

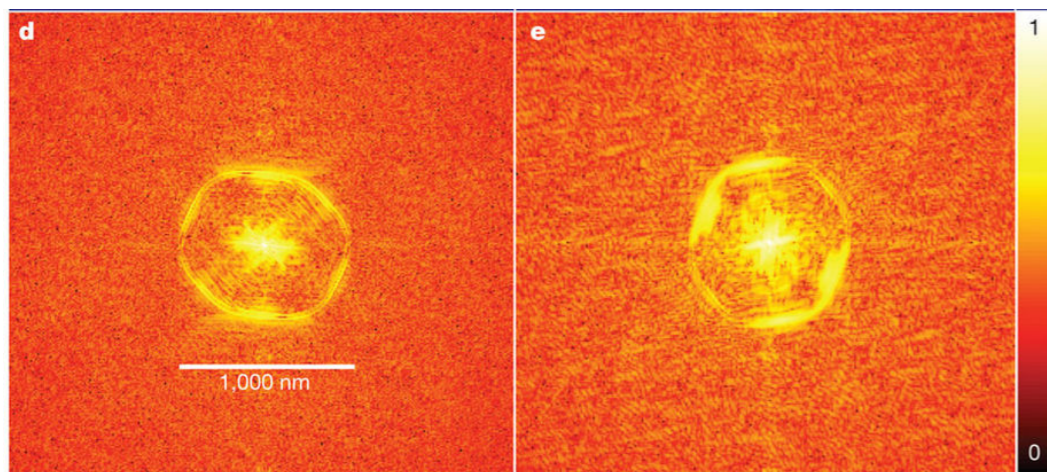
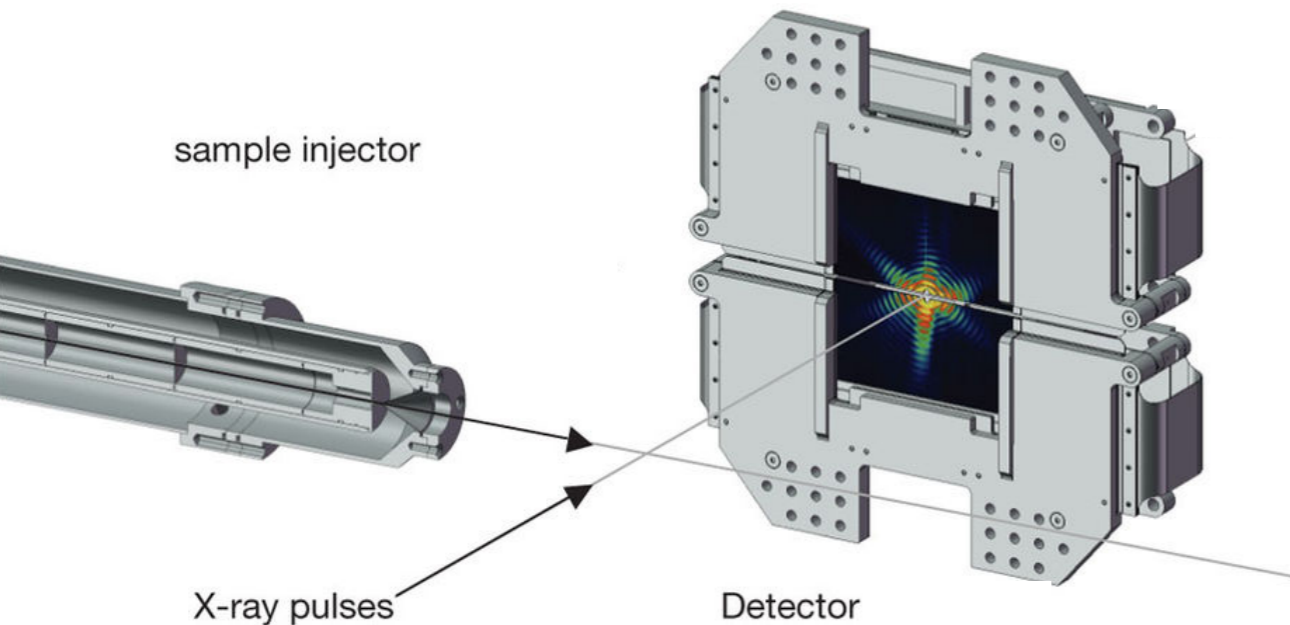
# Superconductivity, Accelerators & Science

Hermann Dürr

Uppsala University

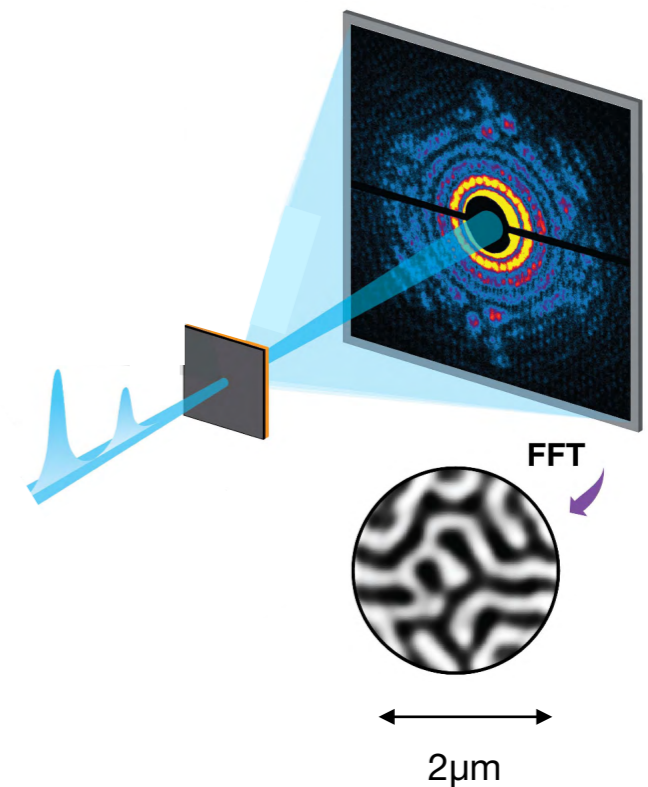
# Science @ Linac Coherent Light Source in Stanford

## Imaging in life science: Holography of mimi viruses



Seibert et al, Nature **470**, 78 (2011)

## Exploring the speed limits in information technology

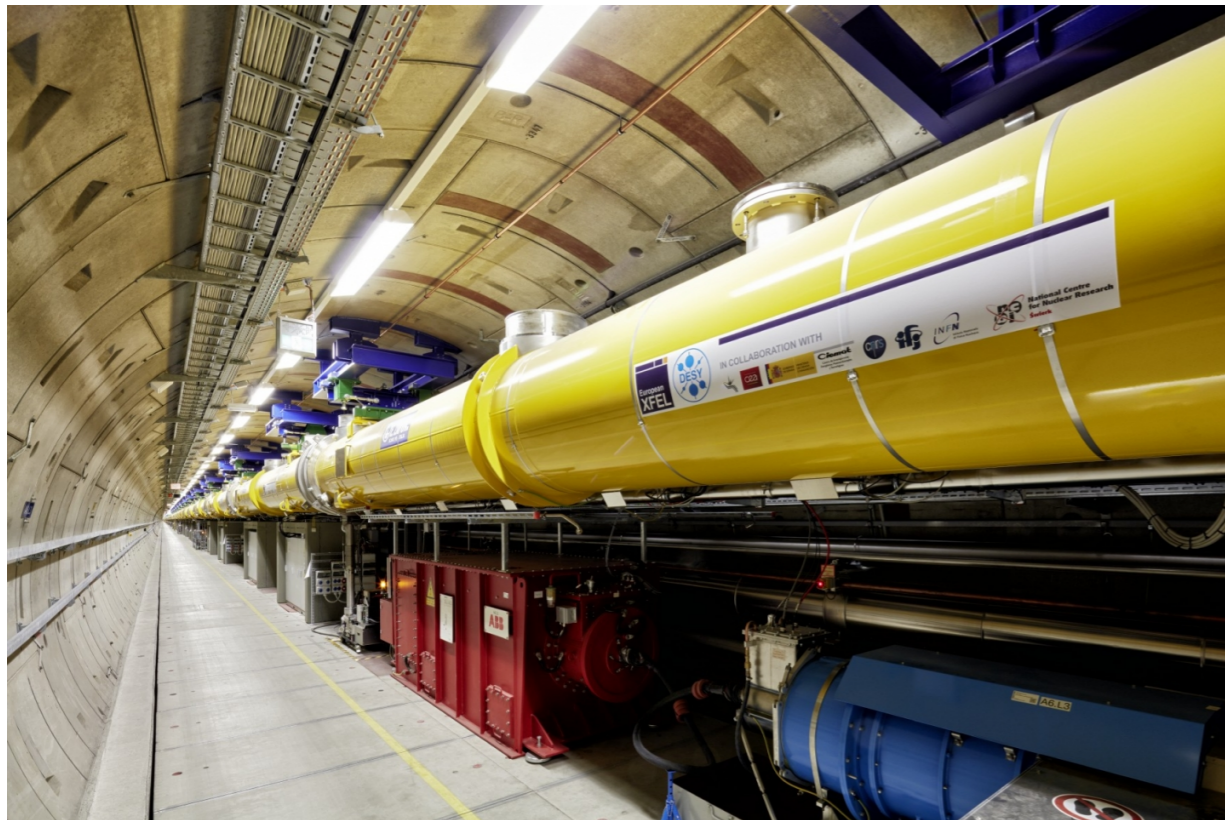


Wang et al,  
Phys. Rev. Lett. **108**, 267403 (2012)



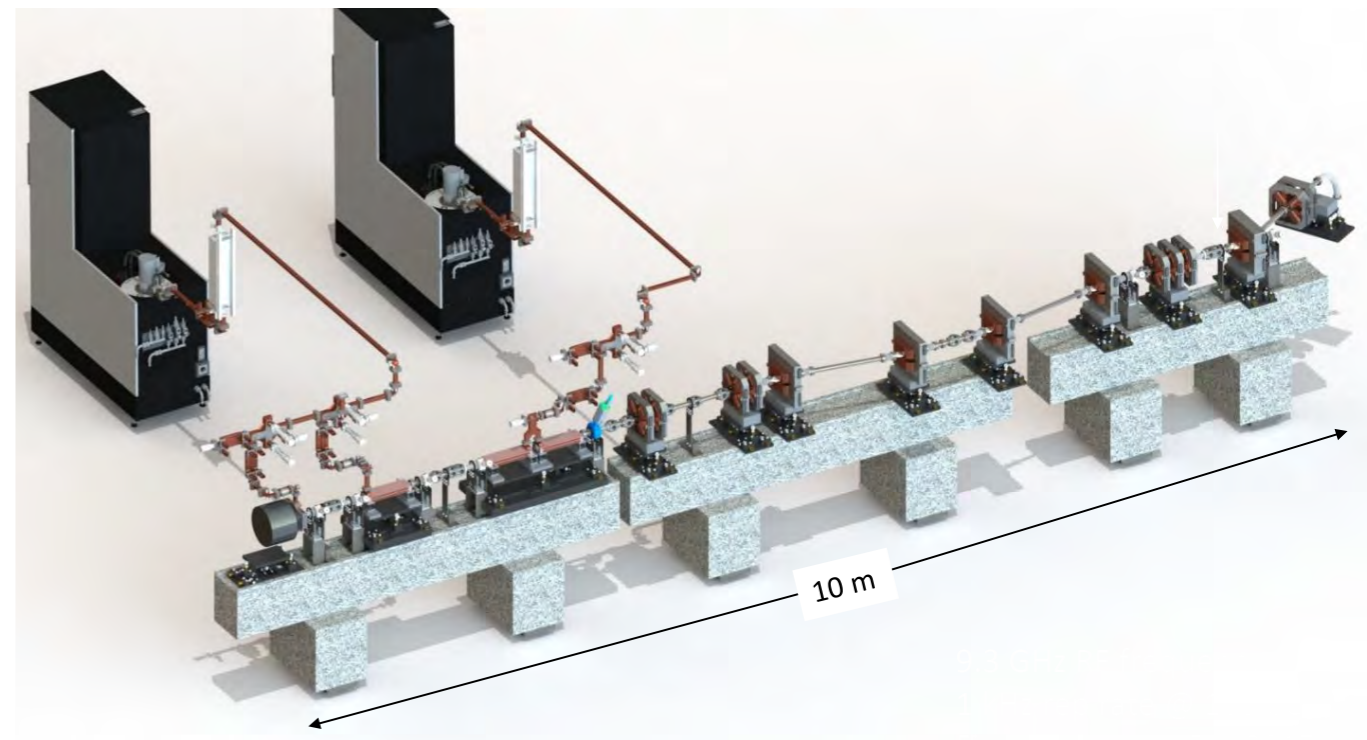
# The Future: Superconducting Free Electron Lasers

European XFEL in Hamburg



...provides hard x-rays at high repetition rates

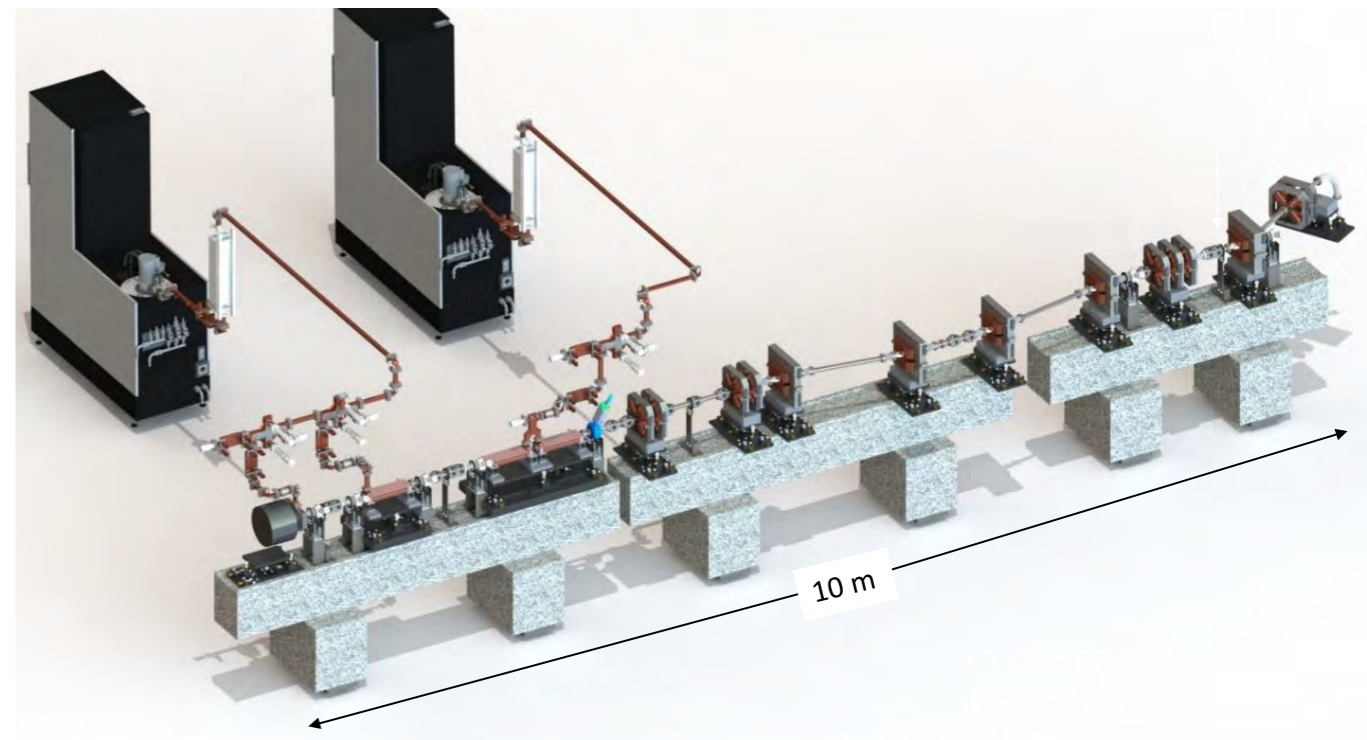
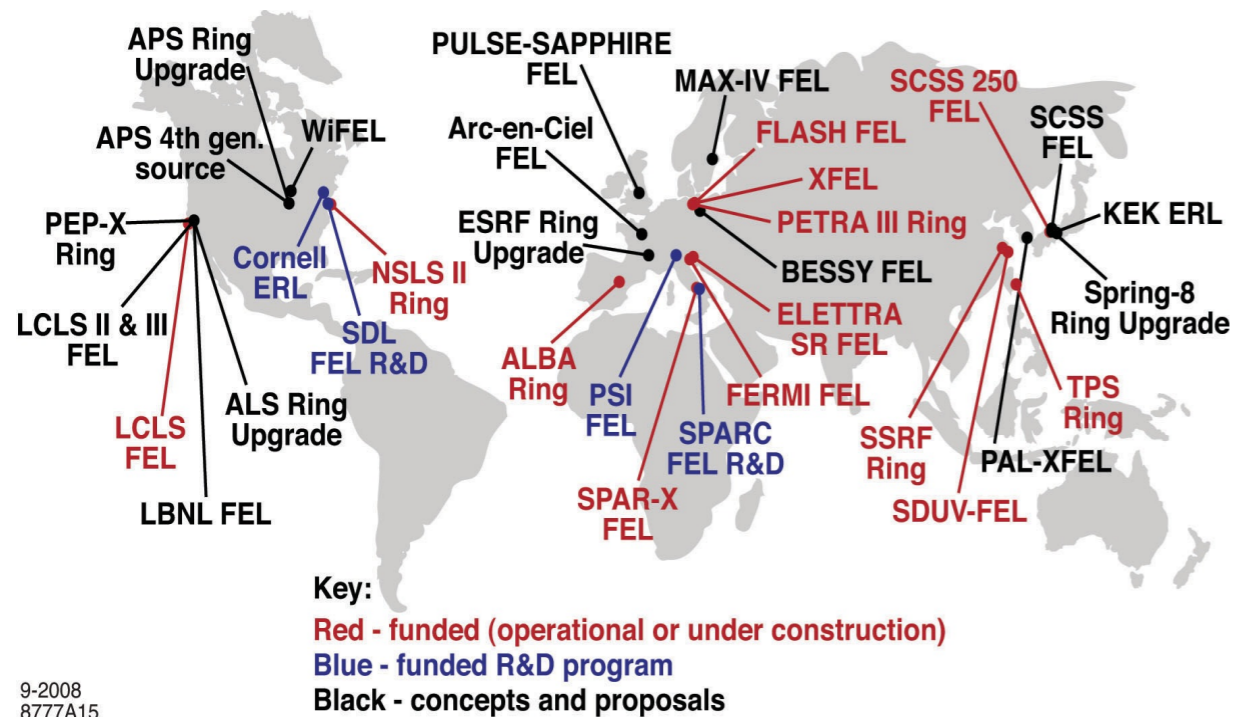
ASU Compact X-ray Light Source



...is based on laser manipulation of electron beams

# The Future: Superconducting Compact Free Electron Lasers

The combination with  
superconducting accelerators  
at FREIA



...provides a market niche

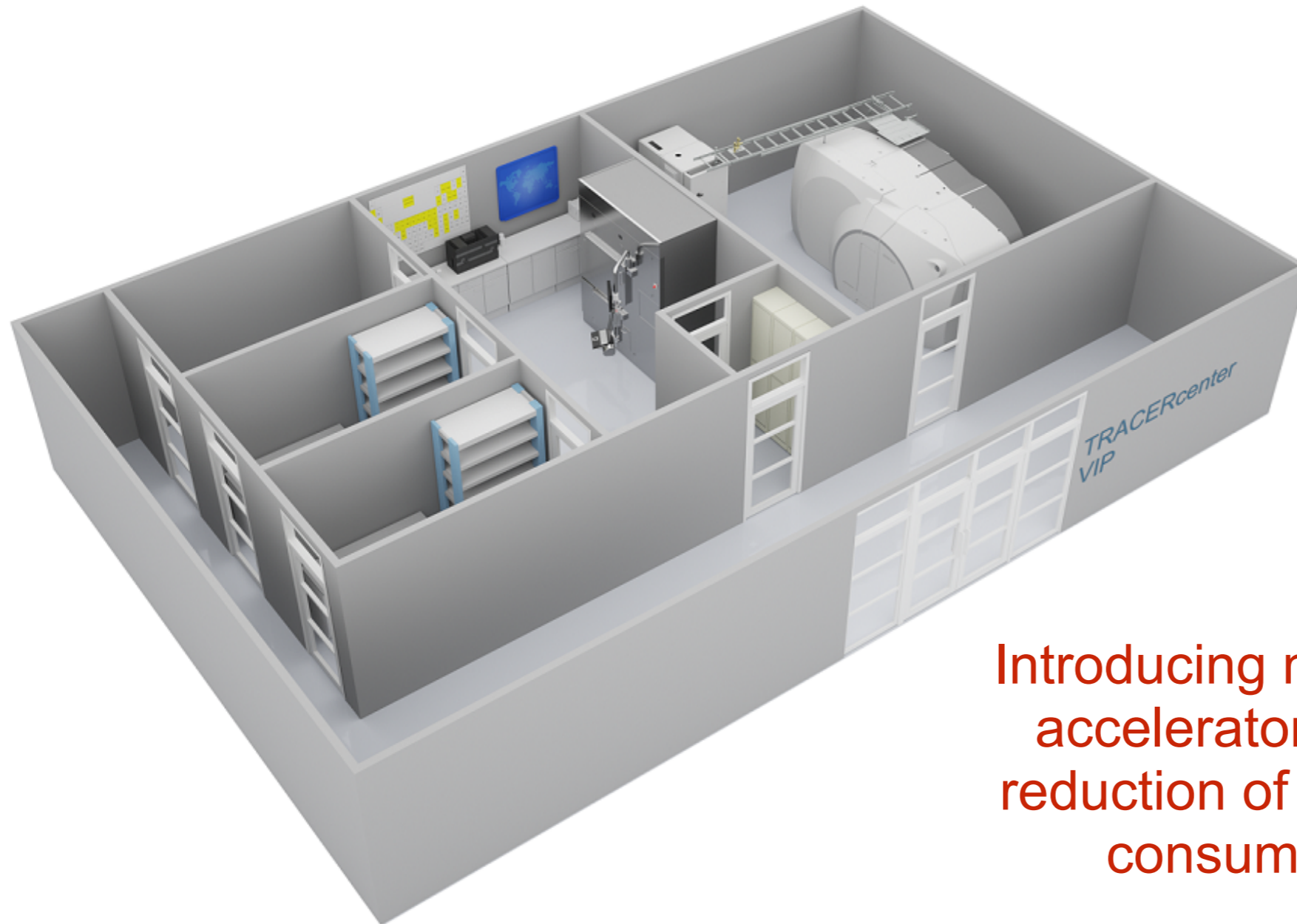
...provides unique science opportunities



# Accelerators in Medicine - positron emission tomography (PET)

---

Schematic of PET tracer production center

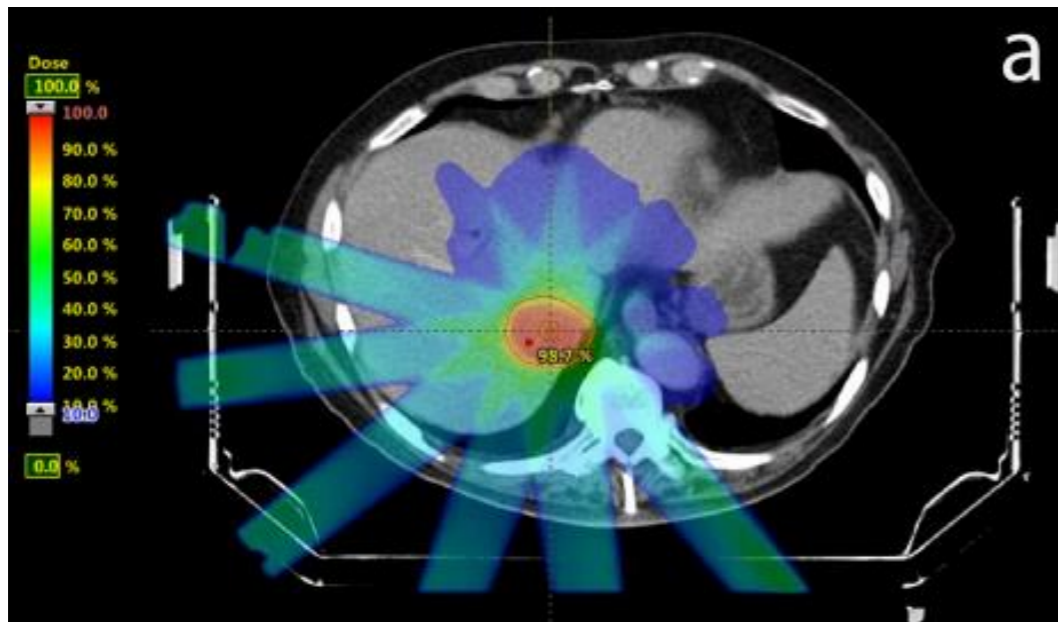


Introducing novel (superconducting) accelerator technology promises reduction of the footprint and power consumption of PET tracer production

Figure courtesy of GE Healthcare

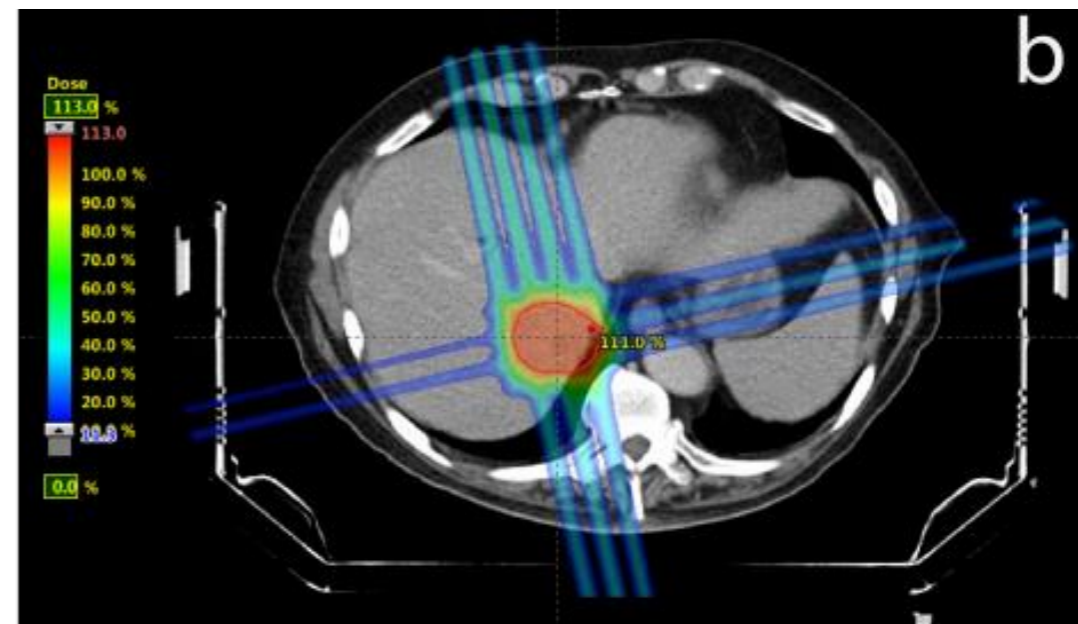
# Accelerators in Medicine

(a) conventional photon therapy on a liver cancer case.

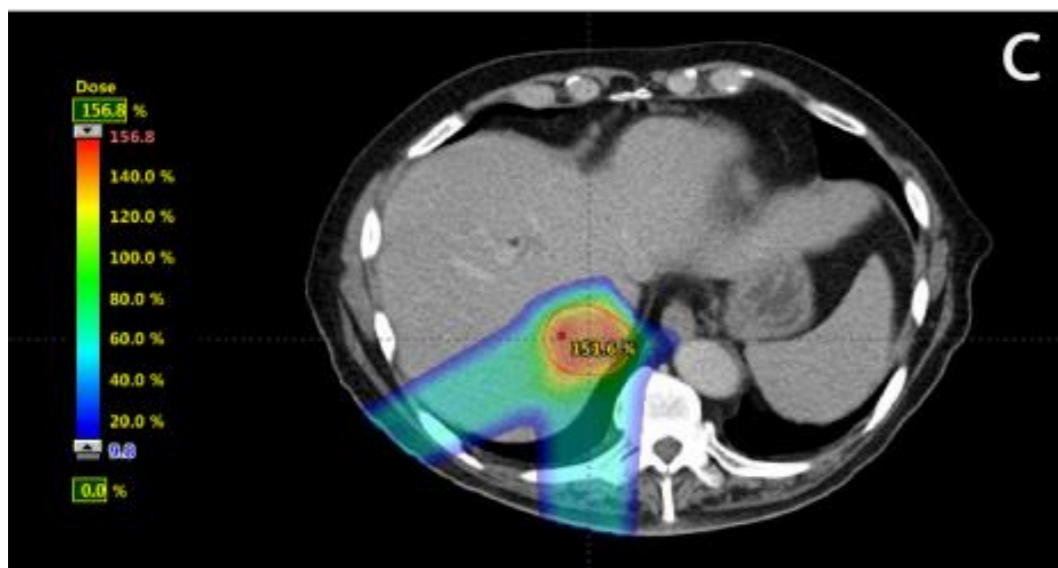


Goal: reduce the dose

(b) interlaced proton grid therapy



(c) proton radiosurgery

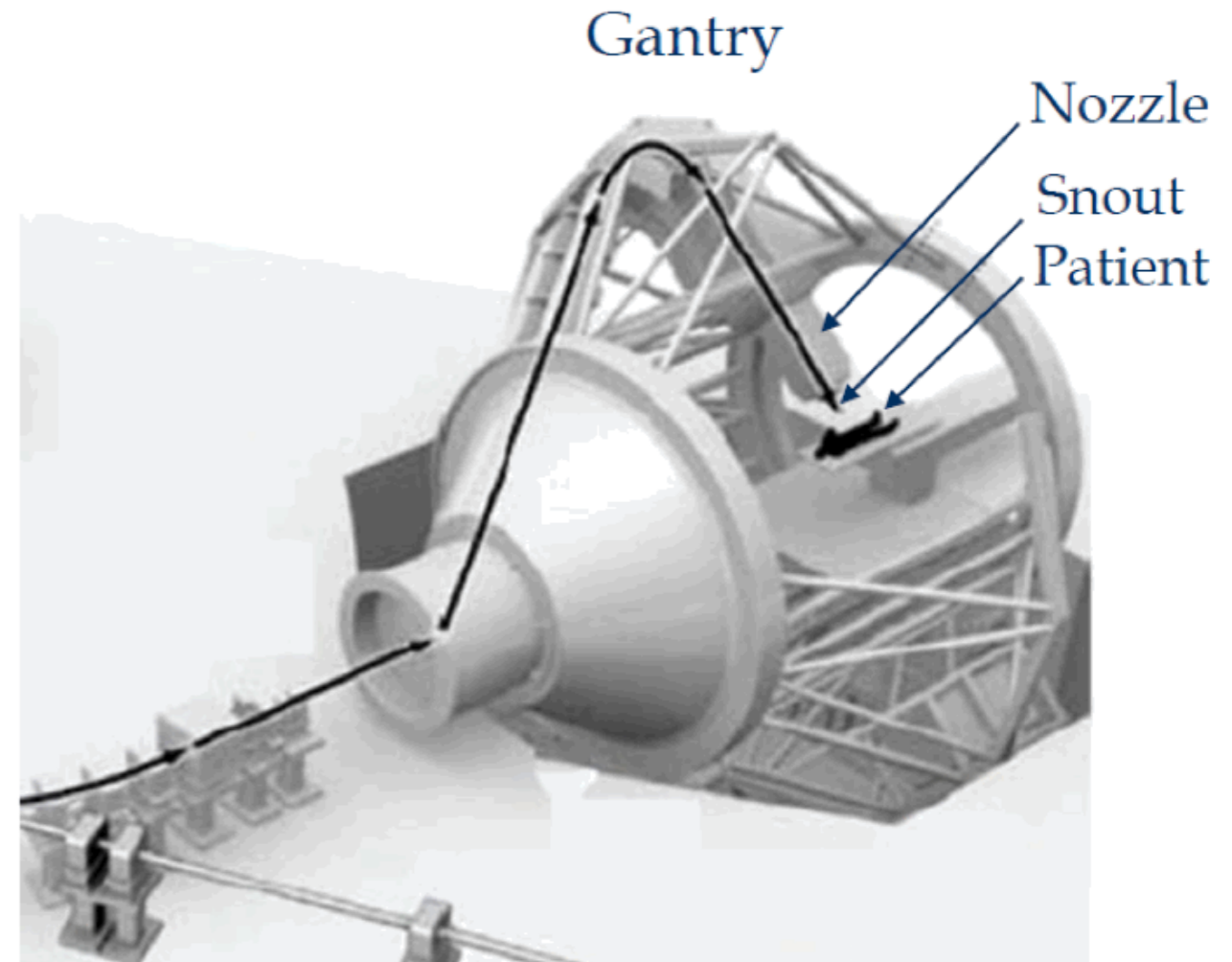


Thomas Henry, PhD thesis Stockholm University (2018)

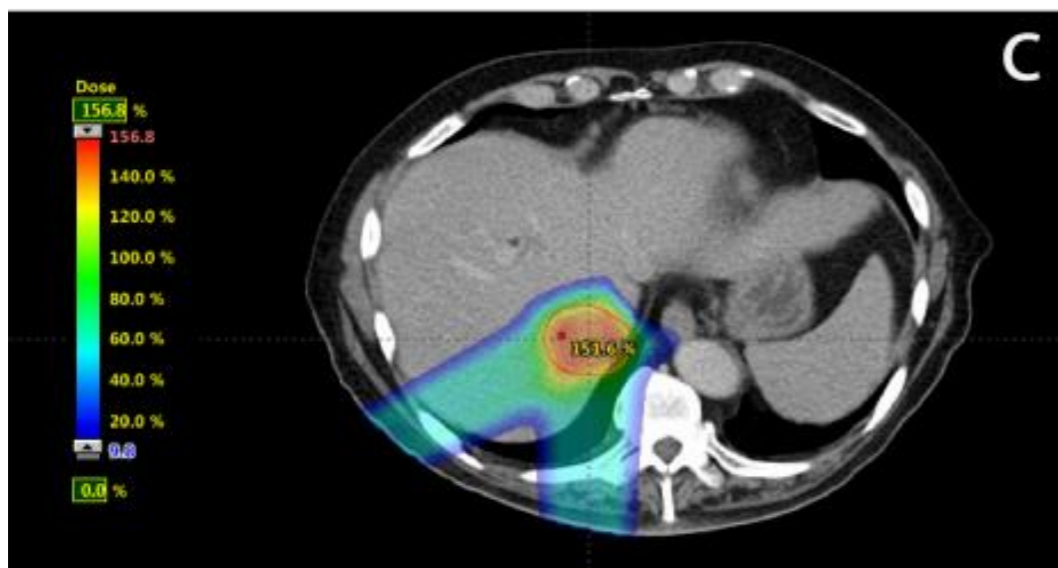
T. Henry, et al. Physica Medica **56**, 81 ((2018)



# Accelerators in Medicine - present



(c) proton radiosurgery

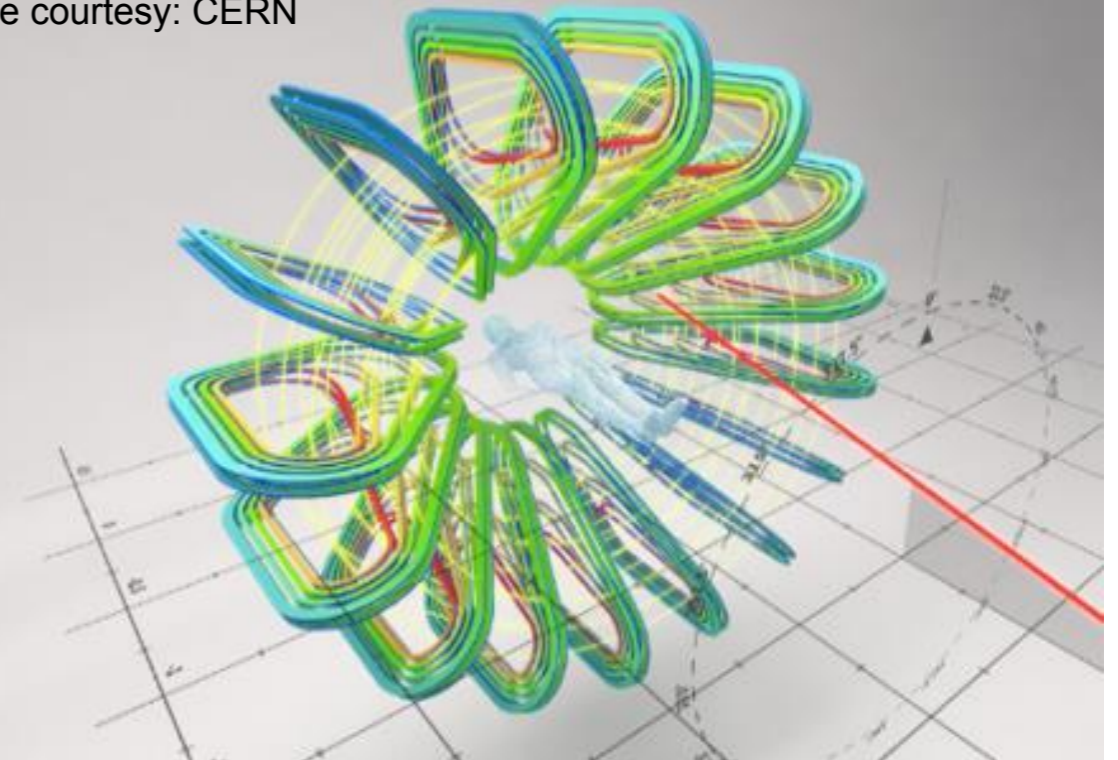


J. B. Farr, et al. Med. Phys. **45**, 953 (2018)

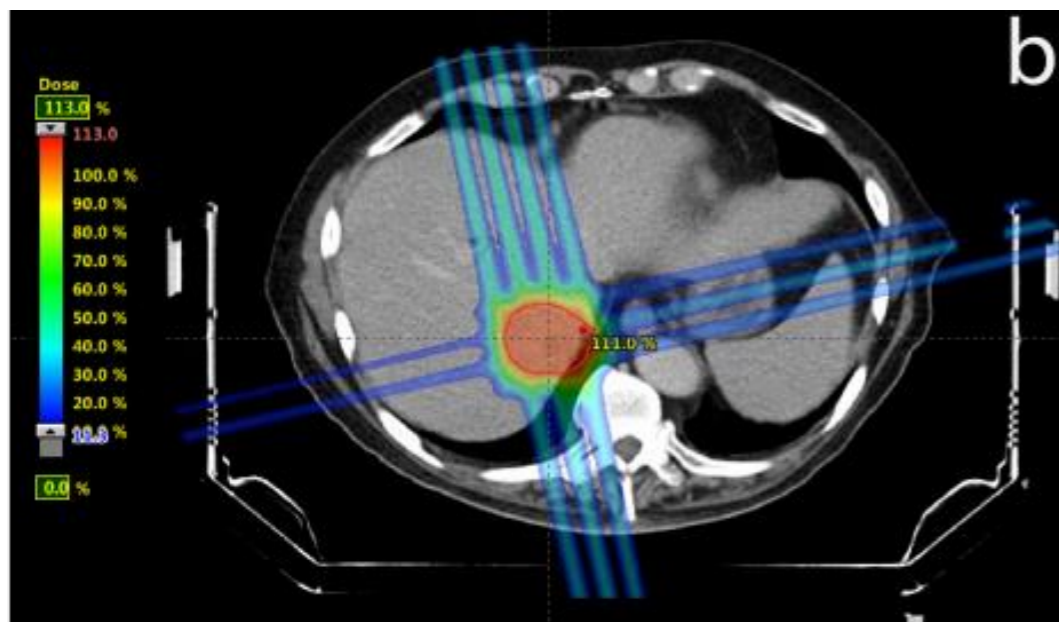
# Accelerators in Medicine - future



Figure courtesy: CERN



(b) interlaced proton grid therapy



Superconducting gantry will enable rapid beam movements and beam focussing essential for reducing the patient dose



# Summary: Superconductivity, Accelerators & Science at FREIA

Develop and test superconducting components to reduce footprint and power consumption of cancer therapy applications

Figure courtesy: CERN

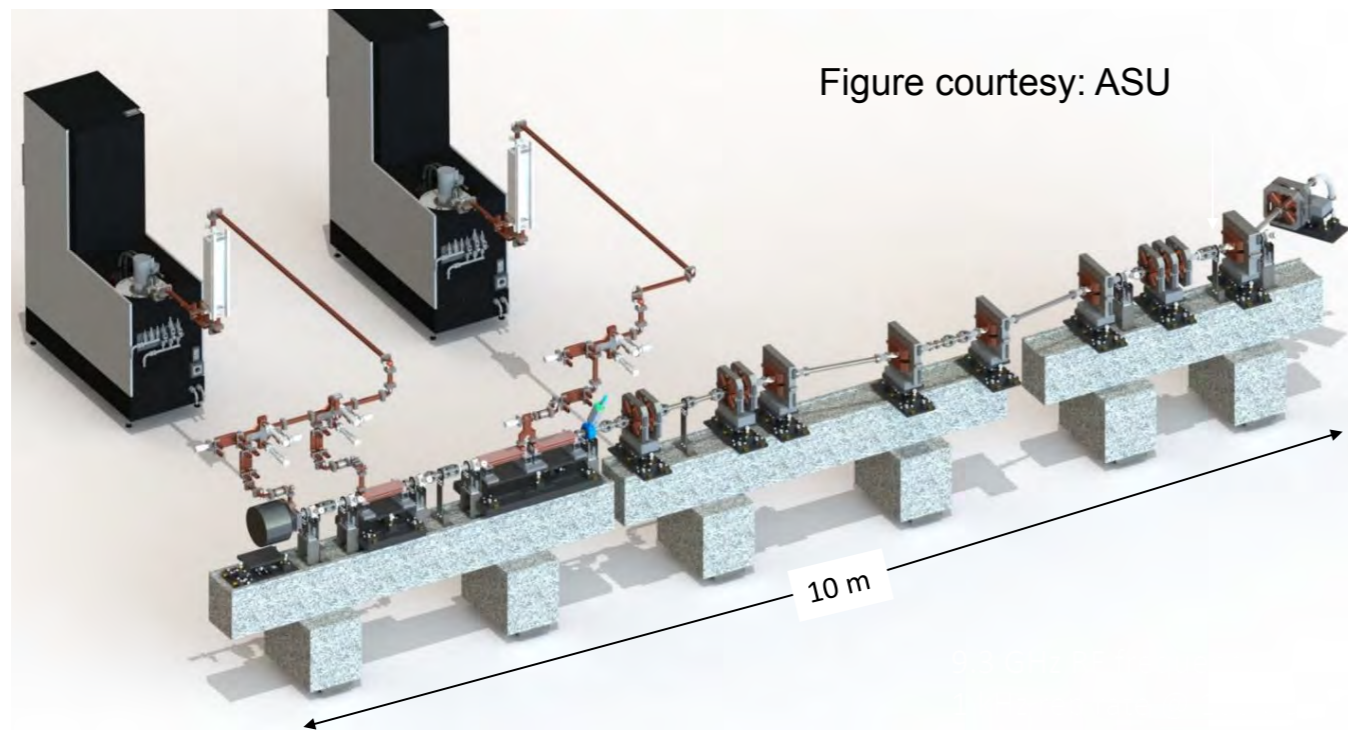
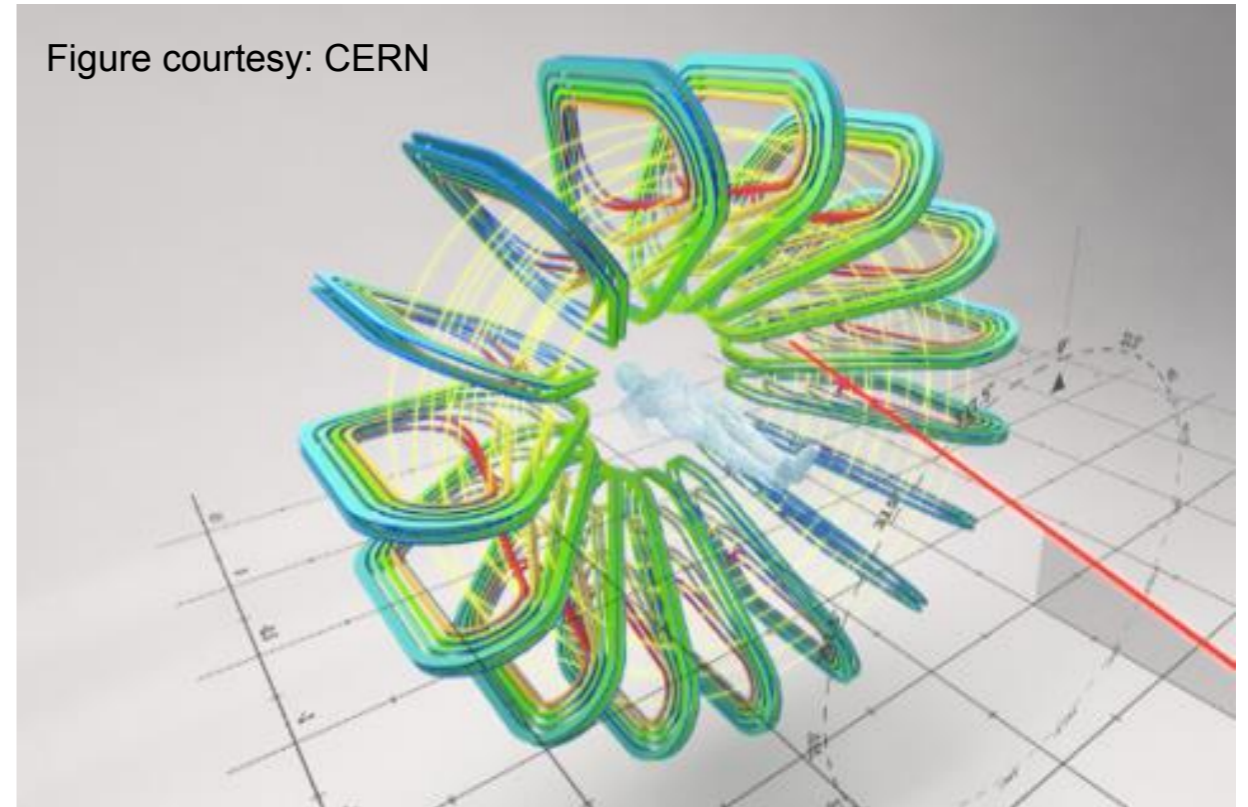


Figure courtesy: ASU

Develop new compact superconducting light sources for research

