XFEL Collimation and Beam Switchyard Vacuum Issues

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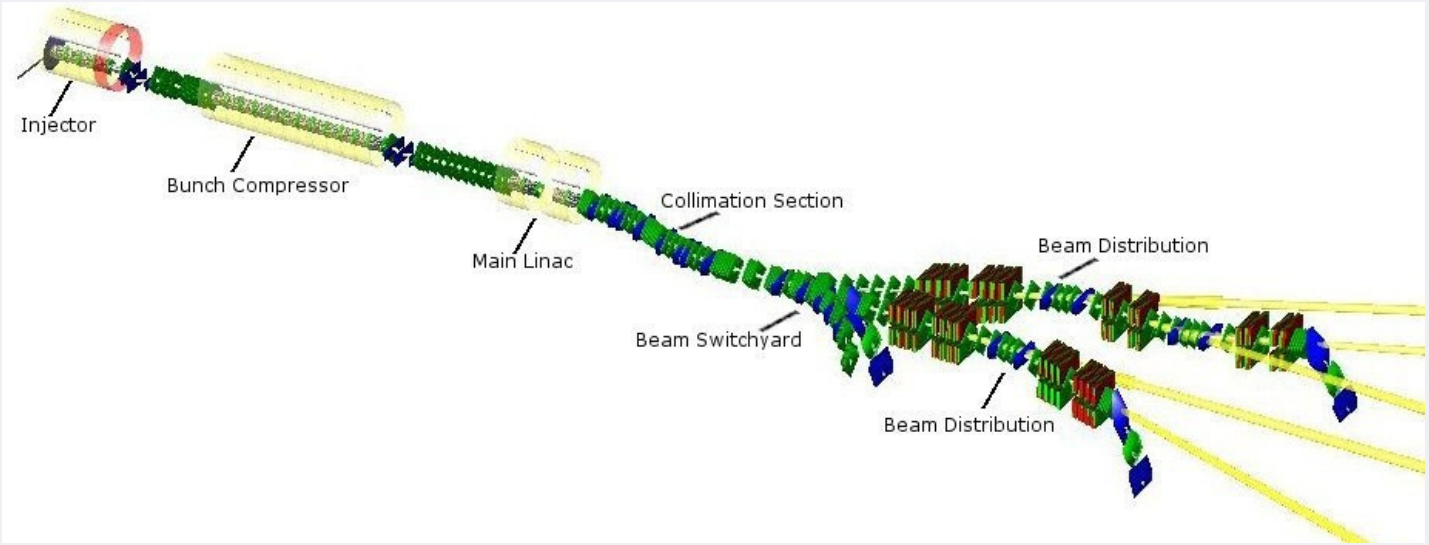
XFEL Beam Dynamic Meeting

Collimation and Beam Switchyard

general remarks

Lengths of the Collimation and Beam Switchyard vacuum system :



Collimation: total length ~ 226m

Beam Switchyard: total of TL+T1+T2~150m+132m+112m~394m (Description from Winfried Decking http://www.desy.de/xfel-beam/data/component_list.xls)

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general remarks

Vacuum requirements after the COLD LINAC:

- Pressure needs to be in the range of 10^{-10} mbar the next 30m of the collimation beam line (next to cold sections)
- Pump system: sputter ion pumps and titan sublimations pumps

30m beam line after the COLD LINAC have to be particle free :

- The design of all vacuum components needs to be according to the particle free conditions. Early discussion of the concept of all components including beam diagnostic is necessary!
- All vacuum components have to be cleaned under the particle free conditions (clean room class 100).
- Installations needs to be done under local clean room class 100 conditions.

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general remarks

Vacuum requirements after 30m in the Collimation and Beam Switchyard:

- Pressure requirements are much relaxed in comparison to the storage ring pressure. The range of 10^{-8} mbar after 30m of the COLD LINAC seems to be acceptable.
- Pump system: sputter ion pumps (60 l/s)

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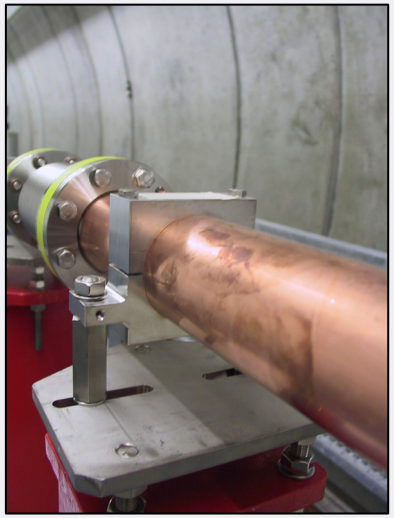
general remarks

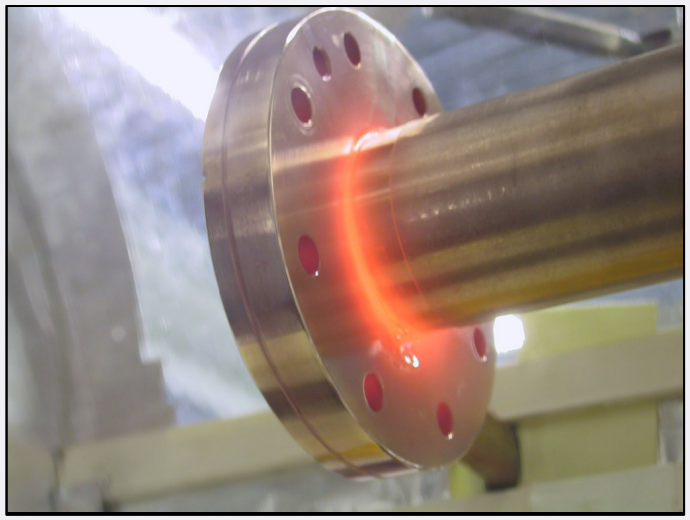
Beam line design:

- Inner diameter of the beam line is 40mm(?) for the main parts of both sections.
- Copper tubes are connected with stainless steel conflate flanges

(inductive brazing) - also copper coated stainless steel will be used for some components.



copper tube vacuum chamber at FLASH



inductive brazing

Collimation and Beam Switchyard

general remarks

RF losses minimizing :

- To minimize the RF losses all bellows behind 30m from the COLD LINAC will be shielded, also the pump ports and gate valves. Early discussion of the concept of these components including beam diagnostic is necessary. The goal should be to minimize the RF losses where it is technical praticable !

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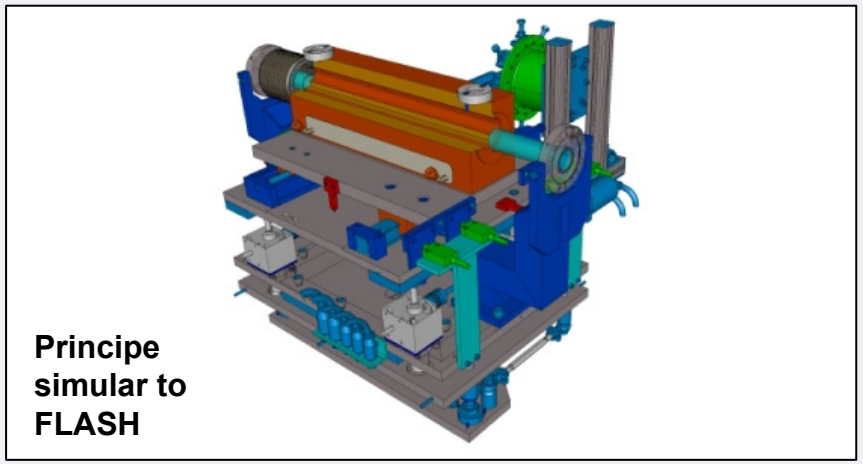
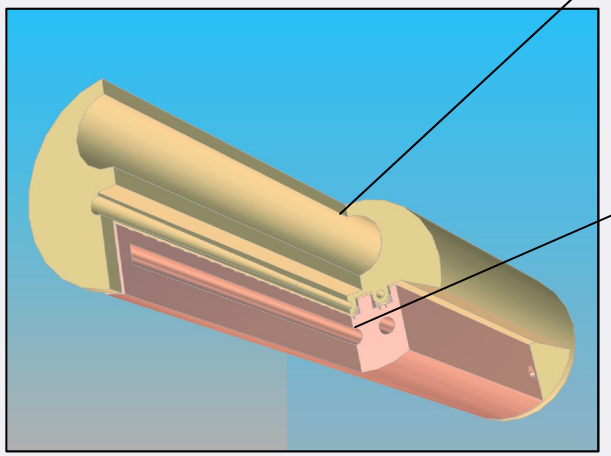
special components

Collimator section:

- Four main collimators, tow for each beam direction (horizontal, vertical)
- Choose Ti for high stress resistance in case of mis-steered beam hit (N.Golubewa, V.Balandin)
- Important as well: acceptance of significant average beam power from dark current (don't know how much, planning for a few kW)
- Concept: Ti insert with brazing connection to water cooled Cu block



Principe simular to FLASH



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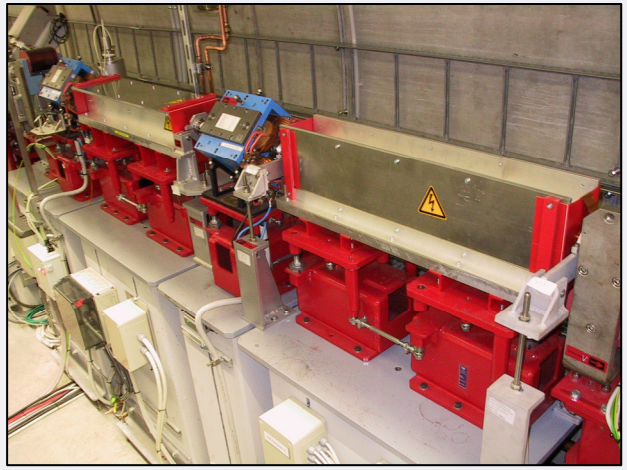
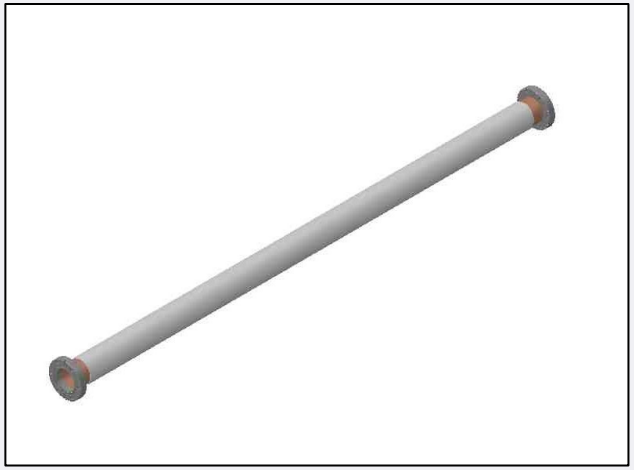
special components

Switchyard section:

- Ceramic vacuum kicker chamber: inner diameter 18-20mm (?) abt. 500mm long with thin coating inside of stainless steel or titaniumnitrid (under development). For XFEL we need 48 devices



Kicker chamber with kicker at FLASH



Ceramic chamber with onside coating

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girders frames and support

- Support for the vacuum chambers will be designed by the vacuum group.
- In the concept to mount the collimator section and the switchyard from the top or button, all girders and frames or concrete pylon with girder should be designed by the group MEA(?).
- We prefer to mount these systems from the button in analogous manner to BC1 and BC2:
  - **concrete pylon with girder are cheaper then a frame with girder construction!**

An examination with respect to stability, oscillation behavior etc. must be done in both cases!

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schedule

Draft:

- Design of collimation and beam switchyard~ 1.5 year
- Fabrication of all components ~ 1.5 years
- 2008, A rough concept should be settled for the girders/frames concept including electronics and diagnostics as well as part of the layout of the components.→ layout for the arrangement of the components should be available!
- 2009, The detailed concept for the layout of the components, electronic concept and the girder and frames concept should be finished.

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open issues

- Do we have to mount both system from the top or from the bottom?
  → we prefer to mount these systems from the bottom !
- Do all components need to be copper coated in both systems?
- Can the RF-shielding remain the same as for FLASH or
  do we have to design a new concept for the flange connections,
  bellows, valves and pump connections?
- What diagnostic installations will be needed next to the beam line?

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Thank you for your attention!