Status of design and development of CEPC-DHCAL readout electronics

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Introduction

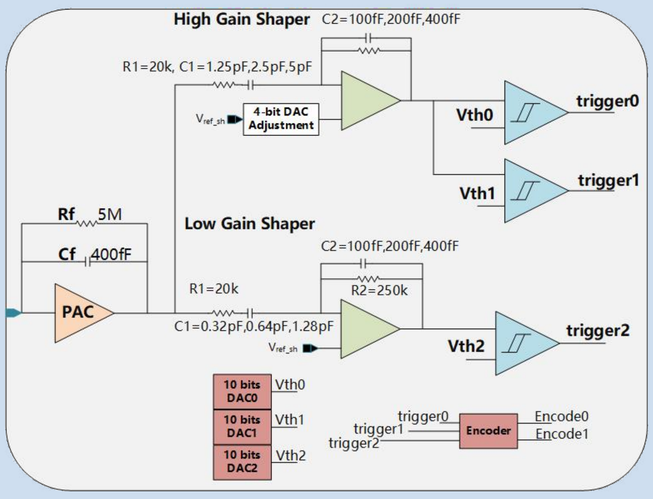
- The goal of this research is to provide a feasible readout scheme for CEPC DHCAl.
- As the active detector element of sampling calorimeter has finely segmented readout pads of $1 \times 1cm^2$, it's a real challenge to access huge mount data from calorimeter.
- In our research, a double layer GEM using self-stretching technique has been used. It consists of 3mm drift gap, 1mm transfer gap and 1mm induction gap and the effective area is $30 \times 30cm^2$with $1 \times 1cm^2$ readout pads.
- The chip choosen to readout is a tri-thresholds ASIC called MICROROC (MICRO-mesh gaseous structure Read-Out Chip)

MICROROC ASIC

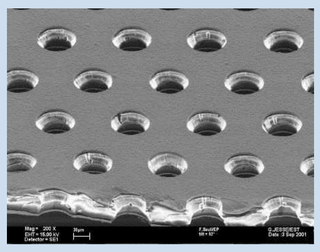
MICROROC is a 64-channel Semi-Digital readout chip, developed at IN2P3 by OMEGA/LAL. The package of MICROROC chip is TQFP which means the thickness is about 1.4mm. Each channel of the MICROROC chip has:

- A very low noise charge preamplifier, able to handle a dynamic range from 1 fC to 500fC
- Two different adjustable shaper. A high gain shaper for small signal and a low gain shaper for large signal
- Three comparators for tri-thresholds readout
- A random access memory used as a digital buffer

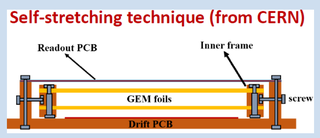
The structure of the analog part is shown below:



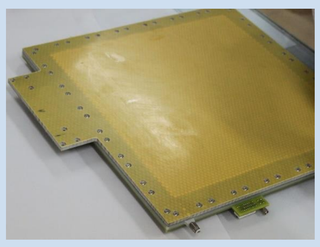
GEM Detector

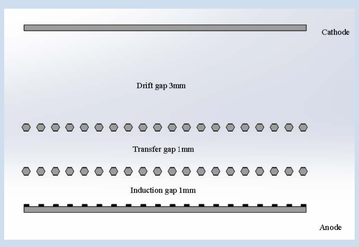


1. Cu:t = 5μm
2. Kapton:T = 50μm
3. Diameter: d = 60μm
4. D = 80μm
5. pitch: 140μm



1. Assembling process is easy and fast
2. No dead area inside the active area
3. Uniform gas flow
4. Detachable



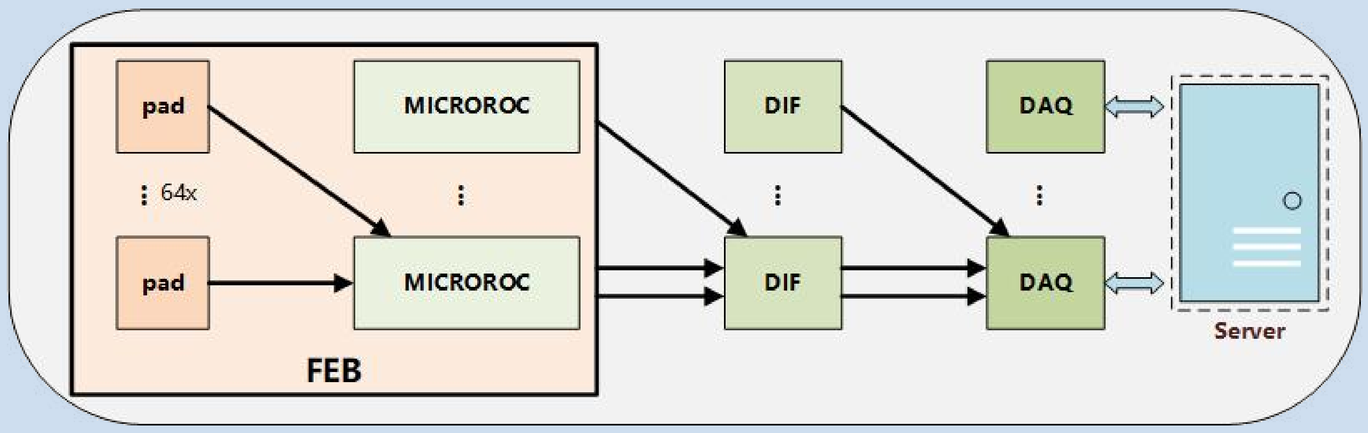


Readout System Structure

The readout system is developed on SRS(Scalable Readout System), which means users can reuse the same system just changing the front-end board.The whole system includes flowing parts:

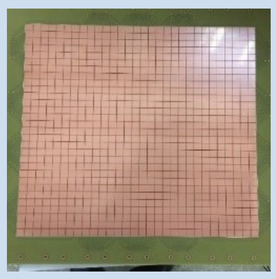
- FEB(Front-End Board):Combination of detector and readout ASIC
- DIF(Detector InterFace):Control the ASIC and read back data
- DAQ:Distribute clock and command. Gather data from DIF

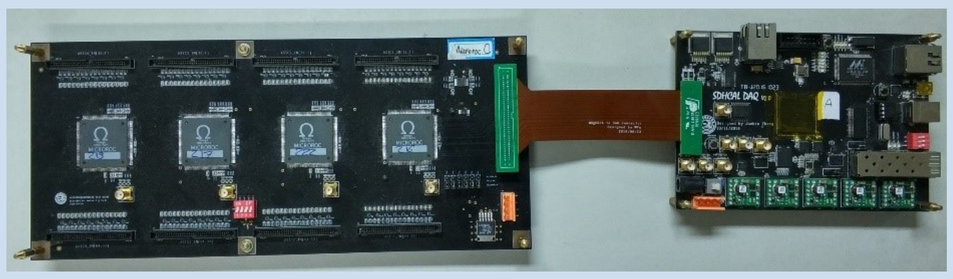
The system structure of the hole system is shown below



Phase I Design and Test

A "Phase I" design is completed to verify the readout structure and test the performance of MICROROC. The front-end ASIC is separated from the detector plane. The system shown below contains the GEM detector, FEB and DIF.





Next Step

Conclusion

Total Conclusion

- d
- c
- b
- a

- d
- c
- b
- a

Acknowledgements

This study was supported by National Key Programme for S&T Research and Development (Grant NO.: 2016YFA0400400). Thanks to Stéphane CALLIER and Christophe de LA TAILLE at OMEGA - IN2P3/CNRS for helpful discussions and useful suggestions