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The Artix®-7 based

SIS8172 MTCA.4 FMC Carrier

Dr.
Matthias
Kirsch

Outline

- Motivation
- Module Design
- Firmware Framework
- Software
- FMC and RTM Application Examples

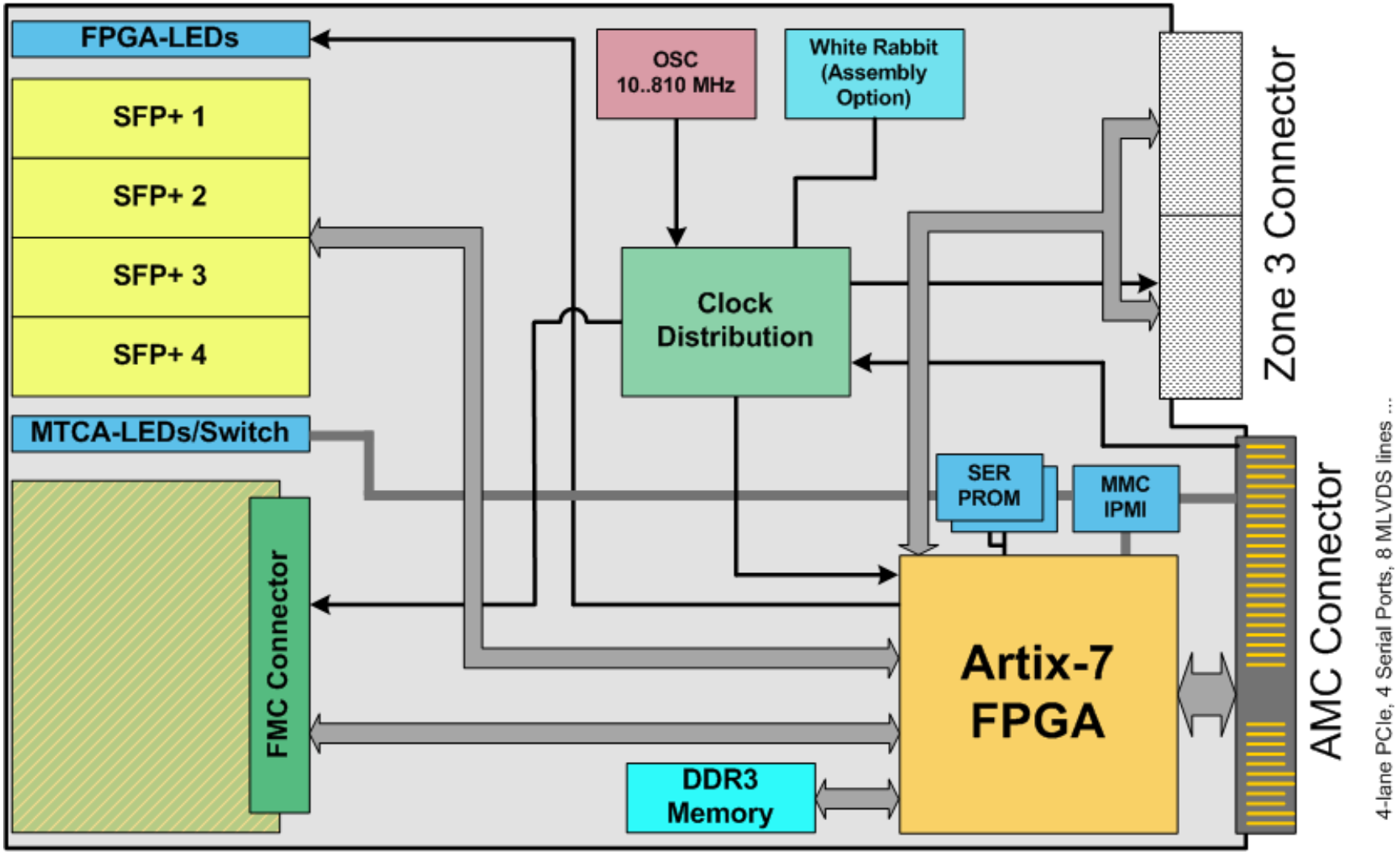
Motivation for SIS8172 Design

- Replacement for Virtex-5 based legacy digital I/O FMC carrier
- Migration to Vivado
- New compact Digital I/O applications

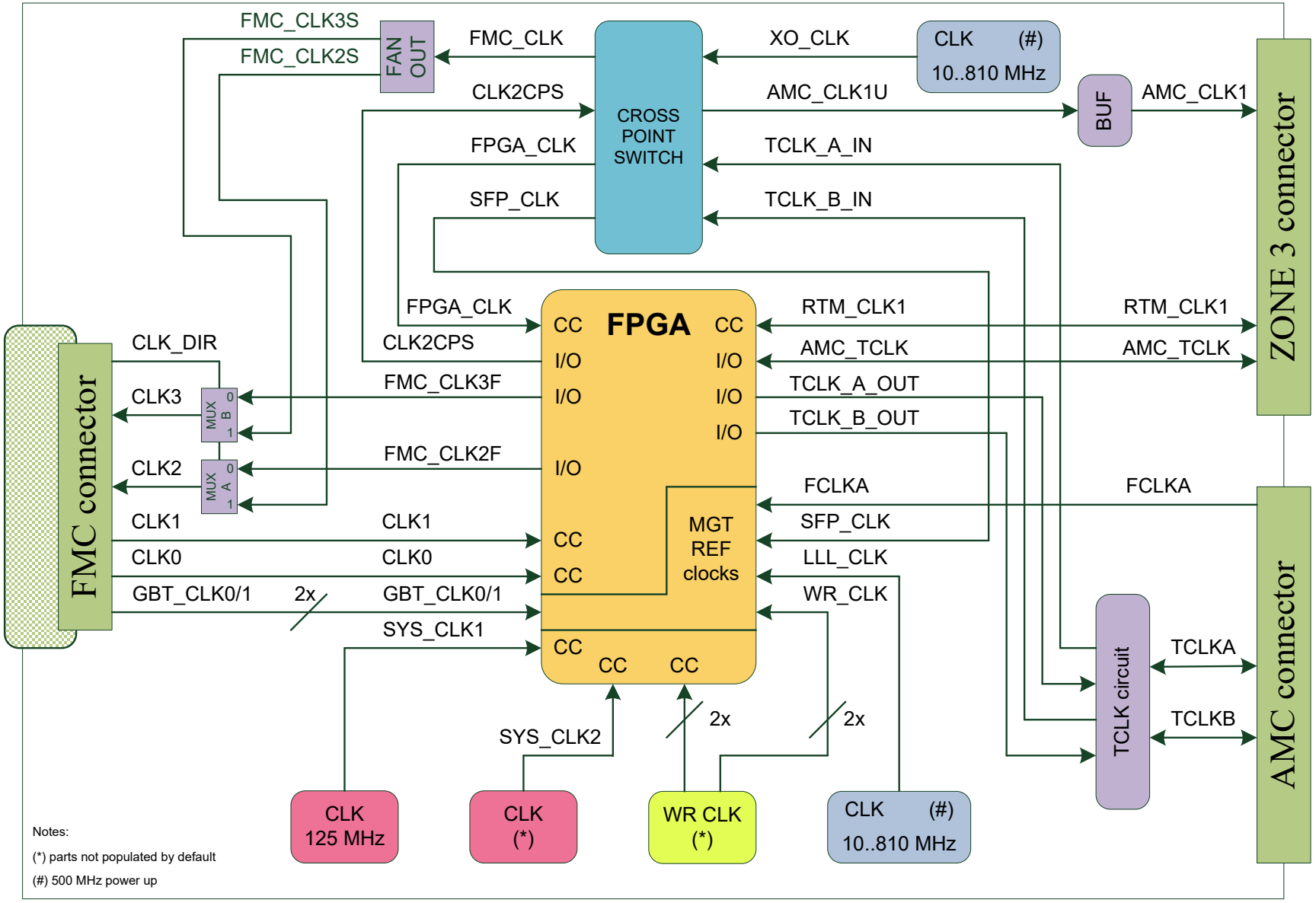
SIS8172 Module Design

- MTCA.4 AMC
- Zone 3 Class D1.0 Implementation
- XC7A200T-2FGG1156C Artix®-7 FPGA
- Dual FPGA Configuration Flash
- 4 Lane PCIe Gen2
- 256 M x 32 Bit DDR3 Memory
- Quad SFP+ Cage
- HPC FMC Site
- 4 Point to Point Link Backplane Interface
- 4 AMC Ports MLVDS (8 MLVDS lines)
- White Rabbit Timing Option
- DESY MMC1.0 with Atxmega
- Standalone Operation
- In-field firmware Upgrade Support

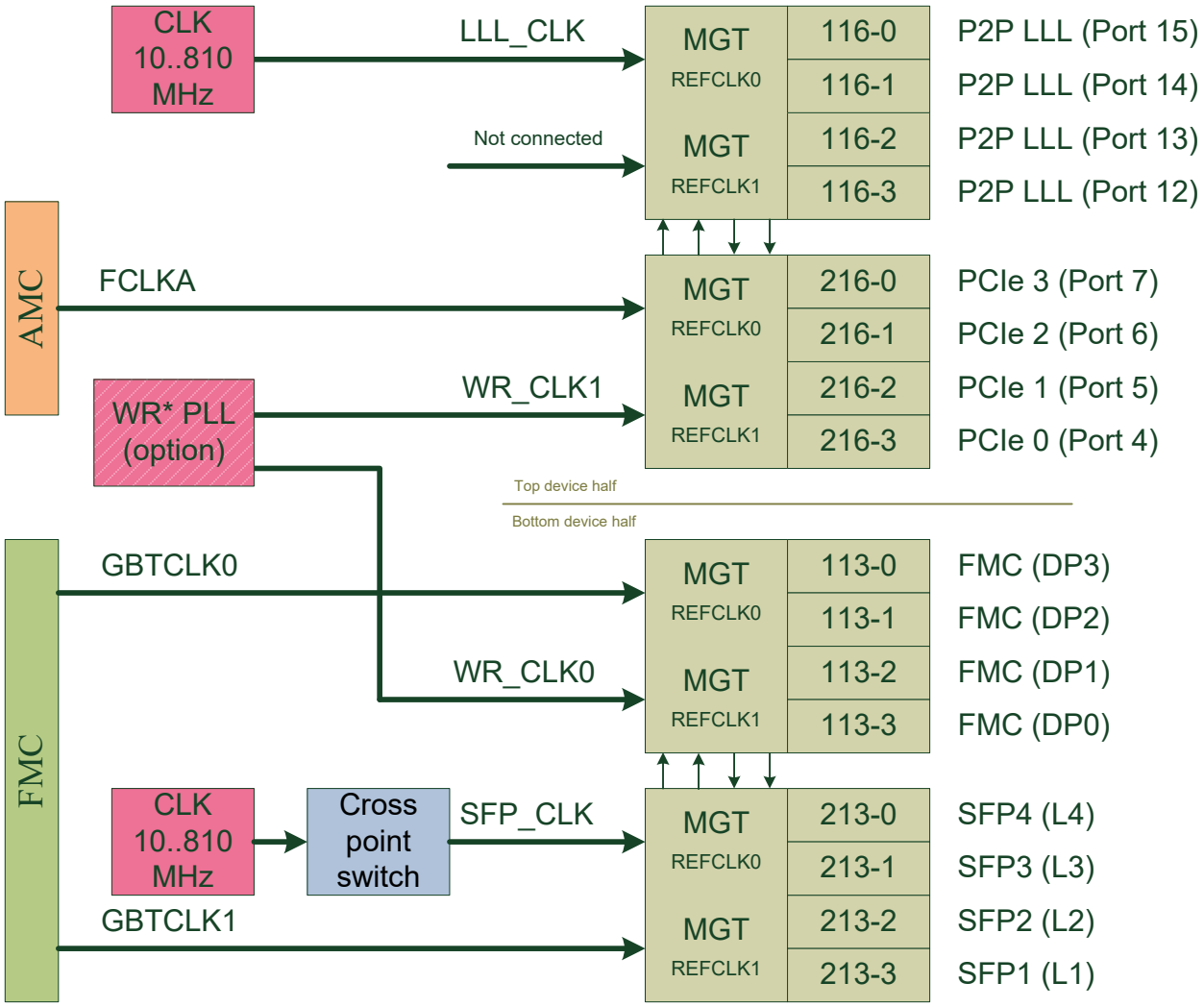
Block Diagram



Clock Distribution

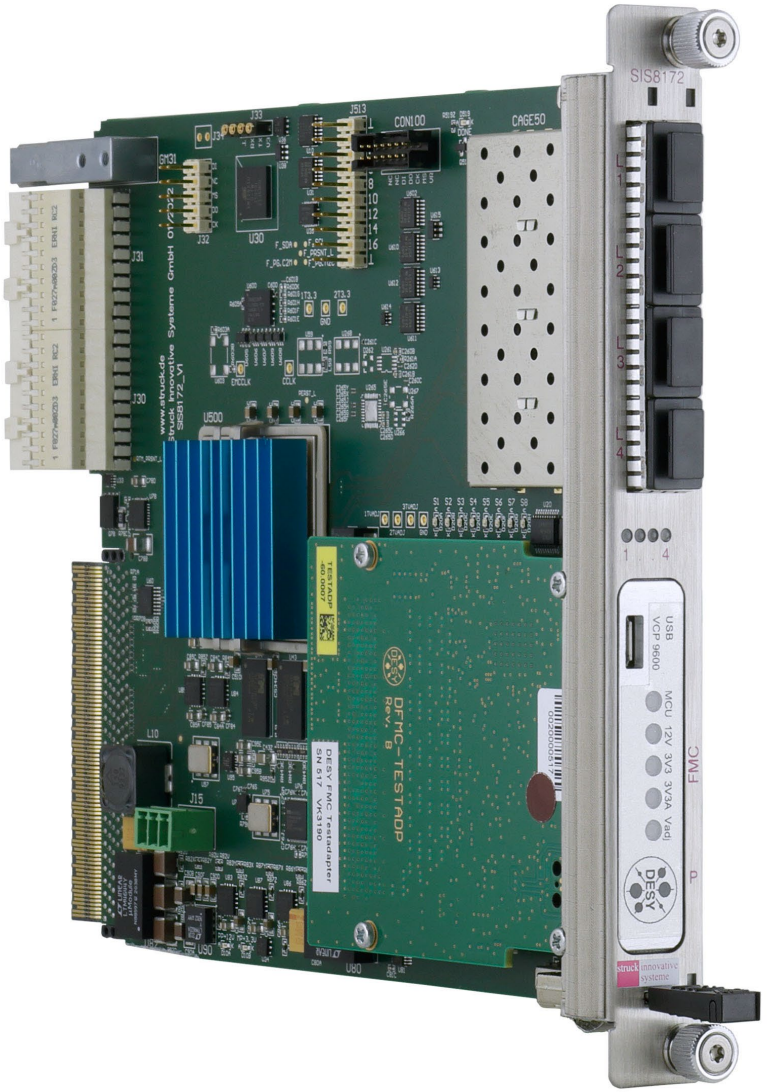


MGT Clock Scheme



* WR – White Rabbit

SIS8172 with DESY TESTADP FMC



Artix®-7 FPGA Limitations

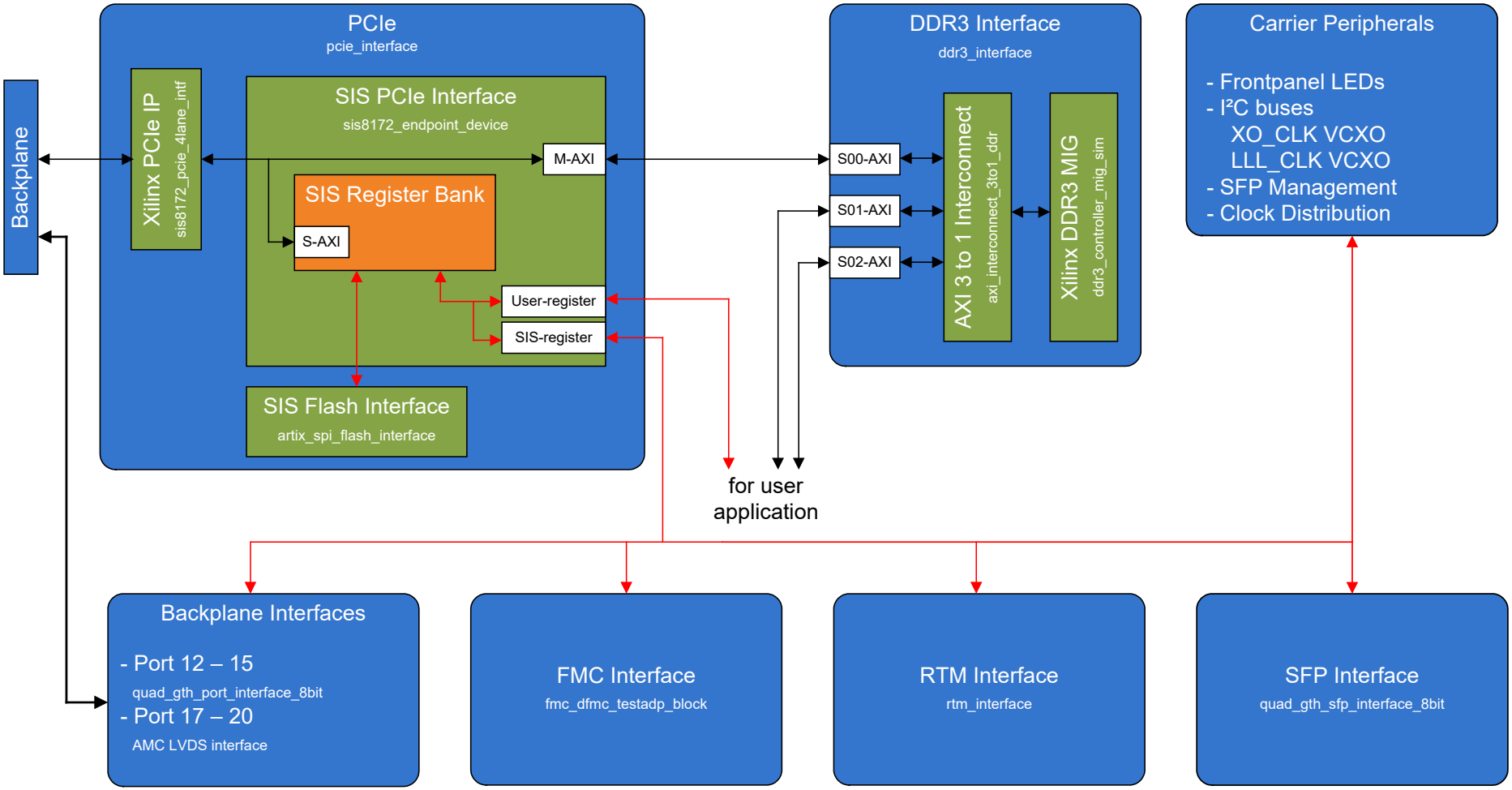
- PCIe Gen2
- DDR3 Memory
- 6.6 Gbit/s MGT Speed

Compared to (Virtex-5)

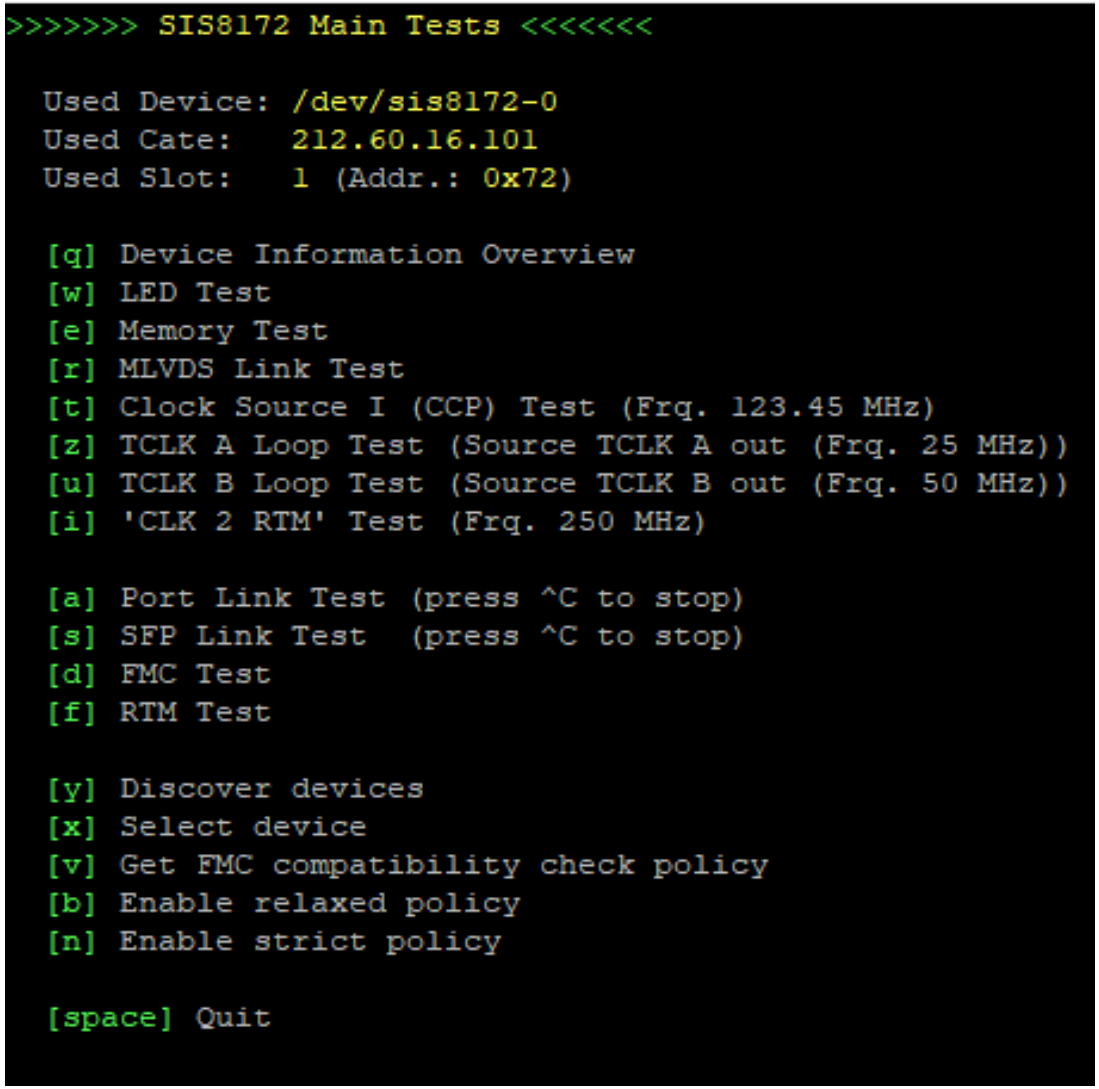
- PCIe Gen2
- DDR2 Memory
- 3.75 Gbit/s MGT Speed (LX, SX)

but: @ decent cost

SIS8172 Vivado Base Project

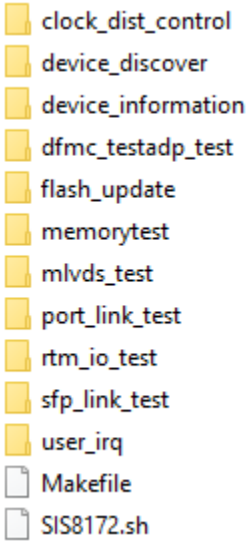


SIS8172 Test Suite



SIS8172 Example Software

- Available in source code



SIS8172 FMC Applications I

Open Hardware (OHWR)
FMC DIO 32 CH TTL A
In-/Output programmable in 8 channel groups

- General purpose I/O
- SIS8800 Multi Purpose Scaler- like FW implemtation e.g. in combination with DESY motion controller (Michael Fenner talk)

Available through Creotech

Picture courtesy Creotech

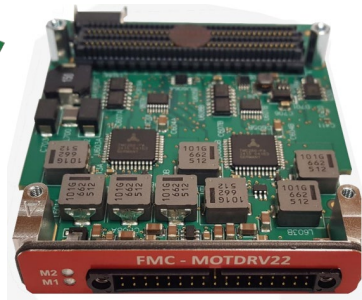
SIS8172 FMC Applications II

PICO-1M4 (CAENELS)
Picoammeter e.g. for Beamlines

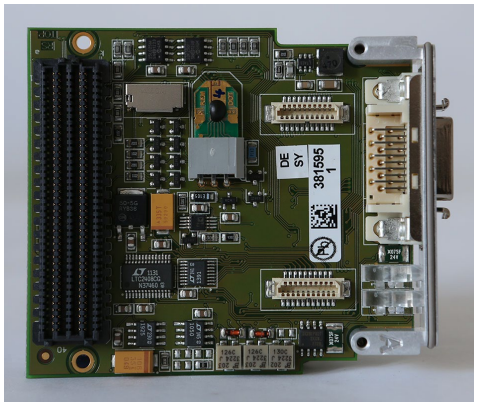
DOSIMON
Radiation Safety

MOTDRV22 (CAENELS)
Motordriver

Digitizer for Spectroscopy
(Talk by Sarmad Adeel)



Pictures courtesy CAENELS



Picture courtesy DESY

SIS8172 RTM Applications I

- Beam Loss Monitor (BLM)
- Machine Protection System (MPS)
- PETRA 4 HF Movement Monitor
- PZT4 Piezo Controller (Low Level Radiofrequency)
- …
- Any existing Zone Class D1.0 RTM
- Yet to be developed…

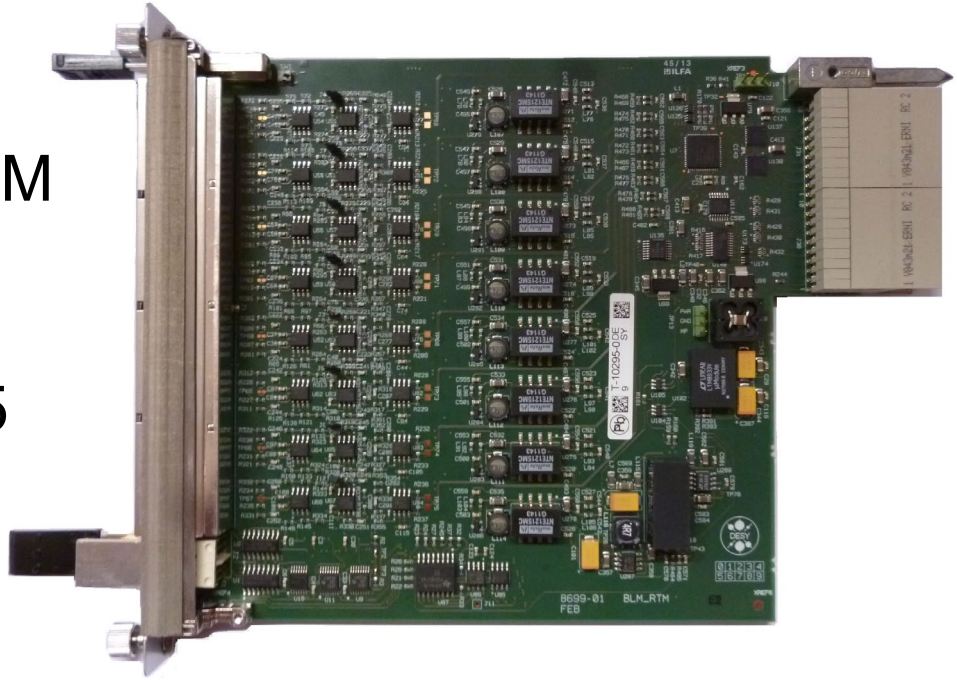
SIS8172 RTM Applications II

Example:

Beam Loss Monitor (BLM) RTM
In use at FLASH and XFEL

Readout of 8 PMTs over RJ45

Compatible redesign
envisaged for Petra IV



Picture courtesy DESY

Summary

- Hard- and Firmware development of flexible semi-custom digital MTCA.4 AMC
- Prototype production run of 10 boards
- Bummer: EOL ITB AMC connector
- Otherwise: Initial revision marketable

First SIS8172 modules shipped in Oct. ’22

→ firmware evaluation/integration underway

SIS8172 with OHWR I/O FMC Demo @ booth

Acknowledgements

We would like to thank

- Kay Rehlich
- Timmy Lensch and
- Tim Wilksen

for their valuable input during the project definition phase.

Questions/Discussion

Quick stopover

option after

WS Dinner Cruise:

Santa Pauli X-Mas Market

Wednesdays open till 11pm

U3 Baumwall 2 stops to St. Pauli