

Overview and Status of LLRF System Developments at the MicroTCA Technology Lab

P.Nonn, Ch. Kampmeyer, Ç. Gümüş, Ch. Schmidt, M. Hierholzer, U. Mavrič,
M. Hoffmann, T. Walter, H. Schlarb
7th MTCA Workshop for Research and Industry

LLRF Development Team of MicroTCA Techlab



Çağıl Gümüş



Christoph Kampmeyer



Patrick Nonn



System Integration

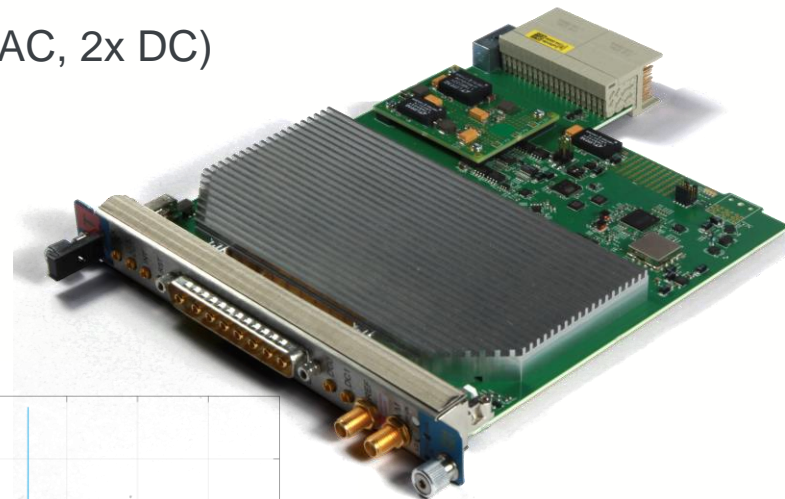
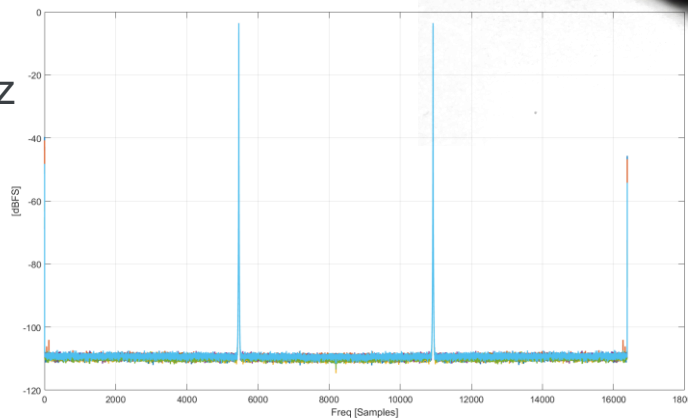
Software
Firmware
Hardware

Training
Support

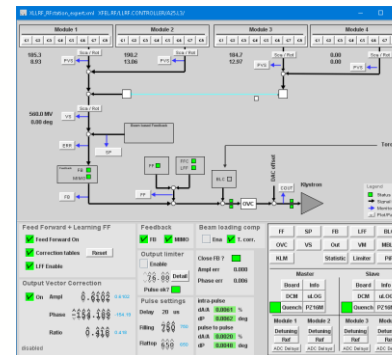
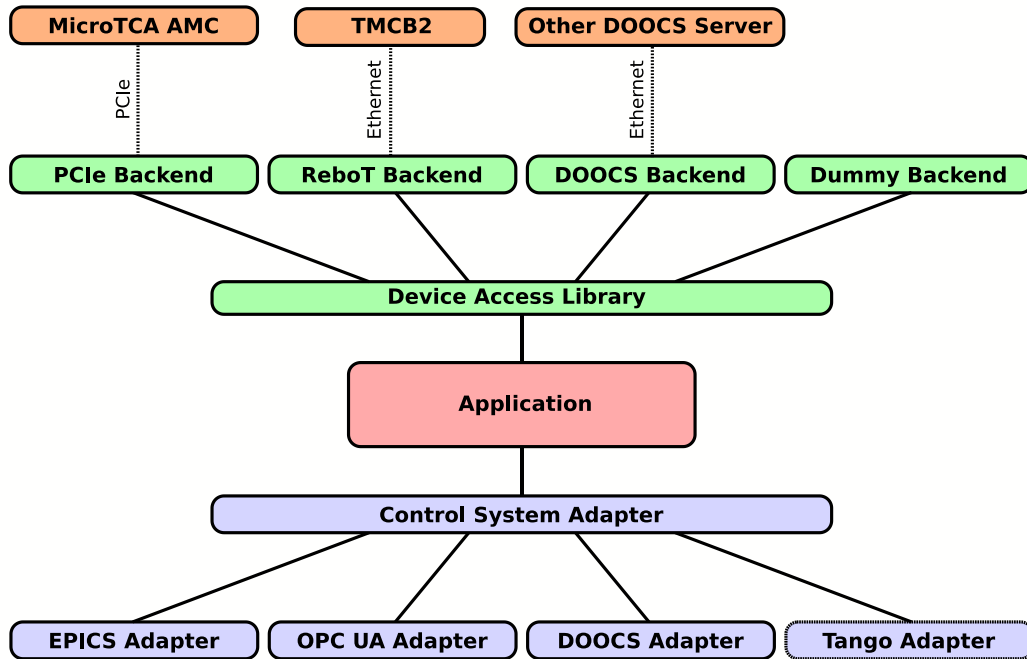
- Direct sampling card with ten input channels (8x AC, 2x DC) plus one vector modulator
- Vector Modulator: 100 MHz to 700 MHz
- Low noise PLL to generate clocks

Example:

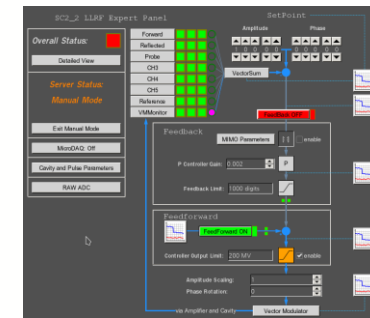
- Input: 26 MHz, DC coupled
- Sample Frequency: 78 MHz
- Uroš Mavrič
- Matthias Hoffmann



DS8VM1 RTM



JDDD Panel (DOOCS)



OPI Panel (EPICS)

Abstracts your Application from Hardware and Control System.

More about ChimeraTK in Martin Killenbergs Talk, later today!





Turkish Accelerator and Radiation
Laboratory in Ankara



...as contractor of...





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Particles Electrons

Max. Energy 40 MeV

Avg. Beam Current 1 mA

RF Operation CW

Micro Pulse Rep. Rate 13 MHz

Macro Pulse Rep. Rate 10 Hz - CW

Transversal Emittance < 13 mm mrad

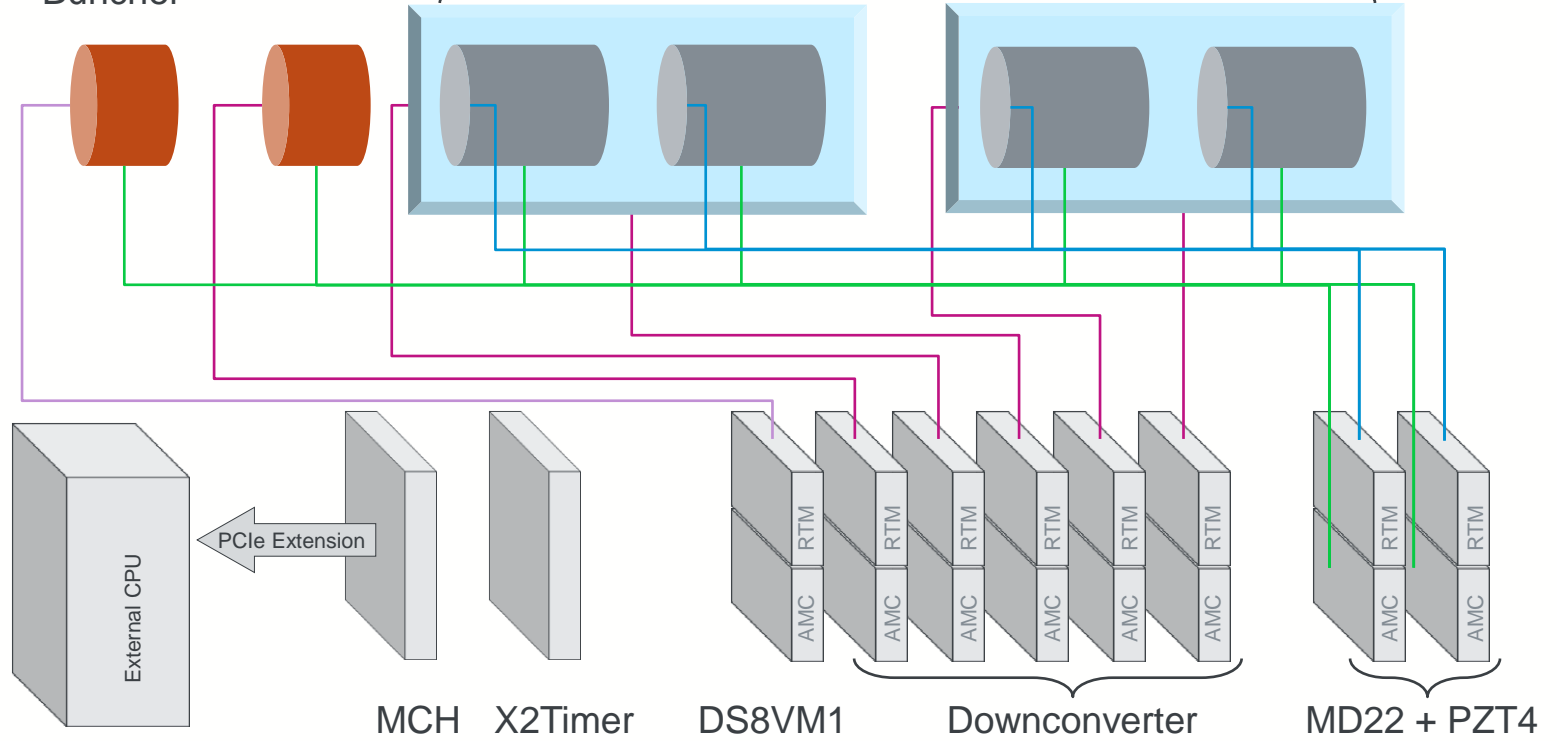
Longitudinal Emittance < 50 keV ps

TARLA: LLRF System

- RF 260 MHz —
- RF 1.3 GHz —
- Tuner —
- Piezo —

Sub-harmonic Buncher
Buncher

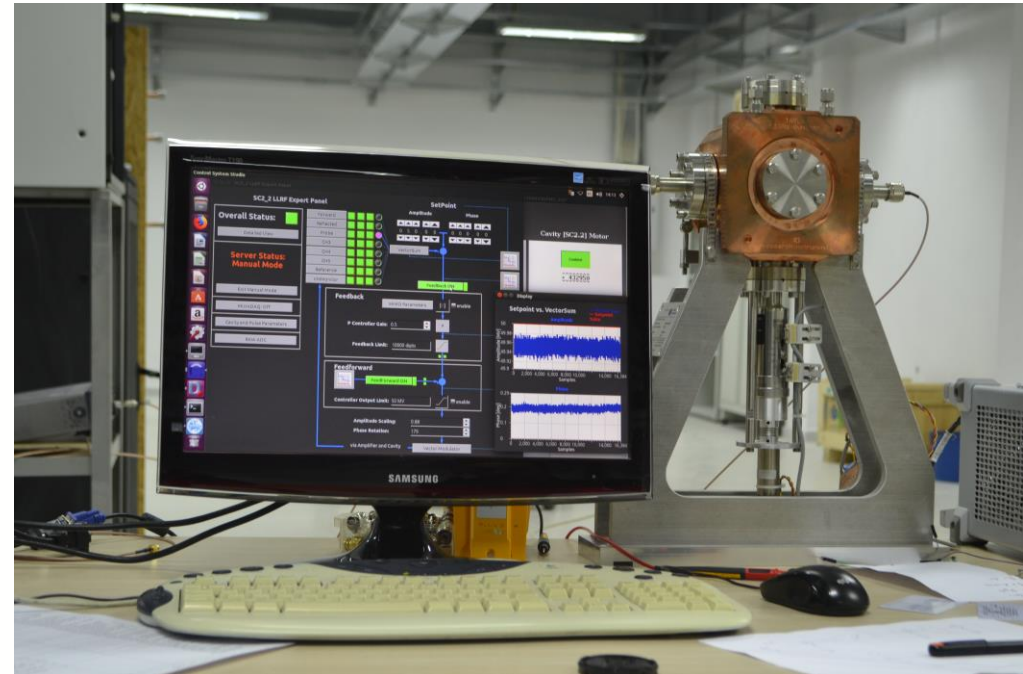
Superconducting 9-Cell Cavities



- A MTCA Crate was prepared for LLRF operation and shipped to Ankara
- Çağıl Gümüş and Christian Schmidt went to Ankara during November



- Stable closed-loop operation of a 1.3 GHz buncher cavity at high power was achieved



Courtesy of Christian Schmidt, MSK / DESY

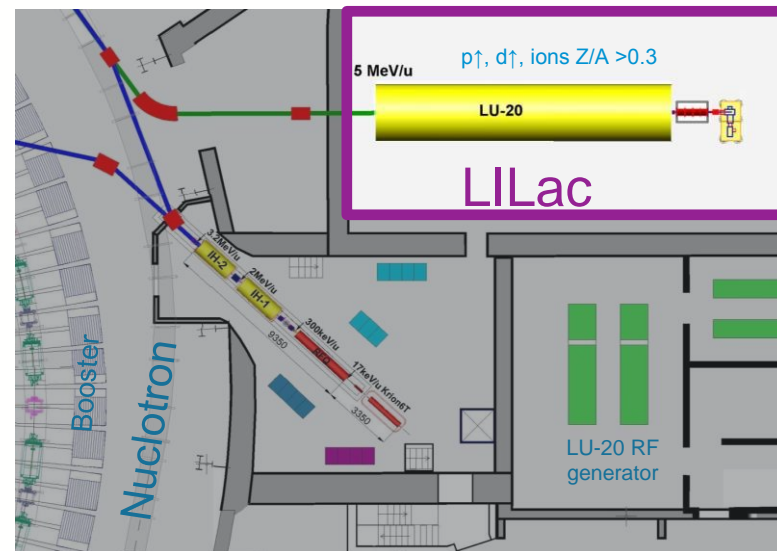
- Inner rack cabling + completing the system integration at DESY
- Shipping Rack to Ankara
- Commissioning of LLRF-System in Ankara



From: NICA: Recreating the first moments of the Universe in the Lab @ youtube

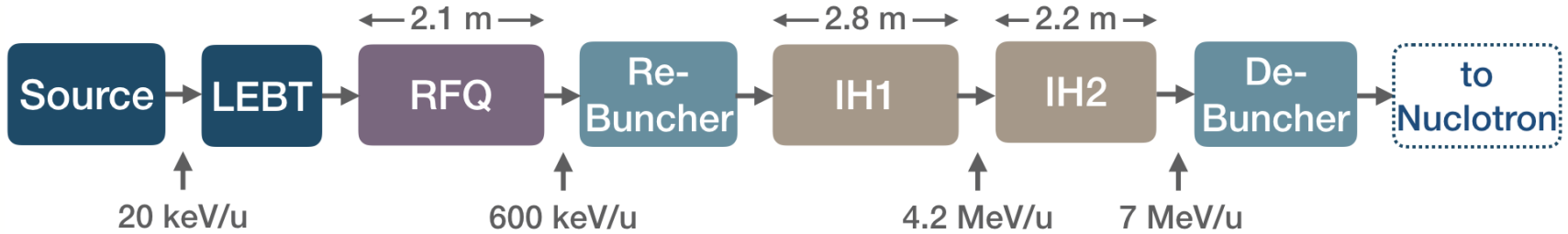
- Light Ion Injector (LILac) for the Nuclotron-based Ion Collider Facility (NICA) at the Joint Institute for Nuclear Research (JINR) in Dubna, Russia
- Providing light ions of mass-to-charge ratio up to 3
- Collaboration with Bevatec GmbH

| | |
|-------------------|-----------------------|
| Particles | Polarized, Light Ions |
| Beam Energy | 7 MeV/u |
| Beam Current | 5 mA |
| Beam Pulse Length | 30 μ s |
| Duty cycle | 0.15 % |

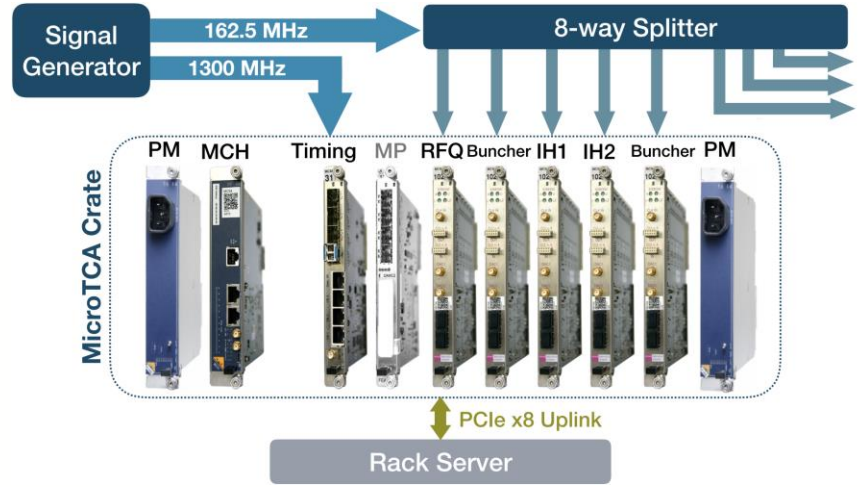


Courtesy of Benjamin Koubek, BEVATECH GmbH





- 1 RFQ, Rebuncher, 2 IH-DTL and Debuncher cavities
- Single-cavity regulations with dedicated solid-state amplifiers



| | |
|-----------------|---------------|
| Control | Single Cavity |
| RF Frequency | 162.5 MHz |
| Repetition rate | ≤ 5 Hz |
| RF Pulse Length | 1 μs – 300 μs |

Diagrams courtesy of Benjamin Koubek, BEVATECH GmbH



- Adaption of Firmware / Software
- Testing components
- Compilation of MTCA Hardware, Firmware and Software
- Installation on site by Bevatech
- Commissioning and Support in collaboration with Bevatech



THANK YOU
FOR YOUR
ATTENTION