LArPix Readout Box

ArgonCube Collaboration Meeting

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FOR FUNDAMENTAL PHYSICS

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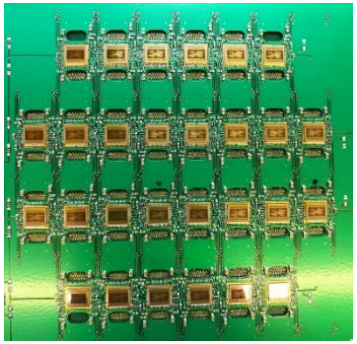
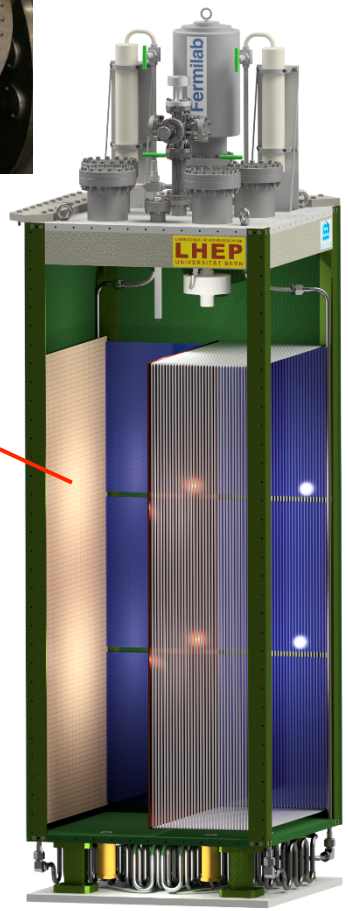
1 Readout Box per Module





Pixel Plane

- 2 readout areas: 60cm * 120cm
- Read out with LArPix
- Pixel pitch: 3mm

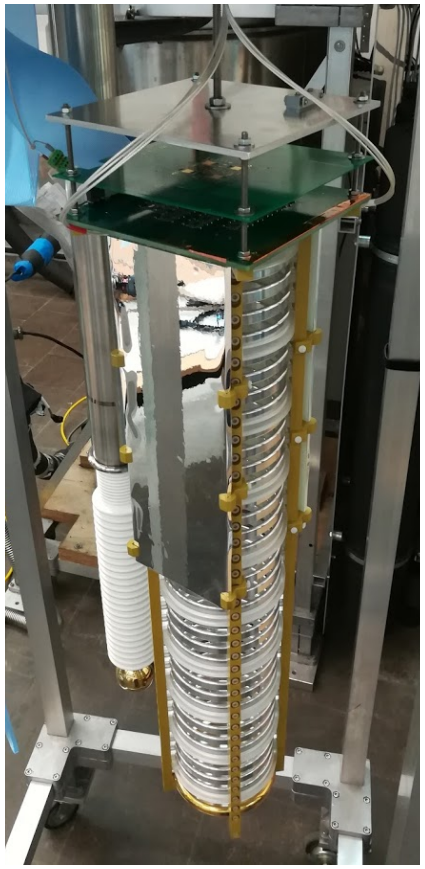
- 1 pixel board:
  - 80’000 pixels
  - 32 pixel/chip -> 2500 chips
  - 100 chips/line -> 25 lines

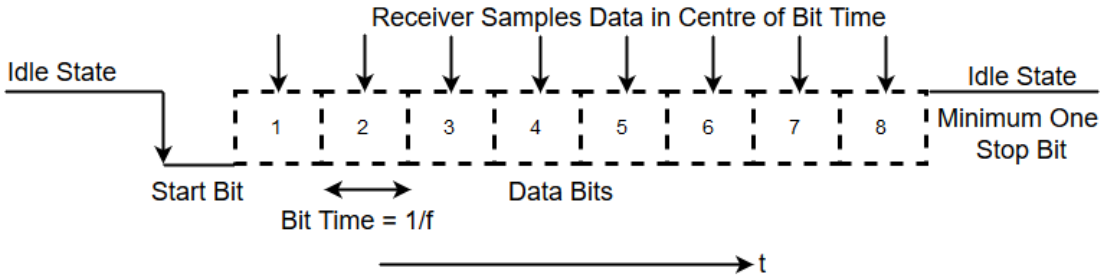
- 1 module: **160’000 pixel**

  5’000 chips

  50 lines

LArPix

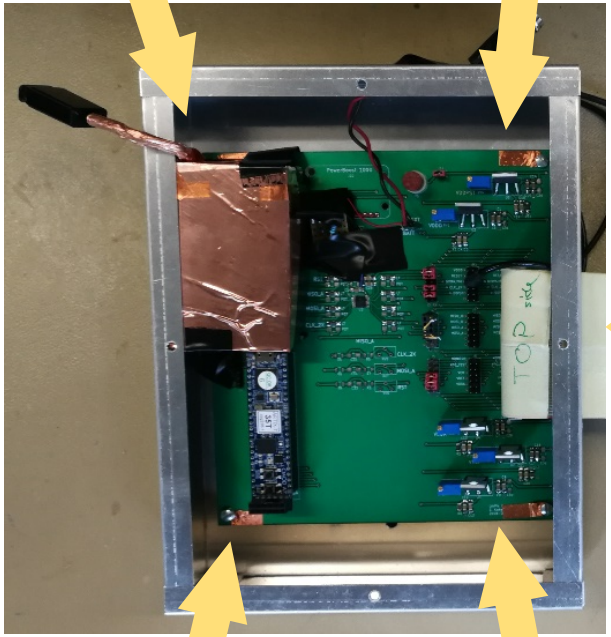




UART-like communication with a 54 bit data word

300Hz	54 bit, 16 chips, 60cm drift
~10Hz	54 bit, 1 chips, 30cm drift
1 chip	540 bit/s
5000 chip	2,7 Mbit/s

Prototype 1 (Setup of the last run)



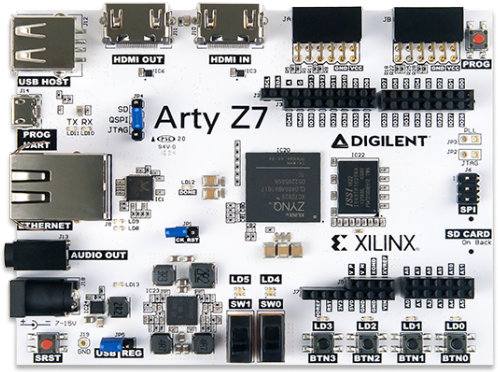
What we need

- LArPix:
  - Power (analog & digital)
  - Analog lines to set the ADC range
  - Digital data lines
- FPGA to convert (ser/des) the data
- Communication to the data server
- Memory to store the firmware

- Scalable system to deal with the huge amount of pixels/lines

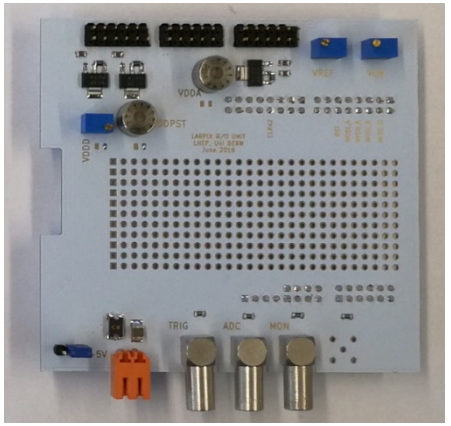
Prototype 2

Arty Z7



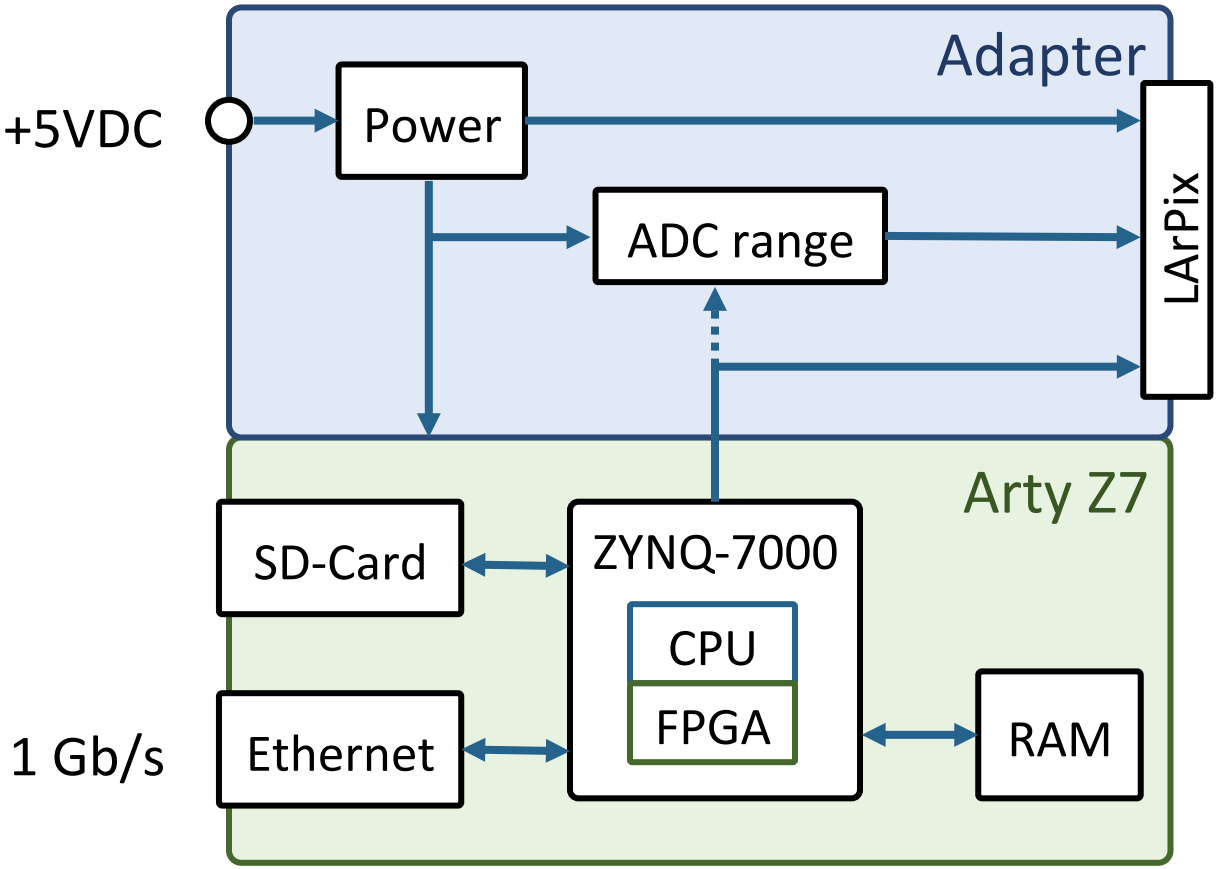
- ZYNQ-7000
  - FPGA
  - Dual ARM Cortex A9
- Ethernet (1Gps)
- microSD slot

Adapter

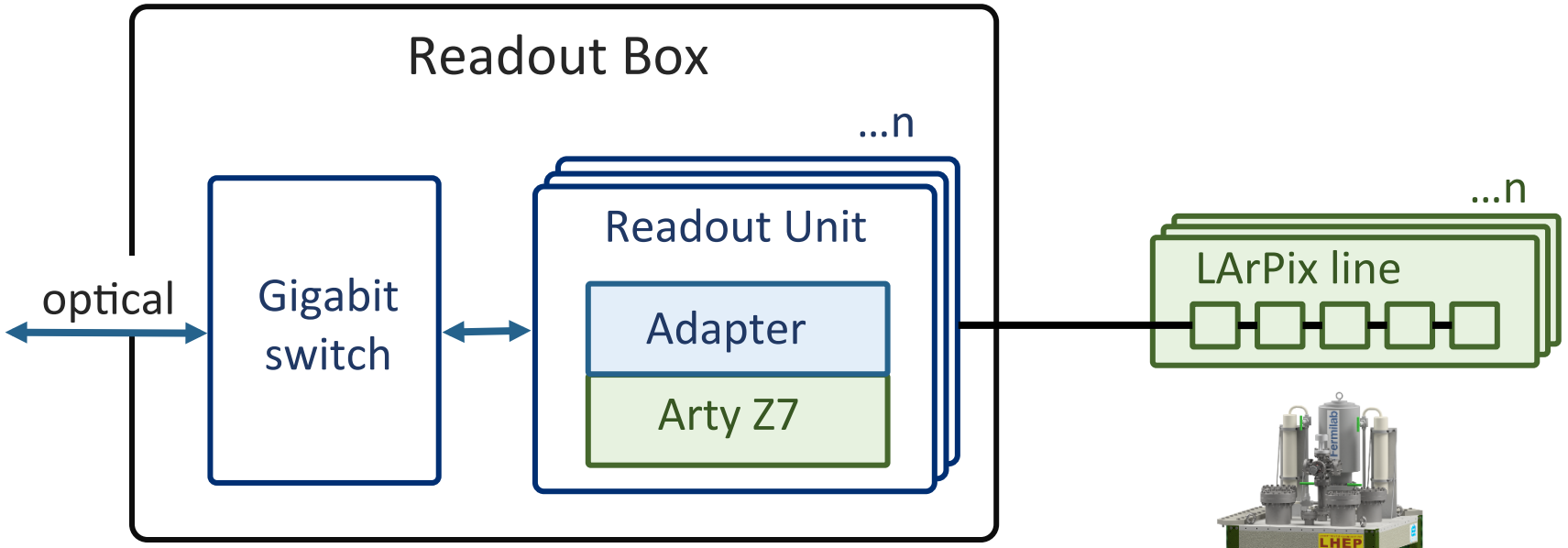


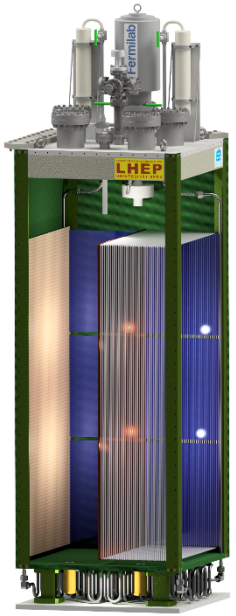
- Power
- Analog lines
- Digital data lines (2 daisy chains)

Prototype 2 - Readout Unit



Prototype 2 - Readout Box





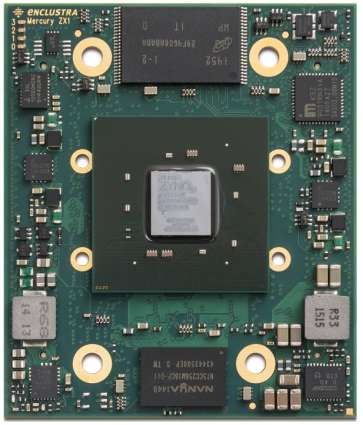
Open Questions:

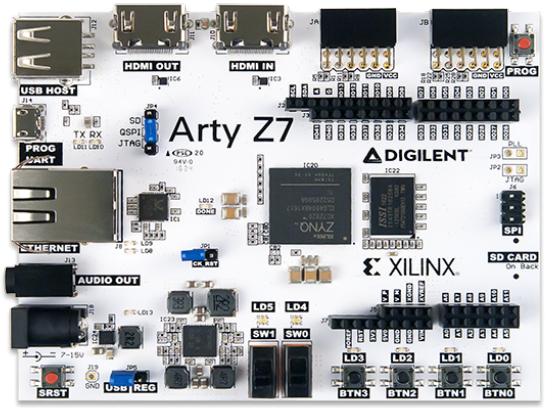
- Number of chips/line?
- Number of lines/unit? < 2
- Number of units/box?

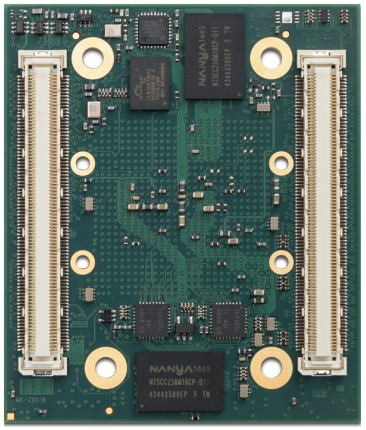
Possibilities

Example of available FPGA boards which could be used.

- Arty Z7 ~ CHF 200
  - (XC7Z020-1CLG400C ~ CHF 110)
- Enclustra Mercury ZX1 ~ CHF 500
  - (XC7Z030-2FBG676I ~ CHF 350)
- Design a specific one?







To be defined

- Modularity, how many Readout Units/Box
- What FPGA board do we use in the final version
- Mechanical design
  - size and shape of Readout Box
  - where to place it (cryostat or rack)

Next steps

- Test the Prototype 2 Readout Unit with the LArPix in warm
- Test the Prototype 2 Readout Box with 1 or 2 Readout Units in the first ArgonCube 2x2 module hardware test
- Test a full Prototype 2 Readout Box with the first fully equipped ArgonCube 2x2 module

Conclusion

- We have first numbers, however precise data rate, number of pixels, chips, and daisy chain lines need to be defined.
- We have a useful base to develop a modular and scalable system.
- After the first test of the Prototype 2 with the ArgonCube 2x2 module we will make further decisions.

Questions ?