

ALCOR - dRICH Readout

Fabio Cossio on behalf of the ALCOR group
INFN Torino

EPIC Electronics & DAQ WG meeting
eRD109 Monthly Progress Reports

07.11.2024

ALCOR submissions plan

ALCOR is designed in UMC 110 nm CMOS technology (submission to IMEC)

ALCOR is part of INFN in-kind contribution

ALCORv3 MPW was planned for 25th Nov

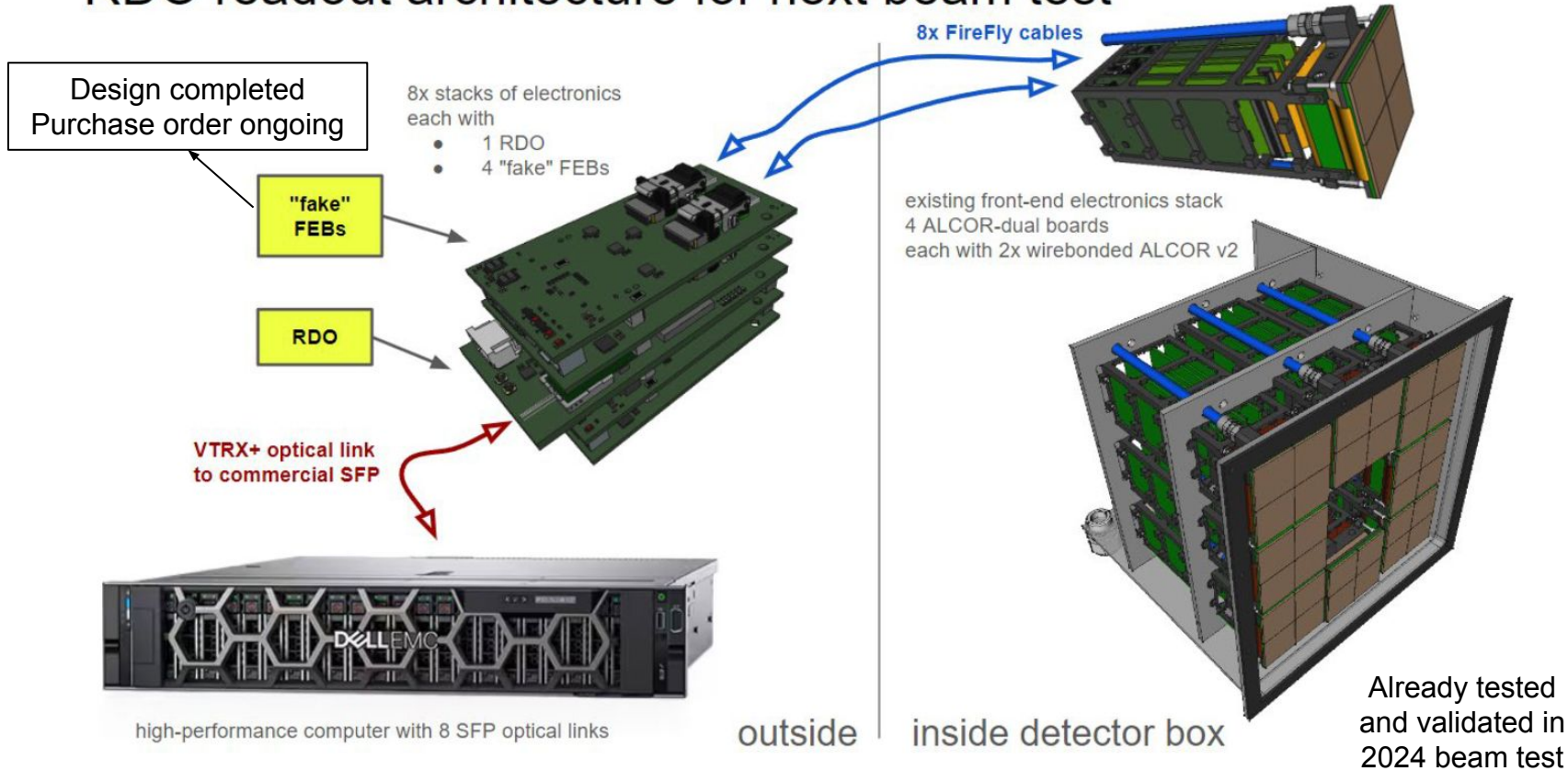
2024: **run canceled by UMC**

Preliminary MPW 2025 schedule: **31st March**

- Rescheduling activities for 2025
- Milestones for 2025 likely to have some delay

2024															
MPW	€ MPW	mini@sic	€ mini@sic												
UMC MPW	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
UMC 28N Logic/Mixed-Mode – HPC		19		22		22	26	30	28						
UMC 40N Logic/Mixed-Mode – LP			11			24	29	26			18				
UMC 65N Logic/Mixed-Mode/RF – LL	2	26							2	21					
UMC L110AE Logic/Mixed-Mode/RF		26				3			2		25				
UMC L180 Logic GII, Mixed-Mode/RF			4					26							

RDO readout architecture for next beam test



This setup will allow us to test the RDO without having to wait for the new ALCORv3

ALCOR recent activities and next steps

New **ALCOR data frames** structure to match **EIC orbit period** ($T = 12.7886 \mu\text{s}$)

- Three levels of reset:
 - *HardReset*: initialize everything
 - *StartOfRun* command: reset Coarse Counter, **reset Frame Counter**, start a new Frame
 - *NewOrbit* command: reset Coarse Counter, **increment Frame Counter**, start a new Frame
 - Frame Counter = EIC orbit counter
- Pixel source code and simulations done, EoC readout source code done, reset FSM under development, physical implementation to be done: new pins between Pixel and EoC, new synthesis and PNR constraints

TMR

- ALCOR previous versions had TMR only for pixels registers (and with auto-correction bug)
- All configuration registers (pixel and periphery) have now been re-implemented using the CERN tmrg tool

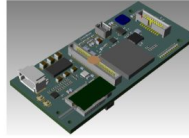
New **irradiation test** campaign at Trento Proton Therapy Centre scheduled for Dec 2024

- SEU, SEL and TID with ALCOR v2.1 and improved setup

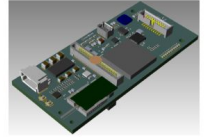
RDO recent activities and next steps

See D. Falchieri presentation from yesterday dRICH general meeting:

https://indico.bnl.gov/event/25481/contributions/99023/attachments/58363/100230/dRICH_RDO_06Nov2024.pdf



Status of the design and conclusions



- the schematic design of **dRICH RDO** is finished:
 - now performing the final checks
- the desired placement is ready
- the PCB layout is going to start soon
- we plan to have the first prototypes ready beginning 2025 and to do extensive debug
- we are working on the firmware in the meanwhile

Preparation for **irradiation test** campaign at Trento Proton Therapy Centre (Dec 2024)

- RDO not available
- Test of several components, more details on P. Antonioli slides from last month report:
<https://indico.bnl.gov/event/24972/contributions/97201/attachments/57716/99114/20241003-eRD109-dRICH-RDO.pdf>

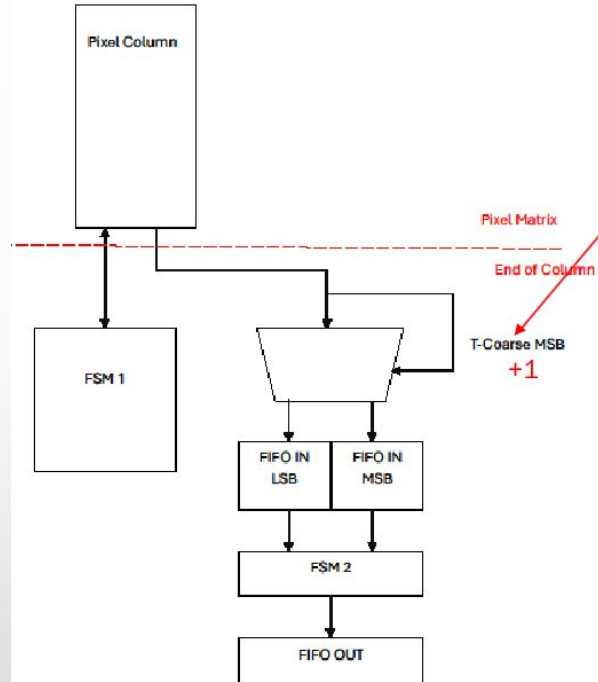
Milestones

- ❑ Readiness at 75% of the final design of ALCOR v3 by September 2024
 - MPW run canceled by UMC, next will be 31st Mar 2025 (preliminary 2025 MPW schedule)
 - Top level integration and verification ongoing
 - New ALCOR data frames structure to match EIC orbit period
 - ALCOR v3 will be ready for tapeout by the end of 2024

- ❑ Completion of irradiation tests on ALCOR v2 and evaluation of SEU cross-section by July 2024
 - Good radiation tolerance for dRICH requirements (results presented at the October eRD109 Monthly Progress Report): no effects from TID up to 200-300 krad, MTBF due to SEU more than adequate for dRICH operations

Backup Slides

Changes



- Pixel:
 - Added one extra bit to the Course Counter
 - Start: reset coarse, reset MSB
 - NewFrame or Coarse Overflow: reset coarse, toggle MSB
- EoC:
- Read LSB FIFO until frame rollover or Start or NewFrame
Wait for FIFO LSB not Empty and timeout
- Write Status Header / Status /CRC / Trailer
- If Start:
 - Read LSB FIFO again
- If NewFrame or Rollover
 - Read next FIFO (toggles between LSB and MSB)