

FREIA: Development work towards super-conducting accelerators

Volker Ziemann Institutionen for Fysik och Astronomi Universitet Uppsala



UPPSALA UNIVERSITET

ESS och MAXIV

Background



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



Low Level RF Signal Generation

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

V. Ziemann: FREIA

MALMO MAXIV 32 **Science City** drygt 600 meter Vid ESS och MAXIV använd ESS Både ESS och MAXIV ko

Ett världsledande centrum för materialforskning och livsvetenskaper

111201 Uppsala

ma i sitt slag, och kar ns bilda ett världsle Internationellt centrum för forsknin om material och livsvetenska



UPPSALA UNIVERSITET



FREIA

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



111201 Stockholm

V. Ziemann: FREIA

3D impressions





Lego FREIA









111201 Stockholm

V. Ziemann: FREIA



UNIVERSITET

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 (or even towards CW operation)
- O(1000) bunches per macropulse with 100s of ns to μ s 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

UPPSALA UNIVERSITET

- With FREIA we're entering the world of superconducting RF development
 - Cryogenics
 - RF power 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



Inside FREIA

UPPSALA UNIVERSITET

