



MeChanICs Project meeting

News on CLIC RF structure production & testing

G. Riddone, 06/09/2011



Content

- Review of main components
- From test structures to CLIC structures
- Production status
- Summary of test results
- Conclusions



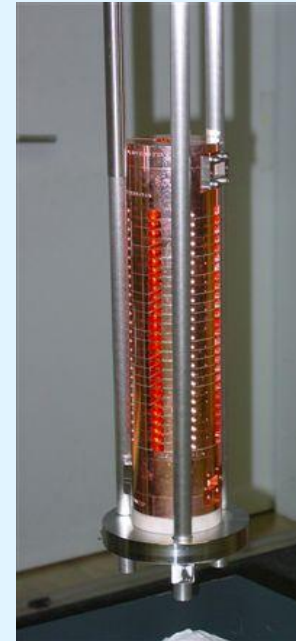
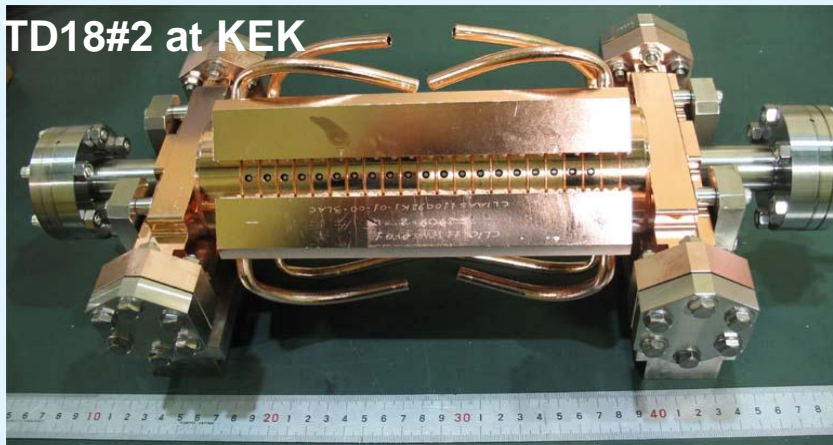
Test RF structures (1)

TD24#2 at CERN
(12 GHz)

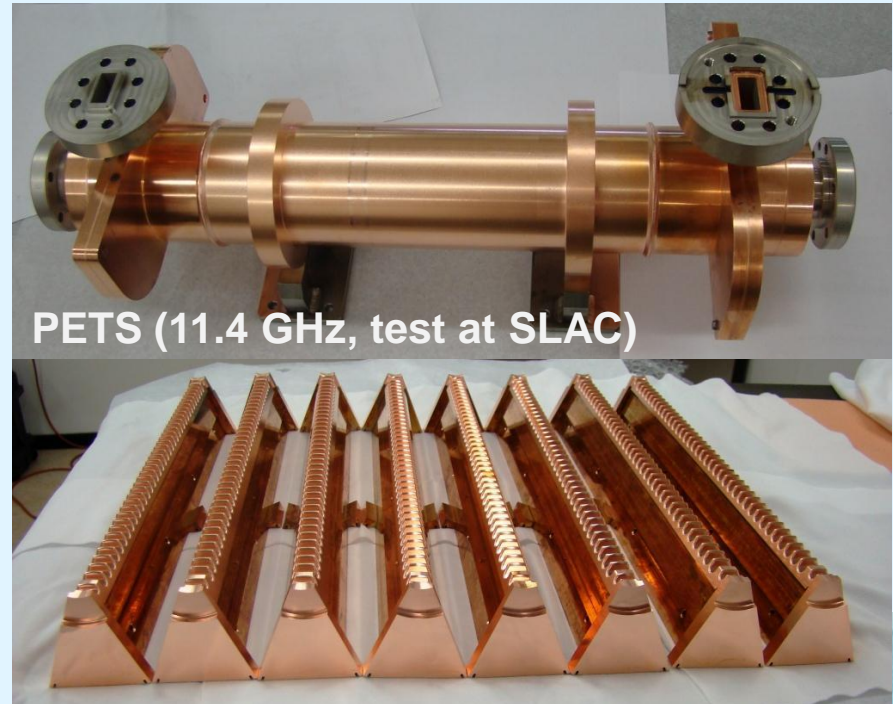
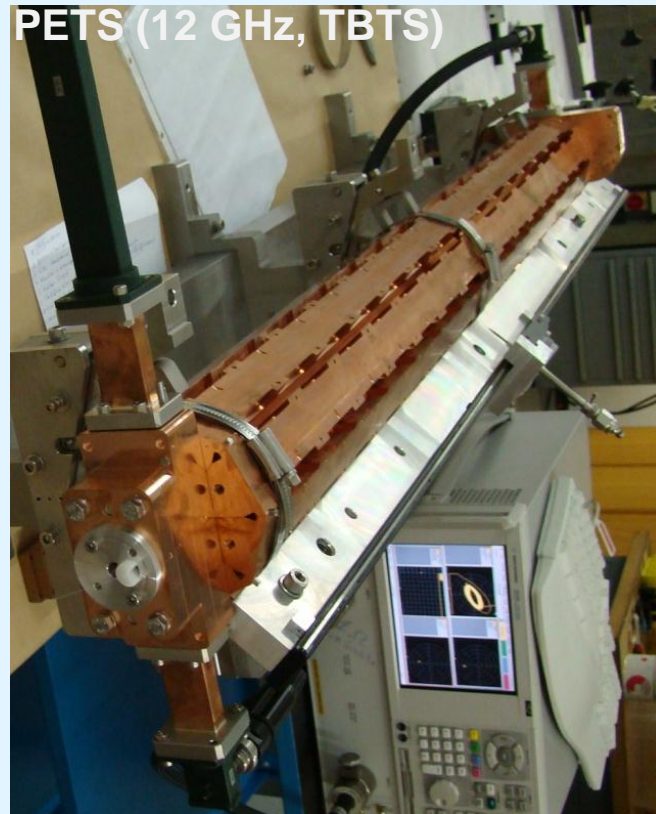
TD18#3 at SLAC



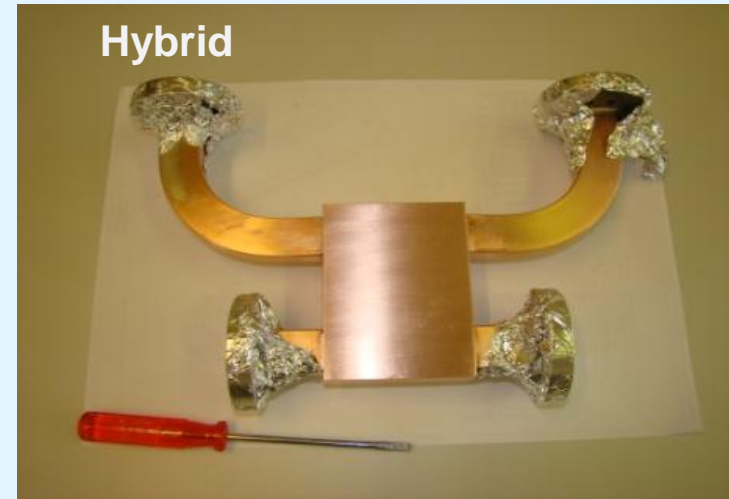
TD18#2 at KEK



- *Cu OFE UNS C10100*
- *Shape accuracy $\pm 2.5 \mu\text{m}$*
- *Roughness $R_a 0.025 \mu\text{m}$*
- *\varnothing 45 to 80 mm, 30 disks*
- *Length 300 mm*

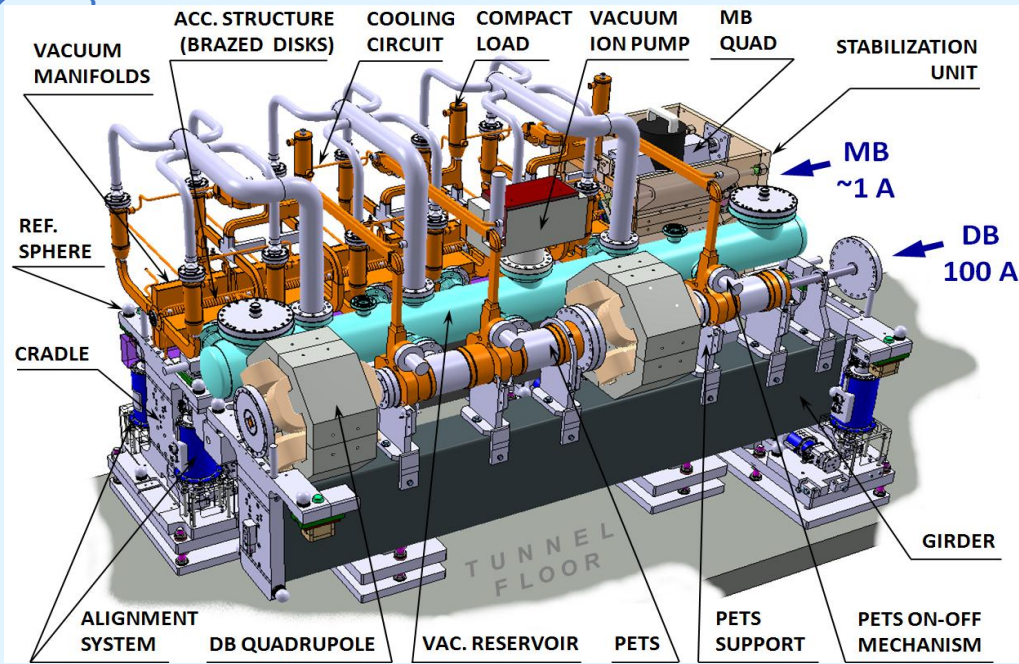


- *Cu OFE UNS C10100*
- *Shape accuracy $\pm 7.5 \mu\text{m}$*
- *Roughness $R_a 0.1 \mu\text{m}$*
- *8 octants*
- *Length 300-1000 mm*



Not treated in this talk.

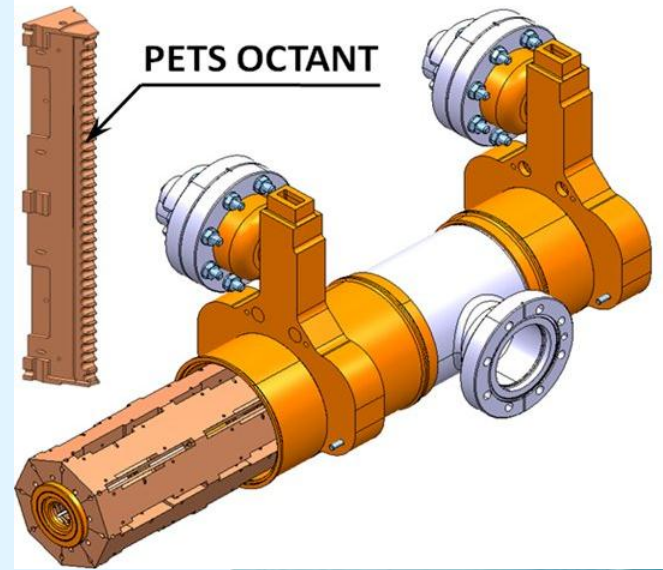
Towards CLIC RF structures (1)



RF structures integrated in modular 2-m long items: two-beam modules

In one module up to 8 acc. structures and 4 PETS

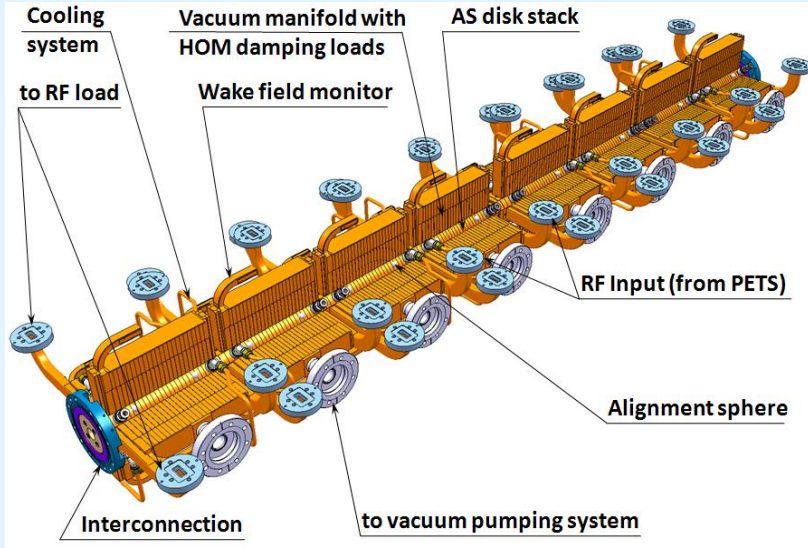
CLIC MODULE PETS



PETS: **P**ower **E**xtraction and **T**ransfer **S**ystem

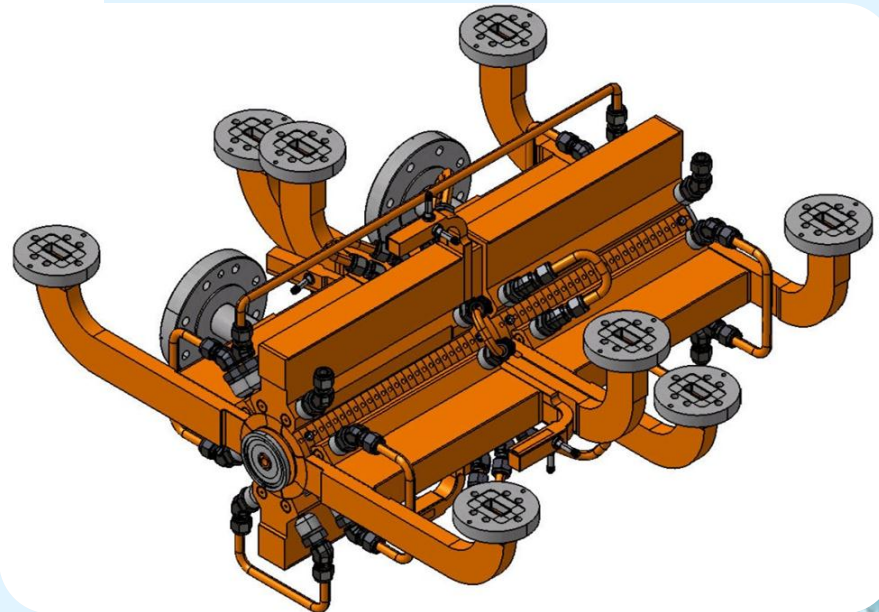
PETS unit: two PETS with coupler as one single unit

Towards CLIC RF structures (2)

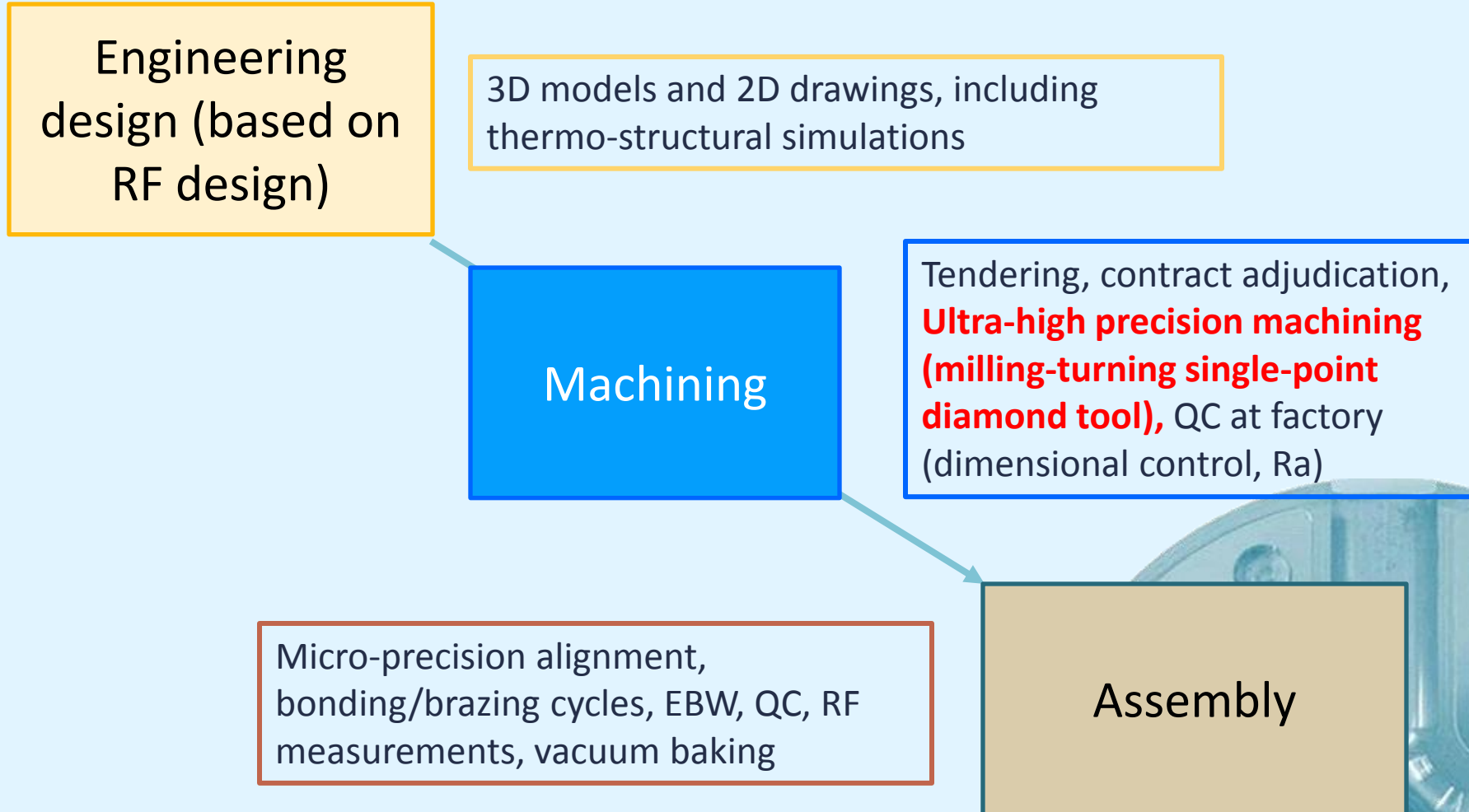


Stack of 8 accelerating structures
 -Each acc. structure contains all features and technical systems
 (see detailed presentations)

The aim is to assemble two acc. structures as one unit
 → super-accelerating structure

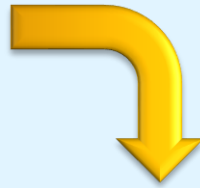


Production phases



Baseline procedure

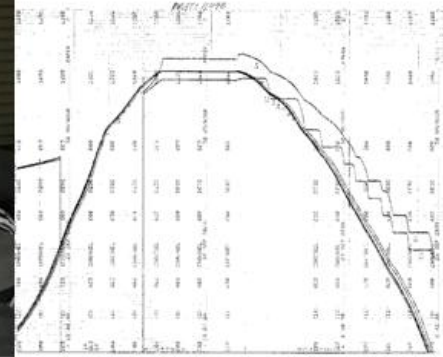
Diamond machining (**sealed structures**)



Cleaning with light etch



Diffusion Bonding of T18_vg2.4_DISC



Pressure: 60 PSI (60 LB for this structure disks)
Holding for 1 hour at 1020°C

J. Wuang

Vacuum Baking of T18_vg2.4_DISC



650°C
10 days

J. Wuang

H2 diffusion bonding/brazing at ~ 1000 °C



Vacuum baking 650 °C > 10 days



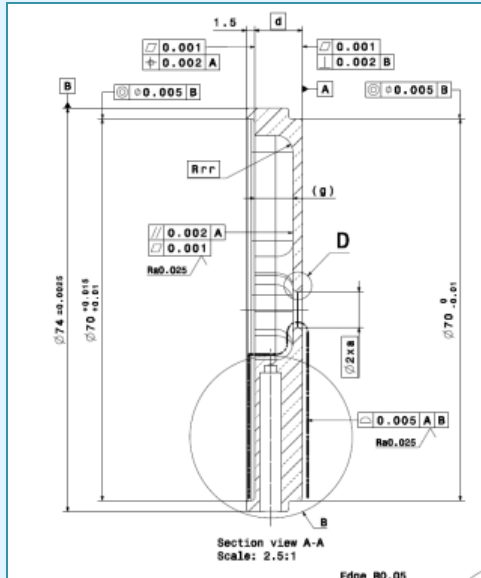
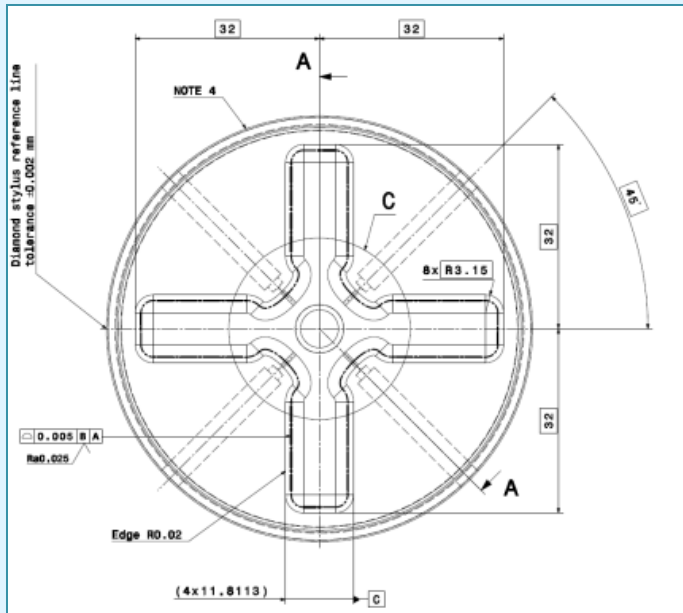
Typical procedure of UHP disk machining

Pre-Fabrication:

- Pre-turning + x100 μm
- Pre-milling + x100 μm
- Tuning holes
- Stress relief ~180 °C
- Finish turning + x10 μm
- Finish milling + x10 μm
- Stress relief ~245 °C

UHP-Machining:

- Mounting of vacuum clamping adapter
- UHP-turning of the support (diamond tools)
- Alignment
- UHP-turning ref. plan A
- Alignment
- UHP-turning opposite side
- Wave guide UHP milling
- Iris final turning (requested up to the nose)



S. ATIEH



Accelerating structures: from TD24 to TD26 CC SiC



- **CLIC feasibility – TD24** (damping features, but no HOM damping material)



- TD24 with **wakefield monitors** (TD24 WFM)
- TD24 with **HOM damping material** (TD24 R05 SiC)
- TD26 with **compact coupler** and no damping material (TD26 CC)

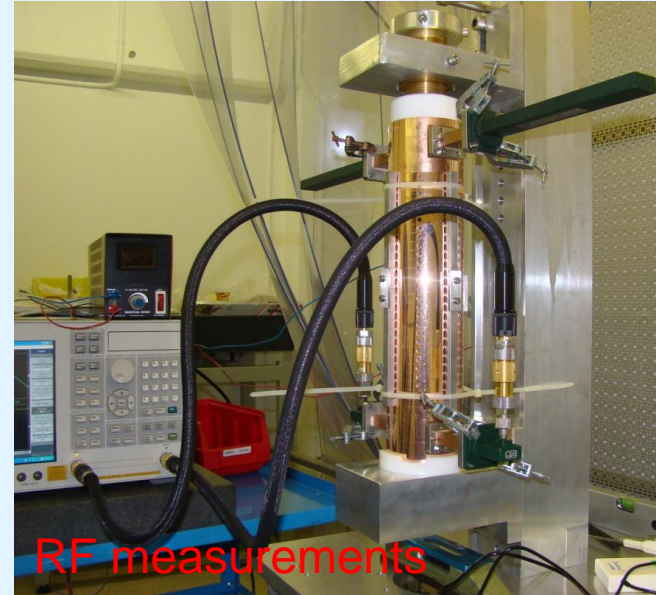


- TD26 with damping material and compact coupler → **fully equipped accelerating structure** (TD26 CC SiC)





Regular disk



RF measurements

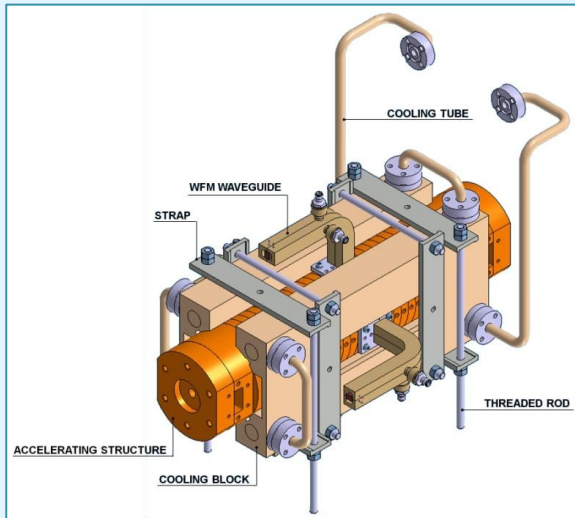


Ready for packaging

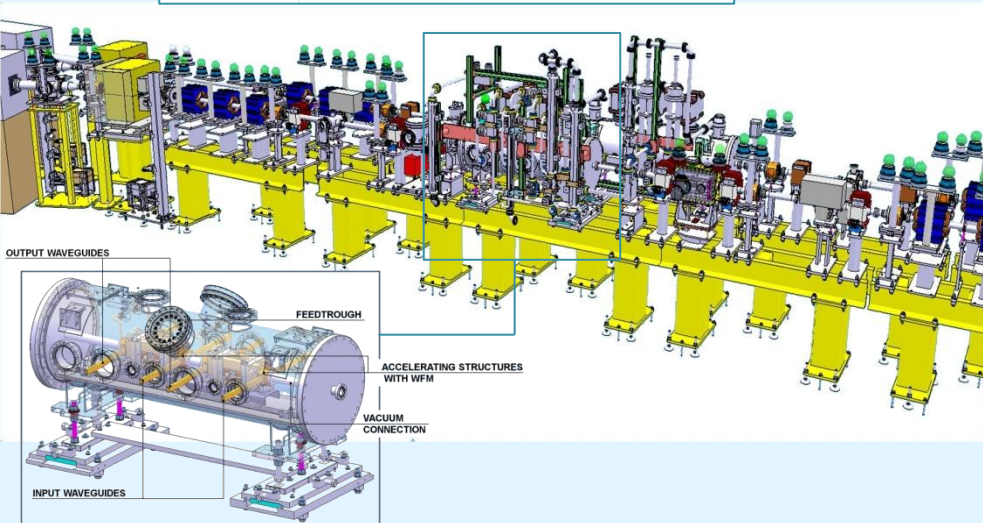
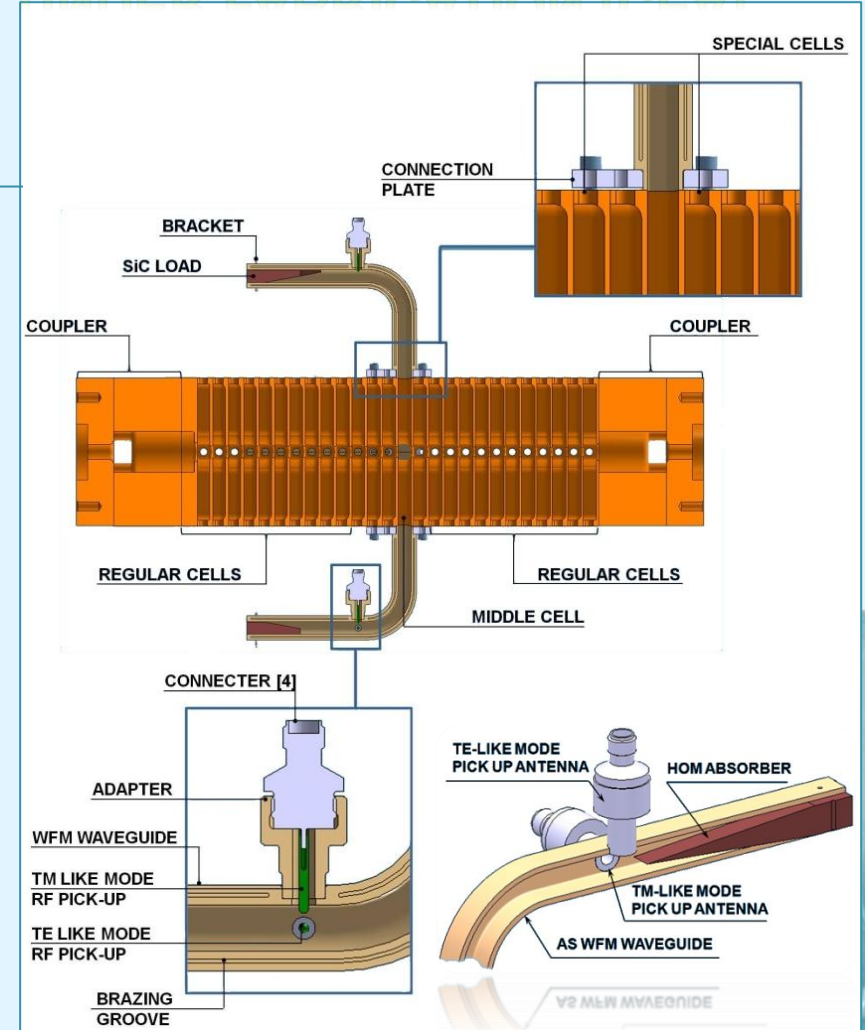


New features (from TD24 R05) :

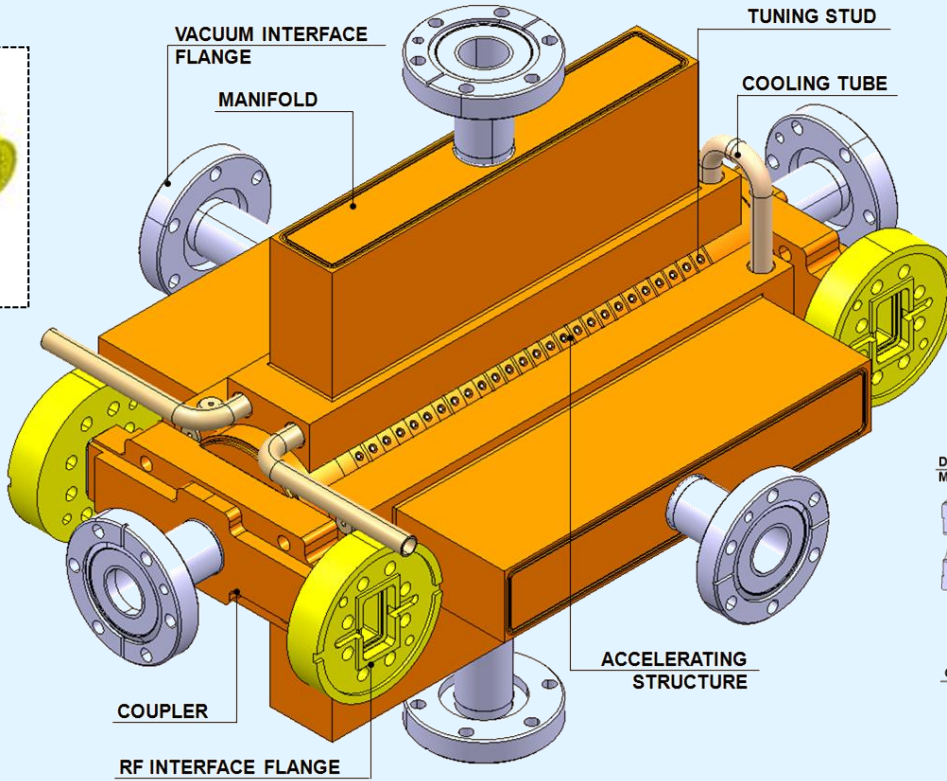
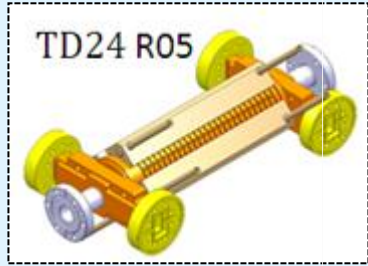
- Wakefield monitors



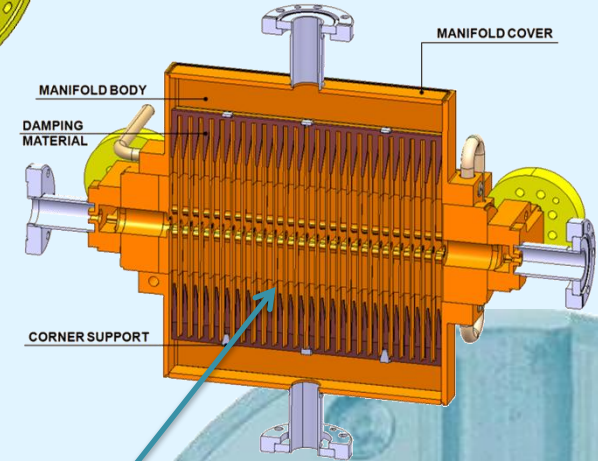
UNDER FABRICATION [CEA]



TD24 R05 SiC



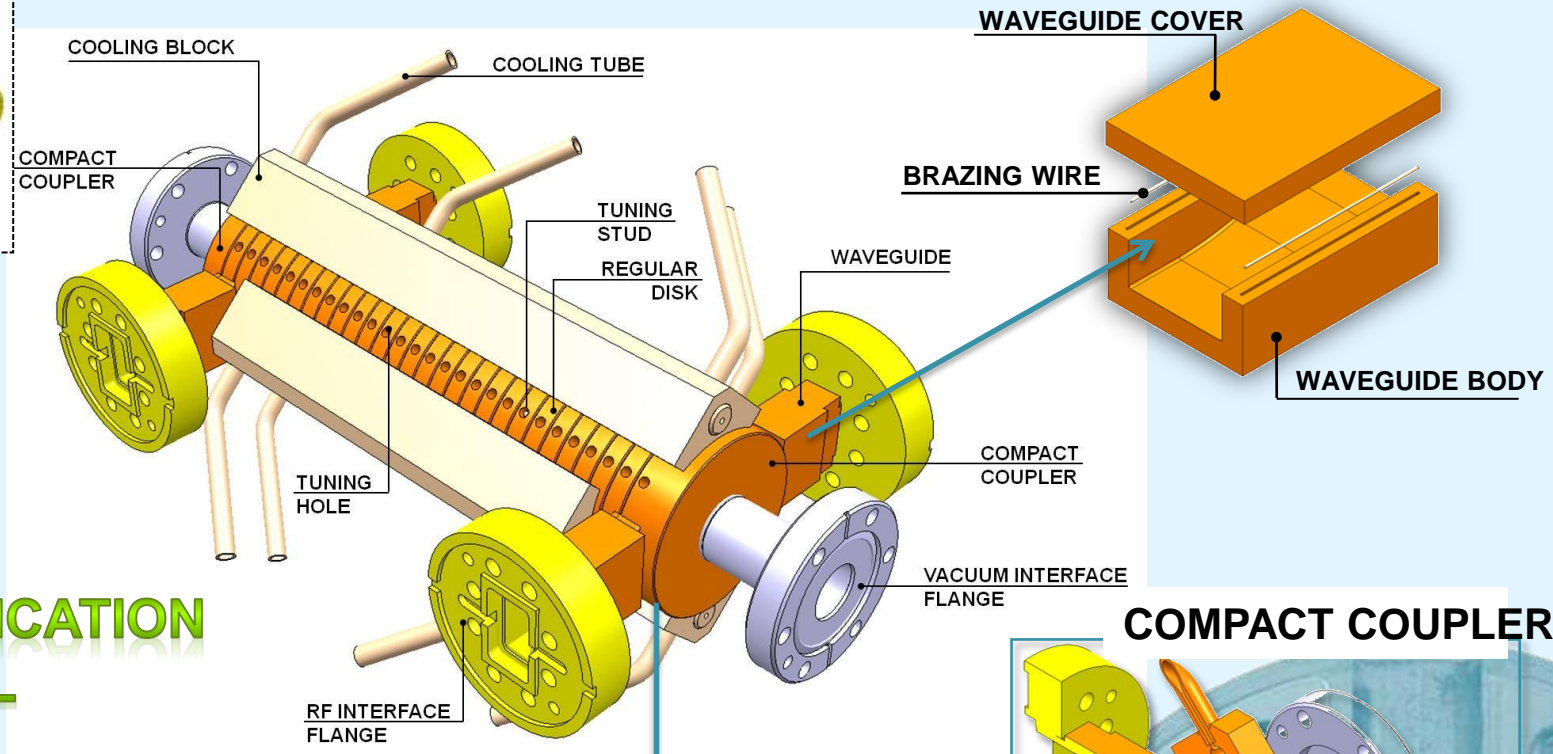
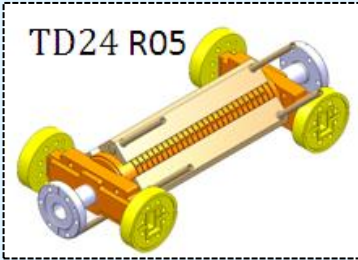
**UNDER FABRICATION
AT VDL**



New features (from TD24 R05)

- damping loads (numerical simulation performed)
- brazing of vacuum manifolds (several tests to validate assembly procedure)
- optimization of cooling circuit design

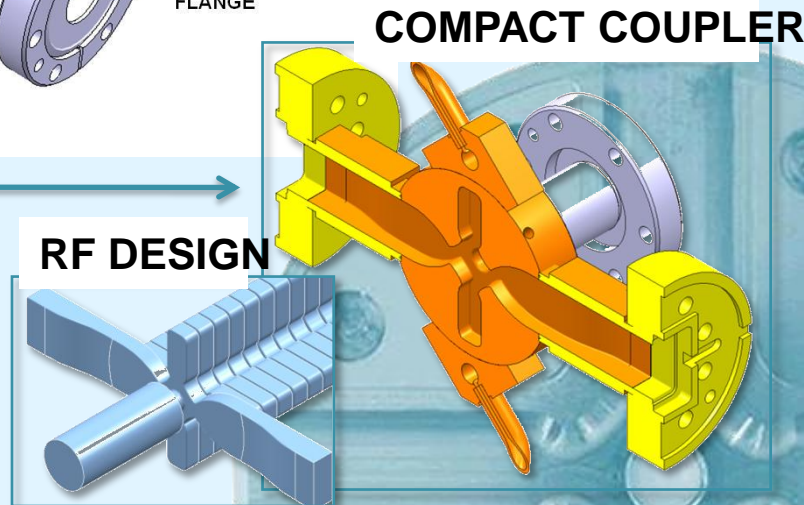
TD26 Compact Coupler



**UNDER FABRICATION
AT VDL**

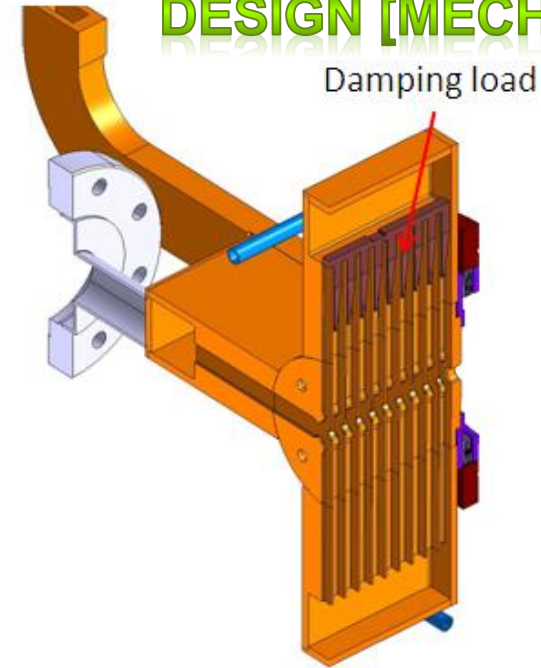
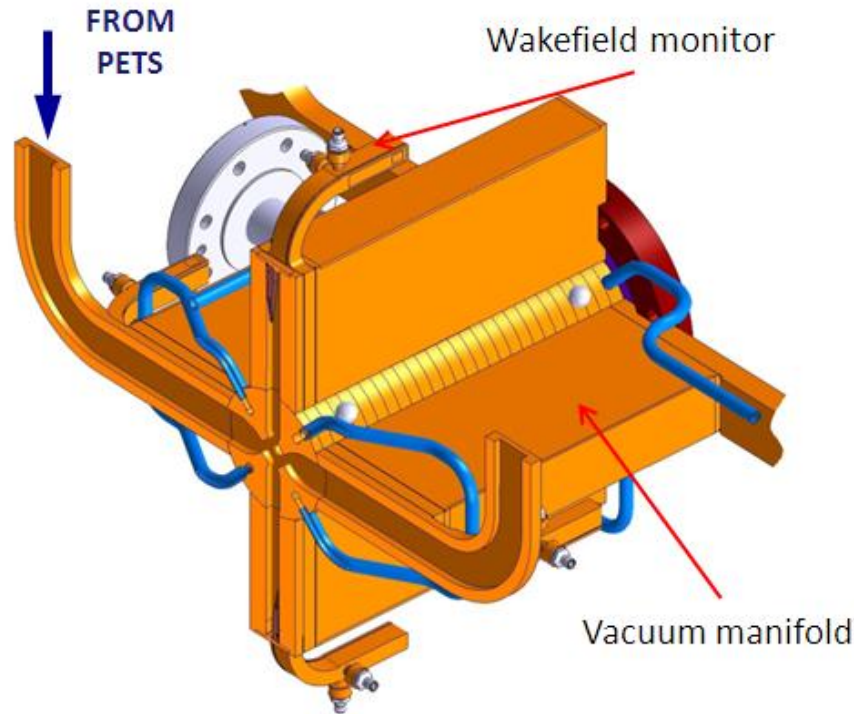
New features (from TD24 R05):

- compact coupler
- new design of waveguides
- additional brazing steps



TD26 CC SiC (towards CLIC structures)

**UNDER ENGINEERING
DESIGN [MECHANICS]**



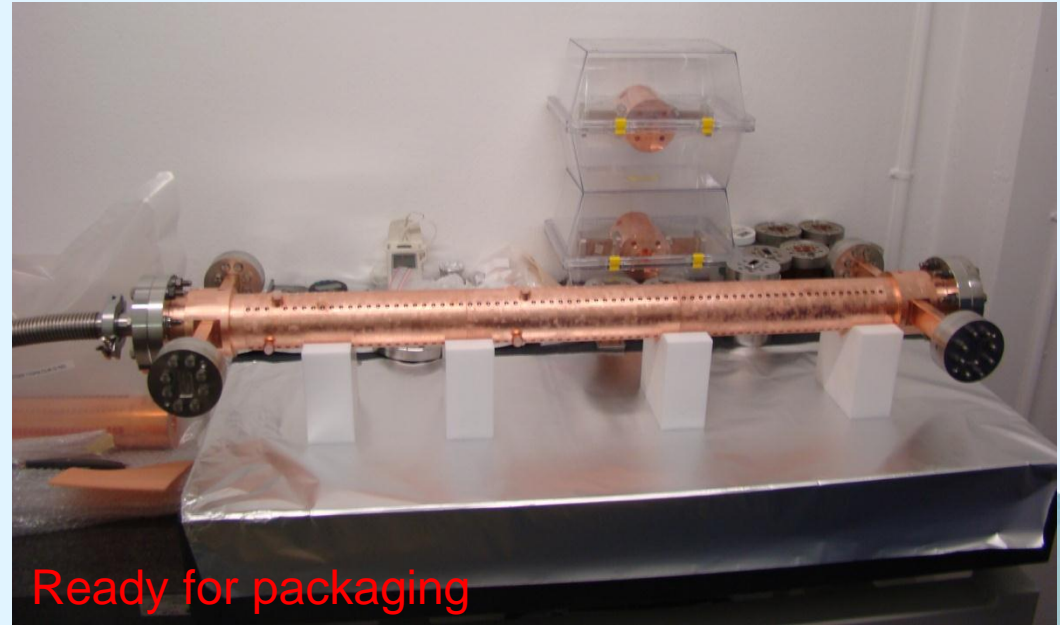
All features integrated:

- compact coupler (as TD26 CC)
 - new design of waveguides
 - additional brazing steps (procedure validated)
- damping material and vacuum manifolds (as TD24 R05)
- WFM (as TD24 WFM from CEA)
- interconnection to adjacent structures/modules

**Many brazing/
bonding/EBW steps
(validation on mock-
ups from August
2011)**

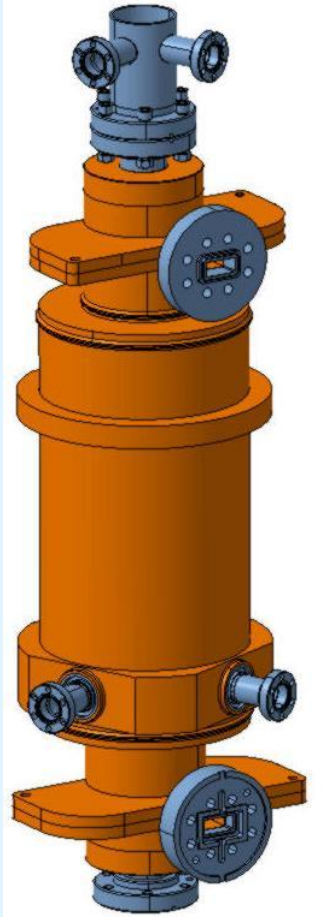


900-mm accelerating structures for PSI/ST X-FELs

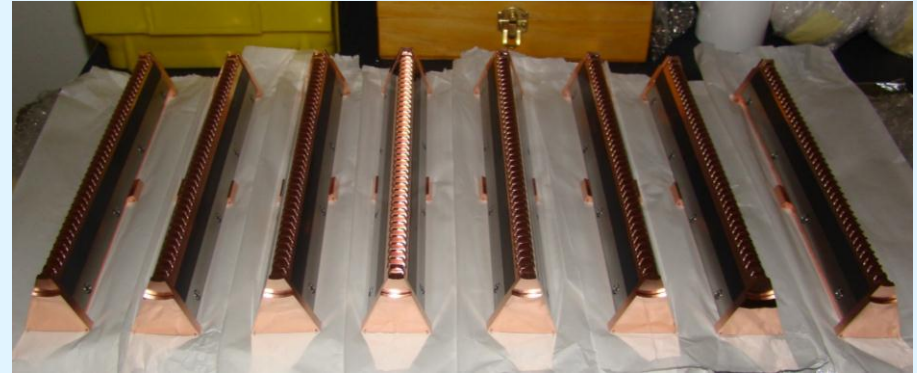
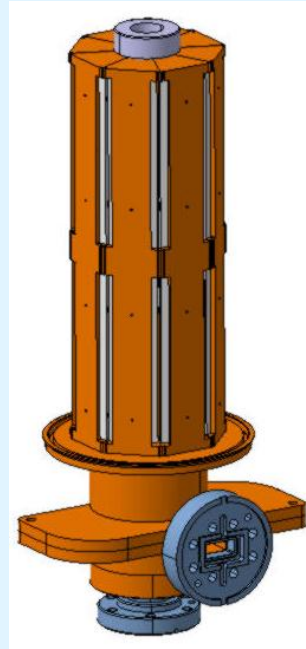


- 900-mm length, 72 regular cells: 3 bonded stacks brazed together to form the structure
- 3 sections with wakefield monitors

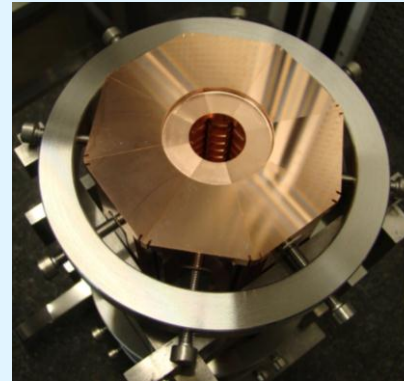
Experience towards longer structures



Assembly of vacuum tank and couplers with 11 GHz PETS inside.



PETS octants with damping material, separated.



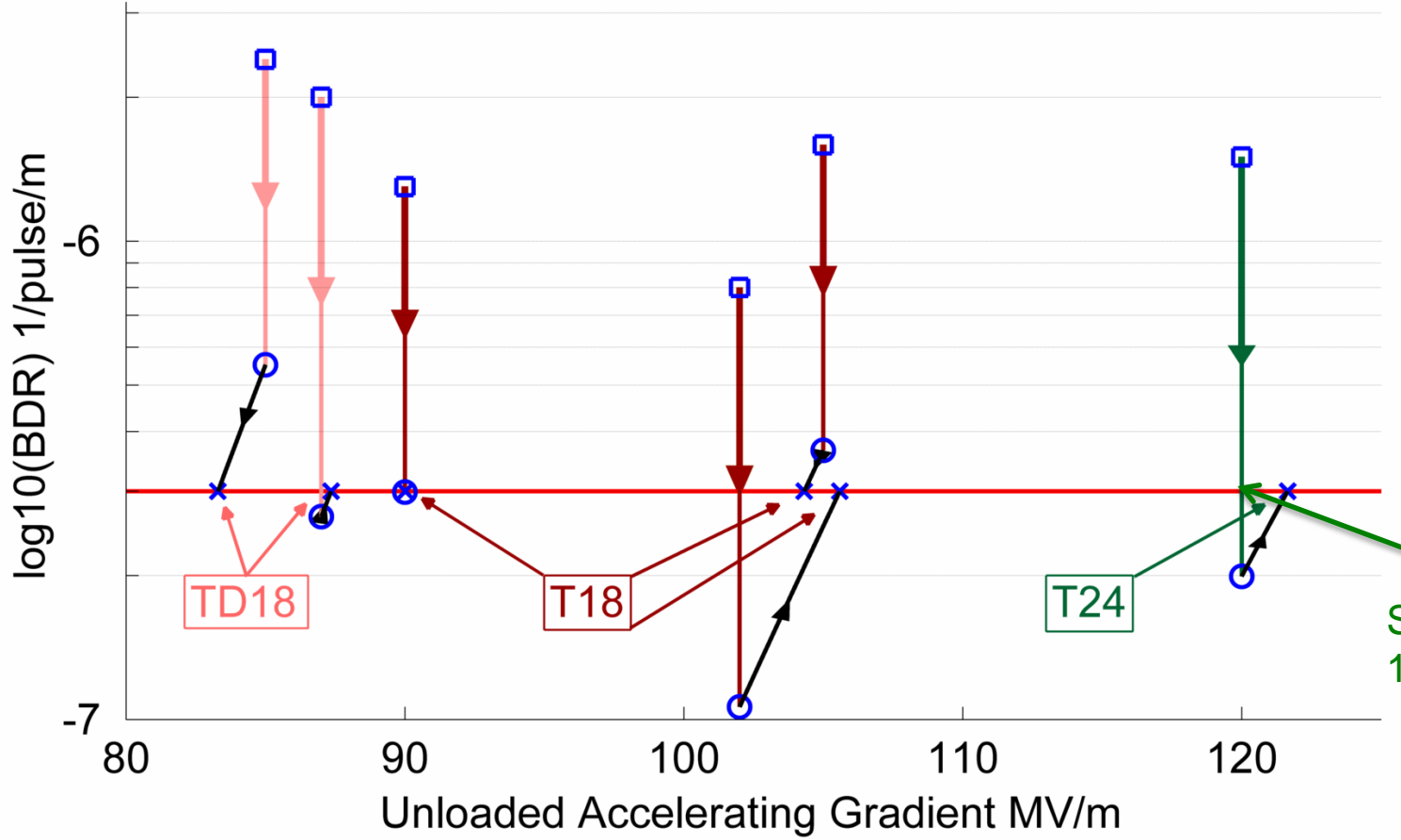
Pre-assembled octants.



Vacuum tank and coupler.

**Assembly procedure validated
Successfully tested at SLAC**

Test results (acc. structures)



Measurements scaled according to

$$p \propto G^{30} \tau^5$$

Same input power as 100 MV/m loaded

	Simple early design to get started	More efficient fully optimised structure
No damping waveguides	T18	T24
Damping waveguides	TD18	TD24 = CLIC goal

TD24: September 15th @ KEK
 Mid-November @ SLAC
 Soon @ CERN



Conclusions

- CERN is getting more and more experience in the fabrication of X-band RF structures for CLIC → to qualify companies and develop assembly procedures is of prime importance
- MeChanICs is a very important program to enhance the production of the CLIC RF structures in Finland
- The aim is the fabrication of a fully equipped accelerating structure by involving expertise from the 5 industrial Partners, HIP and CERN → eng. design under completion
- Industrialization study will be performed based on the acquired experience