High-power RF test areas.

I. Syratchev for the X-band testing areas (XTA) activity group

Status of X-band test areas

Existing areas:

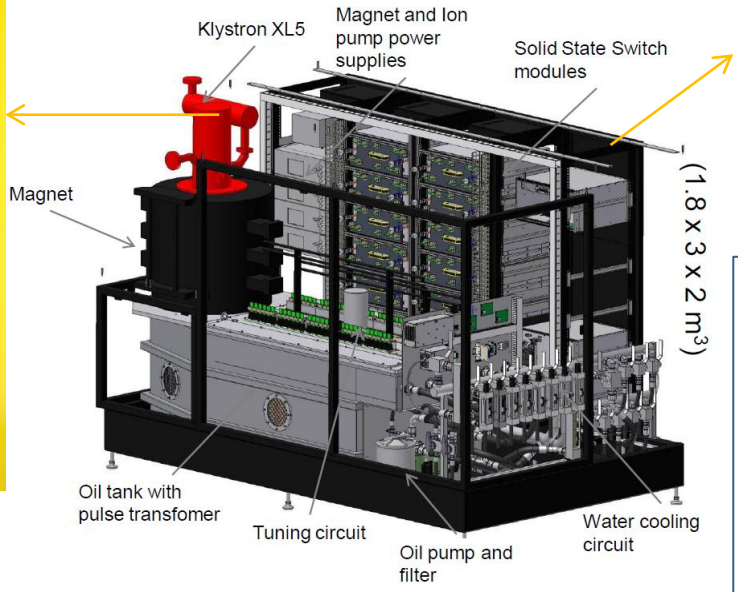
- NEXTEF, KEK – Running and running and running. Full program. We hope to continue for many years more.
- NLCTA, SLAC – We had some great times but is now entirely dedicated to photon science.
- ASTA, SLAC – Is available for testing but on a full cost basis only.
- Klystron at CERN – Still commissioning.

We intend to supplement these stands with:

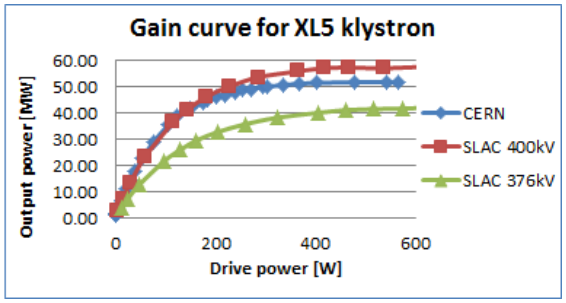
- A test stand at CERN using the first 50 MW XL-5 tube from CPI that we've ordered.
- A test stand at a collaborator using the second 50 MW XL-5 tube from CPI that we've ordered.
- A test stand at CERN based on a combined 5 MW, high-repetition rate tubes.

To be discussed tomorrow

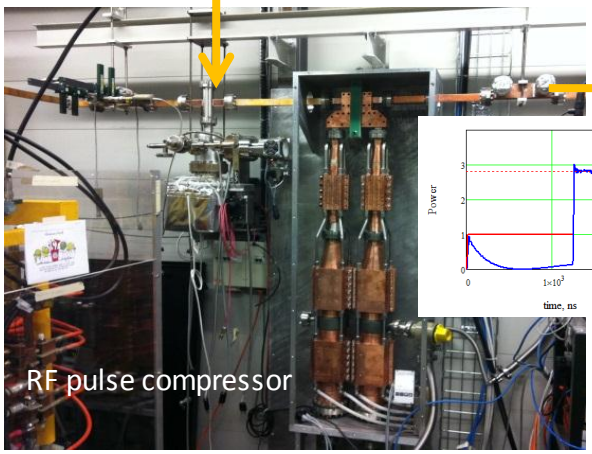
#1 50 MW klystron (XL-5, SLAC) test stand will be able to deliver to the testing area up to 130 MW x 250 ns pulses at 50 Hz repetition rate. The overall power consumption is 43 kW.

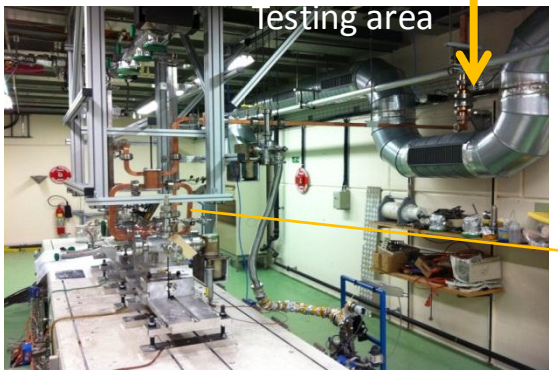


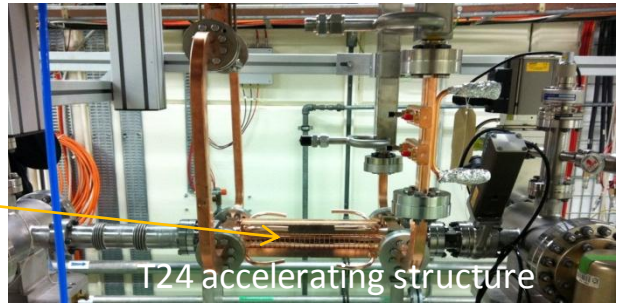
In 2012 Klystron was conditioned with RF directly into the loads up to 50MW, 300ns, 50Hz stable operation at 390kV.



RF transport efficiency 0.8







#1 50 MW klystron (XL-5, SLAC) test stand status and mid term planning

- Final calibration of all the RF system
- Thorough check of all the interlocks

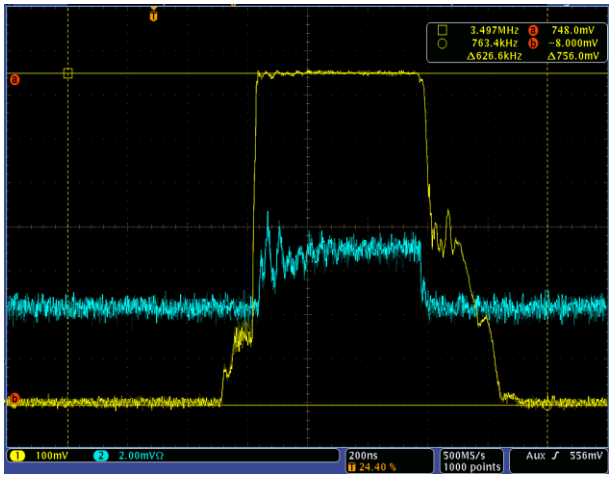
Have started on Monday 07.05.2012

- RF production with <u>detuned</u> pulse compressor with 250ns RF pulse width max.

Expected on Friday 11.05.2012

- Testing of automatic structure conditioning software. Ramping up RF power to 50 MW.
- Operation at low RF power level with <u>tuned</u> pulse compressor.
- Condition pulse compressor and waveguide network to nominal power in parallel with a structure test
- Implementation of controls and eventually necessary hardware upgrades for routine operation.
- Testing the structure routinely. -> mid July 2012

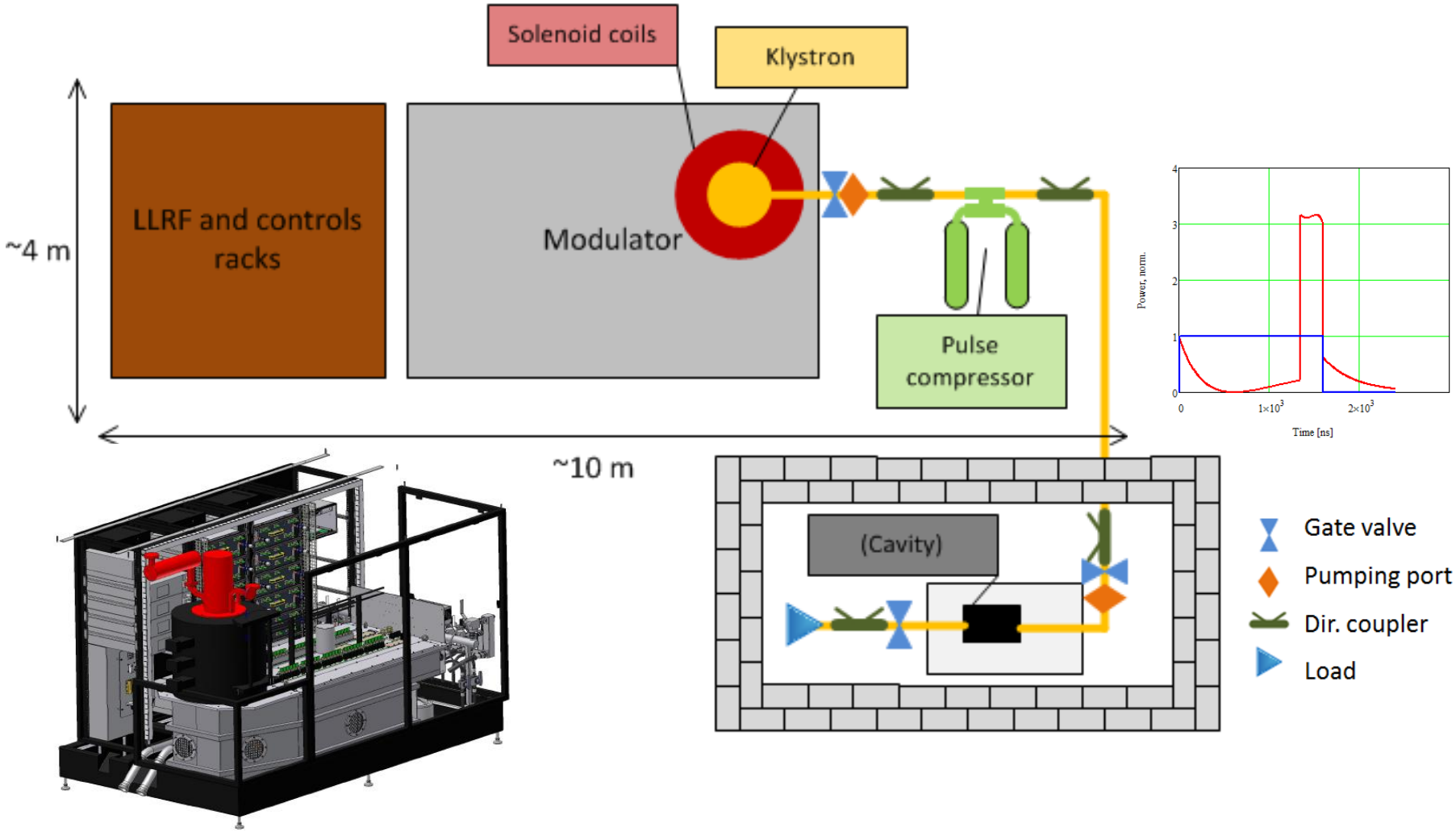
Automatic conditioning and structure test software



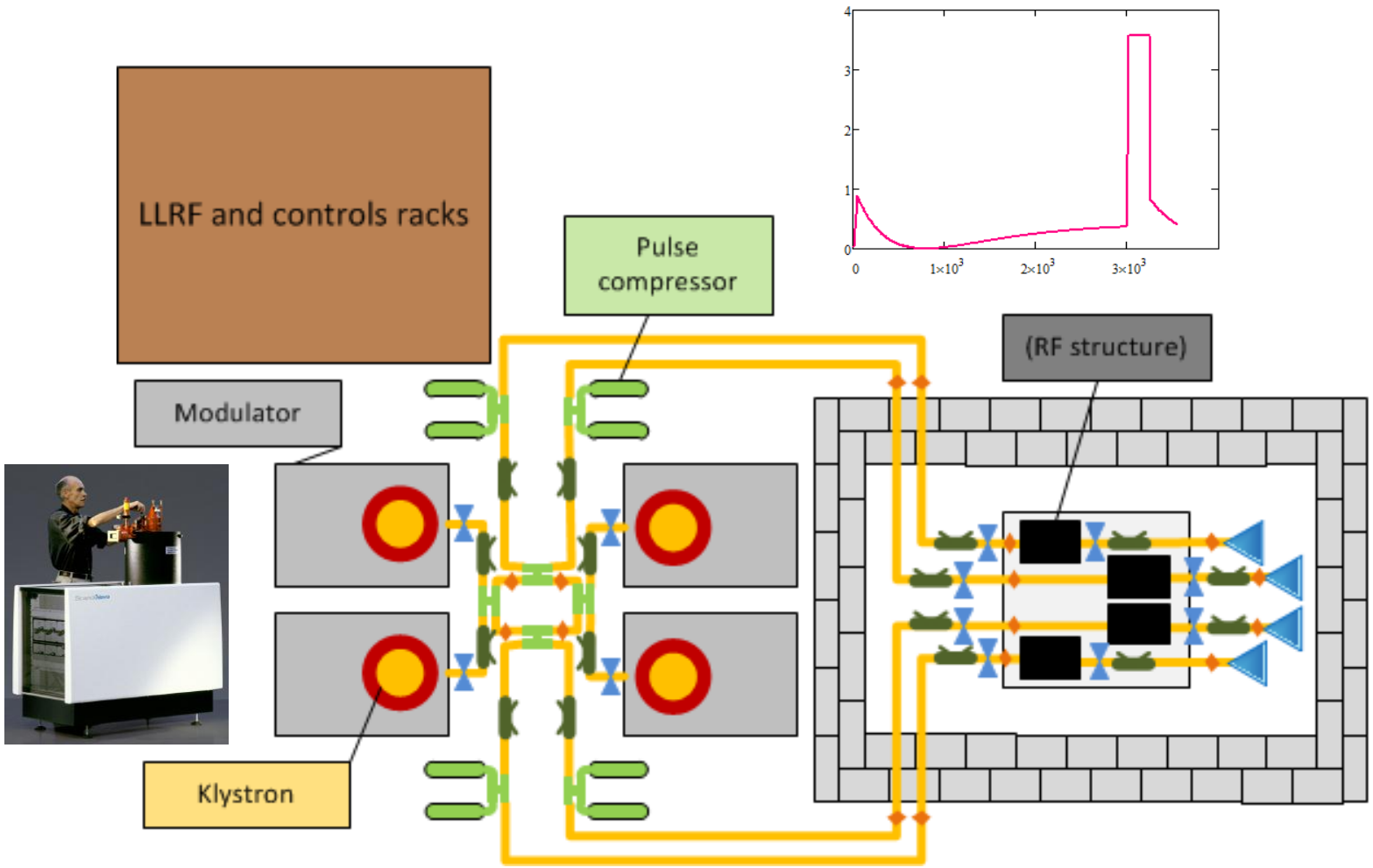
12GHz diode and IQ detector replacement (log detectors, down mixing) under development

Summarised by Jan Kovermann

#2 50 MW klystron (XL-5, CPI) test stand will be able to deliver to the testing area up to 130 MW x 250 ns pulses at 50 Hz (potentially 100 Hz)repetition rate. The overall power consumption is 43 kW.

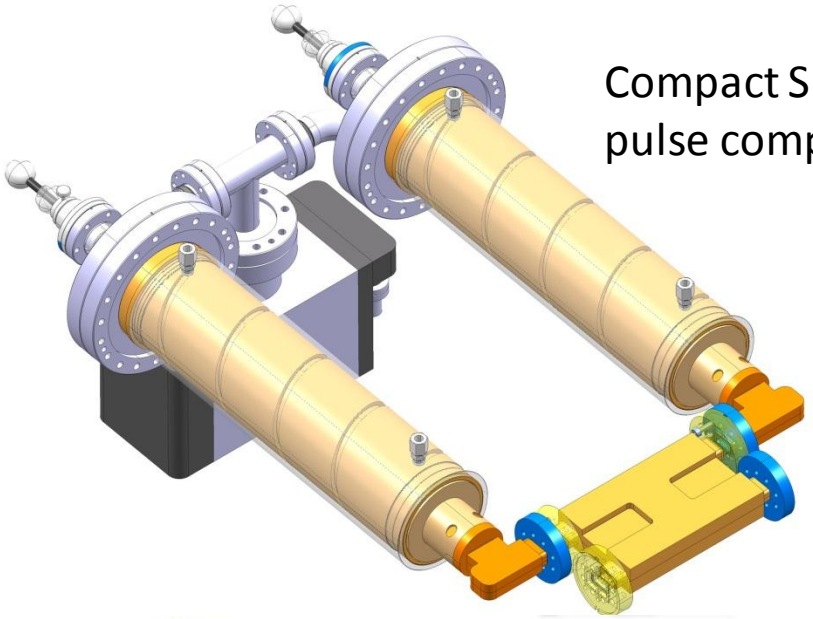


#3 6 MW klystron's cluster test stand will be able to deliver to the x 4 testing areas up to 70 MW x 250 ns pulses at 100 Hz repetition rate in parallel. The overall power consumption is 88 kW.



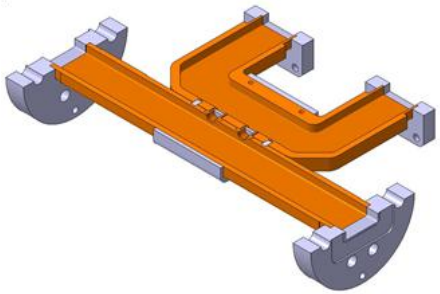
To operate the two new test stands requires massive fabrication of RF components.
To reduce the components cost we developed new compact solutions for some of them.

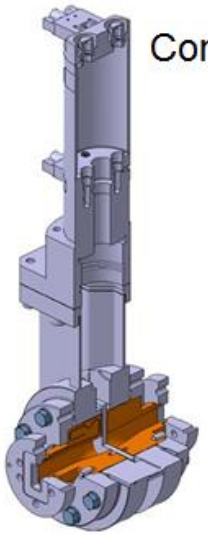
Gate valve	: 16
Pumping port	: 20
Dir. coupler	: 20
Load	: 6
Pulse compressor	: 5
3dB hybrid	: 5



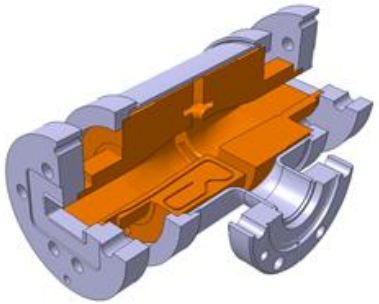
Compact SLED type pulse compressor.

"Simple" -60 dB directional coupler.

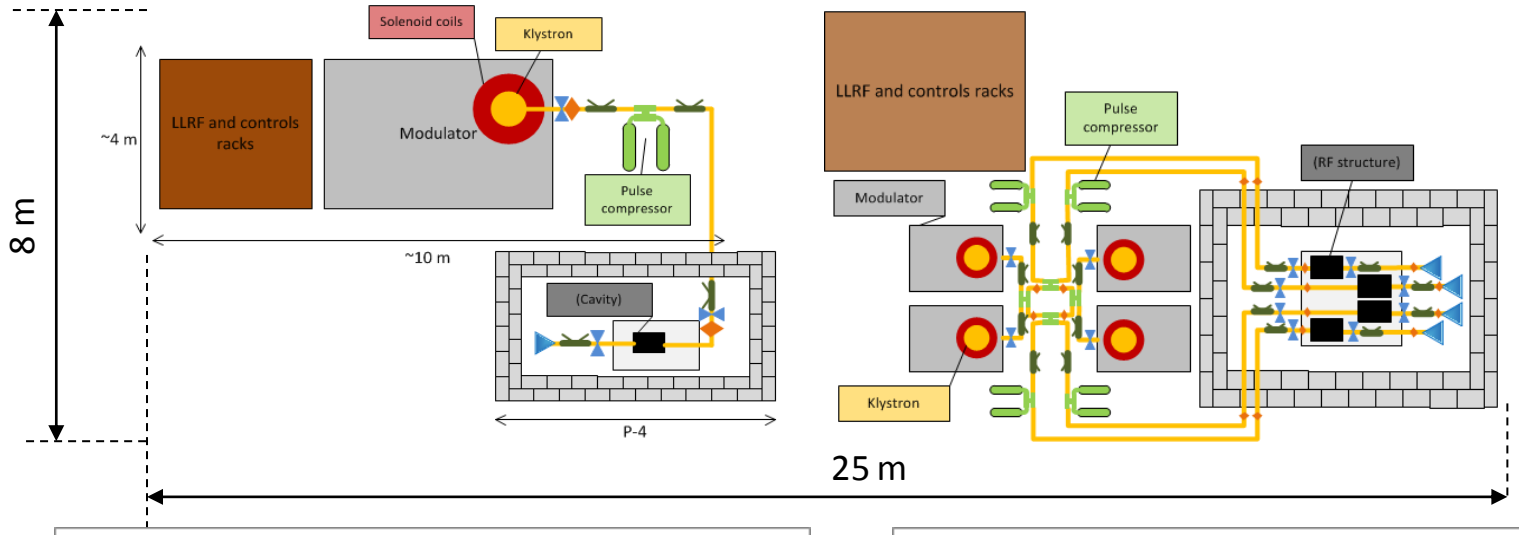


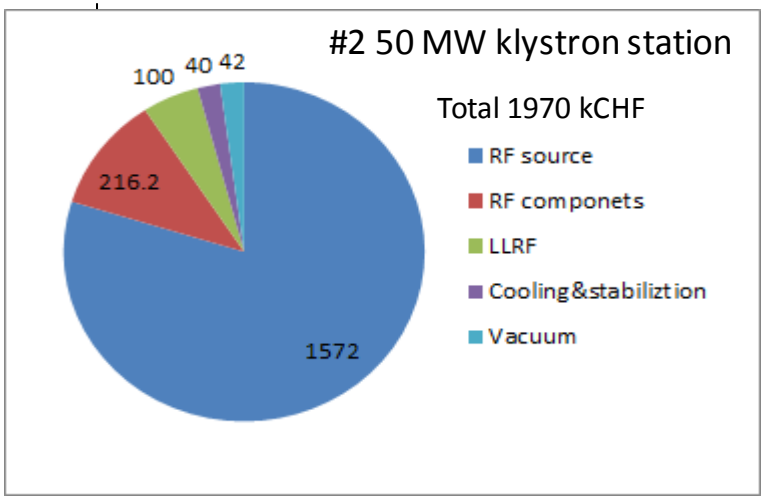


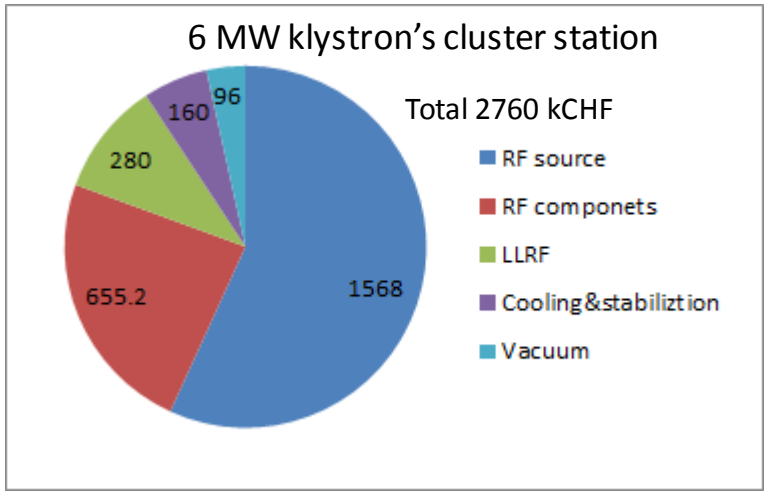
Compact RF/vacuum gate valve and vacuum pumping port.



To host the two new test stands one would need about 200 m^2. The space reservation and waveguides length can be reduced significantly if the two levels option can be adopted.

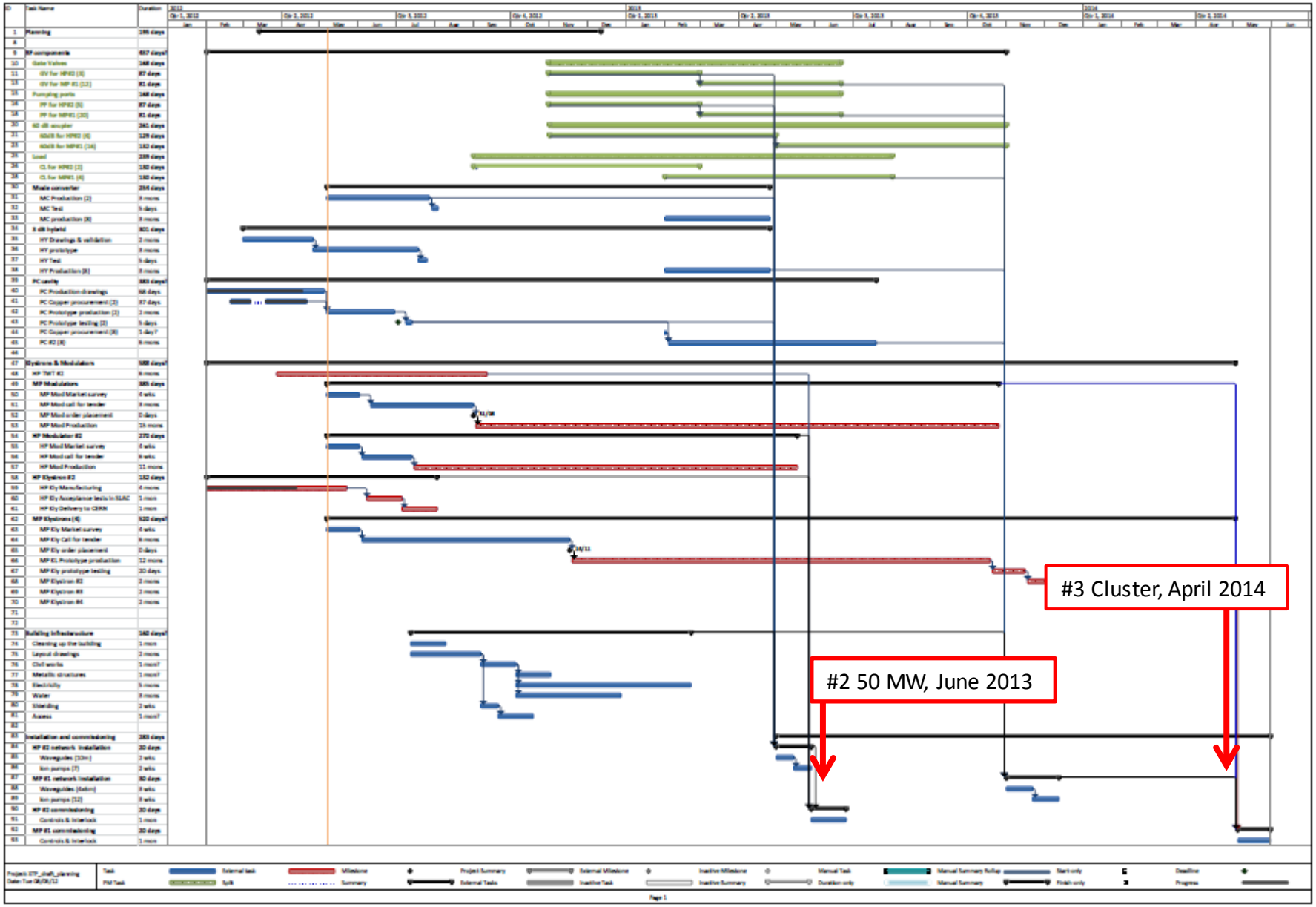






Civil engineering is not included.

Tentative planning for the test areas development.



Budget and technical profile in the medium term

Assumption -> 50MW: 2 structures/year; 5 MW cluster: 4(8) structures/year

Budget [MCHF]	2012	2013	2014	2015	2016	2017	
Design	0.2	0.2	0.2	0.2	0.2	0.2	
Production	1.2	1.6	1.9	2.4	2.8	2.8	
Test areas	2.8	2.8	2.8	0.0	0.0	0.0	8.4
Testing	0.3	0.4	0.6	0.7	0.8	0.8	
High gradient	0.2	0.2	0.2	0.2	0.2	0.2	
Totals	4.7	5.2	5.7	3.5	4.0	4.0	27.1
Cost inputs							
	Infrastucture	rf	Total				
Initial installation for test stands	1.7		1.7				
Marginal cost for one test stand	0.2	1.8	2				
Full cost structure			0.3				
Testing year cost per stand			0.12				
KEK							
CERN 1 (SLAC)							
CERN 2 (CPI1)							
Collaborator (CPI2)							
CERN3 (5 MW)							Sum
Number 50 MW stands	1	2	3	4	4	4	18
Number 5 MW stands	0	0	0	0	1	1	
Number structures tested	2	5	6	8	12(16)	12(16)	44(52)

KEK workshop Walter Wuensch 18 April 2012