CHART

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Swiss Accelerator Research and Technology

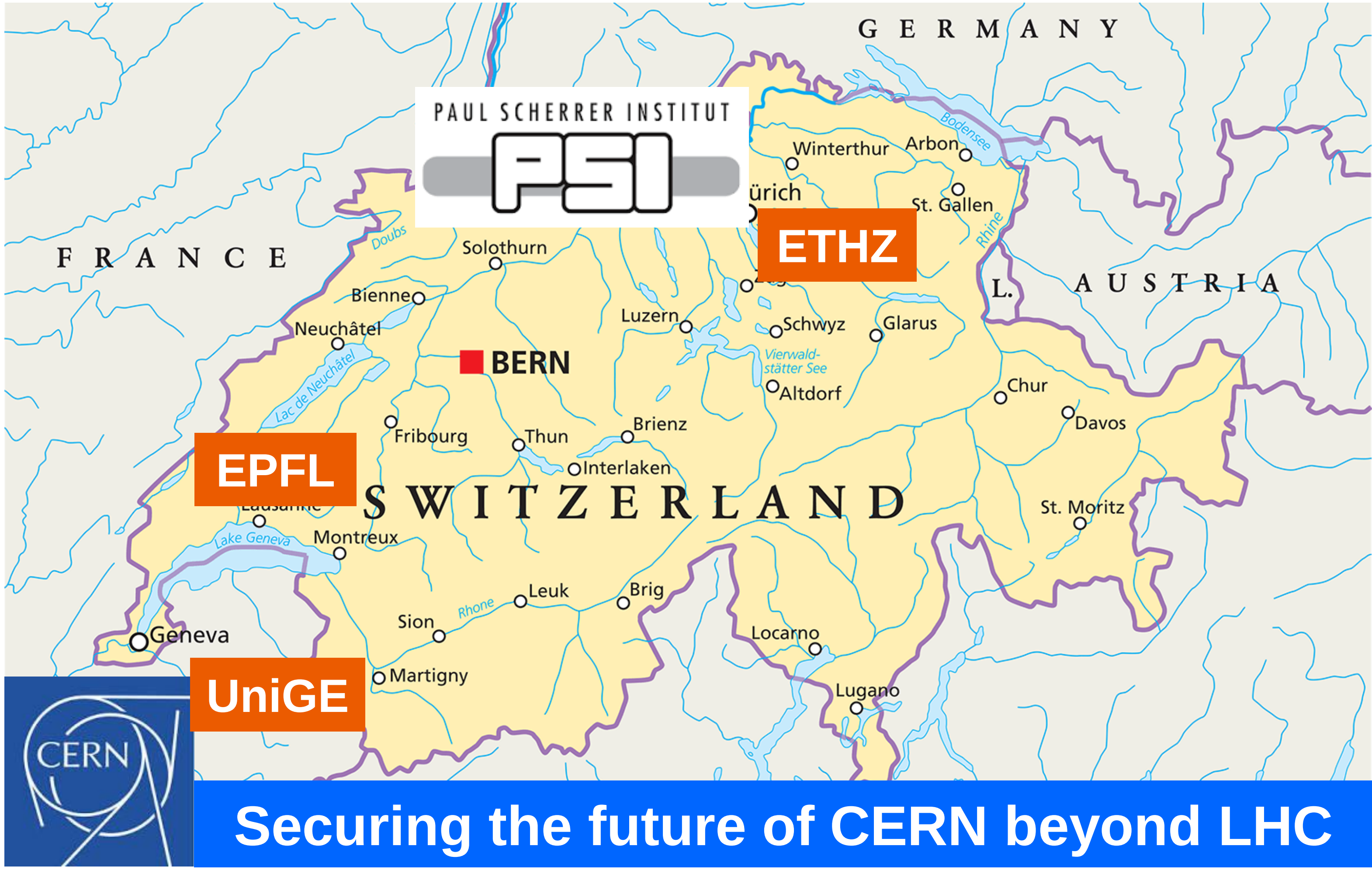
www.chart.ch

Swiss Accelerator Research and Technology CHART Collab

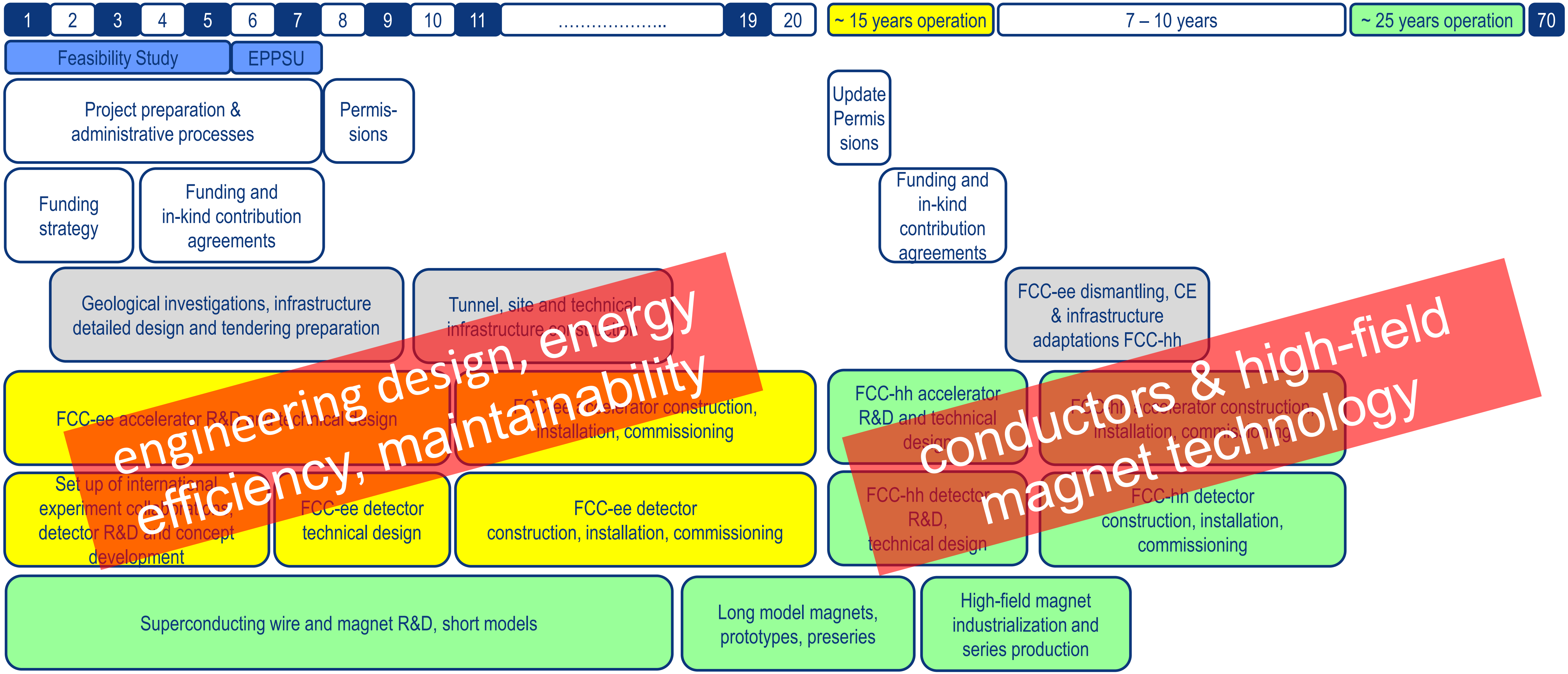
- development of future accelerator technologies
  Emphasis: high field magnets

- development of accelerator concepts beyond the existing technology for synchrotron light sources, medical and industrial applications

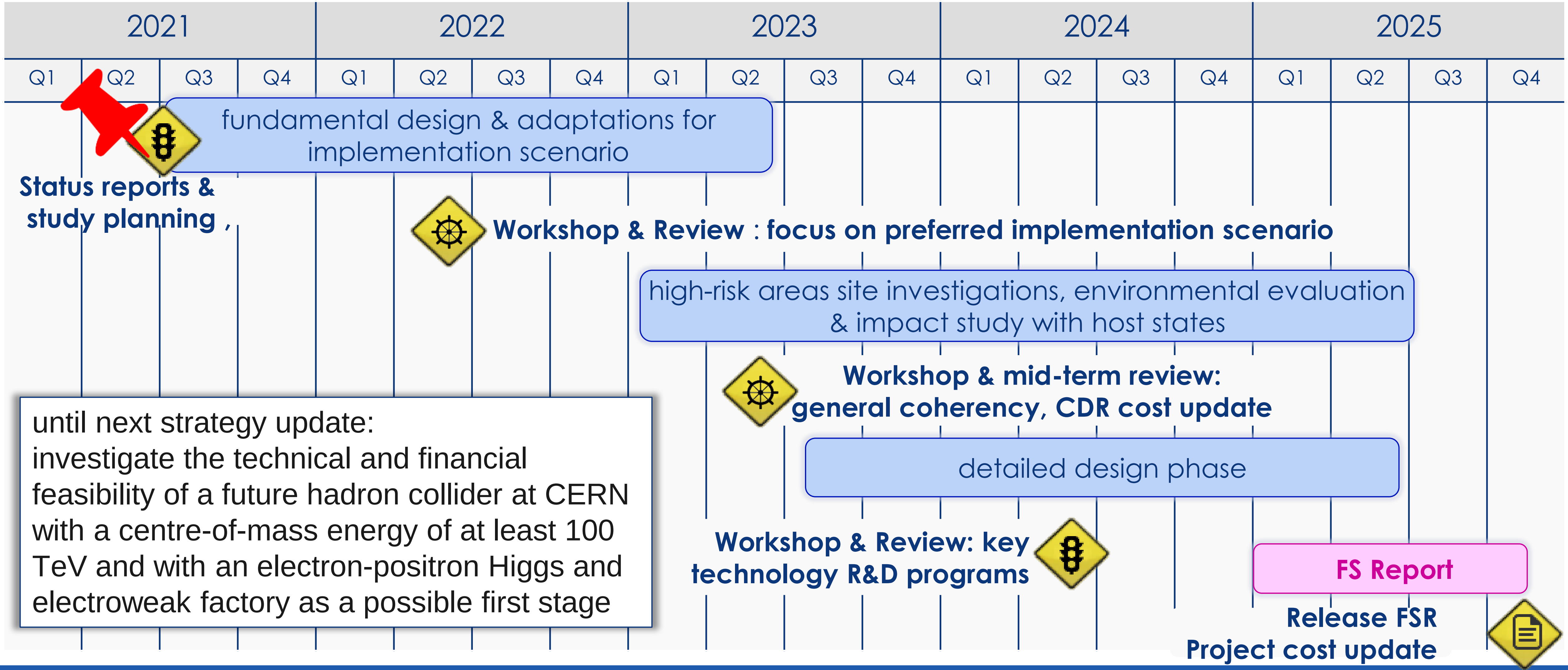
Commitments from SERI, ETHs, PSI, UniGE and CERN for a total sum of 40 MCHF to fund these activities for five years (until 2024)



FCC integrated project technical schedule



Feasibility study timeline



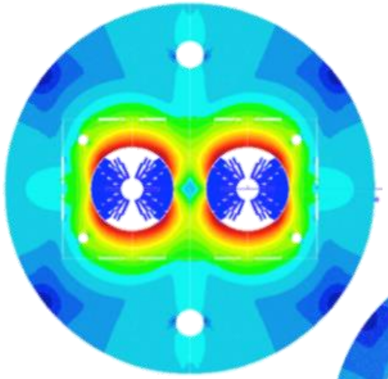
until next strategy update:
investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage

High field magnets R&D

EuroCirCol H2020

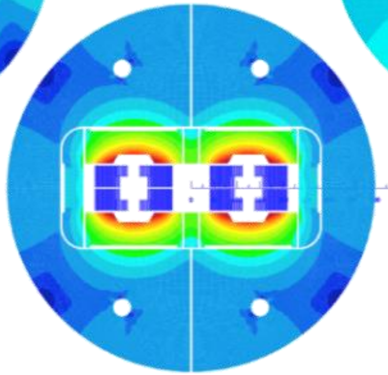
A key to New Physics

Cos-theta



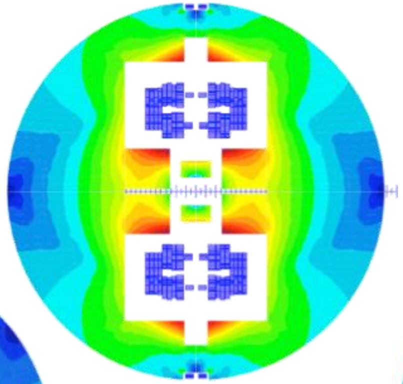
INFN

Blocks



CEA

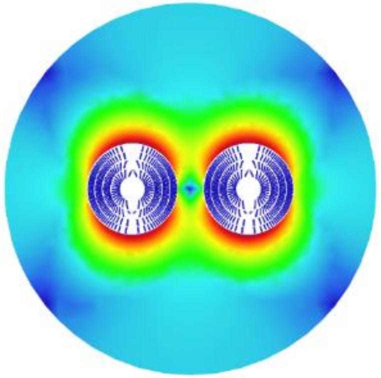
Common coils



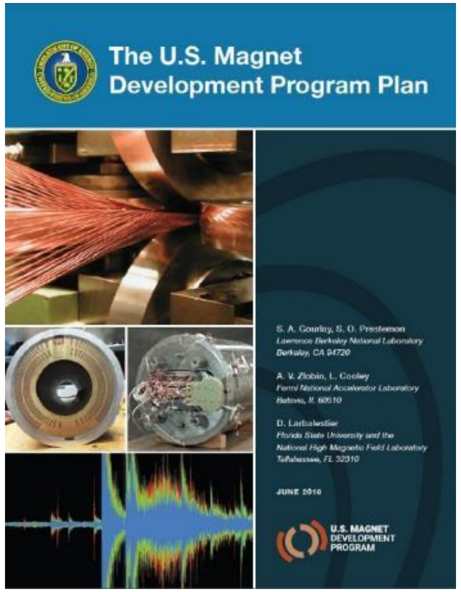
CIEMAT

Swiss contribution

Canted Cos-theta



PSI



The U.S. Magnet Development Program Plan

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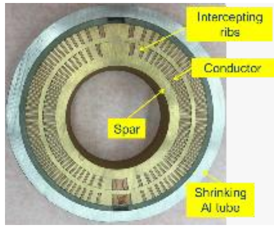
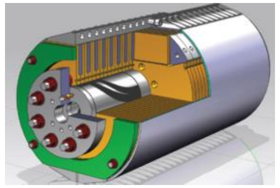
JUNE 2016

U.S. MAGNET DEVELOPMENT PROGRAM

LBNL



FNAL

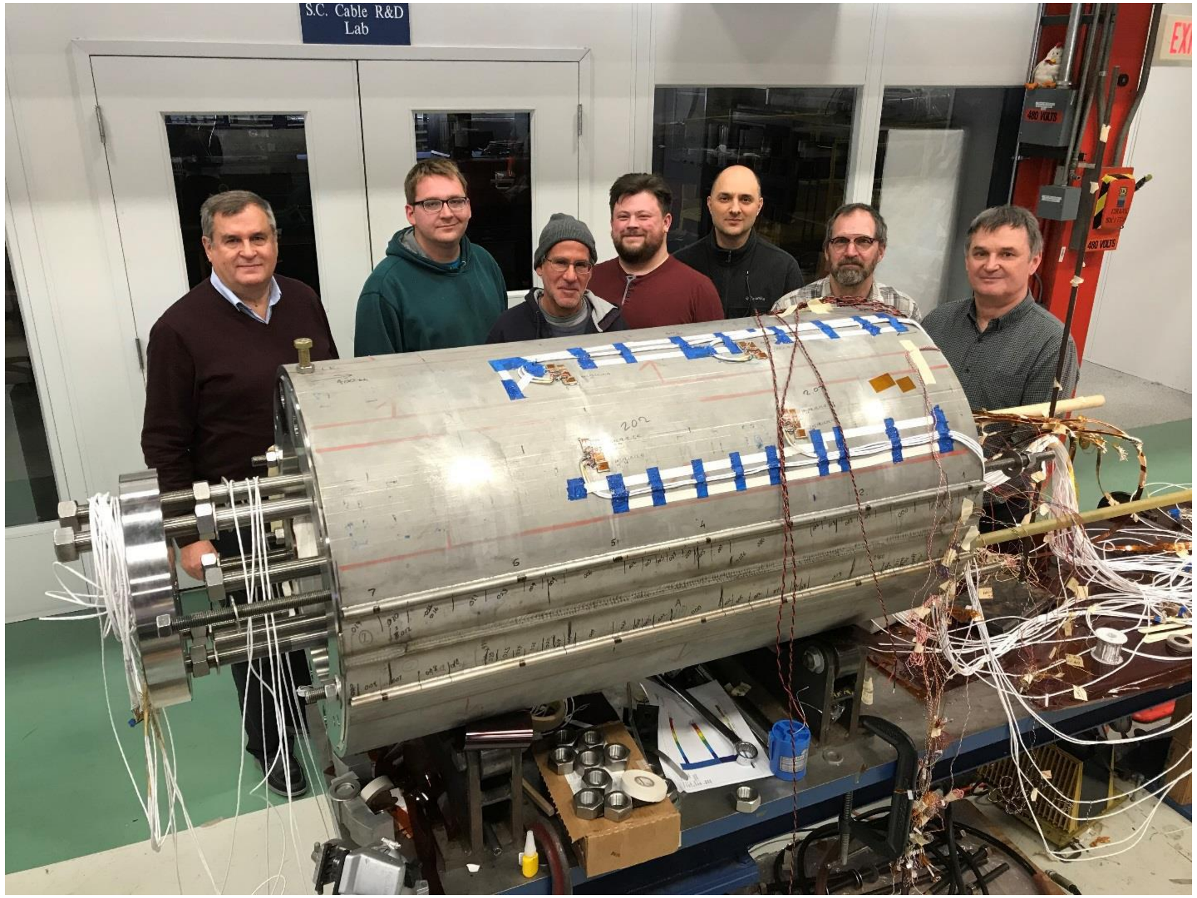


Short model magnets (1.5 m lengths) will be built from 2018 – 2022

Russian 16 T magnet program coordinated by BINP.

B. Auchmann

2019: FNAL demonstrator dipole exceeded 14 T at 4.5 K



2019: PSI CCT demonstrator dipole

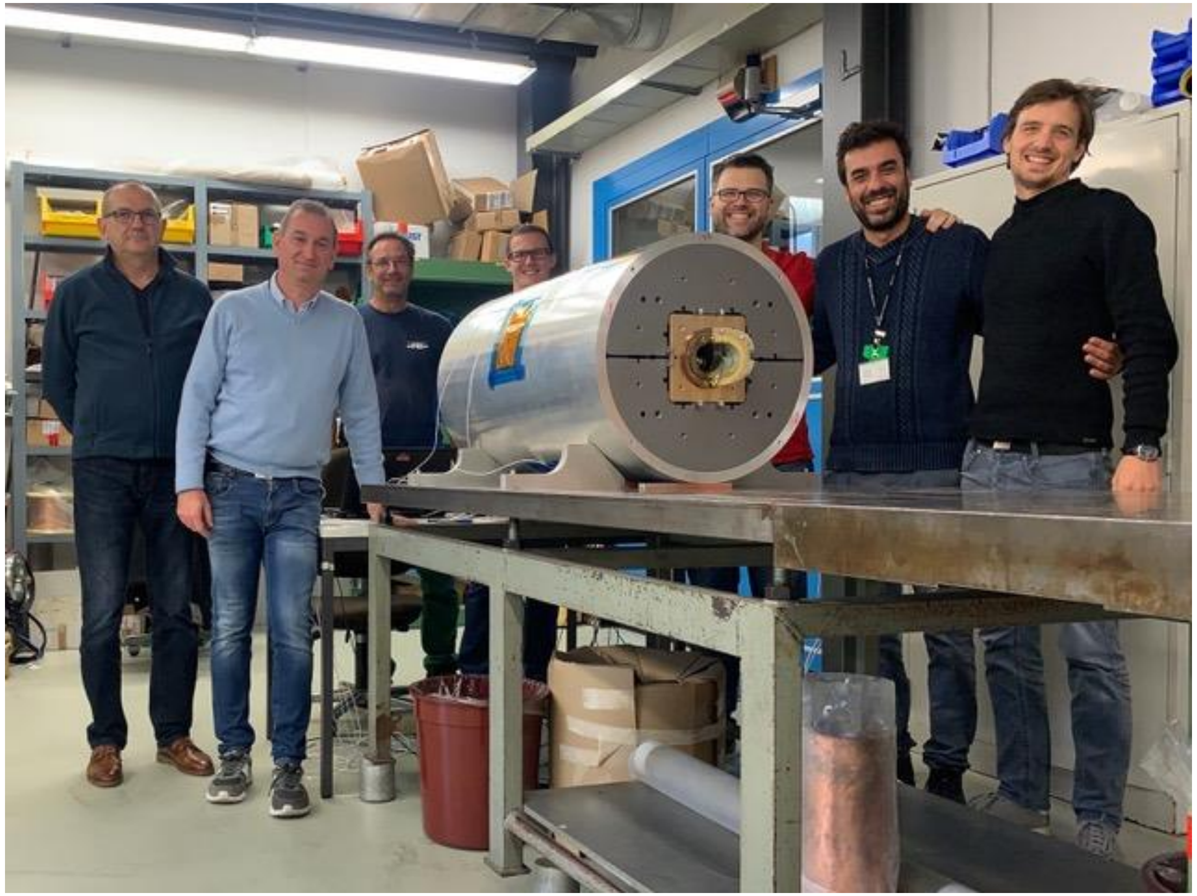
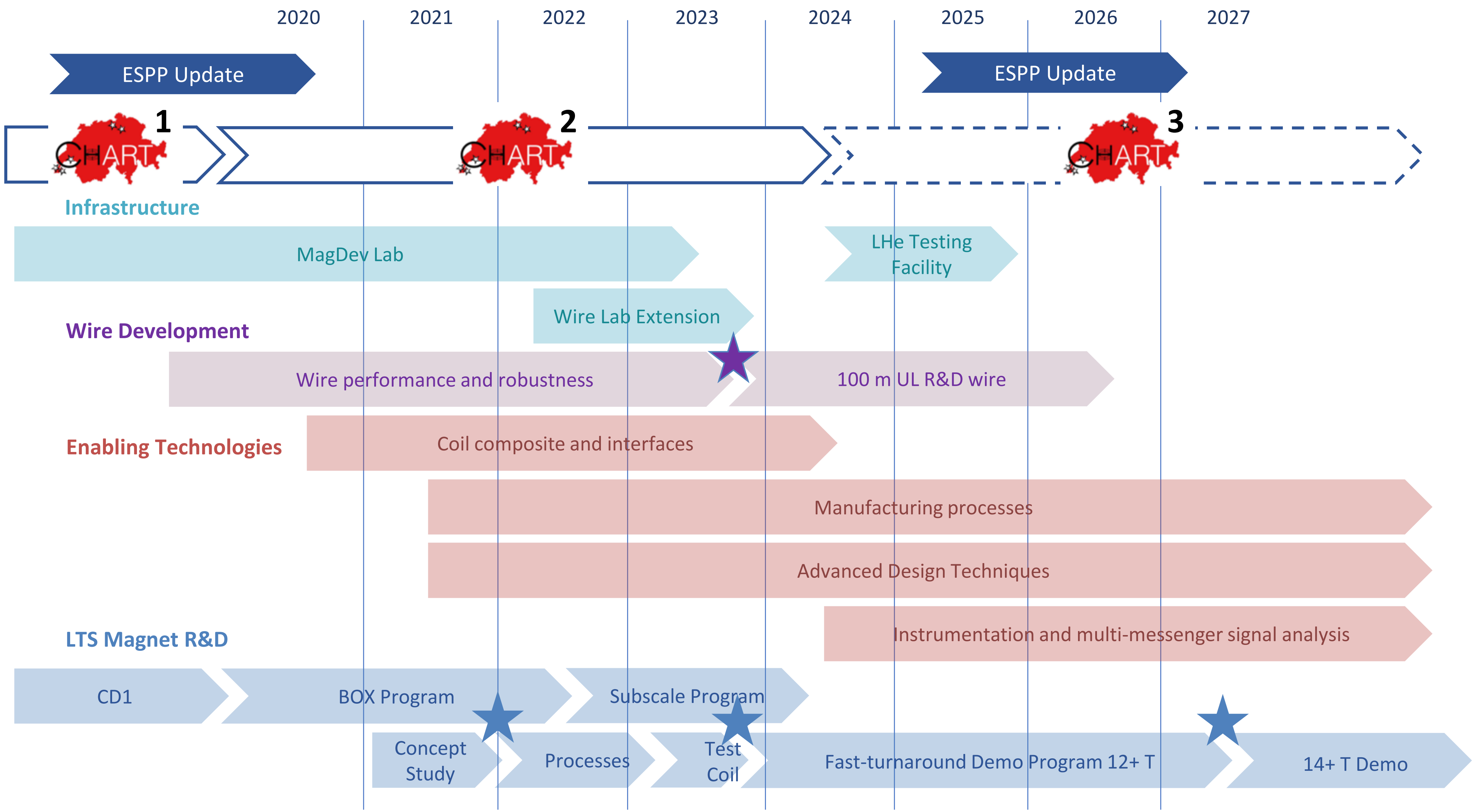
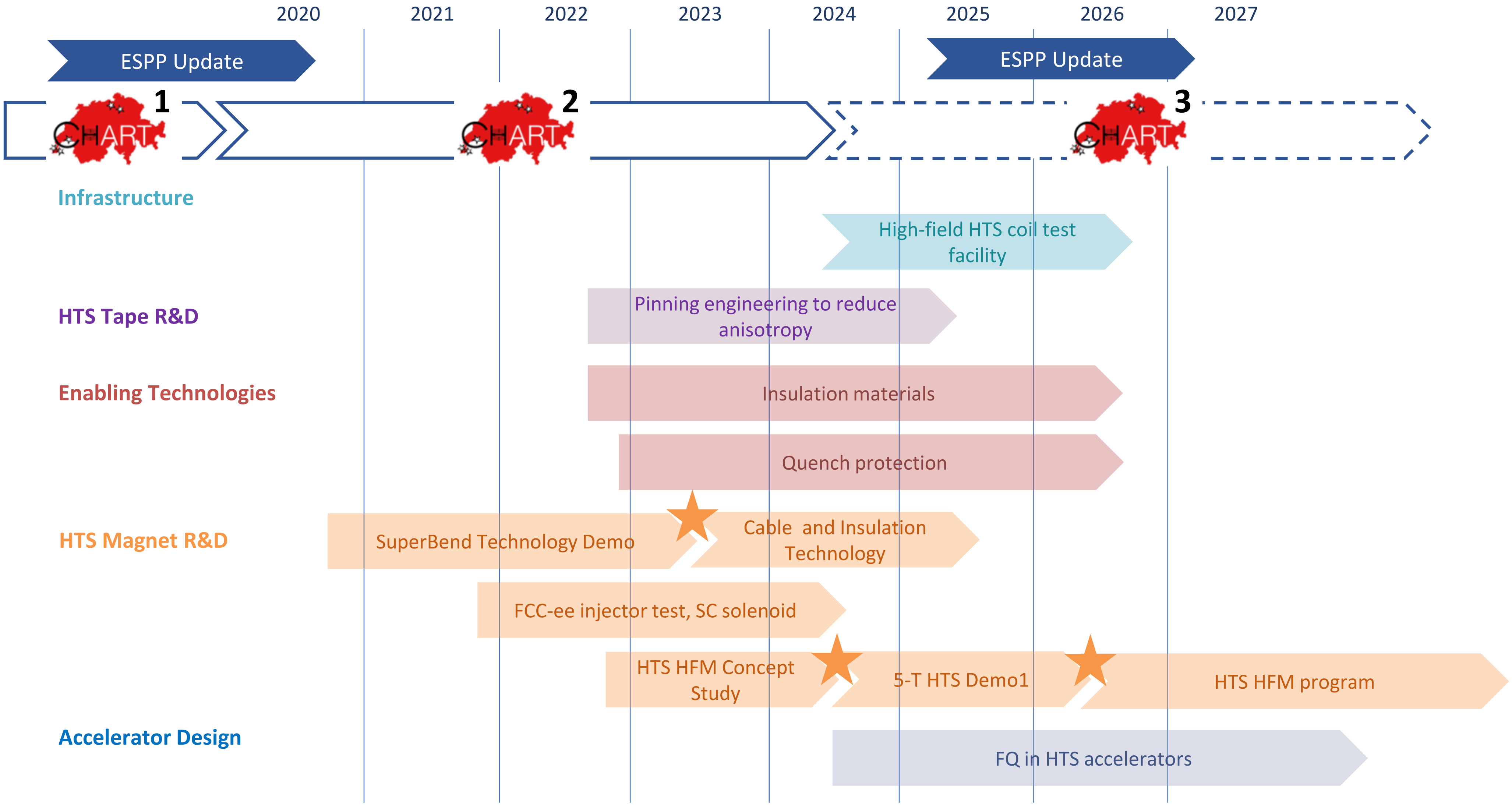


CHART Low Temperature Superconductor HFM Roadmap



aveat: CHART3 is not today an approved program. The funding envelop will determine the possible level of engagement, and a selection of activities may have to be made according to priorities.

CHART High Temperature Superconductor HFM Roadmap



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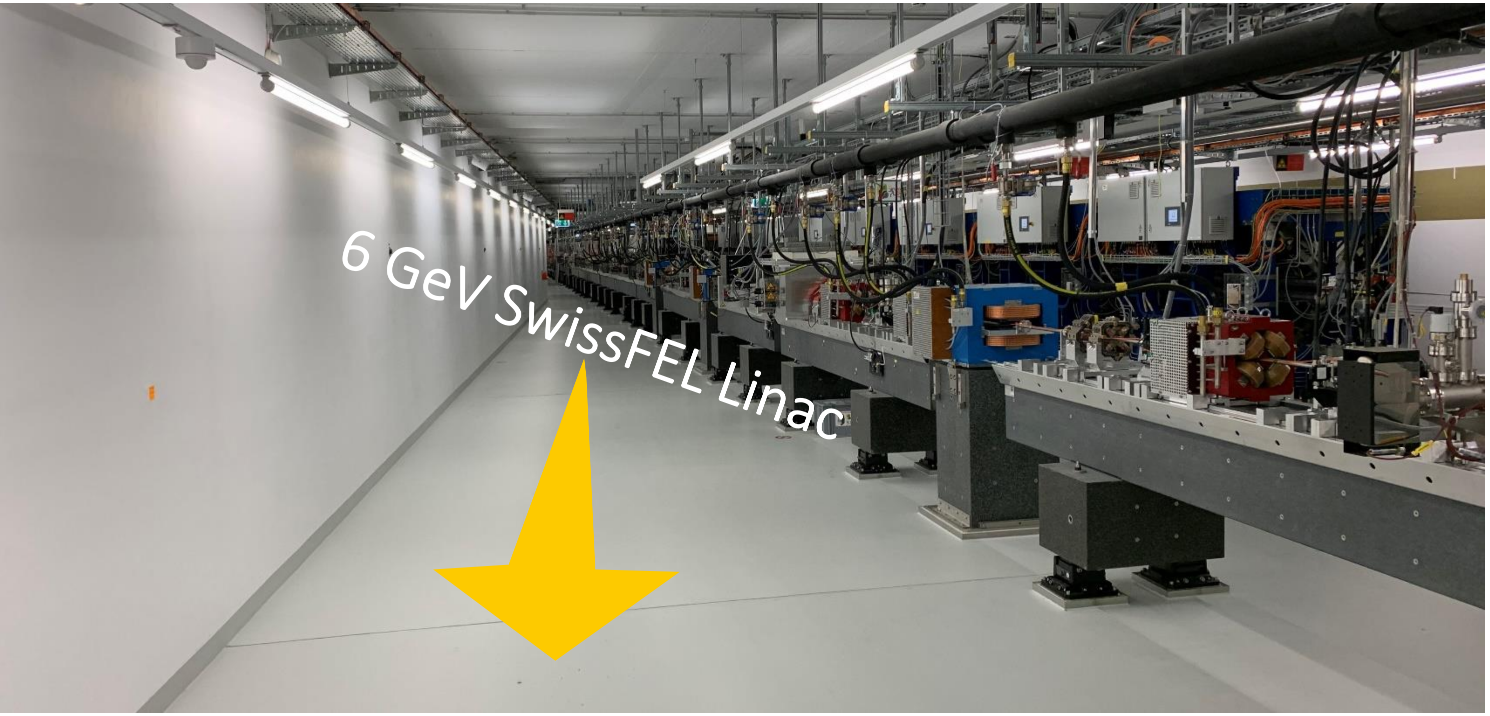
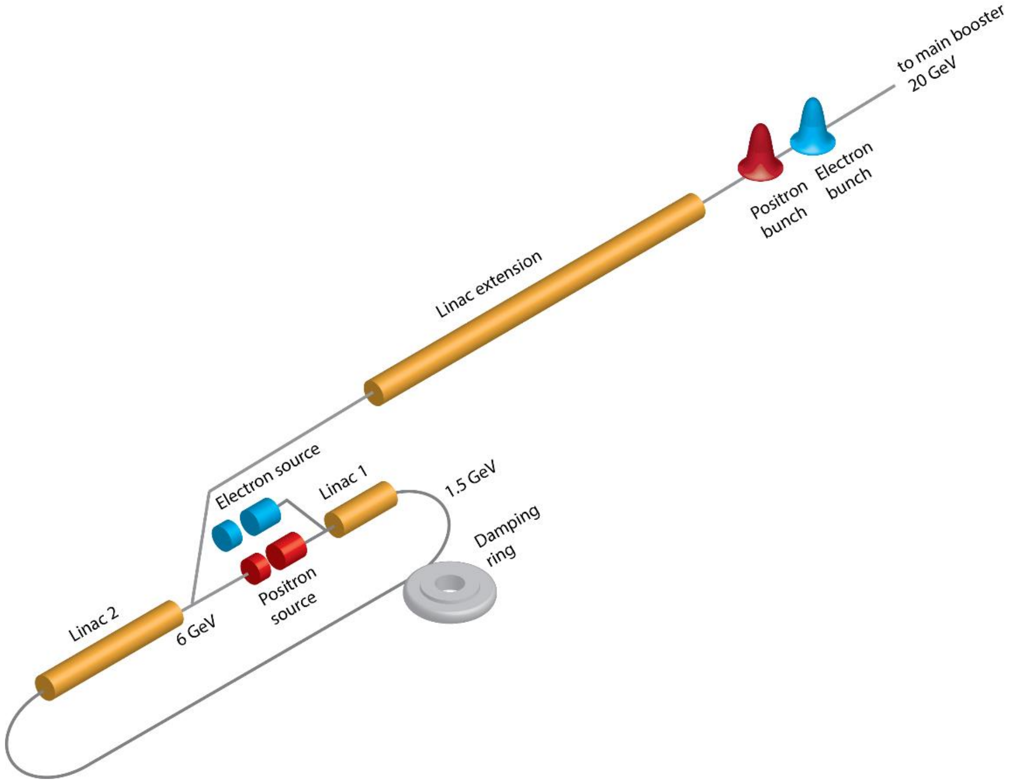
FCC-ee Positron Source Project

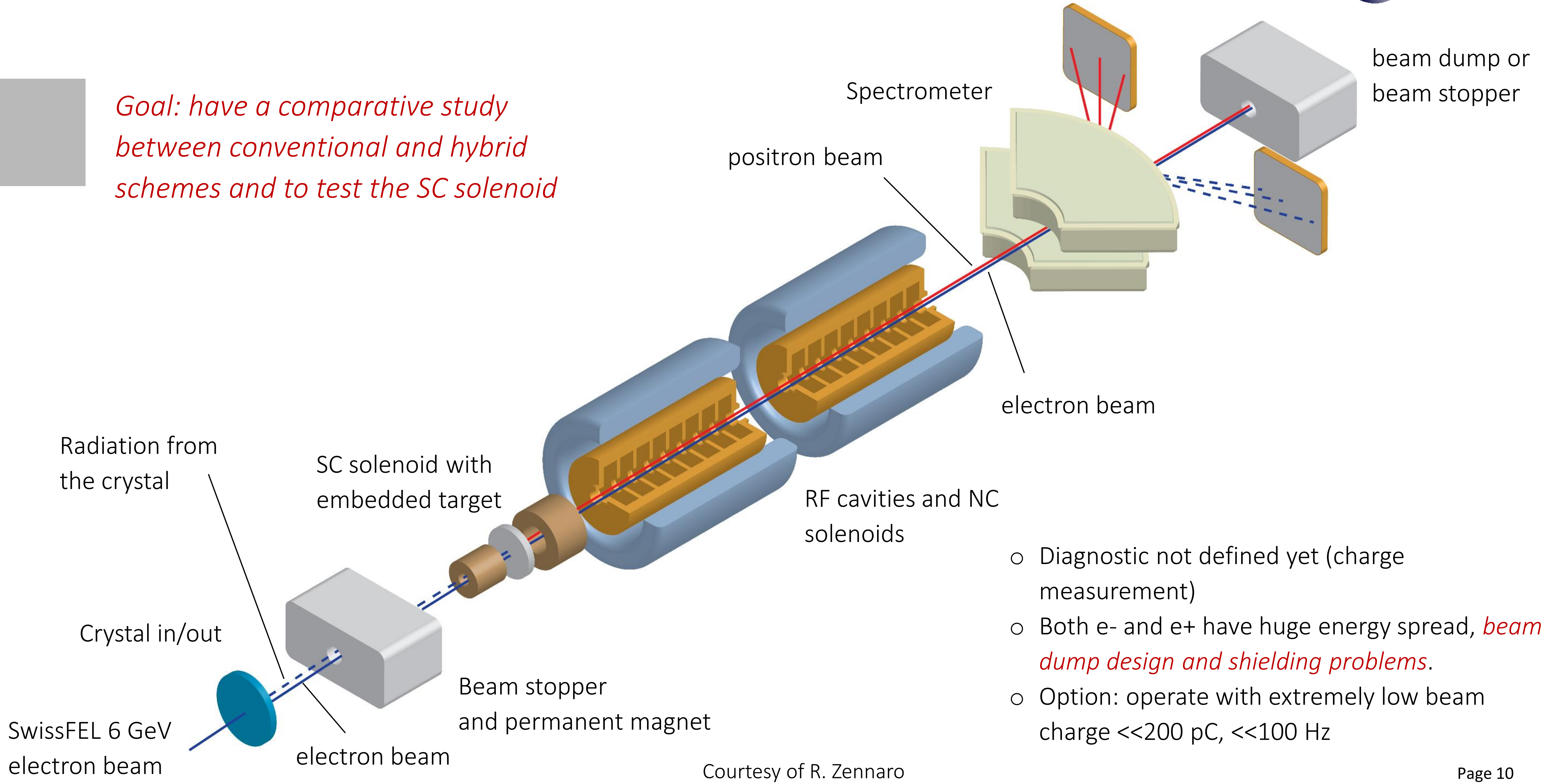




- Key point: Positron production and capture efficiency reduces the cost and complexity of the driver linac, the heat and radiation load of the converter system, and increases the operational margin
- Any progress with R&D on the target and capture systems will have a direct benefit for the injector chain
- **Test bench at PSI/SwissFEL** for the conventional and hybrid schemes using a SC solenoid, mainly for the positron yield (and maybe for the positron beam quality as well)

Experiment layout

Goal: have a comparative study between conventional and hybrid schemes and to test the SC solenoid



- Diagnostic not defined yet (charge measurement)
- Both e- and e+ have huge energy spread, *beam dump design and shielding problems*.
- Option: operate with extremely low beam charge <<200 pC, <<100 Hz

Courtesy of R. Zennaro

Development of simulation framework for FCC-ee (F.Carlier et al)

Why? Some critical simulations for FCC-ee are not within the capabilities of current simulation codes

- Beam-beam instability studies with full lattice descriptions
- Efficient on- and off-momentum dynamic aperture simulations
- Self-consistent optics with beam-beam
- Spin dynamics simulations with complete FCC-ee model

What? Establish a modern and maintainable simulation framework to address key limitations for the FCC-ee

- Integrate and merge functionalities of established simulation tools
- Develop new simulation modules to replace outdated legacy codes
- Perform key simulation campaigns with developed tools: beam-beam, spin dynamics, collimation…

How? Current efforts focus on:

- Updating codes to accept FCC-ee model including tapering and solenoid modelling
- Developing common interface and APIs to move towards multi-code simulations
- Efficient multiparticle tracking modules with synchrotron radiation and beam-beam
- Developing 6D beam-beam model with various levels of approximations

Team:
Félix Carlier (Postdoc EPFL)
Peter Kicsiny (Ph.D. EPFL/CERN)
Guillaume Simon (Ph.D. CERN)
Yi Wu (MSc. EPFL)

Staff and supervisors:
Tatiana Pieloni (EPFL)
Xavier Buffat (CERN)
Daniel Schulte (CERN)
Riccardo De Maria (CERN)
Frank Schmidt (CERN)

Collaboration between EPFL & CERN in synergy with current LHC based efforts at CERN, and with broader interests towards lightsource and muon collider communities

FUTURE CIRCULAR COLLIDER CERN EPFL CHART Swiss Accelerator Research and Technology

CHART

- CERN is key for Swiss science landscape
- Swiss contribution to next generation collider at CERN
- focused on critical technologies and accelerator physics aspects of FCC
- networking between CH institutions & CERN
- involving and educating the next generation accelerator experts

  → developing and maintaining competences during the preparation period for FCC

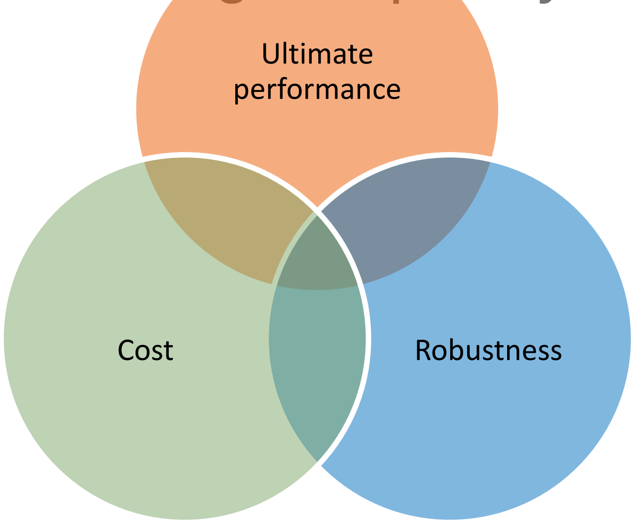
Swiss Accelerator Research and Technology

CHART welcomes your contribution!

Spare Slides

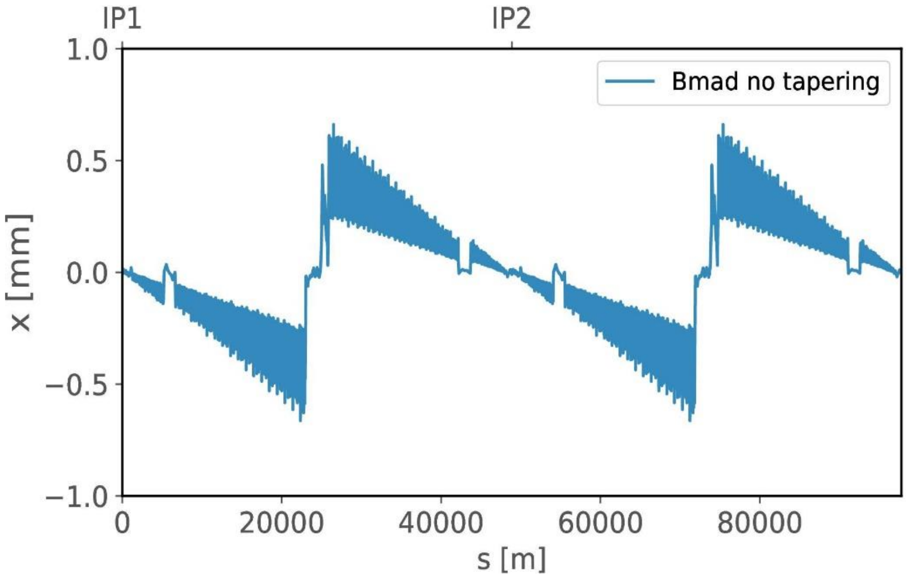
High Field Magnets: Low Temperature Superconductors Driving Questions

- How to increase the overall robustness and performance of Nb_3Sn technology in terms of
  - increased field,
  - increased yield of conforming coils,
  - reduced magnet training to ultimate field, and
  - resilience to operational and thermal cycles?
- To which level can the magnetic field be pushed in an economical way?
- How to reduce the manufacturing complexity and material cost?



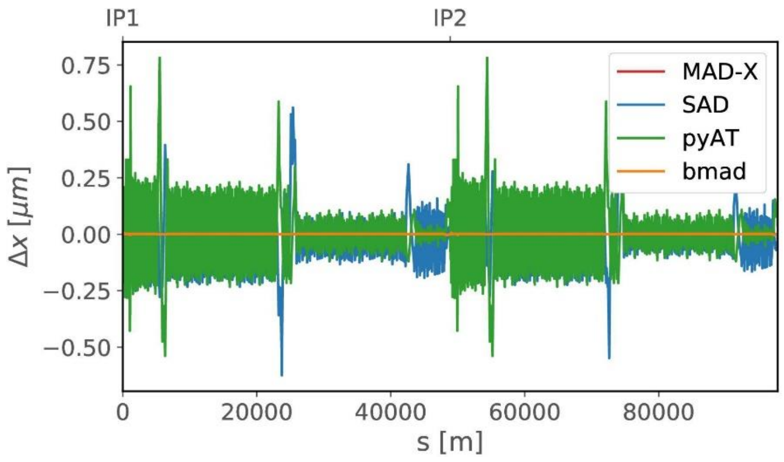
Simulation Framework: **Example Tapering to Compensate SR Losses**

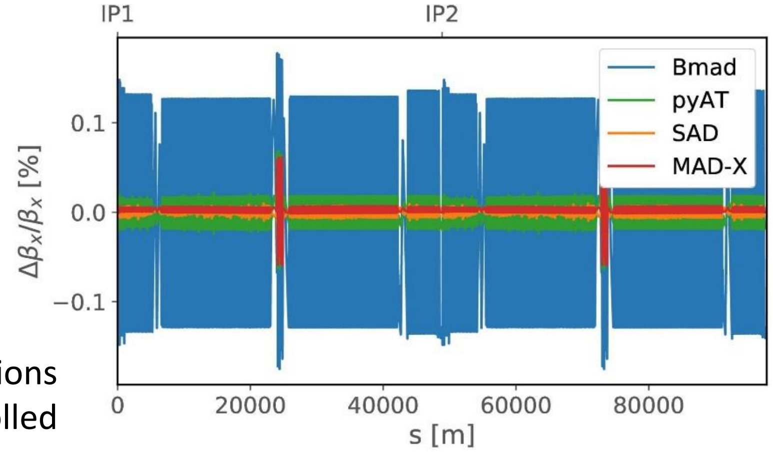
untapered (code Bmad)



Tapering

now implemented for several codes





also optics functions
well controlled