Status of RF at HZB: BESSY II, MLS, bERLinPro and BESSY VSR

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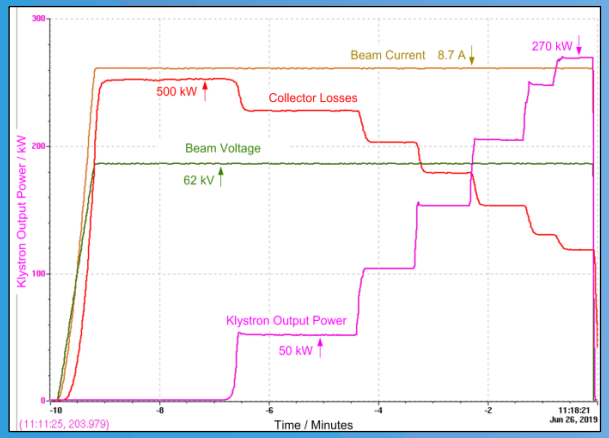
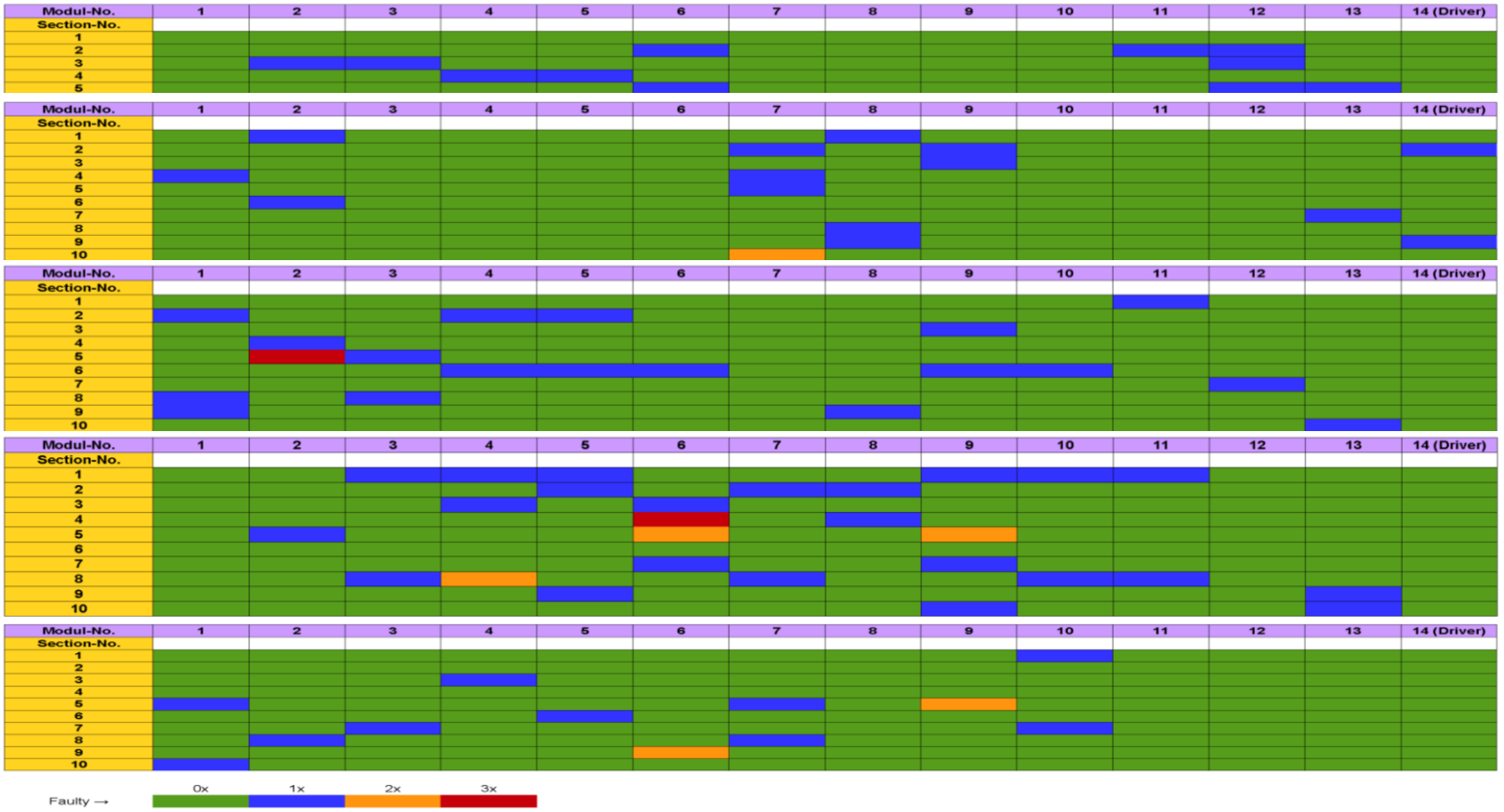


Agenda

- BESSY II
  - 500 MHz SSA operation statistics
  - Rumors on TH2100 klystron
- MLS
  - IOT fault 12000 h
- Projects
  - BP status & problems with water system
  - VSR status
- Ordered Transmitters
  - 270 kW_{cw} 1.3 GHz klystron transmitters (bERLinPro)
  - 15 kW_{cw} SSA (bERLinPro & BESSY VSR)
  - 80 kW_{cw} 500 MHZ SSA (BESSY II & BESSY VSR)
  - Waveguides, Circulators & loads

Operation of 500 MHz SSA



- **Reliable operation of the 500 MHz 80 kW SSA**
- Picture show the module statistic 2014-2019: green no fail, blue 1x, orange 2x, red 3x
- Last 12 month 18 out of 630 modules fail (< 3%) and have been repaired
- Losses mostly Monday at switch on to full power
- No losses in continually operation
- After introducing a power ramp ~sec ➔ fails reduces

Rumors on TH2100 klystron

We heard rumors that our linac klystron TH 2100-1 will run out of production soon.

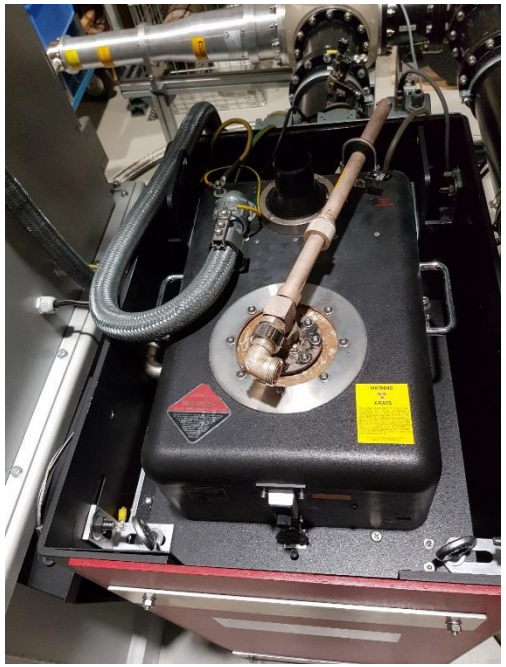
➔ Answer of Thales: There are different types of TH2100. Some of them will be discontinued but TH2100-1 will stay on the production list.

Sehr geehrter Herr Schüler,
nach Rücksprache mit Frankreich kann ich Sie beruhigen. Es ist korrekt, dass einige TH 2100-Typen bereits abgekündigt wurden. Dazu zählt aber nicht die TH 2100-1. Ob und wann dieser Röhrentyp eingestellt wird, ist derzeit unklar. Sollte die Abkündigung zukünftig aber beschlossen werden, so erhalten Sie hierzu eine LBO-Meldung, so dass Sie noch eine letzte Bestellung tätigen können (sollten zwingende Gründe der Produzierbarkeit nicht dagegensprechen). Haben Sie denn für diese Röhre derzeit einen konkreten Bedarf? Wenn nein, vermögen Sie abzuschätzen wann es zu einem konkreten Bedarf kommen könnte? Diesen könnte ich dann schon einmal in unser Forecast-Tool einpflegen(z.B. für 2020 oder 2021), so dass wir da keine Überraschungen erleben. Sollte die Röhre dann in der Zukunft abgekündigt sein und sollten Sie dann doch noch eine Bestellung tätigen wollen, so wären hierfür in jedem Fall Einmalzahlungen (NREs) für die Produktionswiederaufnahme von derzeit unbekannter Höhe fällig. Sicherlich würden diese Kosten aber bei mehreren 10 k€ liegen.

Mit freundlichen Grüßen / Best regards
Uwe Steinke
Sales Manager DefSI / NDT / SPACE – Central Europe Electron Devices Thales Deutschland

MLS 80 kW IOT

- In August the 500 MHz 80 kW IOT by CPI had vacuum failure
- Operation time was only 12,000 h
- Failure occur at operation of 55 kW



CPI 80 kW 500 MHz IOT

Left side top view
Right side disassembled

bERLinPro Status

- All magnets installed
- Vacuum system of injector to beam dump operating
- Vacuum system of recirculator path ordered
- Cryogenics all installed commissioning soon
- Delays at the SRF modules:
- Gun module has been tested but cavity has to be reworked
- Scratch in back wall of the gun cavity during HPR
- Corrosion in water system → has to replaced completely
- ➔ hoping for first beam in 2020

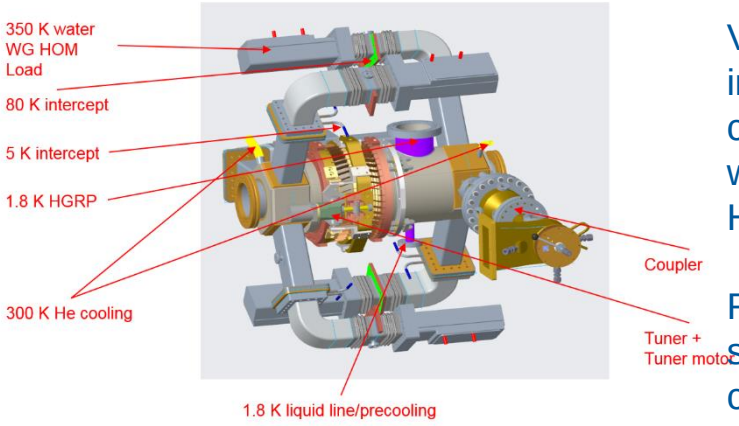
bERLinPro accelerator hall

Corrosion in water system

BESSY VSR Status

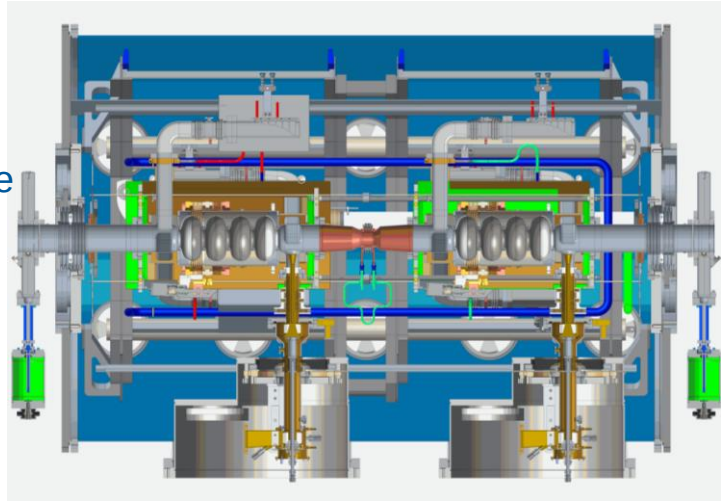
- Cryogenics ordered. Will be delivered 2/2020
- All transmitters ordered
- Diagnostics upgrade started
- SRF cavity, coupler, ferrite HOM loads and module design ready
- Strong cost increase on this components
- No additional money by the institute
- ➔ Need to make a new plan for realization stepwise

Building for the compressors for the cryogenics



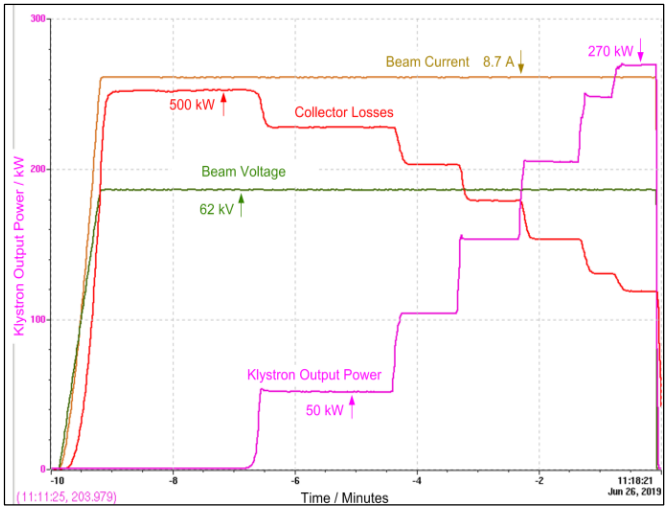
VSR cavity including tuner, coupler and five waveguide HOM dampers

Right side sketch of a two cavity module



270 kW 1.3 GHz Transmitters

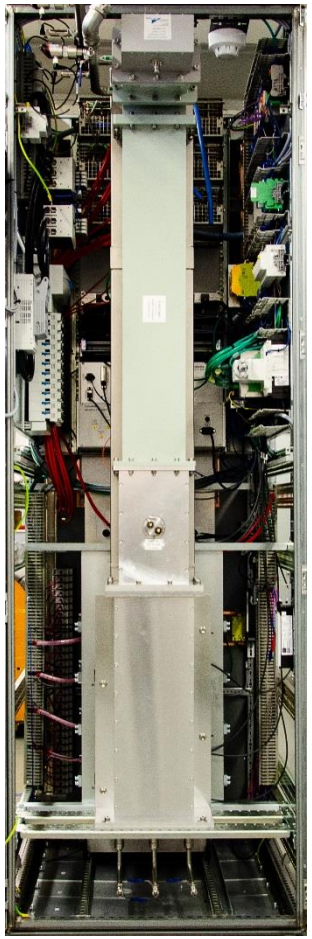
- All klystrons and power supplies installed.
- First klystron test up to 270 kW design value without problems. In picture you see the beam voltage (green), beam current (yellow), collector losses (red) and RF output power (purple).
- Then water problem come up. Now waiting for water to proceed.



Power supply room (left) and klystron gallery (middle). In the right picture you see the klystron and the AFT circulator (left bottom) and the 300 kW load (left top)

15 kW SSA Transmitter 1.3/1.5/1.75 GHz

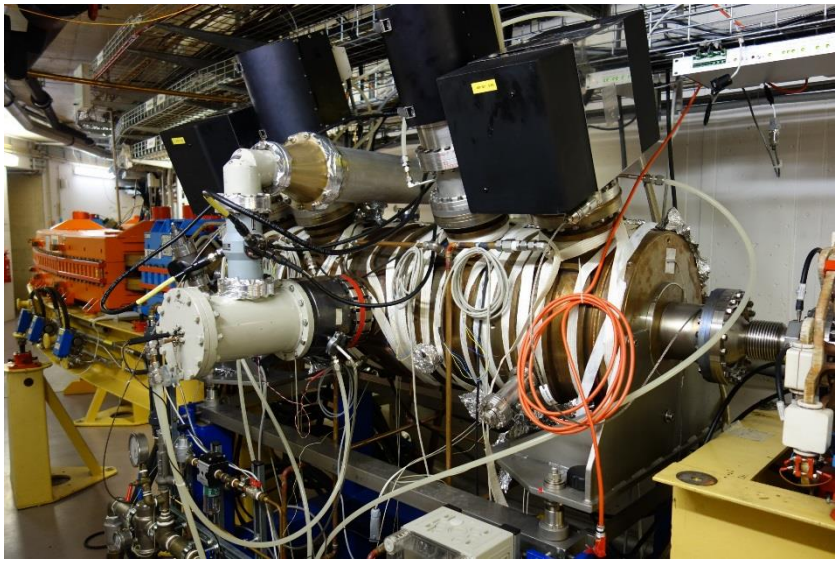
- Several 15 kW SSA have been ordered last year at Cryoelectra.
- For bERlinPro frequency is 1.3 GHz and for BESSY VSR frequencies are 1.5 GHz and 1.75 GHz.
- Parts are mostly produced and first transmitter is mounted. Last adjustments are ongoing.
- Delivery will start soon.



15 kW 1.3 GHz transmitter by ***Cryoelectra***.
Left picture front view and right side rear side door open. The power supplies in the upper part and the RF modules on the lower part of the rack. The waveguide is clearly seen.

80 kW 500 MHz SSA

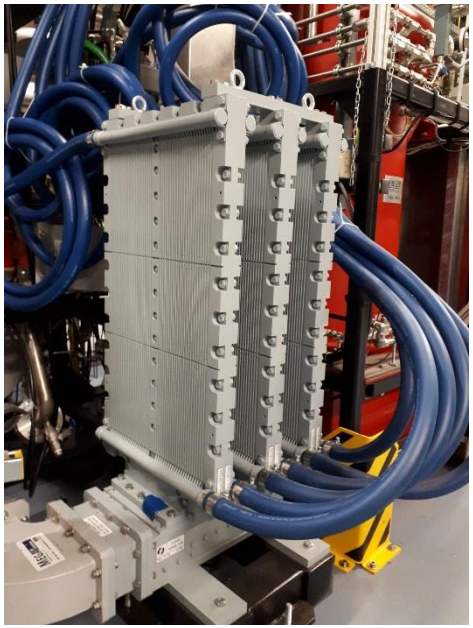
- For BESSY VSR project we have to be able to inject into short buckets in the storage ring ➔ we need shorter bunches in the booster
- Two 5-cell PETRA cavities (from DESY) will be installed. Already in house.
- We ordered two more 80 kW 500 MHz SSA by Cryoelectra to be delivered in summer 2020. Same type as we have already.

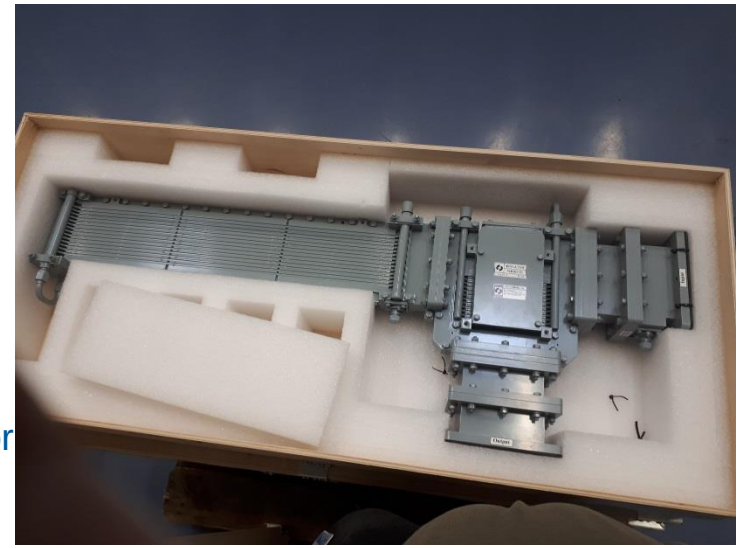


5-cell PETRA cavity installed in the booster and 80 kW 500 MHz SSA (from storage ring) by Cryoelectra

Waveguides, Circulators & Loads

- Waveguides and components (Spinner, MEGA) delivered
- 20 kW circulators (Ferite, Petersburg) and high power loads (20/100/300 kW) delivered





Waveguides,
20 kW circulator
and
300 kW load

Summary

- BESSY II:
  - Normal operation
- MLS
  - 80 kW IOT died after 12,000 h operation
- bERLinPro and BESSY VSR
  - Corrosion in cooling water system of bERLinPro
  - First 270 kW 1.3 GHz transmitter in bERLinPro building tested
  - 15 kW L-band and 500 MHz 80 kW SSA will be delivered soon