LC 2021-25 (draft)

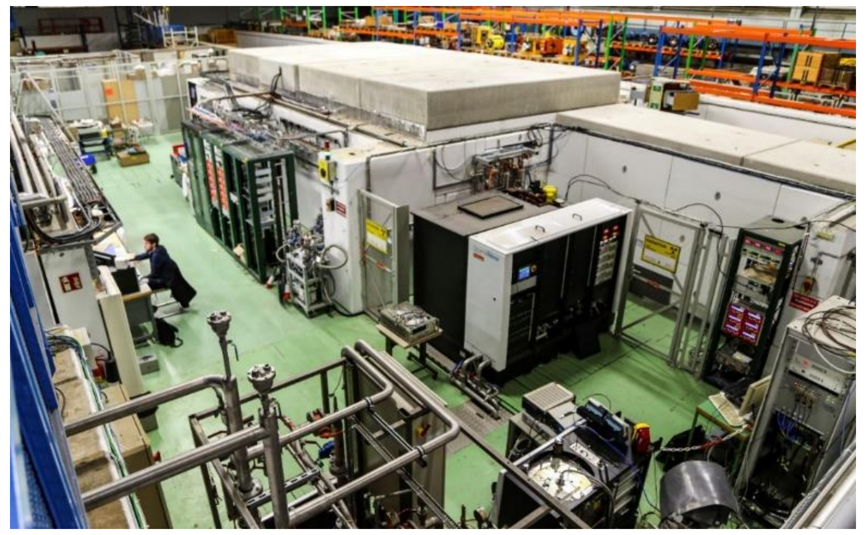
- Maintain CLIC as potential option as a Higgs/top machine for CERN – pursue High Gradient R&D
  - Concentrate on key technologies:
    - High gradient primarily (design, const., tests) – also the key to all applications in research, medical and industrial accelerators (with high relevance for many coll. partners)
    - Nanobeam (limited to beam-delivery) and maintaining capabilities for start-to-end simulations
    - Drive-beam (limited to high eff klystrons – L band)
  - Encourage collaboration activities where possible - fulfill commitments (collaboration agreements, EU projects – ARIES, CompactLight, I-FAST, KT agreements)
- Make sure CLIC technology investments are exploited in compact medical and industrial accelerators where possible, with (as before mostly) external funding – enabled by the High Gradient Technology
- Coordinate common CLIC/ILC activities, from LCC to ILC Development Phase activities, CERN LC/KEK common activities in next phase

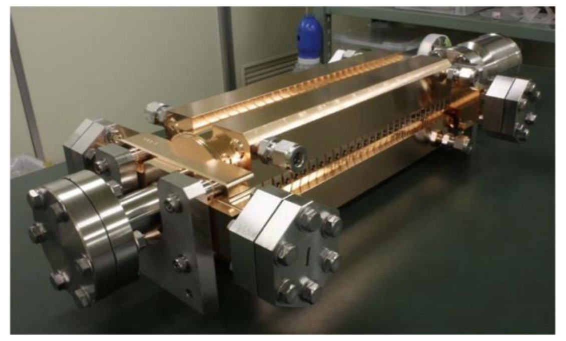
- Additional: "Coordinate" with other CERN acc. R&D activities (Hi-Eff klystrons , injectors with AWAKE, normal temp acc. cavities with RFQ and muon cooling designs, CLEAR, possibly PBC – transfer/combine knowledge and resources

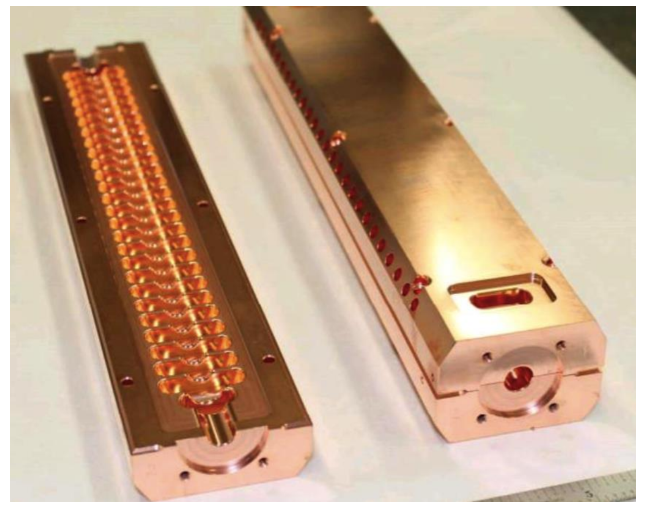
X-band and Xboxes

Studies, activities:

- Structures breakdown limits and optimization
- Operation and conditioning
- Baseline verification
- New ideas
- Assembly and industry qualification
- TNA Aries until 2022
- CompactLight structure in I-FAST
- Systems to Melbourne and Frascati
- Likely: Medical RT structure







Structures – ultimately to test:

- TD26R1 (three units, CLIC 3 TeV baseline prototype)
- TD31 (two units, CLIC 380 Prototype)
- Another TD26 this time done by CIEMAT will be ready by the end of the year
- A CLIC crab cavity made by Lancaster and part of the TNA access
- A deflector from SINAP also part of TNA
- A T24 made in halves done by SLAC
- Four T31
- Di-electric structure
- Compass structure (I-FAST)

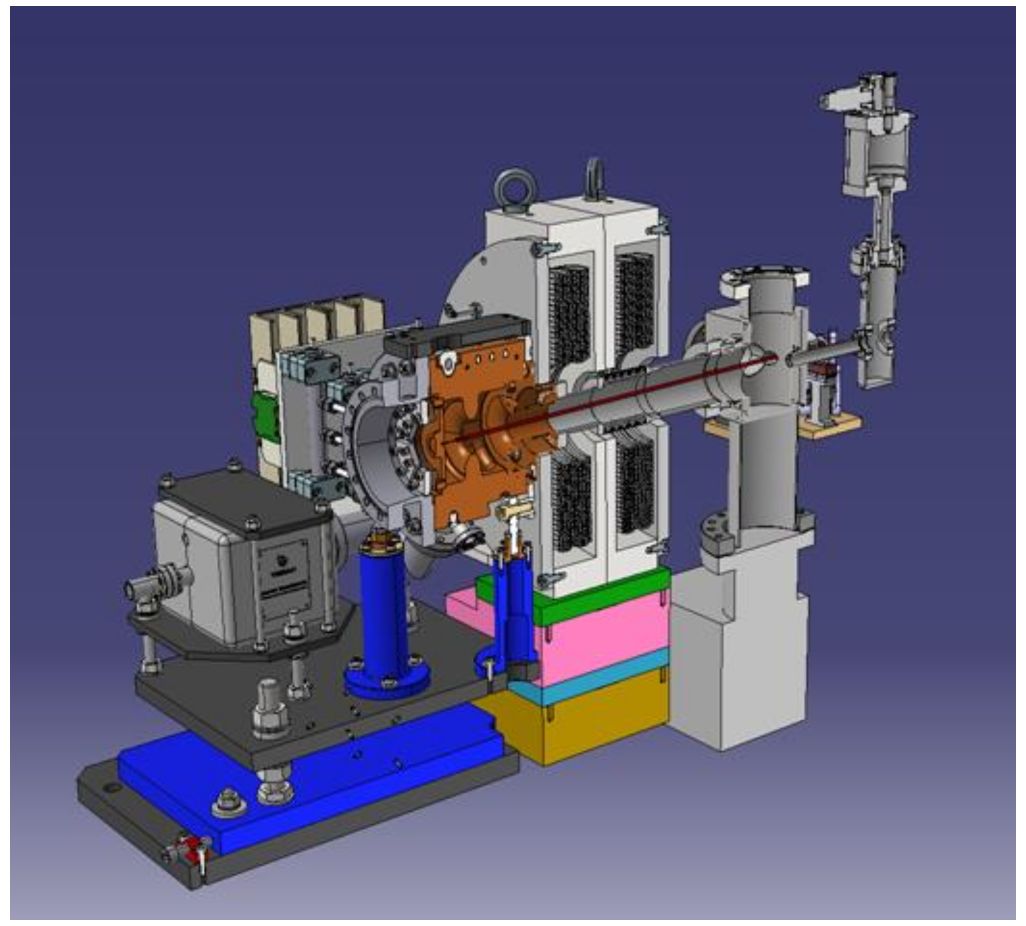
Then we need to tests components:

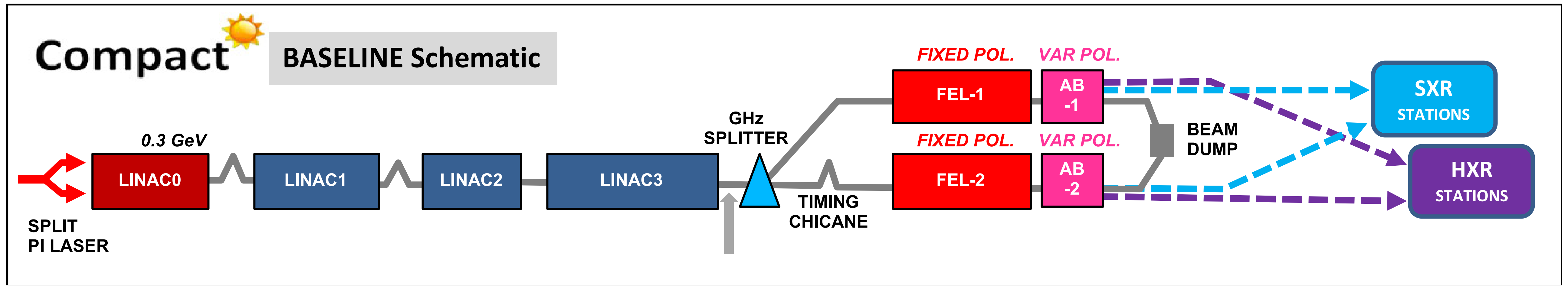
- New windows (3) for which many collaborations are waiting
- New spiral loads
- We also have S-band structures to test. One for us as part of KT and one for Lancaster.

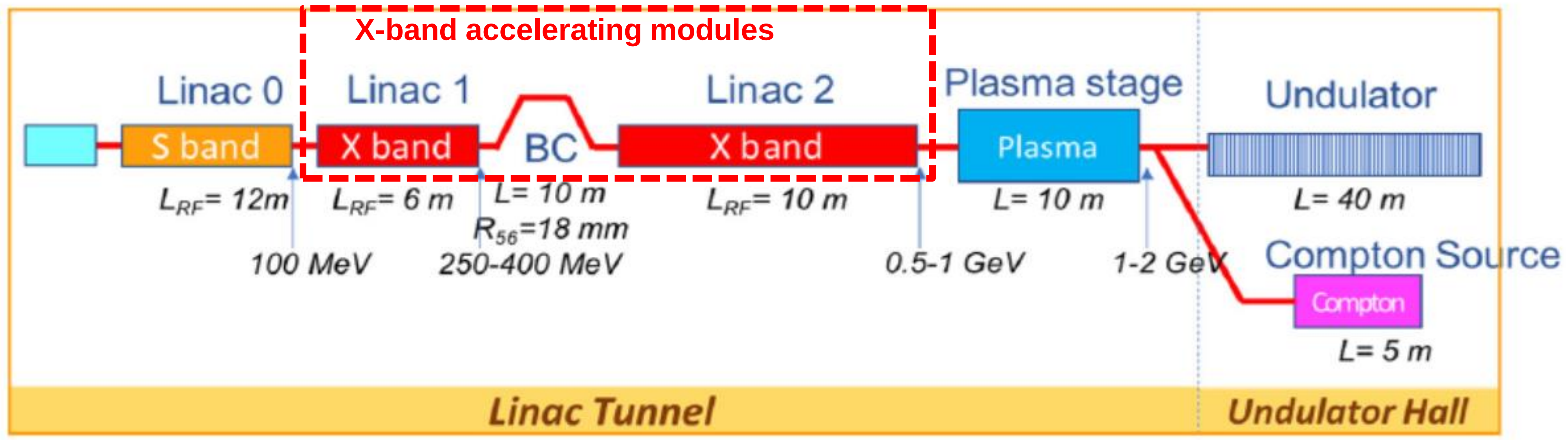
“Applications”, injector

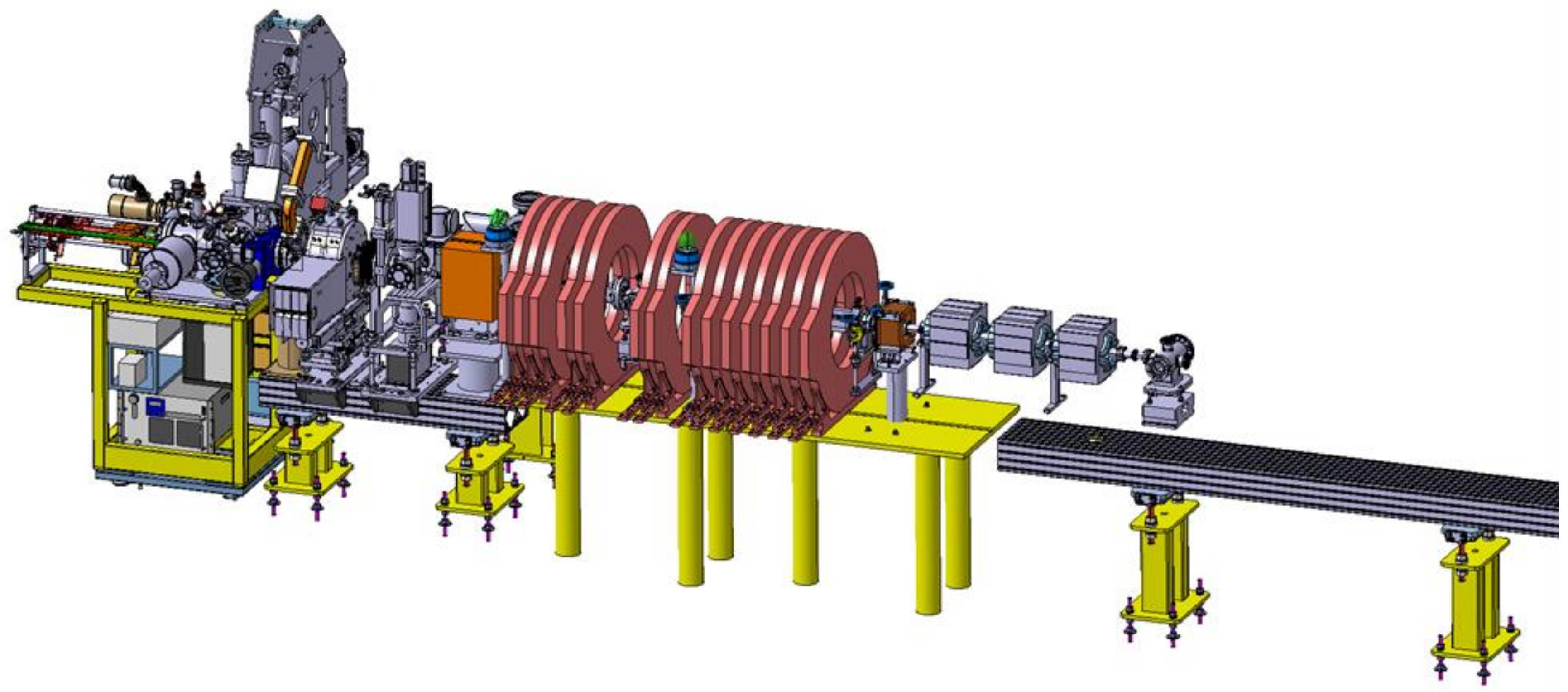
X-band enabler of CLIC and a variety of compact smaller machines , however recognized need for injector knowledge/expertise/studies: CLEAR, all applications (see right), AWAKE, CompactLight – all possible future e+e- machines

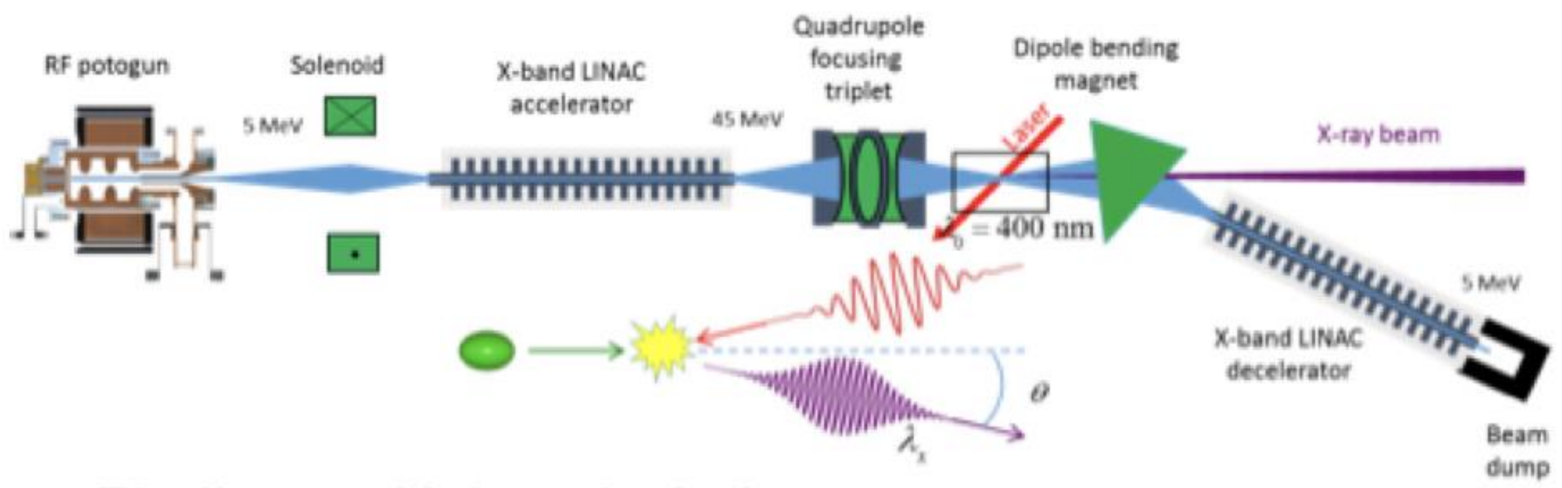
Delivery of gun from Frascati this year (pre-Covid), install in CTF2 for tests and assembly of injector – use in CLEAR and/or AWAKE (a second copy)











Module studies and others

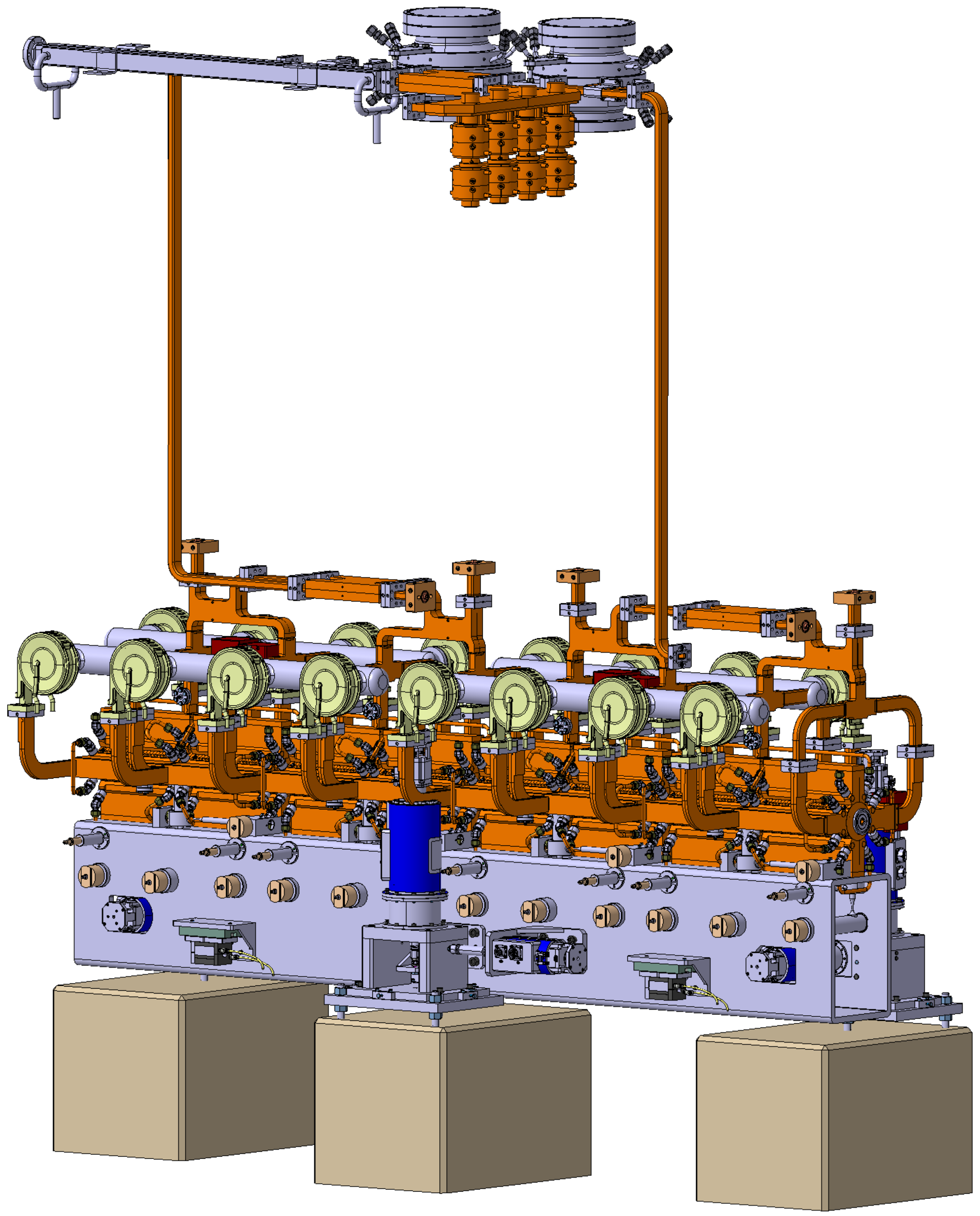
Module studies: Evaluating programme currently (aim to be relevant for CLIC (key specs) and for most of the projects mentioned on previous page, and some more).

Beamdynamis and parameters: Nanobeam (focus beam-delivery), start-to-end simulations (also for applications), pushing limits in multi TeV region (parameters, beam structure vs energy efficiency)

"Project Office": Travels, admin, conferences, outreach

Small technical activities: example ATF2

ILC: Common Fund Development Phase and CERN office at KEK



Drivebeam and High Eff. Klystrons (latter now in separate budget)

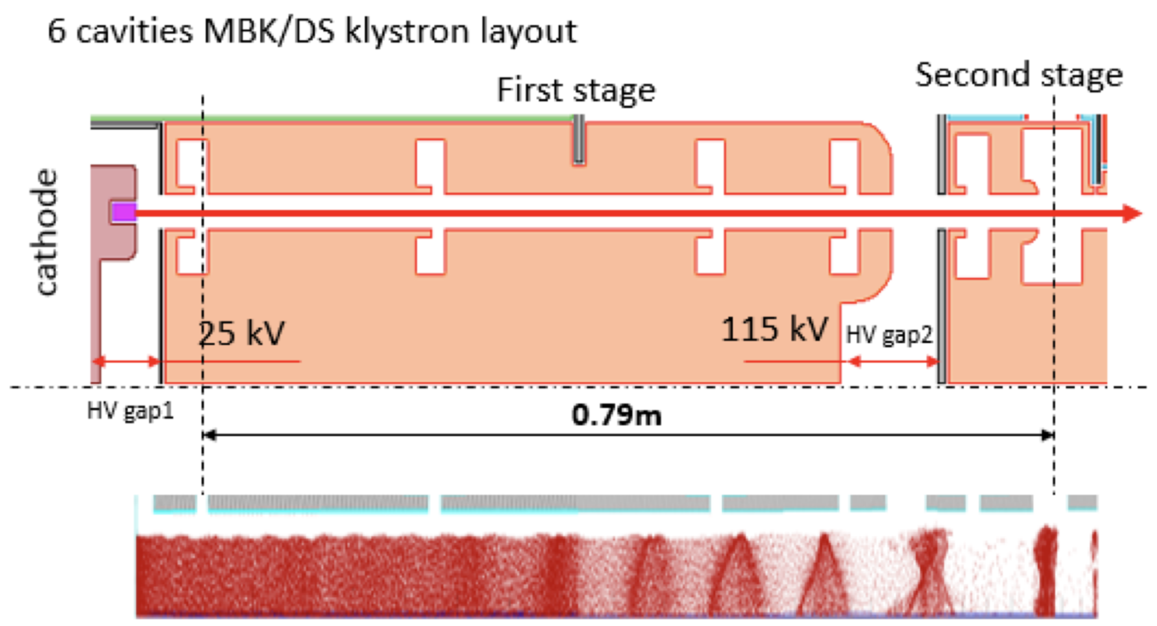
Tailored Technologies. High Efficiency (85%) 24 MW, 1 GHz, CLIC MBK/2S klystron.

Industrial CLIC MBK prototypes delivers **~70 %** RF power production efficiency

The new klystron bunching technologies cannot be directly adopted to the CLIC MBK:

- **COM** requires very long (5m) RF circuit.
- In **CMS**, the 3rd harmonic cavity is not compatible with MB-type cavities layout.

The CLIC MBK with **two high voltage stages**.
Electronic efficiency measured in PIC simulations is **84%**.



Conceptual features:

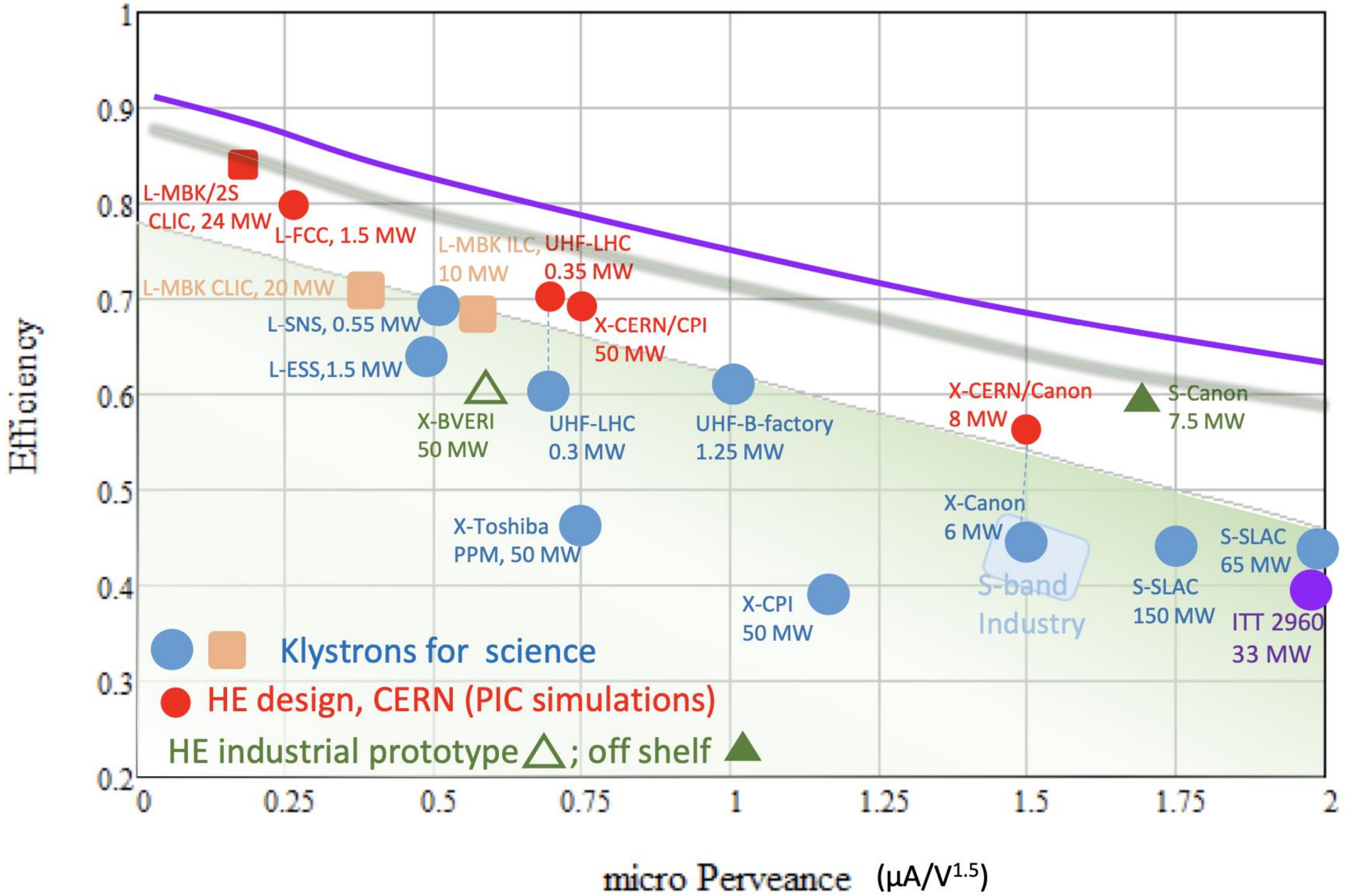
1. Bunching at a low voltage (high perveance). Very **compact RF bunching circuit.**
2. Bunched beam acceleration and cooling (reducing $\Delta p/p$) along the short DC voltage gap.
3. Final power extraction from high voltage (low perveance) beam. **High efficiency.**

I. Syratchev, LCWS, Japan, Sendai, October 28 – November 1, 2019

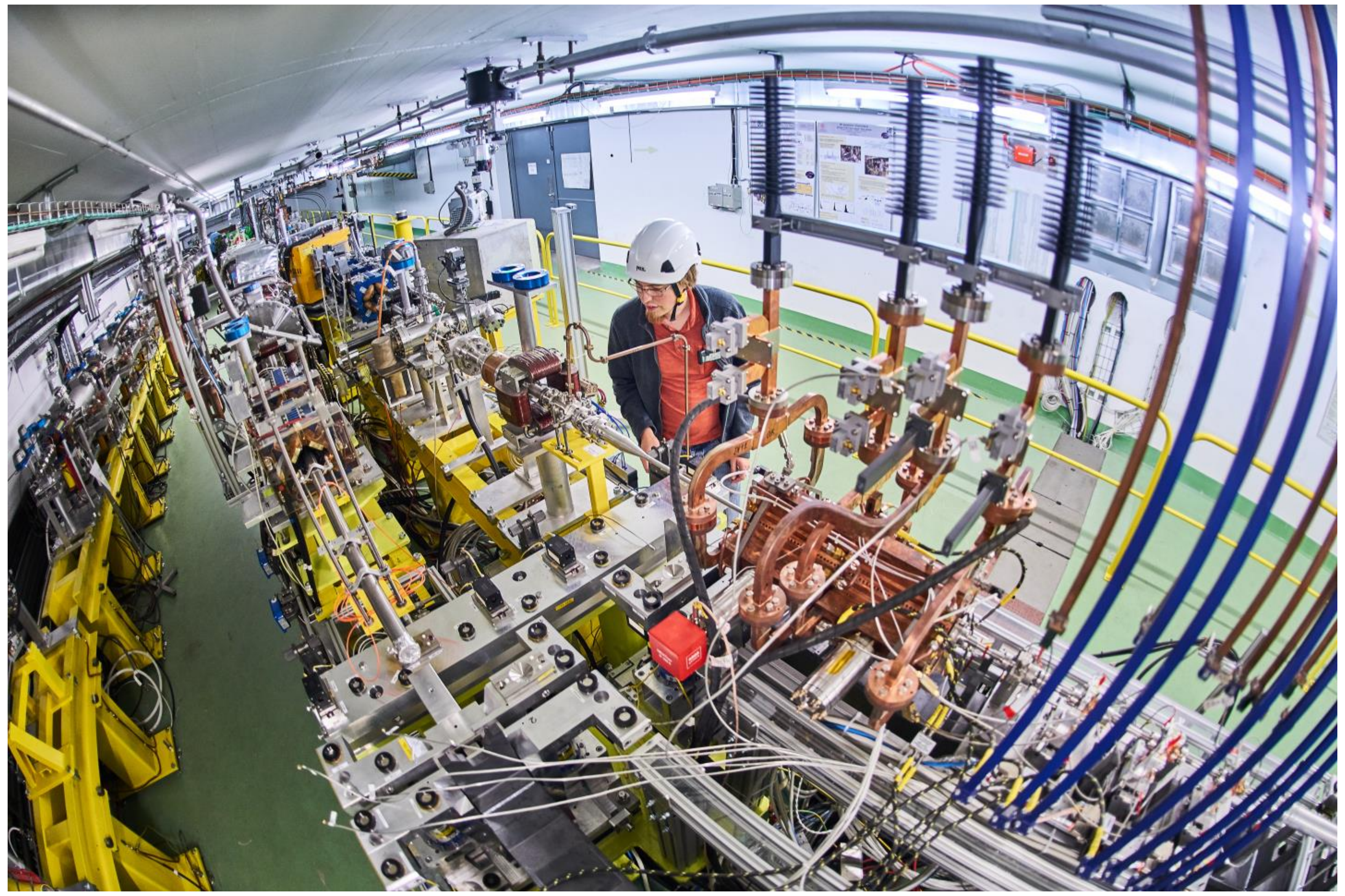
In LC budget line:
Ongoing activity in B112 of tests of delivered hardware (modulator and klystrons - left picture)

Prototyping of new concept: for CLIC (and will also work for ILC), pushing efficiencies further (and reducing size/costs significantly) – not currently funded

Further X-band RF developments to be seen in connection to X-boxes (needs being evaluated)



CLEAR – now separate budget



- Providing a test facility at CERN with high availability, easy access and high quality e-beams.
  - Performing R&D on accelerator components, including innovative beam instrumentation prototyping, high gradient RF technology realistic beam tests and beam-based impedance measurements.
  - Providing an irradiation facility with high-energy electrons, e.g. for testing electronic components in collaboration with ESA or for medical purposes(VHEE), possibly also for particle physic detectors.
  - Performing R&D on novel accelerating techniques – electron driven plasma and THz acceleration. In particular developing technology and solutions needed for future particle physics applications, e.g., beam emittance preservation for reaching high luminosities.
- Maintaining CERN and European expertise for electron linacs linked to future collider studies (e.g. CLIC and ILC, but also AWAKE and FCC-ee injectors), and providing a focus for strengthening collaboration in this area.
- Using CLEAR as a training infrastructure for the next generation of accelerator scientists and engineers.

Experiments/Activities in 2019 – 38 weeks

(Possibly not a complete list)

- JUAS Practical Work Days
- NPL – Irradiation/dosimetry
- CHUV – FLASH dosimetry
- AWAKE Cherenkov BPM
- CLIC Wake-Field Monitors
- EOS bunch length monitor
- Inductive BPMs
- CLIC Structure wake-field kicks
- THz Smith-Purcell radiation
- THz high power generation/bunch length monitoring
- Ionization chambers dosimetry (Oldenburg U. /PTW)
- R2E Irradiation studies SEU-SEE
- R2E – ESA monitor flash
- R2E – displacement damage
- Plasma Lens (Oslo, DESY, Oxford U.)
- VHEE radiobiology/plasmid irradiation (Manchester U.)
- AWAKE spectrometer calibration
- Cryogel radiation length evaluation (FCC detectors R&D)
- Cherenkov X-ray pre-tests (Belgorod)
- RP measurements/neutrons
- Double-bunch generation
- High Charge bunch compression
- Irradiation of DCDC converters for detectors (EP/ESE group)
- IRRAD Beam Profile Monitors prototype tests
- WSM-BPR diagnostics tests
- Cherenkov Plasmonic