Brief Introduction

- Located at Bangalore, India.

- Micropack specializes in fabrication of bare printed circuit boards - Gerber to bare board and caters to customers in the high reliability segment.

- Has been associated with Indian DAE (Department of Atomic Energy) institutes for many projects in the past

- Listed as an approved vendor for CERN

- In late 2013, was introduced to GEM by BARC. Signed ToT with CERN for the fabrication of thin GEMs in 2014

- 2017-18 – Supplied Long & Short Rigid GE 1/1 Drift / Readout PCBs
Thin GEM Foil

- Initial development of Thin GEM with 100mm x 100mm active area.
- Had issues with the availability of the special raw material (FCCL) initially.
- Procured CERN approved material directly from the manufacturer in the first half of 2016.
- Since then, has been able to make significant progress in fine tuning the process to move closer to the desired results. Moved to larger sizes.
- Has been able to achieve good uniformity as well as consistency across the 100x100mm / 300x300 foils. M1 foils of 670mm x 427mm under testing.
- Samples were submitted to BARC, CERN and Delhi University for final product analysis.
100mm x 100mm active area - 70 microns dia / 140 microns pitch
300mm x300mm active area - 70 microns dia / 140 microns pitch
Delhi University built a 3/2/2/2 gap configuration detector using Micropack 300x300 foil

Feedback from DU: “Basic measurements like high voltage, spurious signal and gain was measured. Results are very good nothing, strange behavior was observed during the measurement from foils and the spurious signal rate is < 2 Hz and at the divider current of 700uA, the gain observed is ~10000 which is as expected for this gap configuration.”
50 X magnification

100 X magnification

100mm x100mm active area - 70 microns dia / 140 microns pitch
Image focused to the outer copper ring

Image focused to the inner PI ring

www.micropack.in
Internal verification @ Micropack:

1. Optical Inspection – Outer copper Hole diameter / Inner Hole diameter / Uniformity
2. Insulation resistance – @ 600 V DC
GEM – Our journey so far

2013
- Introduced to GEM foils by BARC, Mumbai

2014
- Visited GEM lab at CERN for better understanding of the product. TOT signed with CERN

2015
- Received initial samples of material from CERN through BARC, Mumbai. Initiated work towards stabilisation of process and production of GEM foils at our facility
- Process for M1 / M5 GEM foils being stabilised with single mask method
- M1 GEM foils along with FR4 frames and spacers + Readout & Drift submitted. Under detector assembly at CERN
- 2000 Sqft area added for GEM fabrication
- 100 x 100 foils fabricated with double mask method. Polyimide etching process stabilised

2016
- Material procured directly from the supplier helping in more frequent trials for process improvement
- 100 x 100 & 300 x 300 foils fabricated successfully. Initially with double mask method and subsequently with single mask method.
- Tested at Delhi University. Results were found satisfactory
- Also tested at BARC, Mumbai with satisfactory results
- 100 x 100 foils supplied to CERN

2017

2018

www.micropack.in
M1 GEM Foil - 670mm x 427mm active area with resistors assembled - 70 microns dia / 140 microns pitch
• 3 #s of M1 GEM foils despatched to CERN for detector assembly

• M1 Readout and Drift PCBs also supplied

• All the FR4 spacers and the FR4 frames / Plexi glass required for the detector assembly also supplied along with the GEM foils

• Detector assembly currently under progress at CERN. Being done by team from Delhi University
Road ahead

- New GEM fabrication floor of about 2000 Sqft has almost been completed – 1000 Sqft for wet processing / 1000 Sqft for exposing + testing

- 16 new tanks for chemical processes and to accommodate 2 meter long foils fabricated. Will be operational by Dec end
• New scanning type LED exposure machine with more 2 metre span ordered. This will help in better hole definition and accuracy. Expected to be installed January 2019
Micropack acknowledge the continued support from

Rui De Oliveira, Alexis Rodrigues, Michele Bianco and Archana Sharma from CERN

Naimuddhin, Ashok and Mohit Gola from Delhi University, India

Lalit Pant from BARC, Mumbai, India
Thank You