



# TTCS Condenser & Transport tubing Progress Report

AMS- TIM- February 4, 2009  
CERN

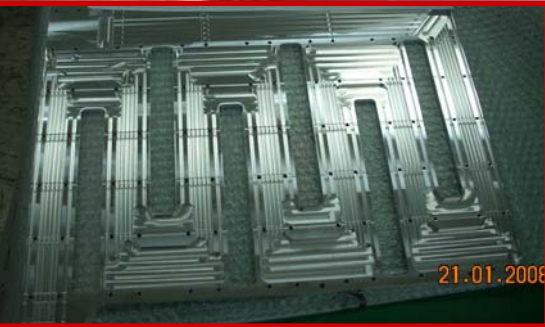
**NLR-team** J. van Es, M.P.A.M. Brouwer, B. Verlaat (NIKHEF), A. Pauw,  
G. van Donk, T. Zwartbol, SM. Bardet

**INFN-AMS-team:** R. Battiston, B. Alpat, C.Gargiulo, E. Laudi, A. Alvino,  
E.Babucci, A.Damiano, L. Farnesini, A.Piluso, S.Bizzaglia et al.

**AIDC-team:** George Y.Y. Shiah, N.J.Lin, Bill C.Y. Hsu, Wei-Min Hsu, Chun-  
Ching Yeh, David Huang, A.J.M. Shue, R. Kuo et al.

**Sun Yat-Sen University team:** ZH. He, KH. Guo, JQ. Ni, SS. Lu, XZ. Wang,  
XM. Qi, TX. Li, YH Huang, WJ Xiao

# Condenser: assembly sequence



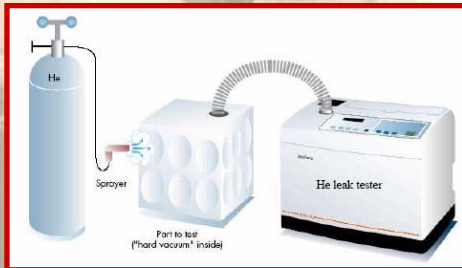
1. Manufacturing



2. Bending



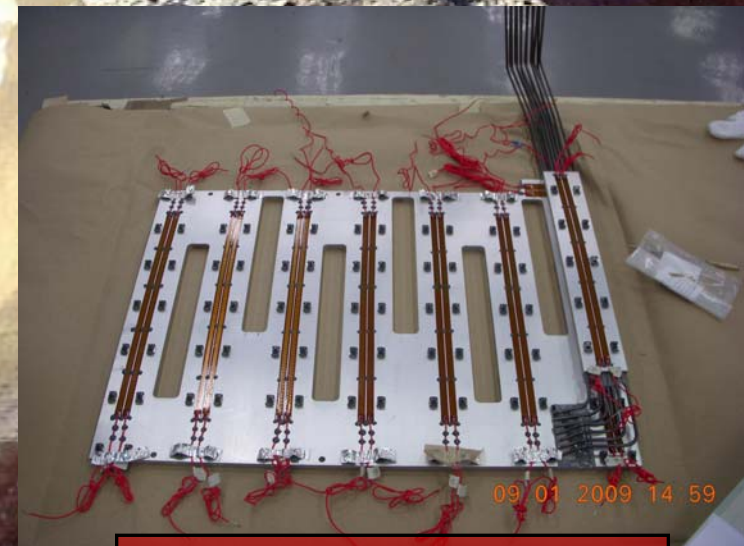
3. Brazing



4. Helium leak test and proof pressure test



5. Gluing

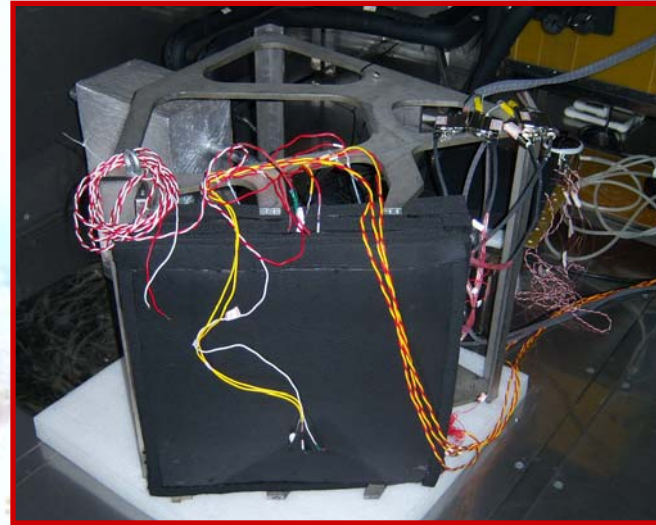


6. Heater installation

# Condenser: assembly sequence



7. Assembly to transport jig



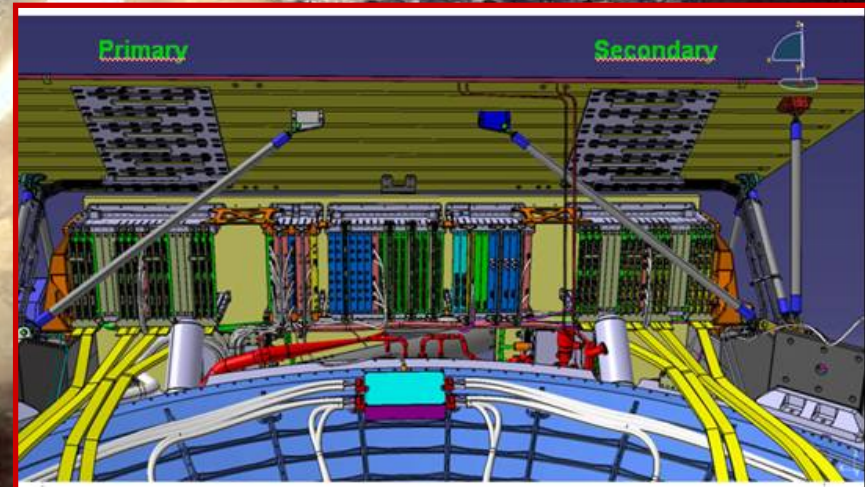
QM

8. Integration on SYSU test loop



4FM's

8. Integration on AMS02



# QM Condenser status

- ❑ QM has been shipped to SYSU for thermal testing. The tests performed were successful (Prof. He presentation)
- ❑ Lesson learned from QM manufacturing:  
review of the fastener design



- ❑ From a *fixed* nutplate....

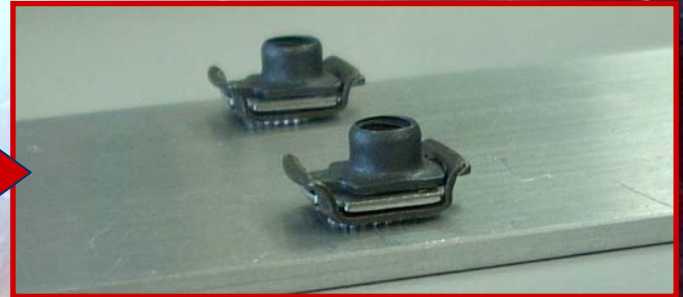
# FM Condenser new design

□ ... to *Replaceable floating* nutplate :

After a strong effort between NASA/NLR/INFN/AIDC:

□ *Nutplates (NASA)*

*GFP6010L-6A*



□ *Installation tool*

*(NLR/INFN) DCBT8600-6:  
adaptation by NLR/AIDC*



□ *Removal tool (NLR/INFN)*

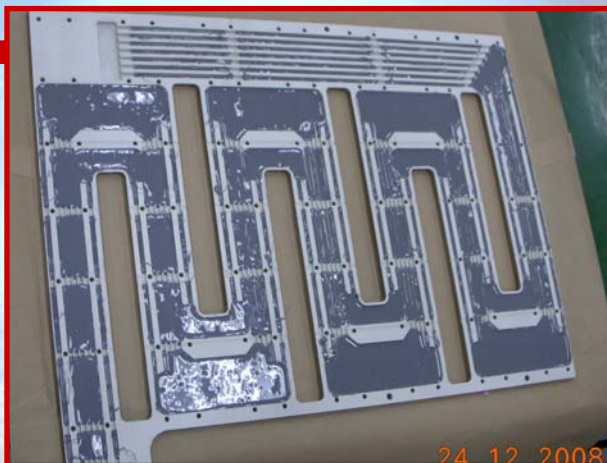
*RB6527-01: adaptation by  
AIDC*



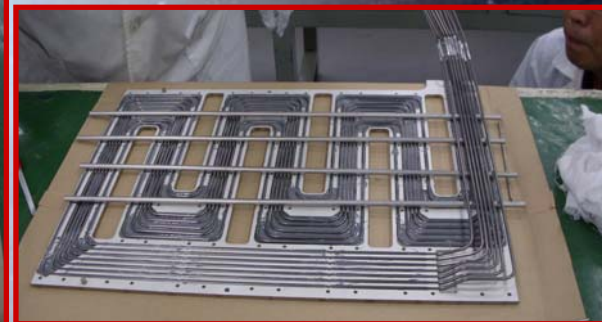
# FM Condensers status-The Gluing recipe...



Do a surface treatment



Put the glue inside the pockets and the channels



Press the tubes



Complete fill the surface with the glue

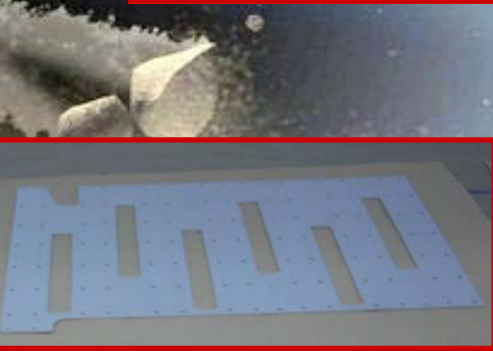


DAY #1

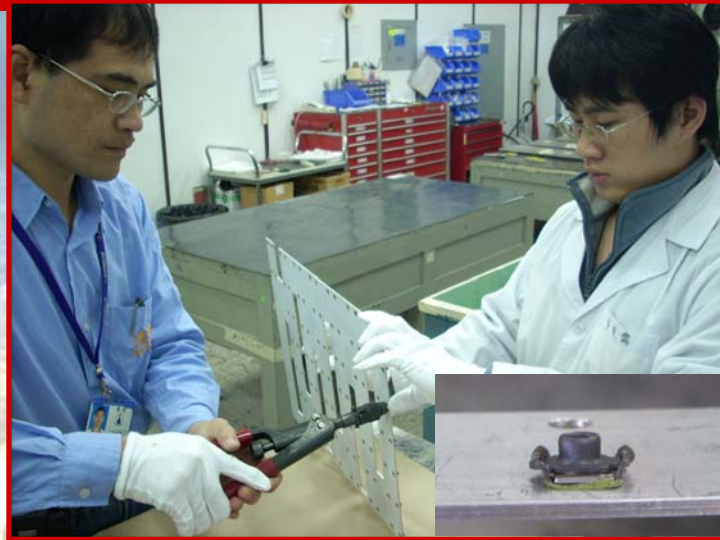


Put the assembly in a vacuum bag

# FM Condensers status-The Gluing recipe...



Do a surface treatment



Install 88 nutplates



Install foil heaters



31.12.2008 14:13

DAY #2

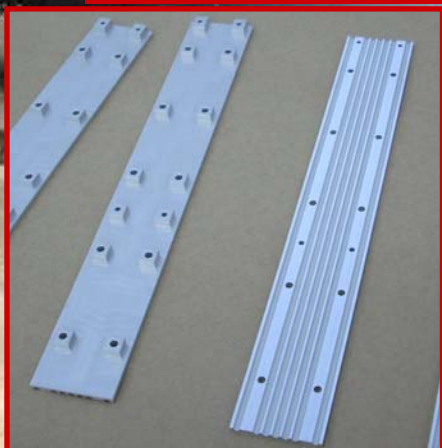


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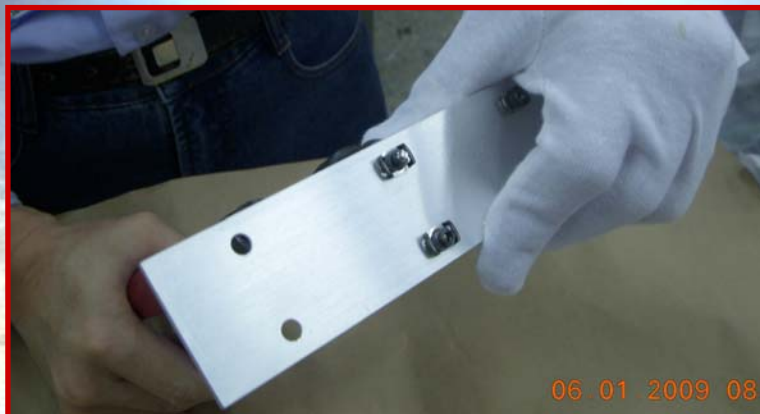
Put a glue layer on the top plate

Put the assembly in a vacuum bag

# FM Condensers status-The Gluing recipe...



Do a surface treatment



06 01 2009 08

Install 10 nutplates

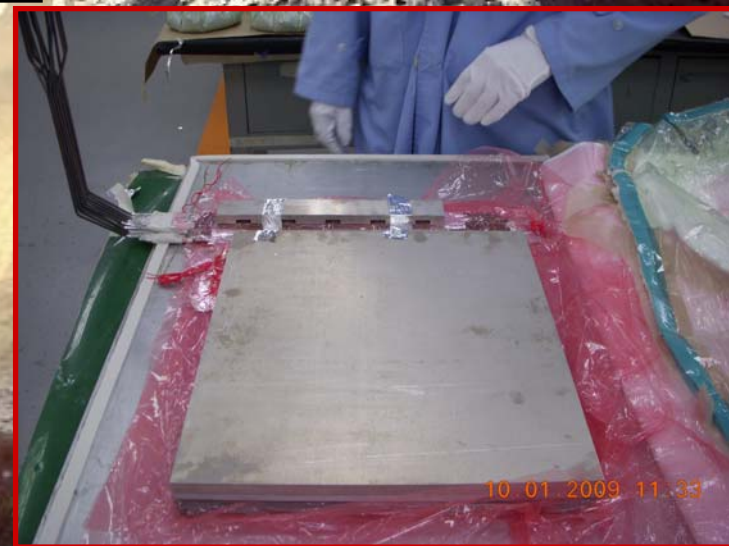


Remove the nut



DAY #3

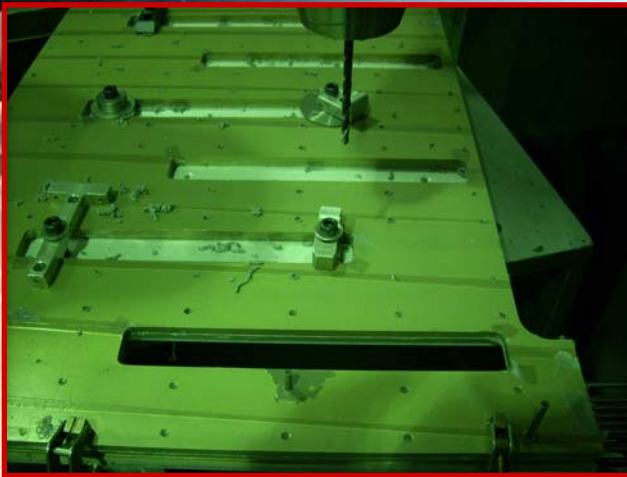
Put a glue layer between the strain relief plates



10 01 2009 11 33

Put the assembly in a vacuum bag

# FM Condensers status-The Gluing recipe...



Drill out the glue



DAY #4



Install the top plate heaters



Re-install the nut



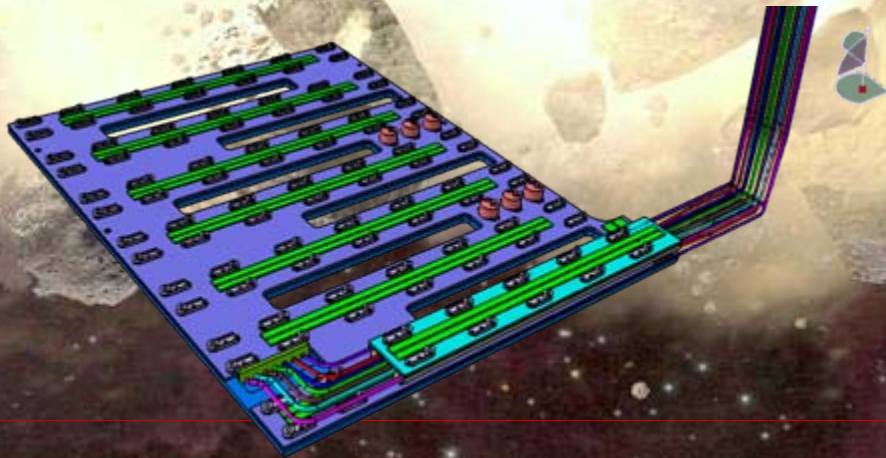
The "sandwich" is ready



# FM condensers status

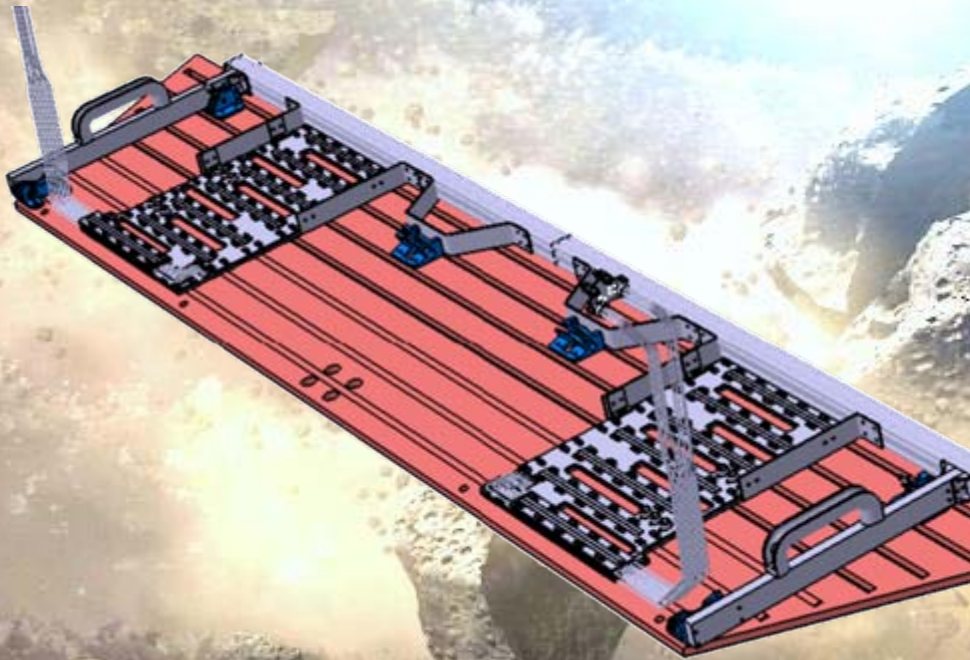
- ❑ 3 FM condensers are completed; FM4 gluing is on going
- ❑ Next Activity at AIDC:
  - Foil Heater test before shipping to CERN by the end of February

- ❑ Next Activities at CERN:
  1. Installation of the wire heaters
  2. TS gluing

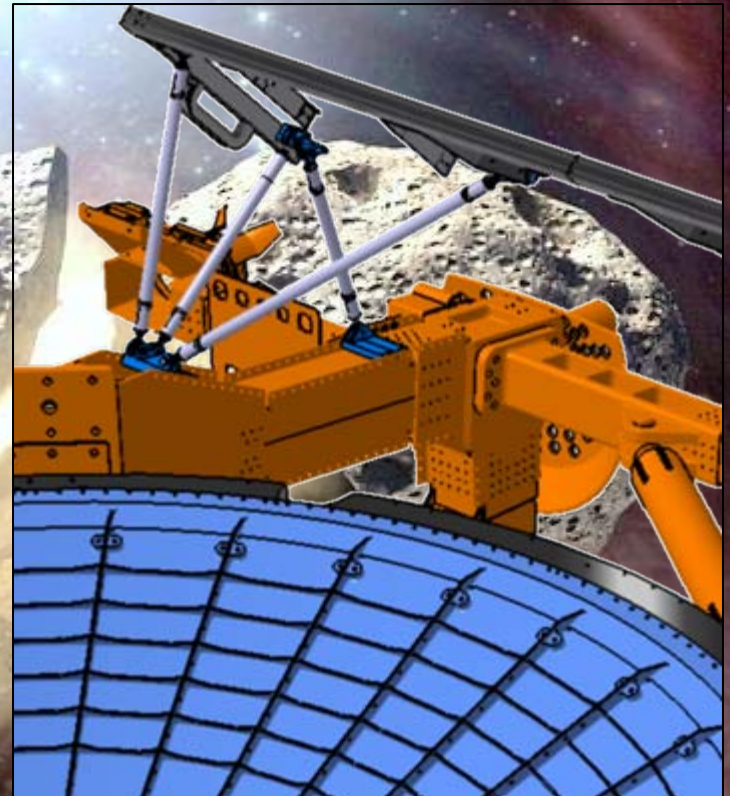


# FM Condensers status

3. Installation to the Tracker Radiator using the integration jig according to the approved sequence:



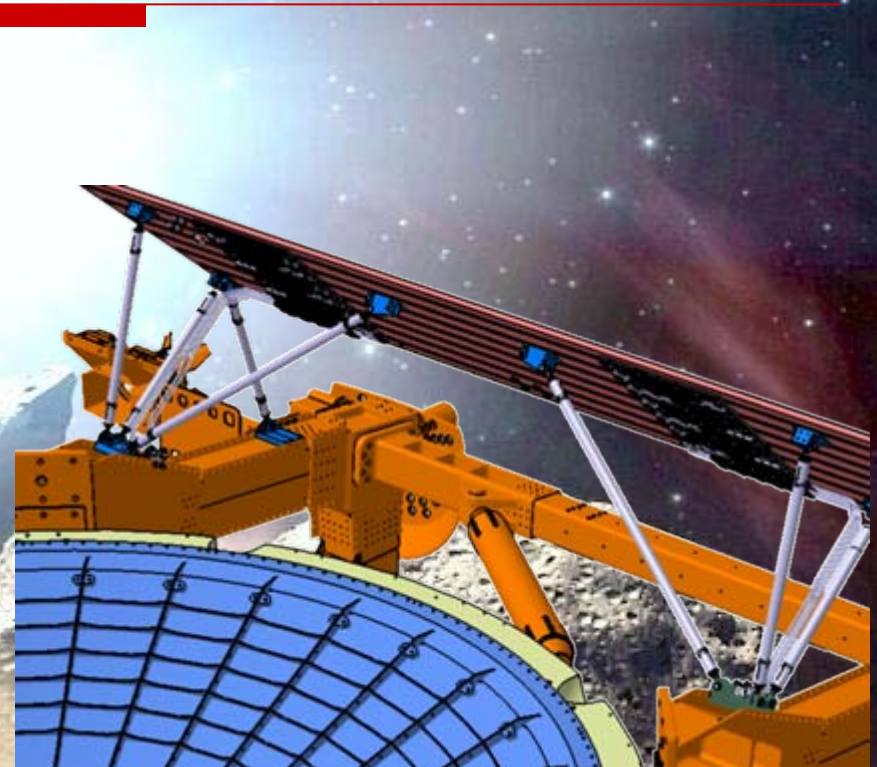
Condenser+ Jig + Radiator (OFF-LINE)



Integration Jig

# FM Condensers status

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**Condensers + integration jig**  
**Welding between manifolds**  
**and transport tubes**

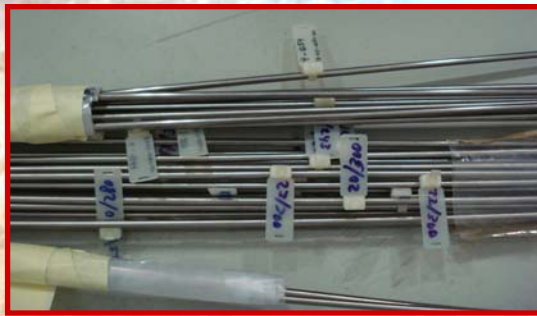
**Radiator installation and jig**  
**removal**

# TTCS transport tubing status

## Integration activities at CERN:

### 1. Equipment survey:

- The tubes have been measured and the batches have been tabled; The cut tubes and the relative scraps (useful for welding qualification) have been labeled with DWG number, part number, length and relative batch



- The brackets (AIDC) & fasteners (NASA/CERN) necessary to hold TTCS tubing have been gathered, inspected and packed. Only few things are missing

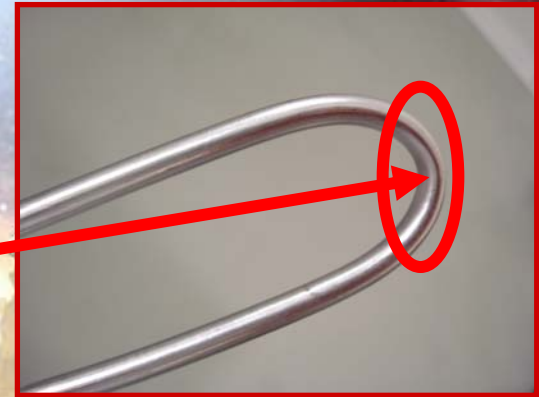


# TTCS transport tubing status

- Integration activities at CERN:
- 2. **Bending of the tubes:**
- Test on a tube: 10 mm radius using the simple tool available; the tool turned out to be unsuitable for a small bending radius



Tube starts  
Kinking/buckling



On going the procurement for a new tool: bending operation to start since February 10th



# TTCS transport tubing status

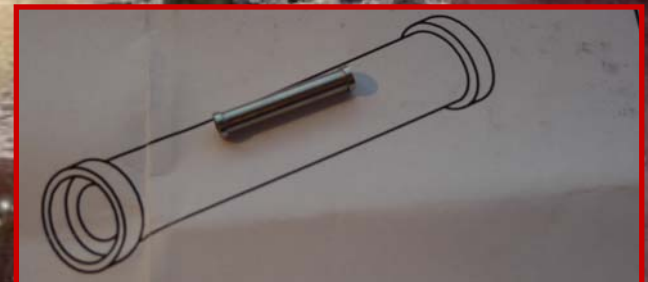
□ Integration activities at CERN:

## 3. Welding:

□ Orbital welding qualification:

- 3 samples - LOW current (or voltage) → tensile test(2); sectioned/inspected (1)
  - 3 samples - NOMINAL current (or voltage) → tensile test(2); sectioned/inspected (1)
  - 3 samples - HIGH current (or voltage) → tensile test(2); sectioned/inspected (1)
- To reduce the number of welding samples:

a special SS joint (suggested by Mr. Sid Mc Clure) to make the alignment of the tubes easier and more precise than a simple butt weld



# TTCS transport tubing status

- Integration activities at CERN:
  4. Bracket installation:

T brackets to hold TTCS tubes from TTCBP to RAM radiators



Brackets to hold both cables and TTCS pipes on the conical flange



Brackets to hold connectors between evaporator and transport tubes

