SCREEN PRINTING IN SACLAY

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• Bulk Micromegas detectors are manufactured in Saclay MPGD workshop since 3 years (~ 150 units).

• In 2014 the workshop was upgraded with a serigraphy machine in order to print resistive pattern on top of readout PCB before bulk processing.

• Goal of the serigraphy @ Saclay:
  • thin strips and/or thin inter strips (< 100 µm) on large surface (600 mm x 600 mm)
  • Gain experience with resistive strips
  • R&D program:
    • different patterns of resistive coating (strips, plain layer, pad,…)
    • different resistive paste (dilution or carbon adding)
    • use of insulating paste and/or silver conductive paste

• This new machine is part of a “fab-lab” together with the bulk workshop and several test benches in the same geographic area that will allow us to built and test prototypes.
The Argon Unostar E serigraphy machine is a professional tool well suited for the type of resistive polymer to be used. Investment is ~ 30 k€ (ANR Splam)

- Maximum surface is 700 mm * 700 mm
- End 2014 a first test was done using a demonstration screen with several patterns to train IRFU technicians on this machine
TEST PARAMETERS

• Screen:
  - Stainless-steel mesh M325, SD90/40 at 15°
  - ENDUCTION on screen of 6-8µ (measure = 8 µm)
  - Theoretical thickness of paste deposition ~ 48 µm
  - Tension of the screen mesh = 28 N/cm in both direction

• Resistive polymers: ESL RS 12115

• Use without addition of solvant

• Substrat for deposition: Kapton of 50µm and mylar of 60µm

• Parameters of machine Argon Unostar E (average speed and pressure)
• The test screen had several types of strips with a pitch of 700 µm, from very thin strip to very thin inter-strip. The strip length was 500 mm.

• Various other patterns (square, circle, connector, ...) of various size where also on the same screen

<table>
<thead>
<tr>
<th>Zone</th>
<th>Strip (µm)</th>
<th>Inter (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>50</td>
<td>650</td>
</tr>
<tr>
<td>Zone 2</td>
<td>100</td>
<td>600</td>
</tr>
<tr>
<td>Zone 3</td>
<td>150</td>
<td>550</td>
</tr>
<tr>
<td>Zone 4</td>
<td>200</td>
<td>500</td>
</tr>
<tr>
<td>Zone 5</td>
<td>250</td>
<td>450</td>
</tr>
<tr>
<td>Zone 6</td>
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<td>Zone 7</td>
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<td>Zone 8</td>
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<tr>
<td>Zone 11</td>
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<td>150</td>
</tr>
<tr>
<td>Zone 12</td>
<td>600</td>
<td>100</td>
</tr>
<tr>
<td>Zone 13</td>
<td>650</td>
<td>50</td>
</tr>
</tbody>
</table>
- Strip of 50 µm on screen
- Result → strips of ~100 µm
• Strip of 100 µm on screen
• Result → strips of ~153 µm
• Strip of 150 μm on screen
• Result → strips of ~275 μm
• Thickness: 22 μm
RESULT ZONE 6

- Strip of 300 μm on screen
- Result → strips of ~482 μm
- Thickness: 36 μm
- Strip of 450 µm on screen
- Result → strips of ~630 µm
- Strip of 650 µm on screen (inter = 50 µm)
- Result → plain resistive layer
- Thickness: ~ 51 µm
With this very first test we were able to print strips of 500 mm length very uniform. The ratio of measured strip-size over screen opening is ~ 1,5.
NEXT STEPS

- Serigraphy + resistivity measurements
  - Two dedicated screens (different mesh down to SCS 45/18) with long strips + pads for resistivity measurement
  - Resistivity versus temperature

- TF1O- R prototype (Active area 12x12 cm, 128 channels)
  - Several resistive coating (strip, plain, mesh, pixel) will be tested:
    - Serigraphy
    - Metrology
    - Resistivity measurement
    - Bulk
    - Test with Fe55 and cosmic bench

- Large 2D prototype (500 mm * 500 mm) with different deposition pattern.