Main logic realization HW

Piotr Amrozik

About me

Piotr Amrozik

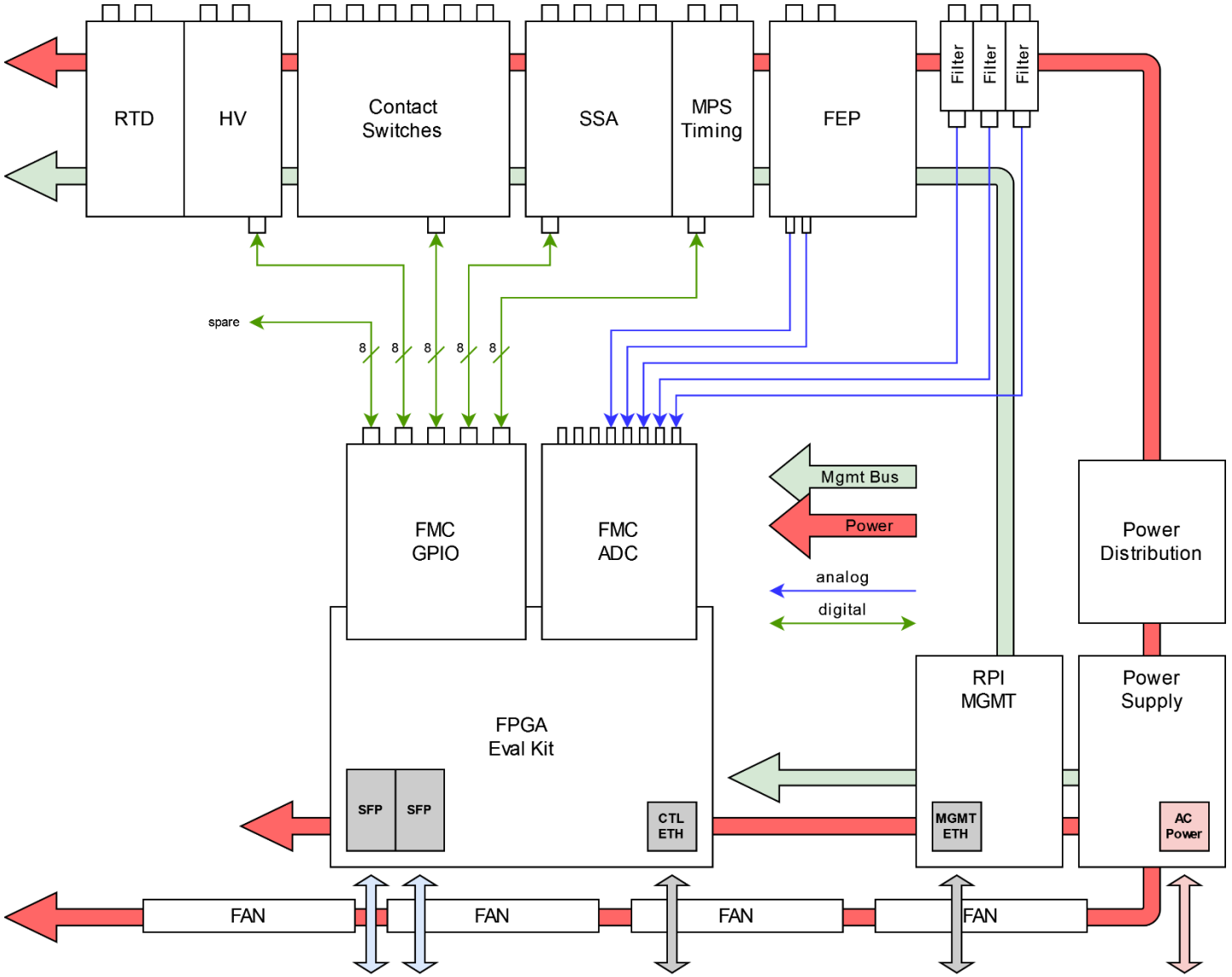
Ph.D. in Electrical Engineering

- Role
  - RFPI project contractor
  - PCB designer / FPGA engineer
- Relevant experience
  - FastLogic Sp. z o.o.: FPGA Expert – FPGA prototyping, timing and synchronization, cryptography and hash algorithms (2020-2021)
  - National projects: Contractor – ASIC designer, PCB designer, FPGA engineer (2017-2020)
  - Ericpol Sp. z o.o. FPGA Engineer – ARUZ Large-scale, FPGA-based Analyzer of Real Complex Systems (2015-2017)

Agenda

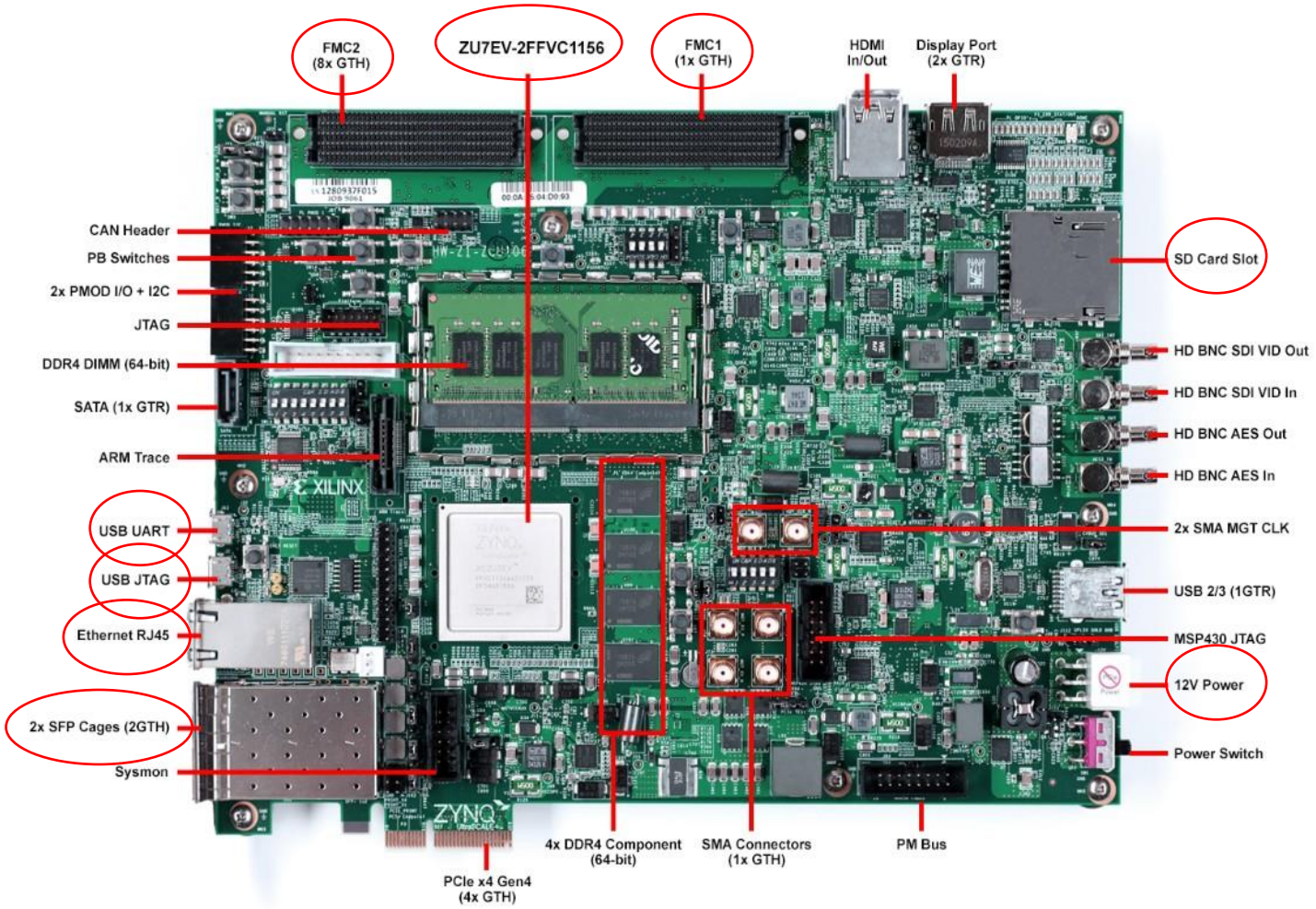
- Main components
- Main FPGA module (features)
- FMC GPIO module:
  - specification,
  - design and schematics,
  - module production, assembly and commissioning,
  - tests results
- The FMC ADC module:
  - specification,
  - design and schematics,
  - module production, assembly and commissioning,
  - tests results
- Summary

The main logic components



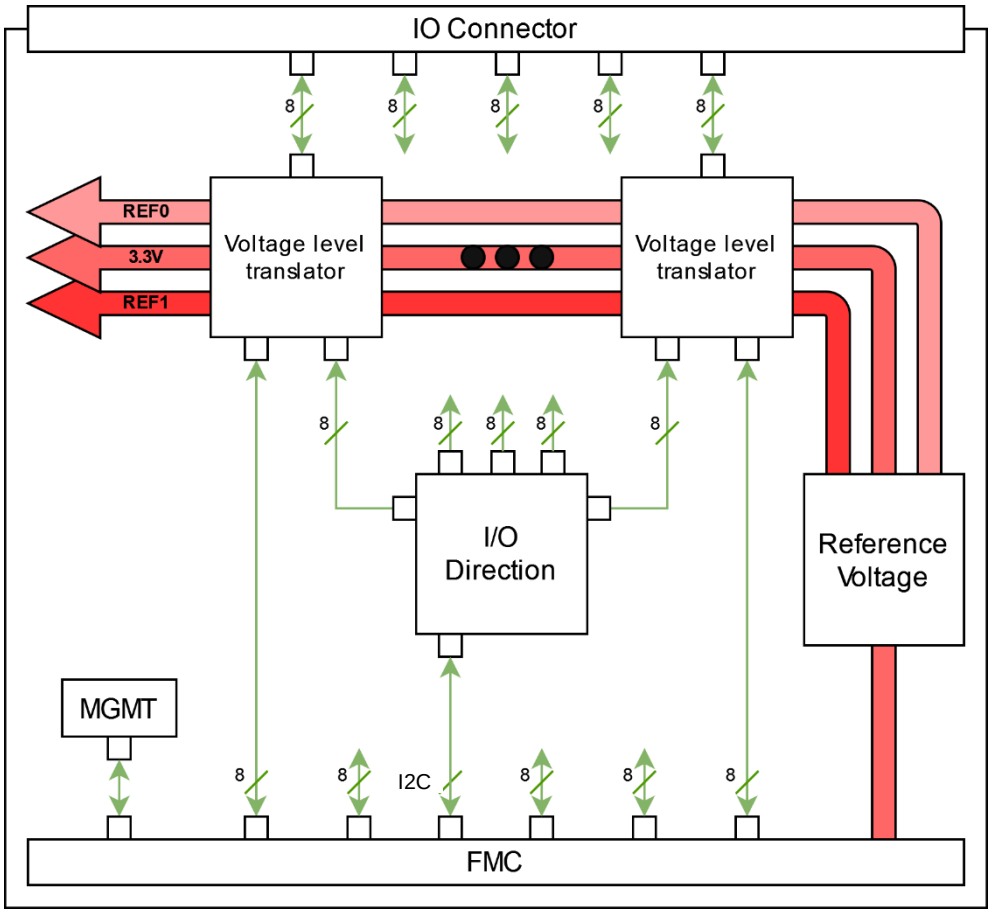
Main FPGA module – Xilinx ZCU106

- Zynq UltraScale+™ MPSoC is equipped with a quad-core Arm® Cortex®-A53 applications processor, and 16nm FinFET+ programmable logic
- 2x FPGA mezzanine card (FMC) interfaces for I/O expansion



FMC GPIO – specification

- FPGA mezzanine card (FMC) compliant
- 8 GPIO single-ended and 2 power connections for every board (40 GPIOs in total)
- Each GPIO leads signals
  - up to 50MHz
  - terminated on external boards
    - Thevenin termination on receiver
    - Series termination on transmitter
  - buffered with voltage translators:
    - with configurable amplitude (3.3V, 1.8V, 1.2V)
    - with configurable direction and Hi-Z state via I2C expanders (controlled by Zynq ARM or programmable logic)
- Board is powered from ZCU106 (12V, 3.3V, 3.3V AUX, VADJ)
- 1.2V and 1.8V produced by on-board DC/DC converters



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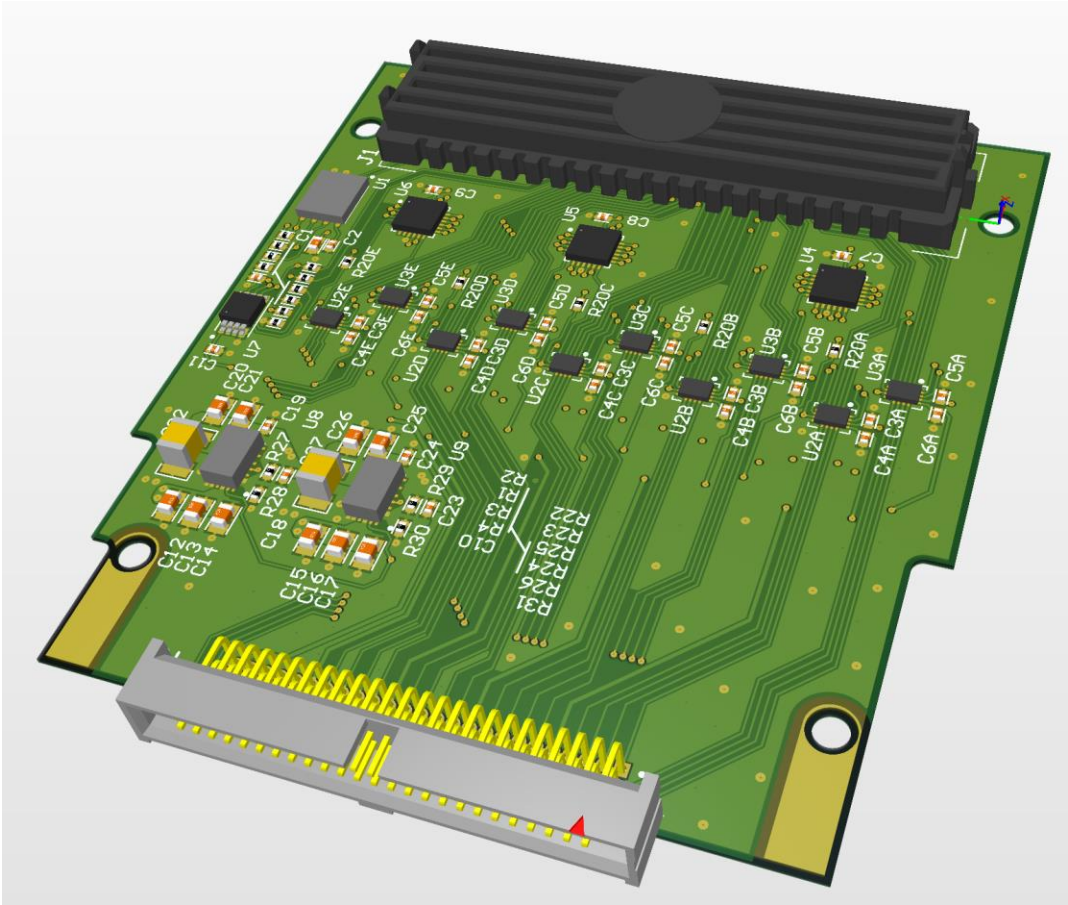
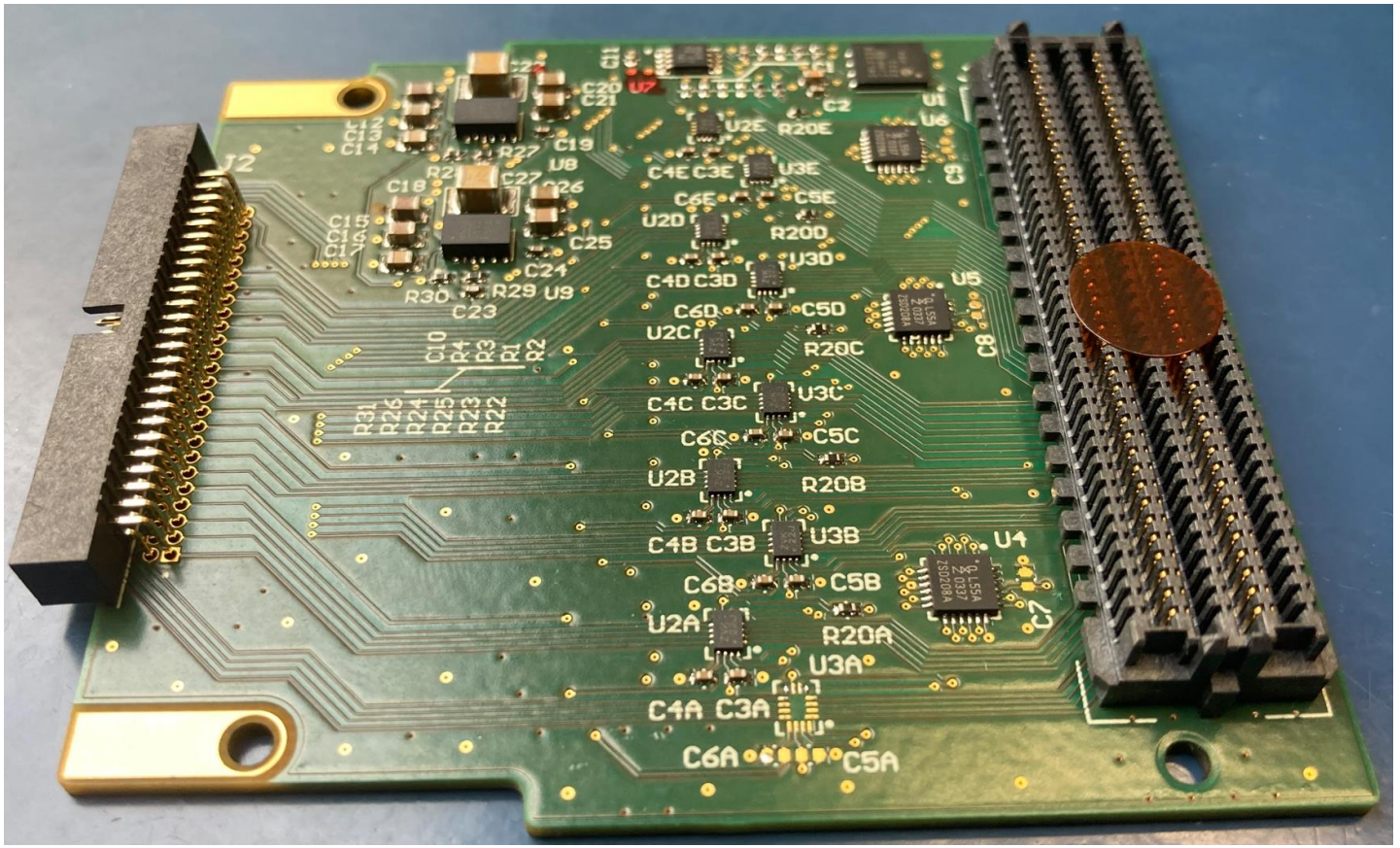


FMC-GPIO – assemebly



FMC GPIO – tests (loopback test)

FMC GPIO – tests (summary)

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- Board is powered from ZCU106 (12V, 3.3V, 3.3V AUX, VADJ)
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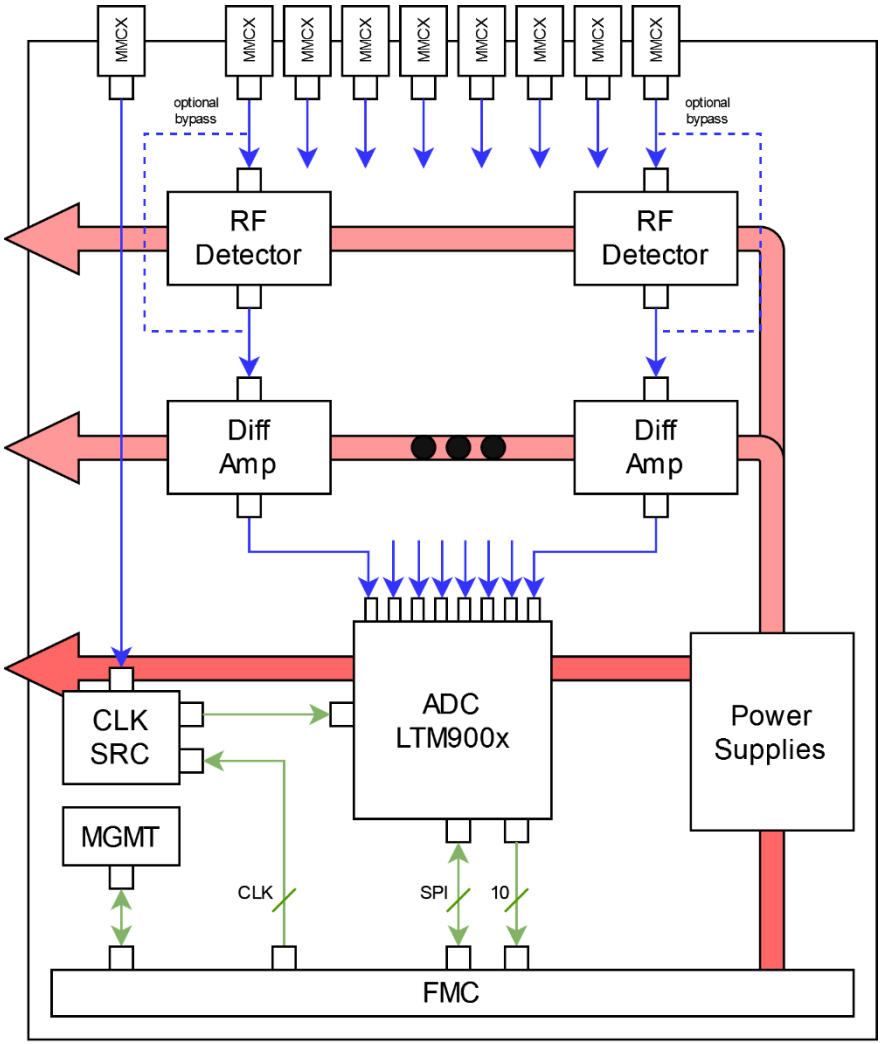
FMC ADC – specification (digital part)

- FPGA mezzanine card (FMC) compliant
- On-board ADC communication LTM9006-14 (8 channels, 14-bit, 25MS/s):
  - control SPI interface via FMC connector
  - 8x data channels
- Clock signal for on-board ADC:
  - produced by FPGA via FMC connector
  - generated by on-board 125MHz oscillator
  - generated externally via MMCX connector
- Board powered from ZCU106 (12V, 3.3V, 3.3V AUX, VADJ)
- 1.8V and 3.0V and V_BIAS produced by on-board DC/DC converters



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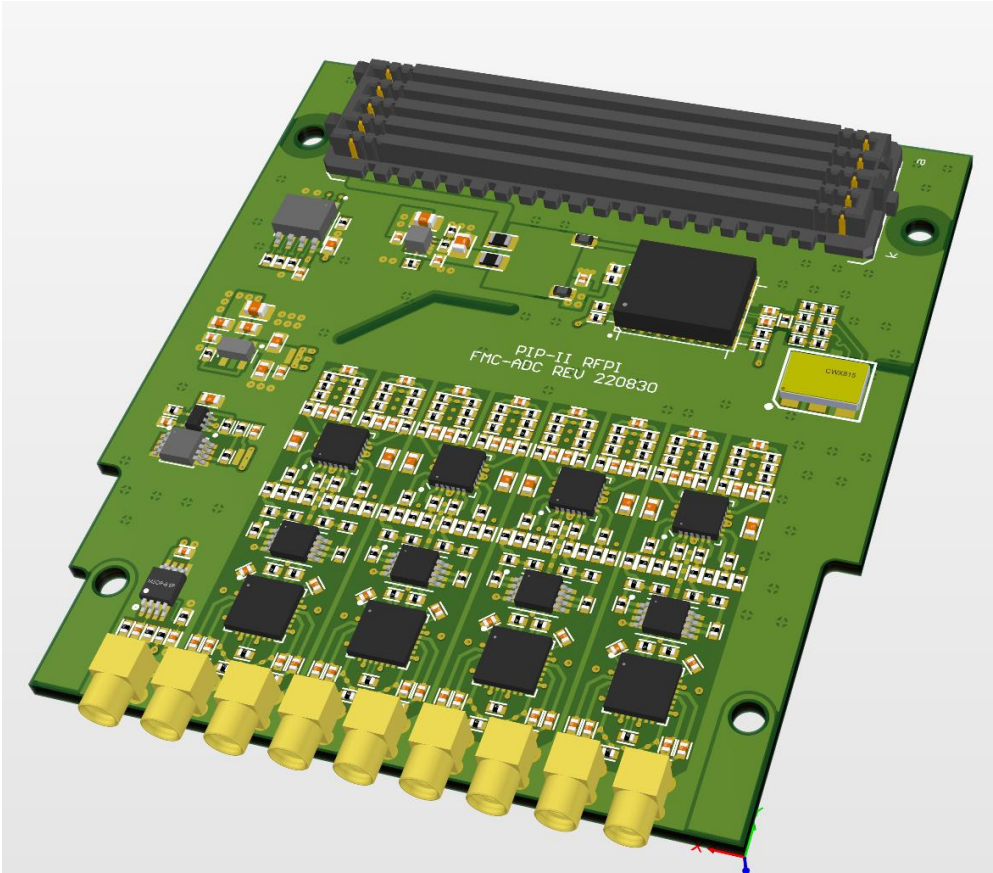

FMC-ADC – tests (digital part)

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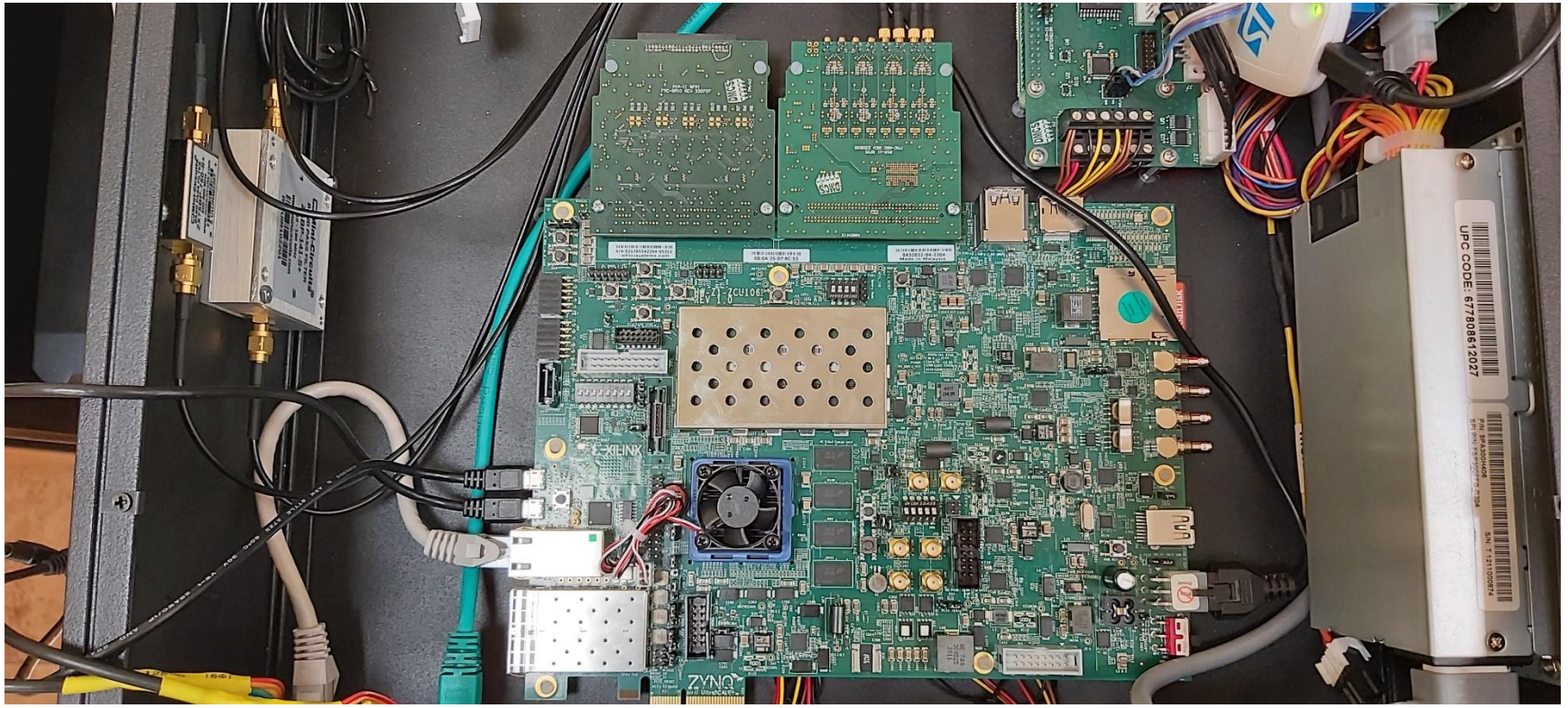
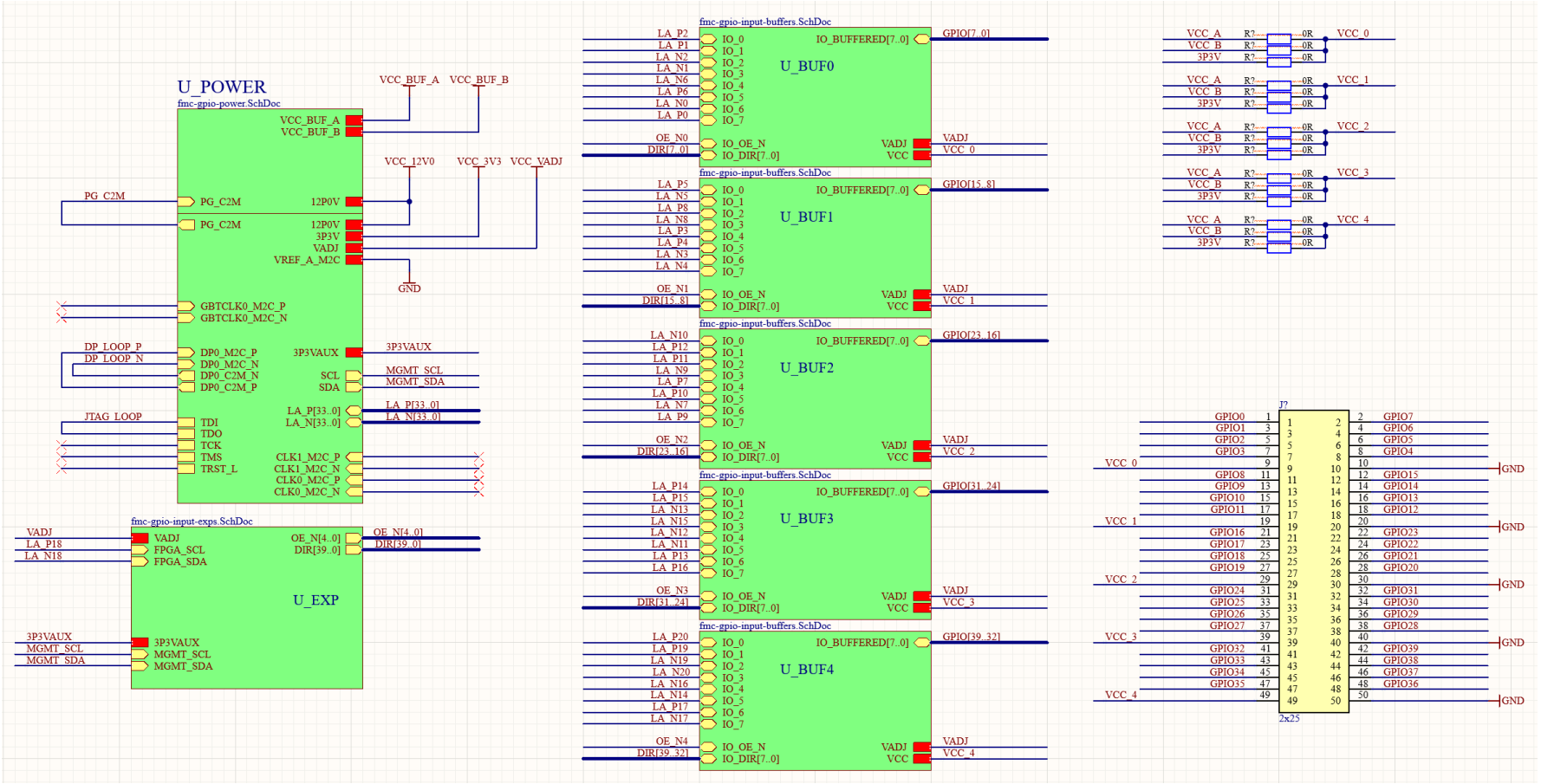
Main logic components assembly



Thank you for your attention!

FMC GPIO – schematic



FMC ADC – schematic