CLIC collaboration working meeting

-

RF session

-

Update of the proposal for a 12GHz CLIC Test Station at Saclay

Franck Peauger
CEA Saclay - IRFU – SACM

History and future strategy of our proposal

- First proposal in 2008
- 2009 – 2012: large involvement of CEA to the 1st test stand design and construction at CERN (modulator, RF components, …)
- 2011: novel idea of 4 x 6 MW high rep rate klystrons and recombination
- April 2012: CERN announcement at the KEK workshop
  -> the 50 MW klystron #2 from CPI will be available for a collaborator

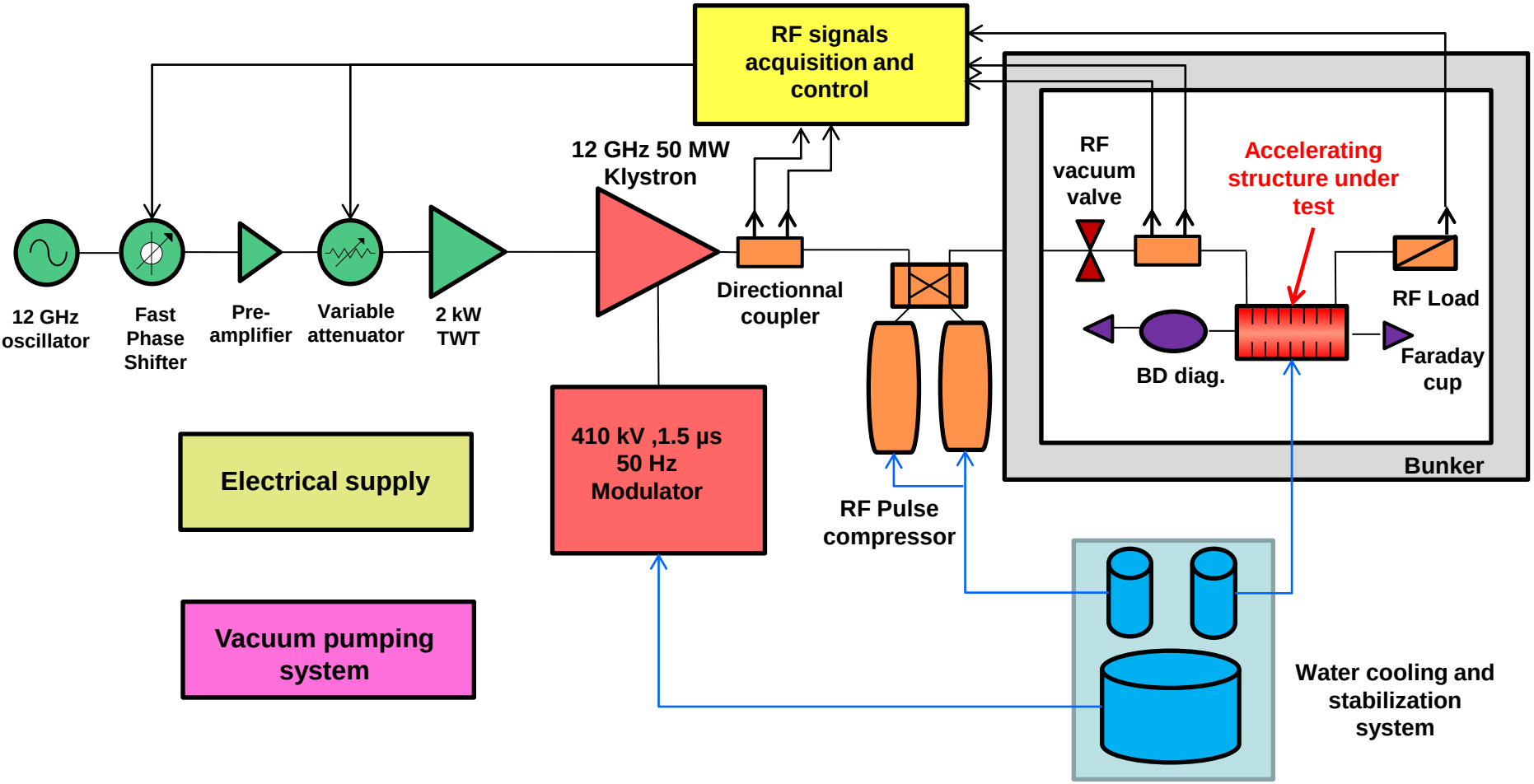
What is our position now ?

- The development of a 12 GHz Test Stand at Saclay is still one of the main objectives for CEA (we also want to continue with accelerating structures activities)
- We prefer the 50 MW klystron based test stand solution and we are candidate to receive and use the 2nd CPI klystron at Saclay. We think it is more straightforward solution where we will fully benefit from our experience on high voltage solid state modulator, 100 MW class RF components, etc…

Saclay test stand layout and specifications

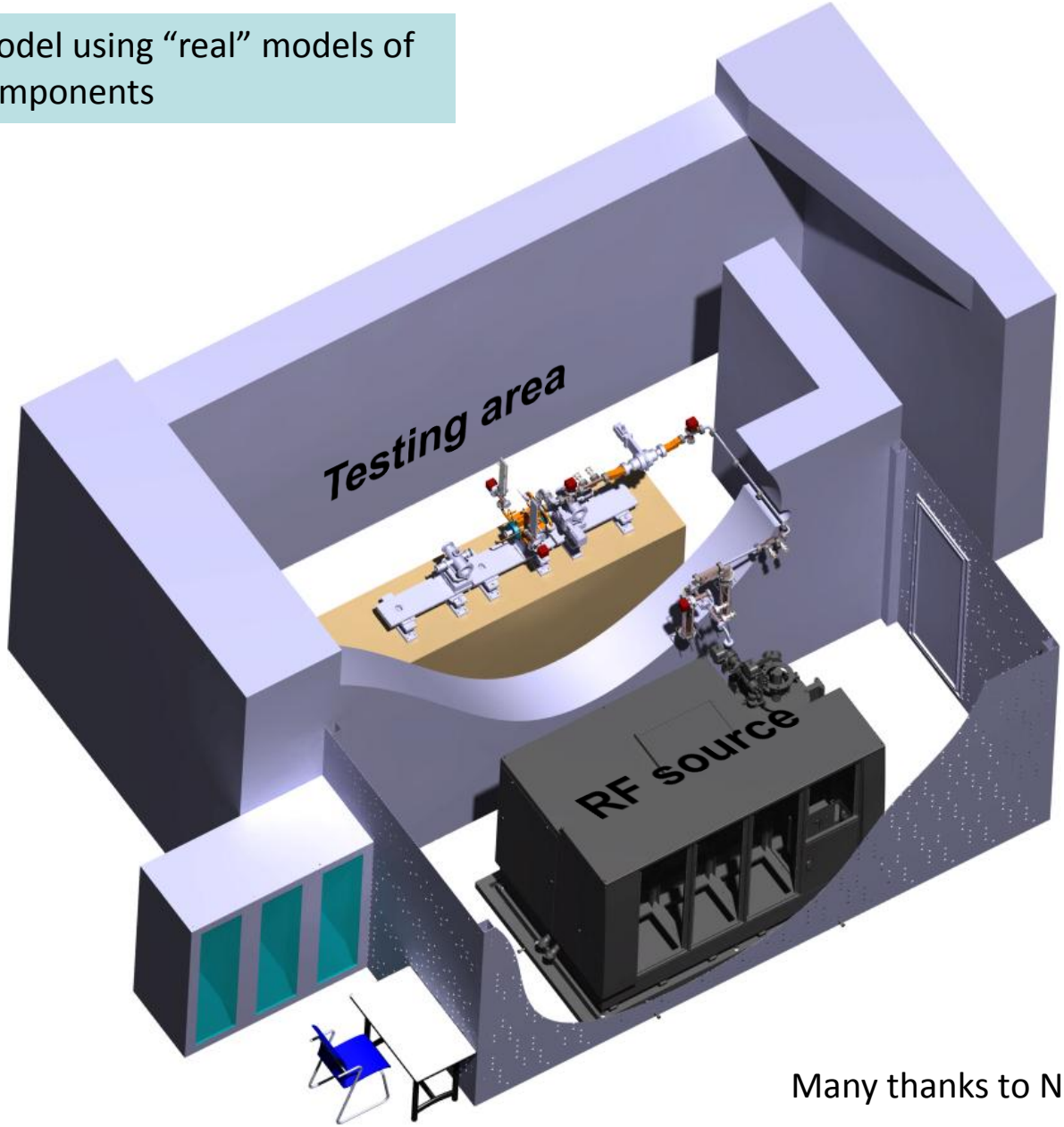
Similar to the CERN test stand:

- **RF frequency:** 11.9942 GHz
- **Peak RF power:** 100 to 120 MW
- **Pulse length:** 250 ns
- **Pulse repetition rate :** 50 Hz



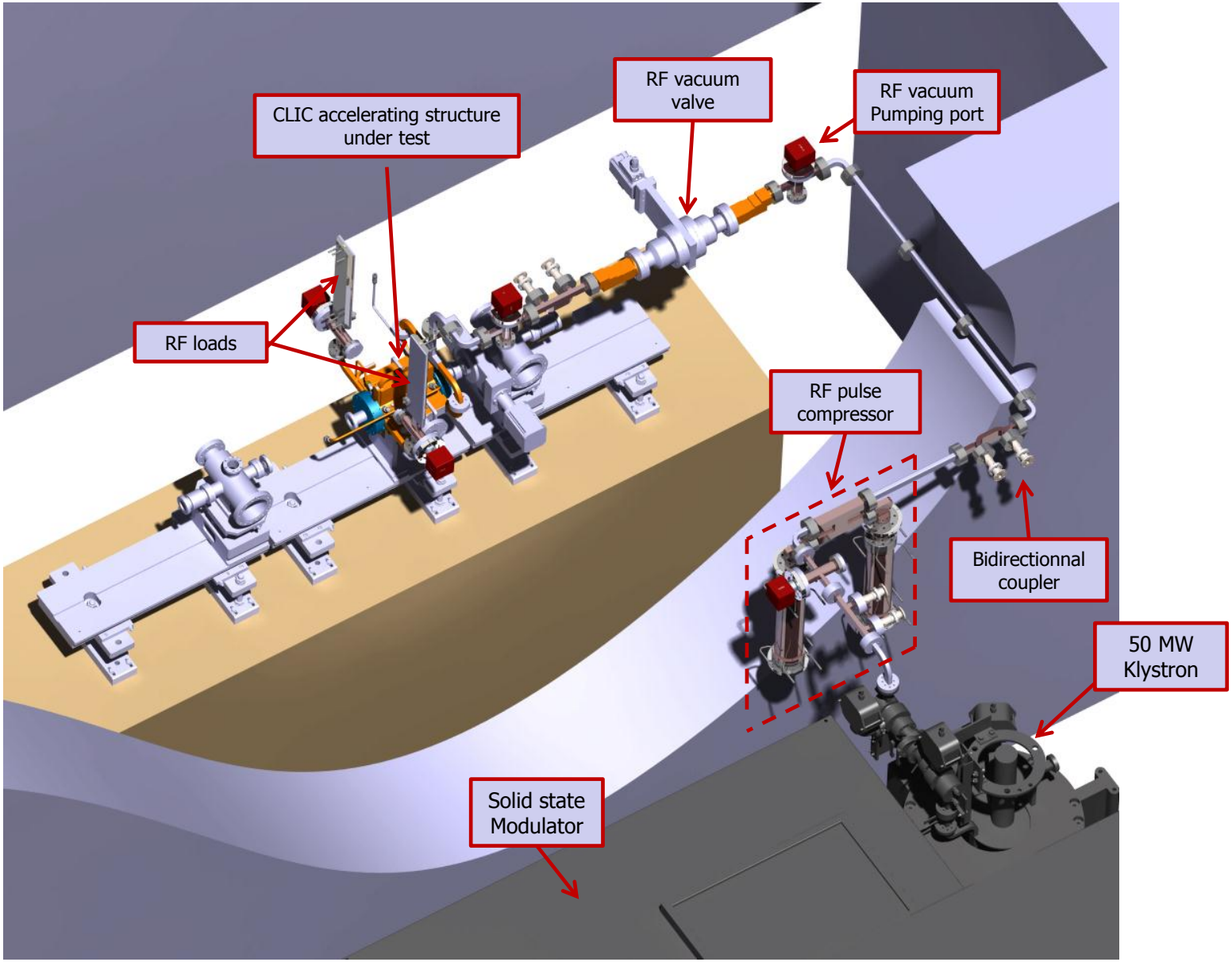
3D implementation at Saclay

- Full CATIA model using “real” models of individual components

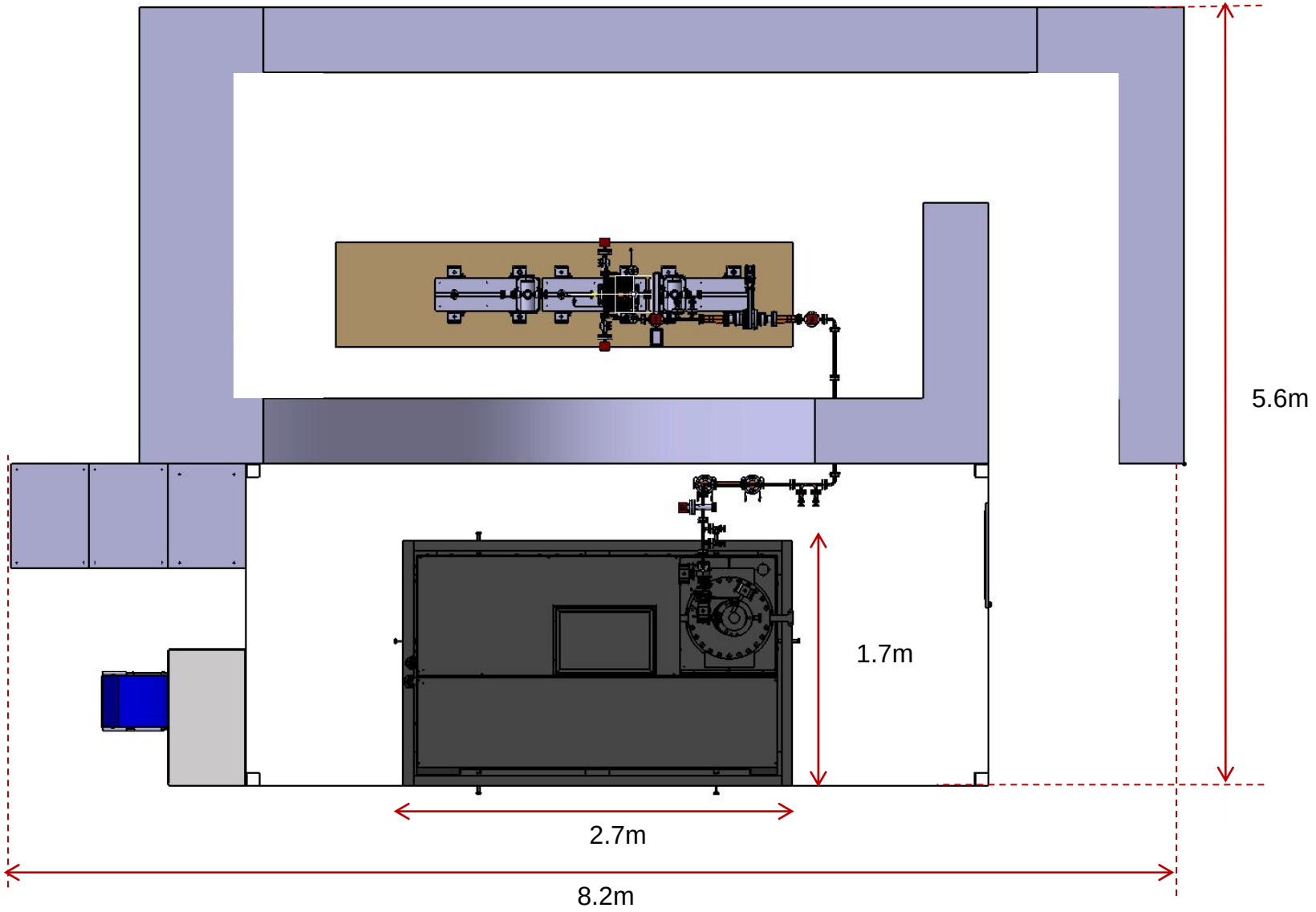


Many thanks to Nicolas MISIARA (CEA)

High power RF network



Top view



50 MW klystron #2 from CPI

SLAC XL5 klystron

The CPI klystron should be identical to the SLAC XL5 klystron in term of RF performances.

But,

The interfaces, handling and storage procedures must be carefully reviewed with CPI:

- Dimensions
- X-ray lead shielding
- Electrical (filament, HV, ion pumps)
- Hydraulic
- …

We think that we have at Saclay the necessary expertise to use and "take care" of such a unique and expensive high power klystron

Modulator

Even if some improvements are still necessary (HV rise time, control command, interlocks…), we think it is worth going on with the solid state technology for its compactness, reliability and stability.

Scandinova modulator at CERN ordered by CEA Saclay

CEA/Scandinova contract

ARTICLE 1 – OBJET

Le présent marché définit les conditions selon lesquelles le CEA confie au Titulaire, qui accepte, la réalisation d'un modulateur Haute Tension 50Hz pour un banc de test 12GHz, ci-après dénommé « l'Equipement » destiné à être livré et installé au CERN (Genève – Suisse).

Les prestations se déclinent comme suit :

- Tranche ferme : réalisation d'un modulateur Haute Tension 50Hz pour un banc de test 12GHz.
- Tranches optionnelles :
  - option n°1 : réalisation d'un second modulateur ayant les mêmes caractéristiques que le modulateur réalisé dans le cadre de la tranche ferme,
  - option n°2 : une année de maintenance préventive et corrective pour un modulateur Haute Tension 50Hz à l'issue de la période de garantie de 2 ans.

Le CEA se réserve la possibilité de lever, par lettre recommandée avec accusé de réception, l'option n°1 jusqu'au 30/06/2012 dans les conditions définies à l'article 20.1 du présent avenant n°2 et l'option n°2 au plus tard jusqu'à 1 mois avant la fin de période de garantie de 2 ans de l'Equipement.

En cas de levée de tout ou partie des options, le Titulaire s'engage à exécuter la prestation correspondante conformément aux conditions définies par le cahier des charges.

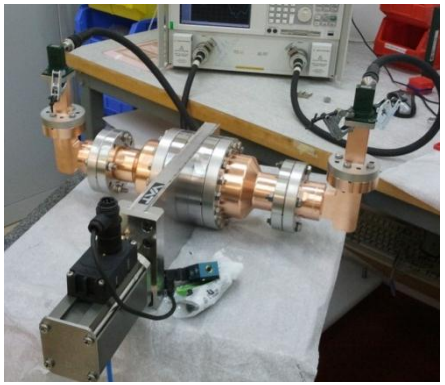
La réalisation de ces prestations sera effectuée pour le compte de la Direction des Sciences de la Matière (DSM), Institut de Recherches sur les lois Fondamentales de l'Univers (IRFU), Service des Accélérateurs, de Cryogénie et de Magnétisme (SACM) basé au CEA/Saclay.

The actual contract with Scandinova includes **an option for a second modulator with a reasonable price**. We must ask Scandinova the possibility to extend this option to the end of 2012 / beginning of 2013

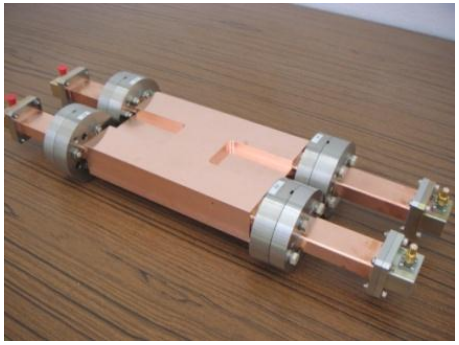
High power RF network and components

In our implementation, the RF network is short and compact (low RF losses)
Most of the components have been developed these last 3 years and some of them have been successfully tested at high power.
The RF pulse compressor is the only critical component and its development is proposed in the frame of Eucard2. A directional coupler with low power RF window is under development now.
Some components are even in stock at Saclay or at CERN (WR90 waveguides, SLAC flanges, 3 dB hybrid, mode converters, Stainless steel 430 for loads)

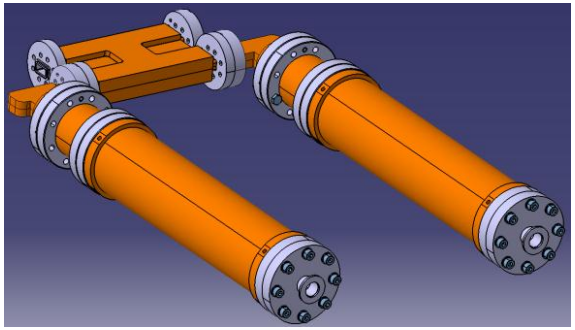
H_{01}^{O} mode converter and RF valve



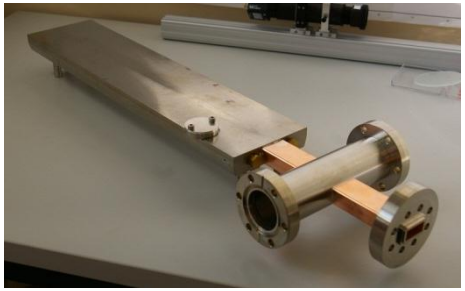
3 dB Hybrid Coupler



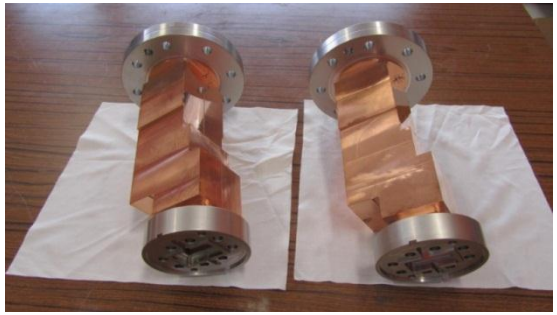
RF pulse compressor



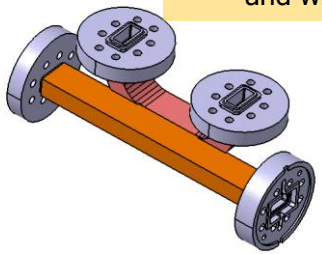
RF loads

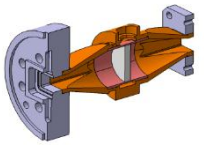


H_{01}^{O} Jog mode converter



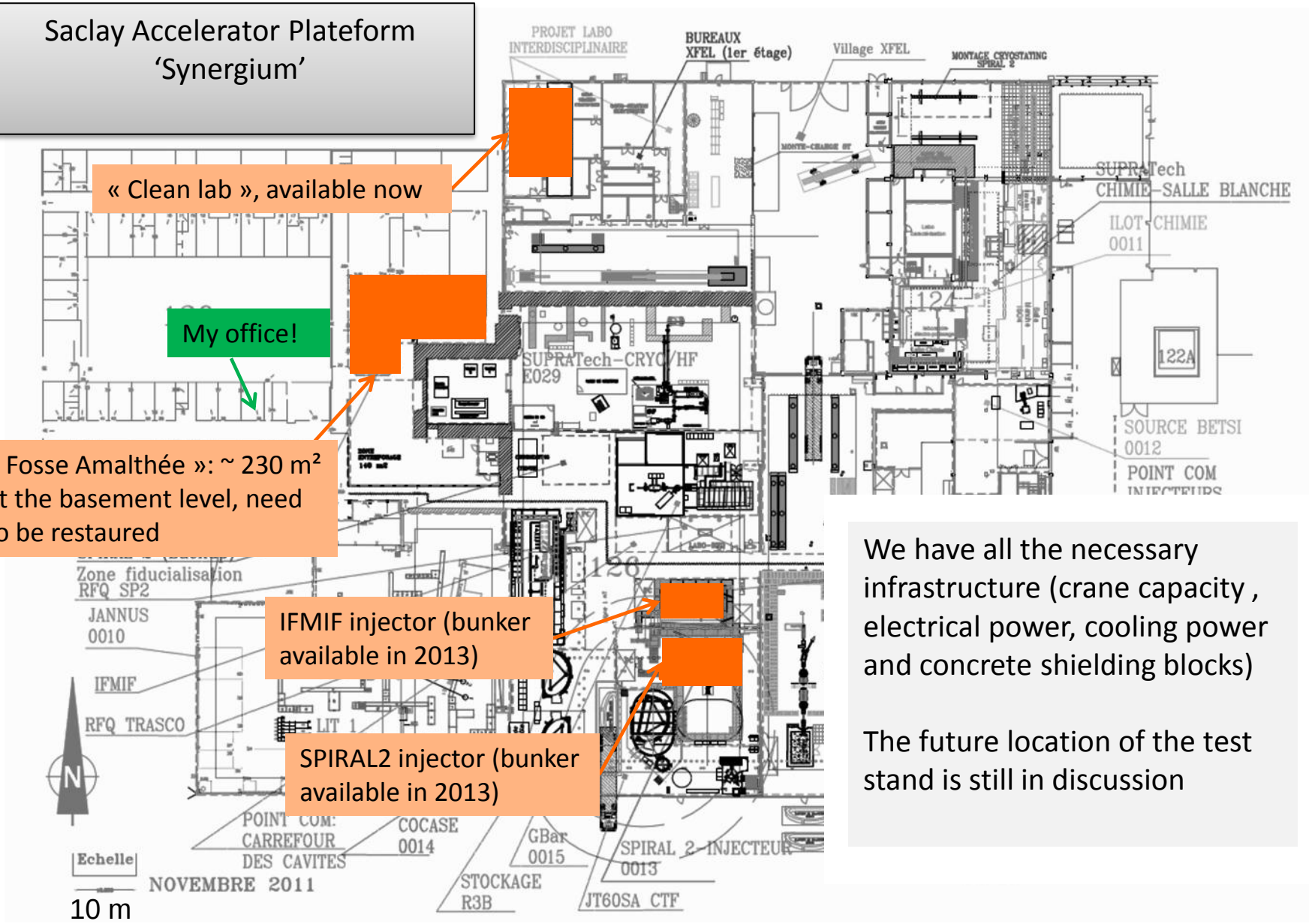
Bidirectional coupler and window





Possible locations at Saclay

Saclay Accelerator Plateform
'Synergium'



We have all the necessary infrastructure (crane capacity , electrical power, cooling power and concrete shielding blocks)

The future location of the test stand is still in discussion

Tentative planning

	Nom de la tâche
1	**12 GHz CLIC power station at Saclay**
2	**Project preparation**
3	CLIC meeting adressing the WP 2012-2016
4	CLIC collaboration working meeting
5	Discussions between CEA and CERN direction
6	Imputation numbers and starting of the project
7	**Klystron 50 MW**
8	Review of the specifications with CPI and CERN
9	Klystron fabrication and tests
10	Klystron delivery at CERN
11	Klystron delivery at CEA
12	**Modulator**
13	Specification and call for tender
14	Modulator fabrication
15	Modulator delivery
16	Modulator testing with klystron
17	**Zone preparation**
18	Definition of the test station and drawings
19	Floor preparation
20	Installation of the concrete blocks
21	Installation of the electrical circuit
22	Installation of the hydraulic circuit
23	**RF components (including Eucard2)**
24	**1) TWT amplifier**
30	**2) Pulse compressor**
40	**3) LLRF and Control**
55	**4) High power RF waveguide network**
60	**5) Assembly and test**
64	**RF commissioning and operation**
65	Commissioning without PC up to 50 MW
66	Commissioning with PC up to 130 MW
67	Operation with first accelerating structure