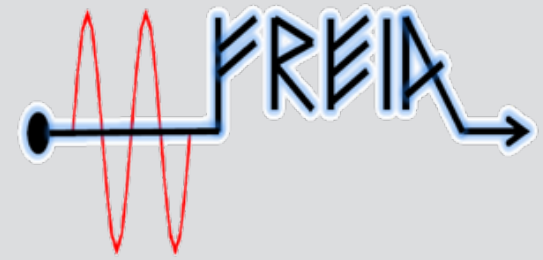




UPPSALA
UNIVERSITET



ESS weekly meeting (2021 W46)

A. Miyazaki et al.

General planning: HL-LHC magnet under test



| FREIA Planning | | 2021-11-04 | | | | | | | | | | | | | | 2022 | | | |
|-------------------------|-------------|------------|--------|--------|--------|-------------|--------|--------|------|-------------|-------|-------|------|---------|--------|--------|--------|-----------|----|
| | | October | | | | November | | | | December | | | | January | | | | | |
| Equipment | Responsible | 27 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 1 | 8 | 15 | 22 |
| | | week # | | | | | | | | | | | | | | | | | |
| | | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 1 | 2 | 3 | 4 |
| Liquefier & 2K pumps | Esat | Blue | Blue | Yellow | Yellow | Blue | Blue | Blue | Blue | Blue | Blue | Blue | Blue | Blue | Grey | Blue | Blue | Blue | |
| RF power stations | Mykhailo | | | | Green | | | Green | | | | Green | | Green | | | | Green | |
| Cryomodule test stand | Akira | CM04 | Yellow | Green | CM03 | Yellow | Green | Yellow | CM06 | Yellow | Green | Grey | Grey | Grey | Yellow | CM07 | Yellow | | |
| Hnoss | Rocio | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | |
| Gersemi (plan A) | | Red | Red | Red | Yellow | Yellow | Yellow | Blue | Blue | Yellow | Blue | Blue | Blue | Grey | Yellow | Yellow | Yellow | Blue | |
| Gersemi - cavity insert | Akira | | | | | | | | | | | | | | | | | | |
| Gersemi - magnet insert | Kevin | | | | | test magnet | | | | test magnet | | | | | | | | CCT China | |

We are here



Absence of Akira
Oct 4 – Nov 26

Send CM06
Receive CM08

- We do not cool down the module in W47 but will focus on Beckhoff driver
- CM06 cooling down in W48 does not cause major delay
 - Still a chance to send CM06 & receive CM08 around Christmas



W45 & W46 progress



| week | | W45 | | | | | | | | | | | |
|--------------|-------------|---------------------------|---|--------------|---|-------------------------|------------|---------------------------------------|---|--|-----------------------------------|--------------------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 8-Nov | | 9-Nov | | 10-Nov | | 11-Nov | | 12-Nov | | 13-Nov | 14-Nov |
| | | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM03 | disconnect cryogenic line | | swap modules | | filling dry N2 | | LEMO test | | doorknob dismounting, VNA shock sensor | | waiting in the box | |
| next CM | CM06 | doorknob mounting | | | | connect cryogenic lines | leak check | connect beam vacuum and start pumping | | | Insulation vacuum; RF calibration | | |
| next next CM | CM07 | preparation at Orsay | | | | | | | | | | | |

| week | | W46 | | | | | | | | | | | |
|-------------|-------------|---------------------------|---|--------------------------|---|--------|---|-------------------------|---|----------------------|---|--------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 15-Nov | | 16-Nov | | 17-Nov | | 18-Nov | | 19-Nov | | 20-Nov | 21-Nov |
| | | m | a | m | a | m | a | m | a | m | a | | |
| previous CM | CM03 | departure to ESS | | preparation of documents | | | | publish test report | | | | | |
| present CM | CM06 | coupler warm conditioning | | | | | | | | | | | |
| next CM | CM07 | departure from Orsay | | transport | | | | reception at UU morning | | thermalization at UU | | | |

We are here

In parallel to this, maintenance work on the 2K pump have been performed and a new SCHe flow meter (FT11) was installed



W47 & W48 & W49 planning



| week | | W47 | | | | | | | | | | | | | |
|--------------|-------------|---|---|--------|---|--------|---|-----------------------------|---|--------|---|--------|---|--------|--|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | | SUN | |
| | | 22-Nov | | 23-Nov | | 24-Nov | | 25-Nov | | 26-Nov | | 27-Nov | | 28-Nov | |
| | | m | a | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM06 | Beckhoff motor driver test Cryogenics occupied by magnet | | | | | | | | | | | | | |
| next CM | CM07 | reception test | | | | | | waiting in the docking area | | | | | | | |
| next next CM | CM08 | preparation at Orsay | | | | | | | | | | | | | |

| week | | W48 | | | | | | | | | | | | | |
|--------------|-------------|--------------------------------------|------------|--------------|---|------------|---------------------------|-----------------------------|------------------------|-----------------|---|--------------------|---|-------|--|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | | SUN | |
| | | 29-Nov | | 30-Nov | | 1-Dec | | 2-Dec | | 3-Dec | | 4-Dec | | 5-Dec | |
| | | m | a | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM06 | Purging | N2 cooling | cooling down | | 4K filling | coupler cold conditioning | 2K pumping | RF calibration at cold | MP conditioning | | CTS thermalization | | | |
| next CM | CM07 | doorknob mounting & water leak check | | | | | | waiting in the docking area | | | | | | | |
| next next CM | CM08 | preparation at Orsay | | | | | | | | | | | | | |

| week | | W49 | | | | | | | | | | | | | |
|--------------|-------------|--------------------------------------|---|------------------------|---|-------|---|--|---|------------------------|---|------------|---|--------|--|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | | SUN | |
| | | 6-Dec | | 7-Dec | | 8-Dec | | 9-Dec | | 10-Dec | | 11-Dec | | 12-Dec | |
| | | m | a | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM06 | CTS test at 2K | | heat load measurements | | | | start warming up | | vent insulation vacuum | | warming up | | | |
| next CM | CM07 | doorknob mounting & water leak check | | | | | | Goal of CM06 waiting in the docking area | | | | | | | |
| next next CM | CM08 | preparation at Orsay | | | | | | | | | | | | | |



Departure of CM03



FREIA

Department of Physics and Astronomy
Uppsala University

Summary of CM03 2nd test

Report time: 20211118

Vacuum

| date | 2021-09-23 | 2021-11-02 | 2021-11-05 |
|-------------------------|------------|------------|------------|
| Temperature (K) | 300 | 2,1 | 300 |
| Beam vacuum (mbar) | 4,6E-3 | 6,7E-10 | <5E-4 |
| Isolating vacuum (mbar) | Below atm | 4,6E-7 | 1000 |

Cavity performance

| | CAV_IN | CAV_OUT | Target | | |
|---|--|---------------------|-------------------|--------|-----------------|
| Cavity name | DSPK09 | DSPK12 | - | | |
| f_0 at warm (MHz) | 351.583 | 351.576 | | | |
| f_0 at 2K (MHz) @ without CTS engaged | 352.135 | 352.119 | 352.090 - 352.174 | | |
| Q_{ext} | 2.01e5 | 1.96e5 | 1.75e5 - 2.85e5 | | |
| Q_i (from Orsay) | 2.2e11 | 2.1e11 | | | |
| Max E_{acc} (MV/m) | 12 | 12 | >9 | | |
| Field emission onset (MV/m) | - | - | - | | |
| $Q_{i@9MV/m}$ | >1.63e9 | >1.63e9 | >1.5e9 | | |
| $P_{e@9MV/m}$ (W) | <2.0 | <2.0 | 2.5 | | |
| Dynamic heat load for CM@9MV/m (W) | 15.39±1.0 | | | | |
| Static heat load for CM (W) | 15.33±1.0 | | | | |
| df/dP (Hz/mbar) | 13.52 | 15.48 | <20 | | |
| CTS | Stepper motor ²⁾ setting for nominal frequency | motor steps | 588800 | 694400 | - |
| | | motor position (mm) | 1.15 | 1.36 | |
| | | driving current (A) | 0.6 | 0.6 | 0.6 |
| | Limit switch position (steps) | -1625 | -3375 | | |
| | Stepper motor tuning | Hz/ step | 0.182 | 0.169 | 0.145 +/- 0.027 |
| | | (kHz/ mm) | 93.3 | 87.6 | - |
| | Piezo1 tuning range (Hz) | unipolar | 665.69 | 405.38 | >640 |
| | | bipolar | 825.58 | 554.37 | |
| | Piezo1 tuning sensitivity (Hz/V) | 3.33 | 2.02 | - | |
| | Piezo2 tuning range (Hz) | unipolar | 640.87 | 509.03 | >640 |
| bip | | | | | |
| Piezo2 tuning sensitivity | | | | | |
| LFD@9MV/m in open loop | | | | | |

| Cryomodule | | 03 | | | | | | | |
|--|--|-----------------|-----------|---|-----------|--|-----------|--|--|
| Location | | UU after repair | | | | | | | |
| Date | | 2021-9-27 | | 2021-10-28 | | 2021-11-12 | | | |
| VNA model | | Agilent | | Agilent | | Agilent | | | |
| T° (C) | | not measured | | 2K | | not measured | | | |
| Pcavity (mbar) | | 5,00E-03 | | 4,00E-10 | | UR | | | |
| Pinsulating vacuum (mbar) | | << 1000 mbar | | 4,80E-07 | | PA | | | |
| Pcryolines (mbar) | | PA | | 31 | | PA | | | |
| | | OK | | RF measurements @ T=300K after delivery | | RF measurements @ T=2K during the test | | RF measurements @ T=300K after testing | |
| Cavity location | | UT | Cavity IN | Cavity OUT | Cavity IN | Cavity OUT | Cavity IN | Cavity OUT | |
| Cavité | | 2 | DSPK09 | DSPK12 | DSPK09 | DSPK12 | DSPK09 | DSPK12 | |
| Coupieur | | 5 | CPL06 | CPL26 | CPL06 | CPL26 | CPL06 | CPL26 | |
| Manchette | | 9 | DWT02 | DWT19 | DWT02 | DWT19 | DWT02 | DWT19 | |
| S11 (off resonance) dB | | | 0,08 | 0,08 | | | 0,02 | 0,02 | |
| S11 (@ resonance) dB | | | -0,59 | -0,6 | | | -0,64 | -0,65 | |
| S21 (@ resonance) dB | | 3 | -84,26 | -83,8 | -76,23 | -73,43 | -84,48 | -85,29 | |
| Frequency (MHz) | | 9 | 351,638 | 351,627 | | | 351,583 | 351,576 | |
| Frequency @ 2K (MHz) | | | | | 352,135 | 352,119 | | | |
| Shift (MHz) | | | | | -0,497 | -0,492 | | | |
| Bandwidth (kHz) | | | 39,18 | 38,12 | 1,85 | 1,91 | 38,51 | 39,76 | |
| Qloaded | | | 8975 | 9223 | 190587 | 184813 | 9130 | 8842 | |
| For information | | | | | | | | | |
| S11 pick-up cable (dB) (measurement @ reception) | | | | | | | | | |
| Cable Ref | | | | | | | | | |
| S11 pick-up cable (dB) (measurement on CM) (if calculated) | | | -3,36 | -3,39 | -1,89 | -1,9 | -3,41 | -3,37 | |



Reports will be circulated after this meeting



Arrival of CM07

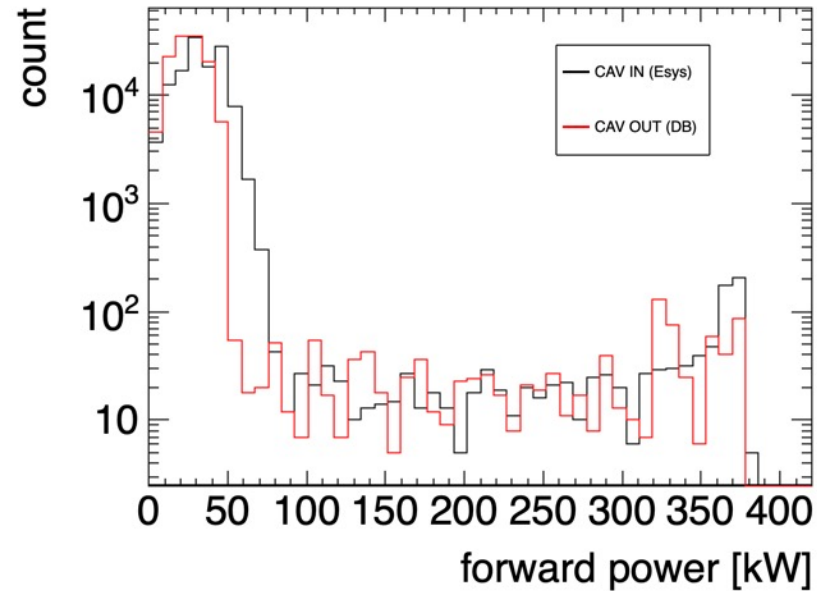
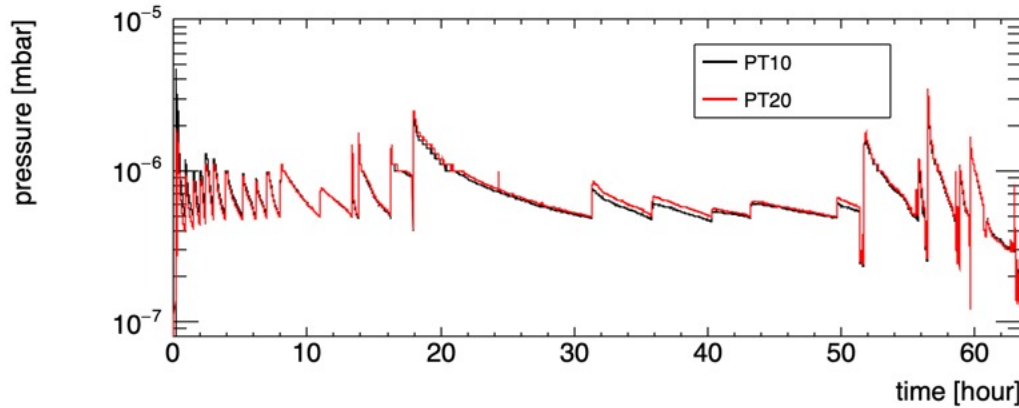
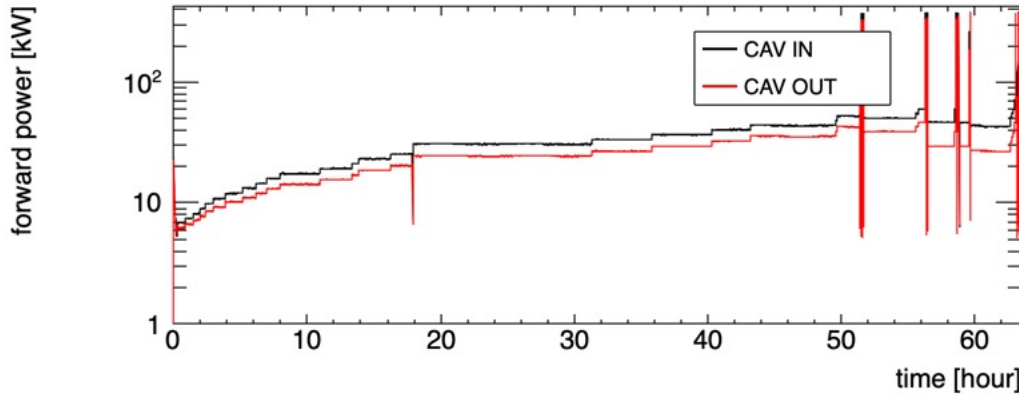


| FREIA Planning | 2021-11-18 | 2022 | | | | | | | | | | | | |
|-----------------------|-------------|----------|----|----|---------|----|----|----|----|----------|----|----|----|--|
| | | November | | | January | | | | | February | | | | |
| Equipment | Responsible | 3 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | |
| | | week # | | | | | | | | | | | | |
| Liquefier & 2K pumps | Esat | 0 | 51 | 52 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| RF power stations | Mykhailo | | | | | | | | | | | | | |
| Cryomodule test stand | Akira | | | | | | | | | | | | | |

Test will be next year but conditioning can be done around Christmas



64 hours of uptime; 71 hours of real time



- Statistics (2 stations; 2 pumps) says we need around 70 hours
- One Crowbar IN in DB-A

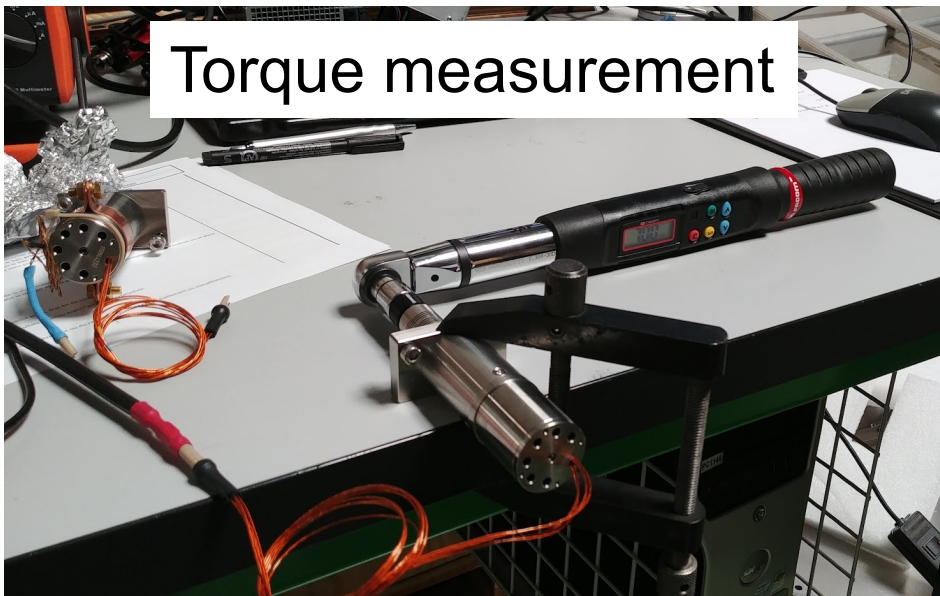


Beckhoff driver test



ESS LEMO box

Please send us one



Torque measurement



Compatibility
in EPICS?



| | | |
|---|--|--------------------------------|
| THALES | | Date : 03 Nov 2021 |
| Customer Technical Support | | MIS-Thonon |
| Failure Analysis Report | | RMA No. : 61 010 632 |
| <i>Compte Rendu d'Analyse Technique</i> | | page : 1/2 |
| Subject / Objet | | |
| Customer / Client : | Uppsala University | |
| Product / Produit : | TH 595A | Serial no. / N° série : 901204 |
| Delivery date / Date livraison : | 30 Aug 2019 | |
| Warranty conditions / Conditions de garantie : | 500 hours FOC / 3500 h PRT / 18 months | |
| Total time of operation / Durée totale de fonctionnement : | 4882(*) | hours (filament) |
| Additional operating data / Données complémentaires de fonctionnement : | | |
| (*) 16 starts. Used together with cavity TH 18595A, up to 200 kW pulse, on DB Elettronica station, RF path B. | | |

Technical analysis / Analyse technique

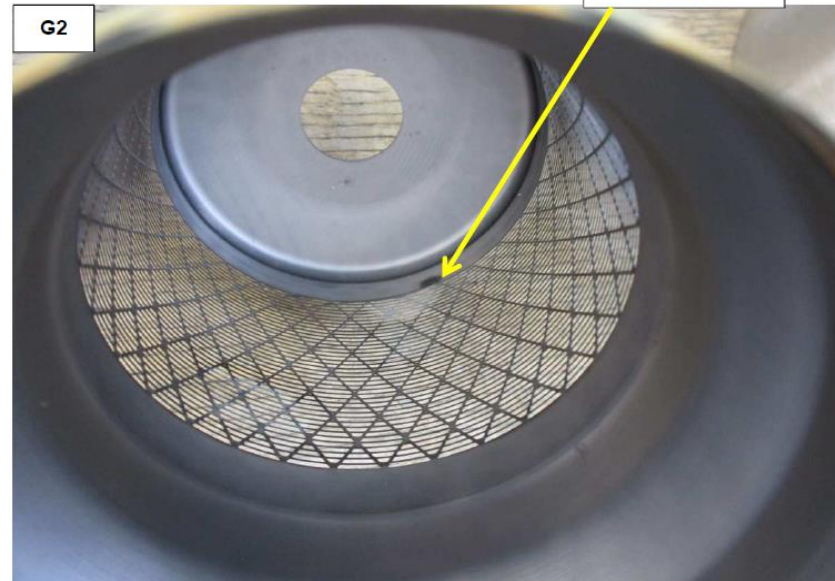
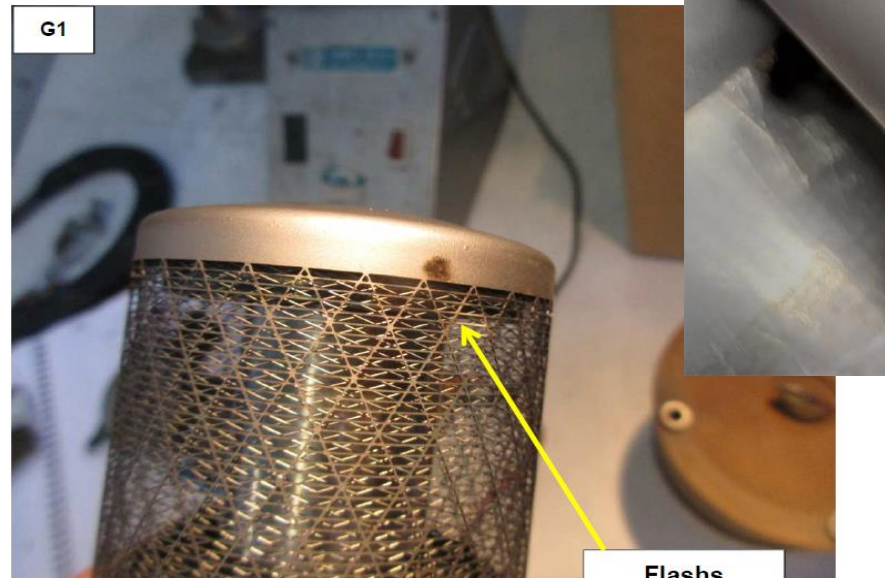
Observed defect / Défaut constaté :

- ▶ Tetrode did pass hi-pot tests: K-G1 (2.0 kV) and G1-G2 (1.5 kV): < 5 μ A; G2-A (35 kV): < 10 μ A
- ▶ Filament current (under $V_F = 8.8$ V): 193 V (vs 191 V as per FAT). Thus not more than 1% decarburization.
- ▶ Cathode emission : regular, about the same as per FAT.

At this last test, filament current was found not quite steady. So it was decided to double-check by setting the tetrode in a test bed dedicated to industrial heating tubes. Alas, the transfer was unfortunate, as the interlock afterwards proved to be defective: the device was processed as if it did not need to be water cooled. The result was fatal damage.

Inspection result / Résultat d'expertise :

Water came inside and altered internal parts. We mention despite this: one obvious arc mark on the top of G1, outside the mesh; cathode is not deformed at all; main insulator shows neither crack, nor suspicious stain.



An obvious burn mark was found between G1 and G2

THALES

| | | |
|--|---|--|
| <p>THALES</p> | <p>PROCES VERBAL DE MESURES (TEST REPORT) RF Power tests</p> | <p>63062854 Rev. B page 2/2</p> |
| <p>CLIENT (Customer's company name) :</p> <p>COMMANDE ou MARCHÉ n° (Order n°) :</p> <p>TYPE (Type) : TETRODE TH 595A</p> <p>► Tetrode S/N: 919288 together with ► Cavity TH 18595A S/N: 909661</p> | | |



A meeting with THALES is planned on Nov 30th