FREIA: Development work towards super-conducting accelerators

Volker Ziemann
Institutionen for Fysik och Astronomi
Universitet Uppsala
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
FREIA

- Horizontal cryostat in bunker
- Modulator and Klystron
- Helium liquefier
- Hole for vertical cryostat
3D impressions
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.
Conclusion

• With FREIA we're entering the world of superconducting 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