The FREIA Laboratory

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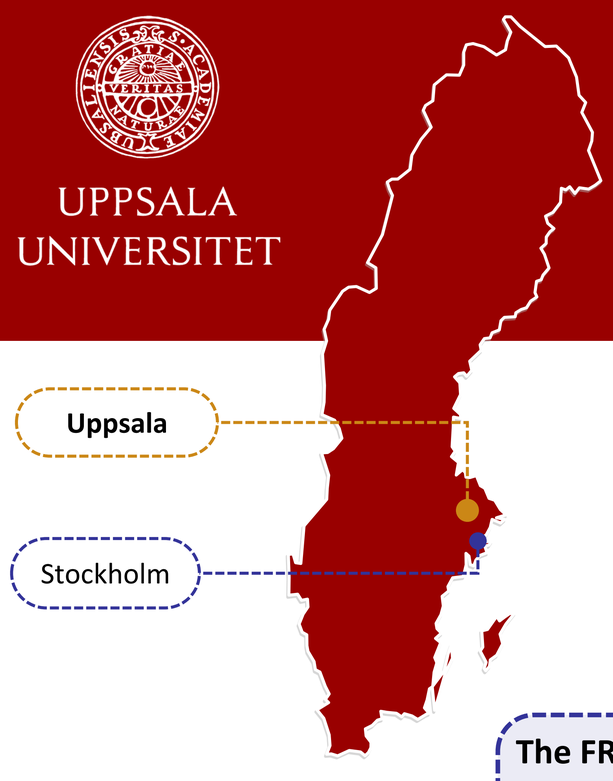
UPPSALA UNIVERSITET



FREIA stands for "Facility for Research Instrumentation and Accelerator Development". The FREIA Laboratory was established in 2011 within the department of Physics and Astronomy at Uppsala University, to develop and test new particle accelerator and detector instrumentation. FREIA is located at the Ångström Laboratory campus and was inaugurated in 2013.

The FREIA hall

- 1000 m^2 large, 10 m high
- Has a 6.3-ton movable crane and other mechanical equipment
- Office space for ~25 people
- Small workshops for mechanics and electronics and 50 m^2 control room

Bunkers

- Three concrete bunkers for equipment producing ionizing radiation
- 1 bunker, 10.4 m x 4.0 m x 4.8 m high, with the horizontal cryostat
- 2 bunkers, dimension 4.0 m x 2.8 m x 2.4 m high
- Monitoring systems for ionizing radiation and oxygen deficiency

Compressor area for cryogenics

- Helium gas compressors
- Helium gas recovery system
- Sub-atmospheric compressor system for 2 K operation in cryostats
- Gasbag

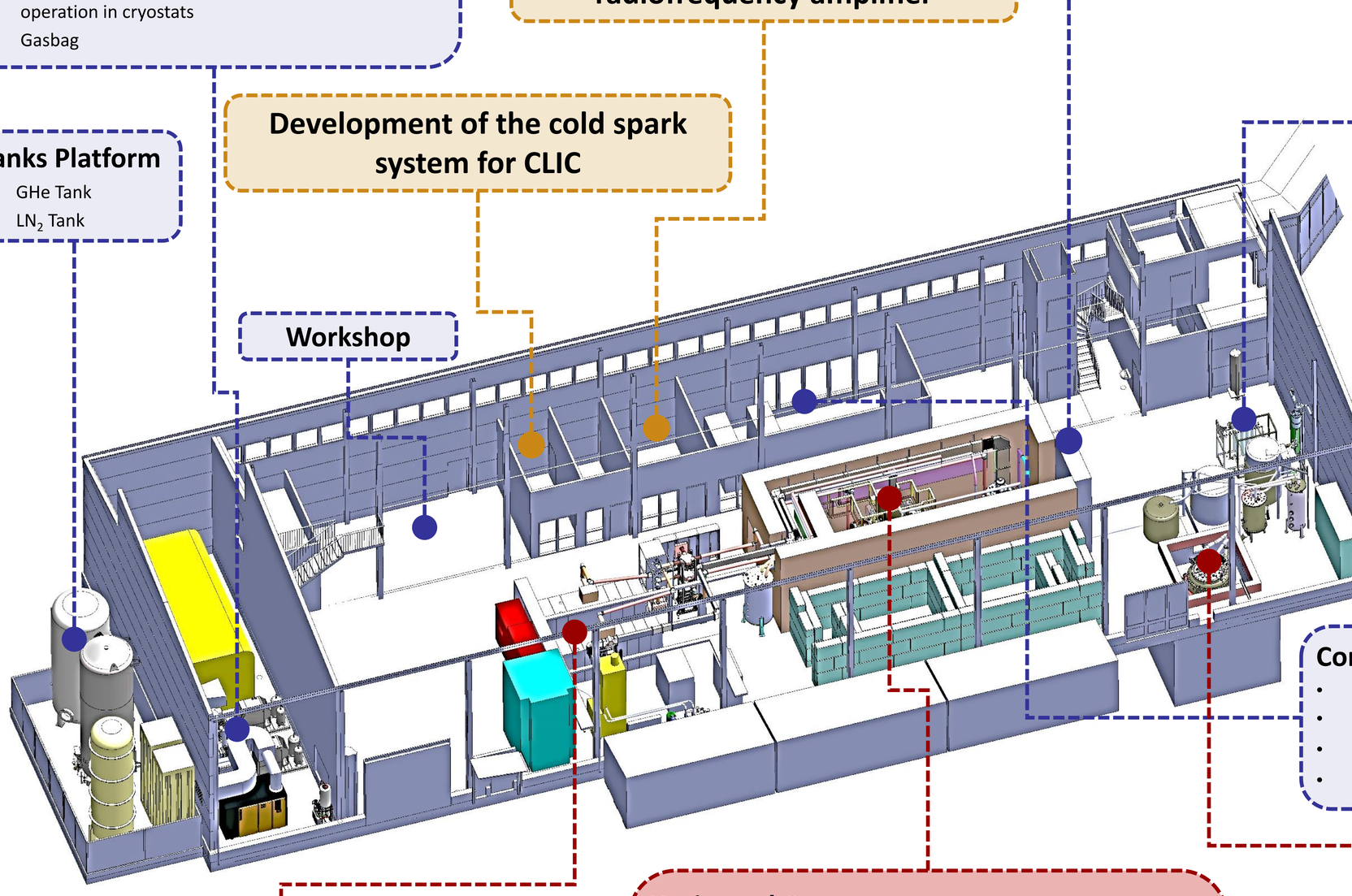
Development of solid state radiofrequency amplifier

Development of the cold spark system for CLIC

Tanks Platform

- GHe Tank
- LN_2 Tank

Workshop



Cryogenics Area

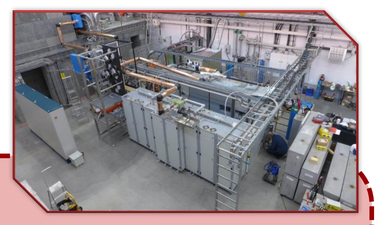
The cryogenic facility produces and distributes liquid helium and provides liquid nitrogen to the test cryostats in the FREIA Laboratory

In addition it provides these cryogens to all other research departments at the University.

- LHe and LN_2 dewar filling area
- Helium liquefier 140 l/h at 1.15 bar
- Liquid helium storage dewar 2'000 l
- Liquid nitrogen storage dewar 20'000 l at 3 bar
- High pressure helium gas storage, 11 m^3 at 200 bar
- High pressure helium gas recovery compressor station, 75 m^3/h at 200 bar
- Impure helium recovery gas storage balloon 100 m^3
- Helium gas sub-atmospheric pumping system, 3 g/s at 10 mbar

Control Room

- The overall control system is based on EPICS
- Self-excited loop, 352 MHz, 1 kW CW
- LLRF controls and RF power measurement
- Standard Measurement Equipment



RF Amplifiers

For research and development of RF power generation, distribution and control for superconducting and normal conducting accelerating cavities for future accelerators

- Tetrode based amplifiers
- 2 x high power RF amplifier, 352 MHz, 400 kW pulsed, 5 % duty factor
- 1 x high power RF amplifier, 352 MHz or 400 MHz, 50 kW CW

Horizontal Cryostat

A versatile horizontal cryostat system for testing superconducting cavities.

- Inner measures 3.2 m length and 1.19 m diameter
- Range of operation: 1.8 to 4.5 K, 16 to 1250 mbar
- Internal warm magnetic shielding: mu-metal, 1 mm
- Pressure stability at 16 mbar: +/- 0.1 mbar
- Cooling power at 1.8 K: 90 W

Vertical Cryostat

A versatile vertical cryostat system for testing superconducting devices such as accelerating cavities and magnets, either in saturated or sub- atmospheric liquid helium baths.

- Dimensions: 1.1 m diameter, 2.8 m height
- Range of operation: 1.8 to 4.5 K, 16 to 1250 mbar
- Pressure stability at 16 mbar: +/- 0.1 mbar
- Cooling power at 1.8 K: 90 W
- Superconducting magnets
- Maximum allowed stored energy up to 500 kJ
- Maximum allowed weight up to 5 ton
- 2 x 2 kA power converters
- Superconducting cavities
- 1 kW RF power in a self-excited loop

Development of ESS high power RF system

Development of ESS superconducting linac

Development of CERN HL-LHC upgrade

Development of:

- **Novel FEL technology and diagnostics**
- **ESS neutrino SuperBeam (ESSnuSB)**
- **Micro-accelerator structures**
- **Medical accelerator**

Project
Equipment
Infrastructure

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