



Status of RF at HZB and SRF at *BERLinPro*

Wolfgang Anders,

Helmholtz-Zentrum Berlin for materials and energy (HZB)

ESLS-RF Meeting 9.-10.10.2011 ALBA

- BESSY II
 - HOM damped cavities
 - Solid state transmitters
 - First year with new Linac
- MLS
 - Transport problem of spare IOT's
 - Ion problems in 80 kW IOT
- BERLinPro
 - Status and time schedule
 - Building
 - Modules & Cavities
 - Transmitter
 - Fundamental power coupler tests

As reported last year, BESSY II is running out of spare parts for old DORIS cavities.

So last year two HOM damped cavities have been ordered at RI.

Delivery expected in November, installation in shutdown summer 2013



It is planned to order next two cavities end of this year.

Three of five klystrons at BESSY II are running more than 100.000 hours (high voltage time).

Klystrons are out of production at Thales and E2V. There is a limited number of spare klystrons in house, but long term a solution is needed.

Since two years the principle decision was to replace the klystron transmitters (4x 75 kW + 1x 40 kW 500 MHz) by solid state transmitters, but there was no budget.

In June 2012 the chance for money was realistic and end of August 2012 there was the decision for financing two transmitters, if first payment is this year.

Call for tender for 2x75 kW transmitters was started immediately. Next year I will report on the results.

Thales 50 MeV Linac in operation since one year

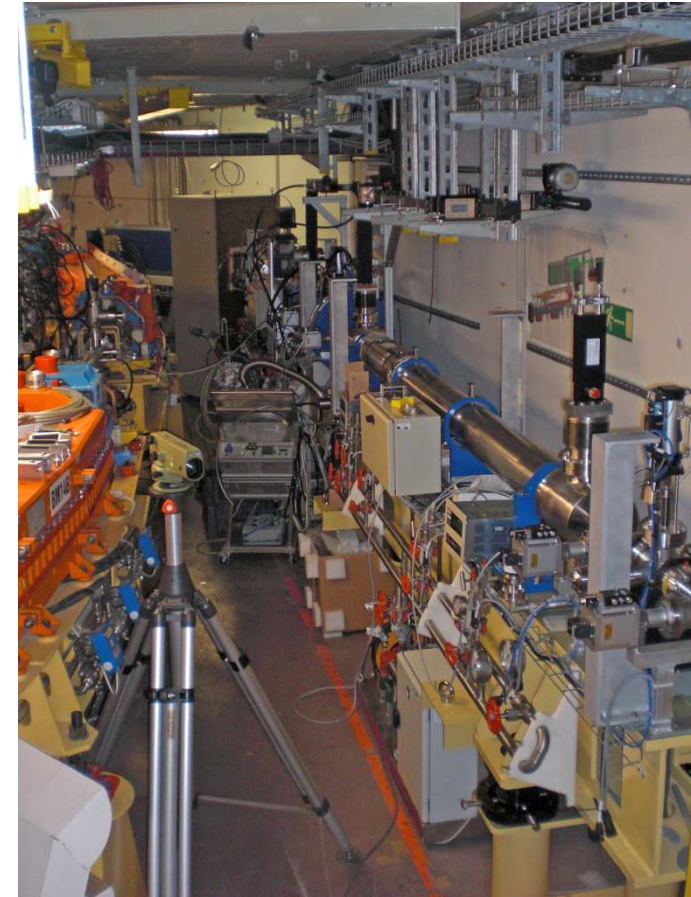
Linac is in specifications

Linac cavity structure had a leakage

→ Repaired

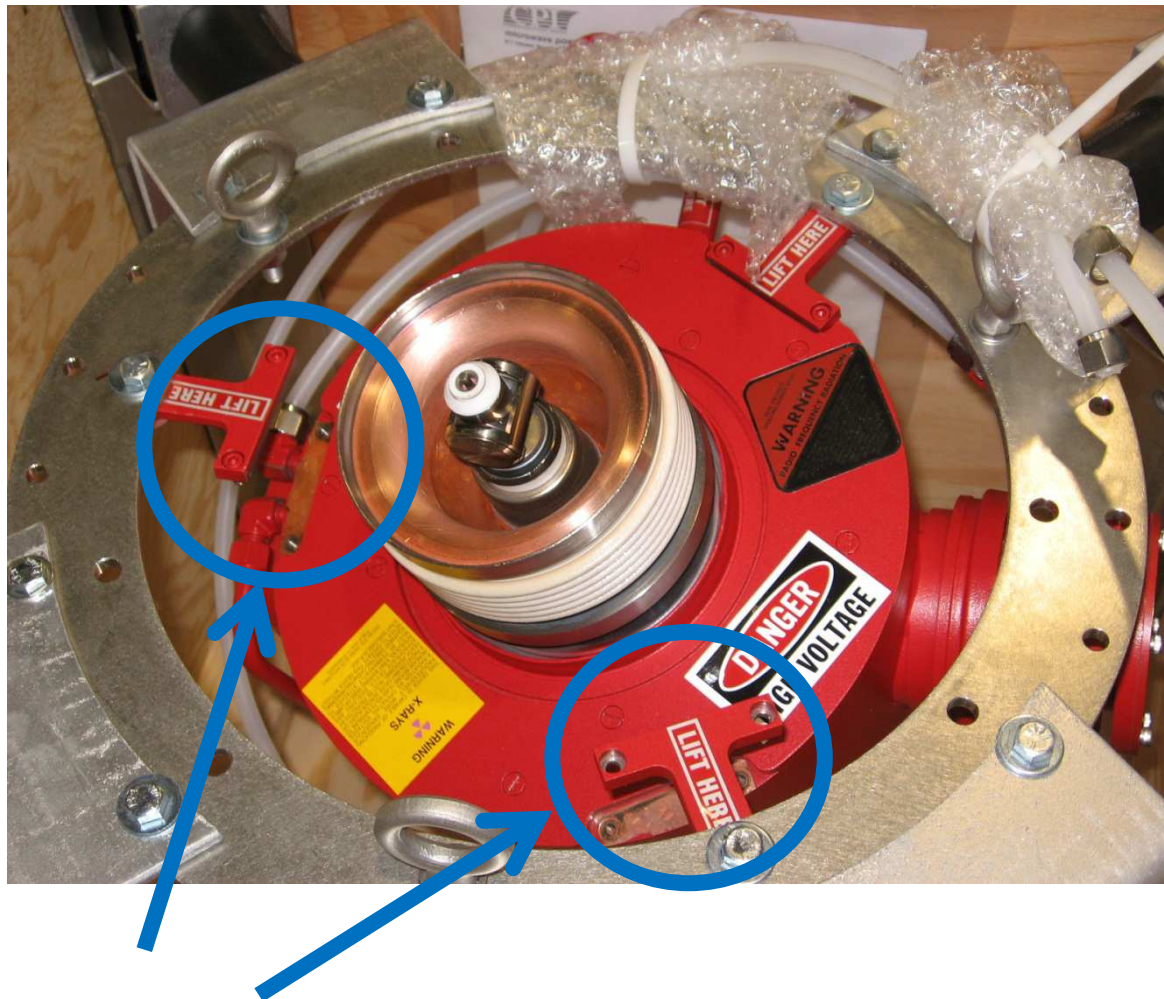
Some room for improvements

- Stability of phase shifters
- Charging power supply is charging during pulse → need blank out trigger
- Poor regulation of charging power supply

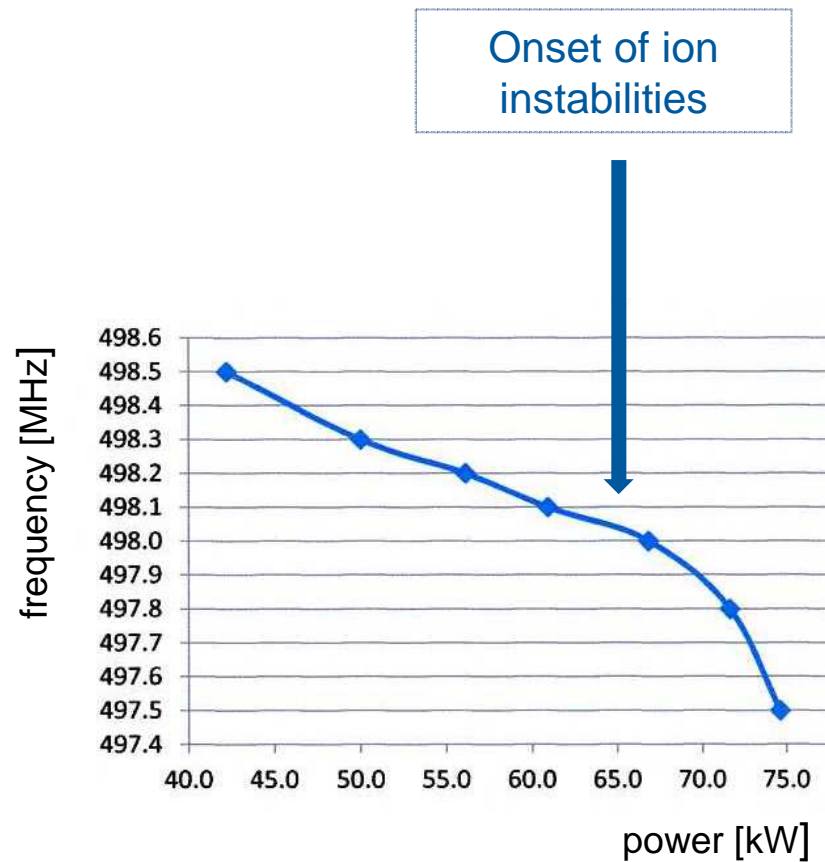


BESSY II injector Linac
during installation

MLS: spare IOT's transport damage



Lost screws while transport of spare IOT from CPI



Courtesy CPI

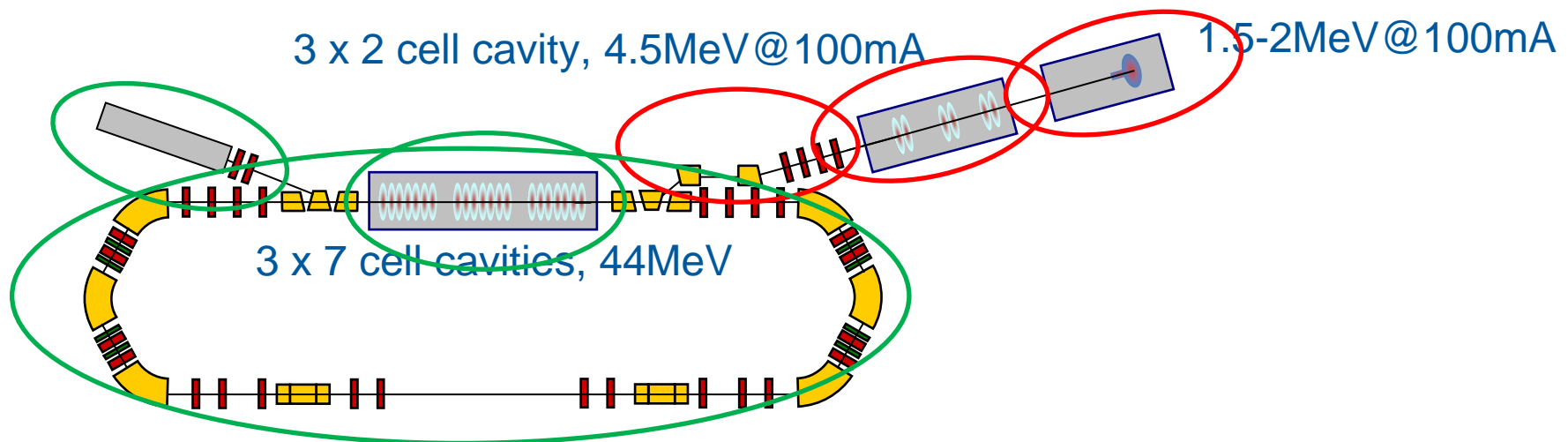
As reported two years ago, there was detected amplitude and phase instabilities in CPI and E2V IOT's

CPI is working on this topic:

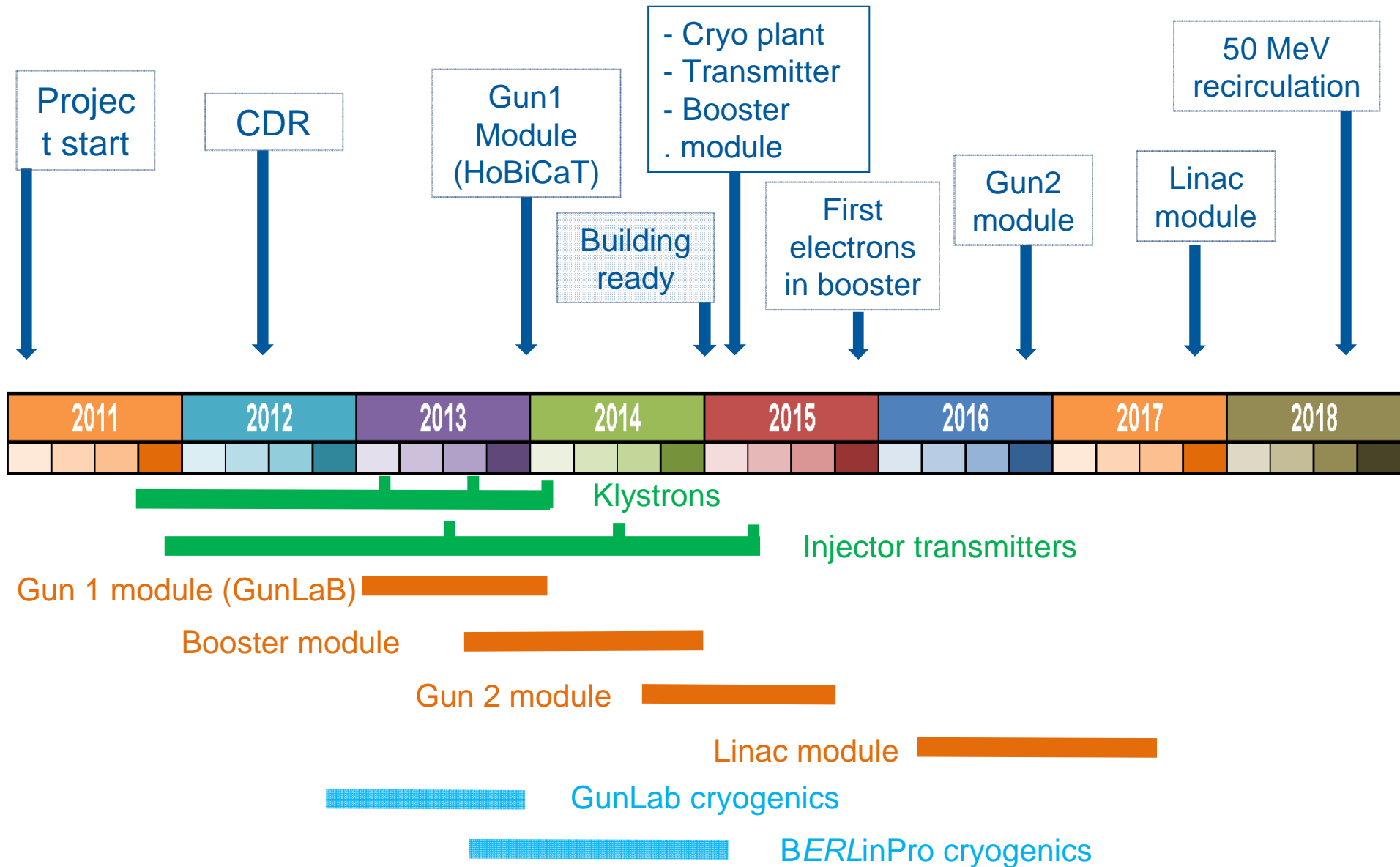
- At the onset of the instabilities there is an increase of the drift of the resonance frequency of the input cavity
- Calculations on the focusing of the beam in the electron gun area show, that the design is not in optimum
- At high power (high beam current) the beam is not properly focused and electrons hit the wall causing a temperature rise and a frequency shift of the input cavity
- Calculations and tests are ongoing

Status BERLinPro:

- Rescoping to 50 MeV accepted by MAC
- Budget readjusted to ~36 M€ and approved by board of directors
- Time schedule readjusted
 - 2011 – 2015 photo injector, booster and merger magnets
 - 2016 – 2018 linac, recirculation and beam dump



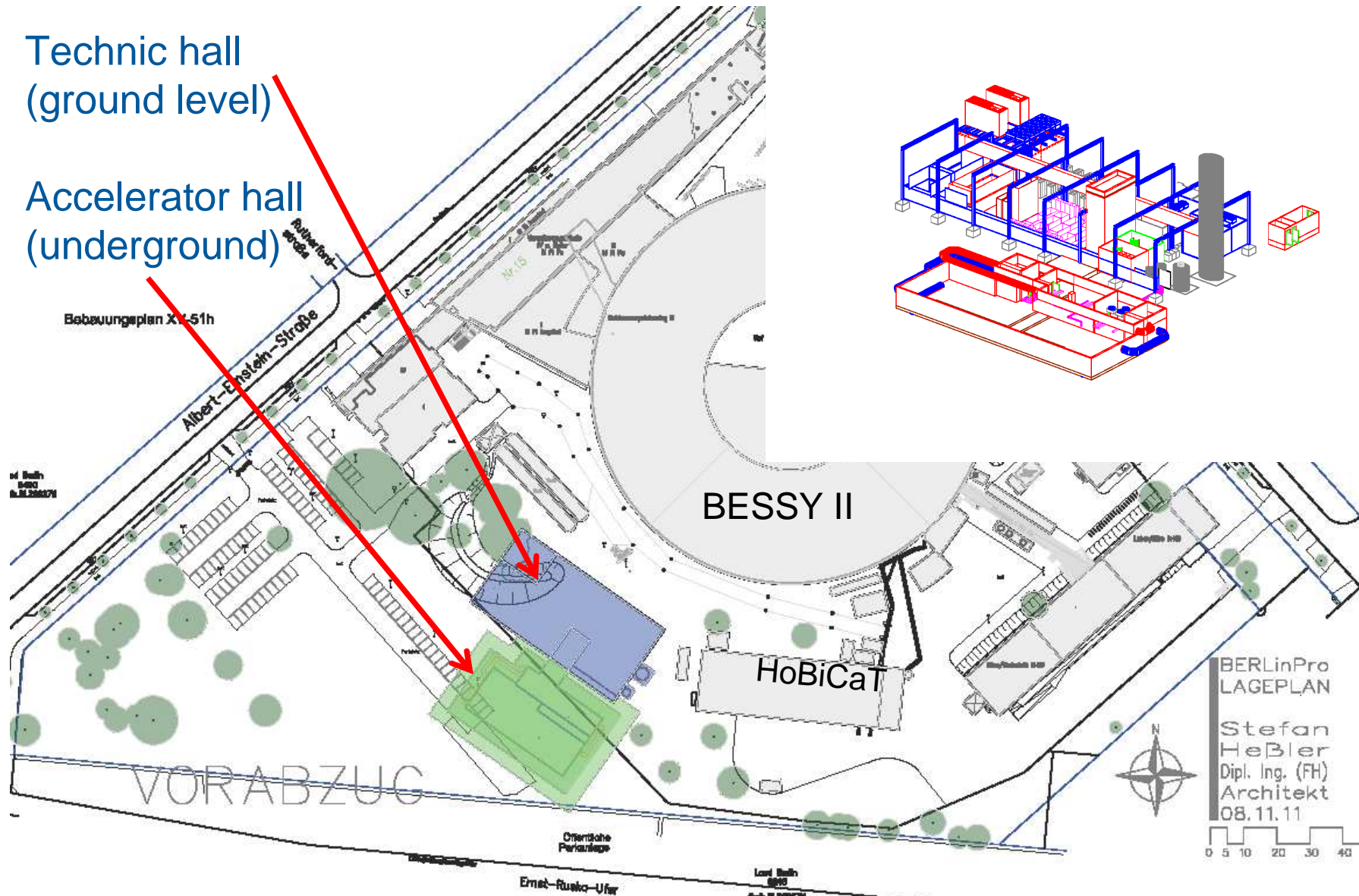
BERLinPro: Time schedule



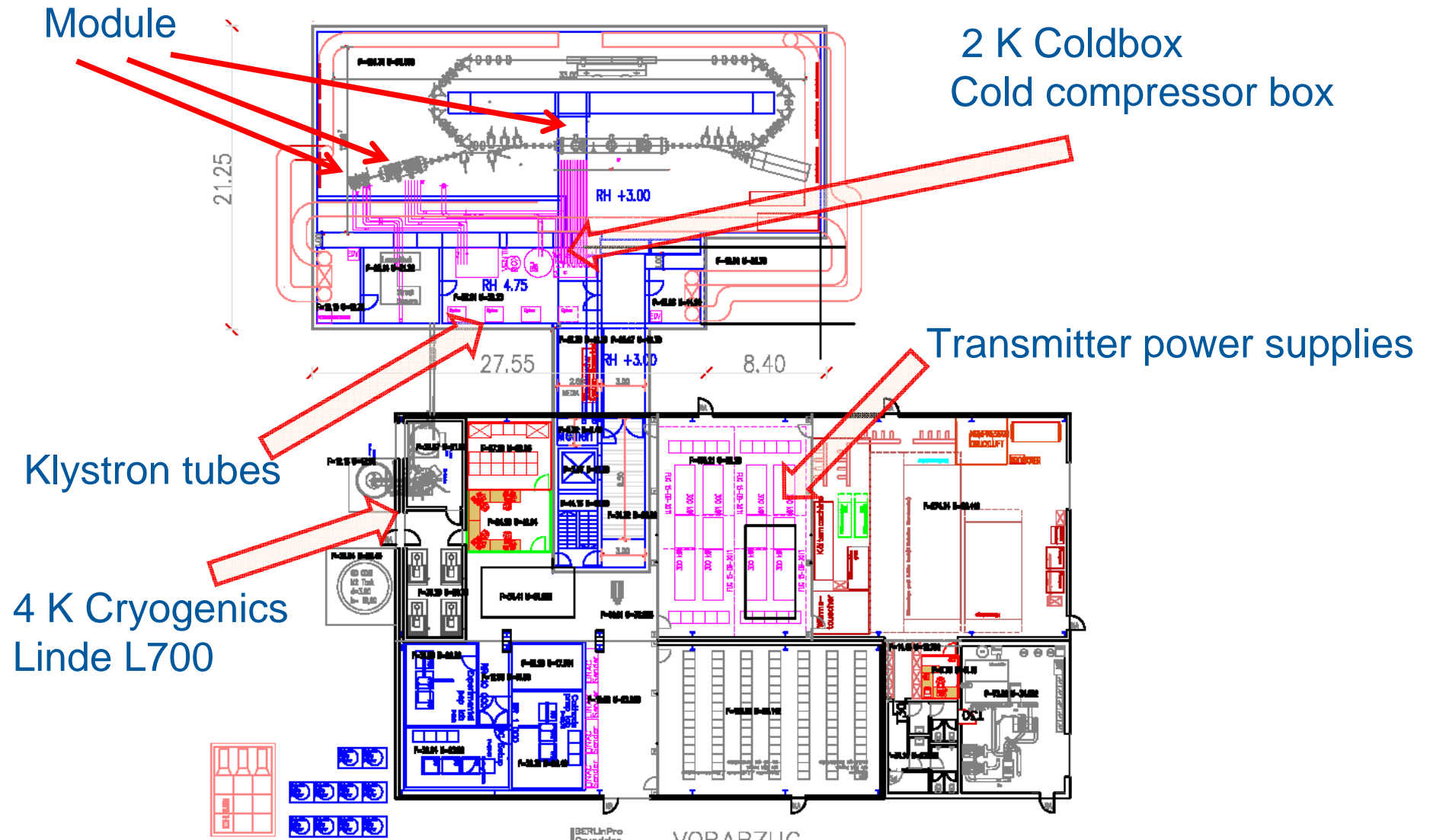
BERLinPro: Building

Technic hall
(ground level)

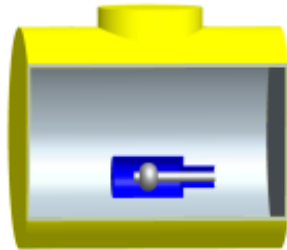
Accelerator hall
(underground)



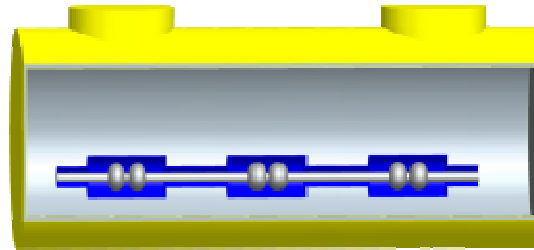
Lageplan Grundlage ist der Lageplan des Vermessungsbüros R&S, Rek & Dr. Schwenk vom Oktober 2011



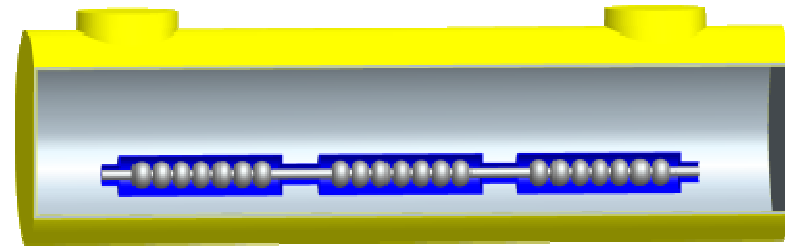
Gun



Booster



Linac



**Gun 1 module
ready 1/2014**

**Booster module
ready 1/2015**

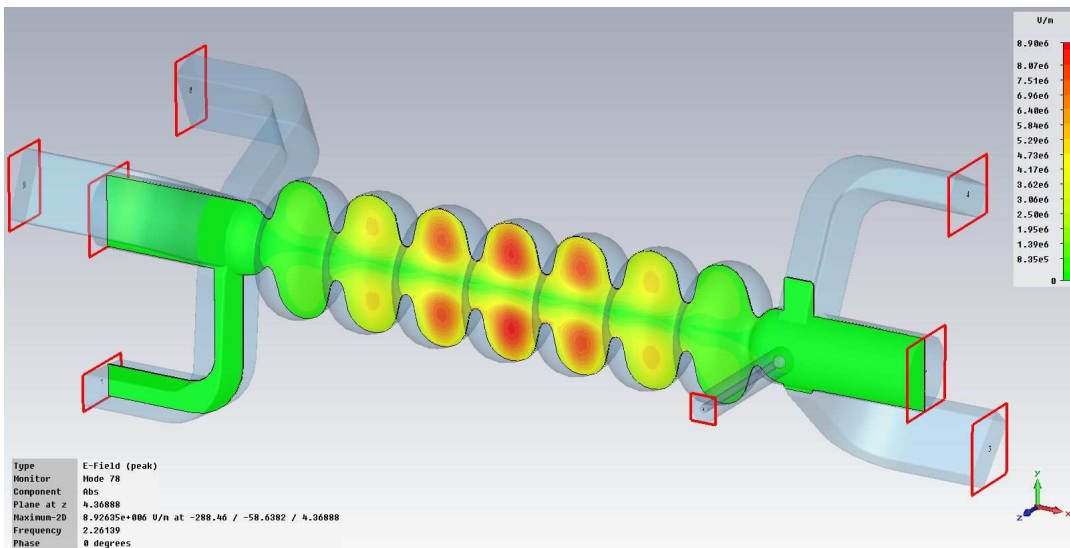
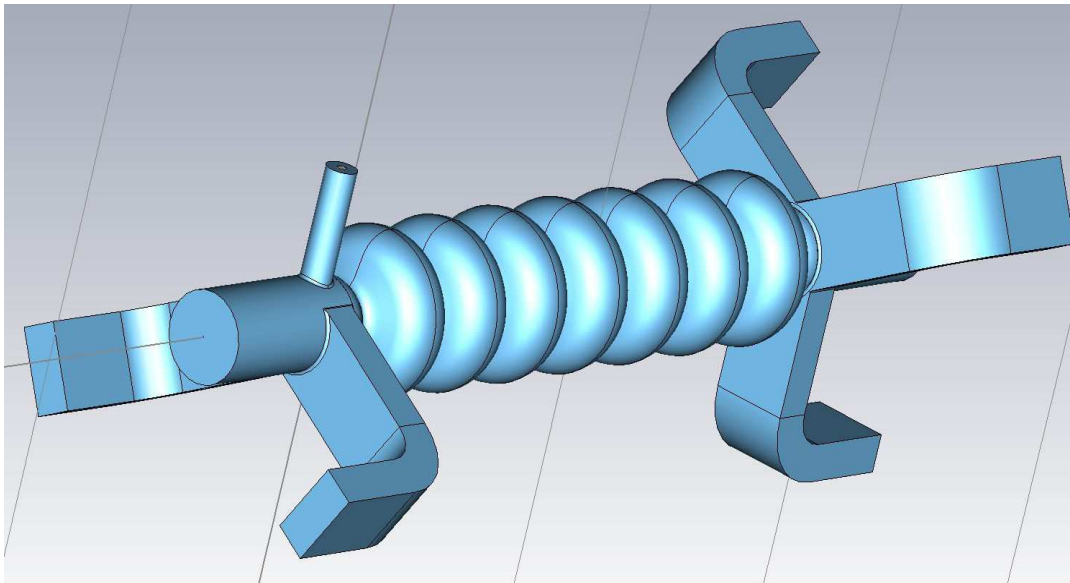
**Linac module
ready 3/2017**

damper
2 KEK coupler

**Gun 2 module
ready 10/2015**

damper
• 3x 2 KEK coupler
• 2x 160 / 270 kW +
1x 15 kW transmitter

• waveguide from
damper
• 3x 1 BESSY coupler
• 3x 15 kW transmitter



- The BERLinPro main linac will consist of three 7- cell cavities using five waveguide HOM dampers
- Cavities are developed in cooperation with Technical University Dortmund (DELTA) and University Rostock financed by „Verbundforschung“
- Calculations ongoing
- Copper model in production
- Bead pull setup is ready

BERLinPro: RF transmitters overview

	base design		upgrade option
	stage 1	stage 2	
	transmitter power		
Gun cavity	160 kW	270 kW	270 kW
Booster Cavity 1	15 kW	15 kW	80 kW
Booster Cavity 2	160 kW	270 kW	270 kW
Booster Cavity 3	160 kW	270 kW	270 kW
Linac Cavity 1-3	15 kW	15 kW	15 kW

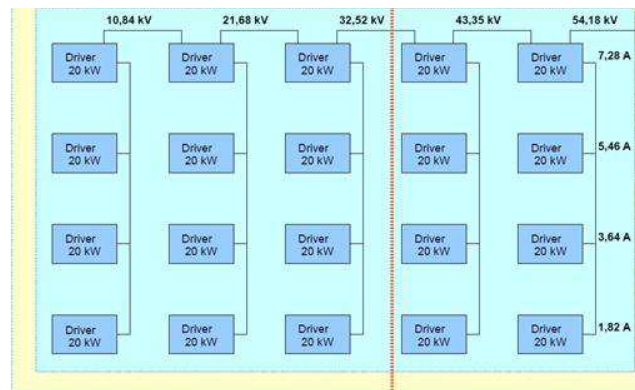
ordered
call for tender
ordered
ordered

400kW Drivers power (20 Driver a 20kW)

CPI-Klystron:
120 kW: 50kV / 6A
200 kW: 56kV / 7.7A
280 kW: 62.5kV / 8.96A

20 Driver : 54.18 kV / 7.28 A
Klystron - RF - power : ~ 160 kW

Staging of RF transmitters



54.18 kV / 7.28 A

Power supply modules for the klystron transmitters.

• 20 modules:

54 kV 7.3 A → 160 kW_{RF}

• Upgrade to 30 modules:

→ 62.5 kV 9 A → 270 kW_{RF}

Eiji Kako KEK

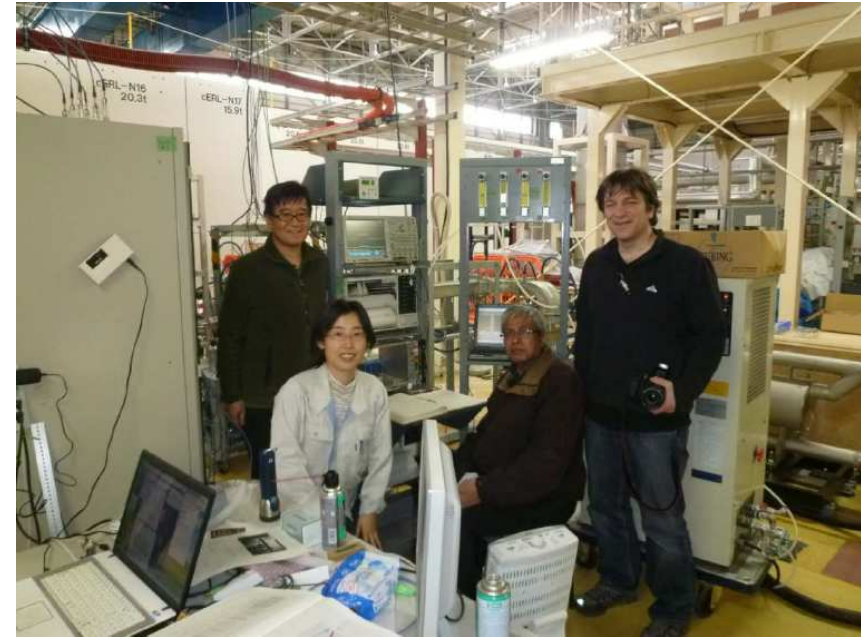
Oliver Kugler HZB

Amiya Mitra TRIUMF

Takako Miura KEK



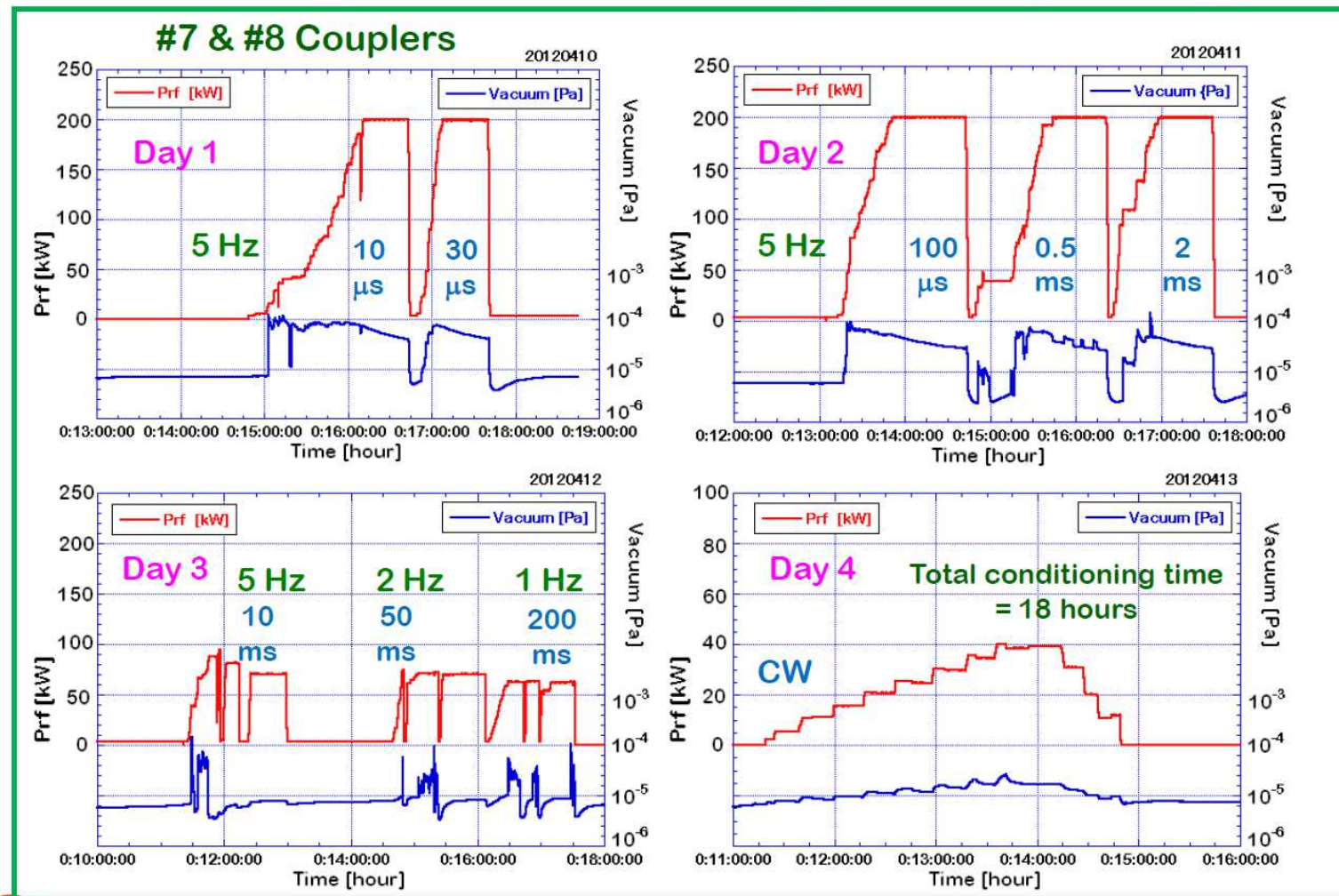
Coupler test stand at KEK



Collaboration on CW input
couplers between
KEK/HZB/TRIUMF



Conditioning Results of CW Input Couplers (1)



200 kW
pulsed

40 kW
CW

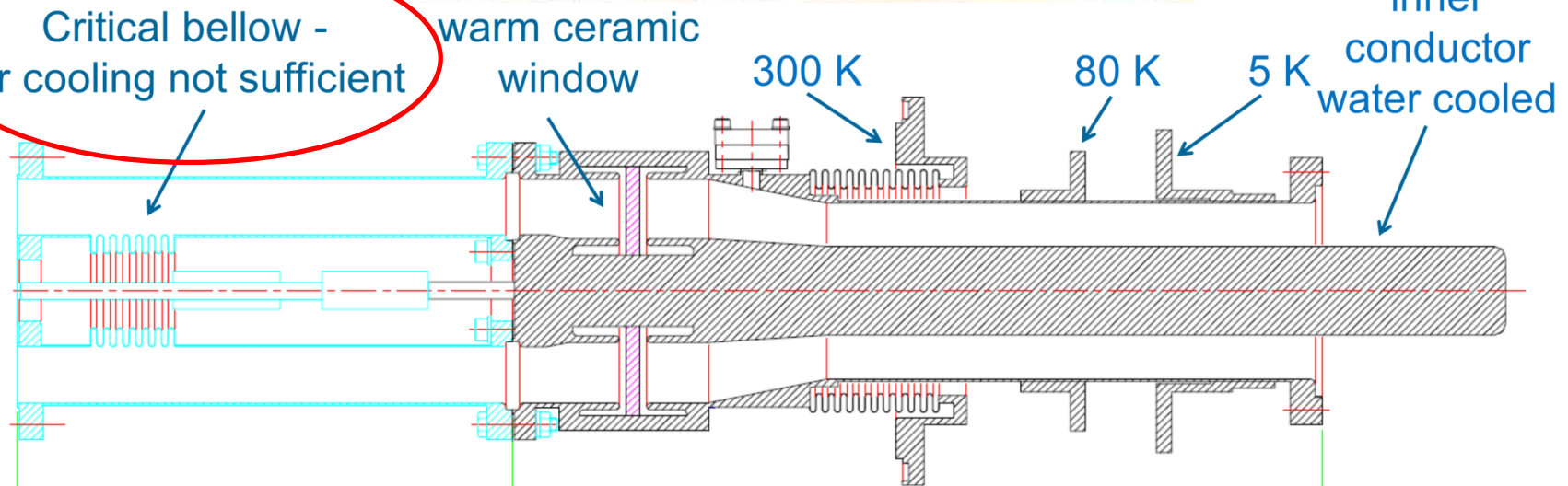
We need
 ≥ 120 kW

Courtesy E. Kako

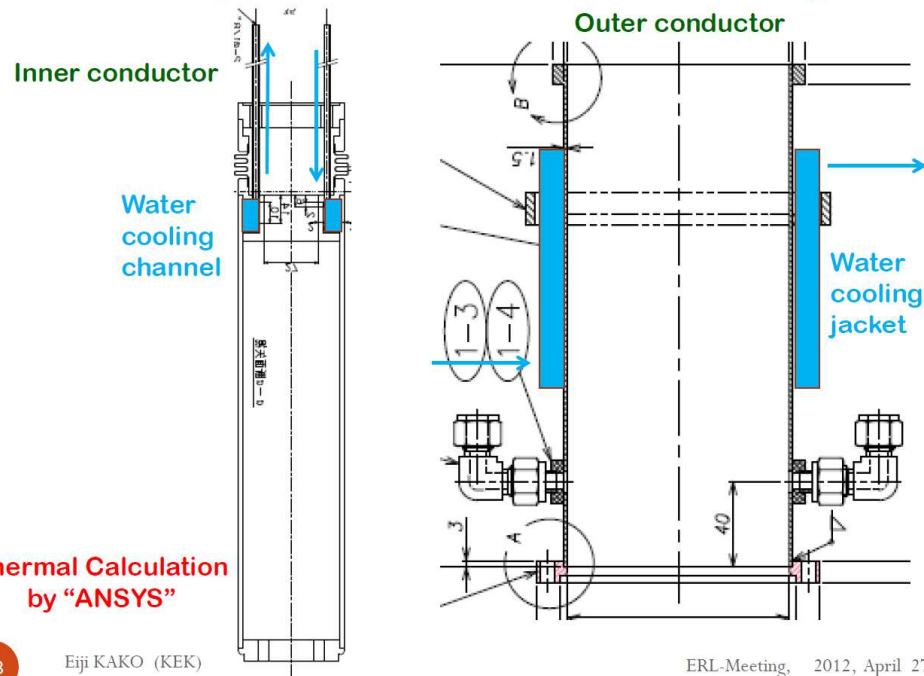
BERLinPro: INJECTOR COUPLERS CRITICAL PARTS



Critical bellow -
air cooling not sufficient



Further Improvement for efficient cooling



HZB will do some minor modifications:

- to reduce coupler kicks (Pringle)
- for horizontal mounting

To check all the modifications a copy of the cERL coupler test stand is planned at HZB to be realized summer 2013 (when first transmitter is in house)

cERL proposal of water cooling of critical parts

“Best of All – Module” Example Gun1 module

Module design will be used for
Gun1, same components for
booster, linac ???

Cathode insert (HZDR)

Cavity support structure (Cornell)

HOM damper
(Cornell/DESY)

Blade tuner
(INFN/DESY)

Cavity structure (HZB)

Coupler (KEK)

Moveable Solenoid (HZB)

Wolfgang Anders

Status of RF at BESSY II and SRF at BERLinPro

- BESSY II: Replacement of old components started:
 - DORIS cavities by HOM damped cavities
 - Klystron transmitters by solid state transmitters
- MLS: CPI is working on instabilities in 80 kW IOT
- *BERLinPro*:
 - New time schedule of the project
 - First layout of the building
 - SRF modules
 - Status of transmitters
 - Coupler tests at KEK
 - First design of photo-injector module

Thank you !