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FREIA: Development work towards super-conducting accelerators

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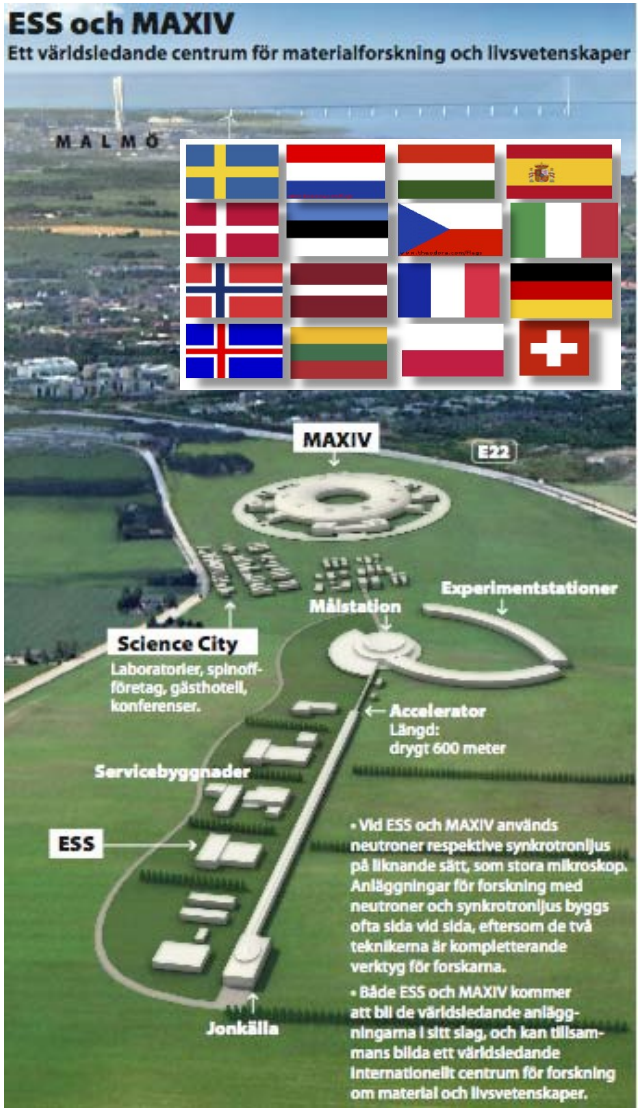
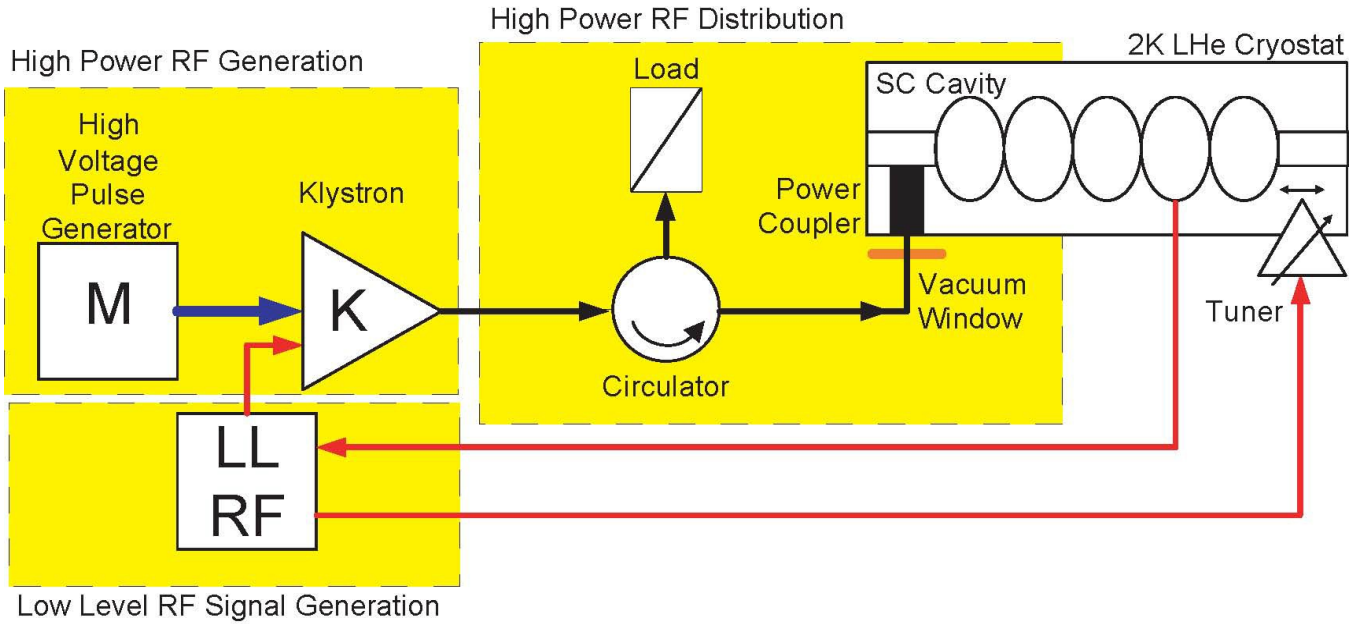
Background



ESS suggested that we take responsibility for the radio-frequency distribution system of the ESS (~ 200 cavities at 352 and 704 MHz)



- Team: T. Ekelöf, R. Ruber, V. Ziemann, A. Rydberg
- Contract signed by UU Rektor Anders Hallberg and ESS director Colin Carlisle in July 2011

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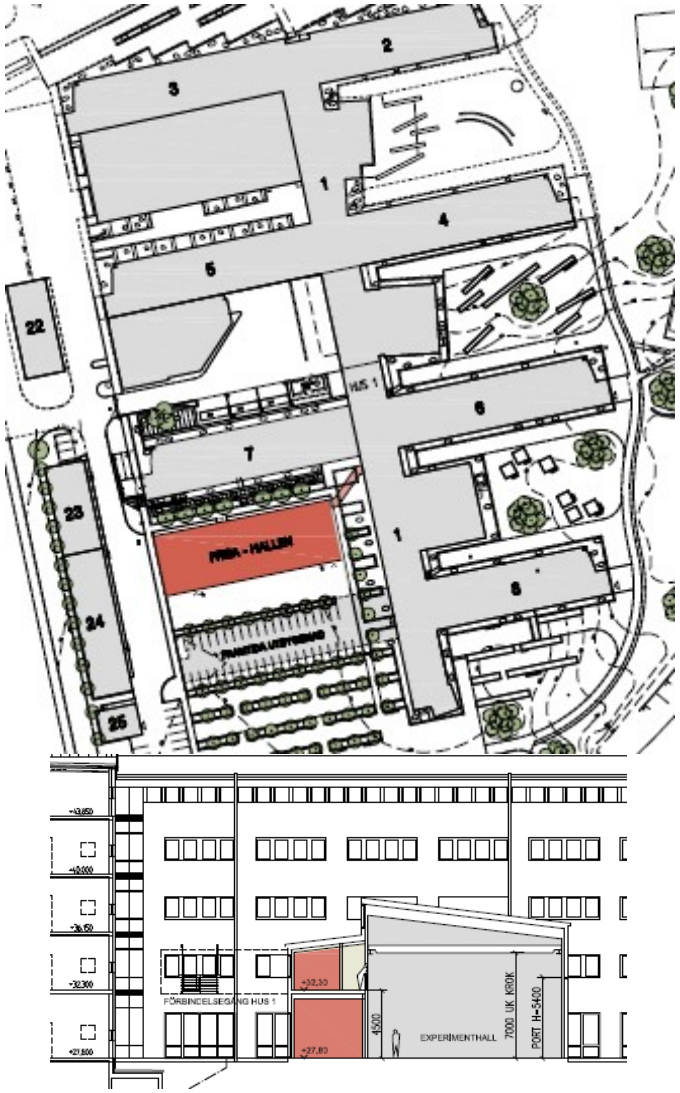
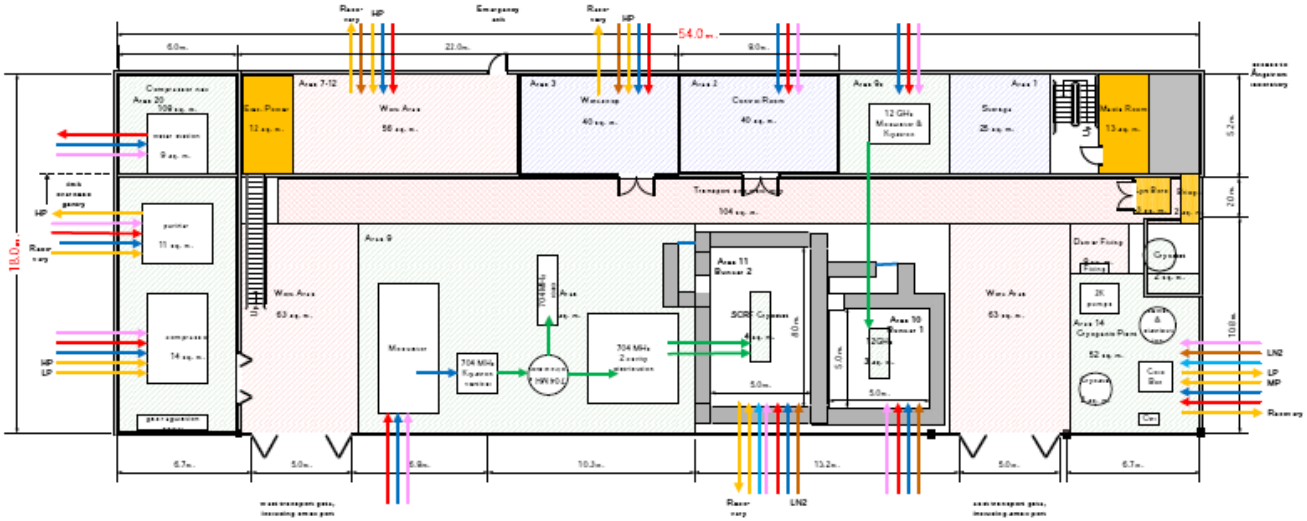
- Horizontal cryostat in bunker
- Modulator and Klystron
- Helium liquefier
- Hole for vertical cryostat





Inside FREIA

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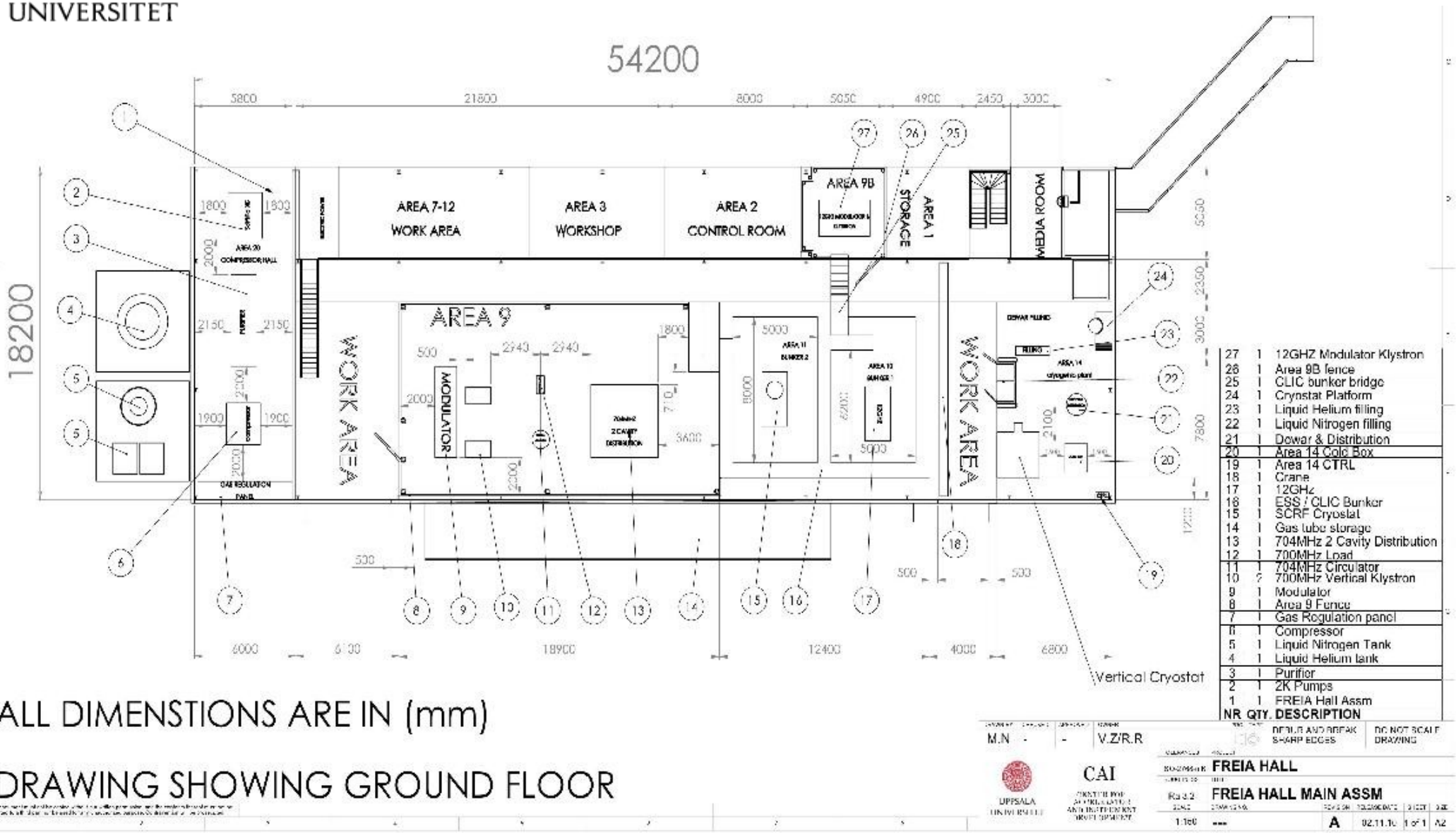

ALL DIMENSTIONS ARE IN (mm)

DRAWING SHOWING GROUND FLOOR

M.N - - V.Z/R.R DEBUR AND BREAK SHARP EDGES DO NOT SCALE DRAWING

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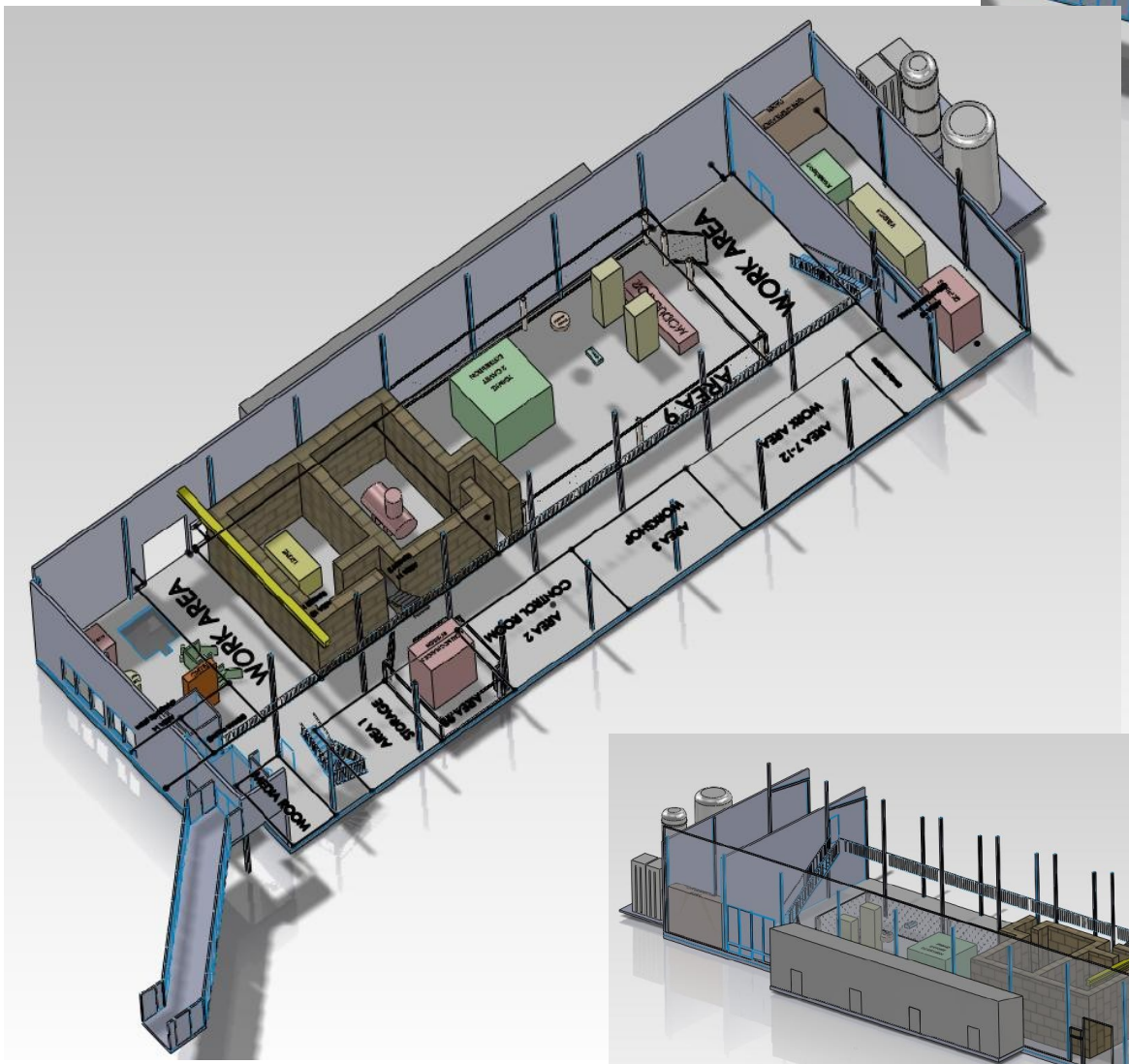
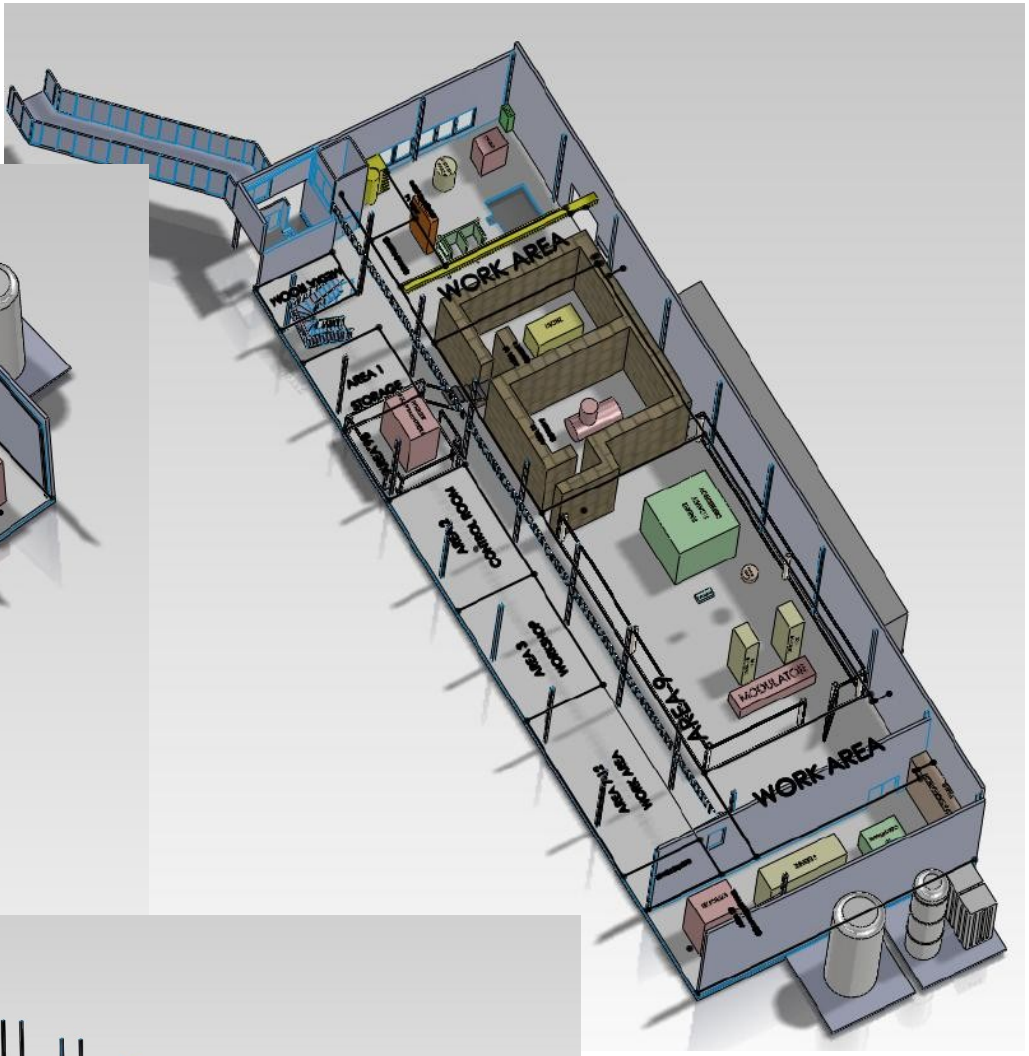
FREIA HALL

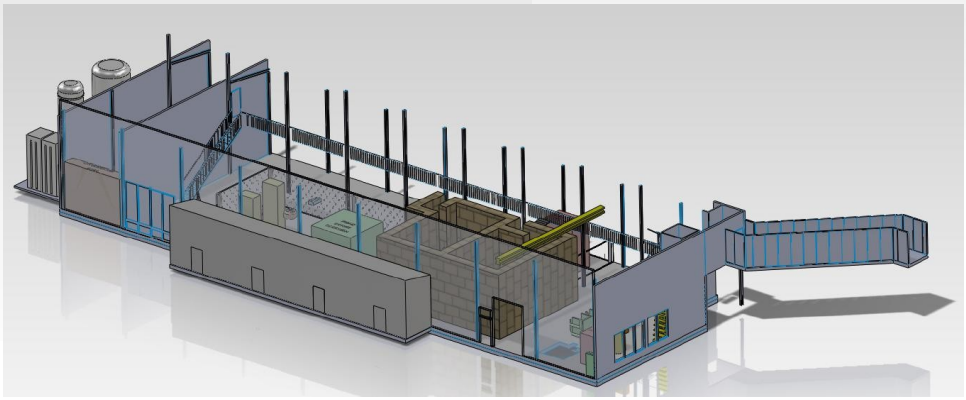
FREIA HALL MAIN ASSM

1:100 --- A 02.11.10 1 of 1 A2

3D impressions







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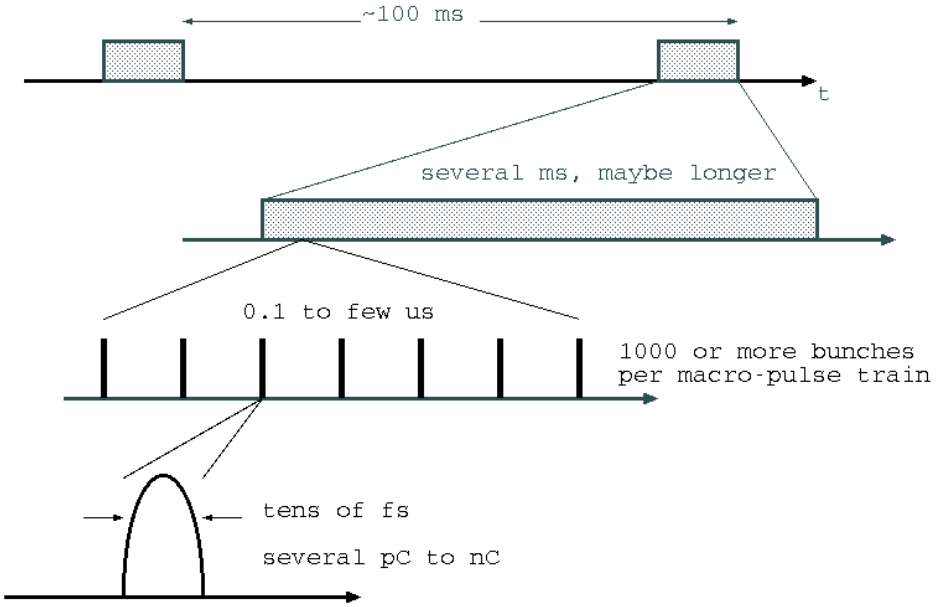
What's so special about a super-conducting linac?

- The time structure
- Low losses in the accelerating cavities allow for very long macro pulse duration on the order of ms...
- ...at a repetition rate of ~Hz
- O(1000) bunches per macro-pulse with 100s of ns to μs spacing.
  - Lots of photons
- With tens of fs bunch length an kA peak current.



- Large bunch spacing of μs allows to guide bunches to different experimental areas or undulators

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Conclusion

- With FREIA we're entering the world of super-conducting RF development
  - Cryogenics
  - Power RF generation and distribution
  - RF control system
- and if we intend to use that as a base for future FEL activities it affects
  - the macro timing
  - but not the micro timing (bunch length)
  - we get loads of photons