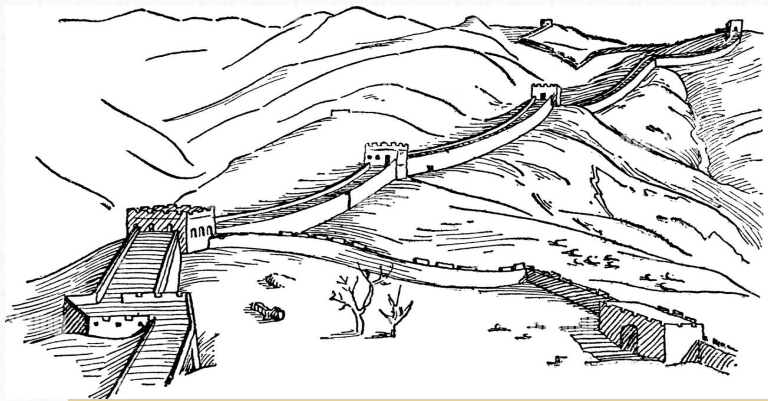


From ArriaV GX to Cyclone10
GX FPGA device -
Update on firmware porting

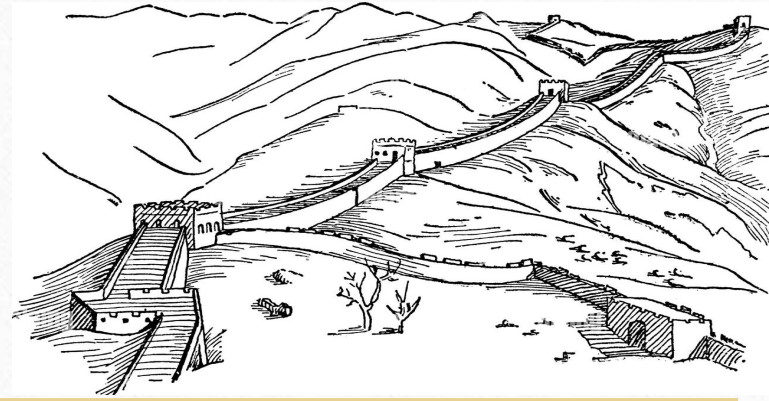
Ilaria Neri

UNIVERSITY OF FERRARA AND INFN

6th November 2023



Outline



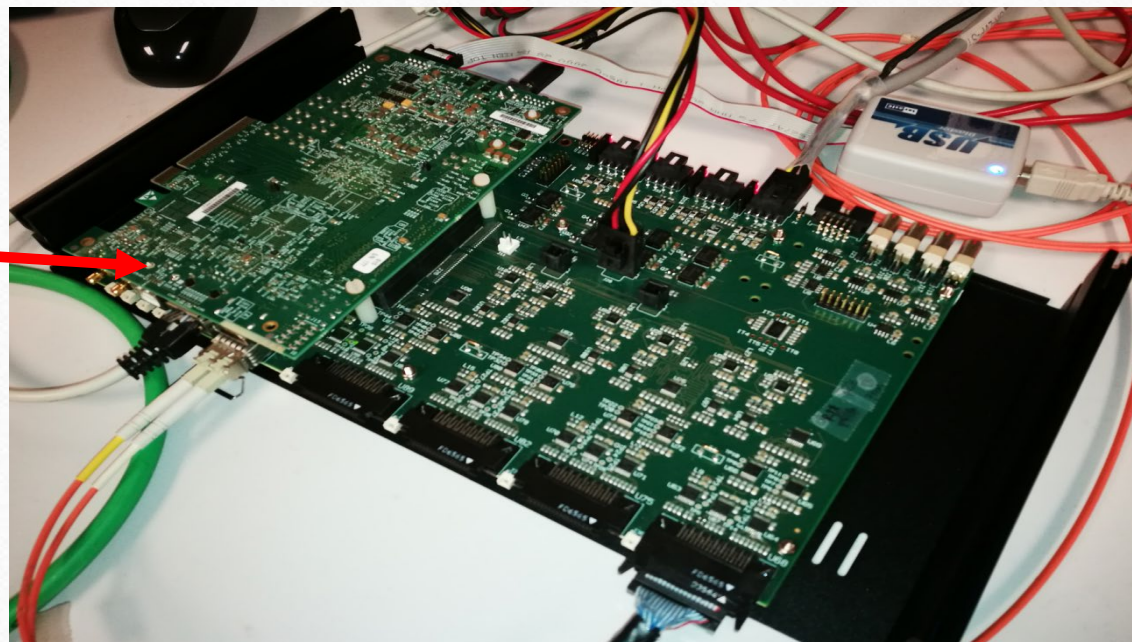
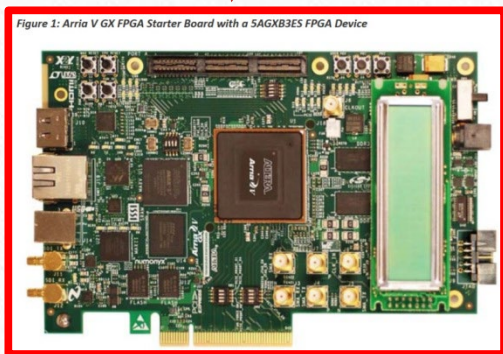
- Aim: replacement of the Intel/ALTERA ArriaV GX dev. kit of the GEMROC module since its production discontinued in 2020.
- Cyclone10 GX220 FPGA as candidate
- Current status of firmware porting



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GEMROC: Off-detector readout card for BES-III CGEM-IT detector
GEMROC = GEMROC_InterFace Card (A.C.R.) + ArriaV GX development kit
(DK-START-5AGXB3N) (development kit production discontinued in 2020)



GEMROC module dimensions: 334mm x 176mm x 44mm

Candidates for the replacement of the ARRIAV GX dev. kit

1) Cyclone 10 GX dev. kit Trenz TEI0006-03-220-5I:

- onboard FPGA: 10CX220YF780I5G; year launched: 2017; TSMC's 20nm technology
- Status: active; cost: 498.00€ (current, Trenz)
- accessory carrier board Trenz TEIB0006-02 cost: 179,00€ (current, Trenz)

Same FPGA module

2) Cyclone 10 GX dev. kit Intel DK-DEV-10CX220-A:

- onboard FPGA: 10CX220YF780E5G; year launched: 2017; TSMC's 20nm technology
- Status: active; cost: 1.074,12€ (current, Digikey)



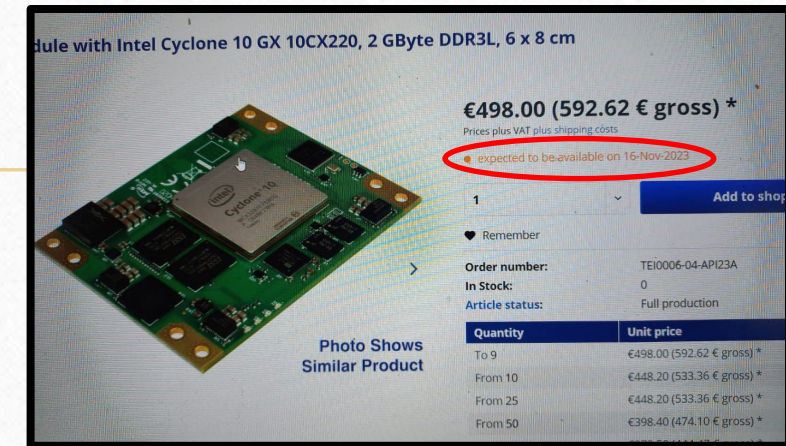
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Trenz dev. kit TEI0006-04-API23A with Cyclone10 GX-10CX220 FPGA

1)

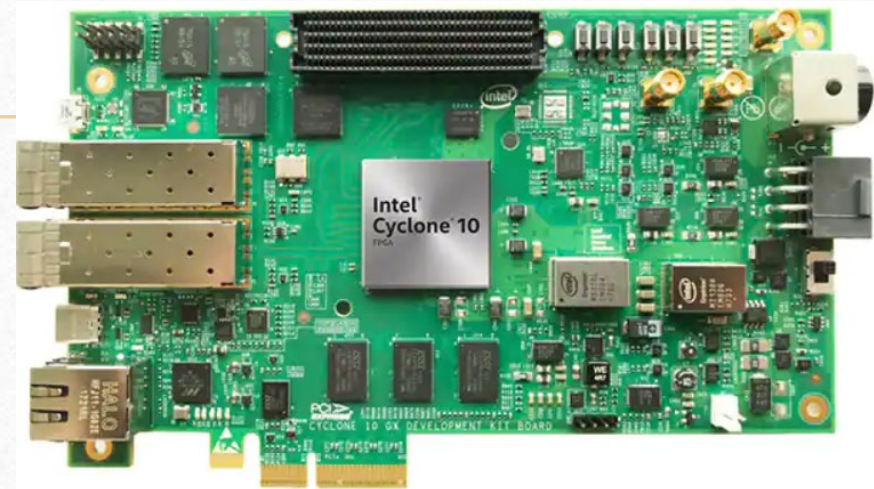
- A carrier board is needed to provide expansion ports (Ethernet, SFP, FMC) to the Cyclone 10GX FPGA
- a dedicated adapter to the GEMROC module would have to be designed.
- but.. its availability is always being shifted at least since July 2023!



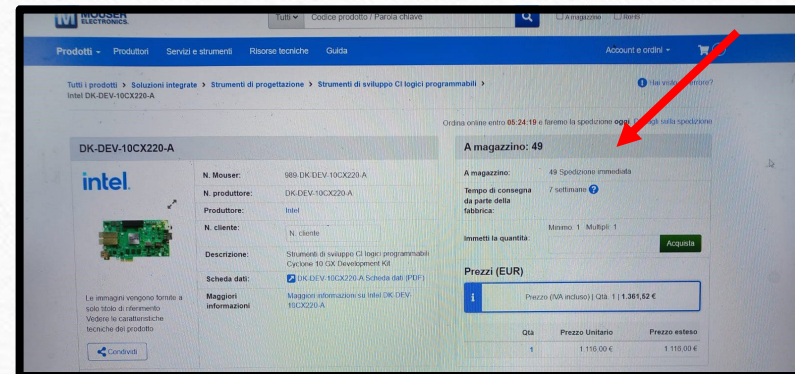
Cyclone10 GX dev. kit Intel DK-DEV-10CX220-A

2)

- Currently available: a dev. kit has been bought and I am using it for tests.
- Since the footprint is not compatible, a dedicated adapter to the GEMROC module would have to be designed.

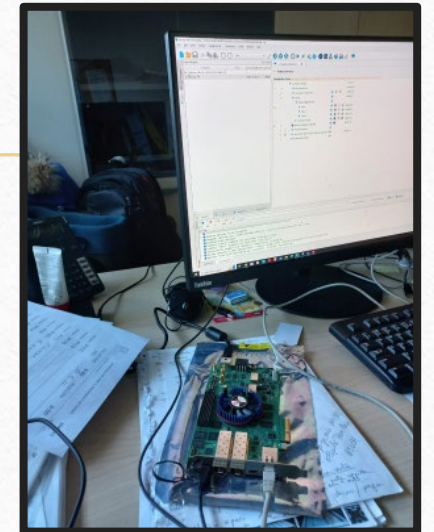


FPGA device: 10CX220YF780E5G



Current status – Cyclone10 GX FPGA firmware porting

- Porting of GEMROC firmware onto this platform is in progress:
 - From Standard version to Quartus Prime Pro 23.2 migration was done.
 - The upgrade of all instantiated Intel/ALTERA IP blocks was done.
 - A QSys - Platform designer- project has been realized.
 - Full compilation to get an output top.sof file has been done.
 - Ethernet Port interface (Fast and Slow control Ports) quite completed and to be tested.
 - A Europractice licence has been purchased for Triple Speed Ethernet IP, for an unlimited time of use. Estimated time of arrival – 1 month
- Software for Cyclone10 GX FPGA dev. under development.



Cyclone10 GX dev. kit as GEMROC BES-III FC system FANOUT (FCF)

- Usage of Cyclone10 GX FPGA module in the GEMROC System Fanout instead of currently used ArriaV GX boards. This would allow to have more spare ArriaVGx boards in short times.
- A QSys - Platform designer- project has been realized to include the NiosII processor and its peripherals for the slow control port.
- Ethernet interface slow control Port quite completed and to be tested.
- Main trigger functions to be implemented (signal reception from BESIII Fast Control System and their distribution to FCS local fanout).
- Software code for reception/transmission command under development.

Estimation completion date: January 2024.

