

# **SNU application for membership in ePIC**

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**2025 / 01 / 23**

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**Inseok Yoon (Seoul National University)**

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**ePIC Collaboration Council @ Monte Porzio Catone (RM)**

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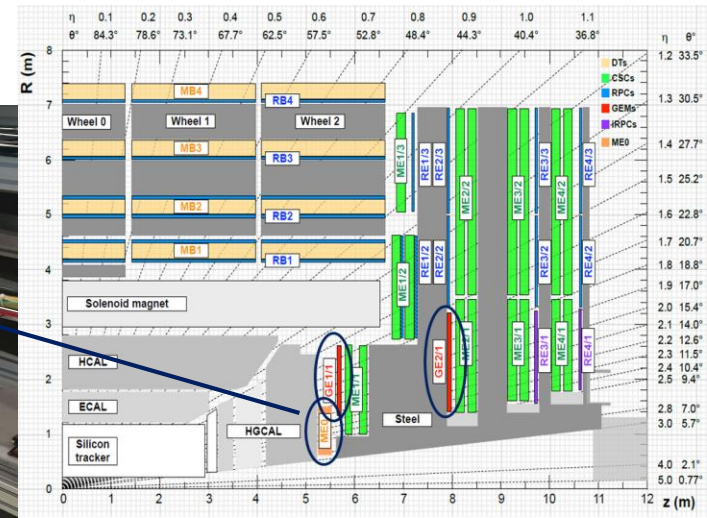
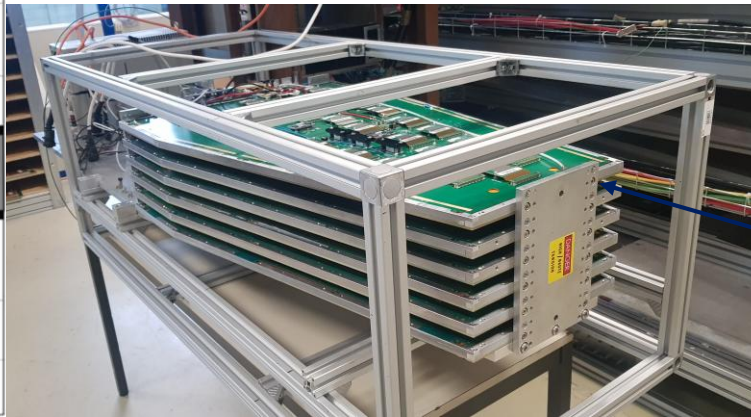
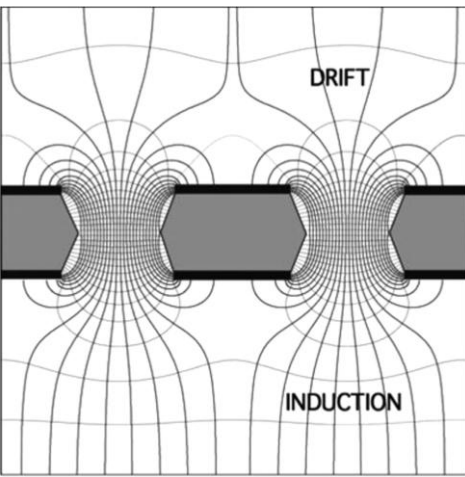
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- Expertise of SNU on MPGD production
  - GEM foils production for CMS Phase-2 upgrades
- Contribution plan toward GEM +  $\mu$ RWELL ECT
  - $\mu$ RWELL R&D status
  - Budget status
- Person power

# 1. Expertise of SNU on MPGD Production

- CMS phase-2 upgrades
  - Three GEM stations: GE1/1, GE2/1 & ME0
  - Too many GEM foils for CERN micro pattern workshop (MPT) produce alone
    - Korea CMS group (KCMS): production of half of GE2/1 and ME0 foils ~ 1100 foils
- As a member of KCMS, SNU is leading R&D for GEM foil production & aging and mass production

NIMA 805 (2016) 2–24



# 1. Expertise of SNU on MPGD Production

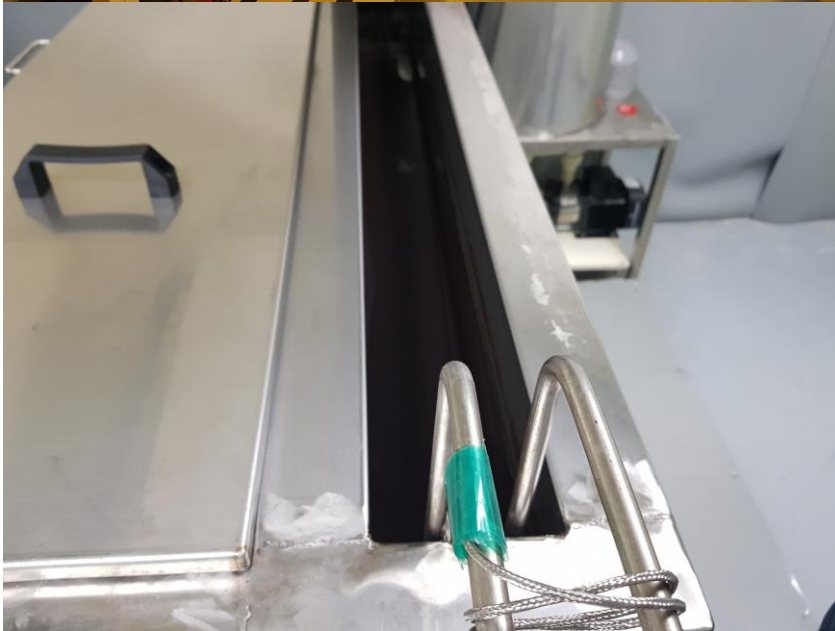
- Along with KCMS technicians, I developed the GEM foil production process and validated the produced GEM foils
  - 2023 JINST **18** C06010
  - NIMA 1057 (2023) 168723
  - Green light from CMS
- Currently, mass production of ME0 is ongoing smoothly
  - It is expected to be completed by the end of this year
- Maximum size:  $120 \times 58 \text{ cm}^2$   
Double-mask technique & glass mask



# 1. Expertise of SNU on MPGD Production

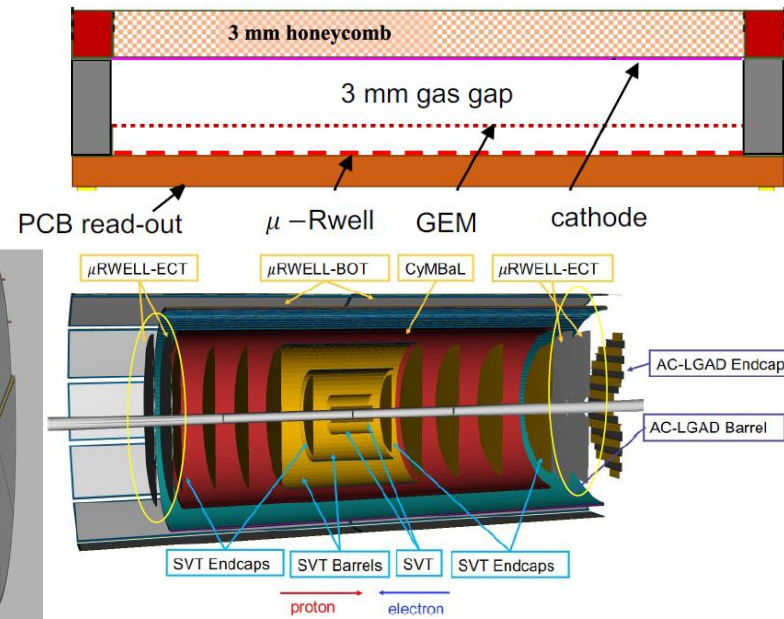
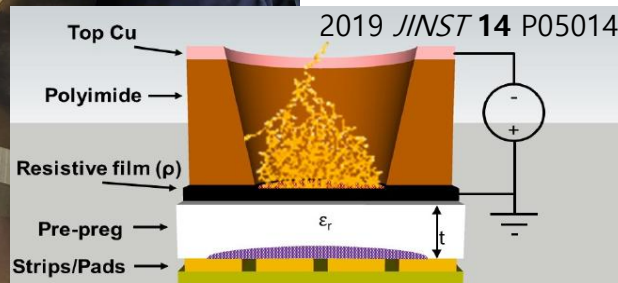
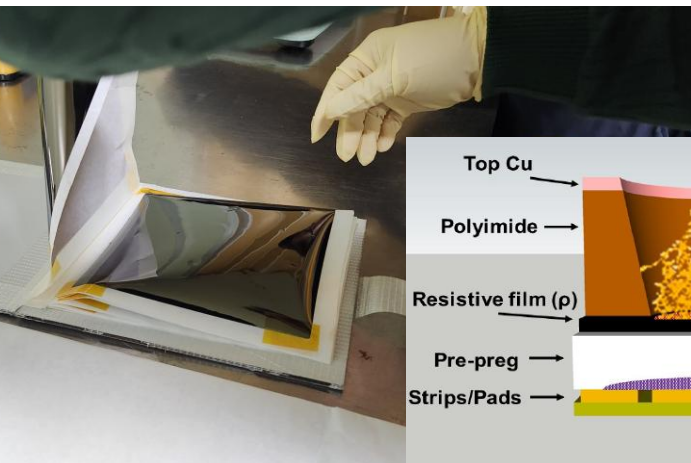


# 1. Expertise of SNU on MPGD Production



## 2. Contribution plan for ECT

- We hope to provide in-kind contributions of GEM foils and  $\mu$ RWELL PCBs for ECT production
  - We can help alleviate the MPGD procurement burden that the ePIC experiment is also experiencing
  - To provide person power for detector assembly and integration
- Because  $\mu$ RWELL is resistive variant of GEM foils, those share most of production process
  - Had a meeting with Rui to secure production know-how
  - Production of  $10 \times 10 \text{ cm}^2$   $\mu$ RWELL is ongoing to check production feasibility



## 2. Contribution plan for ECT

- Ministry of Science and ICT, National Research Foundation, and physics community are very supportive of this plan
  - 1.4 - 2.1 M USD is quite likely to be allocated starting next year
  - By utilizing the existing equipment and trained personnel, it is possible to provide in-kind contributions for ECT with a modest budget
- SNU is already maintaining close contact with Kondo and Annalisa regarding the GEM foils and  $\mu$ RWELL PCB for the ePIC



# 3. Person Power



- Seonho Choi (SNU)
  - Professor
  - Expert of Physics which will be studied by ePIC



- Inseok Yoon (SNU, KCMS)
  - Senior researcher



- 2-3 Ph.D Students



- Yeonggun Jeong (KCMS)
  - Technician



- Seongho Park (KCMS)
  - Technician

- External Contractors
  - PI etching
  - FCCL gluing
  - DLC sputtering

# Summary

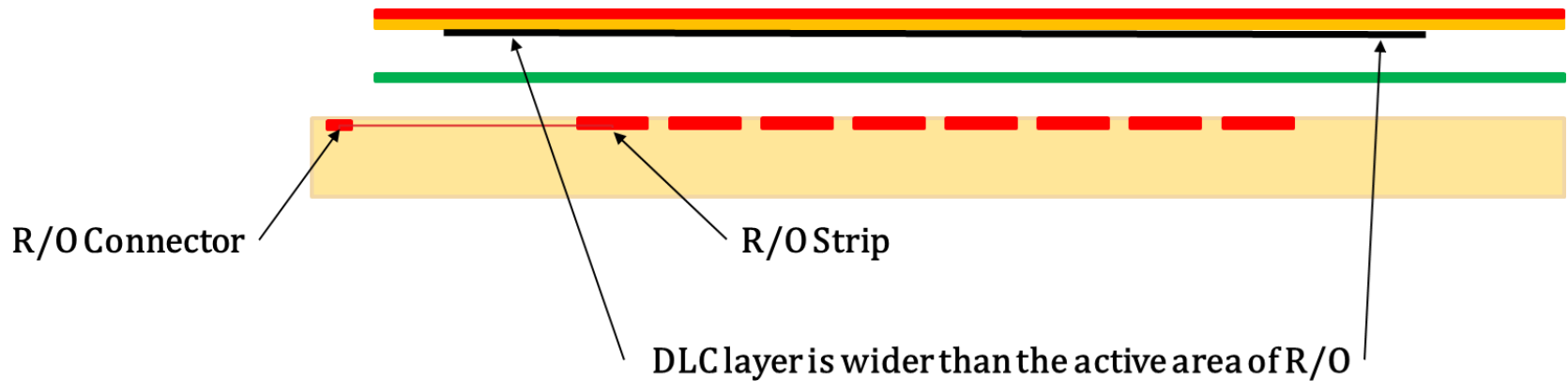
- SNU would like to join the ePIC experiment
  - During the construction phase, SNU is willing to contribute GEM and  $\mu$ RWELL for ECT production as in-kind and provide person power for detector assembly and integration
  - Budget for this contribution is very likely
- SNU is a proven producer of GEM foils and expanding capability to  $\mu$ RWELL
  - Since  $\mu$ RWELL is a resistive variant of GEM, it shares technical similarities with GEM
- Now SNU has an appropriate structure and become fully online

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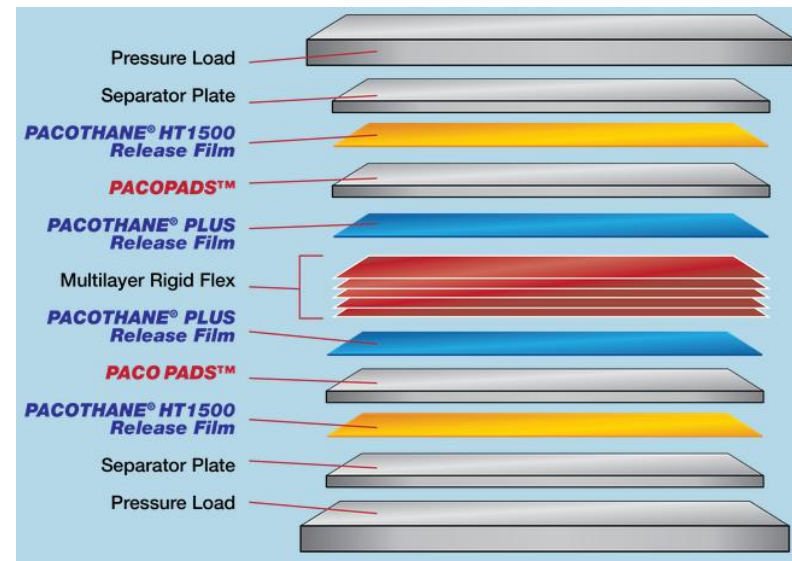
# Back Up

## 2. Production processes

- The DLC layer is formed by a sputtering process and are procured by ordering it from CERN or other suppliers

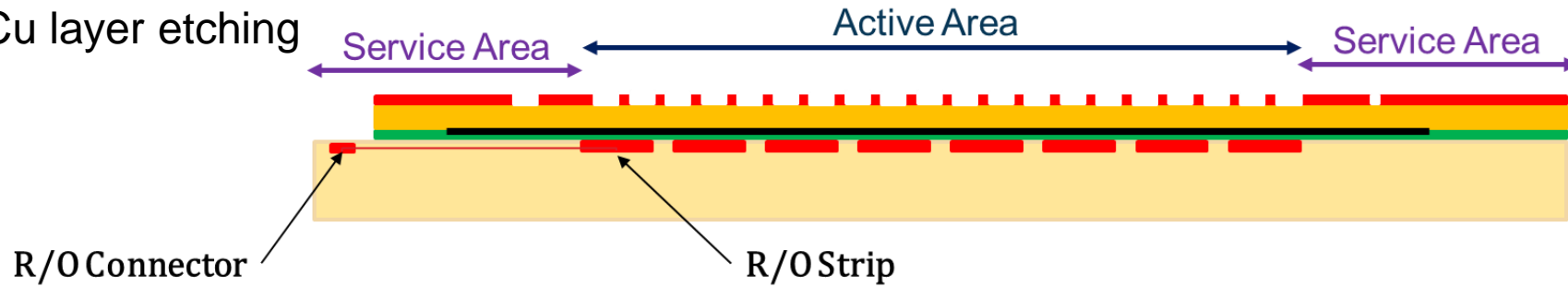


- Pressing DLC FCCL, pre-preg and RO PCB at high temperature in a vacuum chamber
  - Will be done by PCB maker
  - Common PCB pressing process, but requires know-how to construct “stack” to control the flatness issue

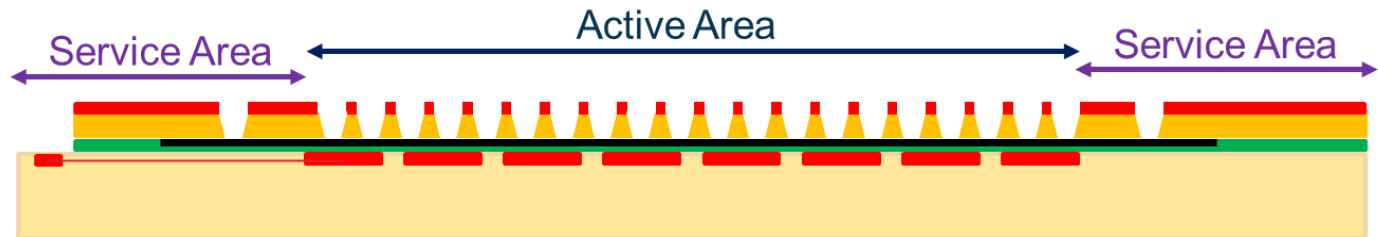


## 2. Production processes

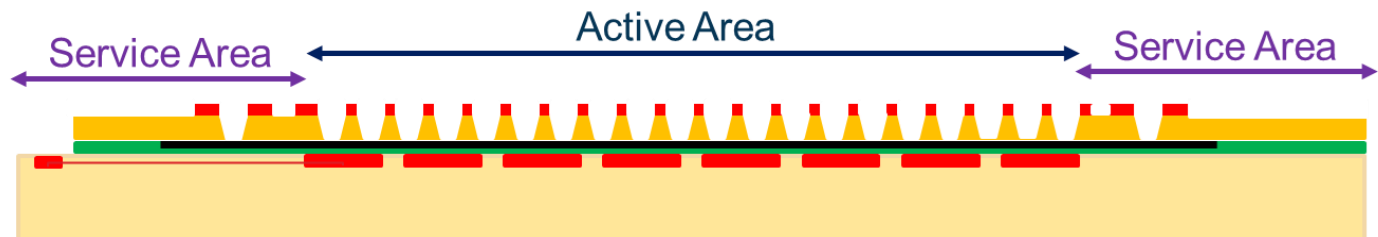
- 1<sup>st</sup> Cu layer etching



- PI layer etching  
- KOH, amine

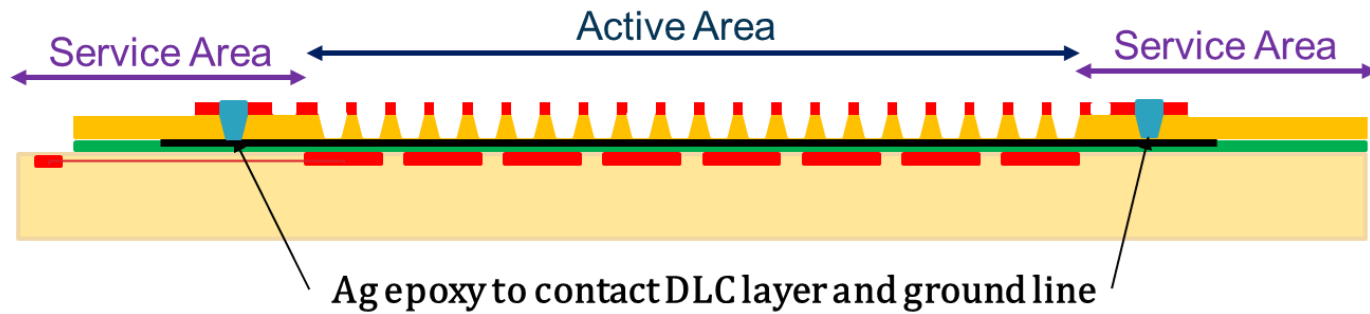


- 2<sup>nd</sup> Cu etching



## 2. Production processes

- Ag epoxy pasting



- Soldering connectors and cleaning
  - C-cleaning & E-cleaning needs lots of know-how
  - We have the know-how through KCMS GEM production

