



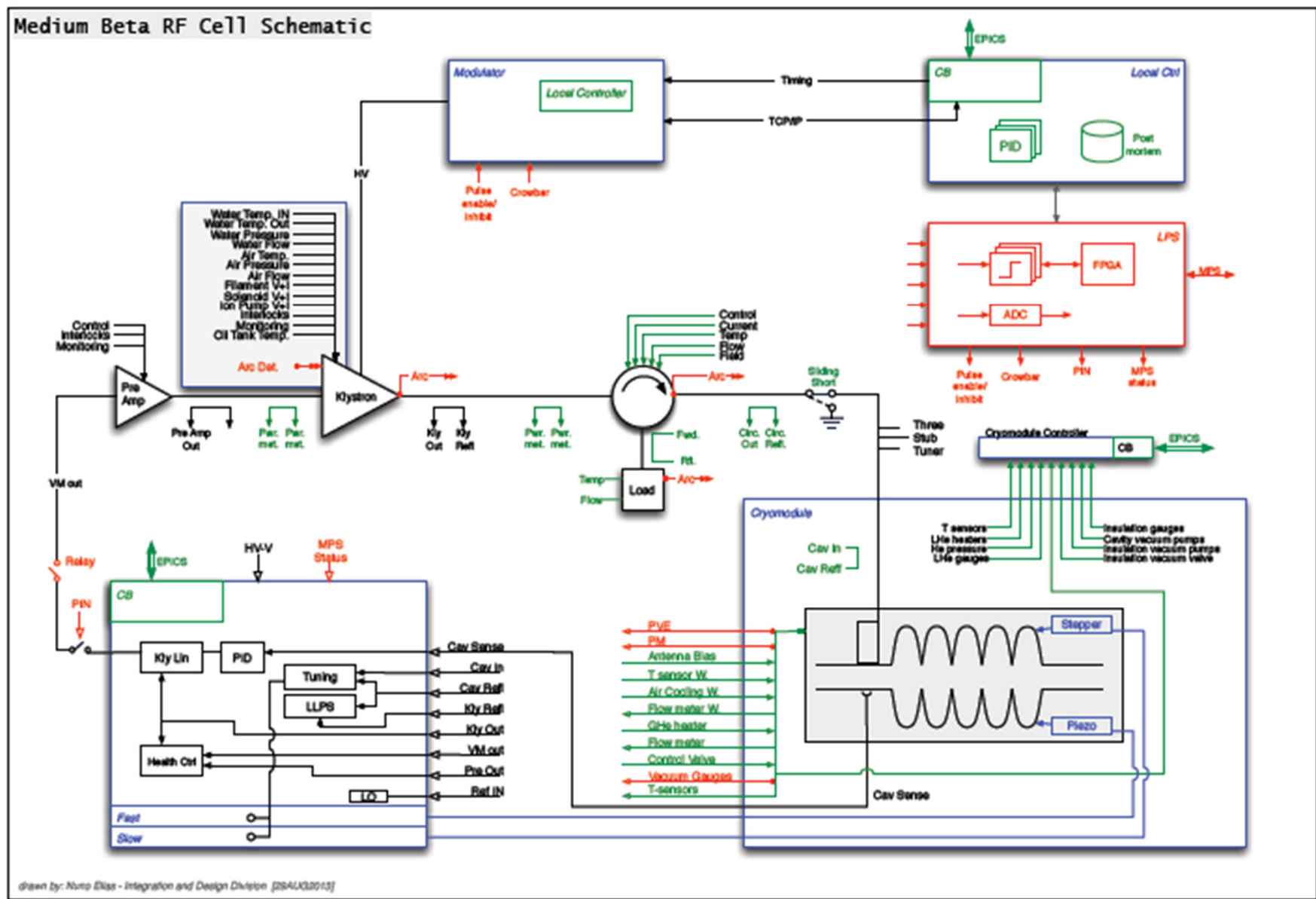
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LLRF for ESS Overview

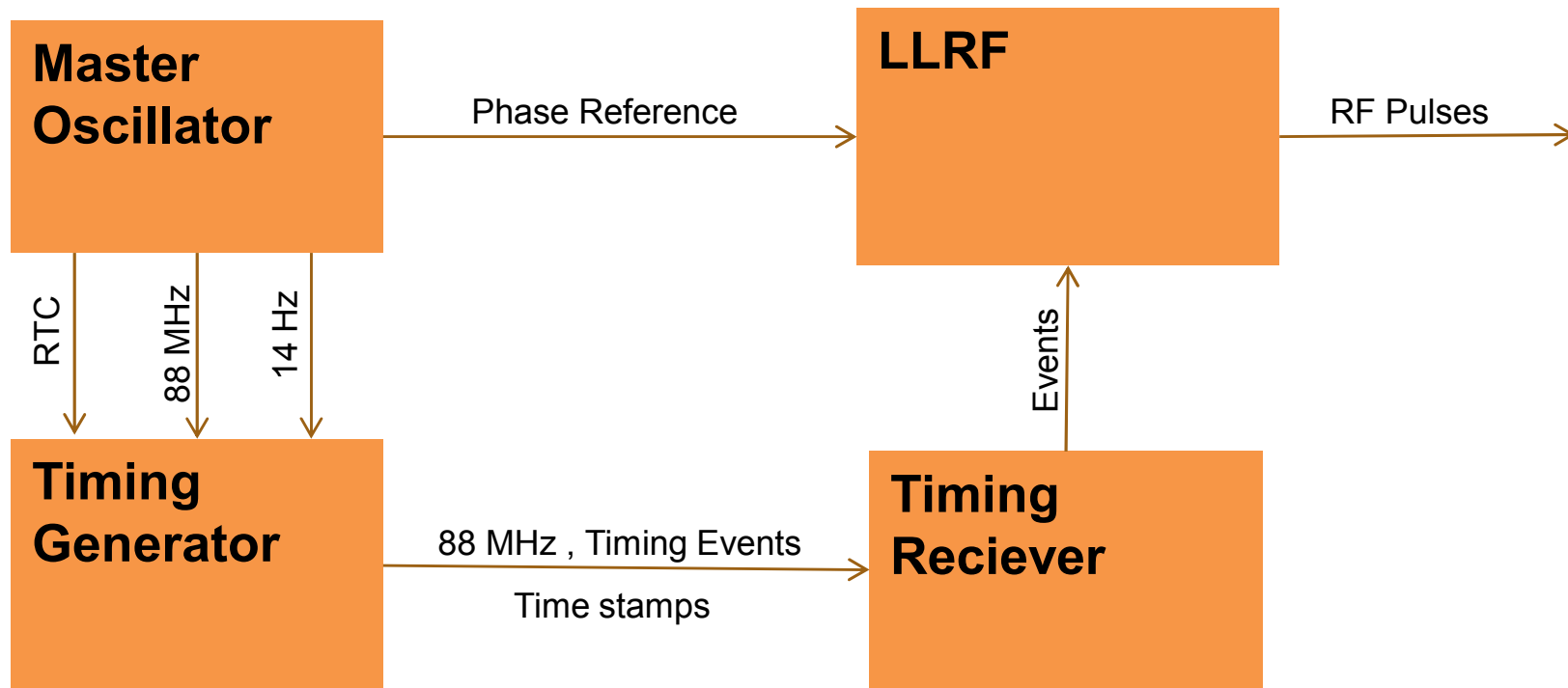
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ESS RF Cell overview (Draft)



Timing system for LLRF



LLRF scope

- The LLRF system for ESS consist of the following main functions:
 - Control of the field in the cavity
 - Control of the slow tuner actuator
 - Control of the fast tuner actuator

LLRF field control

- The field in the cavity is measured, and then controlled by a combination of:
 - PI-control
 - Adaptive feedforward error correction from last pulse
 - Amplifier linearization
 - Modulator droop compensation (Klystrons)
- The LLRF saves data each pulse for post-mortem analysis.

Additional inputs

- The LLRF system works as the main RF digitizer for the RF systems. It has 8 RF inputs, used for:
 - Cavity probe
 - Reference input
 - Vector modulator output
 - Pre-amp output
 - Main amp output
 - Main amp reflected
 - Cavity forward
 - Cavity reflected

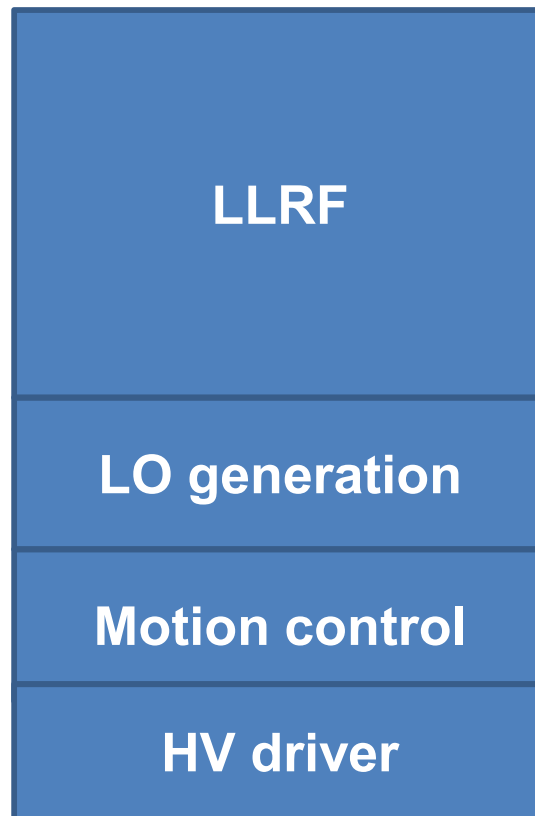
Fast tuner control

- The superconducting cavities incorporate two fast tuner actuators in the form of piezo elements.
- The piezo elements can be used both as sensors and actuators.
- They will be controlled from a driver board in the MTCA.4 chassis.

Slow tuner control

- The slow tuner of the superconducting cavities use stepper motor actuators, working in cold and vacuum.
- The stepper motors do not have any encoders or limit switches.
- The stepper motors must be protected from over-use as they are not lubricated.
- The stepper motors will be controlled by a standard ESS motion control crate over EPICS, which will incorporate safeguards.

Schematic LLRF rack (Superconducting)



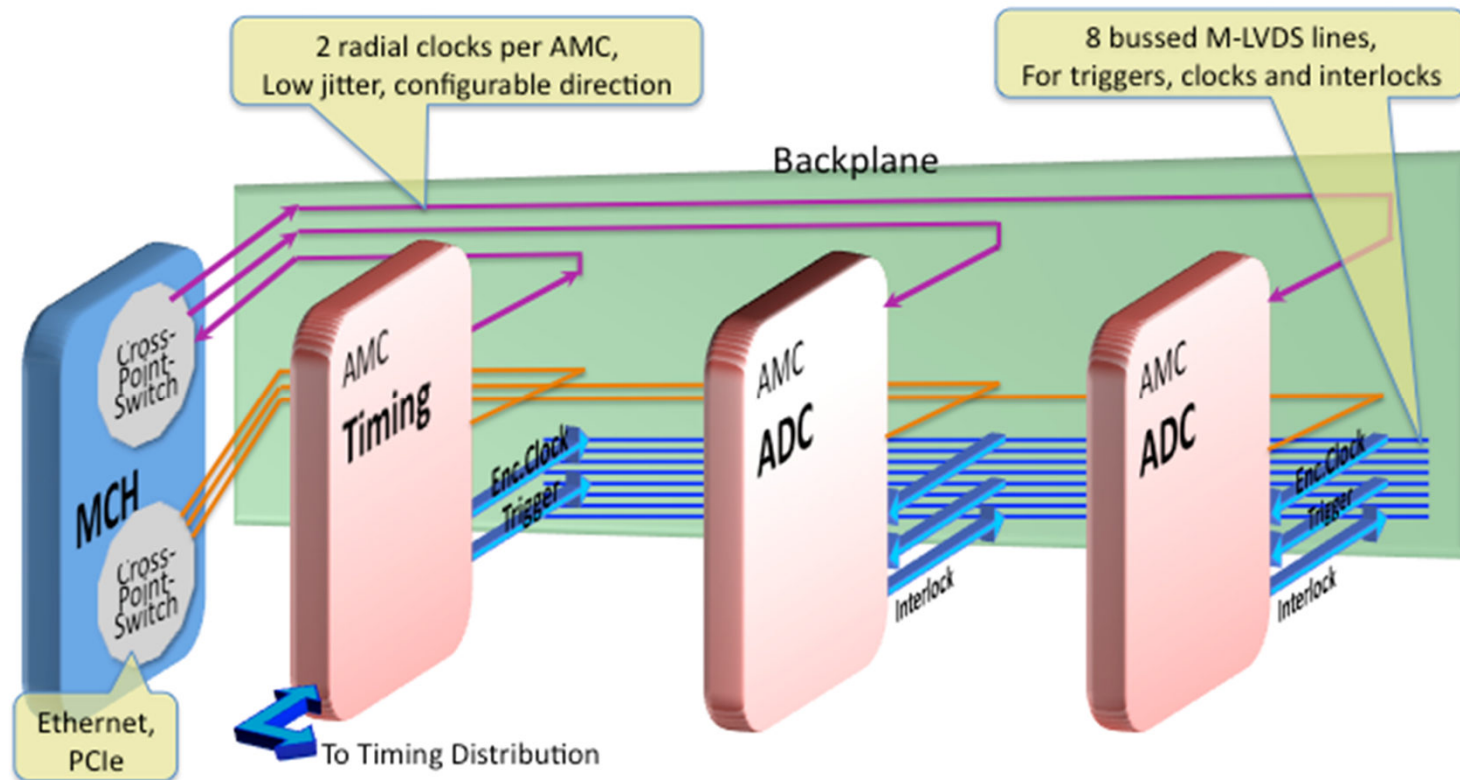
MTCA.4

Micro Telecommunications Computing Architecture

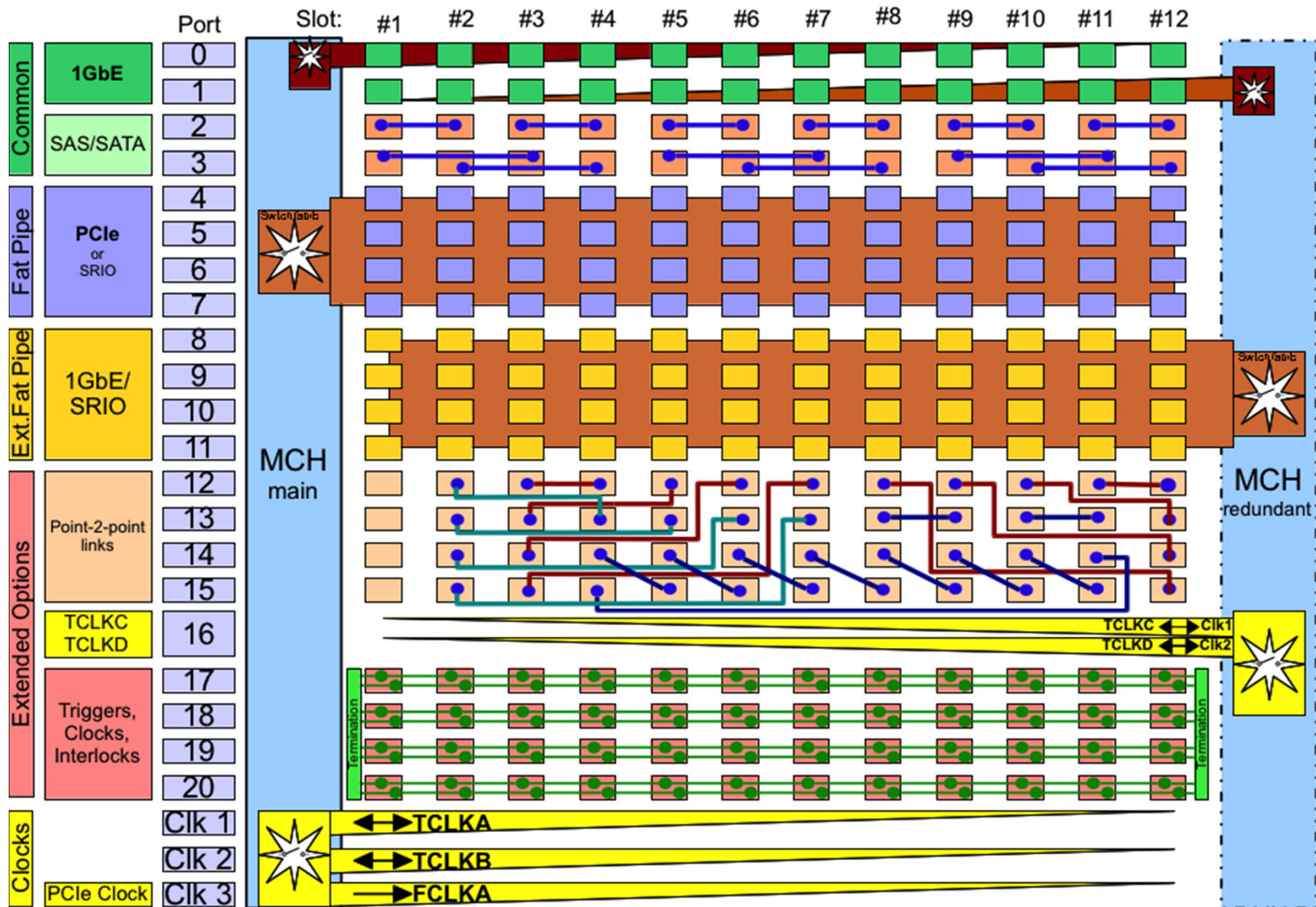


- Modular design
- MTCA.4 designed for Physics
- Designed for high availability
 - Redundant fan trays
 - Redundant power
 - Redundant control
- All hot swappable
- Standardised elements
- Multiple vendors

MTCA.4 Overview



MTCA.4 Backplane

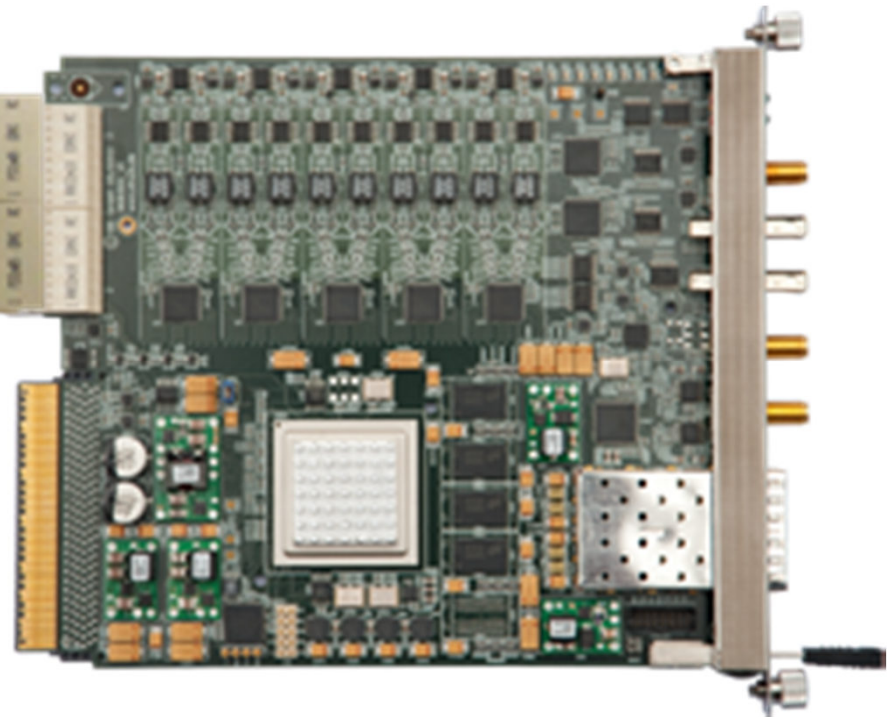


RTM and AMC module.

All cables connected from the back.

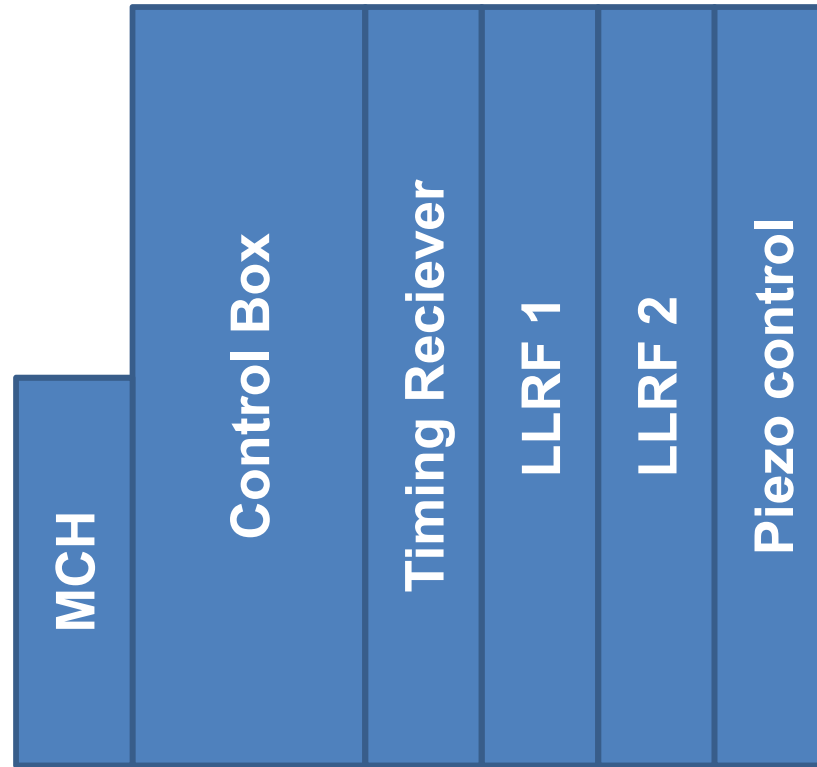


8 Channel RF downconverter



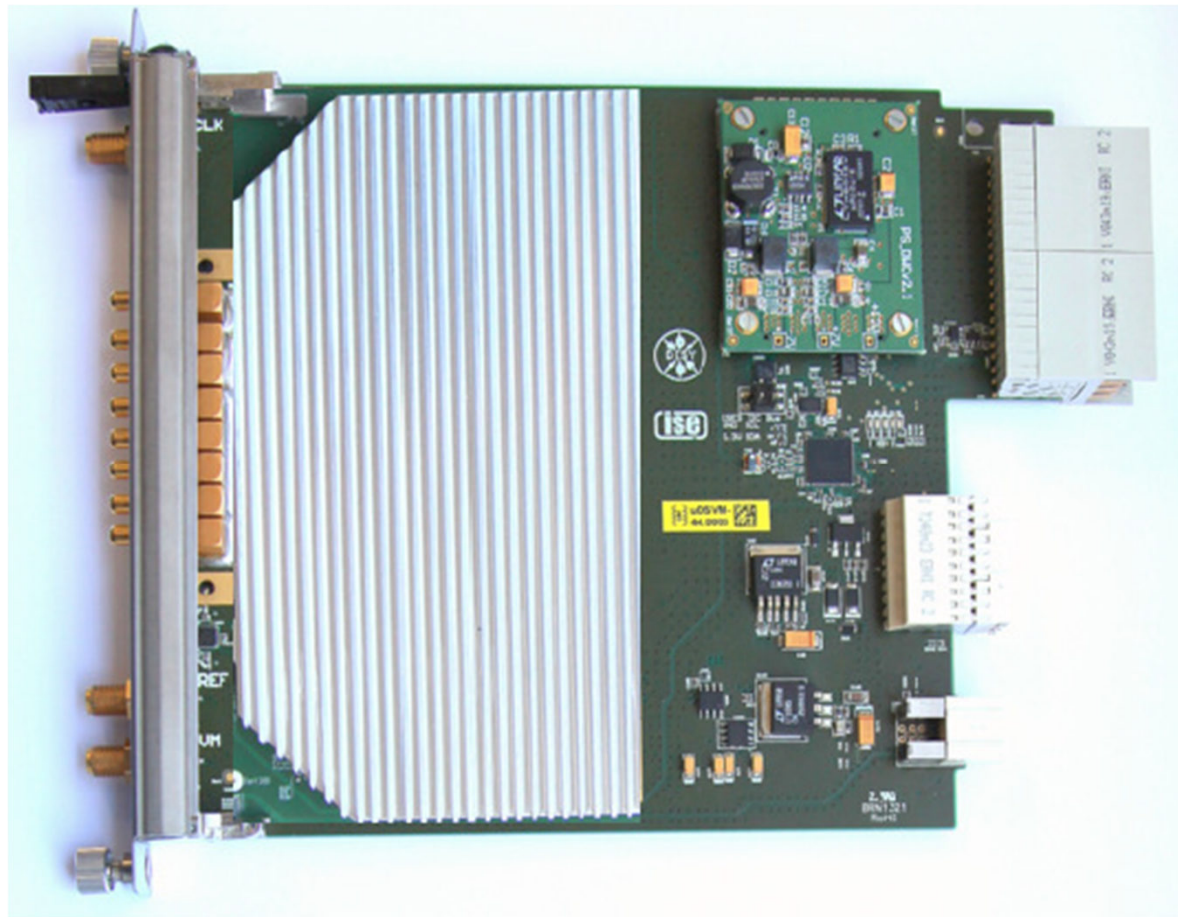
10 channel ADC 125MS/s

LLRF MTCA.4 rack (Schematic, 2 spoke Cryomodule)



DRTM-DS8VM1

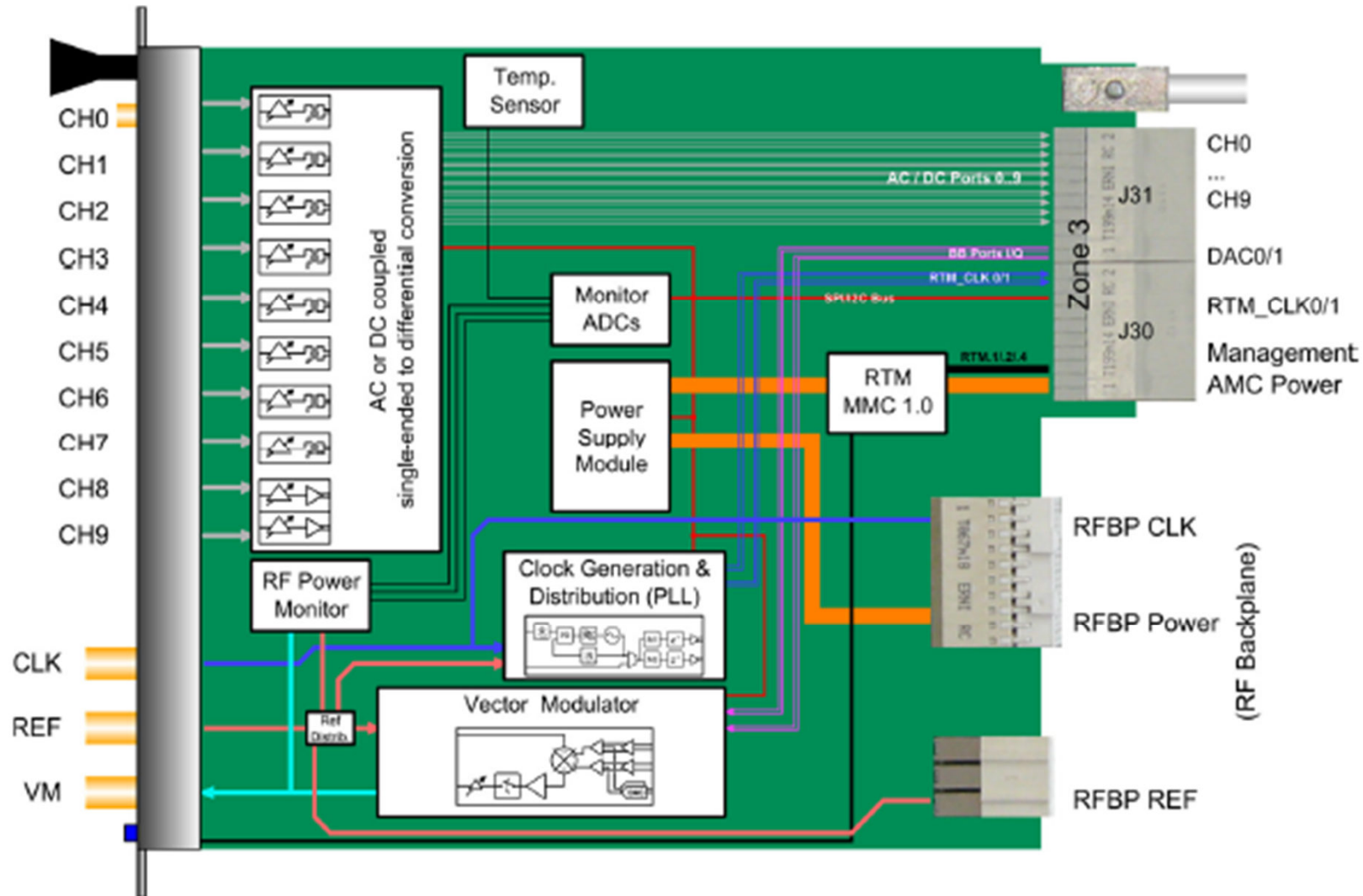
RTM 8-channel Direct Sampling 1-channel Vector Modulator



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DRTM-DS8VM1

Funktional Block Diagram



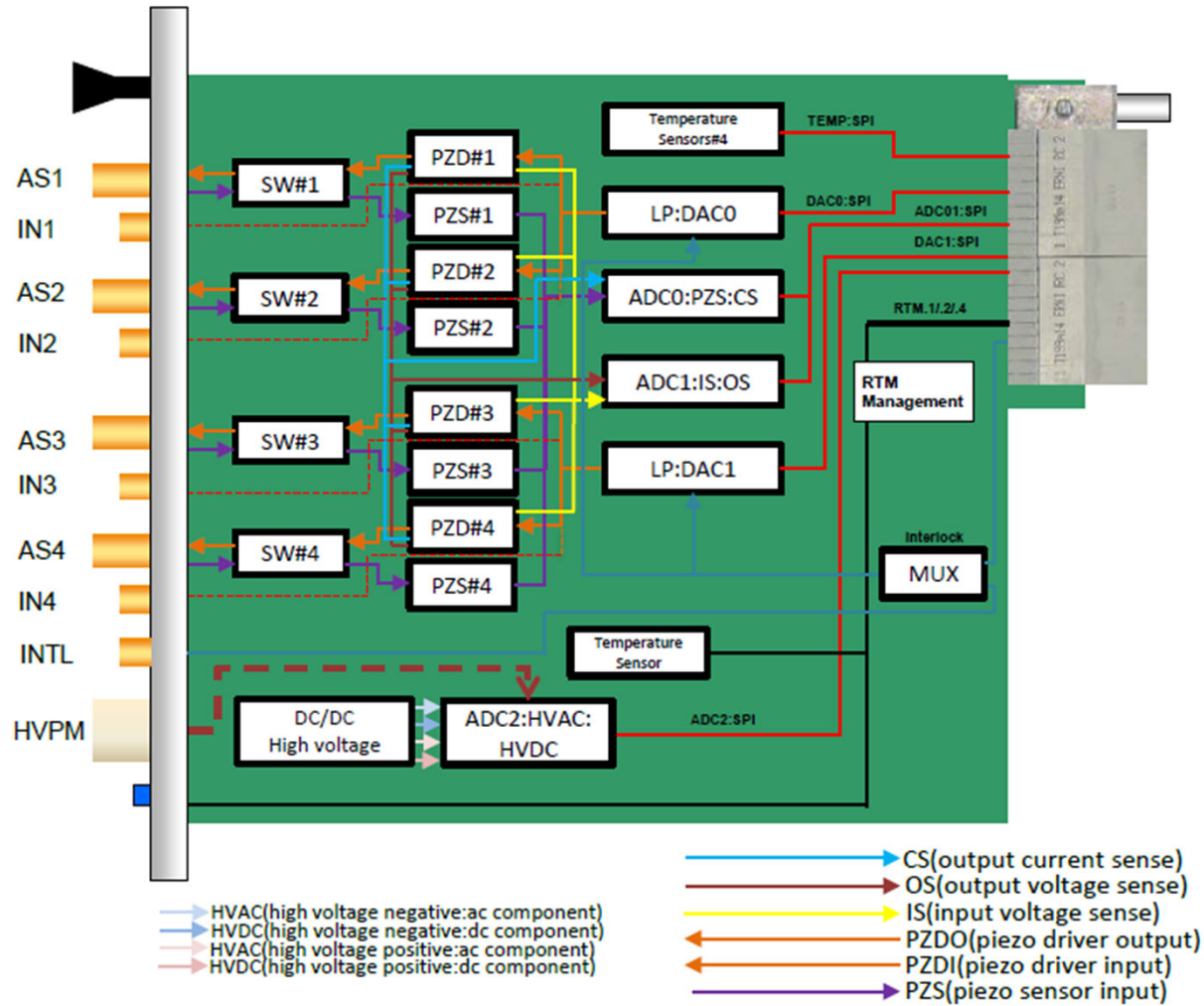
RTM-PZT4

4 Channel Piezo Driver



RTM-PZT4

Functional Block Diagram





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