

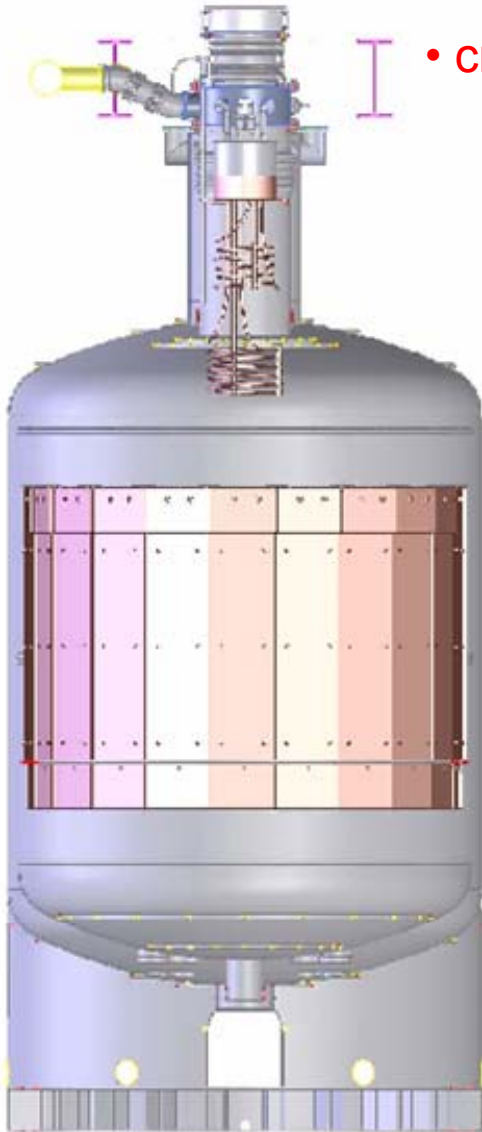


# **Cryogenic Vessel & Infrastructure**

## **Status Report for TG04**

K.T.Knöpfle  
MPI Kernphysik, Heidelberg  
[ktkno@mpi-hd.mpg.de](mailto:ktkno@mpi-hd.mpg.de)

GERDA Collaboration Meeting at Cracow  
18 - 20 February 2008



- cryostat fabrication

schedule v6

installation makrolon / superinsulation  
inner/outer vessel integration

tests:

pressure, He leak, loads,

evaporation, Rn emanation

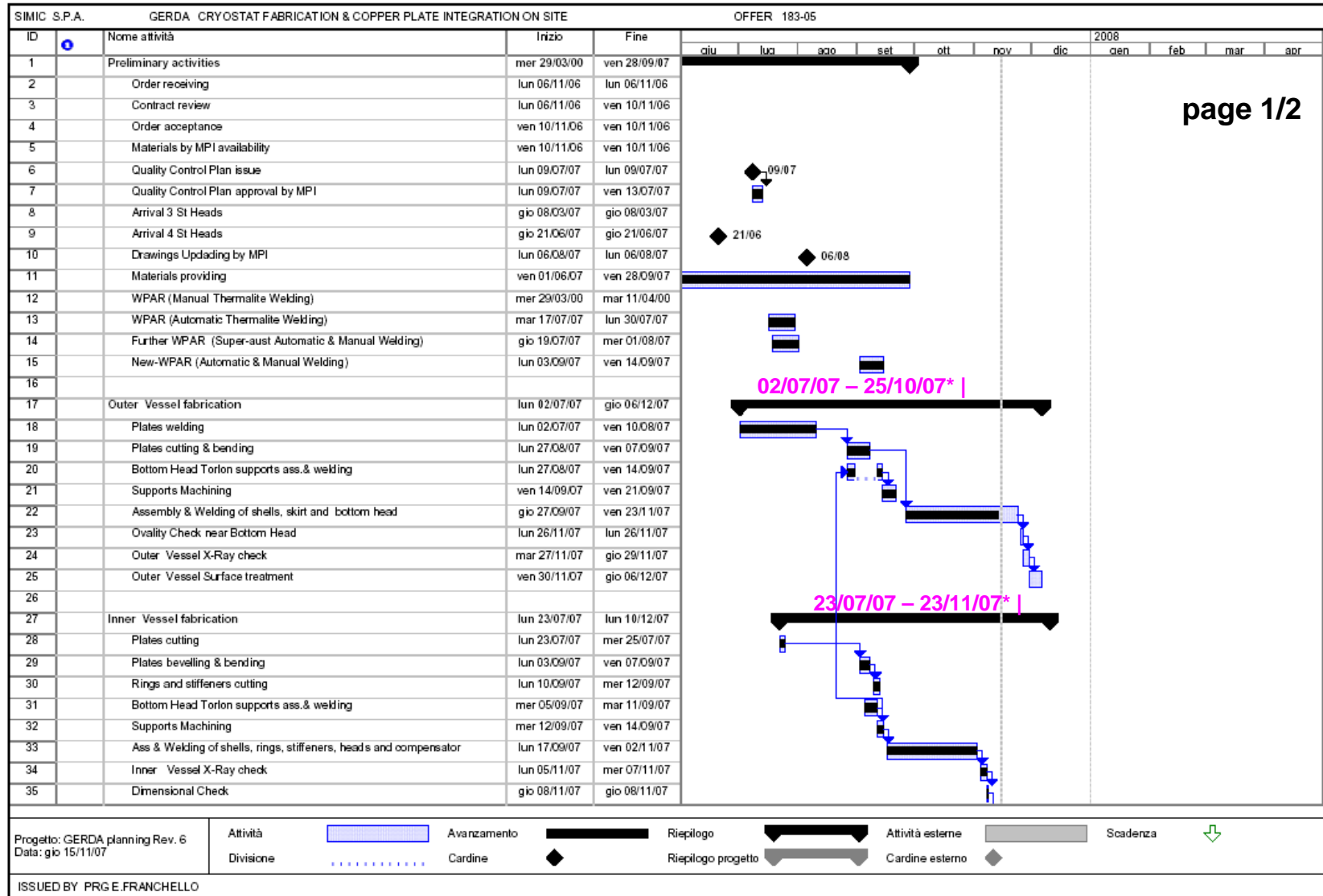
mounting tool for copper shield

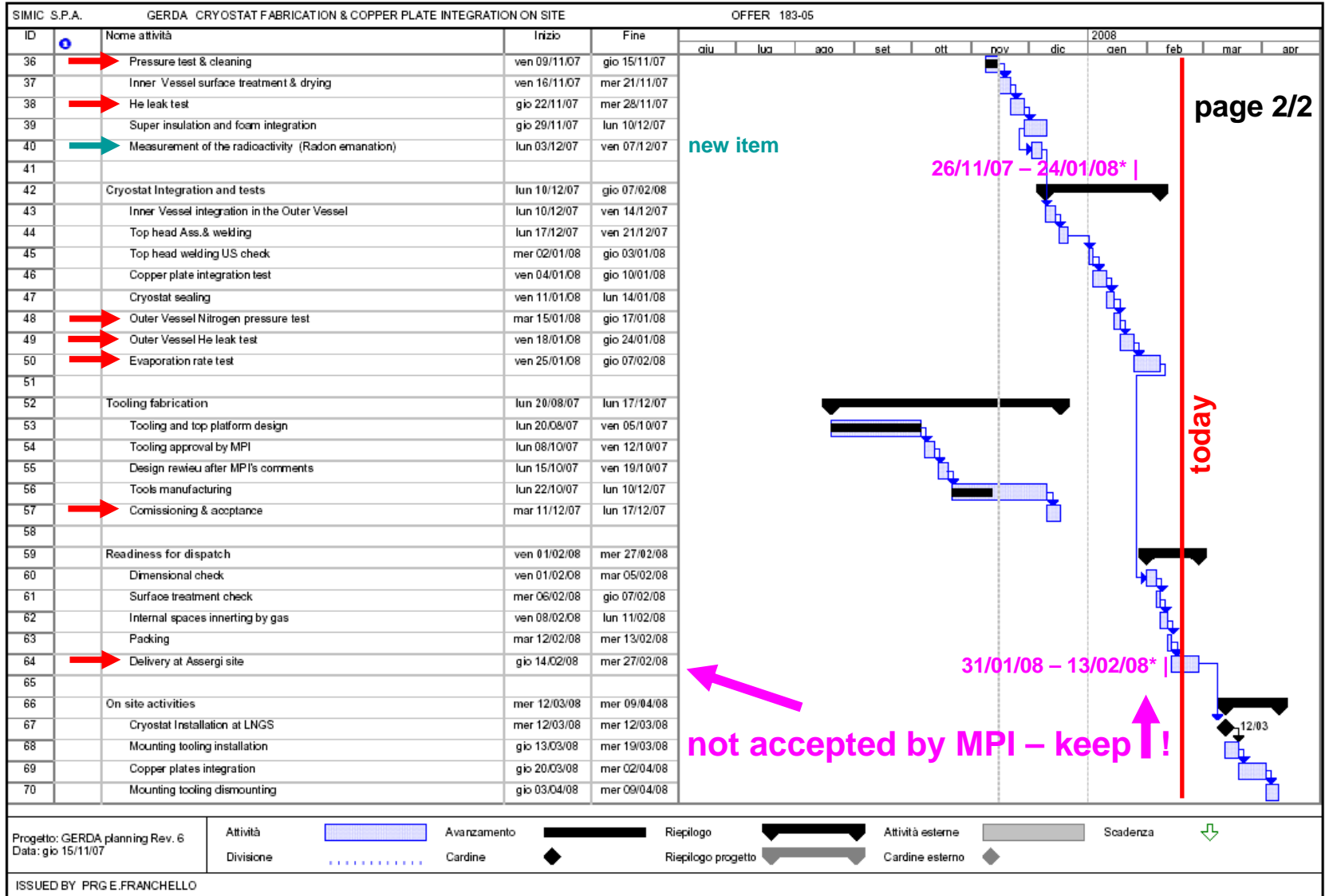
- cryogenic infrastructure

status of tendering

- conclusions







page 2/2

today

not accepted by MPI - keep!

He leak test inner vessel  
after pressure test on 12nov



26nov07

part of outer  
vessel

skirt

26nov07

installation superinsulation



04dec07



Makrolon installed below SI:  
9 pcs: 1811x1396x6 mm  
9 pcs: 2001x1396x6 mm





parallel to SI installation

**Rn emanation test**

- more in Hardy's talk -



05dec07

inner / outer vessel integration



12dec07

VERMAZZA

VERN





03206

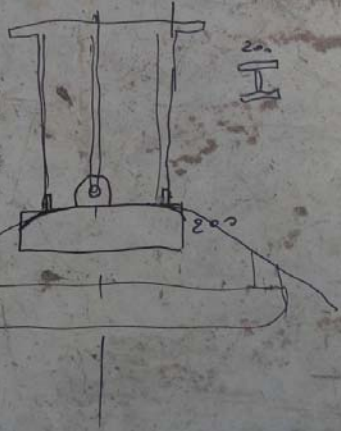
ABAZA

**JLG LIFT**  
S.A.V.I.S.  
PIATTAFORME AEREE  
TORINO - TEL. 011/26184

Marklift

SHRIC  
SAVVIS

concrete design  
of 6dec07



ceiling almost too low



**verify**

(a) alignment of top and bottom pads

(b) equal load distribution on all 8 pads

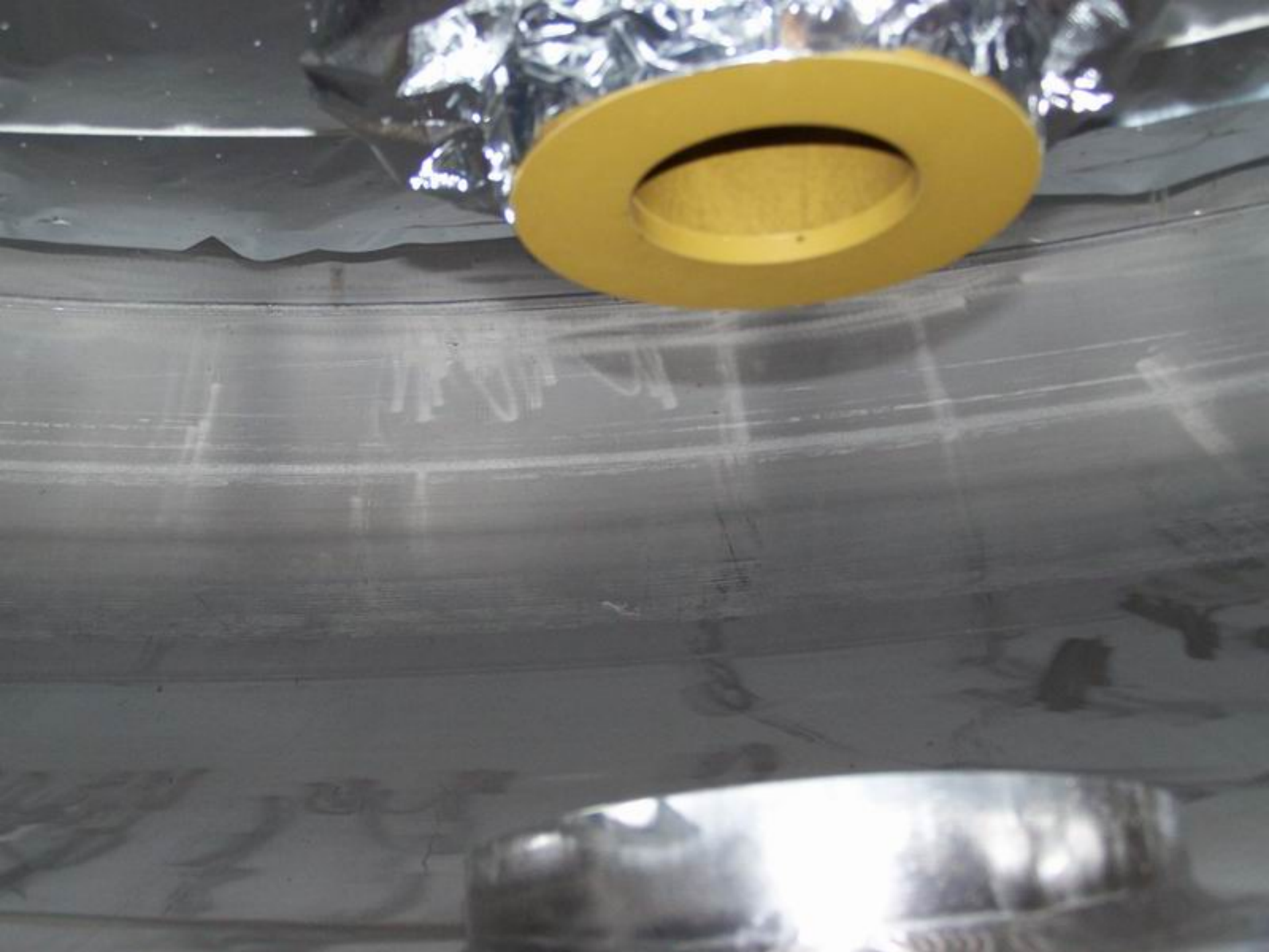


JLG LIFT





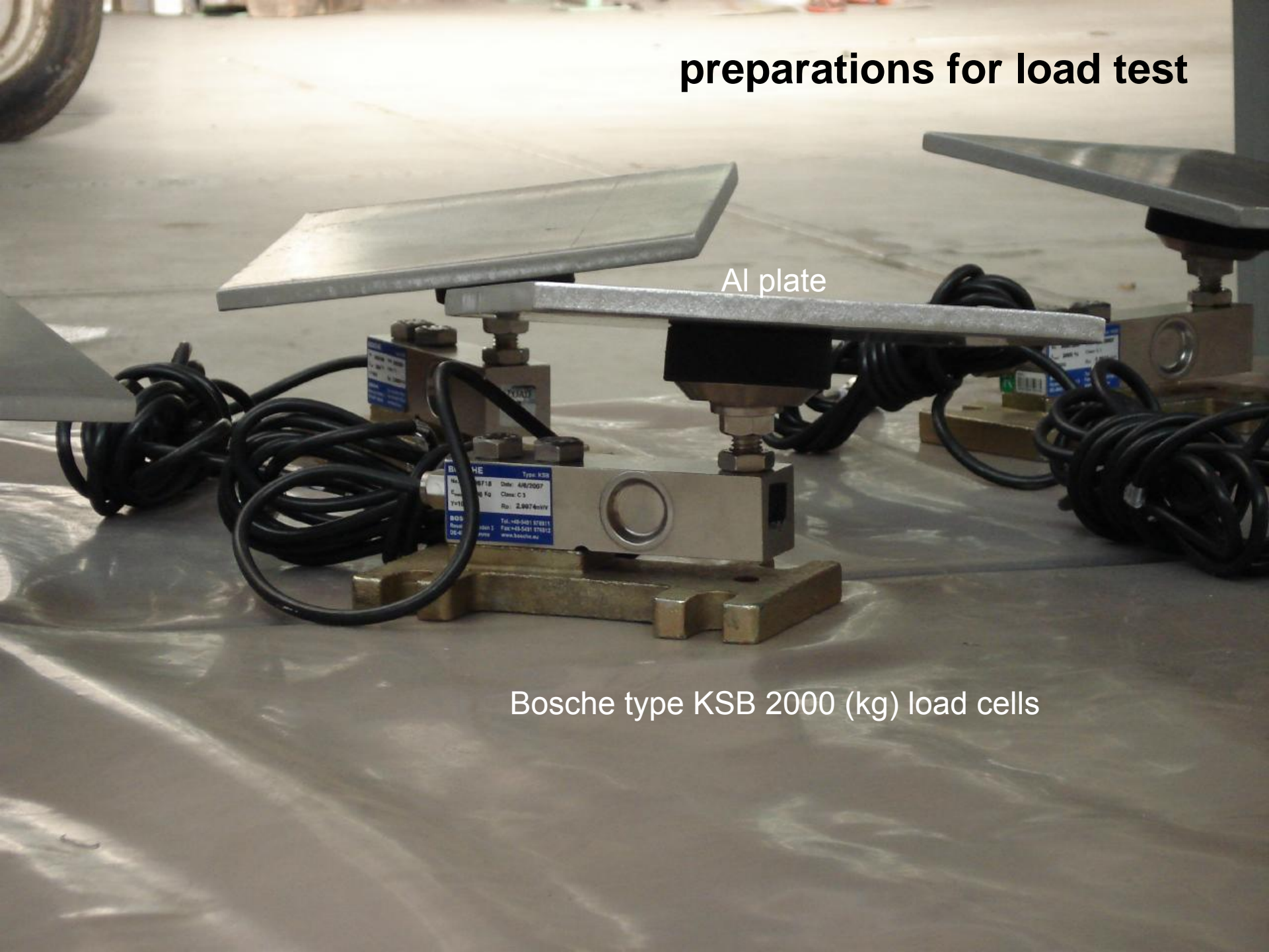


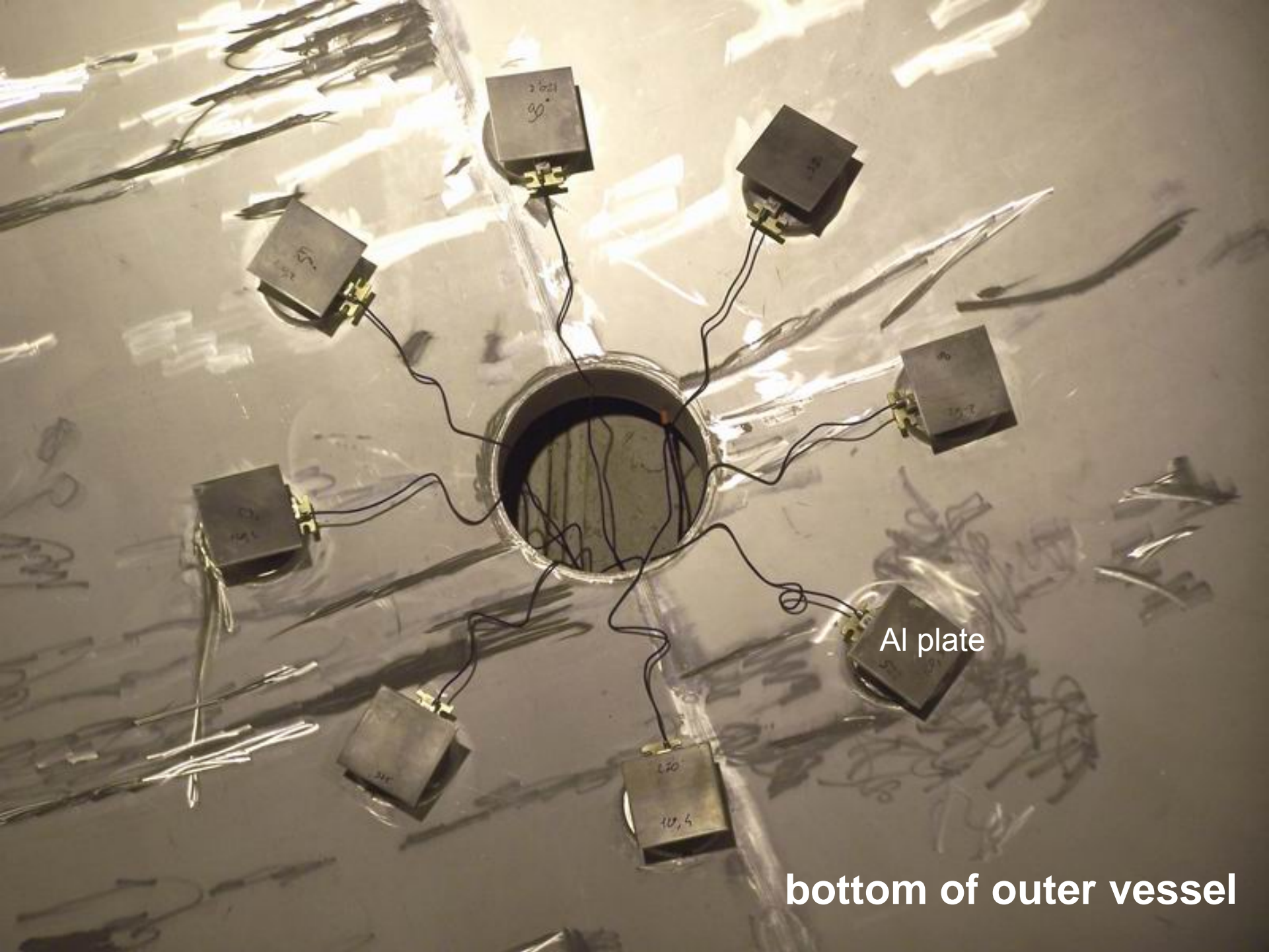


# preparations for load test

Al plate

Bosche type KSB 2000 (kg) load cells





Al plate

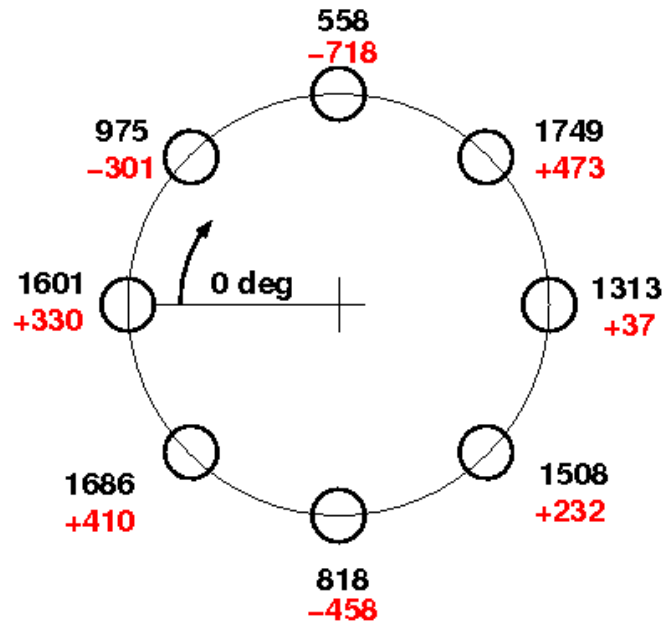
bottom of outer vessel

12dec07



load test in progress

## results



total: 10208 kg  
ave : 1276 kg

stiffness of Belleville springs:  
59 kN / mm each

neck covered with SI



ring to generate cylindrical shape

13dec07

end of 2007

vessel height 25 mm less than specified



20dec07



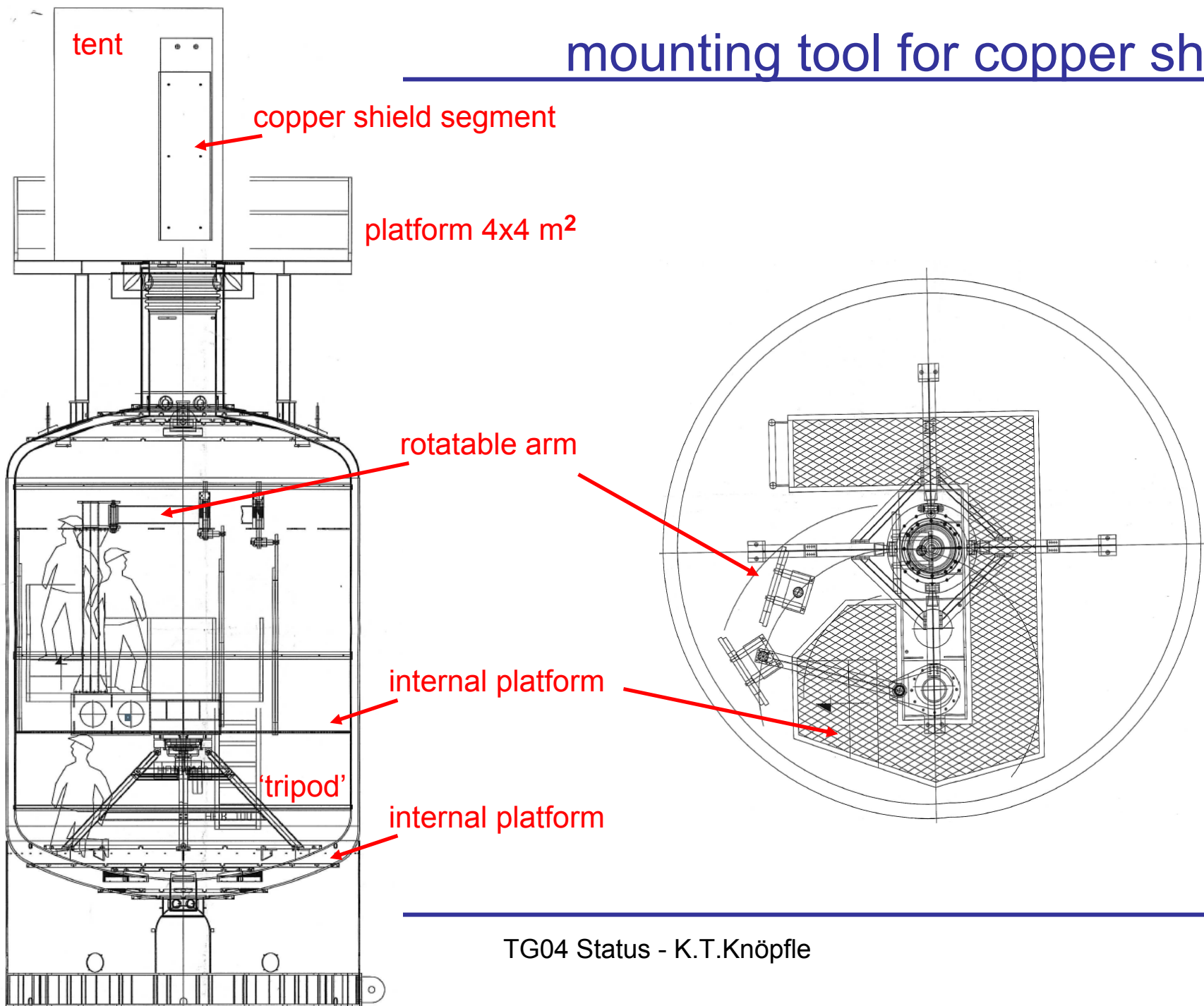
2008

pumping for acceptable isolation vacuum



14jan08

# mounting tool for copper shield



view from platform

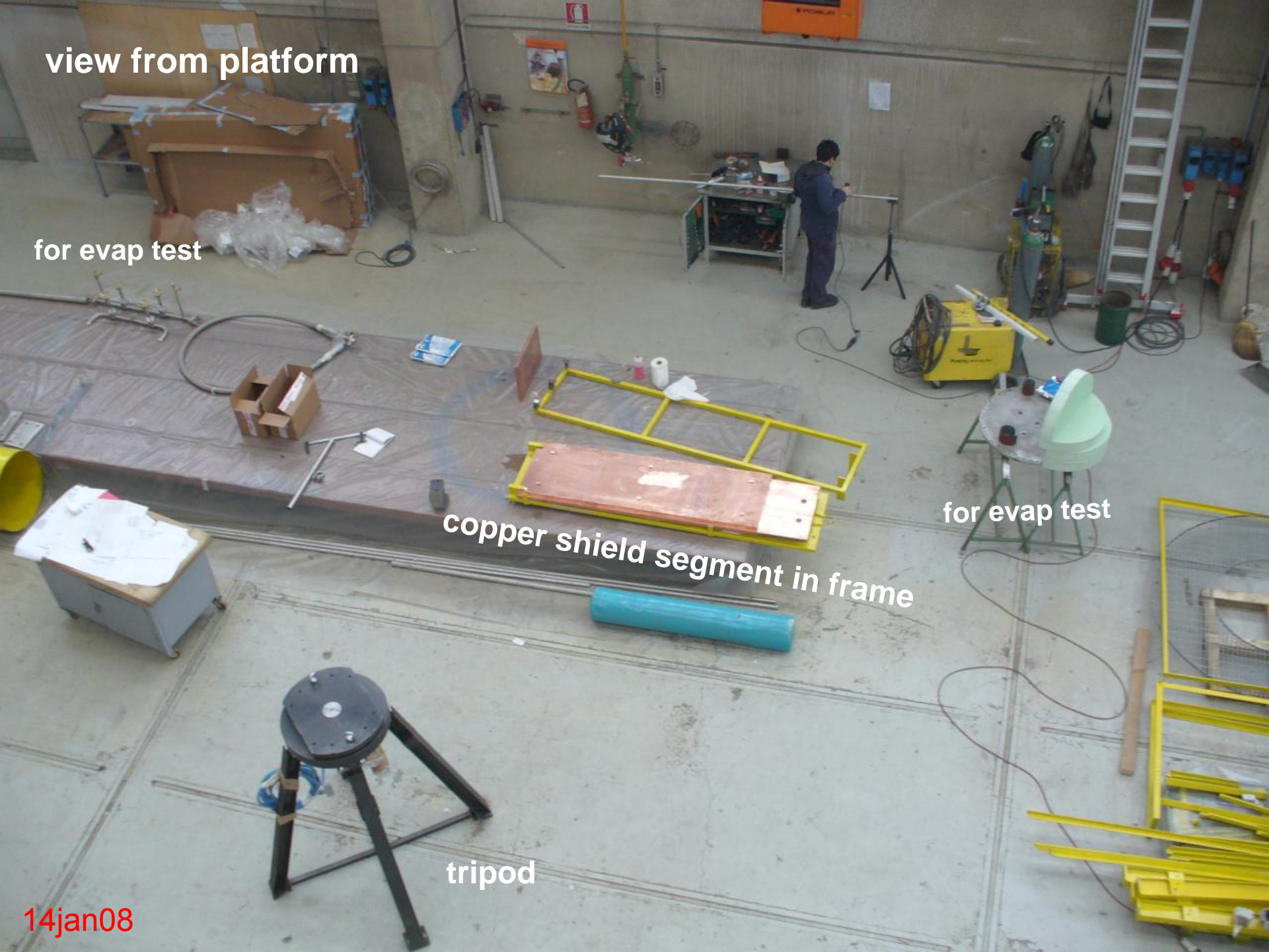
for evap test

copper shield segment in frame

for evap test

tripod

14jan08



# mounting tool - parts



2008 Feb 18

TG04 Status - K.T.Knöpfle





installation thru neck



installation test of large segment








installation test of large segment

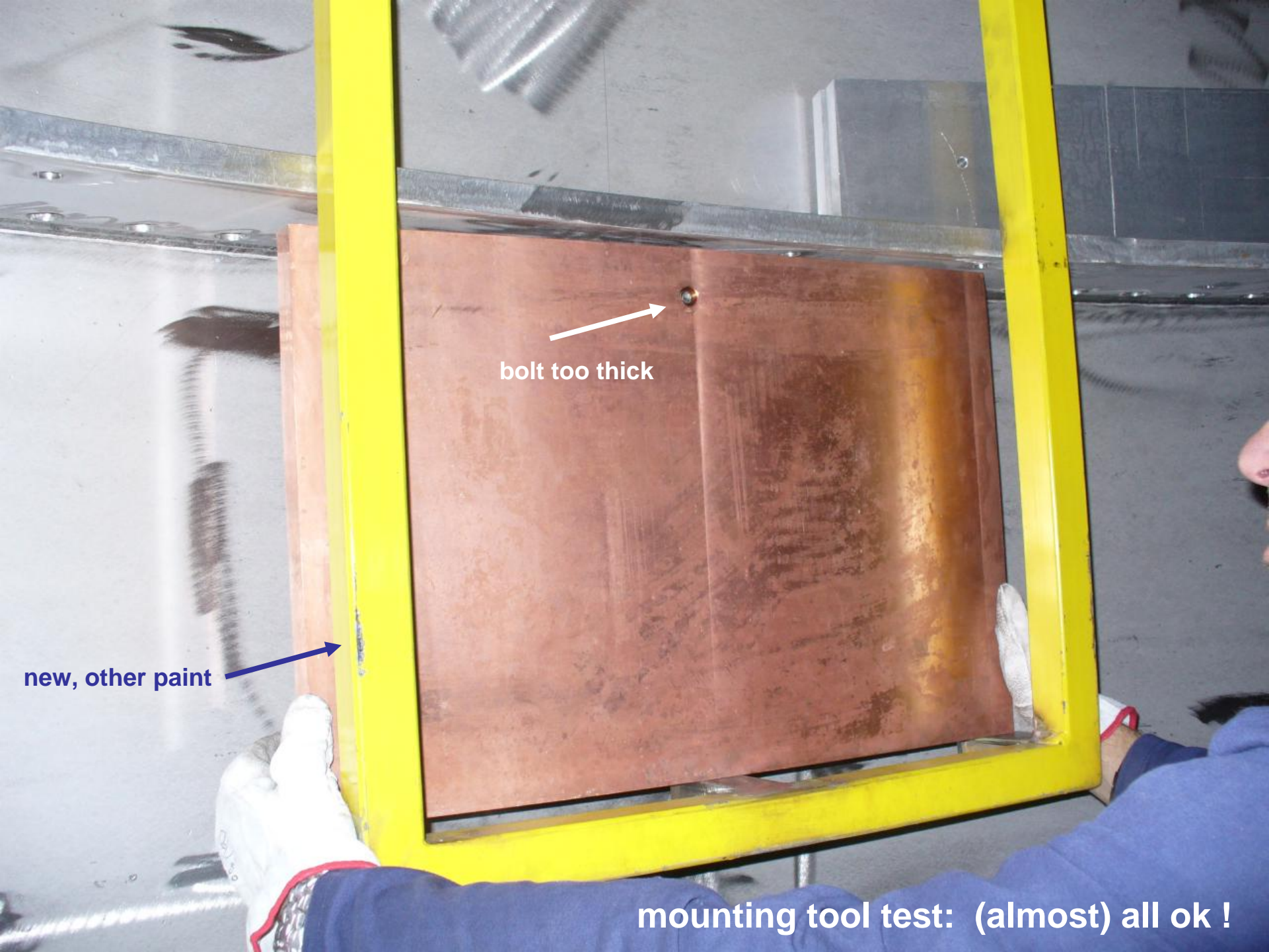


one of 20 Al dummies

installation test of large segment



installation test of small segment



bolt too thick

new, other paint

mounting tool test: (almost) all ok !

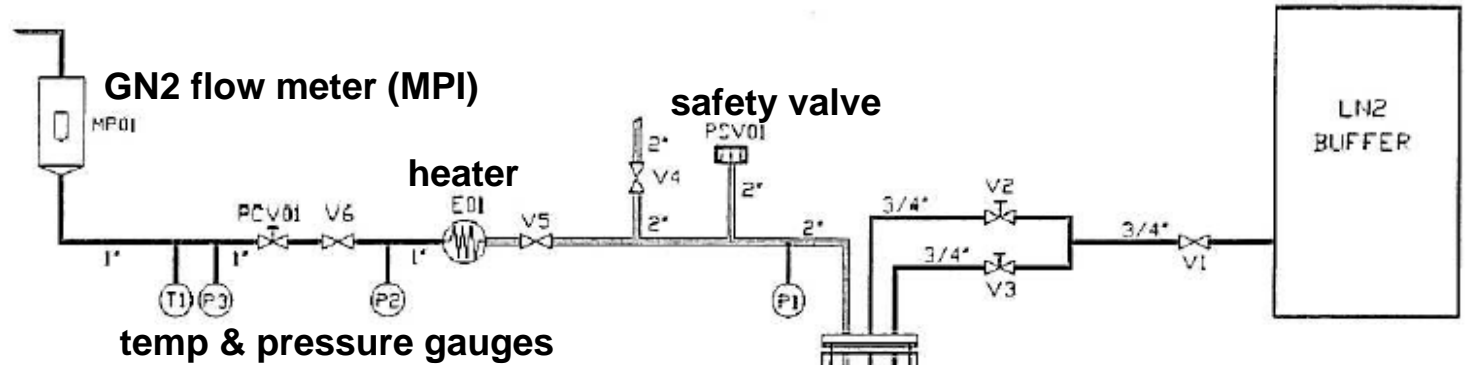
# He leak test of isolation vacuum volume



15jan08

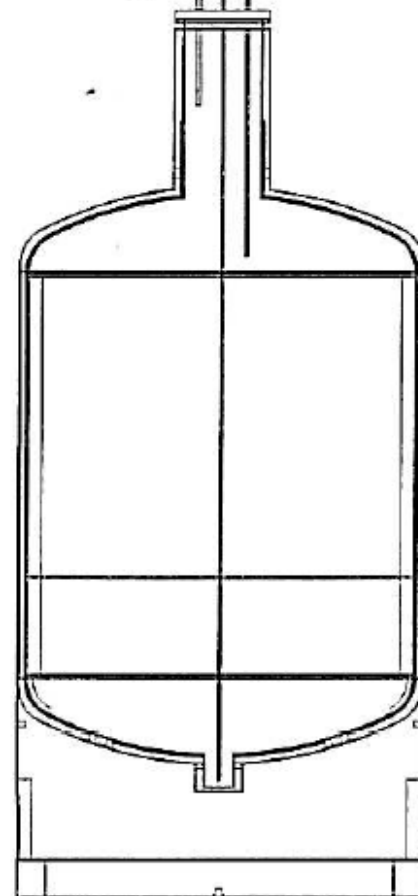
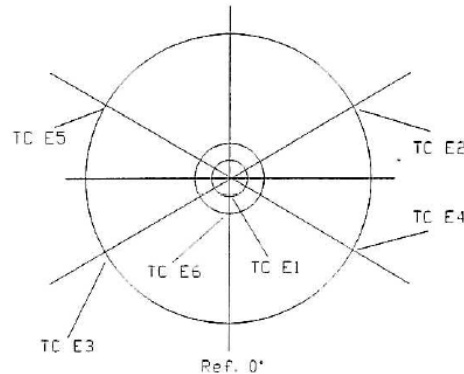
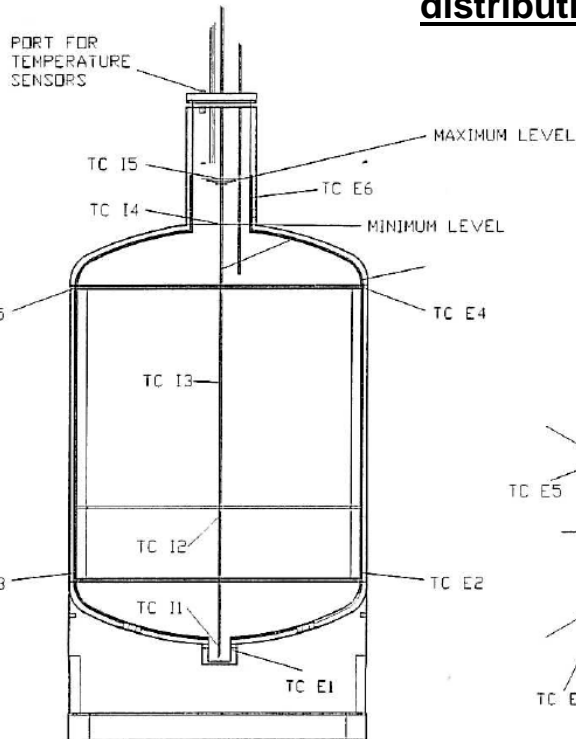
small problem fixed with Terostat

# setup for evaporation test



## distribution of thermo couples

control of  
cool down (ok)  
fill level (not ok)



Mo/Tu cool down  
Tu/We filling  
We/Th settling  
Fr/Mo measure  
Mo/We drainage  
Th/Mo warm-up



23jan08



GN2



heater

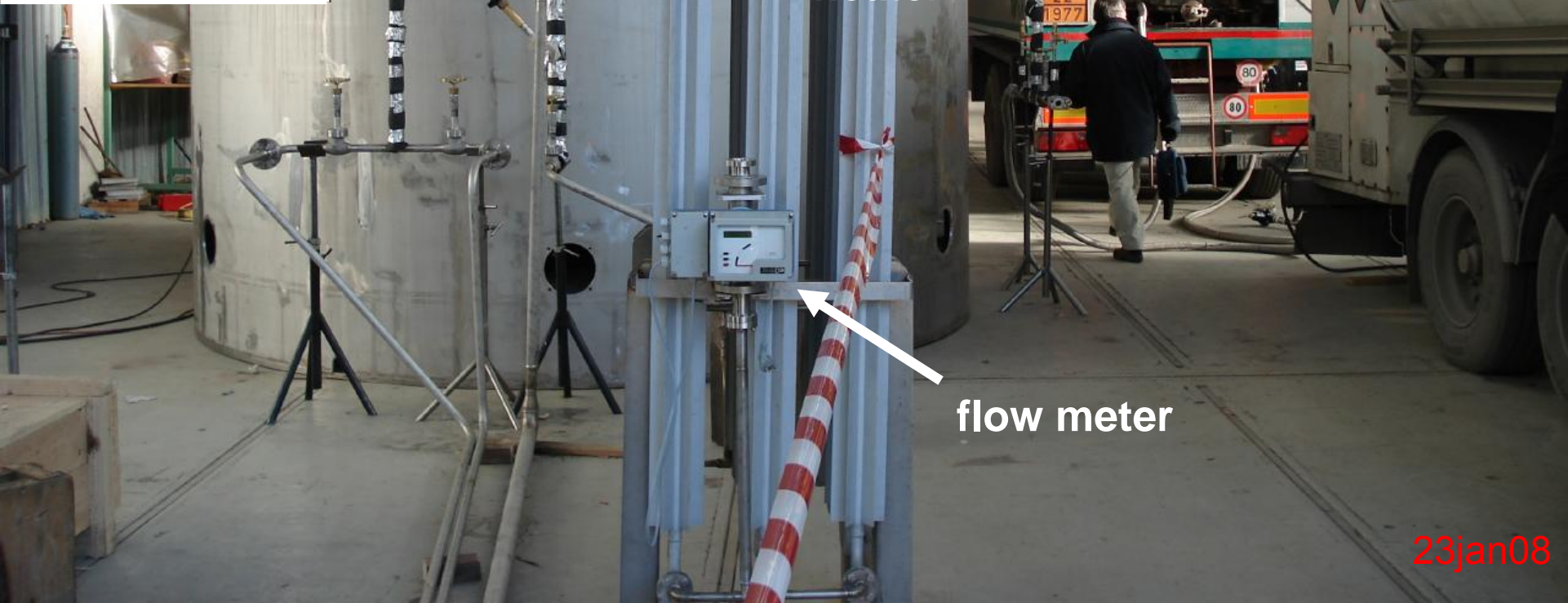
LN2



25 m<sup>3</sup>  
LN2

flow meter

23jan08







23jan08



to pump

TC feed-thrus



24jan08



← W10

pump stand

Marktfit

REIFFER VACUUM

23jan08





600 m<sup>3</sup>/h 'ambient  
air vaporizer'



# evaporation test

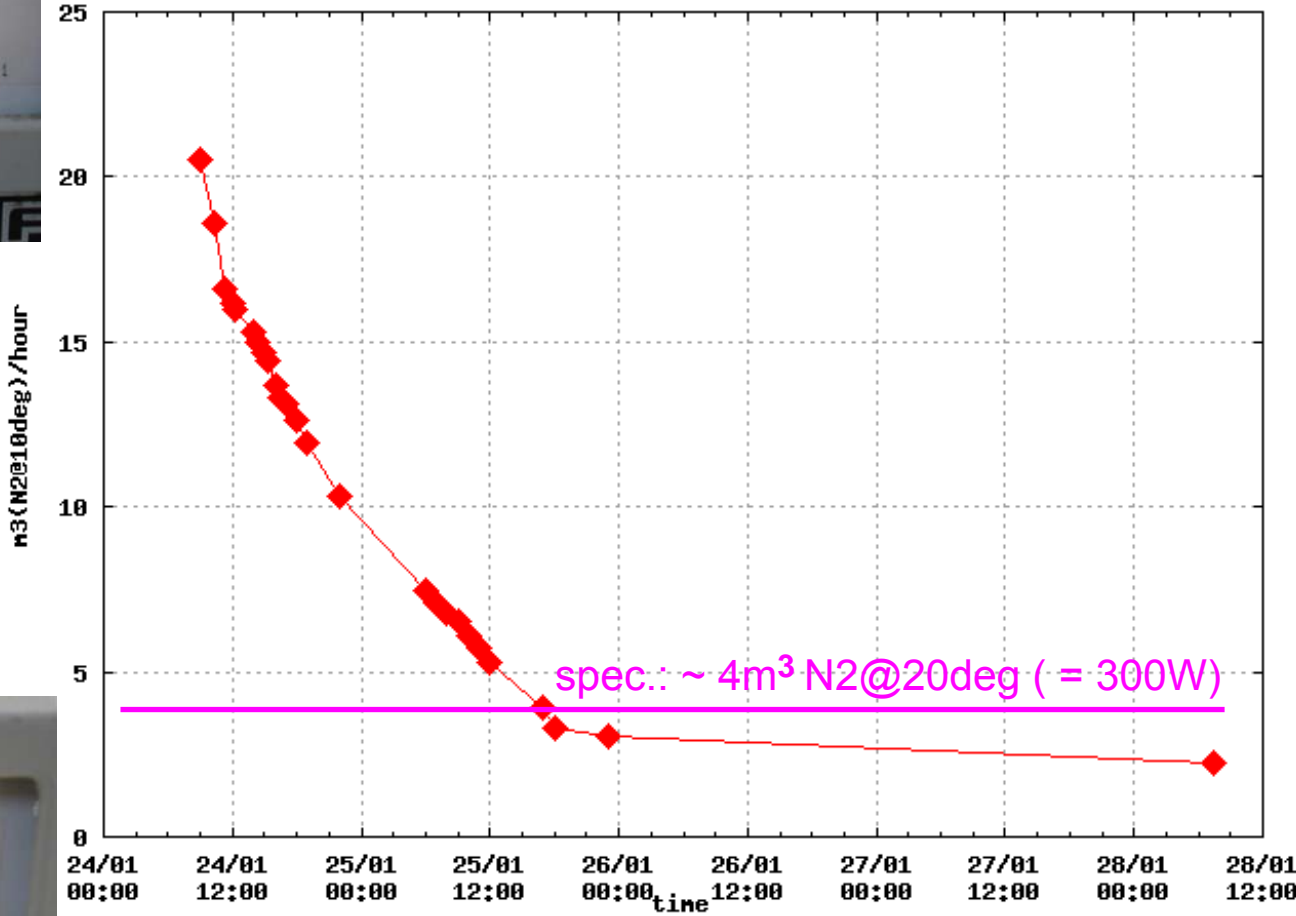


24jan08 9:07

25jan08 12:14

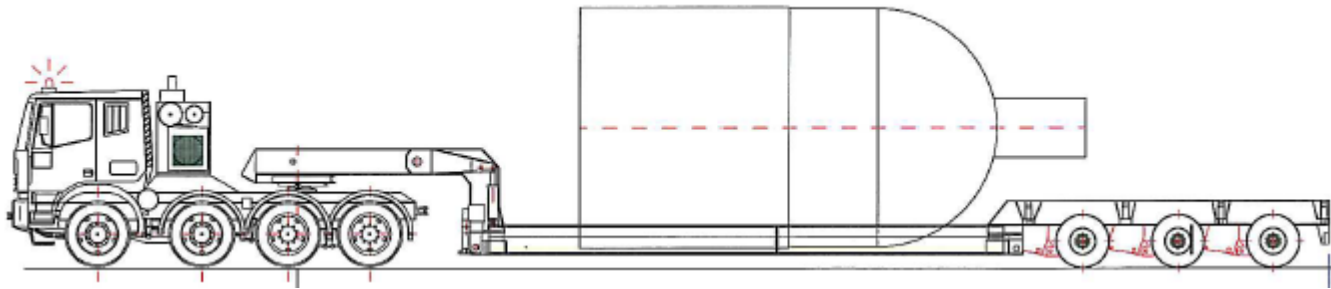


LN2 EVAPORATION TEST AT SIMIC (2008)



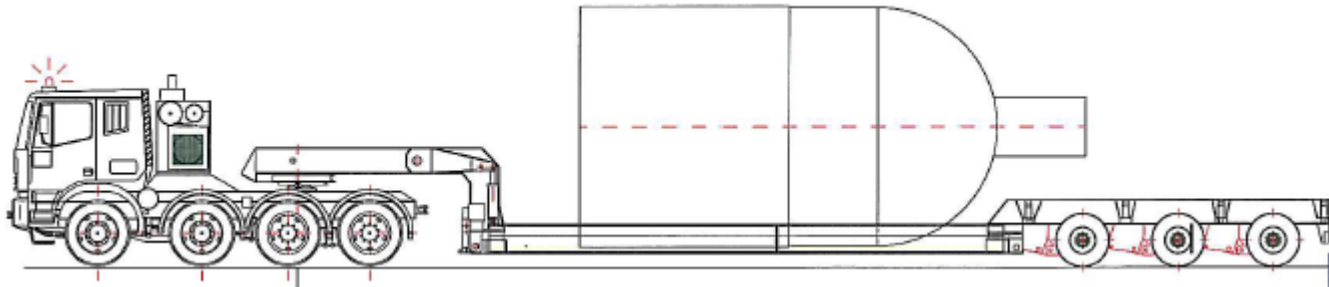
very nice result !

# why GERDA cryostat not on photo?



**! W10 !**

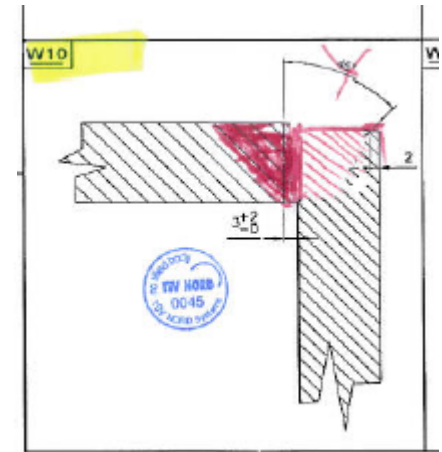
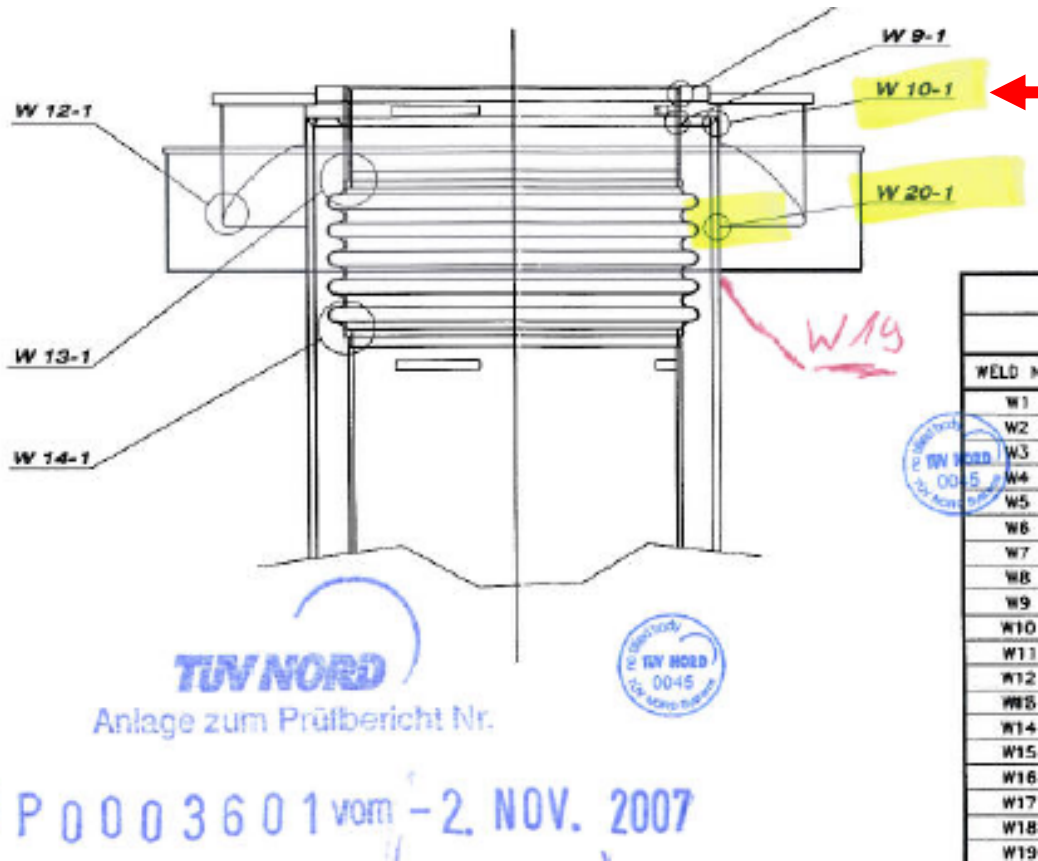
**outer vessel pressure test 2x postponed**





# parts of TÜV approved weld map

weld W10



modification by TÜV -  
however, previous design  
(45 deg at cylinder)  
also accepted

Fillet weld (,Kehlnaht') not allowed by AD2000!



20dec07

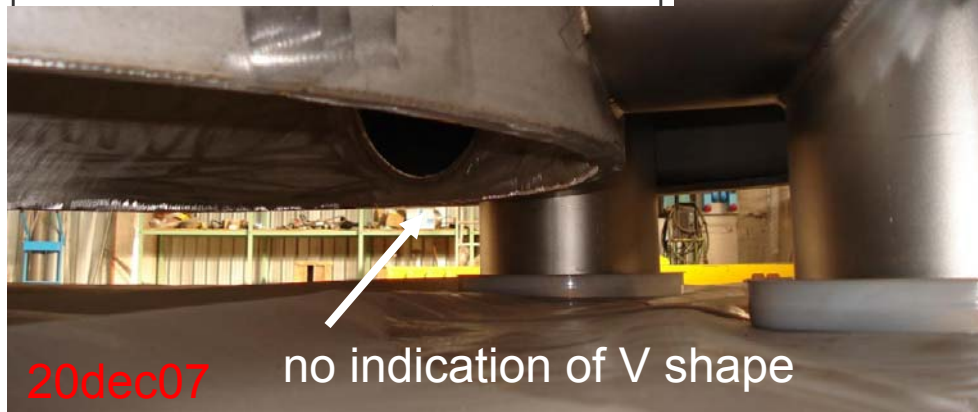
SIMIC SPA CAMERANA (CN)	WELDING PROCEDURE SPECIFICATION	WPS N° 16155/13 rev.2 DATE 11/12/2007
----------------------------	---------------------------------	--

Supporting: \_\_\_\_\_ WPAR 0036/MI/S/T-0410-2007

Welding process: a) \_\_\_\_\_ GTAW - 141      Welding type: a) \_\_\_\_\_ Manual  
 b) \_\_\_\_\_      Welding type: b) \_\_\_\_\_  
 c) \_\_\_\_\_      Welding type: c) \_\_\_\_\_

JOINT		WELDING SEQUENCE DETAIL	
Joint	Fillet		
Backing	Yes		
Backing material	Base metal		
Branch connection angle	n.a.		
BASE METAL			
Group	8.1		
Specif. Type and grade	1.4404		
to specif. Type and grade	1.4404		
Thickness			
Butt joint	3 to 24 mm		
Branch connection			
Fillet Base metal			
Throat thickness			
Outside diameter	> .500 mm		
Fillet joints	> 150 mm (PA weld pos)		

FILLER METAL		
Electrode classification	N.A.	
Wire classification	EN 12072: W 19 12 3 L	trade name <b>Thermanit GE 316L</b>



20dec07

no indication of V shape

communicated 11feb08

SIMIC (Dr. A.C.) on Thursday 14 Feb 08, 17:45, by phone:

- 1) W10 weld is fillet weld ('Kehlnaht')
- 2) fillet weld can be certified according to ASME
- 3) little delay since SIMIC is familiar with procedure
- 4) detailed calculations to follow

No official written statement by SIMIC available until now.

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Document 2008-27384-EN



Current language Data

31/01/2008 S21 European Communities - Supply contracts - Open procedure

I. II. III. IV. VI.

D-Heidelberg: Piping

2008/S 21-027384

CONTRACT NOTICE

Supplies

## SECTION I: CONTRACTING AUTHORITY

### 1.1) NAME, ADDRESSES AND CONTACT POINT(S):

Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. Max-Planck-Institut für Kernphysik, Max-Planck-Institut für Kernphysik, D-69117 Heidelberg. Tel. (49-6221) 51 60. E-mail: [Einkauf@mpi-hd.mpg.de](mailto:Einkauf@mpi-hd.mpg.de). Fax (49-6221) 51 62 20.

#### Internet address(es):

General address of the contracting authority: <http://www.mpi-hd.mpg.de>.

**Further information can be obtained at:** Max -Planck -Institut für Kernphysik, Saupfercheckweg 1, Attn: Prof. Dr. Karl Tasso Knöpfle, D-69117 Heidelberg. Tel. (49-6221) 51 65 09. E-mail: [ktkno@mpi-hd.mpg.de](mailto:ktkno@mpi-hd.mpg.de). Fax (49-6221) 51 66 03.

**Specifications and additional documents (including documents for competitive dialogue and a dynamic purchasing system) can be obtained at:** Max -Planck -Institut für Kernphysik, Saupfercheckweg 1, Attn: Herrn Hartwig, D-69117 Heidelberg. Tel. (49-6221) 51 60. E-mail: [einkauf@mpi-hd.mpg.de](mailto:einkauf@mpi-hd.mpg.de). Fax (49-6221) 51 62 20. URL: <http://www.mpi-hd.mpg.de>.

**Tenders or requests to participate must be sent to:** Max -Planck -Institut für Kernphysik, AUSSCHREIBUNG 200803 Saupfercheckweg 1, D-69117 Heidelberg.

### 1.2) TYPE OF THE CONTRACTING AUTHORITY AND MAIN ACTIVITY OR ACTIVITIES:

Other.

Other: Grundlagenforschung.

The contracting authority is purchasing on behalf of other contracting authorities: no.

## SECTION II: OBJECT OF THE CONTRACT

### II.1) DESCRIPTION

#### II.1.1) Title attributed to the contract by the contracting authority:

Infrastructure for the GERDA liquid argon cryostat.

#### II.1.2) Type of contract and location of works, place of delivery or of performance:

Supplies.

Purchase.

Main place of delivery: Laboratori Nazionali del Gran Sasso S.S. 17 BIS km. 18.910 67010 Assergi L'Aquila Italy.

NUTS code: ITF11 .

tender for supply contract:

submitted 08Jan21

published 08Jan31

**TED document 2008-27384**

time-limit for receipt of tenders:

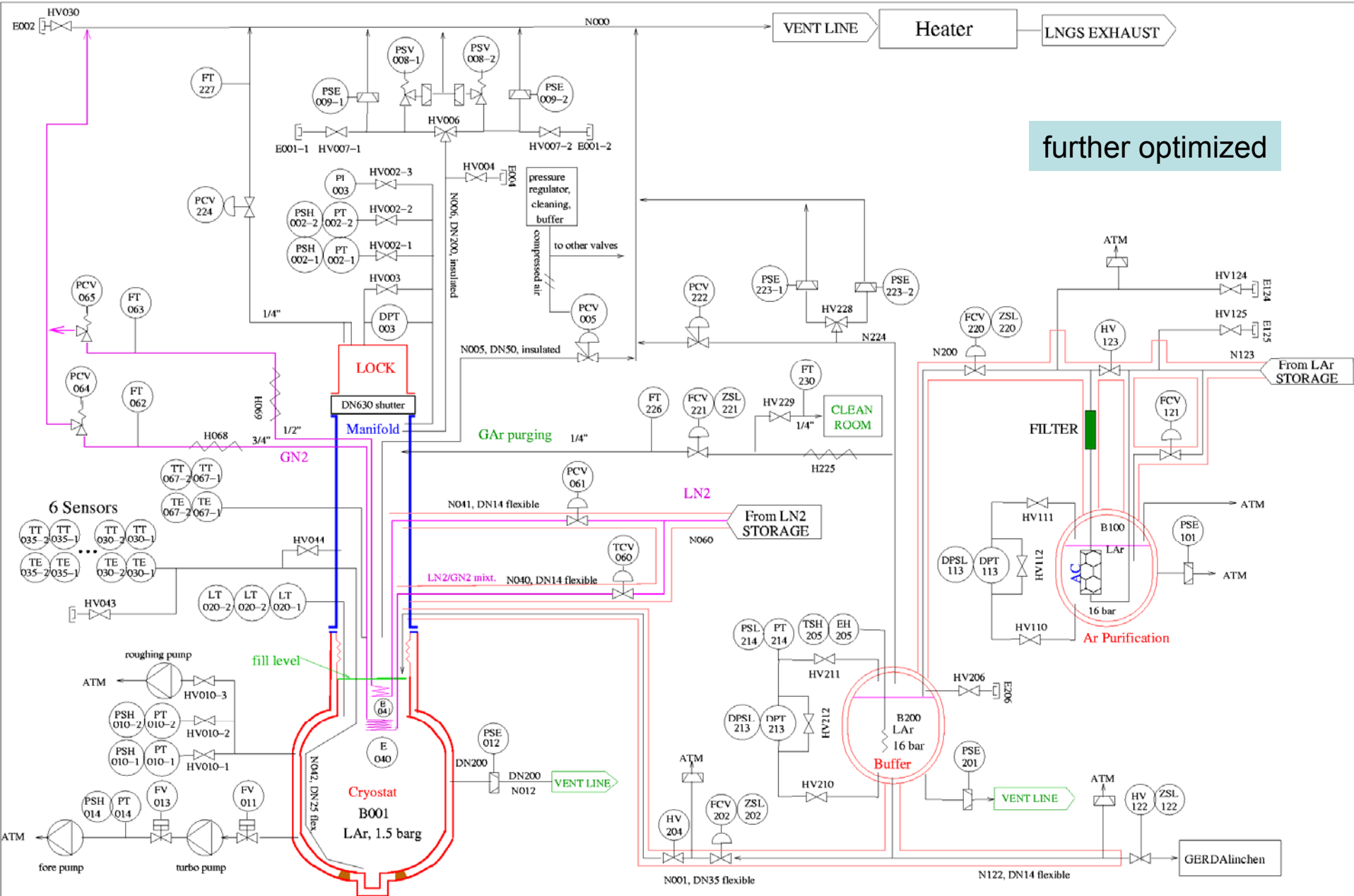
**08Mar17**

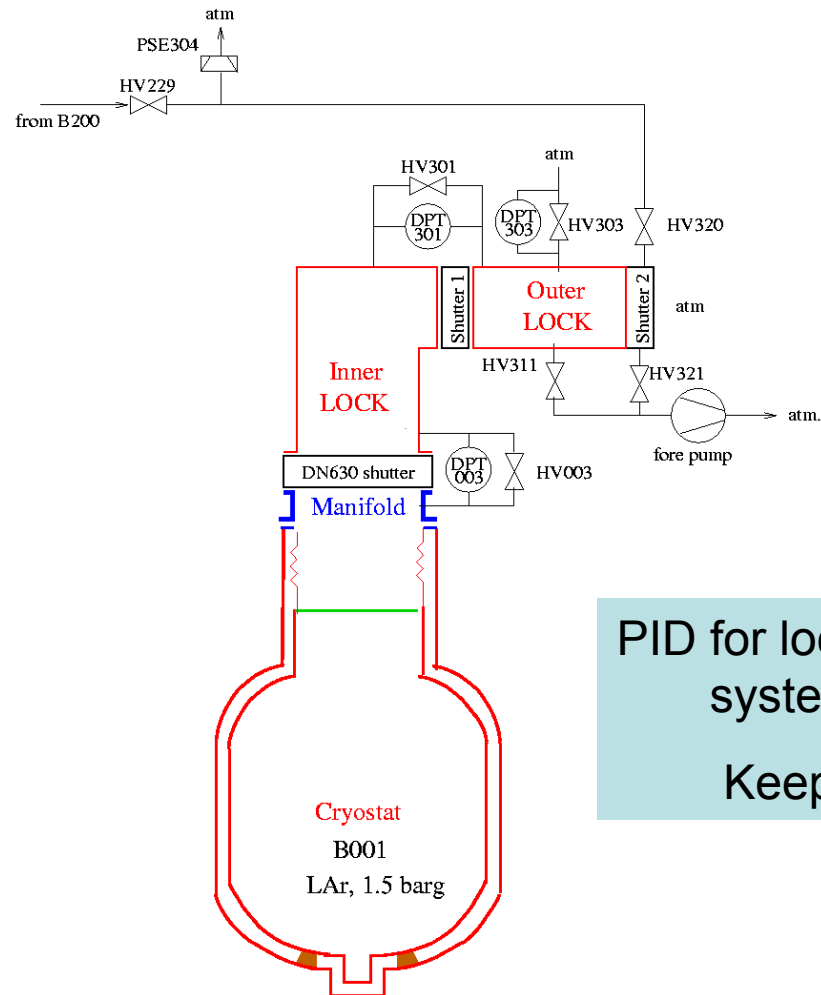
tender documents incl. Tech Specs:

[www.mpi-hd.mpg/GERDA/tender](http://www.mpi-hd.mpg/GERDA/tender)

(so far, more than 5 requests)

# PID for tender





PID for lock which is relevant for system aspects

Keep it simple & safe!

to be discussed in integration session

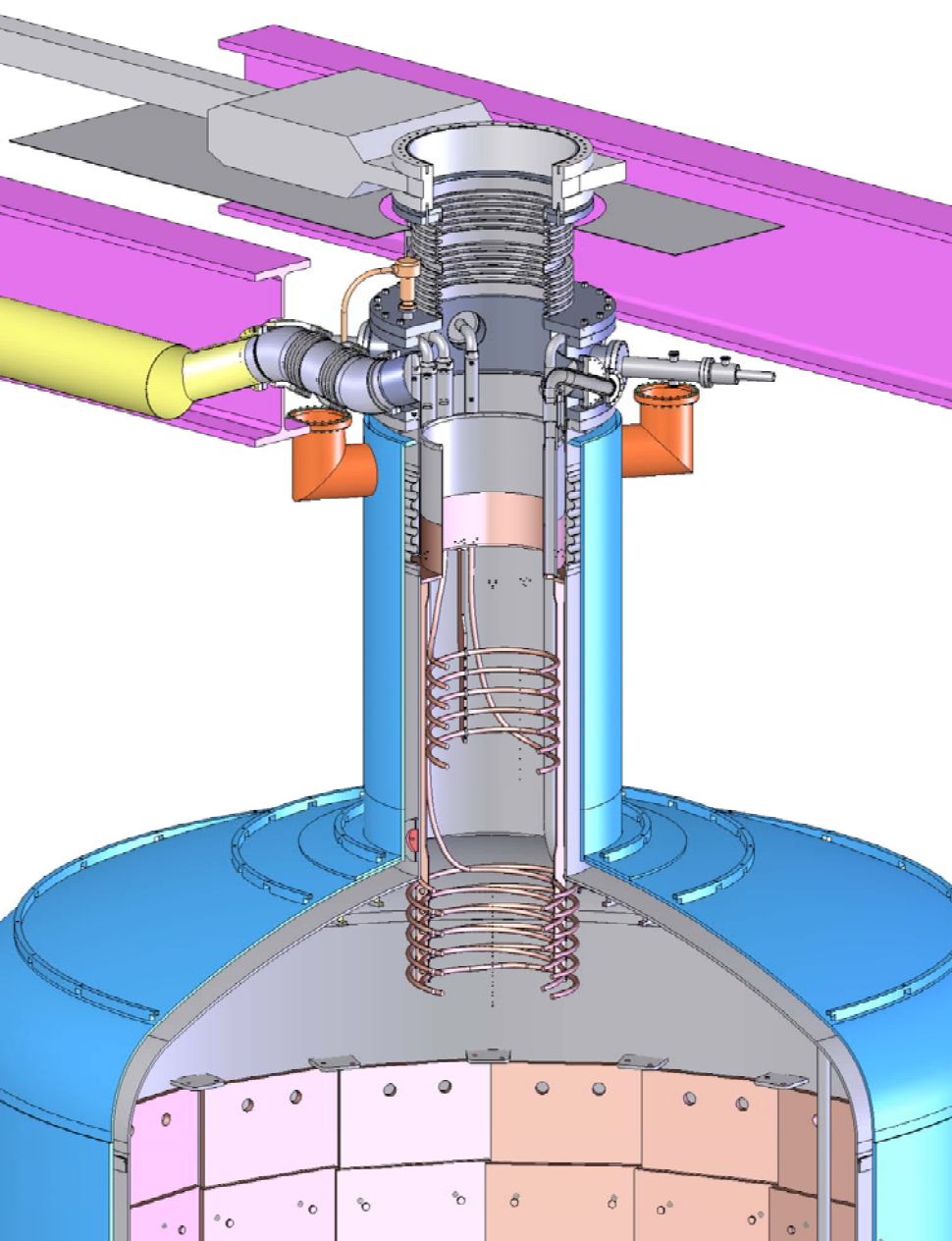
# cryogenic infrastructure

## further progress:

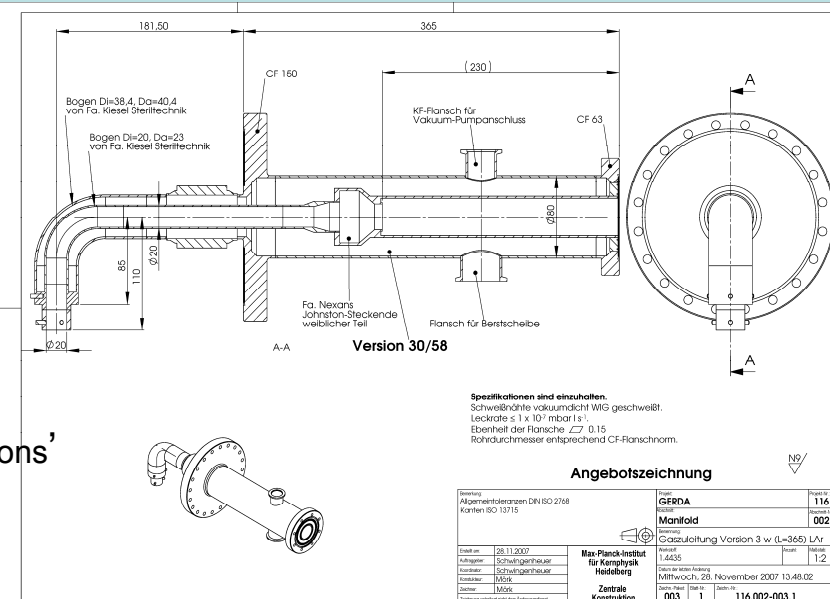
- design & layout further optimized
- part of hardware (vacuum) bought (T)
- quote for manifold available
- heater not in tender, new development: LNGS indicates ok for 2000 m<sup>3</sup>/h device

## open issues:

- Rn emanation of safety valves (cast stainless steel) not yet shown to be ok.



drawings from 'Technical Specifications'



2008 Feb 18

TG04 Status - K.T.

## summary of fabrication & test history

2007 (since 05 November)

inner/outer vessel pickled, passivated, rinsed with de-ionized water

- 12 Nov inner vessel: pressure test passed (with water @ 3.6 bar)
- 26 Nov inner vessel: He leak test passed (sensitivity a few  $10^{-9}$  mbar  $\ell / s$  )
- w48 Makrolon installed
- w49 major part of superinsulation installed
- 05Dec 1st extraction for Rn emanation measurement (23m<sup>3</sup>) : ~15 mBq
- 06Dec 2nd extraction for Rn emanation measurement (30m<sup>3</sup>) : ~30 mBq
- w50 inner / outer vessel integration
- 12Dec load test / optical inspection passed
- 13Dec neck covered with superinsulation
- w51 top outer vessel head welded, cryostat on skirt



## summary of fabrication & test history

### 2008

- w2 pumping isolation vacuum
- w3 test of mounting tool for copper shield passed
- 15Jan isolation vacuum  $<10^{-3}$  mbar
- outer vessel He leak test passed (sensitivity a few  $10^{-7}$  mbar  $\ell / s$  check!)
- w4 evaporation test with completely filled cryostat ( $\sim 70\text{m}^3$  LN2) passed
- 25Jan 17:00 N2 gas flow  $<4\text{m}^3/\text{h}$
- w5 emptying cryostat, warming-up
- w6 2nd pickling, passivation & rinsing of inner vessel (4Feb @  $5^\circ\text{C}$  )
- 08Feb outer vessel pressure test #1 cancelled by TÜV
- w7 SIMIC communicates WPS for weld W10 (11Feb), OKed by TÜV
- 14Feb outer vessel pressure test #2 cancelled, this time by SIMIC

## next steps

(assuming final pressure test is done)

- at LNGS:
  - 1) Rn emanation test
  - 2) evaporation test
  - 3) mounting of copper shield
    - ▶ schedule & sequence still unclear – however, agreement that items 2 & 3 shall not interfere with WT construction
- evaluation of quotes for cryogenic infrastructure on Monday, March 17, order asap
- evaluate Ar exhaust gas heater options, tender, order asap



# schedule: rev 5 of Sep 21

SIMIC S.P.A.		GERDA CRYOSTAT FABRICATION & COPPER PLATE INTEGRATION ON SITE		OFFER 183-05											
ID	Nome attività	Inizio	Fine	2008											
				giu	lug	ago	set	ott	nov	dic	gen	feb	mar	apr	
1	<b>Preliminary activities</b>	mer 29/03/00	ven 28/09/07												
2	Order receiving	lun 06/11/06	lun 06/11/06												
3	Contract review	lun 06/11/06	ven 10/11/06												
4	Order acceptance	ven 10/11/06	ven 10/11/06												
5	Materials by MPI availability	ven 10/11/06	ven 10/11/06												
6	Quality Control Plan issue	lun 09/07/07	lun 09/07/07												
7	Quality Control Plan approval by MPI	lun 09/07/07	ven 13/07/07												
8	Arrival 3 St Heads	gio 08/03/07	gio 08/03/07												
9	Arrival 4 St Heads	gio 21/06/07	gio 21/06/07												
10	Drawings Updading by MPI	lun 06/08/07	lun 06/08/07												
11	Materials providing	ven 01/06/07	ven 28/09/07												
12	WPAR (Manual Thermalite Welding)	mer 29/03/00	mar 11/04/00												
13	WPAR (Automatic Thermalite Welding)	mar 17/07/07	lun 30/07/07												
14	Further WPAR (Super-aust Automatic & Manual Welding)	gio 19/07/07	mer 01/08/07												
15	New-WPAR (Automatic & Manual Welding)	lun 03/09/07	ven 14/09/07												
16															
17	<b>Outer Vessel fabrication</b>	lun 02/07/07	gio 25/10/07												
18	Plates welding	lun 02/07/07	ven 10/08/07												
19	Plates cutting & bending	lun 27/08/07	ven 07/09/07												
20	Bottom Head Torion supports ass. & welding	lun 27/08/07	ven 14/09/07												
21	Supports Machining	ven 14/09/07	ven 21/09/07												
22	Assembly & Welding of shells, skirt and bottom head	lun 10/09/07	ven 05/10/07												
23	Ovality Check near Bottom Head	lun 08/10/07	lun 08/10/07												
24	Outer Vessel X-Ray check	mar 09/10/07	gio 11/10/07												
25	Outer Vessel Surface treatment	ven 12/10/07	gio 25/10/07												
26															
27	<b>Inner Vessel fabrication</b>	lun 23/07/07	ven 23/11/07												
28	Plates cutting	lun 23/07/07	mer 25/07/07												
29	Plates beveling & bending	lun 03/09/07	ven 07/09/07												
30	Rings and stiffeners cutting	lun 10/09/07	mer 12/09/07												
31	Bottom Head Torion supports ass. & welding	mer 05/09/07	mar 11/09/07												
32	Supports Machining	mer 12/09/07	ven 14/09/07												
33	Ass & Welding of shells, rings, stiffeners, heads and compensator	lun 17/09/07	ven 12/10/07												
34	Inner Vessel X-Ray check	lun 15/10/07	mer 17/10/07												
35	Dimensional Check	gio 18/10/07	gio 18/10/07												

Progetto: GERDA planning Rev. 5  
Data: ven 21/09/07

Attività: Avanzamento Rieplogo Attività esterne Scadenza

Divisione: Cardine Rieplogo progetto Cardine esterno

ISSUED BY PRG E.FRANCHELLO

# schedule: rev 5 of Sep 21

