Status of the CR Debuncher

- Status of Main Components
- System Tests, Technical Issues / Problems
- Planning of Infrastructure / Installation
- Outlook

U. Laier on behalf of the RRF Department of GSI

Component Status I:

Cavities:

All five Cavities have passed FAT and SAT Aa. One cavity is currently in the testing-hall. Four cavities are in the external warehouse in Weiterstadt.

Component Status II:

Power Amplifiers:

Same Status as cavities: All five amplifiers have passed FAT and SAT Aa. One amplifier is in the testing-hall. Four amplifiers are in the external warehouse in Weiterstadt.

Component Status III:

Power Supplies:

All five PSUs have passed the FAT; four also the SAT Aa. One PSU is in the testing-hall. Three are in the external warehouse.

One power supply is at the manufacturing site (OCEM, Bologna) to support further EMI / EMC studies by the manufacturer. It will be delivered end of 2020.

Component Status IV:

Driver Amplifier + LLRF Components (Control Loops):

All five driver amplifiers are at GSI: one in testing-hall, four in external storage.

Varying status regrading LLRF modules. Few are still in development phase, some are available in prototype numbers, lots are in the series production phase and for some the full number is already available. The mounting of the LLRF racks for FAIR (including CR DB) has already started.

System Tests I (FoS):

The testing of the FoS have been performed in 2017/2018.

The system was able to show, that it's performance is as required

Resonance Frequency	0.85 – 1.44 MHz	
Cavity Impedance	1270Ω	
Q factor (@40kV$_p$)	3.4-2.8	
Time for full Frequency Swing	2:10min	
	Pulsed	CW
Harmonic Purity	<-38dB	<-50dB
Stability (ripple, noise) of Gap Voltage Amplitude	±0.7% @40kV$_p$	±1.9% @2kV$_p$
Pulse to Pulse Stability of Gap Voltage Amplitude (30min)	<0.7% @40kV$_p$	<1.7% @2kV$_p$
Stability of Gap Voltage Phase	±1.3° @40kV$_p$	±1.2° @2kV$_p$
Rise Time (10%→90%)	<25µs @40kV$_p$	<70µs @2kV$_p$
Fall Time (90%→10%)	<10µs @40kV$_p$	<10µs @2kV$_p$
Endurance Test	5x24h OK	

System Tests II (SoS):

The second CR DB system has been fully integrated in autumn 2019. Tests have begun. Two main problems have turned up so far:

- Shutdowns due to false interlocks

  ↳ Unreliable connection from small PS to main FPGA control of PSU. Fixed (new connection).

  Configuration is under test.

- Rupture of cooling water hose in the amplifier

  ↳ The cooling water circuit in the amplifier has been reworked (new type of hose, new type of connection between hose an tetrodes). This setup is currently under test.

System Tests III (SoS):

Current Status:

- Last endurance test ran 12 days before shutdown most likely due to sparc-over
- System currently inoperable due to problems with firmware update inside PSU
- New coaxial feedthrough between amplifier and cavity (first two expected end of November) ⇨ Testing
- After successful endurance testing: Continuation of SAT measurements to qualify SoS

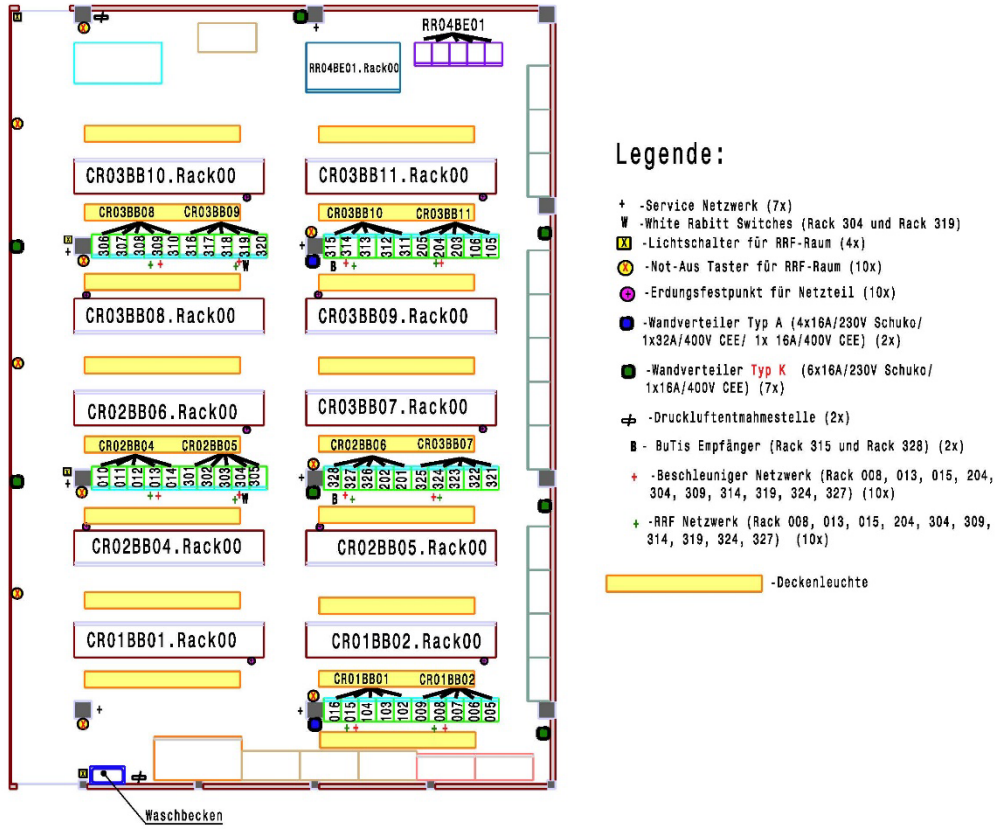
Infrastructure / Installation I:

- Components database contains all RF parts (power + cooling requirements)
- PLM/Storage database complete. What is future relation between component database and PLM database?
- Cable data base up to date. Some adaption required:
  - Changes regarding handling of gap signals
  - More detailing regarding the end point of the cables in the LLFRF system
  - At least one mistake have to be corrected
- RRF needs some time to verify the content of component and cable database. When will the databases be closed?
- Grounding concept in CR building?
- Measures to reduce EMI?

Infrastructure / Installation II:

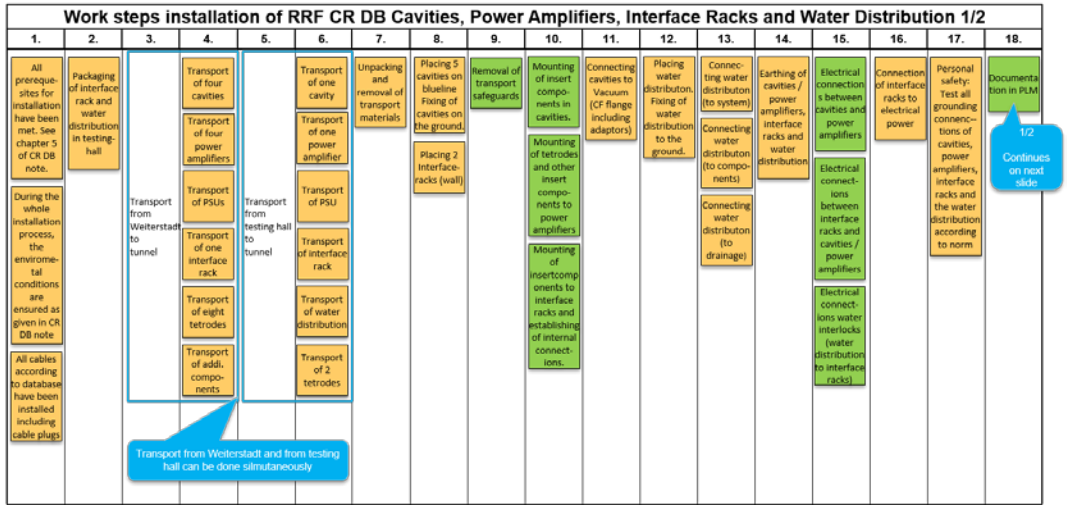
Due to rearrangements (e.g. of the main columns) it was necessary to fully replan the RF supply area in the CR building.

- A new, even better arrangement has been found
- Nomenclature of RESR LLRF Racks unclear (possible impact on databases as well)
- Detailed planning (position of lights, light switches, emergency stops, sink, pressurized air, different network sockets) has been done.
- Detailed planning of RRF cable trays in preparation
- Most recent model (additional columns)?



Infrastructure / Installation III:

- Overview note describing all installation work associated with CR Debuncher is distributed
- Detailed notes describing work to be done by groups outside the GSI RRF department in preparation
- First installation plan available, harmonized with H. Hagelskamp, H. Reich-Sprenger
- Before the installation of CR Debuncher can start, all requirements described in the overview note have to been met.



Next Steps:

- Endurance test of second system (reliability?)
- Continuation of SAT measurements of second system
- Test of coaxial anode feedthroughs. If successful: series manufacturing
- Test of G2 capacitors. If successful: adaption of other four amplifiers
- EMI / EMC Study of power supplies. Possible adaption of power supplies
- Powering of anode modules in regular intervals to prevent degradation
- Setup and integration of first batch of series LLRF racks
- Continuation of infrastructure / installation planning
- Creation of declaration of conformity