# The dual-readout calorimeter module R&D using innovative 3D metal printing for future e+e- colliders

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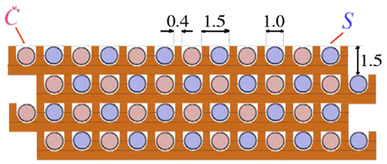
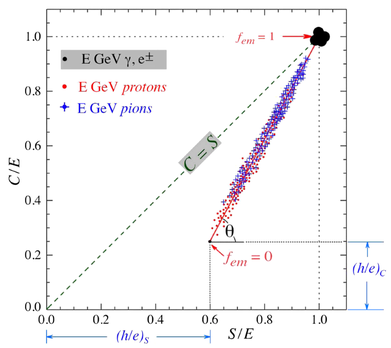
DREAM FOR FUTURE

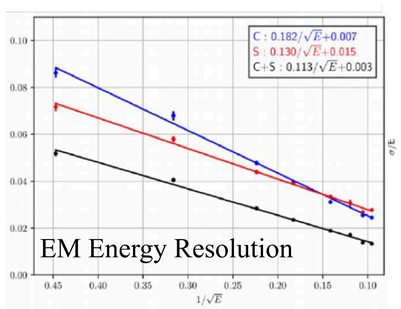
## Dual-Readout Calorimeter (DRC)

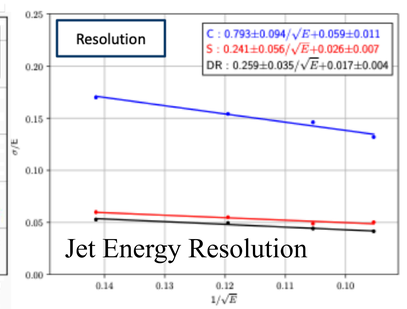



*Fiber pattern RD52*

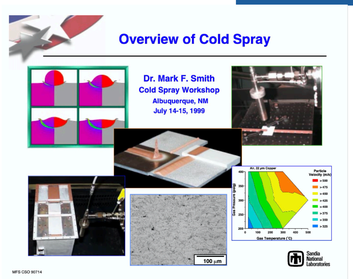


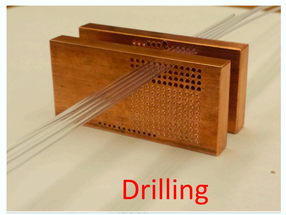

- DRC offers high-quality energy measurement for both EM particles and hadrons
- DRC consists of two different optical fibers (S, C) in a single component
- EM shower components of hadron showers (fem) can be determined using the measured values of S and C signals
- Excellent hadron energy resolution can be achieved by correcting the energy of hadron event-by-event
- DRC has been proposed in IDEA detector conceptual design report (CDR) for both CEPC and FCC-ee projects

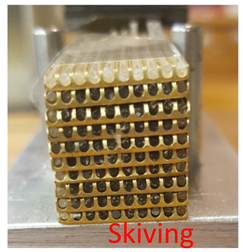


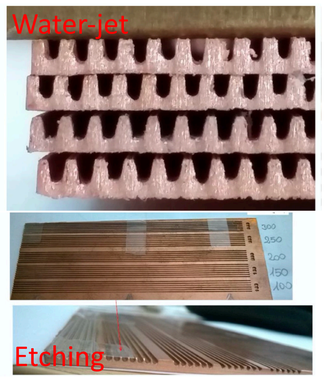




## Copper Forming

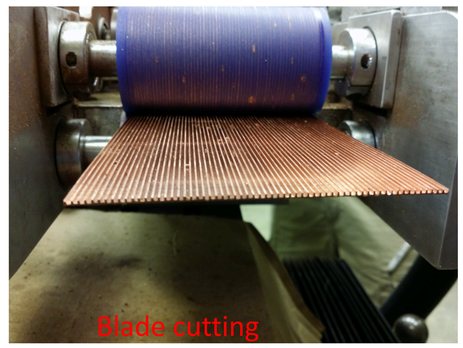


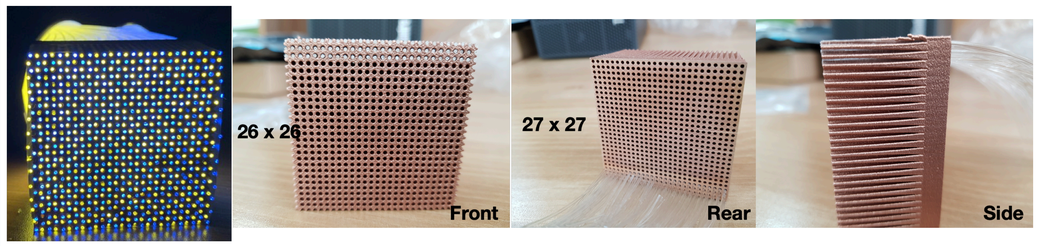



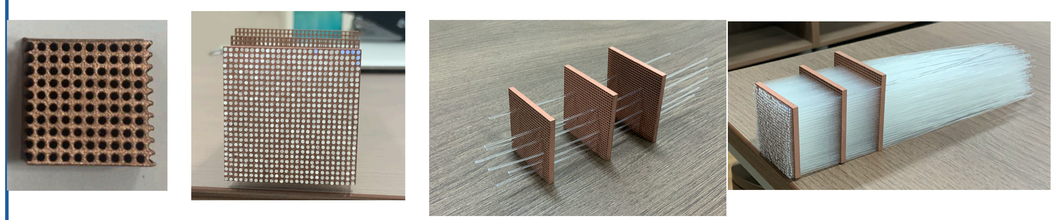

- Former DRC modules were produced using the blade cutting




## Innovative 3D Metal Printing

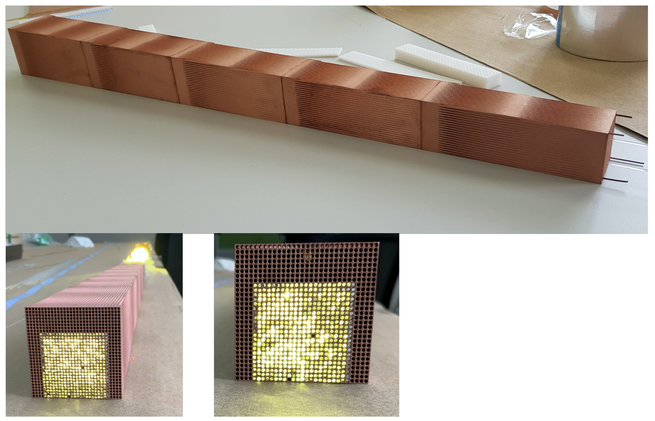
- Two major questions on the DRC for engineering aspects: complex design and projective shape
- Innovative 3D metal printing technology can be a solution
- Collaborate 3D printing consultant company in Korea with world-wide networking
- Successful precision achieved after many trials



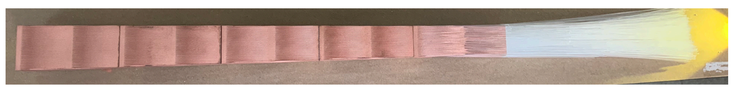



## First Projective DRC Module

- First projective DRC module in history



- Initial assembly to insert optical fibers was quite successful
- Copper forming is now possible with sufficient precision and flexibility for engineering aspects
- Prototype module is under assembly with fibers, PMTs and electronics for the experimental test



## Summary

- Dual-readout calorimeter has been proposed in IDEA detector for both CEPC and FCC-ee projects
  - It's R&D is quite active in Korea with world-wide international collaboration team
- Innovative 3D metal printing technology has been tested
  - Copper forming for complex and projective module shape is successfully achieved
  - Prototype module design and production are underway