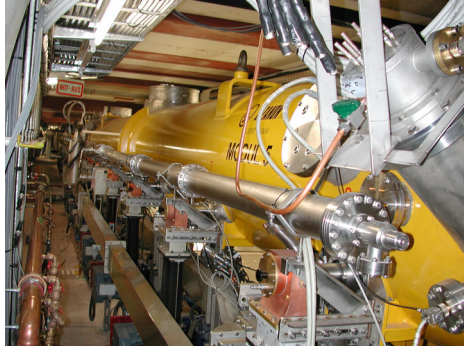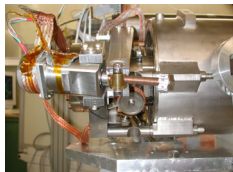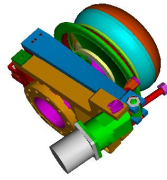# Accelerator Modules for XFEL

Construction Module Type III
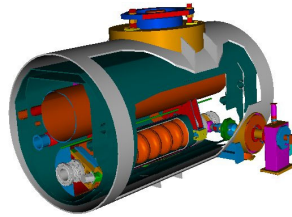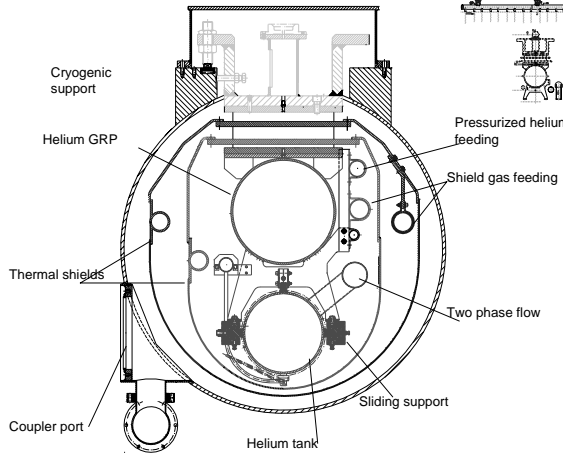

Module 5 in the TTF-Tunnel

Cold frequency tuner

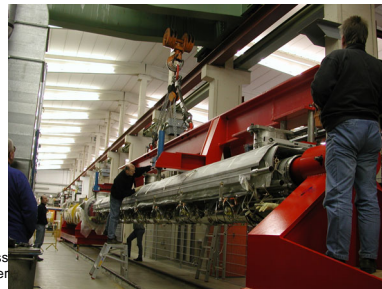| Technical Data:	
Length	12,2m
Diameter	965,2mm
Weight total	7,8 t
Weight Coldmass	2,7 t
Cavities	8
Quadrupole Doublets	1

Simplified Alignement Strategy

- Four C-shaped stainless steel elements clamp a titanium pad welded to the helium tank.
  - Rolling needles reduce drastically the longitudinal friction
- Cavities are independent from the elongation and contraction of the HeGRP.
- Lateral and vertical position are defined by reference screws
- Longitudinal position can be fixed by the use of an Invar rod

Cryogenic support
Helium GRP
Pressurized helium feeding
Shield gas feeding
Thermal shields
Two phase flow
Coupler port
Sliding support
Helium tank

Spring Washers
C-shaped support
Rolling needles
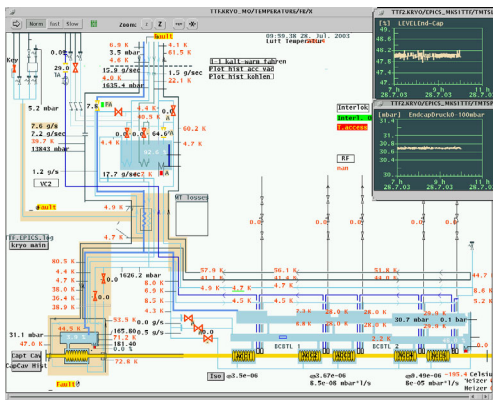Pad
Runner
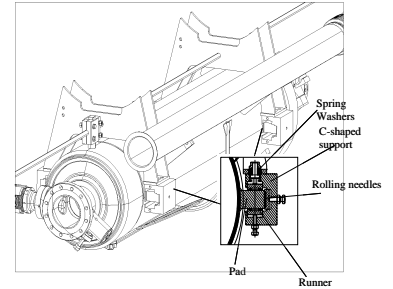
Module Assembly

Cavity string connected

Cavity string with coldmass in the cantilever
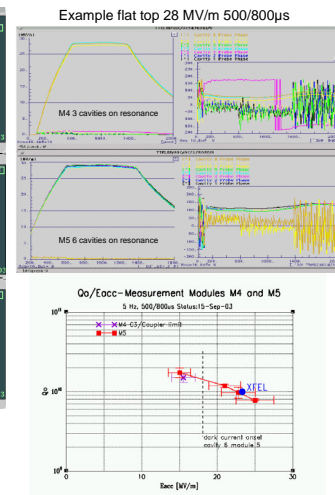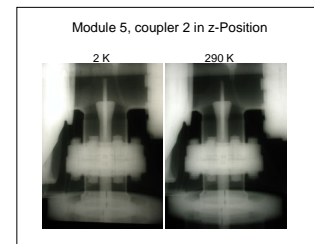

Vacuum vessel sliding over coldmass

Operational Experience and first Results at TTF

Example flat top 28 MV/m 500/800µs

Average Gradient in M4 > 25 MV/m

M4 3 cavities on resonance

M5 6 cavities on resonance

Average Gradient in M5 > 28 MV/m

Qo/Eacc–Measurement Modules M4 and M5

Module 5, coupler 2 in z-Position

2 K   290 K

Designed, estimated and measured static cryo-loads TTF-modules in TTF-Linac
Status:15-Sep-03 R.Lange -MKS1-

Module	40/80 K [W]			4.3K [W]			2 K [W]			Notes
	Design	Estim.	Meas.	Design	Estim.	Meas.	Design	Estim.	Meas.	
Module 4	115.0	76.8	74	21.0	13.9	13.5	4.2	2.8	<3.5	1 end-cap
Module 5	115.0	76.8	74	21.0	13.9	13.0	4.2	2.8	<3.5	1 end-cap

Design and estimated values by Tom Petersen 1995 -Fermilab-

Summary of Vacuum/He Leaks in TTF2-Modules
Status:12-Oct-03 R. Lange -MKS-

Module	M4	M5
Number of leaks Vac	0	0
Number of cool/warm	1	1
He->insulation	0	0
Insulation->coupler	0	0
Insulation->beam pipe	0	0
Coupler->beam pipe	0	0
He->beam pipe	0	0

Improvements for XFEL

- Cold frequency tuner with piezo
- 2 K-Quadrupol with HT-current leeds
- Alignment tooling (optic- to laser-technology)
- Transport safeguarding (shipping, road, ...)

responsible author:
Lange/Jensch, DESY
Rolf.Lange@desy.de,
Kay.Jensch@desy.de, Oct 2003