PANDA Beamline Update

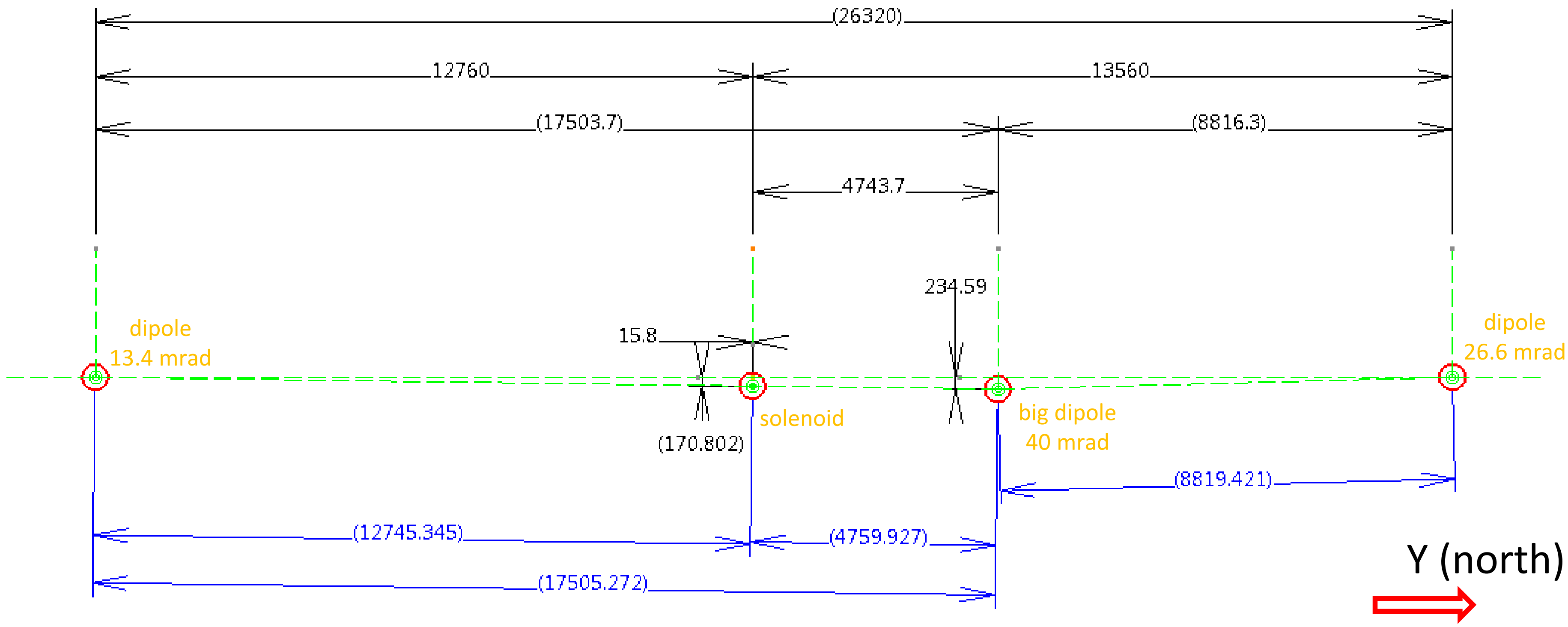
MEC Session, PANDA Collaboration Meeting 21/3

J. Lühning, GSI

- PANDA chicane in HESR
- Some of the advancements this year
- Positions of flange connections to be opened frequently
- Other flange connections
- Pumping port between FT1 and FT2
- Support option for FT1/FT2 setup
- Choice of flange connections

PANDA chicane in HESR

Position of magnets settled June/July 2017 after discussions among Raimund Tölle (FZJ), Bernhard Laatsch (FZJ), Jost Lühning (GSI). Uploaded to *https://edms.cern.ch/document/2053635/1*

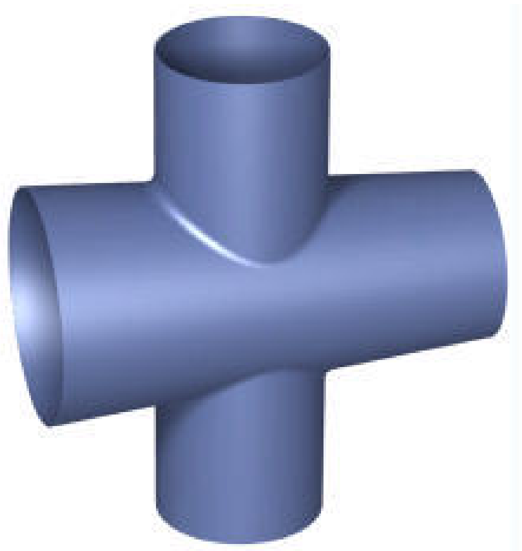


Coordinates of PANDA magnets w.r.t HESR center
(X: west-east direction, Y: south-north direction, {X=0, Y=0} at geometric center of HESR-oval

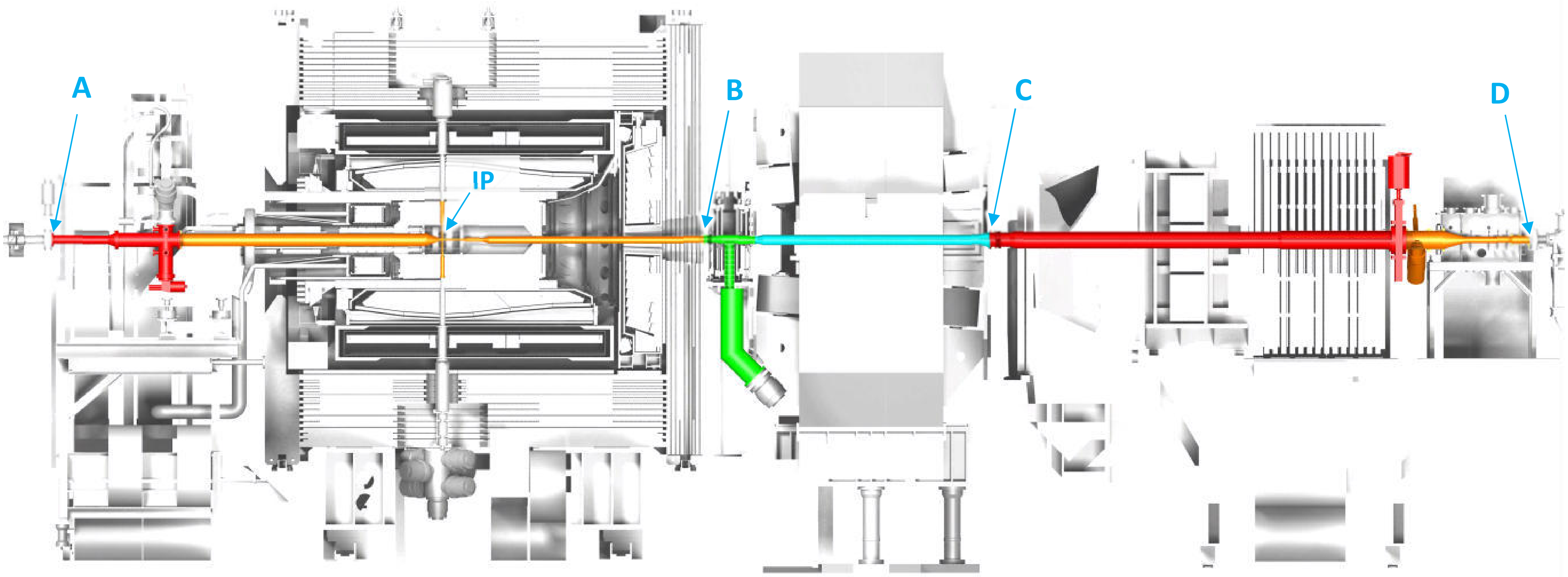
Magnet	Y-coordinate /[mm]	X-coordinate /[mm]
1st dipole	-12760	46294
Solenoid (IP)	-15.8	46294+170.80
2nd (big) dipole	4743.7	46294+234.59
3rd dipole	13560	46294

Some of the advancements this year

- Beam-target-pipe meeting (online) 2021-02-19, one result: transition from Ø40mm section to Ø77.3mm section already 517 mm downstream of IP: improvement of downstream vacuum.
- 3D-model of beamline from cryo-pump section (upstream) to Luminosity detector (downstream), edited by Ralf Schmitz and Herbert Schneider (2021-04-26, FZ Jülich).
- Prototype development of beam-target cross at FZ Jülich. The central part (s. figure) of this prototype was simplified for easier manufacturing: cone is now 55 mm long, upstream inner Ø 28 mm, downstream inner Ø 20 mm, target tube inner Ø 20 mm, wall thickness 0.2 mm.
- Pumping port between detectors FT1 and FT2 modified.



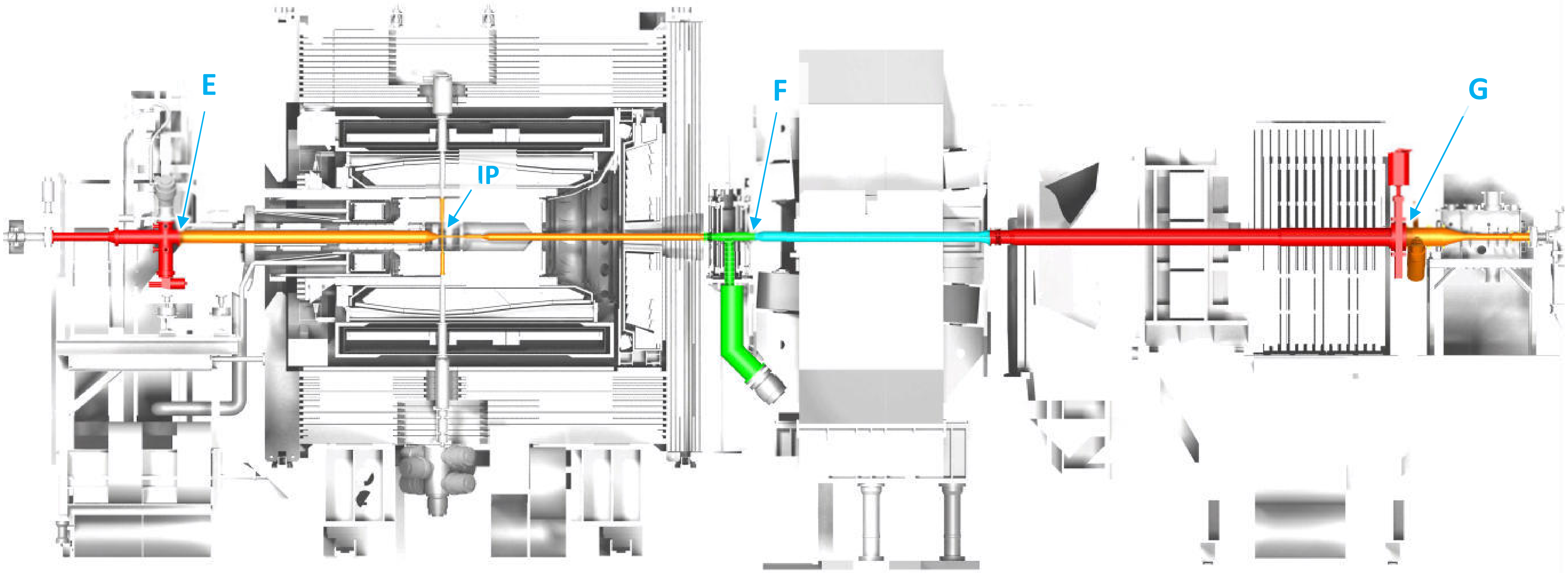
Positions of flange connections to be opened frequently



- The red and orange sections between A and B indicate the beamline components which will be rolled out with the TS.
- The green and turquoise sections indicate the beamline components in the dipole area which will always stay in place.
- The red and orange sections between C and D indicate the beamline components which will be rolled out with the FS.

Z-coordinates (Z=0 at IP) of flange connections to be opened frequently:
Z(A) = -4331mm (downstream side of DN 89-shutter),
Z(B) = 2900mm,
Z(C) = 6070mm,
Z(D) = 12138mm (downstream side of DN 89-shutter).

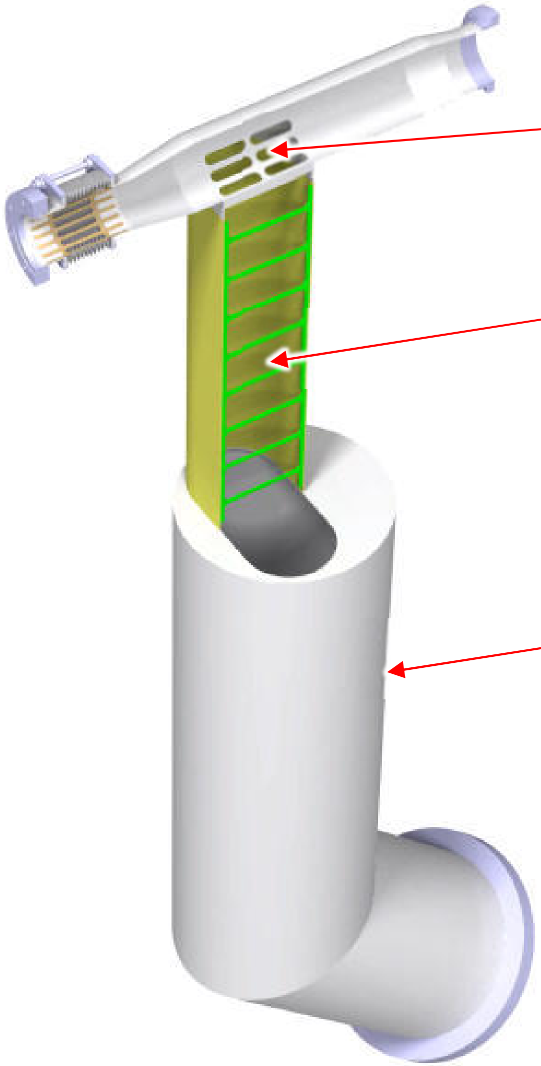
Other flange connections



Z-coordinates of other flange connections:

- Z(E) = -2913mm, upstream of E (red) cryo-pump section designed by WWU Münster
- Z(F) = 3464mm, upstream of F (green) pumping port between FT1 and FT2 designed by GSI
- Z(G) = 10682mm, downstream of G (orange) vacuum section of Luminosity Detector, in charge: JGU Mainz

Pumping port between FT1 and FT2



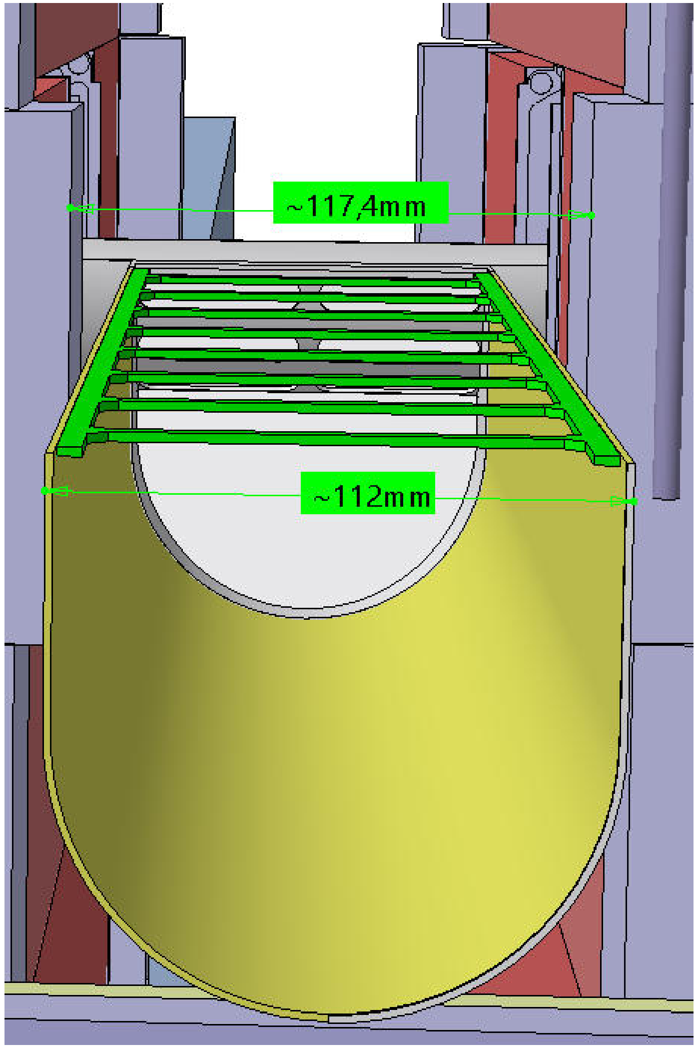
Port slits, conductance cross section 70 cm², molecular conductance for H_2 about 3000 liters/s

Tube with oval cross section between FT1 and FT2, inner width 108 mm, length 49 cm, wall thickness 2 mm (confirmed by FEM analysis), conductance cross section 210 cm², molecular conductance for H_2 about 2900 ltr/s

Ø 250 mm tube, length about 105 cm, 210 cm², molecular conductance for H_2 about 5700 ltr/s

- In-series conductance of these components about 1170 ltr/s
- Effective pumping speed with a 1000 ltr/s turbo pump 540 ltr/s.
- Effective pumping speed with a 1500 ltr/s turbo pump 660 ltr/s.

Pumping port between FT1 and FT2

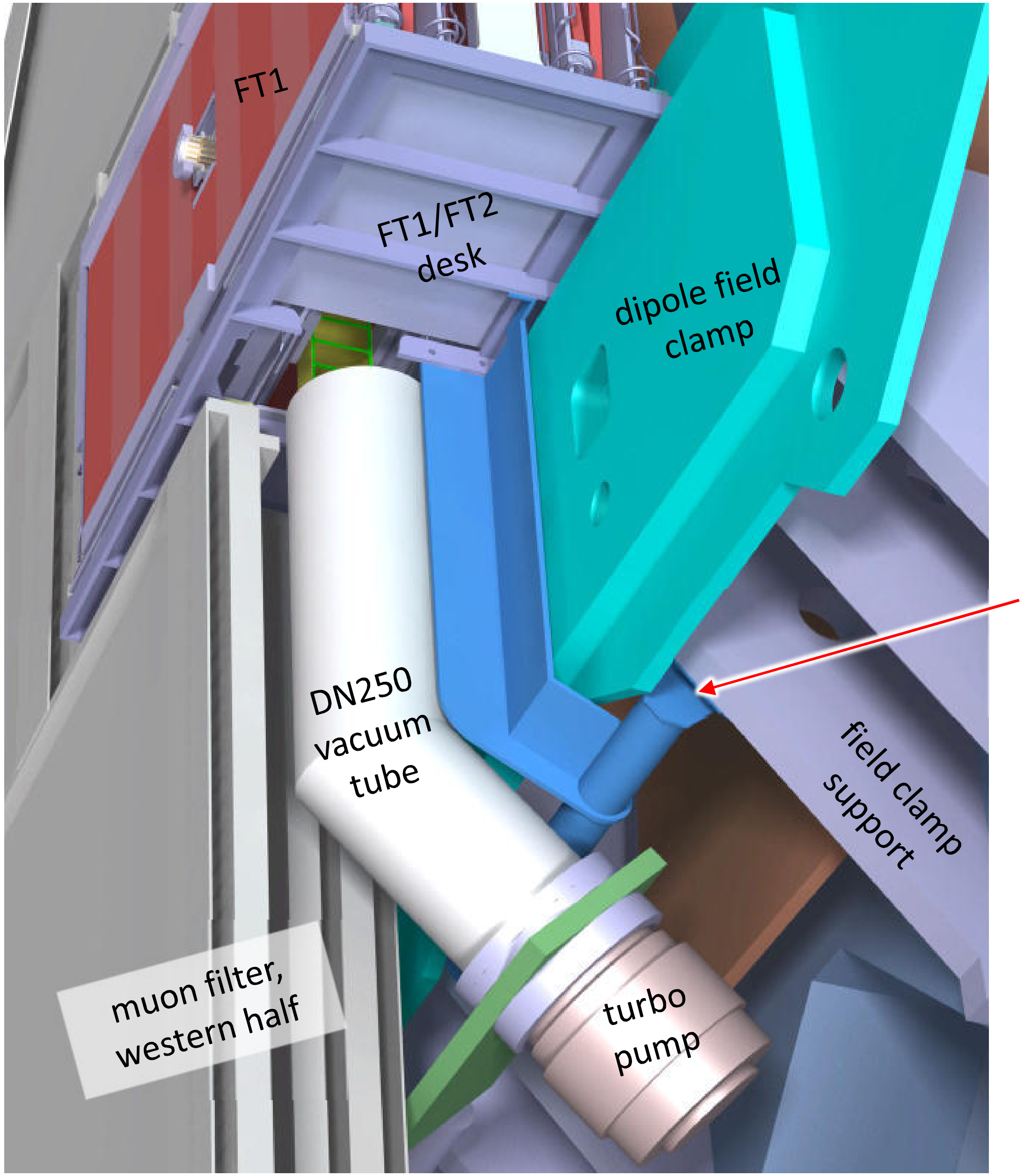


View from the bottom of the (yellow) pumping port: The clearance to the narrowest components of FT1 and FT2 is about ±2.7 mm.

There are considerations to increase the clearance.

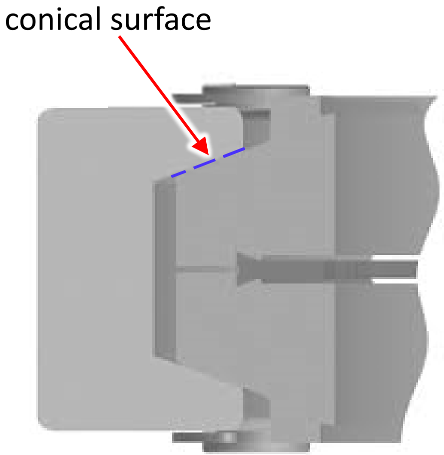
The nominal center of both the FT1/FT2 setup and the pumping port is 3182 mm downstream of the IP.

Support option for FT1/FT2 setup



FT1/FT2 support (blue) fixed to field clamp supports.

Choice of flange connections



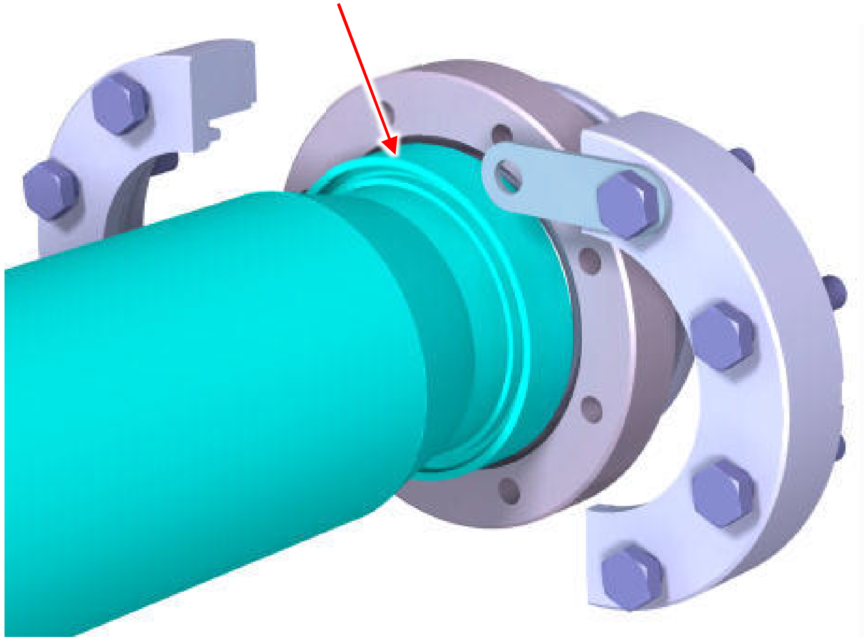
source: vacom.de

QCF compared to conventional CF:

- Components with QCF flange can be mounted like rotatable flanges in any angular position
- Same sealing principle (ISO 3669-2) and same standard copper gasket as the conventional CF connection
- About 50% less axial space required. Outer Ø of flange smaller but with clamp chain 50% more radial space needed (at the screw heads)
- Friction (azimuthal and radial) on the conical surfaces

Choice of flange connections

small outer
flange diameter



Horse-shoe flange, as used at the downstream end of the TS beam-pipe:

- custom product
- outer Ø not bigger than the Ø of the copper gasket