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Libera LLRF Software

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Libera WORKSHOP 2009

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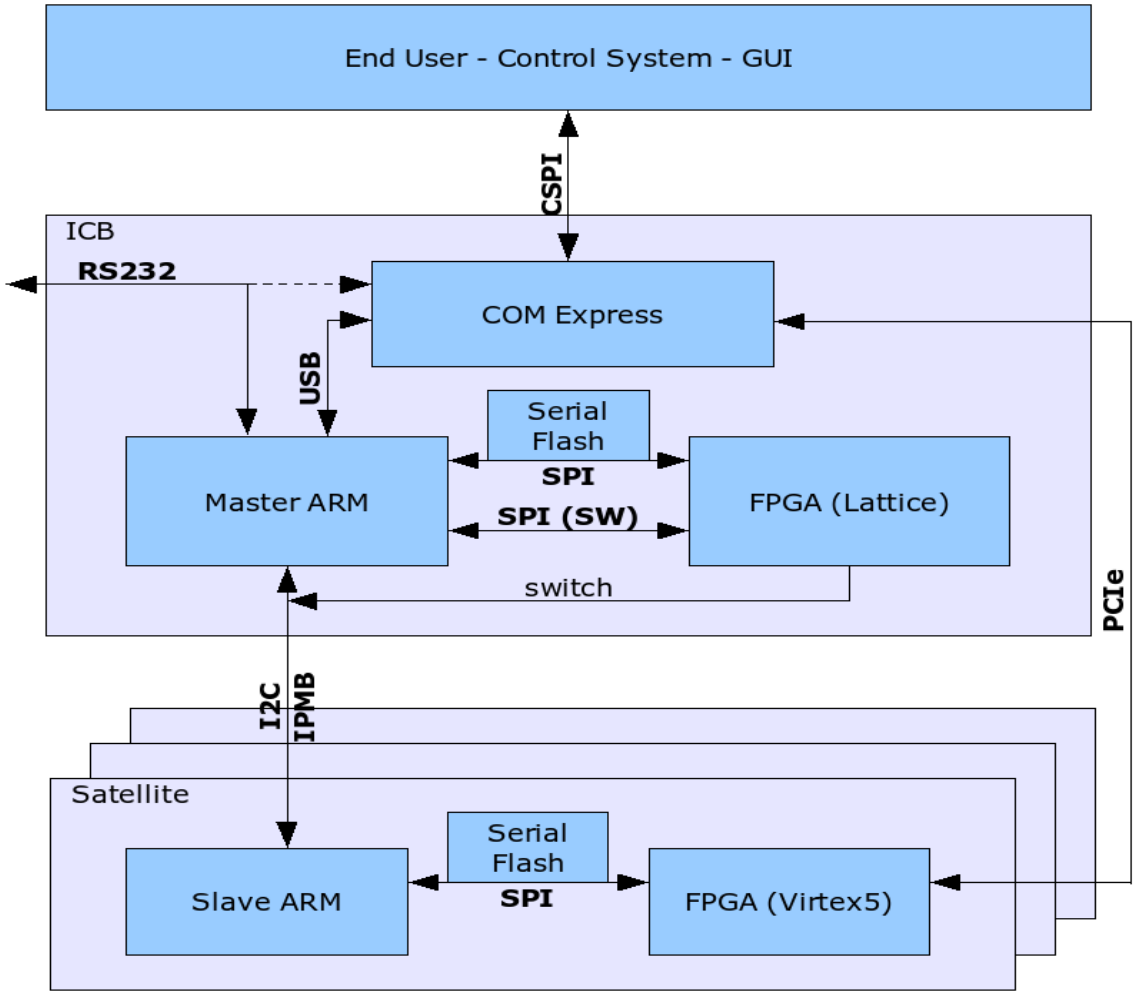
Libera LLRF SW Concept

- **Generic as much as possible**
- **@ Low level:**
  - 1-1 relation to HW satellite boards
  - Modular, but with minimal or no impact on performance
- **@ Mid & High level:**
  - Generic data paths
  - High level mapping for “instrument specifics”

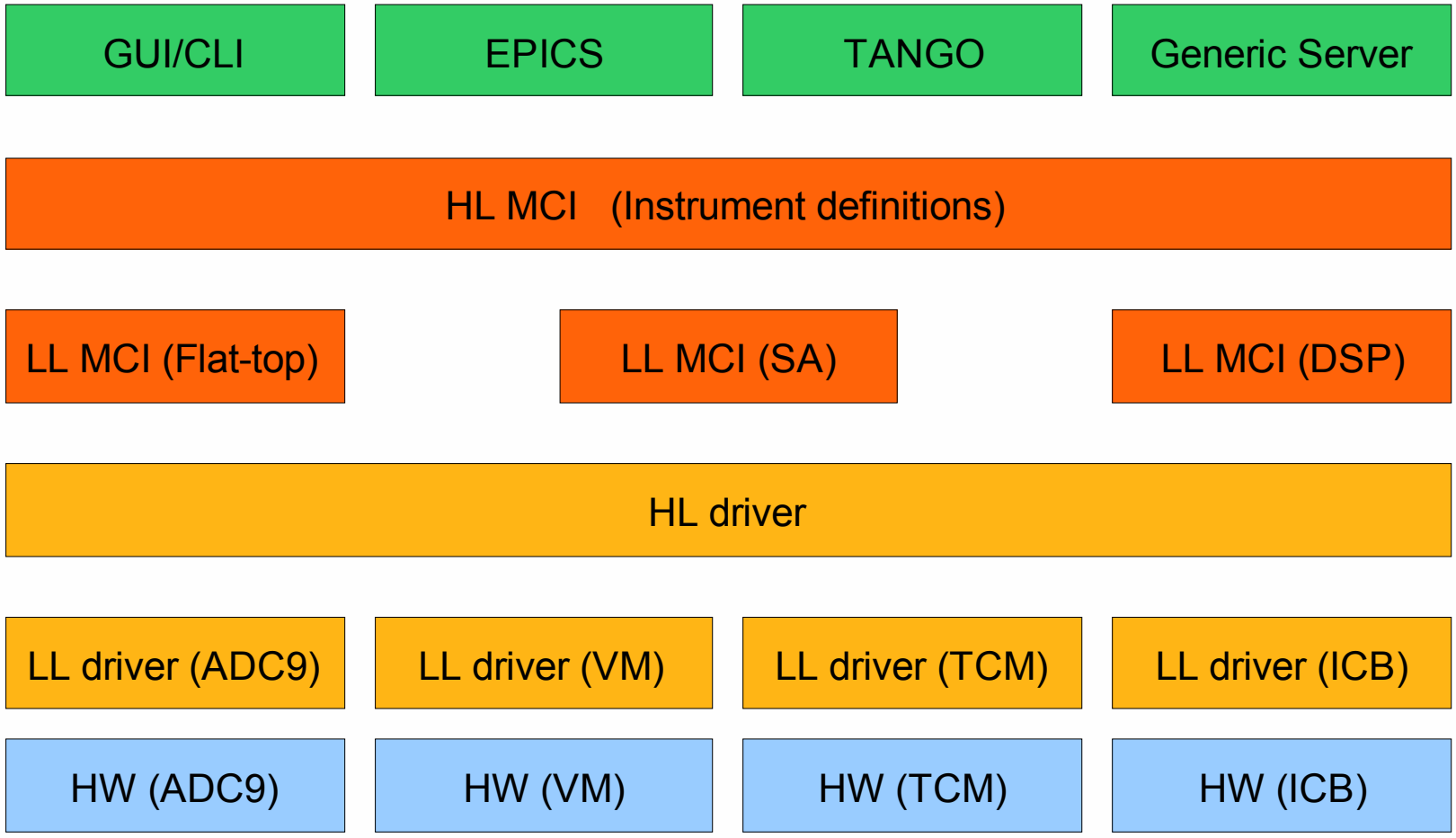
Low level (Chasis) Software

- As close to **IPMI standard** as possible **(Intelligent Platform Management Interface)**
- **Firmware upgrades**
- **JTAG access (FPGA debugging)**
- **Environmental monitoring**
  - Temperature
  - Voltages
  - Fan speed

Low Level SW


End User - Control System - GUI
CSPI
ICB
RS232
COM Express
USB
Serial Flash
SPI
Master ARM
SPI (SW)
FPGA (Lattice)
switch
PCIe
I2C
IPMB
Satellite
Serial Flash
SPI
Slave ARM
FPGA (Virtex5)

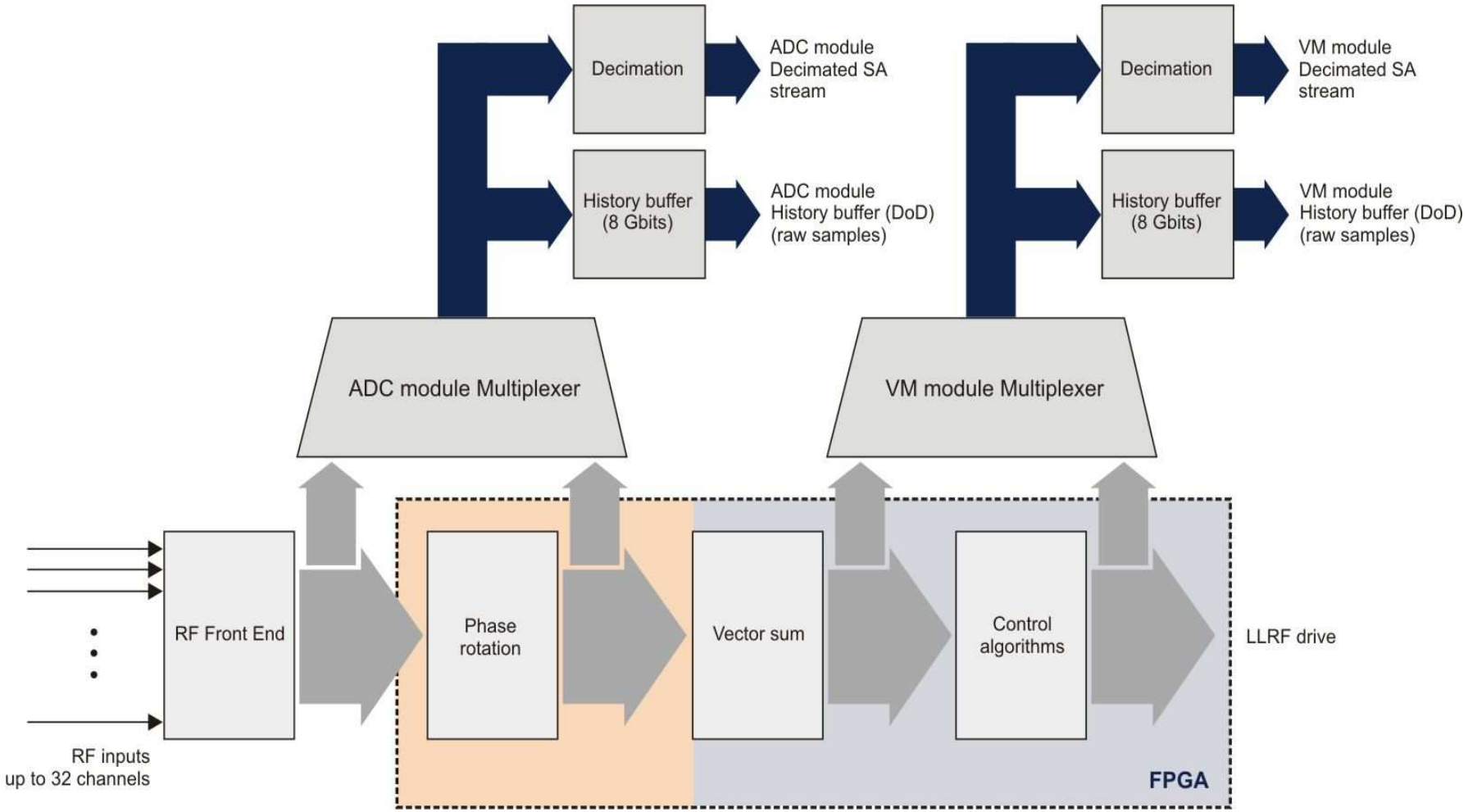
Mid & High Level Software

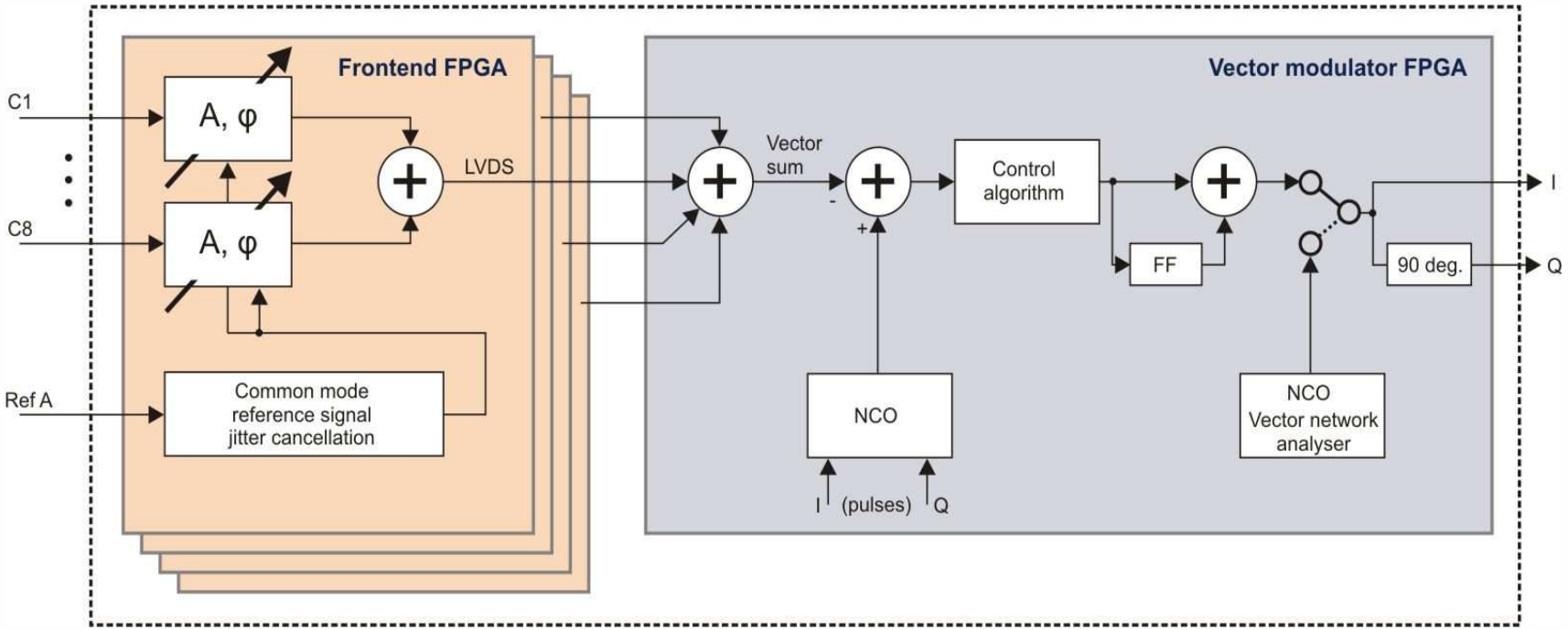


Mid Level Software

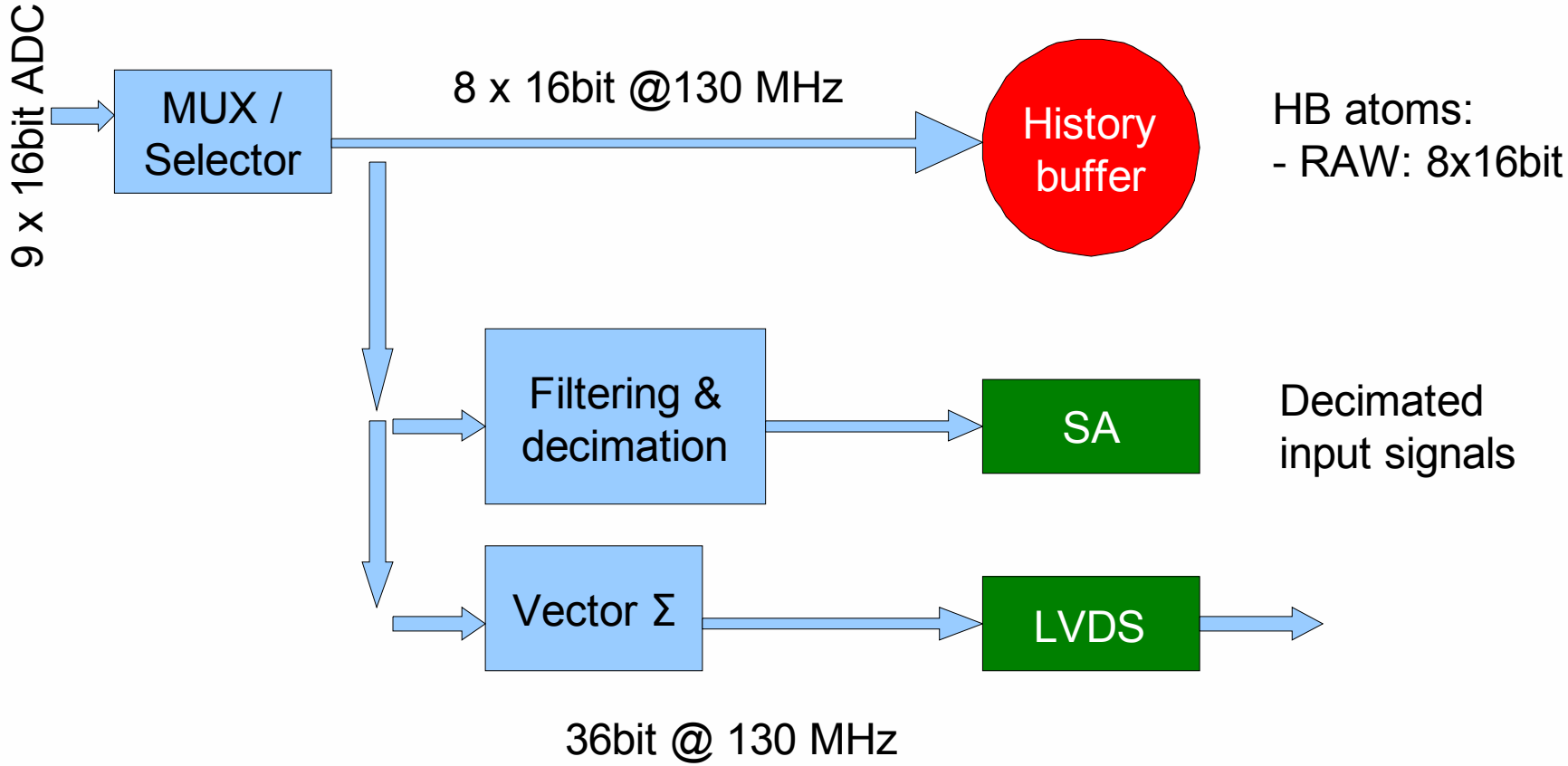
- **FPGA modules on internal bus:**
  - ADC, DAC, I/O, DDR2, PCIe
  - Timing & synchronization
  - DSP & Application
- **GNU/Linux driver modules:**
  - Flat-top, SA, DSP channels
  - DMA
  - Built-in debugging

LLRF Application & Monitoring

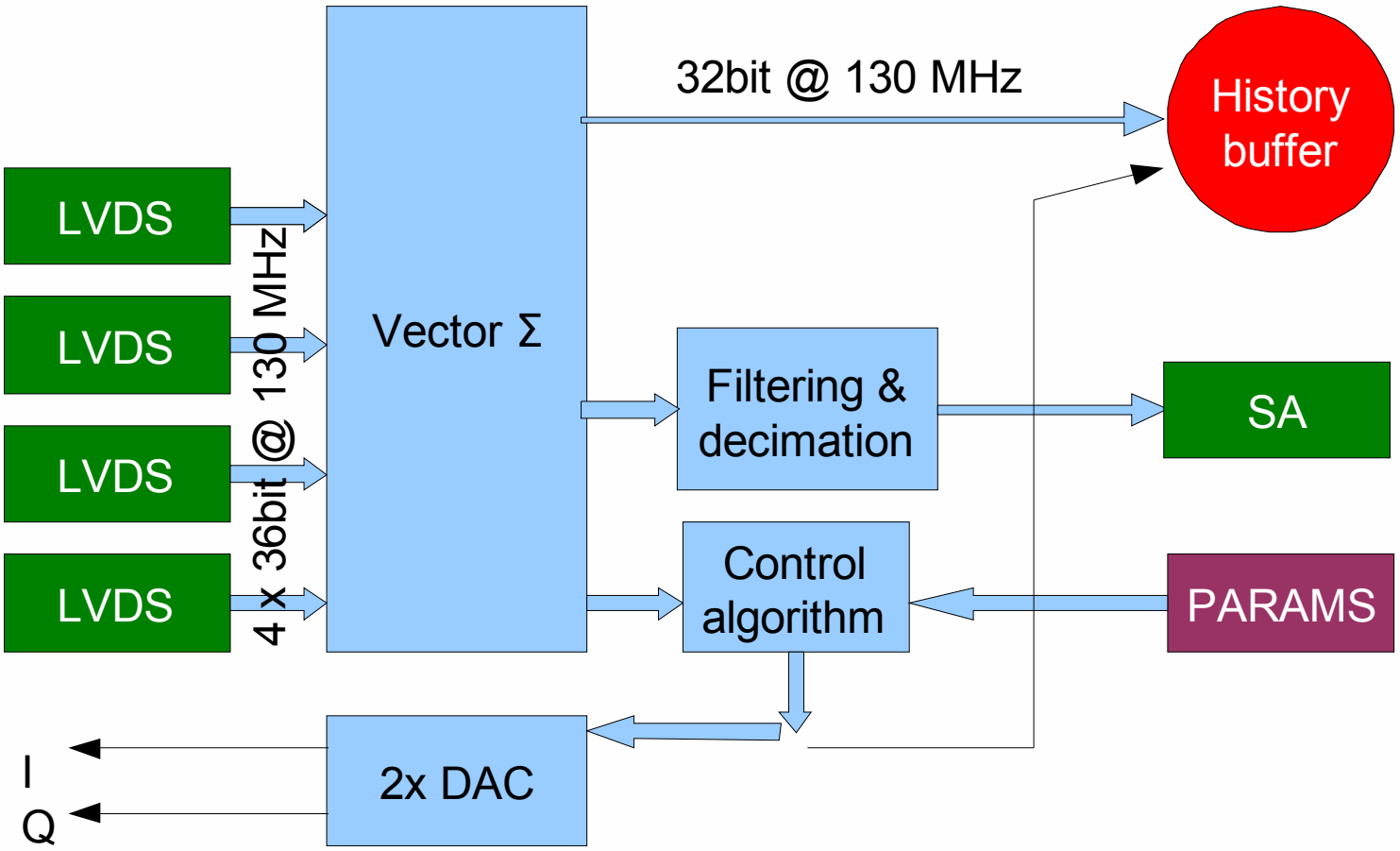



Frontend FPGA
Vector modulator FPGA
C1
C8
Ref A
A, φ
A, φ
LVDS
Common mode
reference signal
jitter cancellation
Vector
sum
Control
algorithm
FF
90 deg.
I
Q
NCO
I
(pulses)
Q
NCO
Vector network
analyser

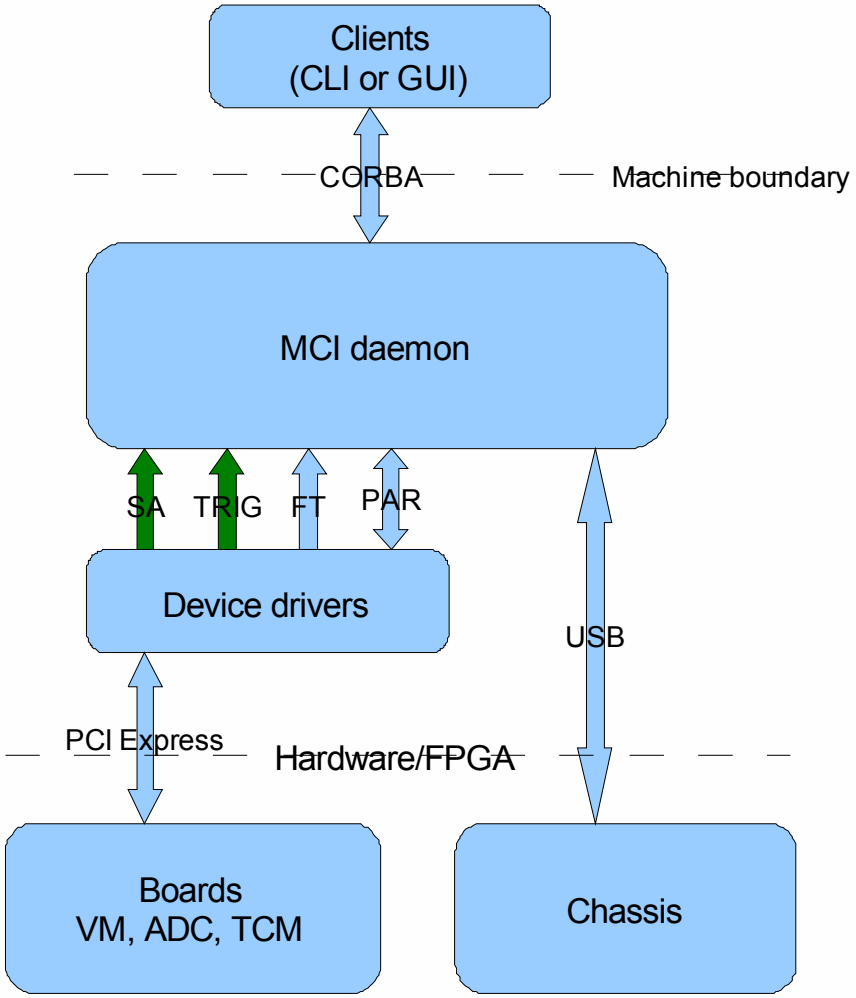
LLRF – Data Paths (ADC9)



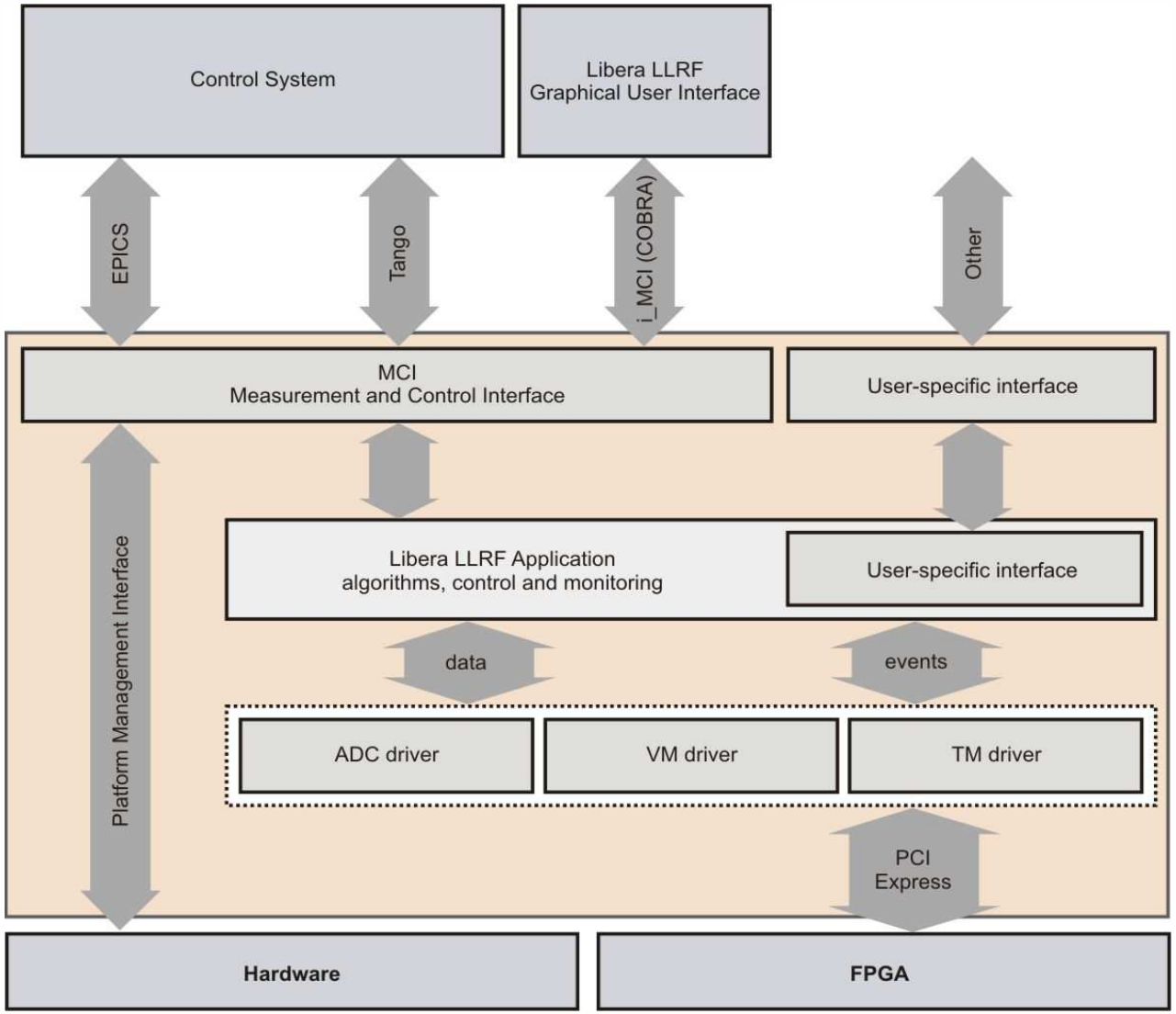
LLRF – Data Paths (VM)



Software Interfaces



- **Measurement Control Instrument (MCI) is implemented in MCI daemon:**
- **Enumeration: List of boards, signals, sensors.**
- **Information (attributes, state,...) about board, signal, sensor, application.**
- **Provide signal data via callback receiver: bounded to BoardID, SigID, stream type (SA, Flat-top) and stream processing (eRaw/eAmpPhase/eIQ).**
- **Provide sensors attributes and data via USB IPMI protocol.**
- **LLRF application specific control (Sweep, Decay, Stability, Loop control, Trigger, ...).**
- **Chassis control (status, temperature control, FPGA load, Power control, ...).**


Control System
Libera LLRF
Graphical User Interface
EPICS
Tango
i_MCI (COBRA)
Other
MCI
Measurement and Control Interface
User-specific interface
Platform Management Interface
Libera LLRF Application
algorithms, control and monitoring
User-specific interface
data
events
ADC driver
VM driver
TM driver
PCI
Express
Hardware
FPGA