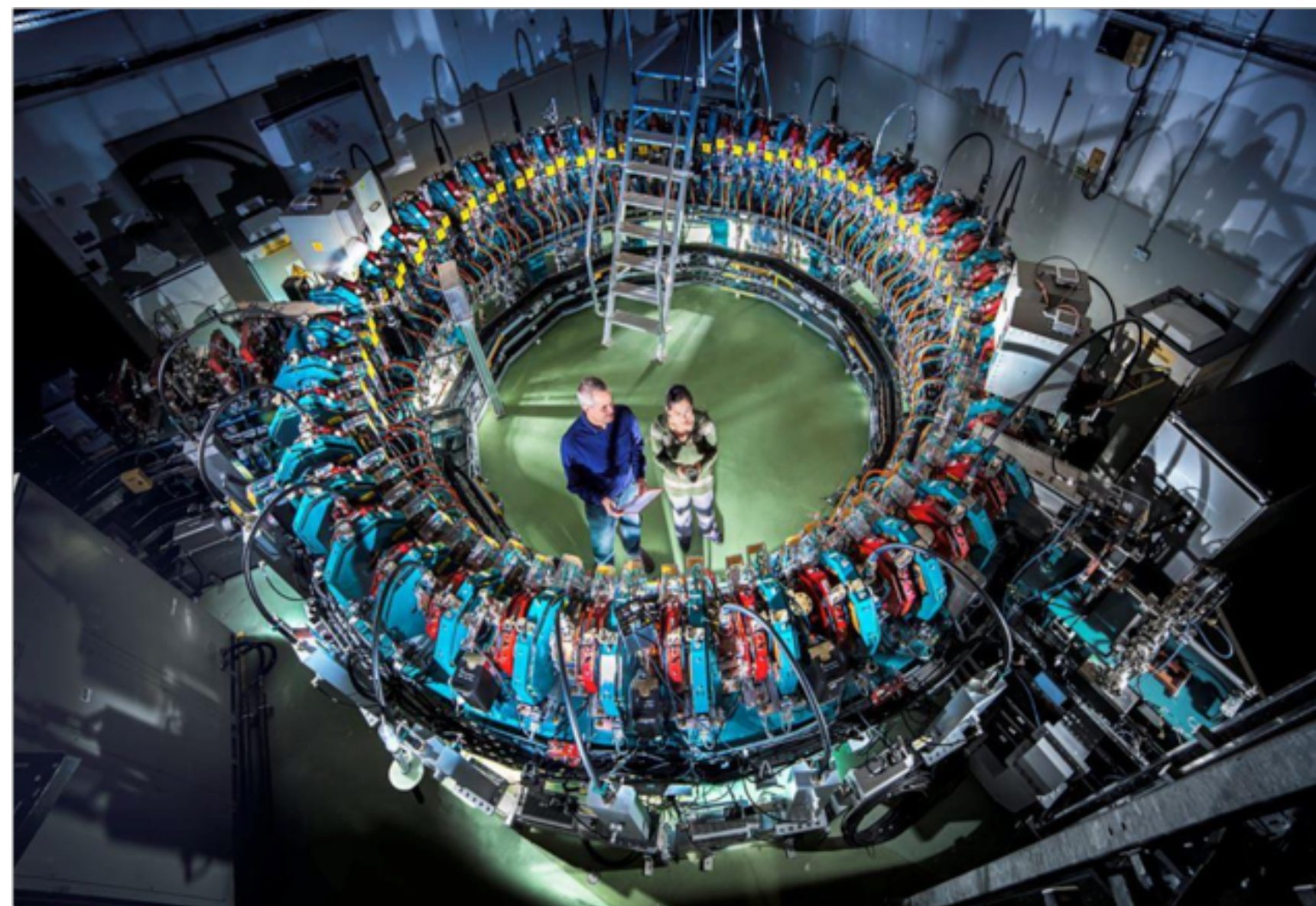
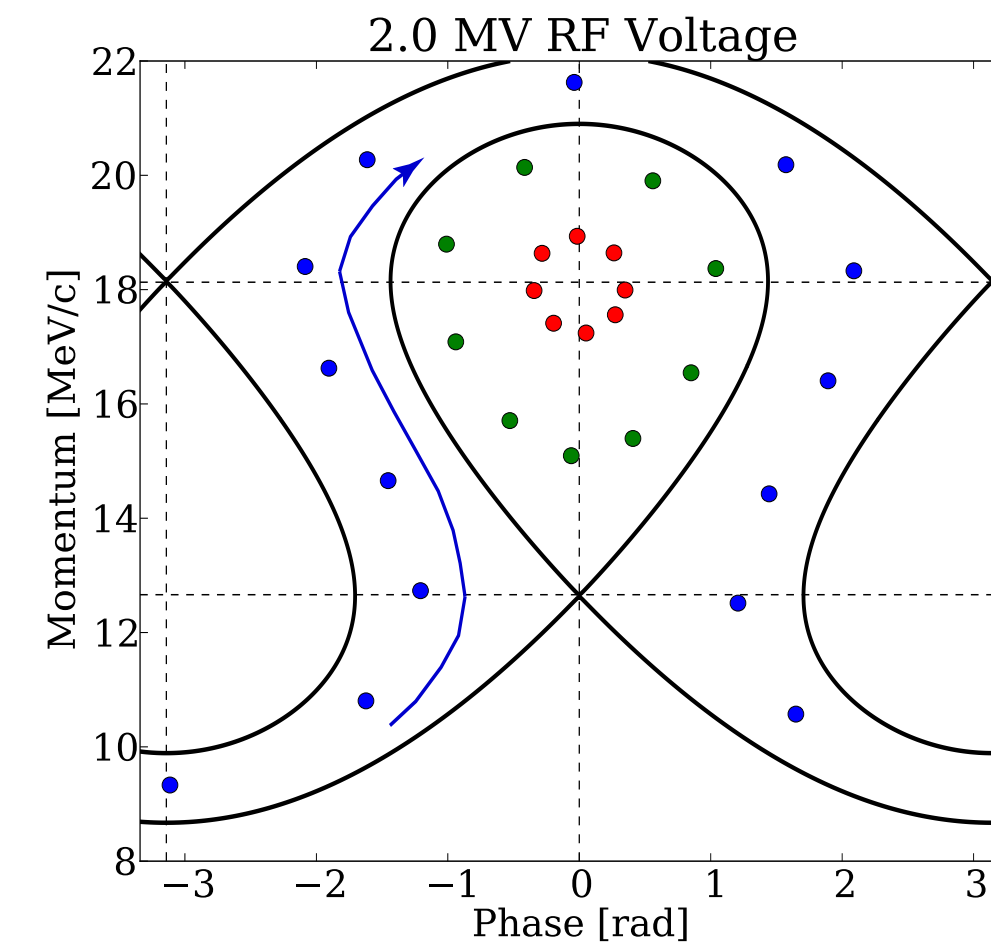
- > Came to **Hamburg** in May 2018!
- > Joined the FLASHForward collaboration



- > Fixed magnetic field
- > Beam traverses radially with energy
- > Very rapid acceleration
- > Very large acceptance.



- > EMMA (Electron Machine with Many Applications)
- > Proof-of-principle machine
- > Highly compact accelerator lattice
- > 2.4m radius
- > 10-20 MeV in 5 rotations (300ns)
- > 1.3 GHz RF system



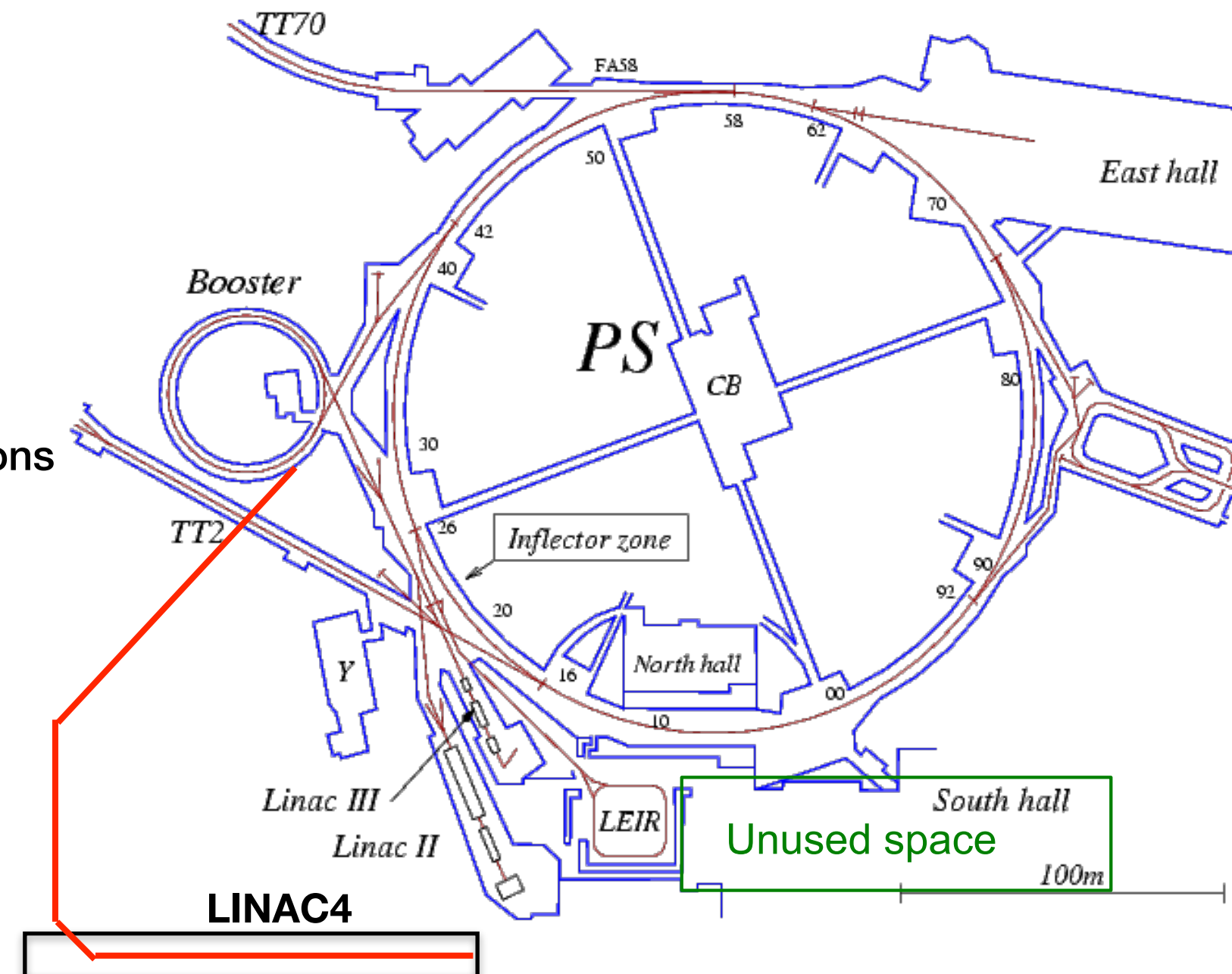
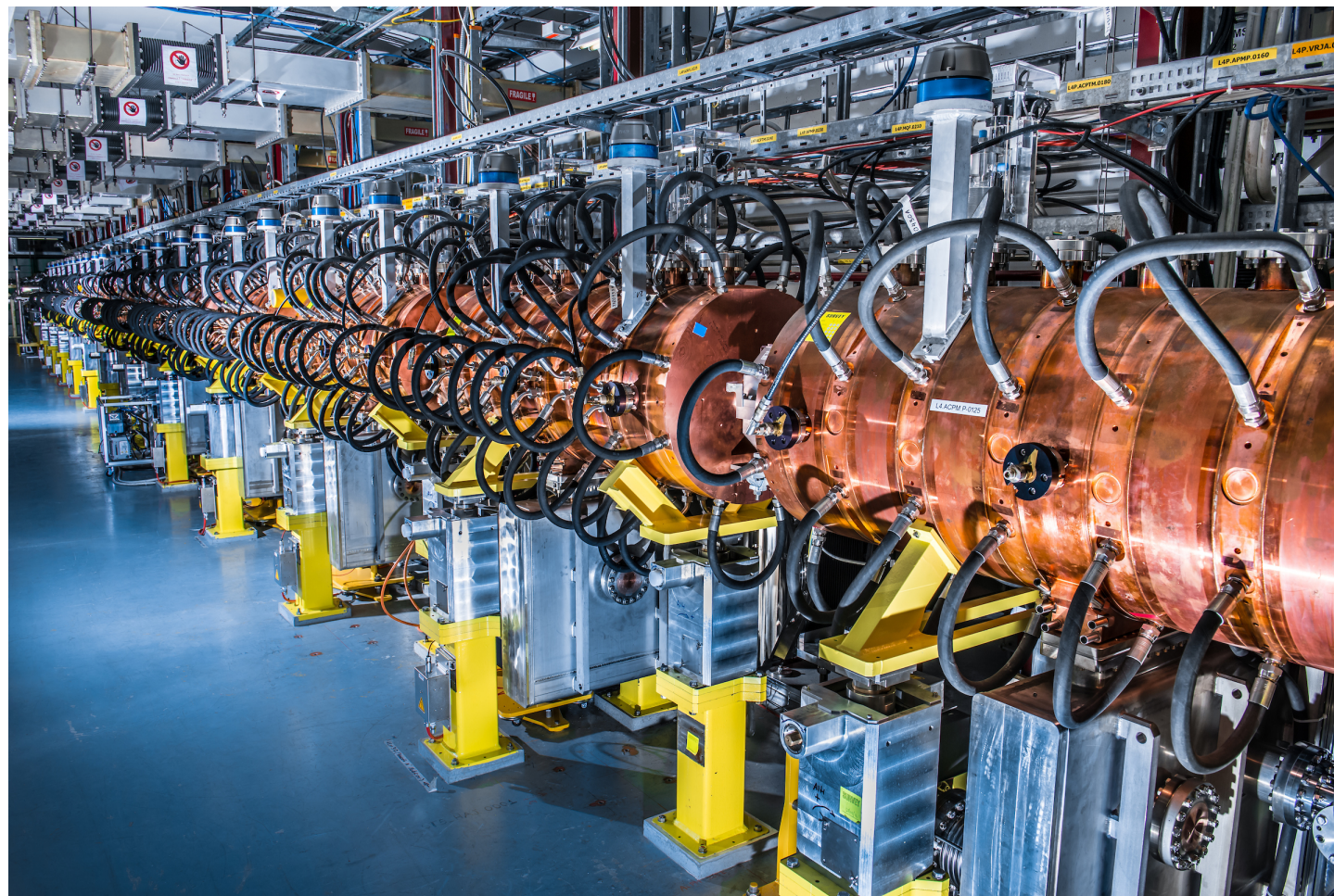
> Applications:

- > Medical accelerators - cancer therapy using protons
- > ADSR by neutron spallation from protons
- > Nuclear waste transmutation
- > Muon accelerators

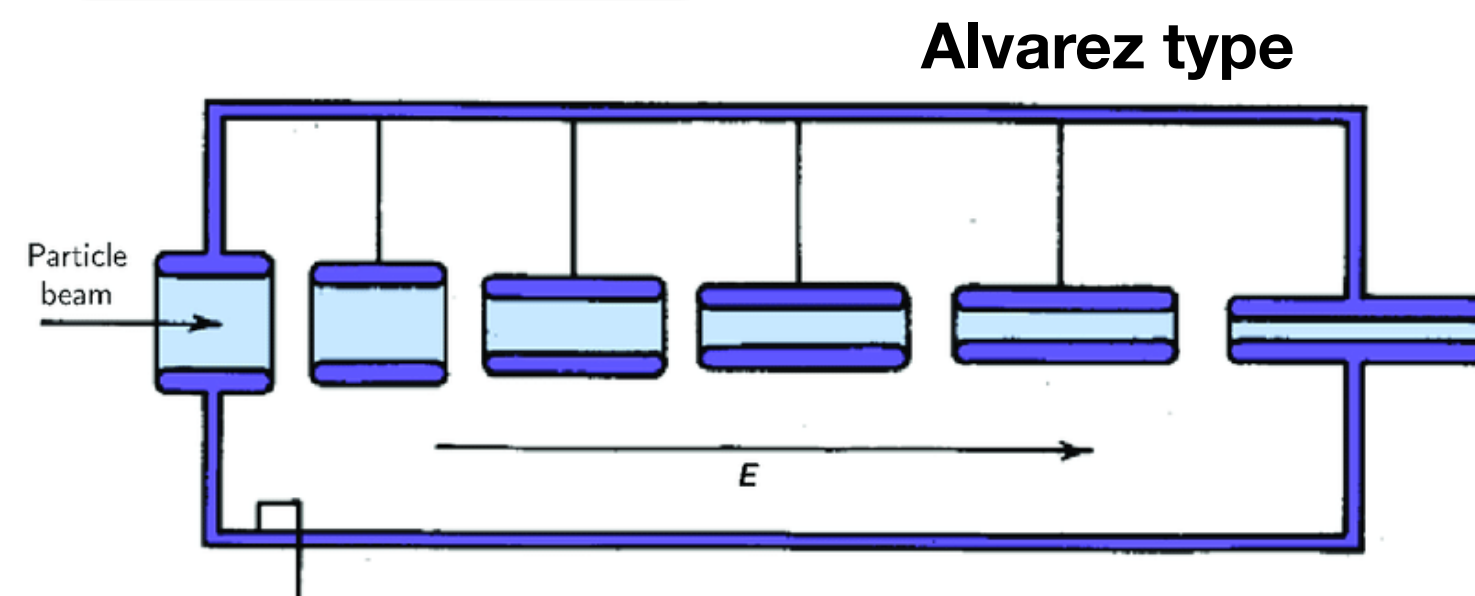




- Commissioning **LINAC4**
- H- linac to replace LINAC2 as CERN's source of protons
- Charge exchange injection => higher brightness
- 160 MeV into the Booster (linac2 - 50MeV)
- Alvarez type accelerating cavities

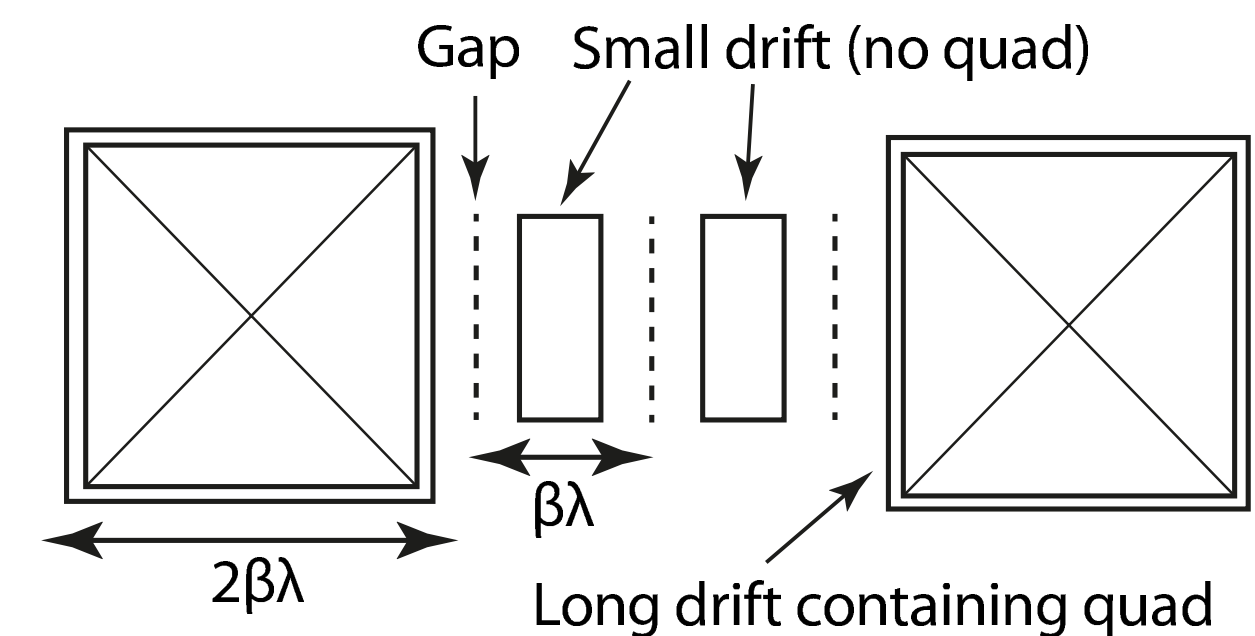


- Design a light ion linac for medical applications - **BioLEIR**
- Protons -> Oxygen ions
- Novel quasi-Alvarez design was developed
- Shorter linac structure with ion species flexibility



- Fixed frequency => drift tubes increase in length with energy
- Quadrupole in each drift tube

Quazi-Alvarez type

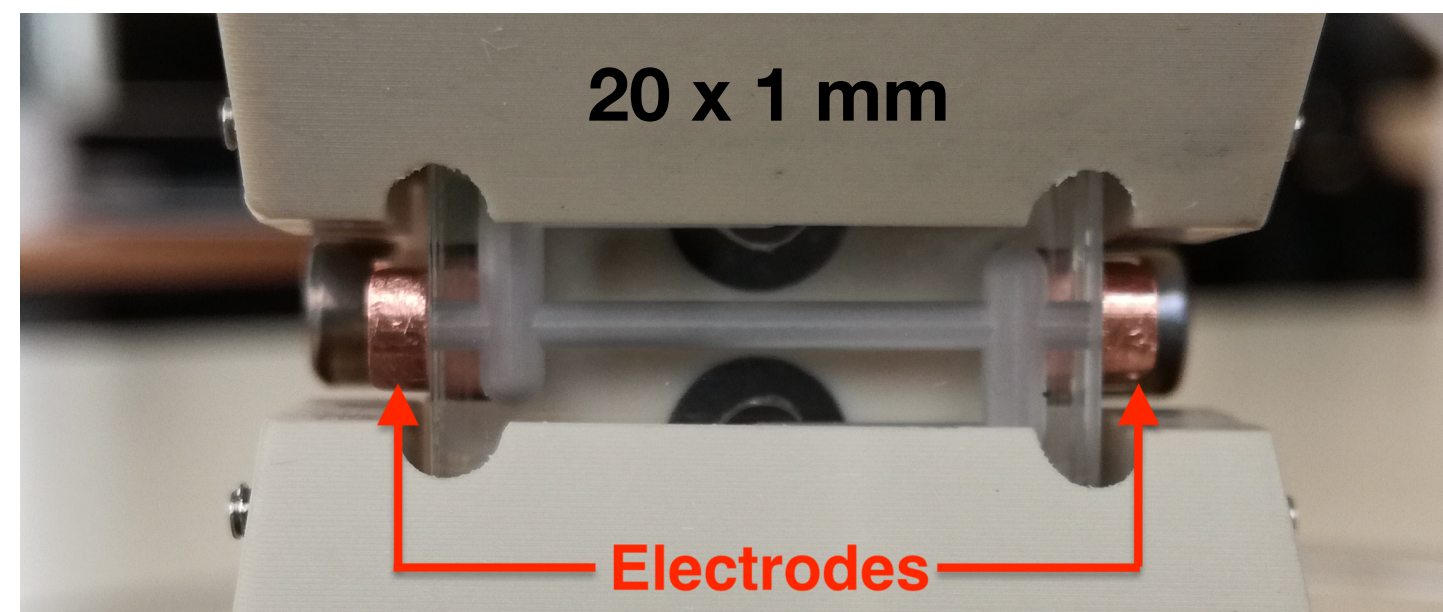
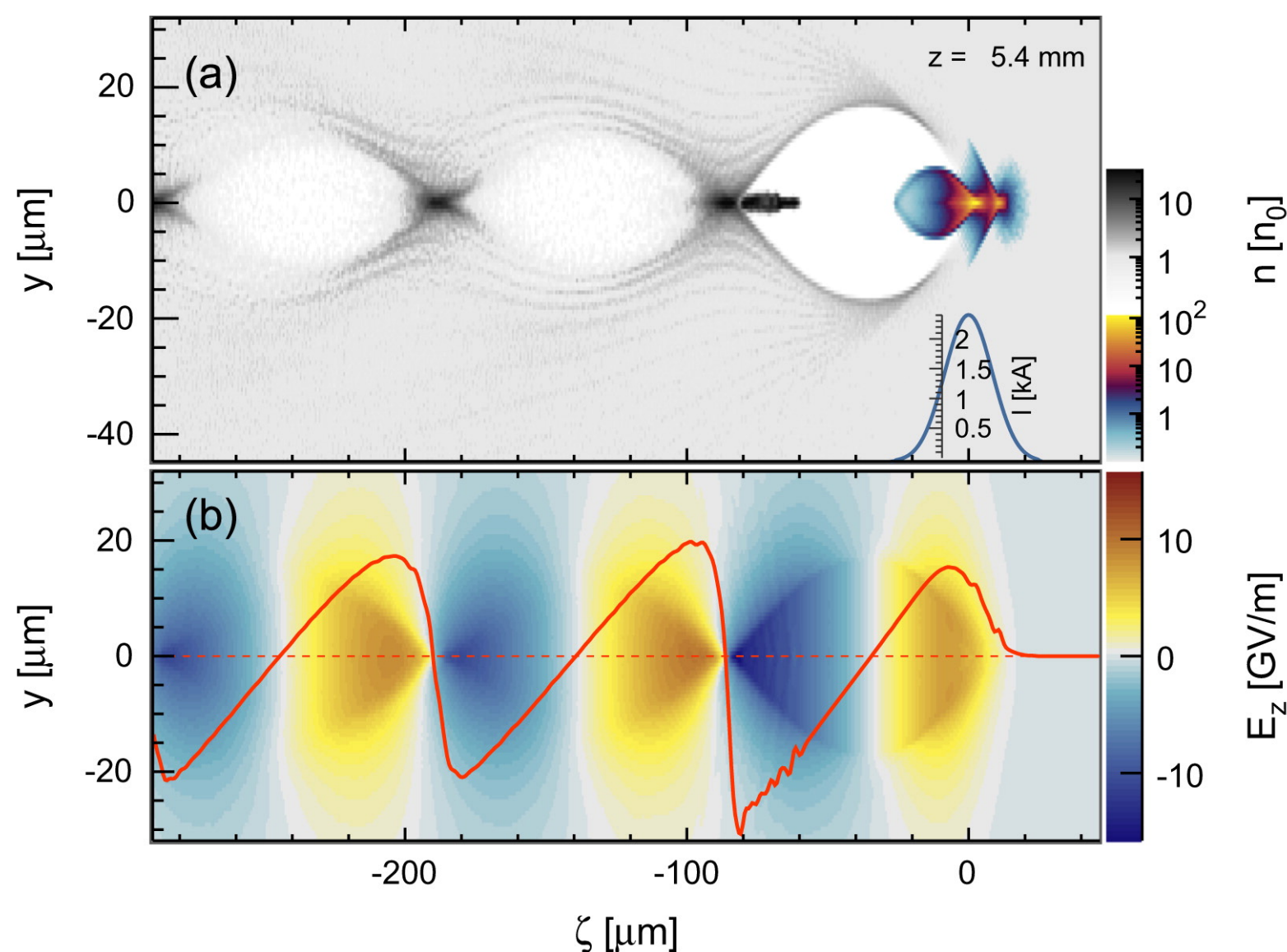
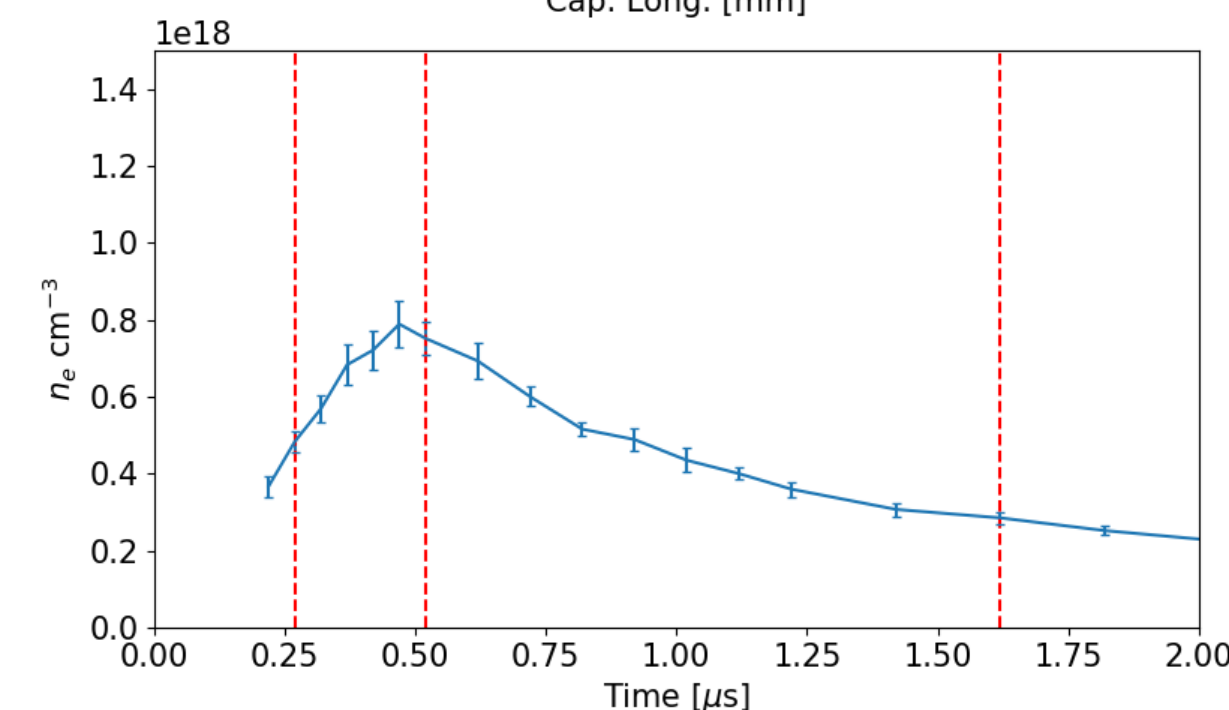
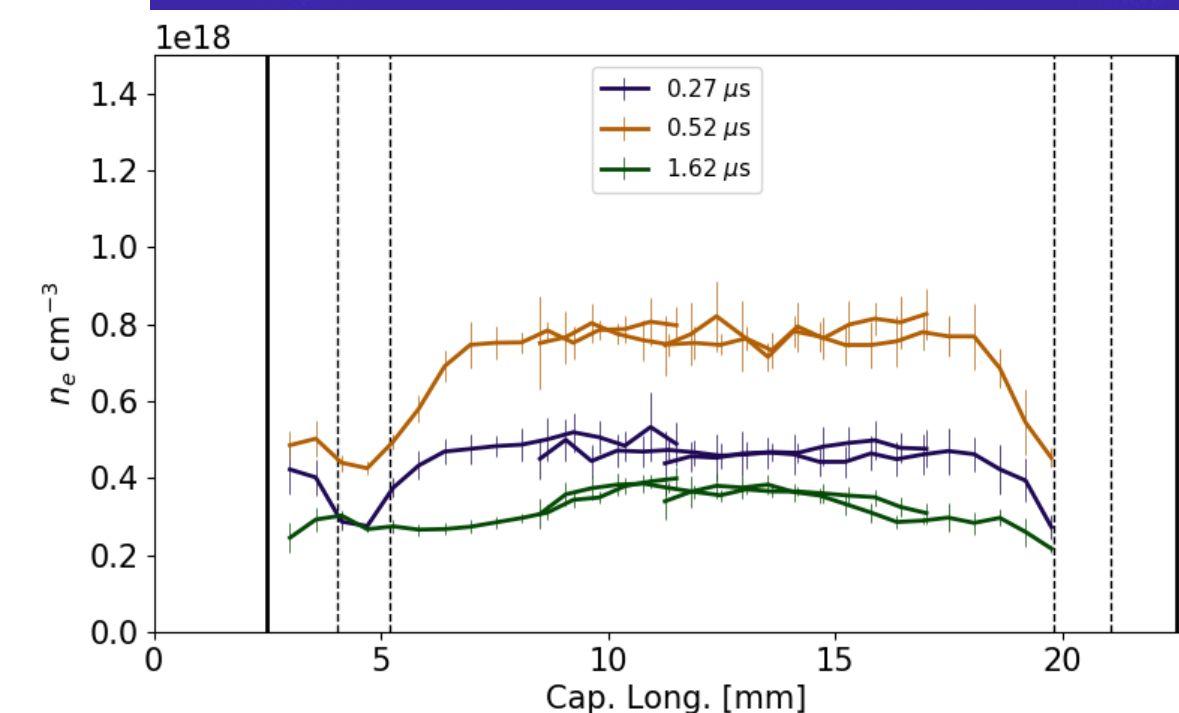
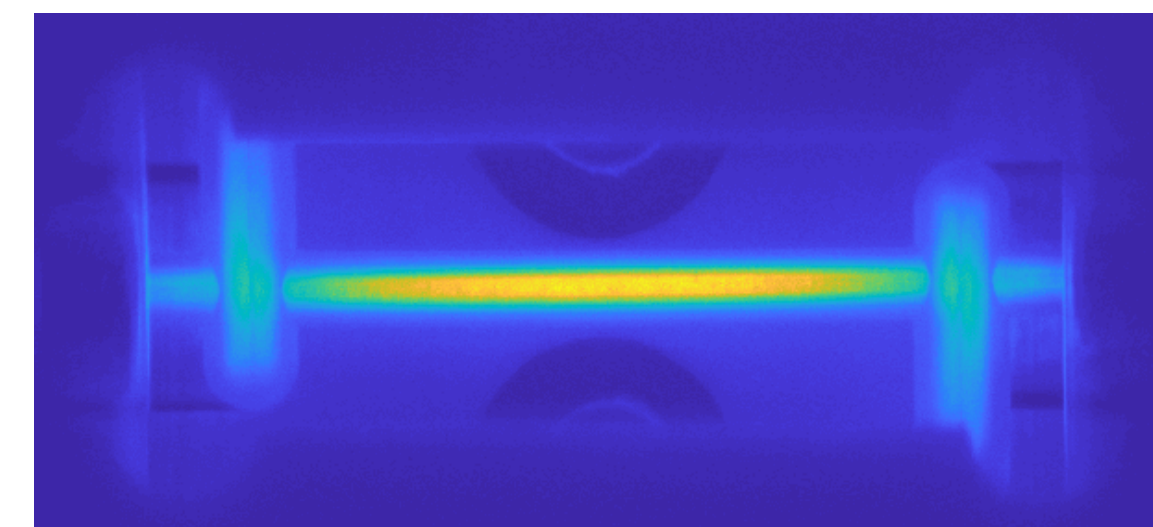
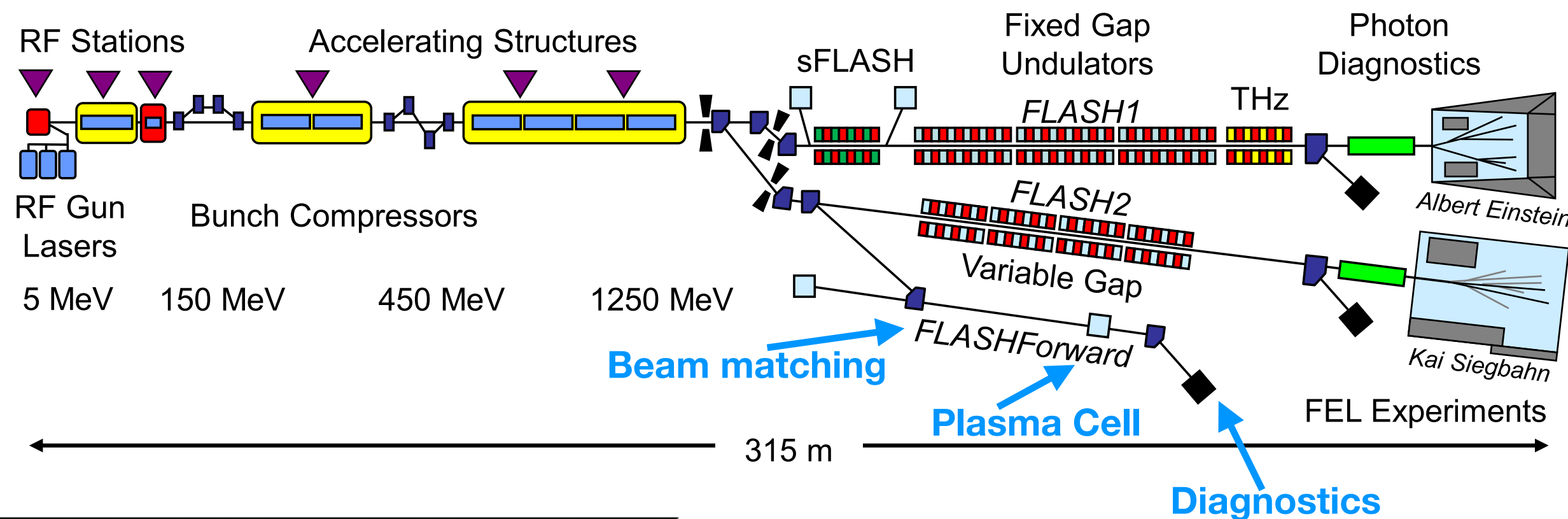


- Quadrupole in nth drift tube
- Double frequency => shorter => cheaper

- FLASHForward is a plasma wakefield accelerator experiment here at DESY
- FLASHForward beam-line extends from the FLASH accelerator (FEL facility)

- Accelerating field is orders of magnitude larger than conventional RF cavities.
- Potential for greatly reduced accelerator length

- Plasma is created from neutral gas using an electrical discharge or a high-power laser
- Understanding of plasma spatial distribution and temporal evolution is critical.



Shameless Promotion...

Thanks for listening!

