

TTF3 Power Coupler

Update on Operating and Fabricating Issues

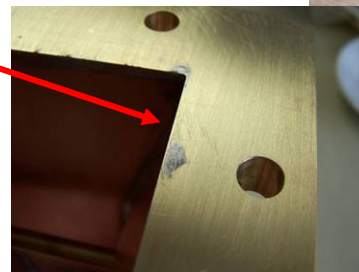
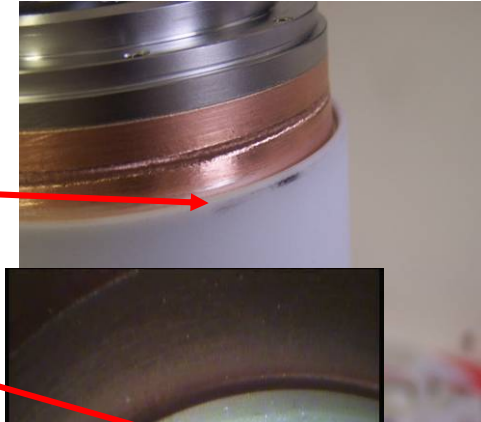
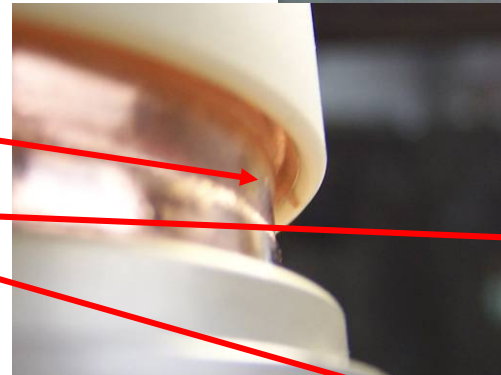
TTC Meeting, FNAL, Chicago, April, 19th-22th 2010

Wolf-Dietrich Möller, DESY

1. Fabrication Issues
2. Operation in FLASH

Experience with the Fabrication of 139 TTF3 couplers, 1st

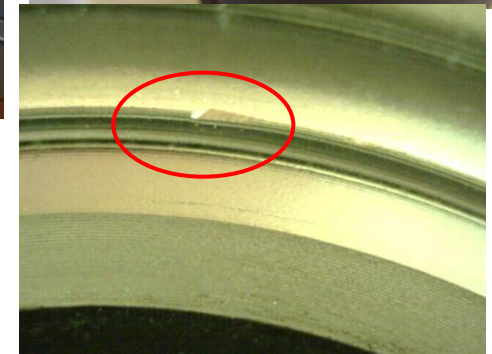
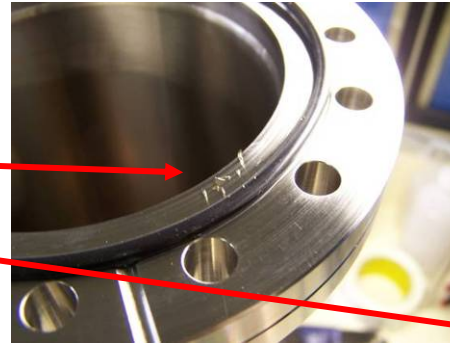
- Critical fabrication steps:
- Copper plating
 - blisters
 - adhesion
- TIG welds
 - surface irregularities
- e-beam
 - metal vapor
 - metal scratches from protective shields
- Soldering
 - insufficient fill
 - material on flange surface



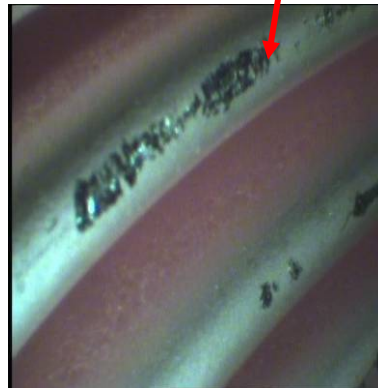
Experience with the Fabrication of 139 TTF3 couplers, 2nd

- Handling problems

- dents at Conflat knife edges
- dents at RF contacts
- scratches on RF surface
- chip at ceramic edge



It is important that the companies understand the main functions and develop an adequate handling.

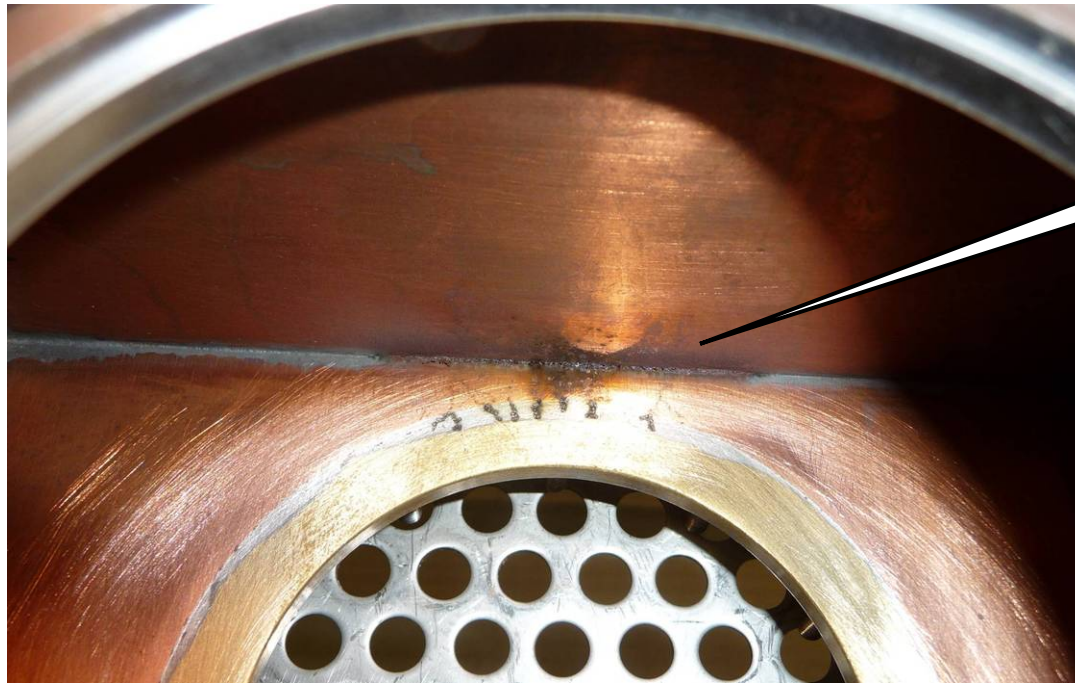


TTF3 Power Coupler FLASH Operation

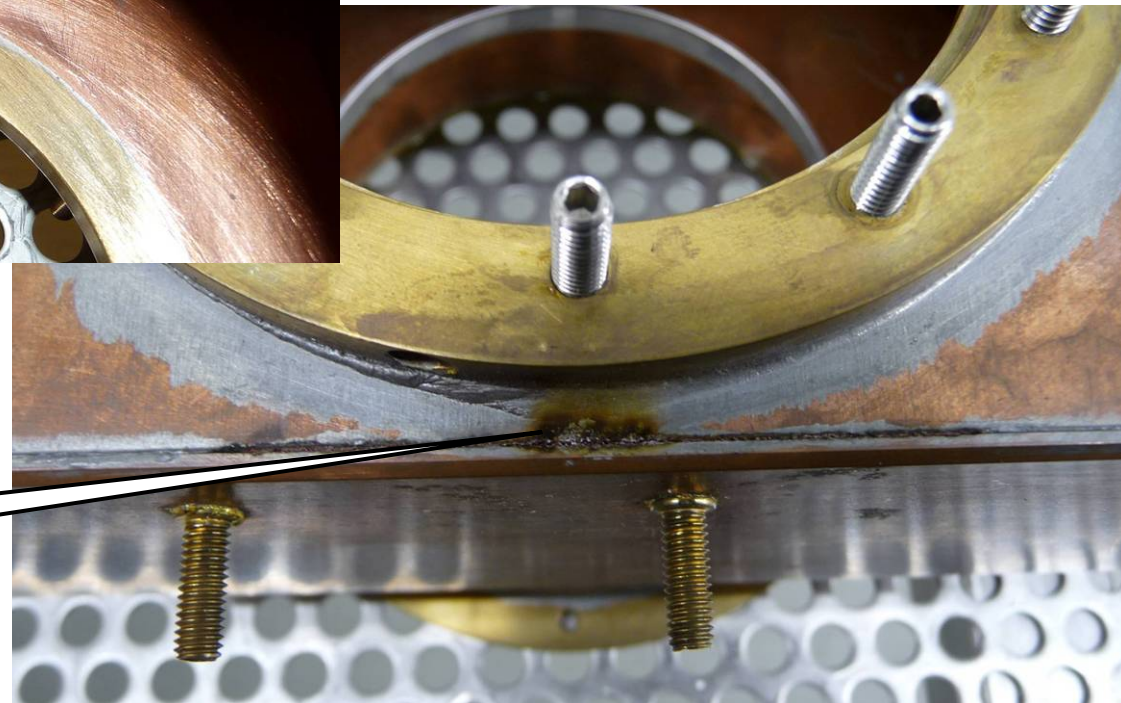
Coupler type	FNAL	TTF 2	TTF 3
cold window	conical	cylindrical	cylindrical
warm window	flat wave guide	flat wave guide	cylindrical
bias	no	yes	yes
fabricated totally	16	20	139
tested	16	20	90
used in TTF modules	12	19	27
assembled in modules	ACC 1, 2	ACC 2, 3, 4	ACC 1, 3, 5, 6
time of operation	1997 - 2005 ~ 105,000 coupler*hr (not updated)	1998 - 2005 ~ 115,000 coupler*hr (not updated)	2002 - 2009 ~ 700,000 coupler*hr

FLASH operation (250-350kW) was never limited by the TTF3 power couplers, but...

TTF3 Power Coupler after 5 years of Operation in FLASH, 1st

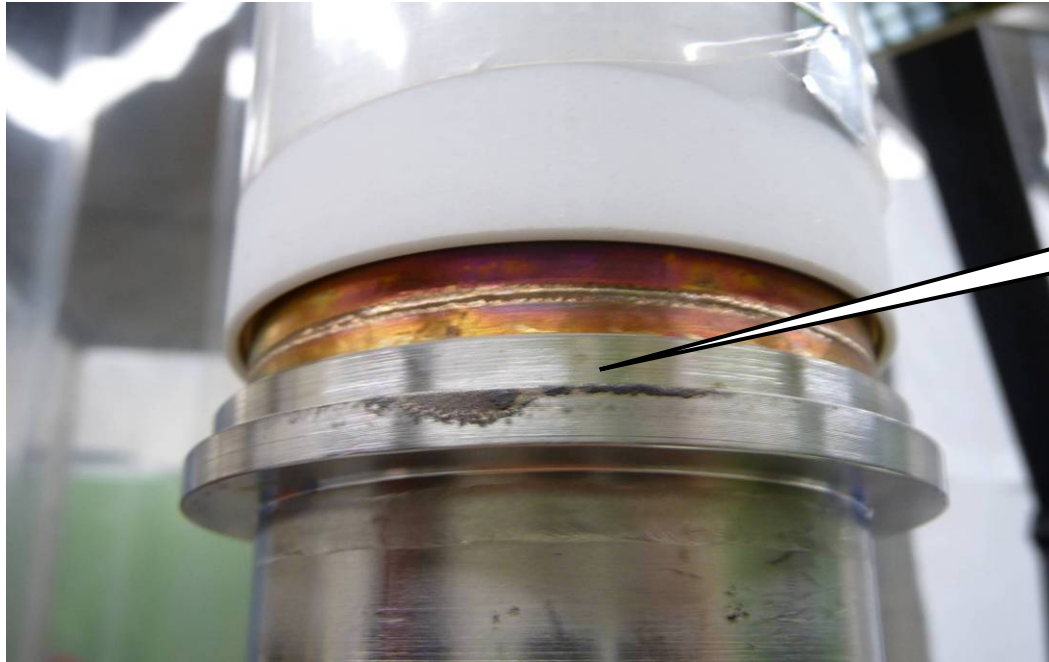


wave guide box soldering
burn marks inside



wave guide box soldering
burn marks outside

TTF3 Power Coupler after 5 years of Operation in FLASH, 2nd



warm part outer conductor burn marks
(contact to WG)



capacitor inner contact burn marks
(contact to coax)

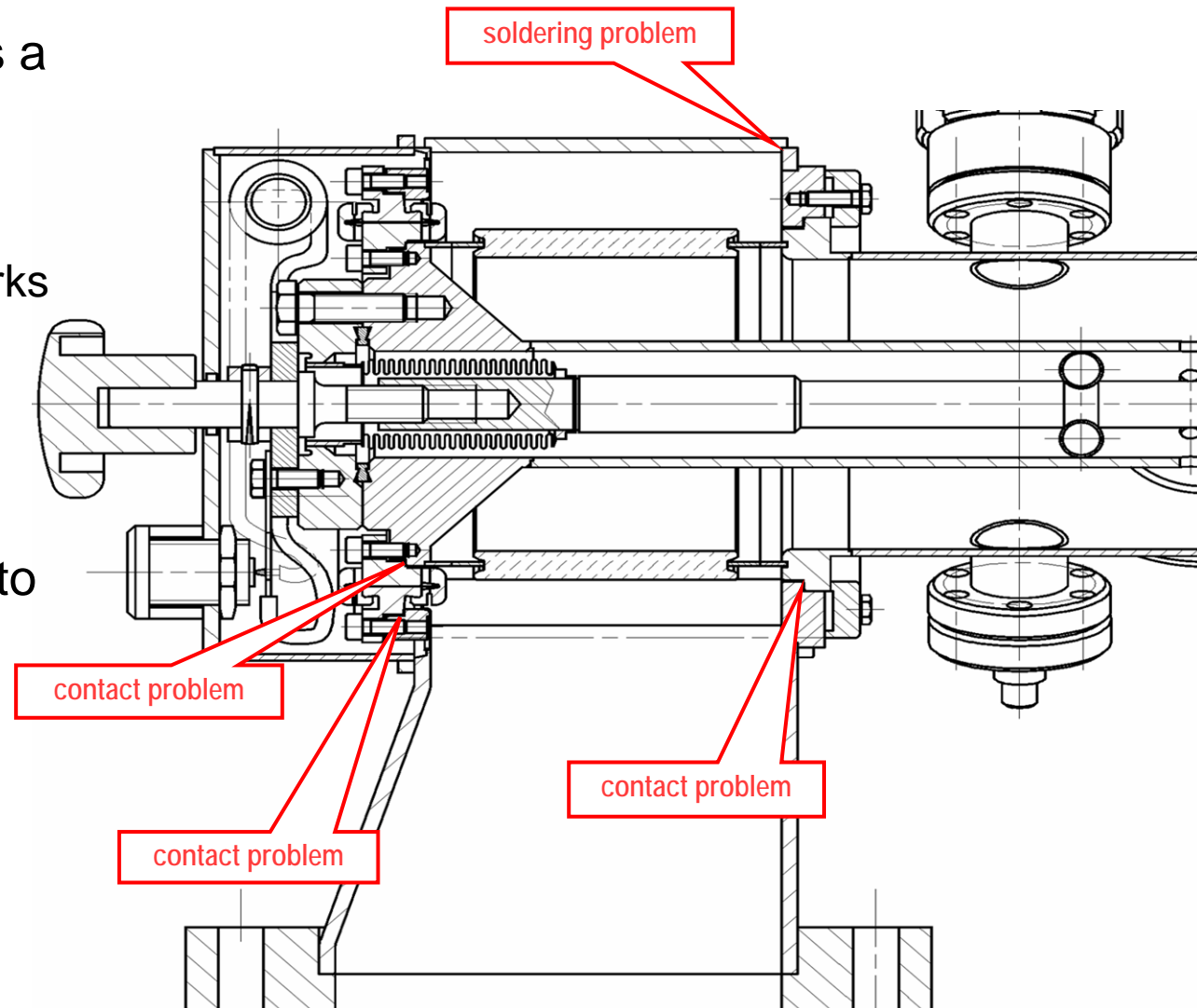
TTF3 Power Coupler after 5 years of Operation, 3rd

TTF3 wave guide box is a soldered design:

→ micro cracks in the soldering caused sparks

2. TTF3 contacts are machined very precisely and have to be assembled very carefully:

→ misalignment caused sparks



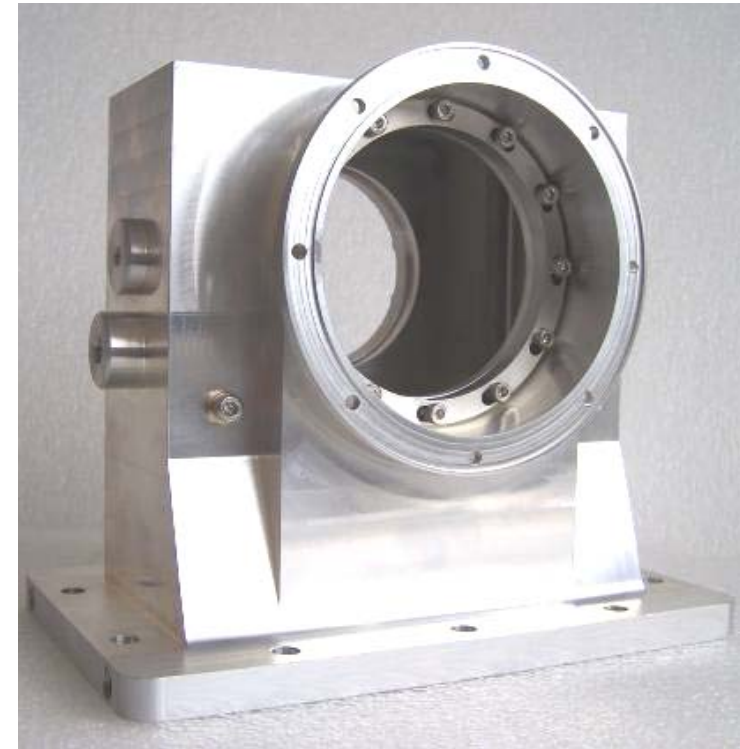
Solutions, soldered wave guide

Soldering of the box is done by hand - the process is not easy to control.

1. machining from bulk Aluminium

But:

- flexibility for fabrication tolerances not easy to apply, redesign necessary (the original design has a membrane for length compensation)
- braze wave guide
 - copper too soft
 - use copper plated stainless steel and keep the membrane part from copper (two test wave guides are under fabrication)



1. Careful assembly

we have many couplers tested and operated without any problems

But:

In a mass production we need a 'fail safe' solution

2. Change the design for RF spring or solid flange

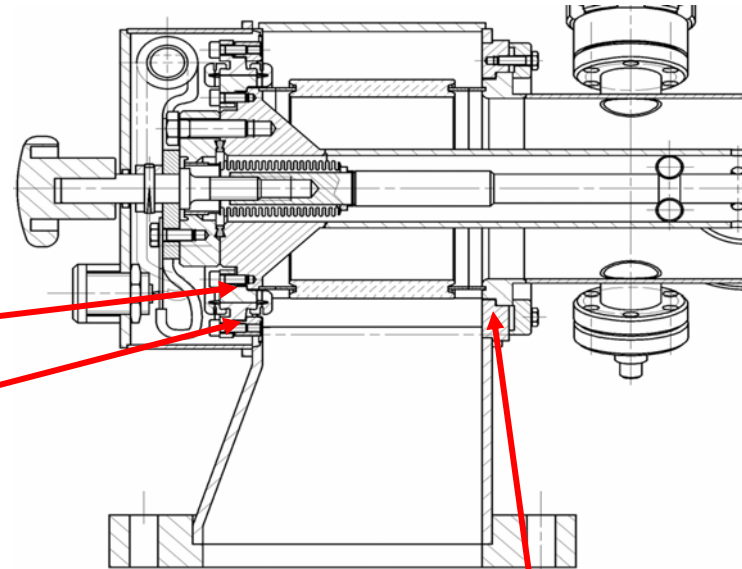
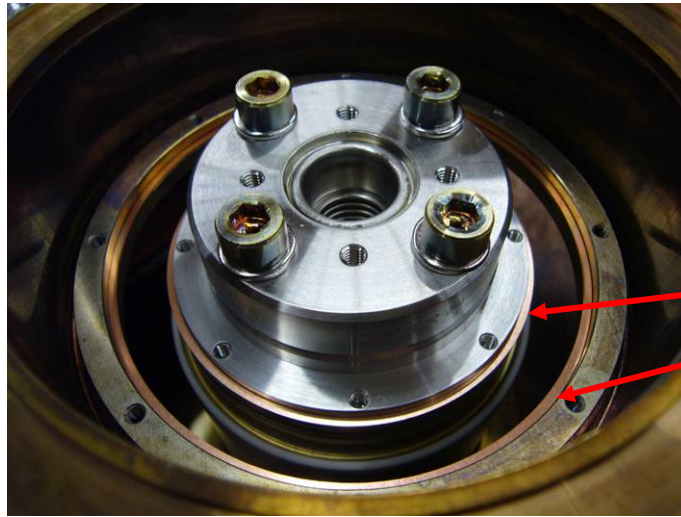
But:

Not enough time for development and tests before XFEL production

3. Add contact seal between the flanges

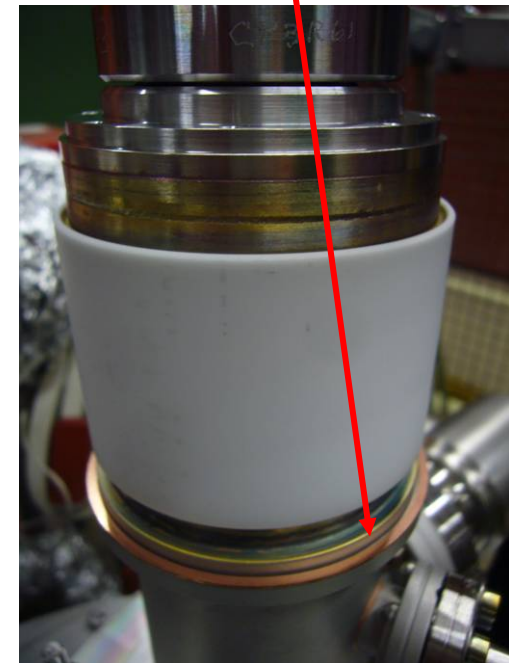
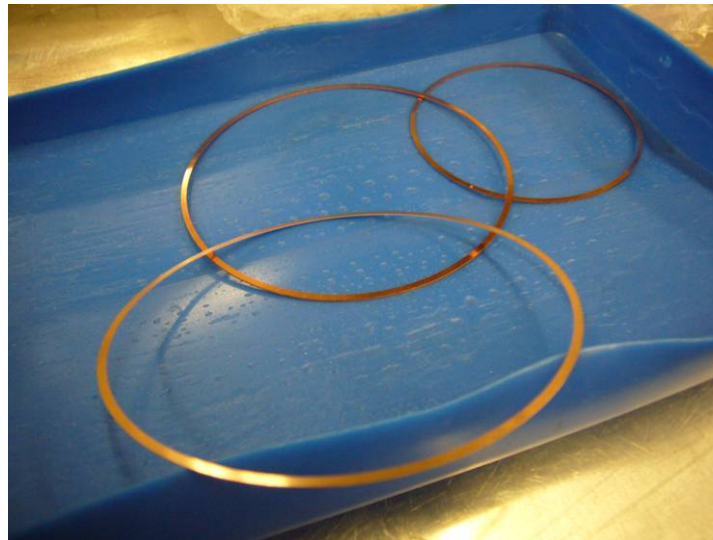
4. Replace the capacitor (Chris Adolfsen, SLAC)

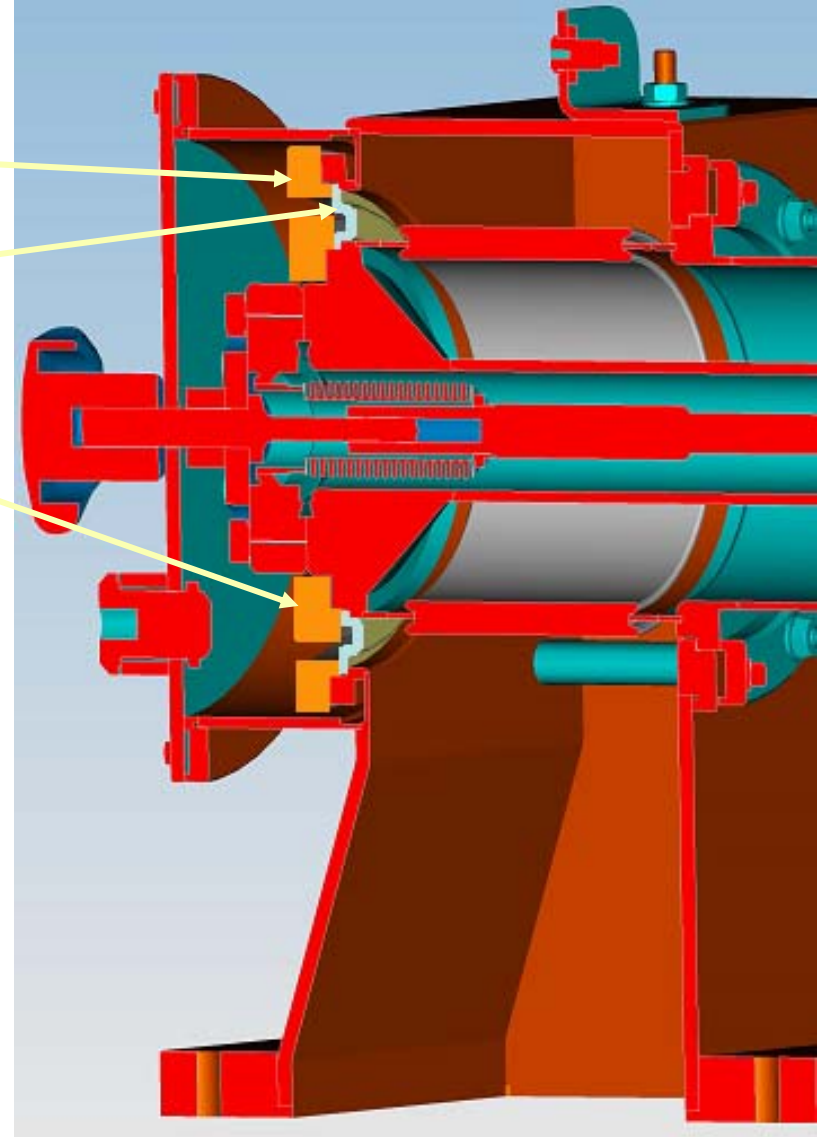
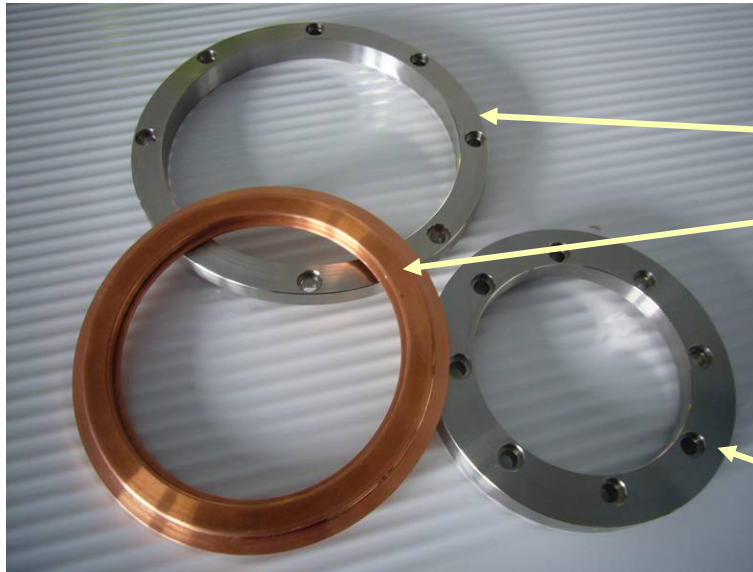
Solutions, RF seal between flanges



two seal solutions:

- thin spring like Cu Be seal, tested – OK
- soft copper seal, test just started





Bias was never necessary
during FLASH operation

- replacing the capacity by a copper membrane
- membrane is clamped between flanges for good RF contact

Replacement of the capacitor, SLAC RF test (Chris Adolfsen)



International Linear Collider
at Stanford Linear Accelerator Center

TTF3 Couplers

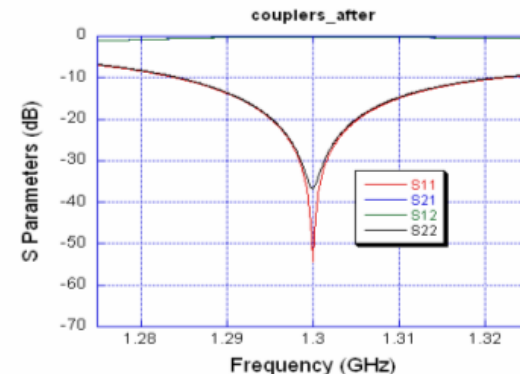
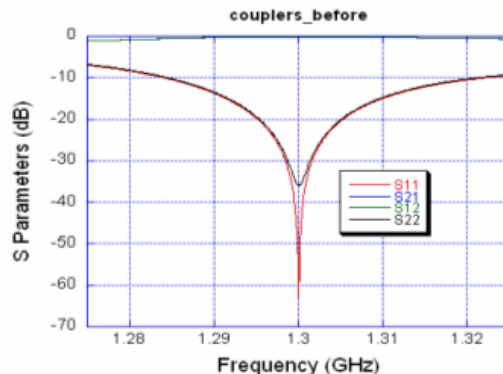
NON STANDARD TEST REPORT

Created by: TN	Date: 03-17-2010	Report # 1
Supplier SLAC NATIONAL ACCELERATOR LABORATORY	Supplier Address 2575 SAND HILL RD MENLO PARK, CA. 94025	
Part name/ Number COAX GASKET GASKET RETAINER GASKET RETAINER P/N: SK-GB-100211 SK-GB-100212 SK-GB-100213	Serial Number(s) 001	Qty 1 EA

TASK: This test was performed on build #4. FC / FH 06 – FC / FH 07
THIS TEST IS WILL MAKE AN ATTEMPT TO RESOLVE THE ISSUE OF THE COUPLERS ARCING DURING TESTING FROM THE CAPACITOR TO THE WAVEGUIDE. THE 0.050 THICK OFF COPPER GASKET, WAS ANNEALED DEAD SOFT IN A HYDROGEN FURNACE, TO BE INSTALLED ON FH06, R.F. IN WAVEGUIDE, IN THE LOCATION WHERE THE CURRENT CAPACITOR ASSY(P/N: RDES9298356F000) IS INSTALLED. BEFORE THE ORIGINAL CAPACITOR IS REMOVED A COLD TEST WILL BE PERFORMED TO ESTABLISH A BASELINE. AFTER THE ORIGINAL CAPACITOR IS REMOVED AND THE NEWLY DESIGNED COPPER GASKET IS INSTALLED IN ITS PLACE, ANOTHER COLD TEST

WILL
GASK
HARI
R.F. I
DATA

Test Documents and Attachments: COLD TEST BEFORE AND AFTER INSTALLING TEST PARTS



TEST SUMMARY:

POST TEST INSPECTION SHOW NO SIGNS OF ARCING