Design and Status of the MicroTCA.4 Based LLRF System for TARLA.

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6'th MicroTCA Workshop for Research and Industry



TARLA... Turkish Accelerator and Radiation Laboratory in Ankara





Facility Information

Çağıl Gümüş, 07/12/2017, Hamburg



- The Turkish Accelerator and Radiation Laboratory in Ankara (TARLA) is an Infrared Free Electron Laser (IR-FEL) and Bremsstrahlung facility located at Ankara – Turkey.
- 3-250µm FEL, usage of Bremsstrahlung radiation and fixed target experiments
- Collaboration with DESY:
- Installation and commissioning of the Low-Level Radio Frequency (LLRF) Control system.

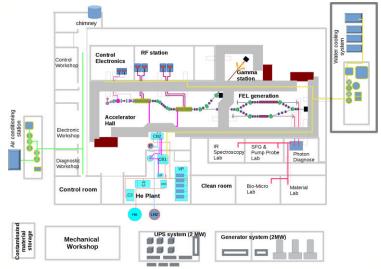






Facility Information





- Similar design with ELBE Accelerator in HZDR (Dresden/Germany)
- Continuous-Wave RF Operation
- Expected Beam Energy ~40MeV
- Bunch repetition rate of 52 MHz (max) 13 MHz nominal

Parameter	Unit	Base Value	Upgrade Value
Beam Energy	MeV	0 - 40	0 - 40
Max Bunch Charge (@13 MHz)	рC	77	115
Max Average Beam Current	mA	1	1.5
Horizontal Emittance	mm mrad	<15	<15
Vertical Emittance	mm mrad	<12	<12
Longitudinal Emittance	keV ps	<85	<85
Bunch Length	ps	0.4 - 6	0.3 - 6
Bunch Repetition	MHz	13	0.001-104
Macro pulse Duration	μ s	10 - CW	10 - CW
Macro pulse Repetition	Hz	1 - CW	1 - CW





Latest Update from Site^[1]

S. 4

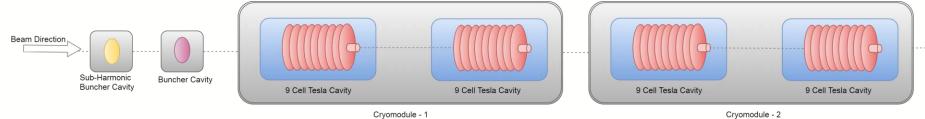
- Commissioning of gun is almost complete
- Injector commissioning on going, will be ready by Q1 of 2018.
- Helium plant commissioning is almost done and will be ready by Q1 of 2018
- First cryomodule tests without beam after finishing He plant tests
- Expected LLRF System shipment is around Q4 of 2018
- First beam is expected by Q1 of 2019

[1] A. Aksoy, "TARLA Project" 13th Nanoscience and Nanotechnology Conference, 22-25/Oct/2017





S. 5



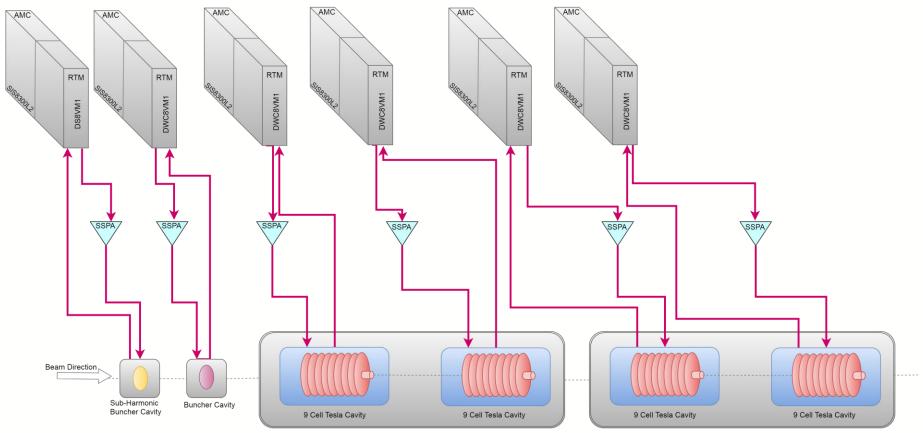
Cryomodule - 2





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S. 6

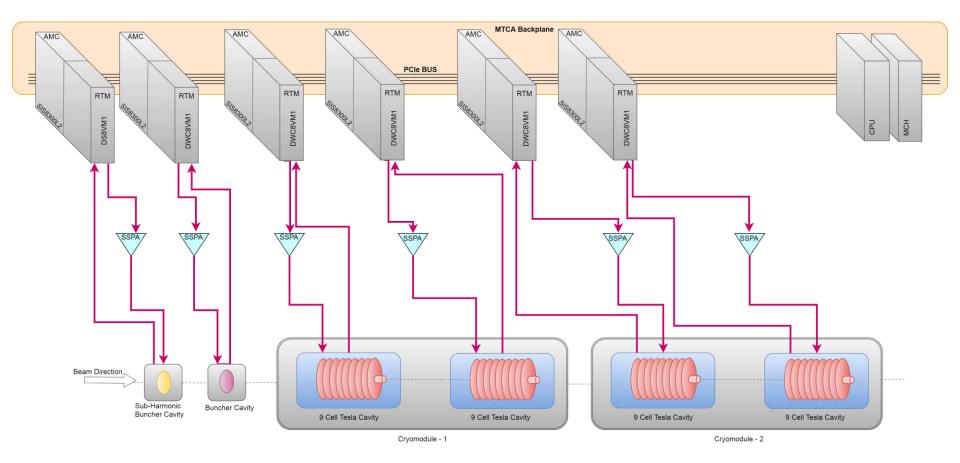


Cryomodule - 1

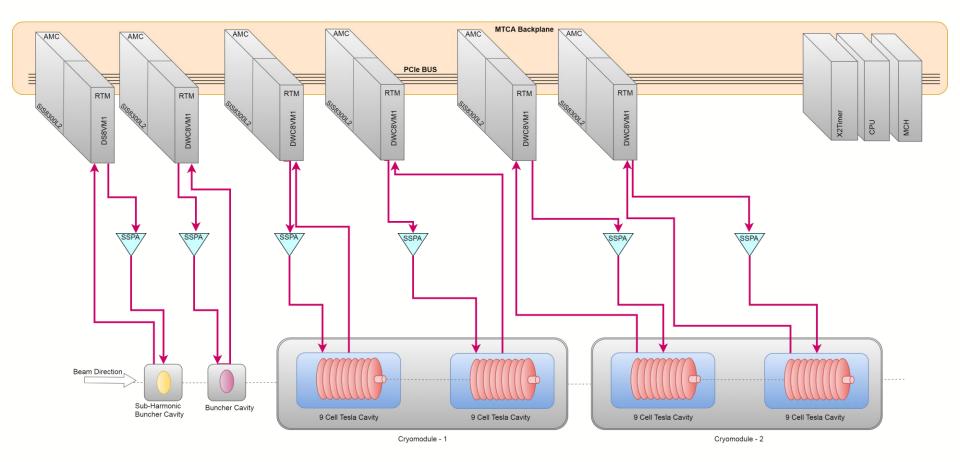
Cryomodule - 2

TECHNOLOGY LAB

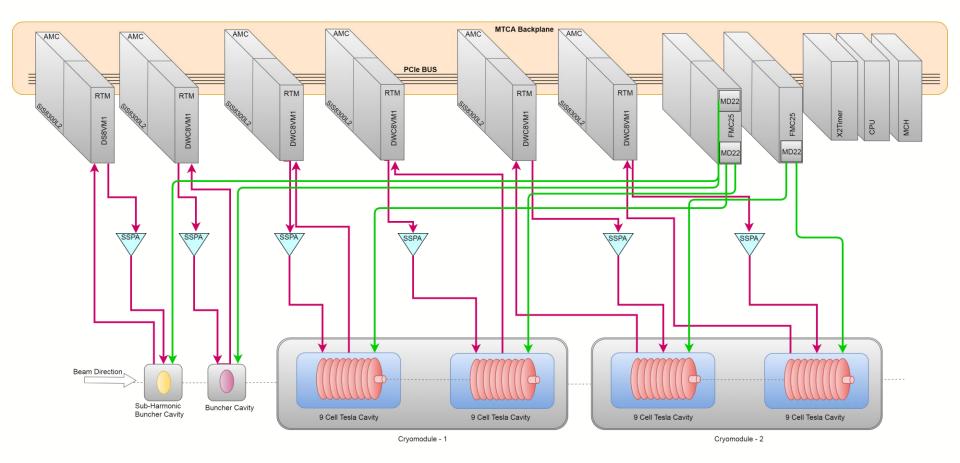






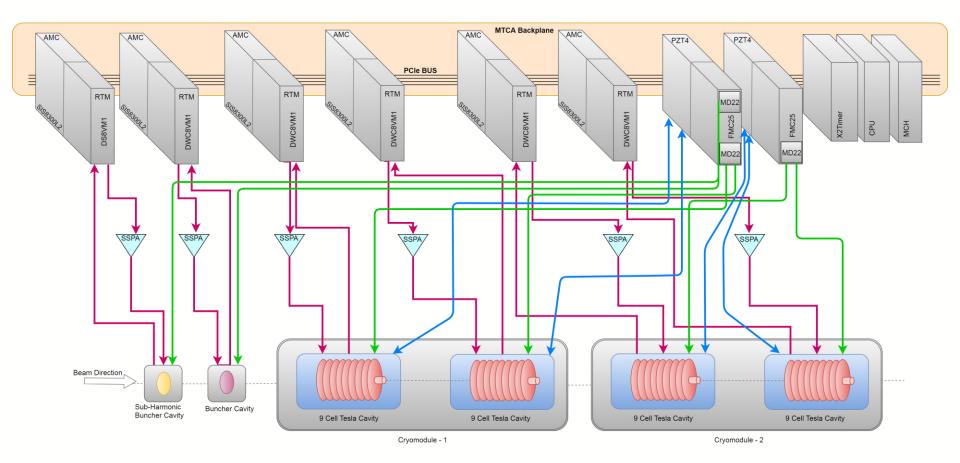




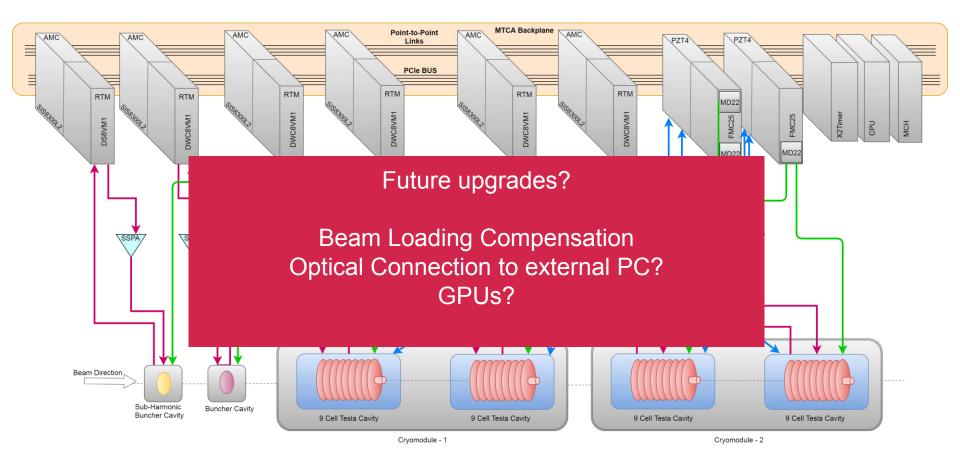




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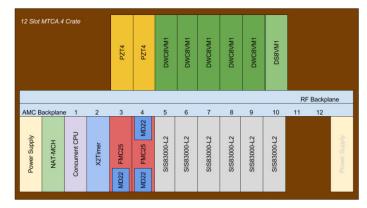




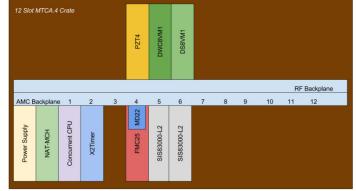
Rack and Crate Layout

S. 12

Main Crate

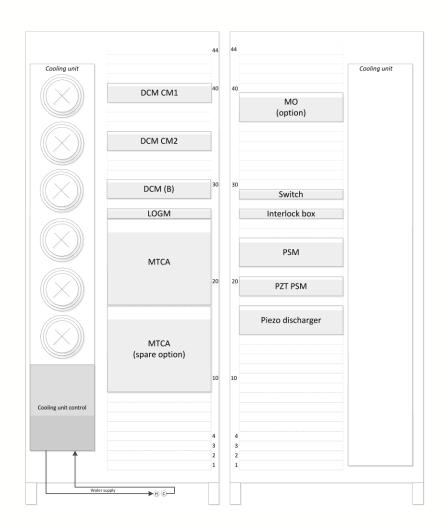




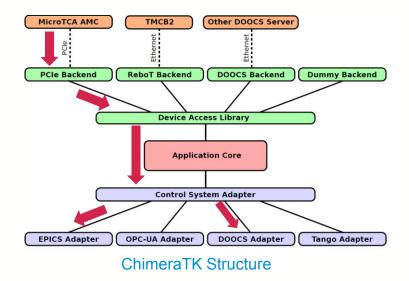






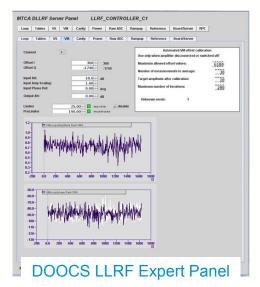


Software



evices:	Modules/Registers:	-Register properties		Options
ADCO		Register name		Continuous read (250 ms)
	- AREA DAC Q MEM AREA FF CORR I - AREA FF CORR Q	Module		Read after write Show plot window
	AREA_FF_Q AREA_GP_I AREA_GP_Q AREA_SP_CORR_I	Register bar	Register width	Operations
		Register address		Read
	AREA_SP_CORR_Q AREA_SP_I		Fractional bits	Write
	AREA_SP_Q BIT_CTL_TABLES_BUF	Number of elements		Write to file
	BIT DAC MEM ENA BIT FB ENA BIT FB INT ENA	Total size	Sign bit	Read from file
	BIT_FF_CORR_ENA	Values		
- BIT SP CORR_ENA - EXT_DČM - VAR CON RTM TYPE		raw (dec) raw (hex) double		
Device is open. Close	WORD CAV PROT RES WORD CNTRL I LIMIT			
Device properties	WORD CNTRL Q LIMIT WORD CW CAV PROT WORD CW PROT STAT			
Device name	- WORD DAC OFFSET WORD DAQ ENABLE			
ADC0	- WORD DAQ MUX			
Device file	- WORD FD AMP LIMIT			
sdm://./pci:pcieunis7	WORD FD AMP LIMIT			
Map file	WORD_FD_AMP_LIMIT			
sincav_sis8300l_hzdr_srf_r2102.map	Sort Modules/Registers	1		(Dest)
Load Boards	Autoselect			

- Initial tests with DOOCS using ChimeraTK
 - Tutorial from Martin Killenberg (DESY)
- Switching to EPICS(3+4) Interface
- Successful integration to OPC-UA Adapter at HZDR
 - Talk from Reinhard Steinbrück (HZDR)







Putting things together at DESY





- Individual component tests using ADC & RTM Test Stand (Performance + Functionality)
- Firmware & Software Development (Parallel with HZDR)
- Complete System Integration + Inner Rack Cabling + Documentation
- → Shipment
- Training of TARLA staff
 - MicroTCA Training
 - Server Structure
 - Hardware Experience







Thank you for your attention!

[2] A. Aksoy, "TARLA Project" 13th Nanoscience and Nanotechnology Conference, 22-25/Oct/2017



