JAGIELLONIAN UNIVERSITY IN KRAKOW

SOLARIS NATIONAL SYNCHROTRON RADIATION CENTRE

Status of Solaris RF system

Marcin Knafel

On behalf of Solaris Team

e-mail: marcin.knafel@uj.edu.pl

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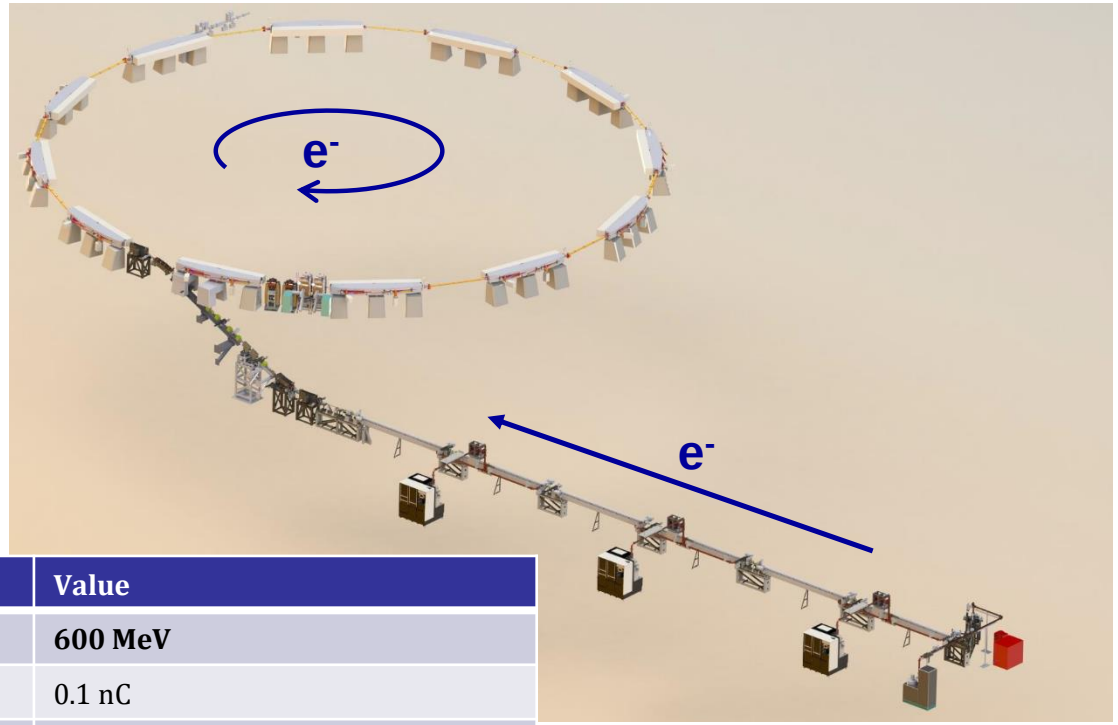
Outline

1. Overview of Solaris
2. RF Projects
3. Issues
4. Future activities

SOLARIS Machine

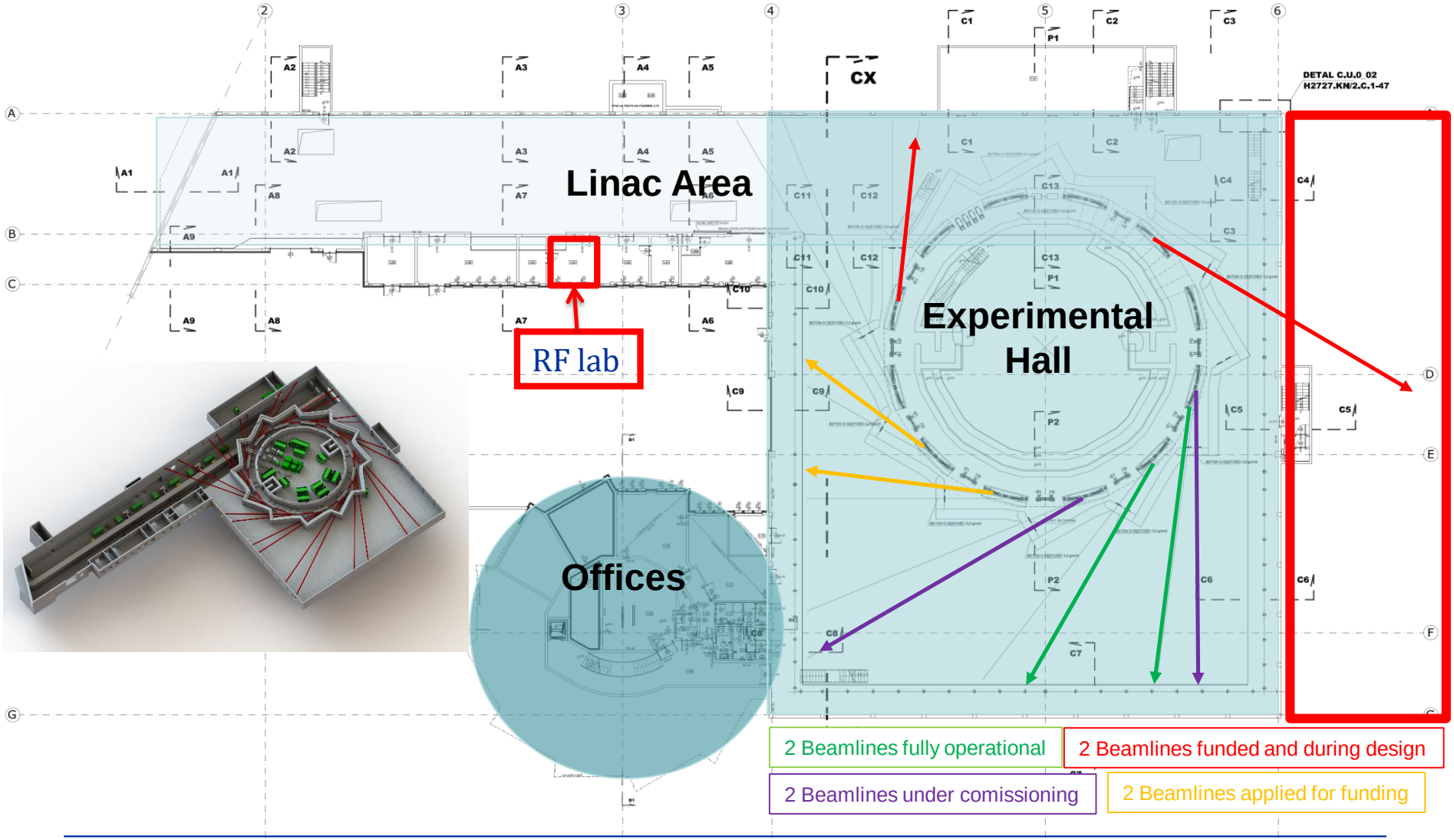
Storage Ring Parameters	Value
Energy	**1.5 GeV**
Current	500 mA
Circumference	96 m
Horizontal emittance (bare lattice)	5.982 nm rad
Coupling	1%
Tunes Q_x, Q_y	11.22, 3.15
Natural chromaticities ξ_x, ξ_y	-22.96, -17.14
Momentum compaction	3.055×10^{-3}
Momentum acceptance	4%
Overall Lifetime	13 hrs



Injector Parameters	Value
Energy max	**600 MeV**
Bunch charge	0.1 nC
Emitance (geom, rms) x/y	3.1 / 2.0 nm rad
Energy spread (rms)	0.23%
Bunch length (rms)	3.68 ps
Injection repetition rate	Up to 10 Hz (linac up to 100Hz)

SOLARIS Building

Experimental hall extension planned 2020



2 Beamlines fully operational

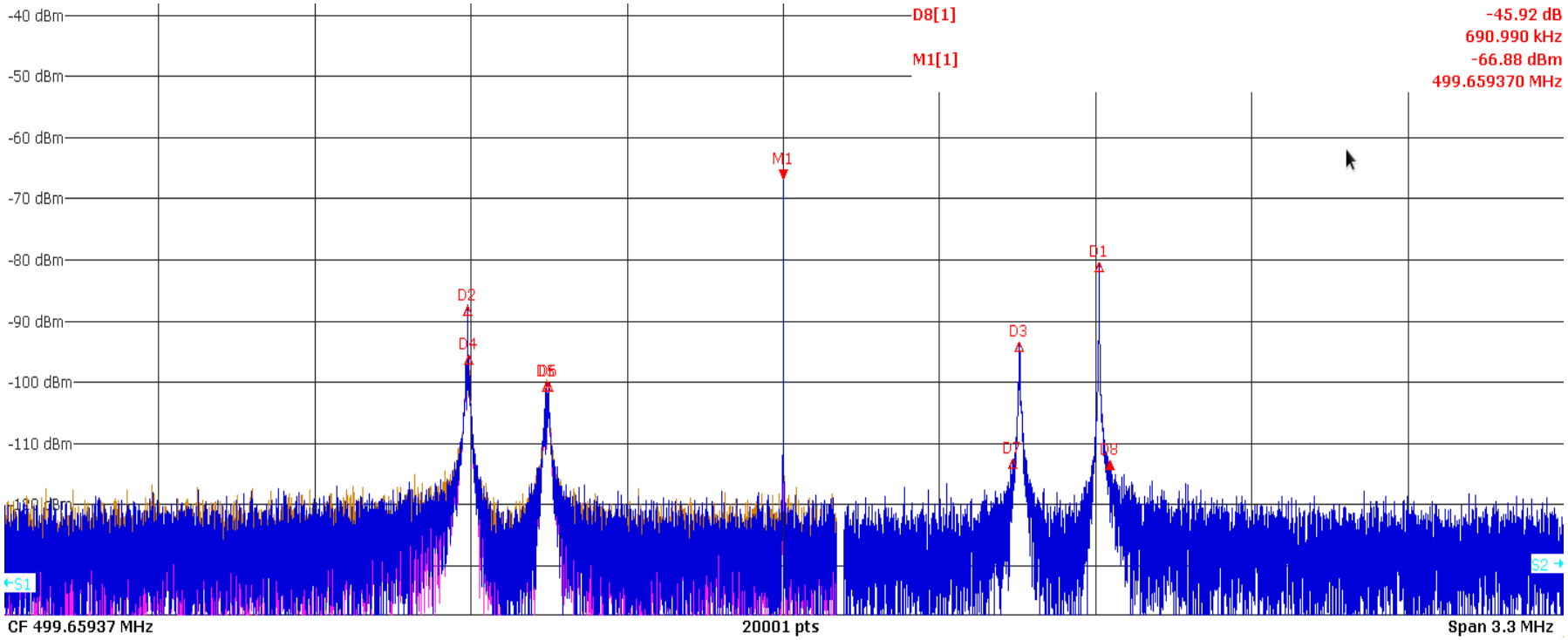
2 Beamlines funded and during design

2 Beamlines under comissioning

2 Beamlines applied for funding

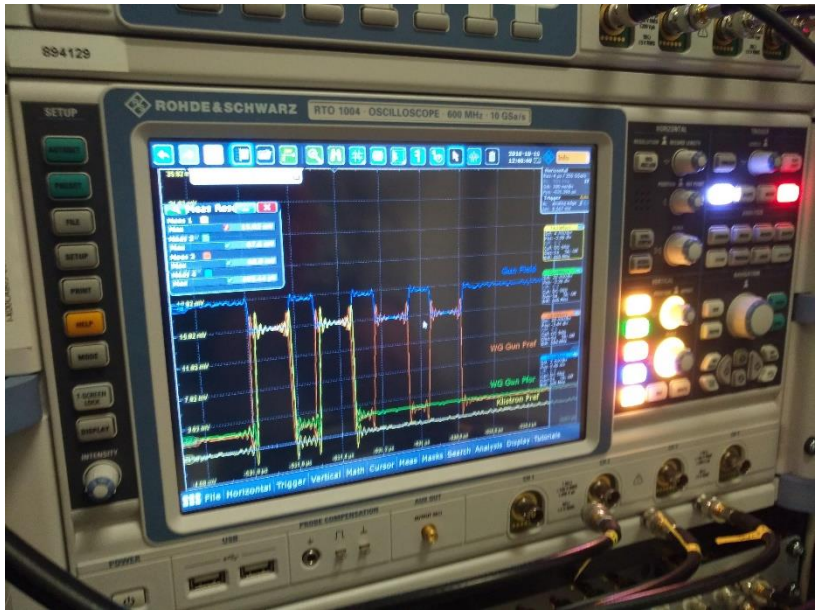
Tune measurement device

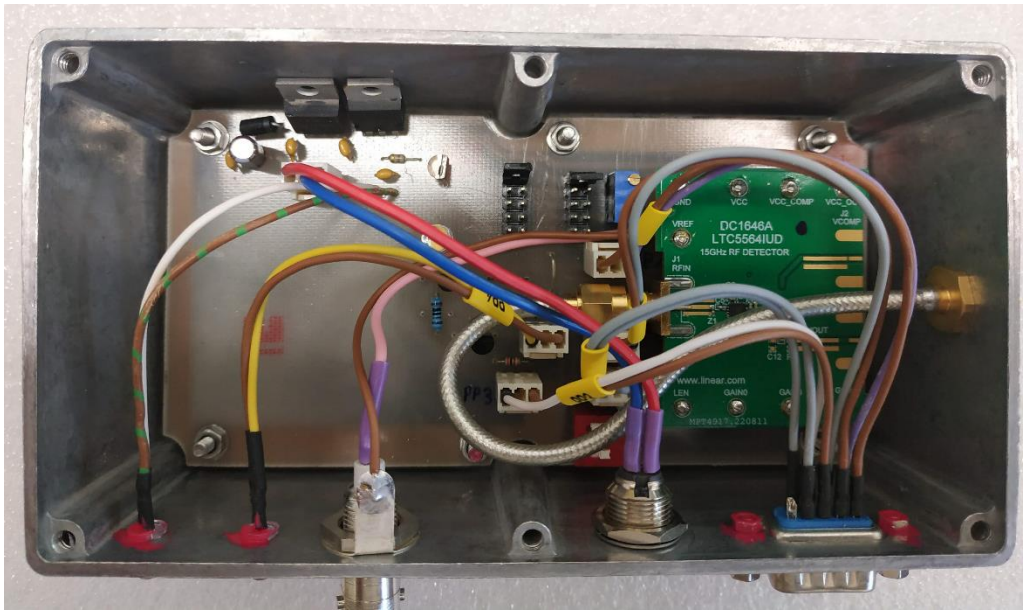
- Built according to MAXLAB specification
- Stripline feeding network and reciever network operational
- Succesful measurements



Analog reflected power interlock for Klystrons

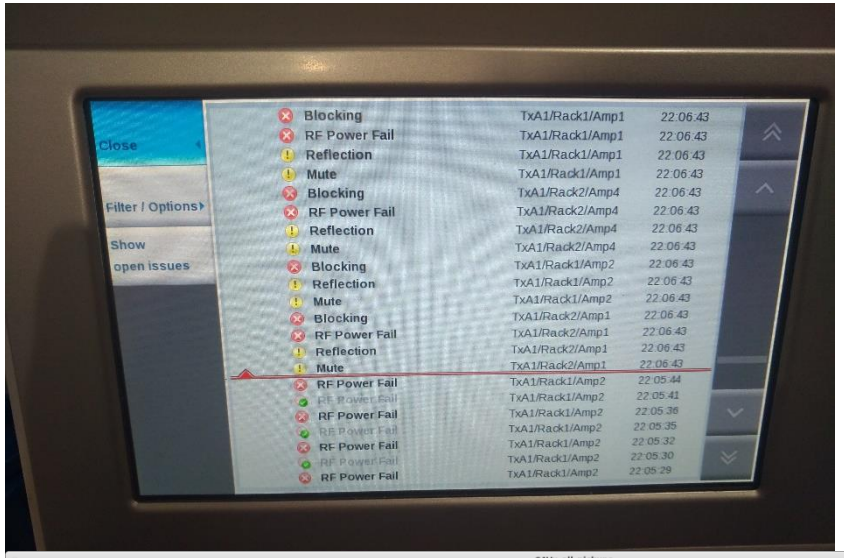
- Unreliable performance of Rhode&Shwarz scopes.
- False reflected power interlocks – unable to inject beam.
- Hardware fix – a dedicated module to detect and signal reflected power levels.

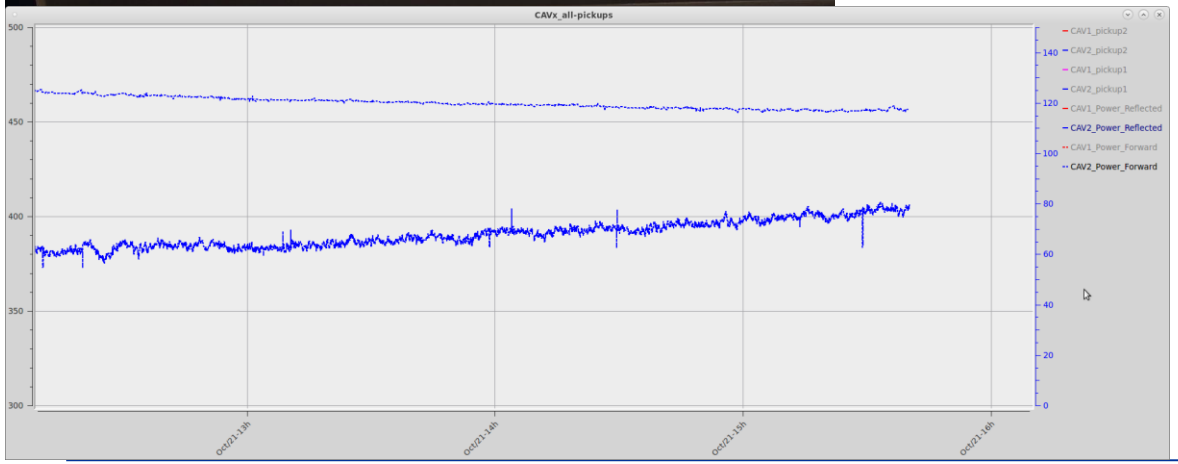




Circulator reflected power issue

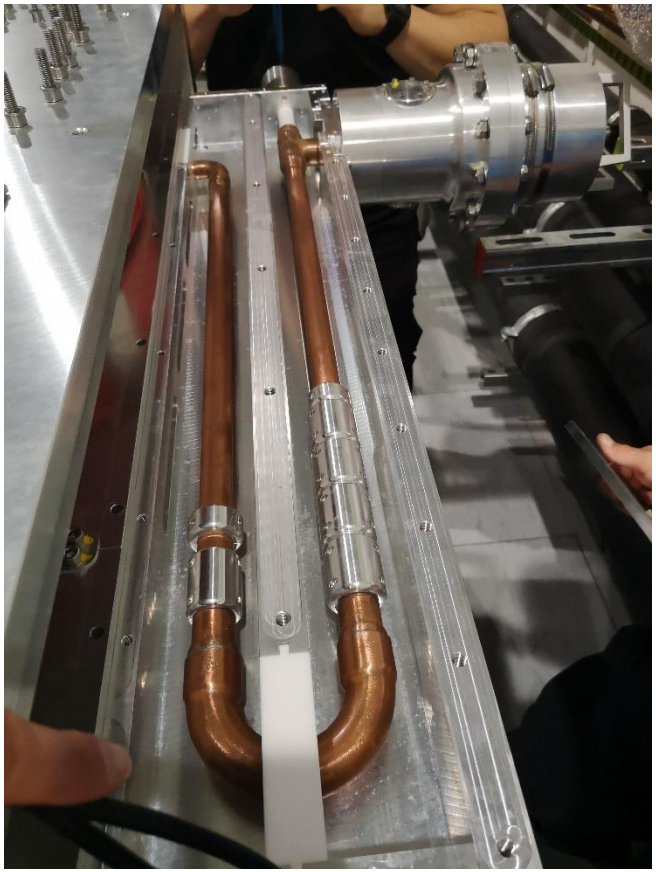
- Mysterious beam dumps caused by sudden loss of RF power on Transmitter 2
  - No signs of reflected power peaks in tango
  - Reflected power alerts in Tx2 GUI
  - Extensive testing carried out
  - Final blame put on Circulator



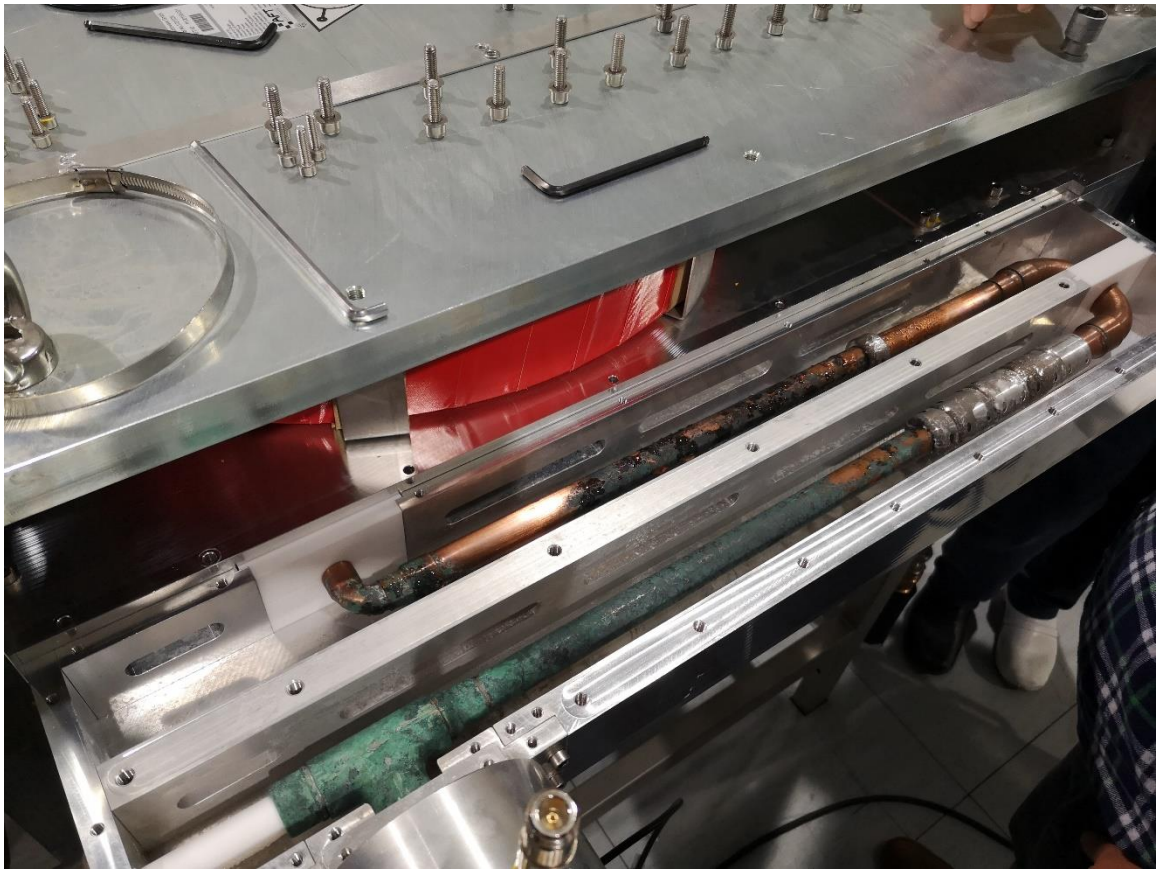


Circulator reflected power issue

- AFT service called in to inspect the insides of the circulator



OUTPUT PORT



INPUT PORT

Circulator reflected power issue

- Solder joints of „hot" conductor were faulty (probably manufacturing defect) – cooling water leaked into the coax line
- RF mismatch caused arcing inside, that wasn't deteced by fiber optics
- Sudden large spikes of reflected power above 23kW Pfor
- Severe corrosion of copper conductor

OPERATION IMPOSSIBLE – IMMEDIATE SERVICE ACTION NEEDED

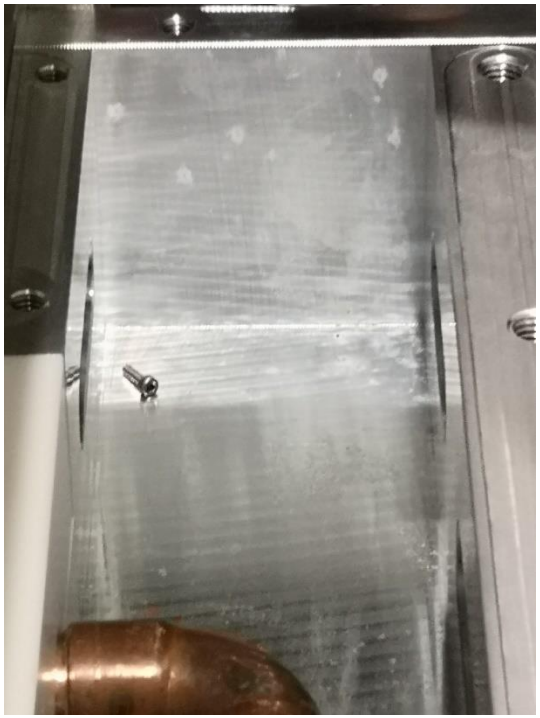
AFT did not want to give us a price estimate of the repair and thay were quite reluctant to even discuss the idea of repair.

They were more than happy to sell us a new circulator for 135k EUR though…

Circulator reflected power issue

- Damaged teflon separator replaced with a new one, made to order
- New piping installed and soldered in place
- Impedance matching with ferrite beads carried out
- Final measurements taken every week for about 2 months after repair concluded, that circulator is entirely operational and fixed

Some things still left us wondering…



K00 Modulator MCU fail

- After a 2-week shutdown, modulator K00 would not start
- „No communication” error
- Faulty MCU diagnosed
- Spares turn out to be faulty as well…
- Quick reaction from ScandiNova, replacement spare parts were sent free of charge the next week
- New set of spares ordered outright

Several faulty PHR901

- Most PHR901 amplifiers reaching end of warranty
- Amplifiers notoriously fail due to dead PSU
- Each fault takes about a month for R&S to repair and return the module
- Plans to introduce our own test & repair setup in RF lab

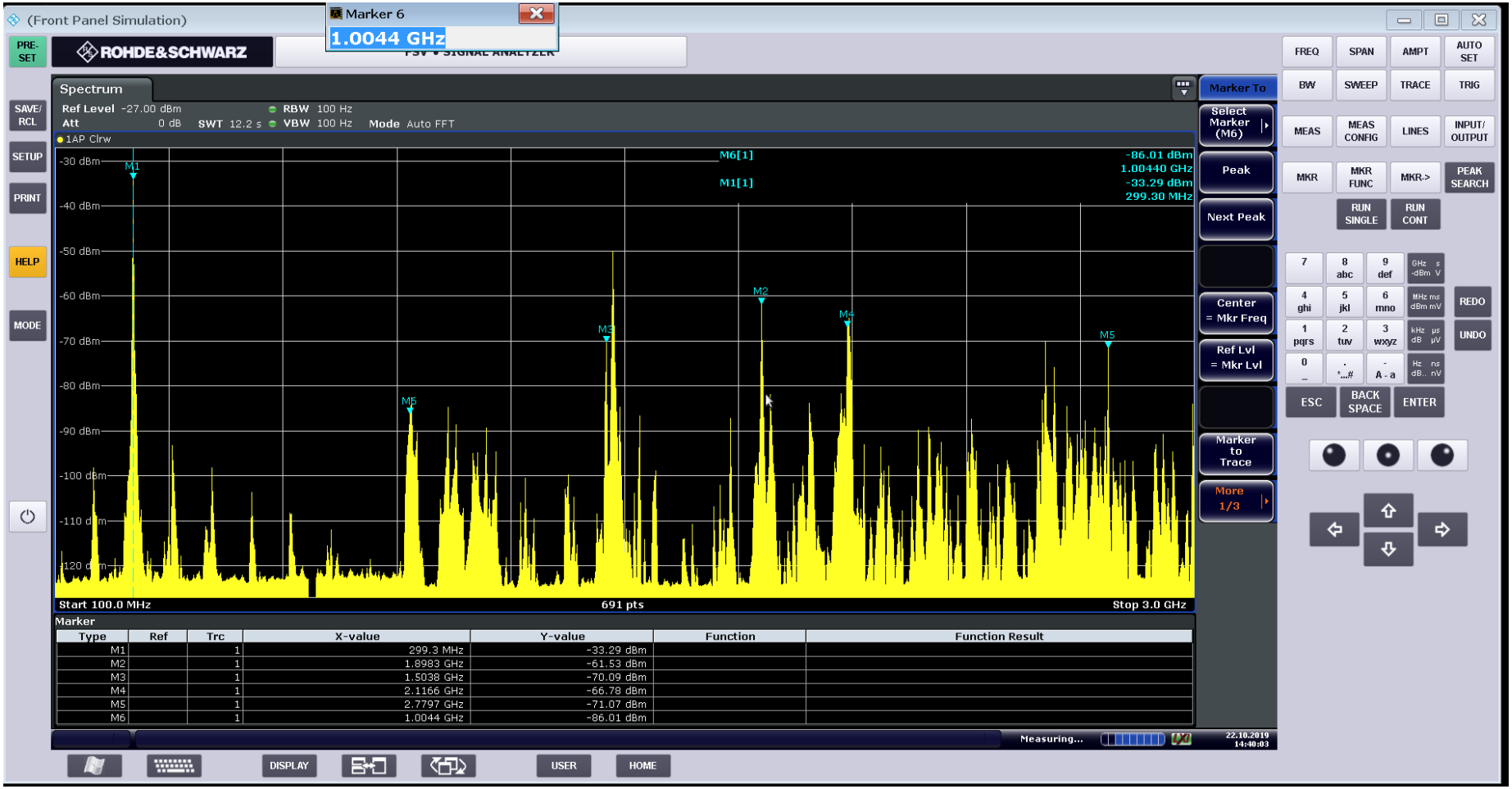
SOLARIS Issues

Modulator HMI panels aging poorly

- HMI Panels in modulators are working continuously for over 5 years
- Main screen burned itself permanently into TFT display
- Panels operate Win XP and are slow
- Counters for operation time run backwards (?!)

Difficult to get replacement panels as most use Win 7/10 nowadays.
No response from ScandiNova yet

High concentration of harmonics in SR



Is this a matter of finding a better working point for the SR or does it mean we need HOM couplers?

Bunch modulation

Filling pattern measured on striplines show 800MHz-1,3GHz modulation of individual bunches

Plans for 2020

Linac

- Replacement of capacitors in HVPS modules and HMI panels in all modulators
- Portable oil dehydration unit for the klystron galery
- Optimising injection with chopper.

SR

- A test & repair rig for PHR amplifier modules
- Probing the market for eventual replacement of AFT circulator with a different one, any suggestions welcome
- Introduction of FDL, software is ready, it needs to be tested on a spare LLRF setup before uploading it into the machine.
- Bunch by bunch feedback – plans and documentation needed from MAX IV
- On request from VAC group – a device to clean optical elements of beamlines with RF-induced plasma.

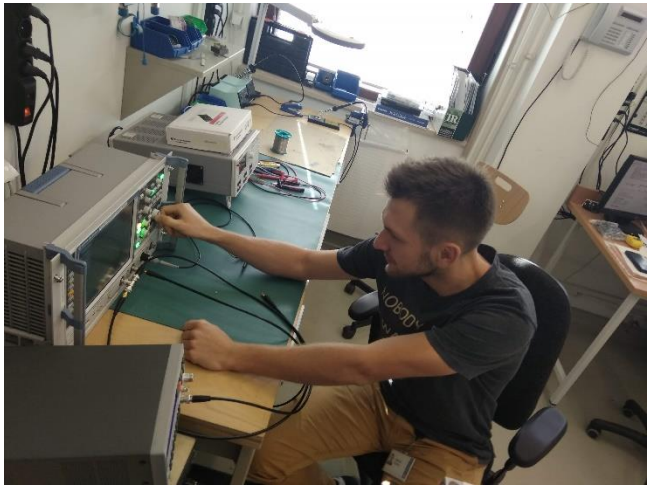
Other

- Since 2020 is planned for expanding the experimentall hall, new, bigger RF lab might be possible
- Need more RF staff – difficult due to high market demand literally across the street (Nokia, Motorola) and very „moderate” salaries in SOLARIS

RF team members

Grzegorz

Marek



Marcin

Thank you for your attention