μRWELL Production R&D Status

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Inseok Yoon (Seoul National University)

MPGD DSC Meeting

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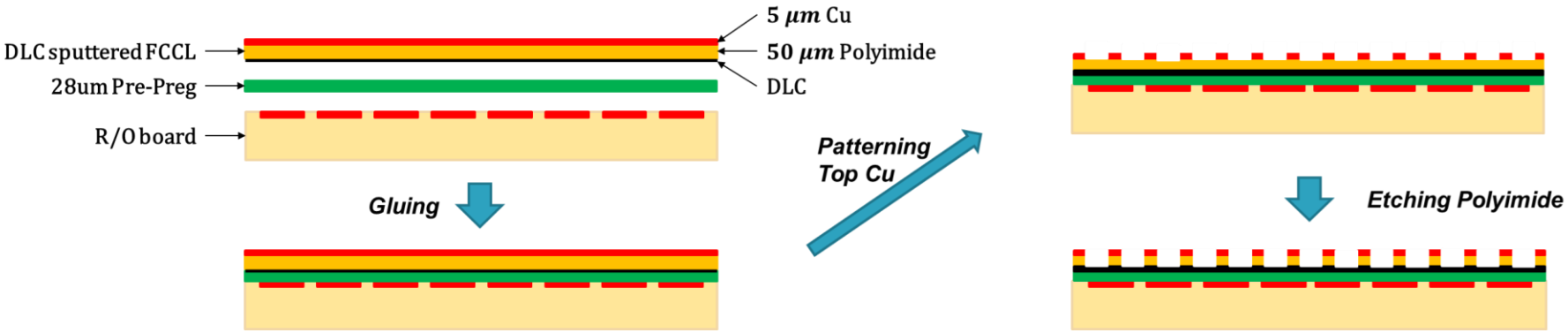
1. μRWELL Production R&D Status

• Currently production of $10 \times 10\ cm^2$ μRWELL is ongoing to study production feasibility

• Had a meeting with Rui in May to discuss production processes in detail

- We are more confident that we can produce μRWELL using the GEM facilities in Korea

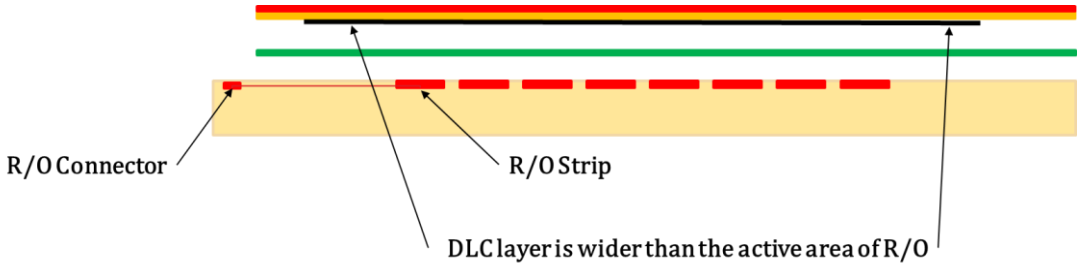
• μRWELL shares many production processes with GEM



• The DLC layer is formed by a sputtering process

- DLC-FCCL will be procured from CERN or company

1. μRWELL Production R&D Status



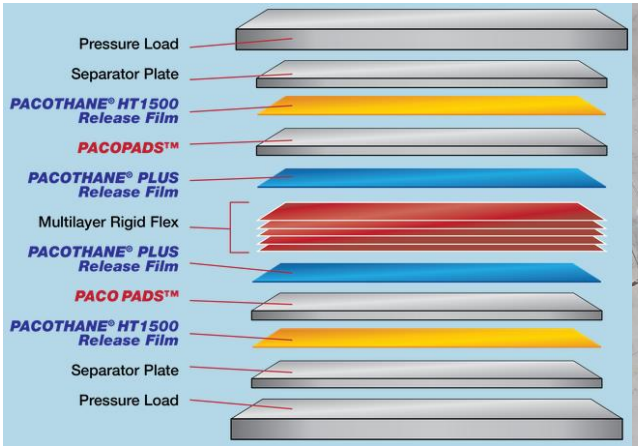
• Gluing

- Pressing DLC FCCL, pre-preg and RO PCB at high temperature in a vacuum chamber

- Pressure: 7-10 bar (Not to damage FCCL)

  Temperature: ~ 100-110 ℃

- Flatness control is the key. Know-how to construct “stack”



1. μRWELL Production R&D Status

• We have looked for press companies

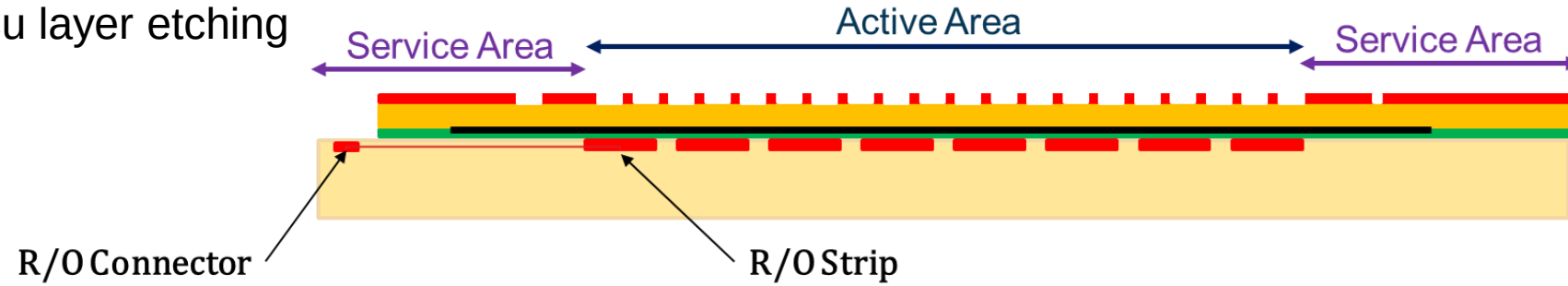
- Found a company that can press up to $70 \times 70\ cm^2$ and initiated discussion
- Enough to produce $10 \times 10\ cm^2$ μRWELL for production process R&D

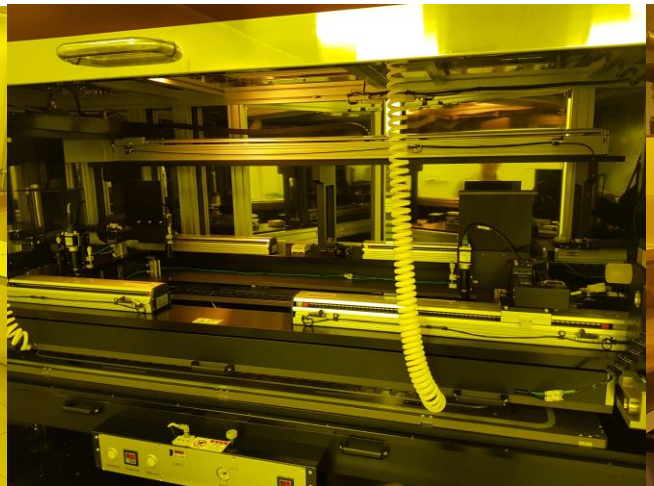
• We are still looking for companies having $1 \times 0.6\ m^2$ or larger press, but they are not common

- How is the selection going in the semicircle or quadrant?
- Whatever the choice, we'll try to find the $1 \times 0.6\ m^2$ press

1. μRWELL Production R&D Status

- 1st Cu layer etching

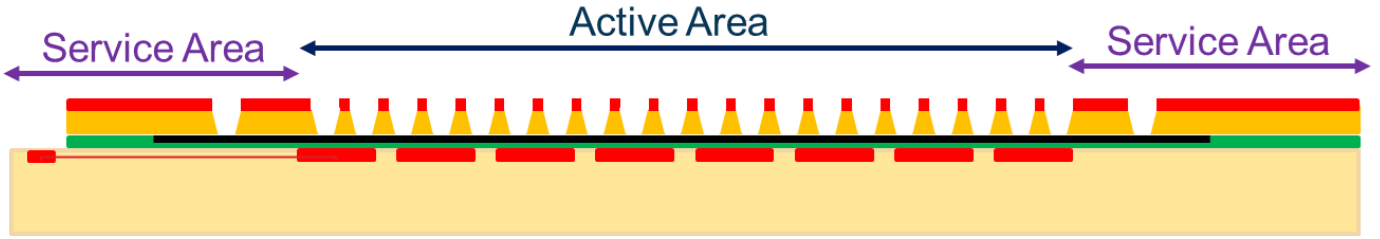


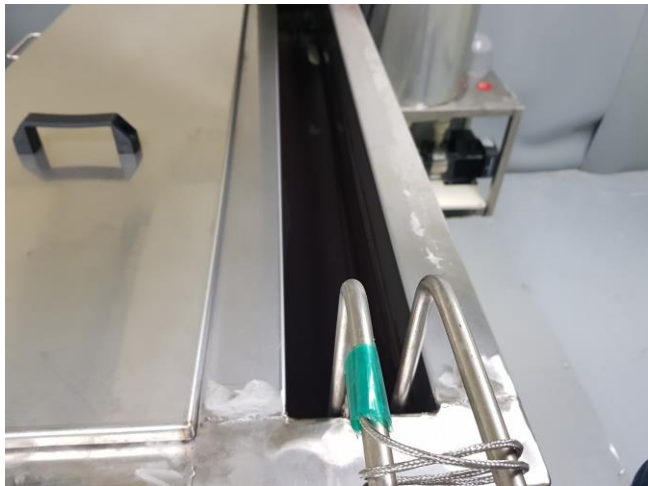


1. μRWELL Production R&D Status

- Seed layer etching

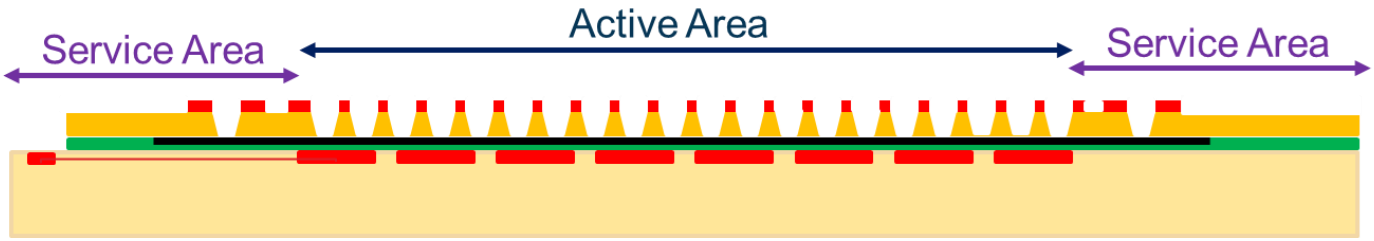
- PI layer etching
  - KOH, MEA



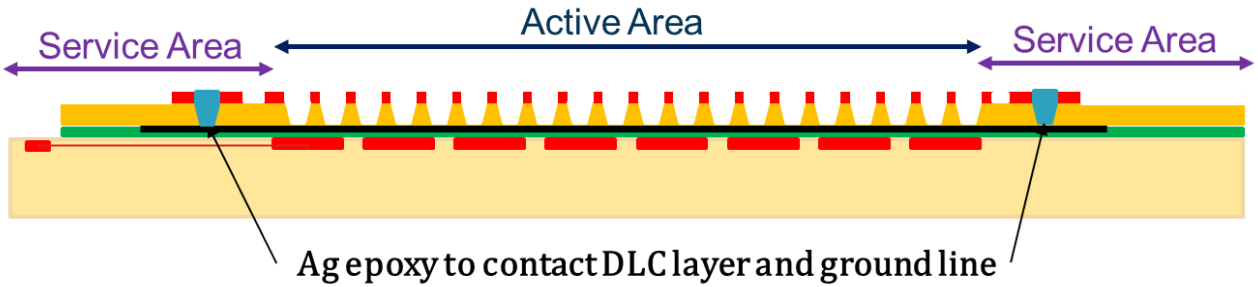


1. μRWELL Production R&D Status

- 2nd Cu etching



- Ag epoxy pasting to make via holes or via grooves & Soldering SMD resistors



1. μRWELL Production R&D Status

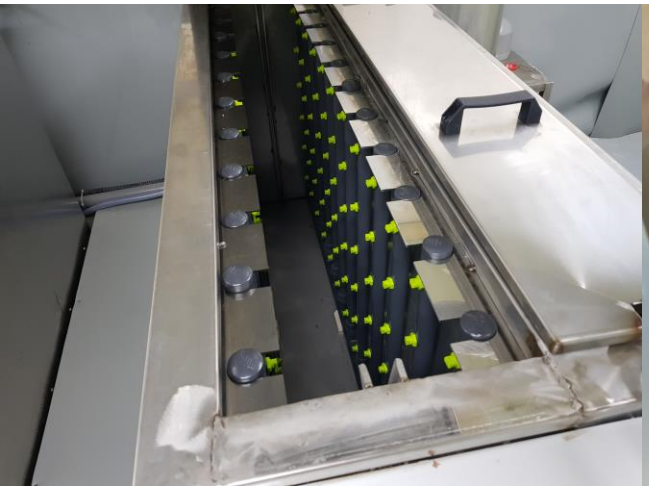
• Cleaning

- Chemical cleaning: surface preparation → micro etching (sulfuric acid + hydrogen peroxide) → neutralization (potassium permanganate) → passivation (chromic acid) → high pressure DI water shower

- Electrical cleaning: controlled burning of contaminants in dry or hot environment

• If GEM or μRWELL becomes short or sparking due to contaminants, it needs additional cleaning

- If it has high leakage current, high pressure DI water shower would be enough



1. μRWELL Production R&D Status

• The components to produce the $10 \times 10\ cm^2$ μRWELL, including the DLC FCCL and RO PCB, will be shipped from CERN next month

- Due date has been delayed

• $66 \times 66 \times 110\ cm^3$ oven has been installed in IBS area for QC and assembly

2. Contribution Plan

• In-kind contribution of GEM & μRWELL for ECT

- High chance to secure budget for it

• Provide assembly site

- It is inconvenient to transport GEM and μRWELL before assembly

- Especially for μRWELL, it is recommended that the production and assembly facilities are close to each other, at least the cleaning facilities

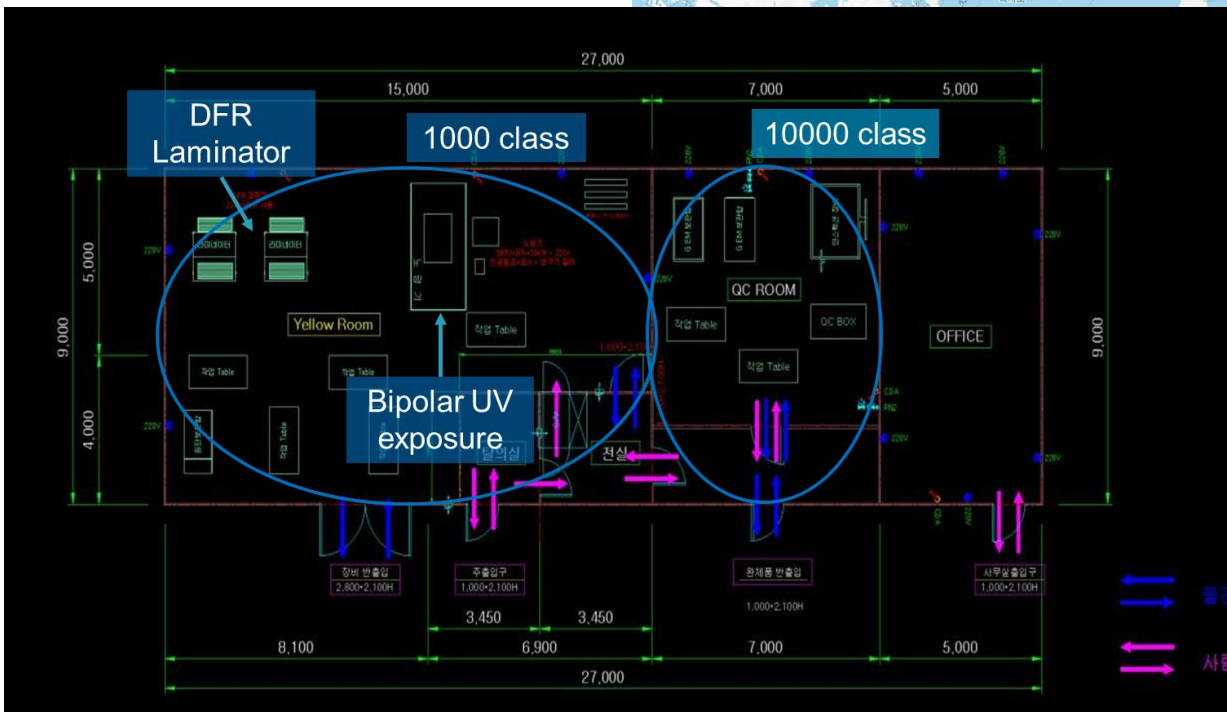
- I think IBS in Korea is an appropriate site for the initial assembly

Here “initial” means assembly before electronics integration

2. Contribution Plan

- Institute of Basic Science: Korean version of FRIB
  - Center of GEM production : photo process and QC

- Assembly in existing 1000 class room or upgrade 10000 class room to 1000 class



2. Contribution Plan

• If we encounter HV instability of GEM or μRWELL especially during assembly, we can send it to PnF to handle it

• We're also considering moving the cleaning equipment into the IBS

- Not feasible to move all of it currently
- Shouldn't be difficult to install the DI water shower and ultra sonicator

• Large pool of trained person power

• Founded for international research, IBS is a good place for hosting ECT researchers

- Three hour from Incheon air port by public transportation
- Dormitory

3. Budget Status

• Intensive discussion ongoing

- Research is being commissioned to guide policy decisions and several meetings convened by the expert advisory committee are underway

• The committee is favorable to the MPGD ECT contribution plan, so the budget is likely to be secured

- At least, the budget for GEM and μRWELL in-kind contributions (1.5 M USD) is likely

- Discussions are underway to secure additional funding (+1.3M USD) to host a facility for the initial assembly

• One issue is that the budget is expected to start spending in March 2026

Summary

- Production of $10 \times 10\ cm^2$ μRWELL is ongoing to study production processes
  - Had a meeting with Rui in May
  - More confident that we can produce μRWELL using the GEM facilities in Korea

- Contribution plan
  - In-kind contribution of GEM and μRWELL
  - Assembly site

- Intensive discussion is ongoing about budget request
  - Budget for GEM and μRWELL is likely
  - Discussion on additional budget for assembly site is ongoing
  - Unfortunate, the budget may start from March 2026