3rd harmonic rf issues: a brief introduction

presented by E. Vogel

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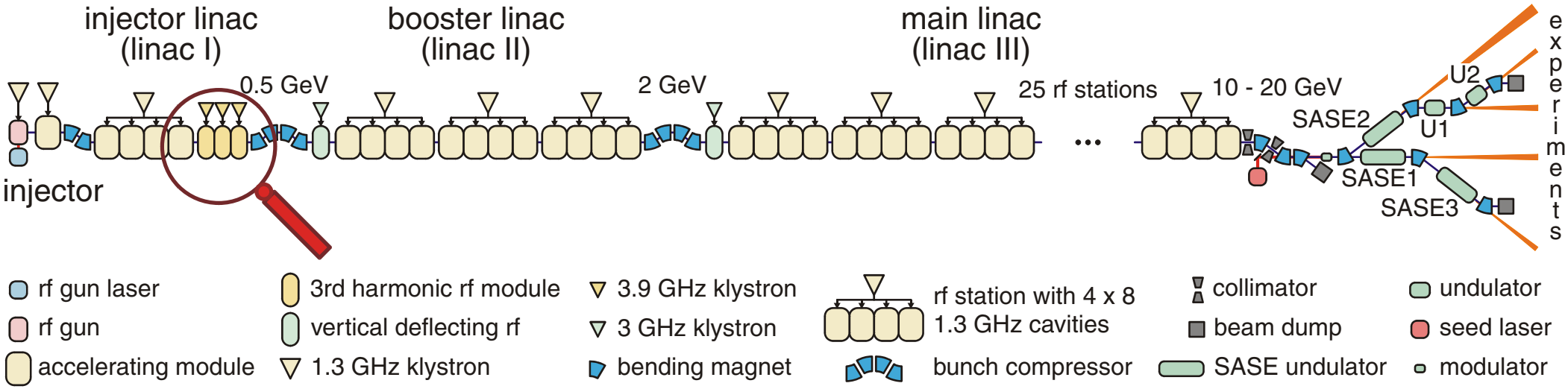
Linearization of bunch energy spread before compression



Status of 3rd harmonic activities:

- 3rd harmonic module for FLASH build by Fermilab
- plans at DESY for ordering three spare cavities from industry
- arising questions while setting up the specifications for these three cavities

Answering these questions may give hints on what to do at the XFEL

Status: FLASH 3rd harmonic module build by Fermilab

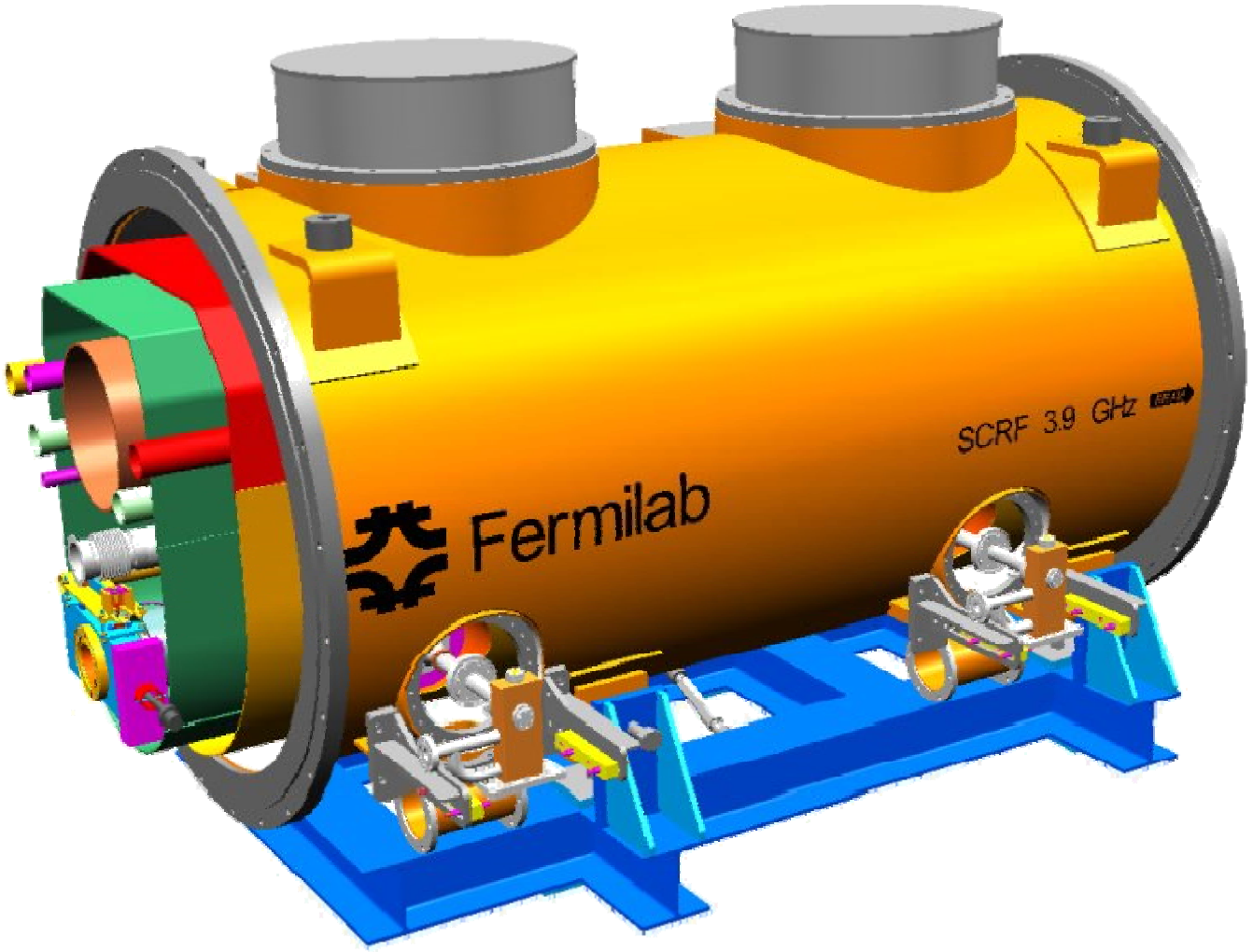
- development of the module well advanced
- assembly tests performed

Problems with cavities

- first vertical tests done
- HOM couplers made trouble
- new HOM couplers ready
- new couplers welded
- tests planned within next weeks

Helium vessel welding

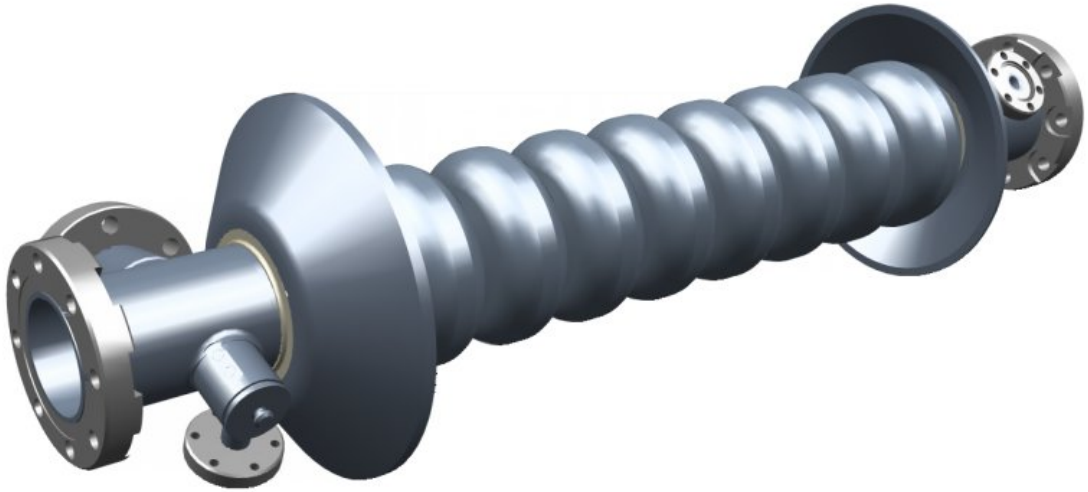
- meetings on welding methods are ongoing

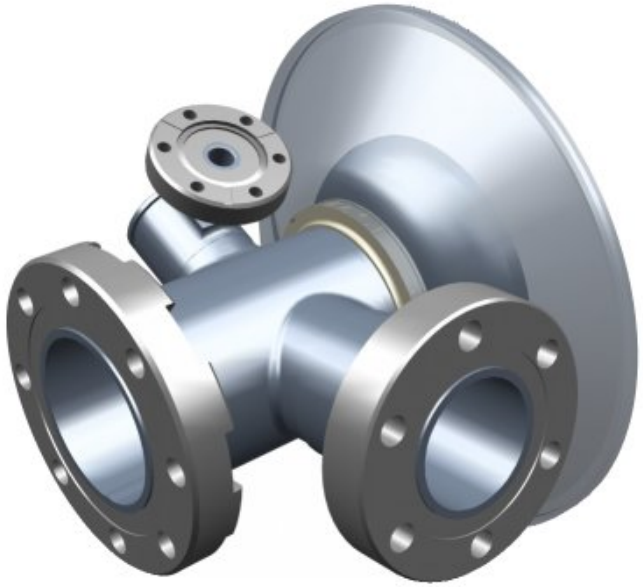


DESY plan to order three spare cavities from industry

Status of the call for tender

- almost ready
- design based on FNAL's work
- subject to alterations in the HOM coupler design and conical disc design





Issues actually under discussion

- Different welding equipment for helium vessel welding at FNAL and DESY may require other conical disc designs?
- There is no space between power coupler and end cell for a reference ring. Hence, what are the alignment tolerances?

Questions on the alignment tolerances

Present numbers from FNAL for the 3rd harmonic module build for FLASH:

- difference between mechanical an electrical cavity axis: 0.15 mm
- accuracy of cavity alignment in module: better than 1 mm

First beam dynamical estimates for FLASH by M. Dohlus and T. Limberg

- transverse wakes are 9 times larger for 3.9 GHz than for 1.3 GHz cavities
- a single bunch 1 mm off axis will suffer a transverse blow up by 5% to 15%
- the single bunch blow up will stay below 5% for the 0.5 mm off axis situation

To be investigated?

- blow up and beam offsets caused by coupled bunch oscillations are expected to be smaller than the single bunch effects?
- kicks caused by the couplers seem to be negligible?
- Does 1.3 GHz HOM's penetrate through the beam pipe and disturb the 3.9 GHz rf field?

Alignment tolerances – how to treat them at the XFEL?

First we need…

- some numbers

  ⇒ see talk from M. Dohlus

to answer, whether we need…

- mechanical movers required to align cavities within the modules installed
- steering magnets between the cavities
- beam position monitors – maybe already done using HOMs (N. Baboi, et.al.)?
- 1.3 GHz HOM damping between 1.3 GHz and 3.9 GHz modules
- additional measures against potential dark current deposition in the 3.9 GHz modules – the beam pipe and the irises are smaller!
- a couple of small modules or a view larger ones containing more cavities
- all the 'forgotten' things we are not thinking about at the moment…