

# MICROTCA.4-BASED LLRF FOR THE SUPERCONDUCTING CW LINAC ELBE – STATUS AND OUTLOOK

**HZDR**



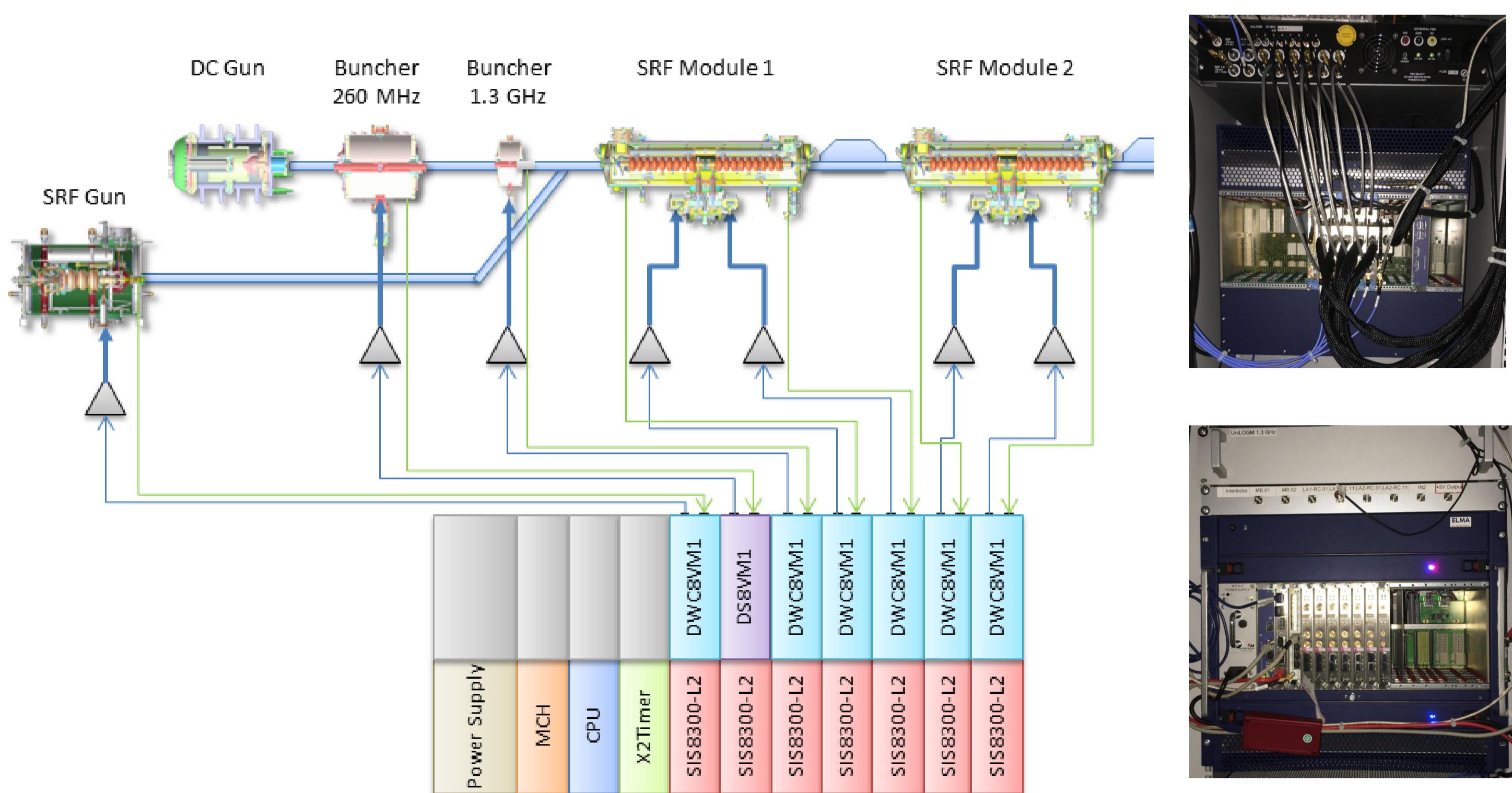
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- ELBE CW accelerator contains **2 NRF buncher cavities, 4 SRF TESLA cavities, 3.5-cell SRF-gun**
- replacement of analogue system with MicroTCA.4-based controller
- **goal:** higher stability, greater flexibility, improved diagnostics, implementation of beam-based feedback

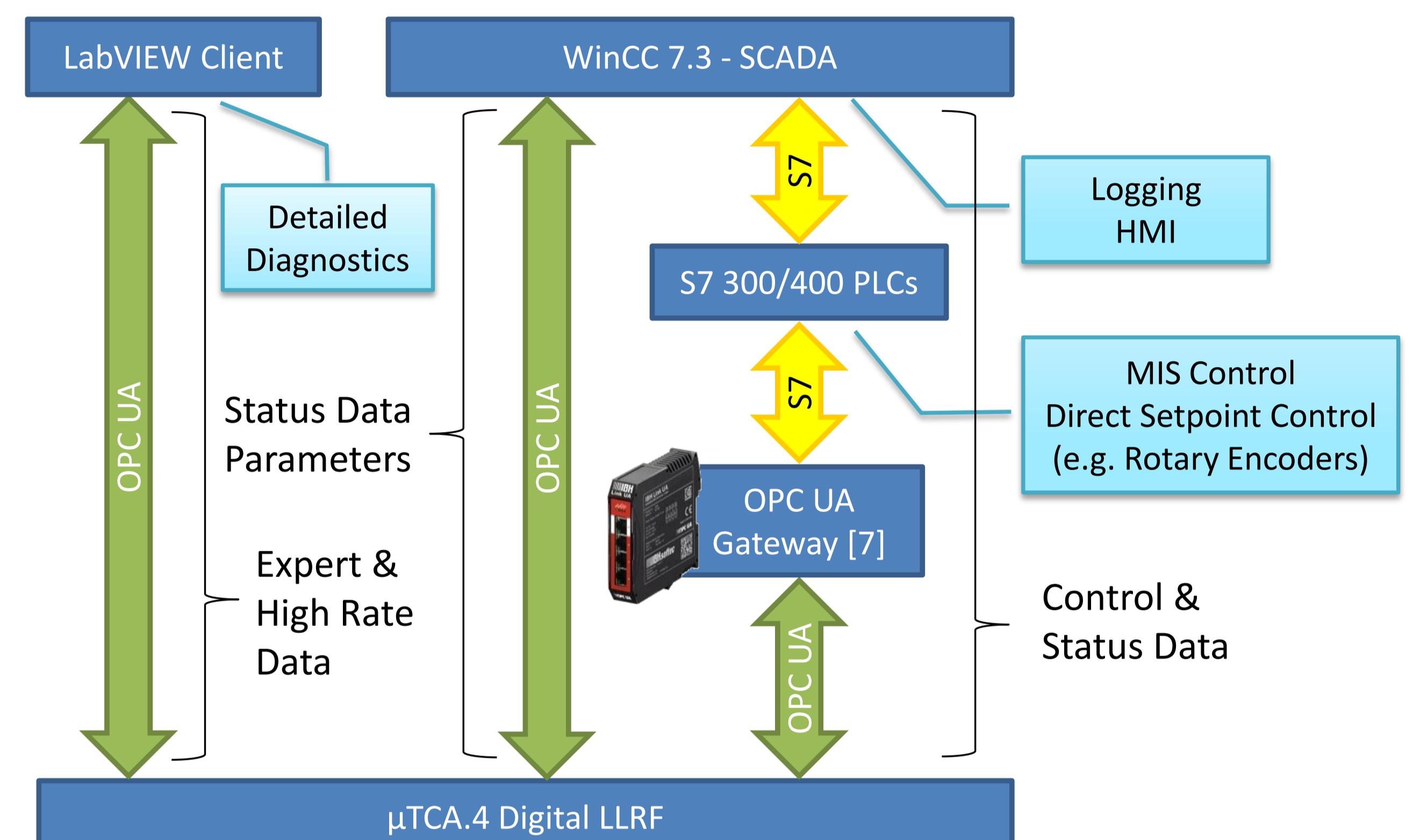


## Hardware Structure

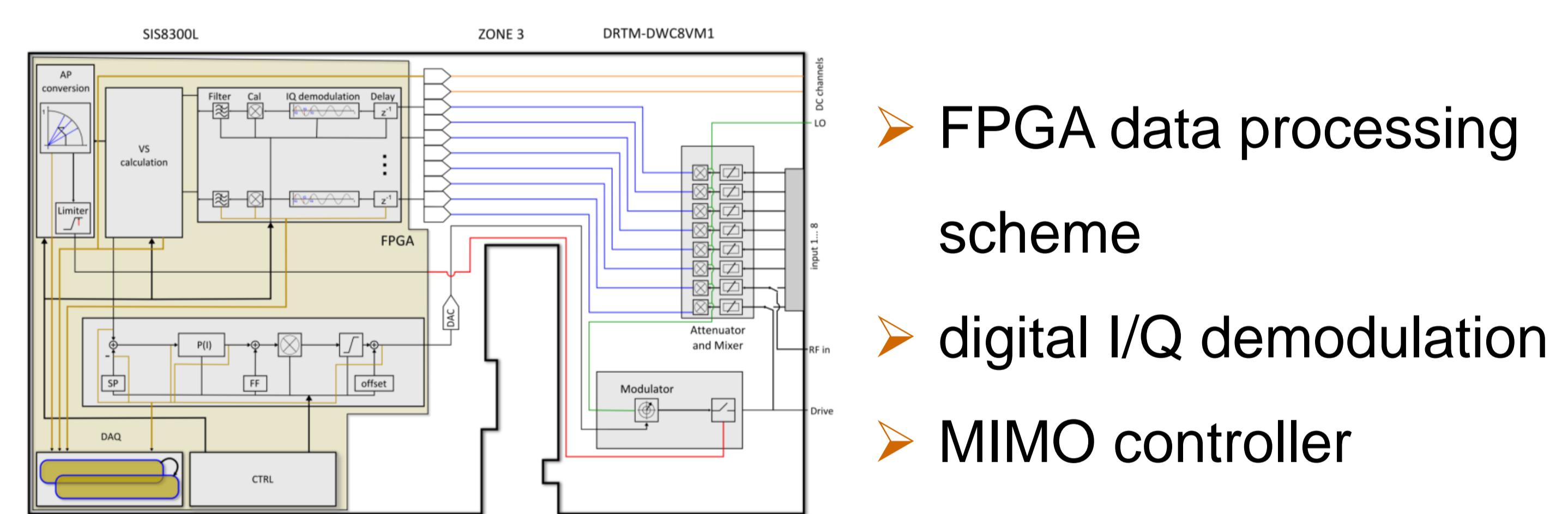


- modular MicroTCA.4 based system
- DS8VM1 board for 260 MHz buncher (direct sampling scheme)
- DWC8VM1 boards for 1.3 GHz cavities (NRF + SRF)
- external trigger provided and distributed by X2Timer
- 12-slot, 8U high rackmount chassis for all cavities

## Software Structure



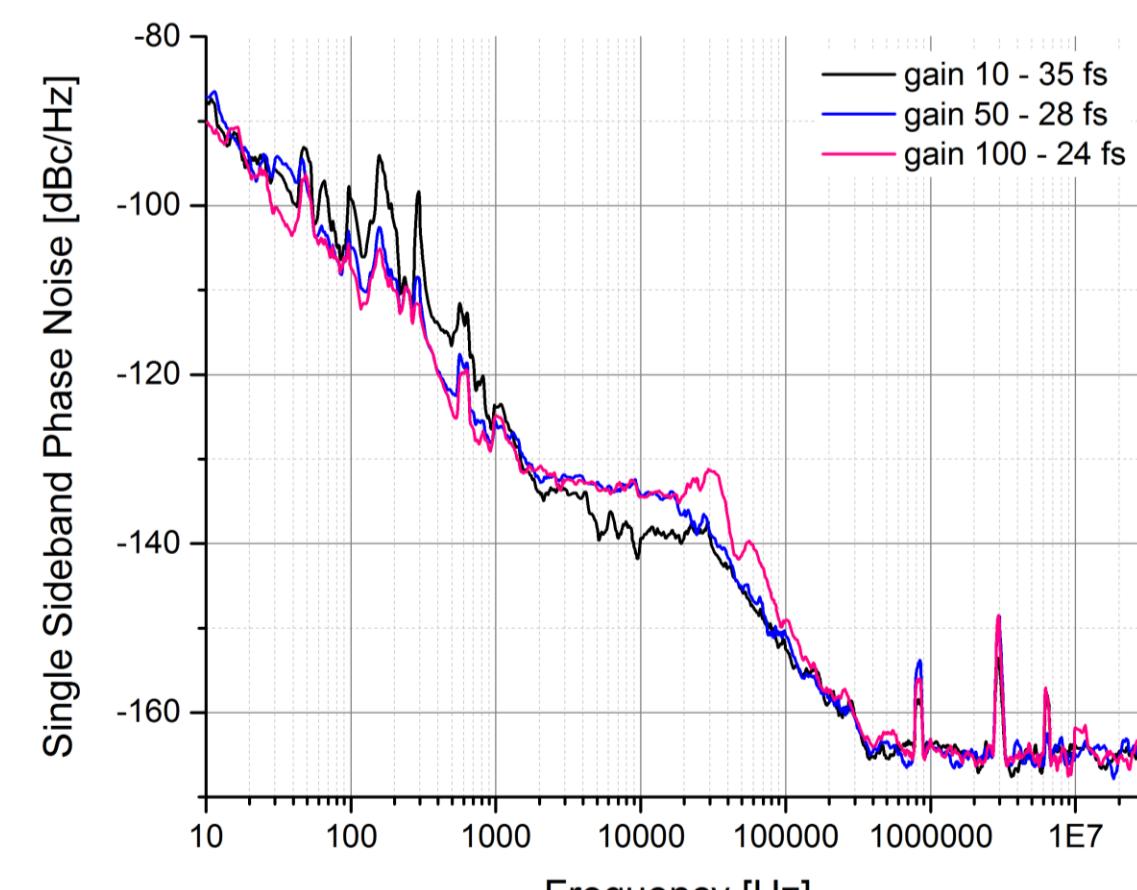
- communication to control system based on OPC-UA protocol
- fast channel for diagnostics to LabView expert panel
- slow control for operators by WinCC interface



- FPGA data processing scheme
- digital I/Q demodulation
- MIMO controller

## Performance studies - snapshot

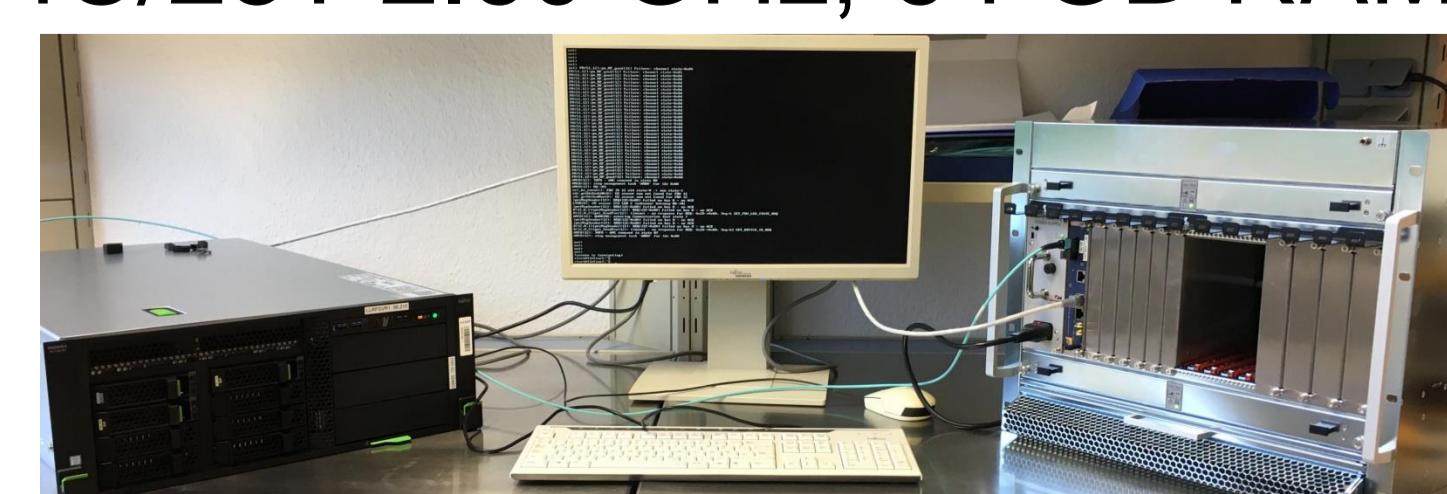
- preliminary performance tests show improved stability
- further optimization ongoing
- long-term tests planned from 09/2017



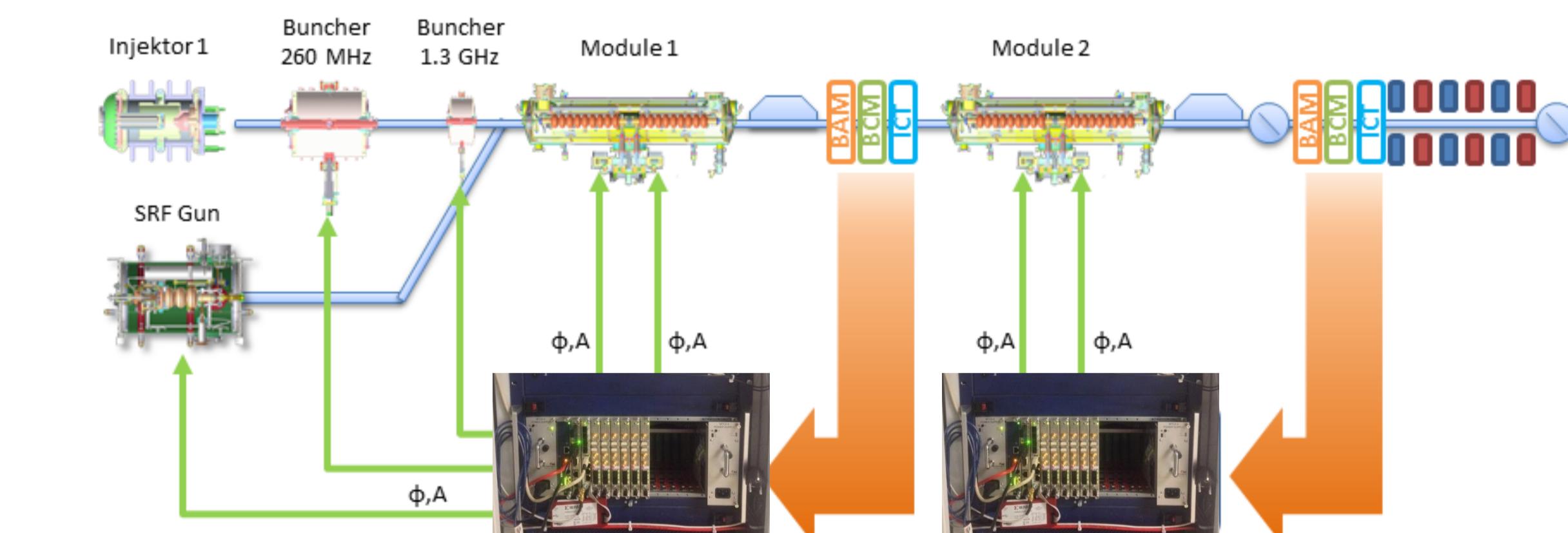
	Digital System	Analog System
Amplitude Stability [%]	0.0145	0.053
Phase Stability [deg]	0.011 (24 fs)	0.046 (98 fs)

## New Setup with high performance CPU

- high CPU load by 7 LLRF Servers + 1 Timer Server
- test setup with external high performance server
- 2x Intel Xeon E5-2690v4 14C/28T 2.60 GHz, 64 GB RAM
- NAT-MCH-PHYS80 with optical PCIe link



## Beam-based Feedback - Outlook



- sequential, active beam-based feedback scheme
- stabilization of arrival-time, pulse duration, beam energy

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2. <https://www.picmg.org/openstandards/microtca/Referenz>
3. M. Grzegrzółka, K. Czuba, I. Rutkowski et al., "MTCA.4 RTM Module for direct sampling based applications", 10.1109/MIKON.2016.7492120
4. [http://mtca.de/sites/site\\_mtca/content/e172206/e205636/e212582/e265135/DRTM-DWC8VM1-Datasheet1\\_eng.pdf](http://mtca.de/sites/site_mtca/content/e172206/e205636/e212582/e265135/DRTM-DWC8VM1-Datasheet1_eng.pdf)
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