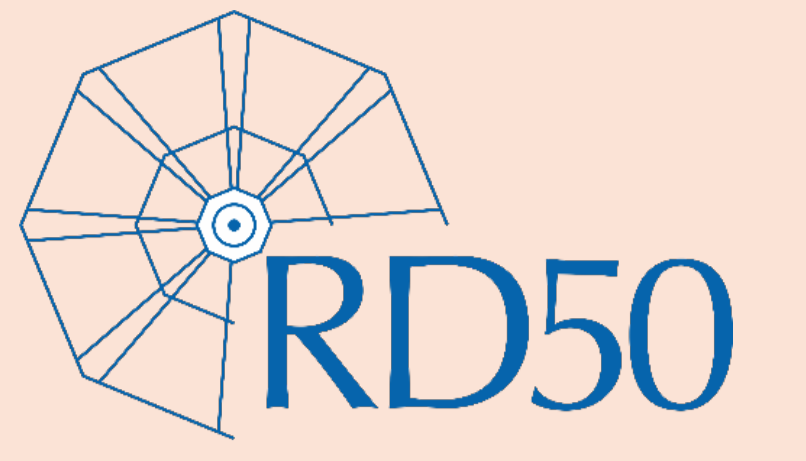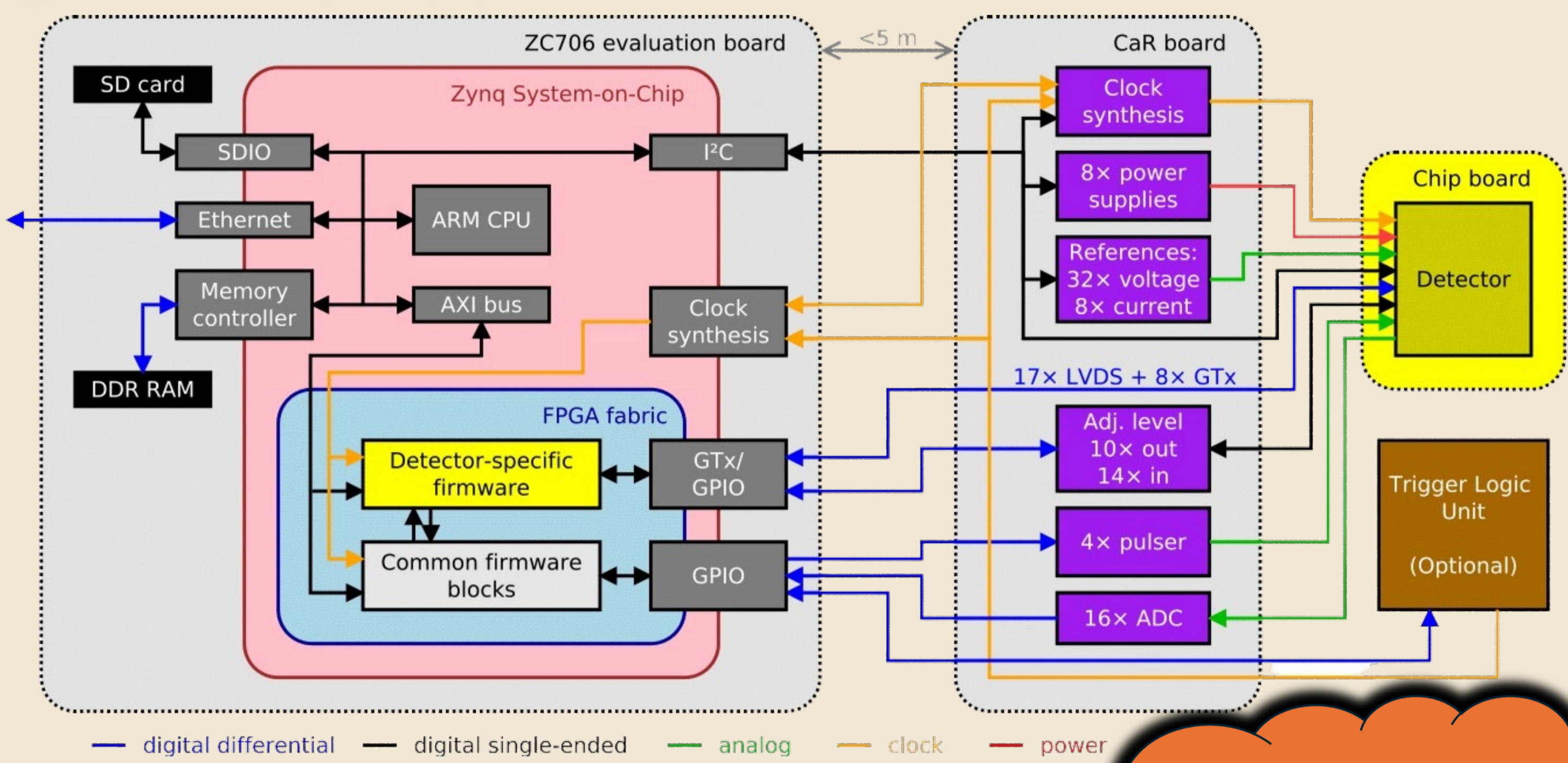# Caribou - A Versatile Data Acquisition System for Silicon Pixel Detectors Prototyping

Y.Otarid [1], M. Benoit [2], E. Buschmann [3], H. Chen [3], D. Dannheim [1], M. Pijacki [4], S. Spannagel [5], S. Tang [3], T. Vanat [5]

[1] CERN, [2] ORNL, [3] BNL, [4] Carleton University, [5] DESY

System Architecture

- ZC706 evaluation board
- Zynq System-on-Chip
- SD card
- SDIO
- Ethernet
- Memory controller
- DDR RAM
- ARM CPU
- AXI bus
- Clock synthesis
- FPGA fabric
- Detector-specific firmware
- Common firmware blocks
- GTx/GPIO
- GPIO
- I²C
- < 5 m
- CaR board
- Clock synthesis
- 8× power supplies
- References: 32× voltage 8× current
- 17× LVDS + 8× GTx
- Adj. level 10× out 14× in
- 4× pulser
- 16× ADC
- Chip board
- Detector
- Trigger Logic Unit (Optional)

Legend: digital differential · digital single-ended · analog · clock · power

Hardware System Upgrade
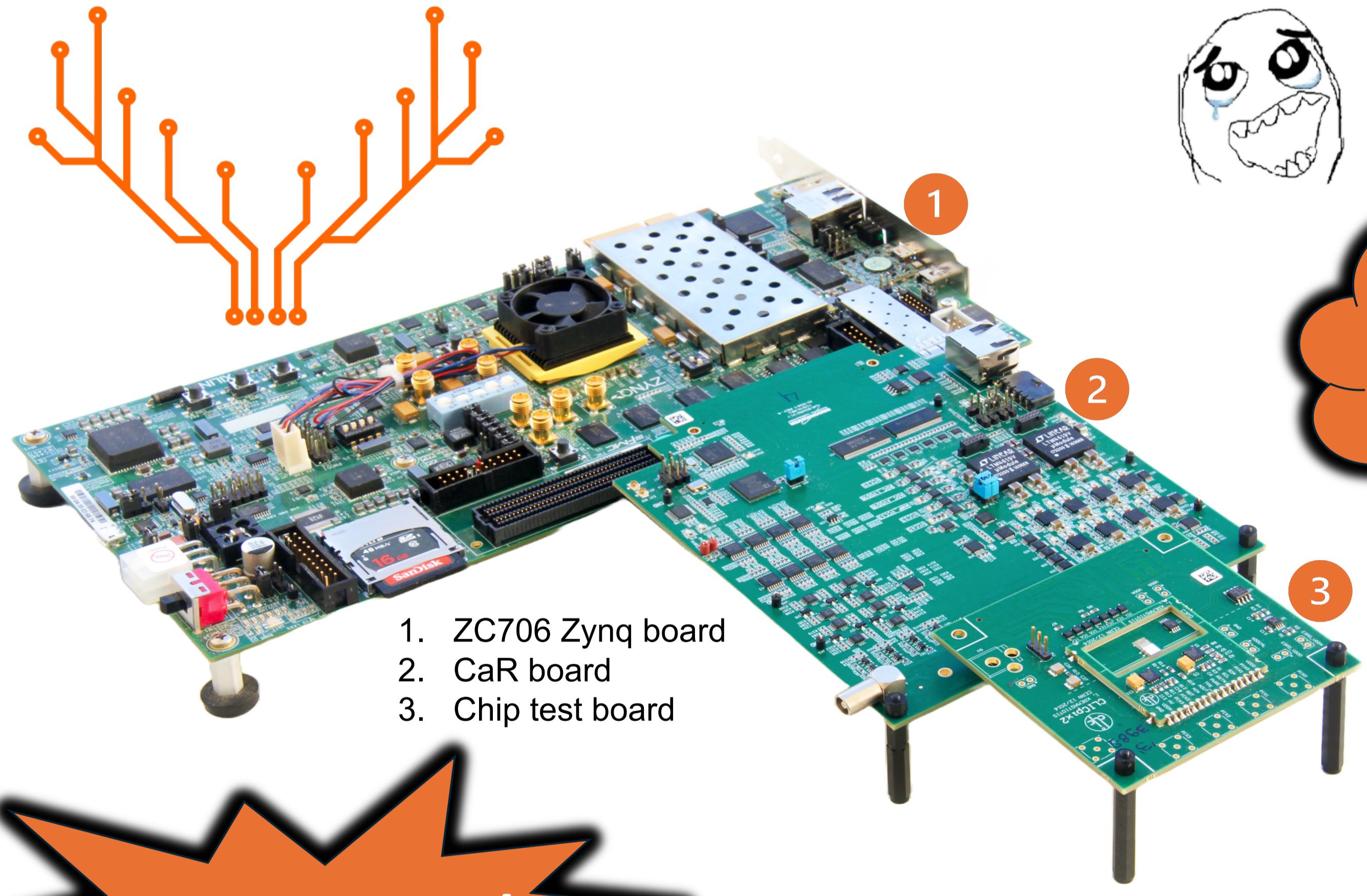
Mercury+ XU1 SoC Module
Zynq Ultrascale+ MPSoC

Zynq board and CaR board unified into modular CaR board

- Single **compact** and **modular** CaR board
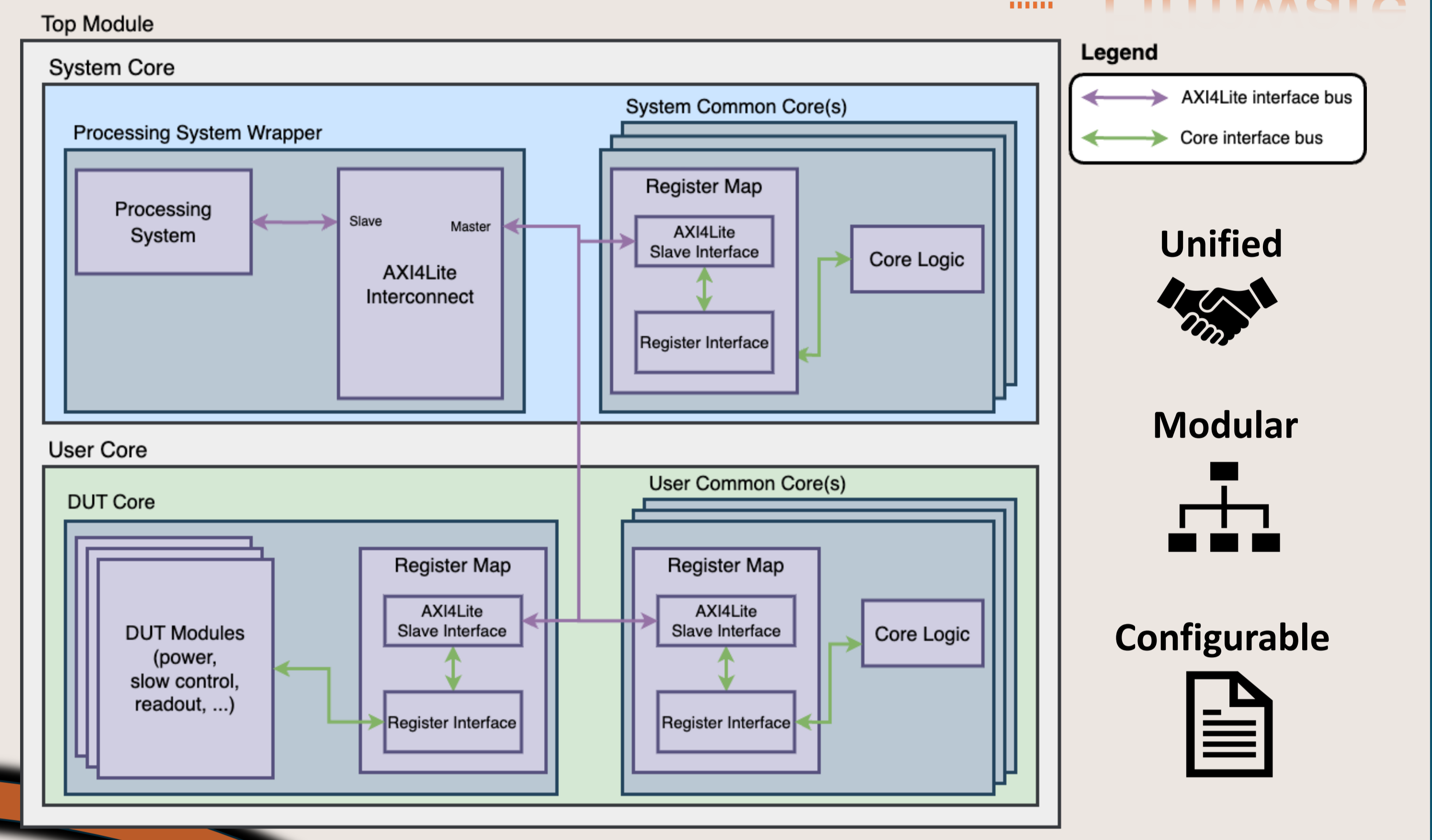- **More** features and processing **resources**

Firmware

Top Module — System Core — Processing System Wrapper (Processing System, AXI4Lite Interconnect, Slave, Master), System Common Core(s) (Register Map, AXI4Lite Slave Interface, Register Interface, Core Logic)

User Core — DUT Core (DUT Modules (power, slow control, readout, ...), Register Map, AXI4Lite Slave Interface, Register Interface), User Common Core(s) (Register Map, AXI4Lite Slave Interface, Register Interface, Core Logic)

Legend: AXI4Lite interface bus · Core interface bus

- **Unified**
- **Modular**
- **Configurable**

AMD XILINX · ocotb · VIVADO · VHDL · SystemVerilog

Vivado project management, code linting, simulation and building

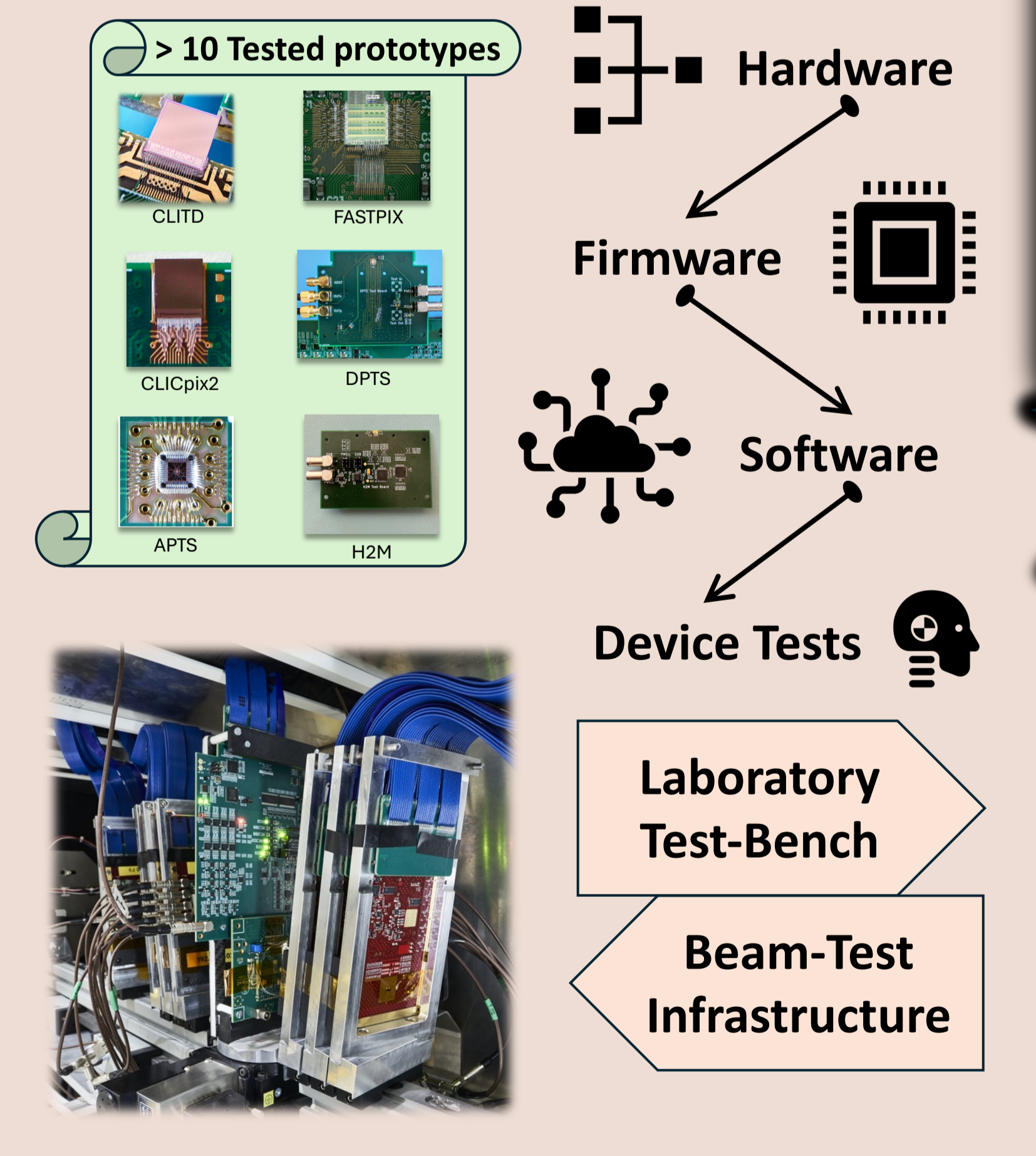### Our motto: *"Minimal work on the base test system development. Maximal focus on detector integration and testing"*

1. ZC706 Zynq board
2. CaR board
3. Chip test board

Design your chip board

Design your DAQ (fw+sw) interfaces

Integrate and test your DUT

Integration & Testing

> 10 Tested prototypes
- CLITD
- FASTPIX
- CLICpix2
- DPTS
- APTS
- H2M

Hardware → Firmware → Software → Device Tests

- Laboratory Test-Bench
- Beam-Test Infrastructure

Power Supply

Software

yocto PROJECT

Yocto-based Linux Distribution
Reference distribution: **Poky**

Unified and modular software framework

openembedded — **OpenEmbedded build system**

Code linting, nightly Yocto builds and Peary deployment

Peary DAQ software
Caribou system and Detector control

Kernel drivers: I²C, SPI, /dev/mem, ...
Hardware Abstraction Layer
Device Manager
CaRIBOu Device (CLICpix2, C3PD, ATLASpix)
Configuration, Logging
DAQ Client
Command Line
Lab Testing
system · DAQ library · user space

Documentation

Caribou — News · Publications · Documentation · FAQ · Forum · Community · Search this site...

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