WP 13.3.3

# Development of a Multi Chip Module using HDI-technology and 3D- mounting of chips for MPGD readout

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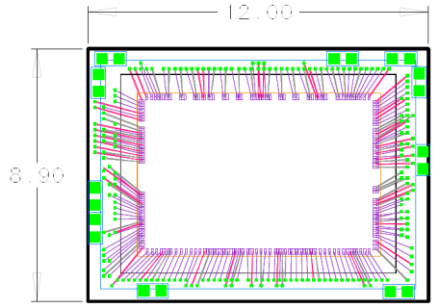
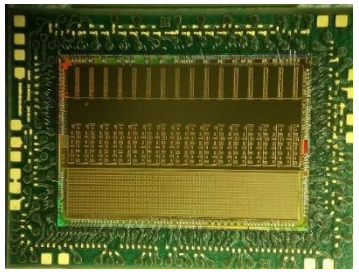
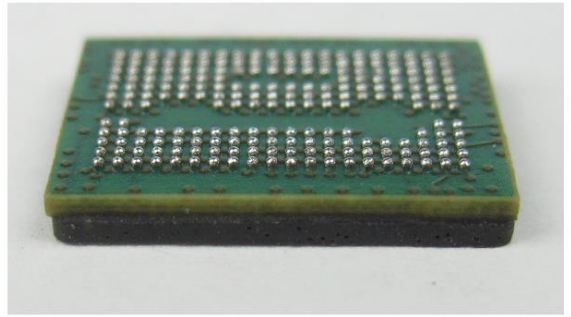
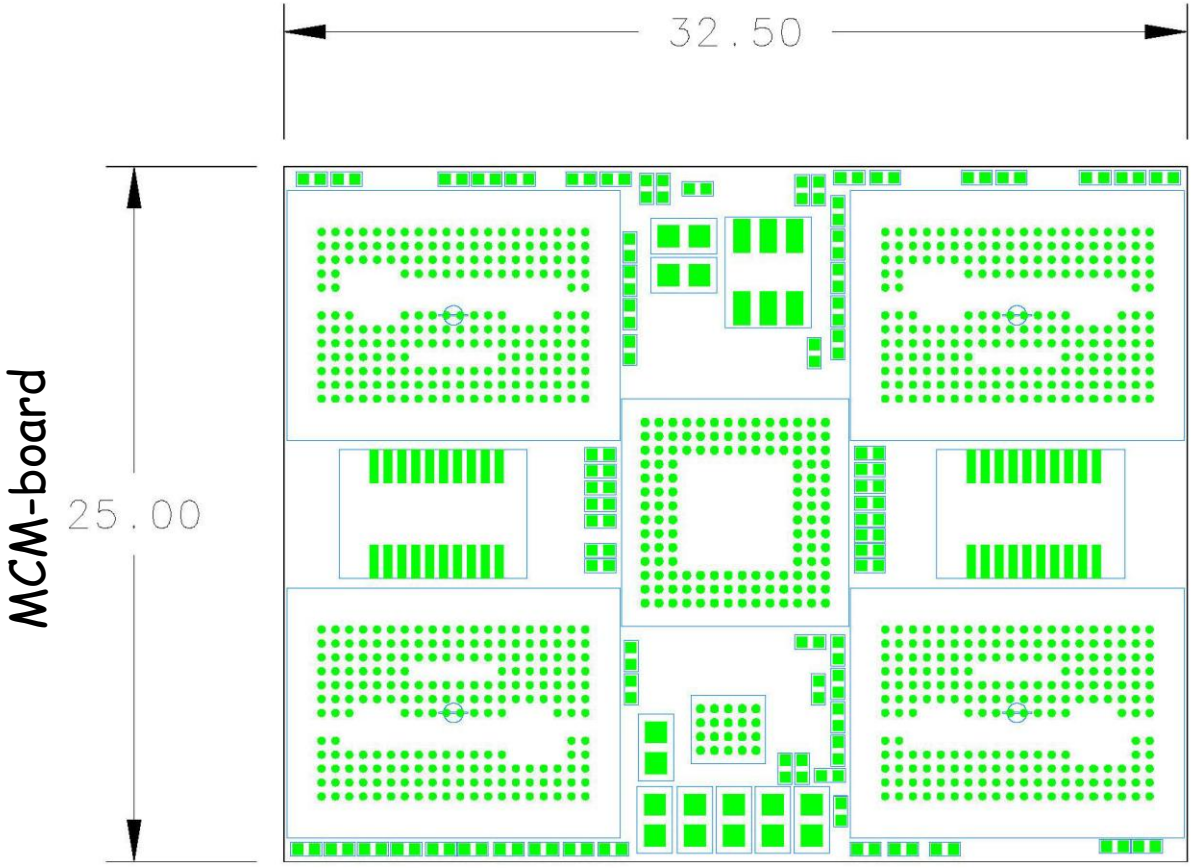
# SALTRO16-chip – Carrier-board – MCM (Multi Chip Module) -board

Carrier-board
and
SALTRO16-chip








- The Carrier-board (8.9x12.0 mm2) with mounted SALTRO16-chip (6.2x8.7 mm2) is presently under test and debugging.

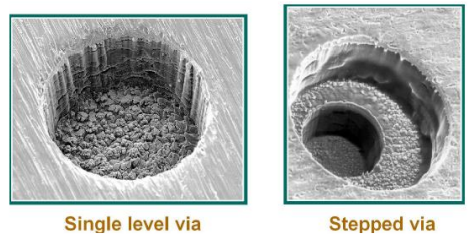
- 8 Carrier-boards will be mounted on an MCM-board (4 on top and 4 on bottom)

- The MCM-board will be designed in HDI-technology (High Density Interconnect)

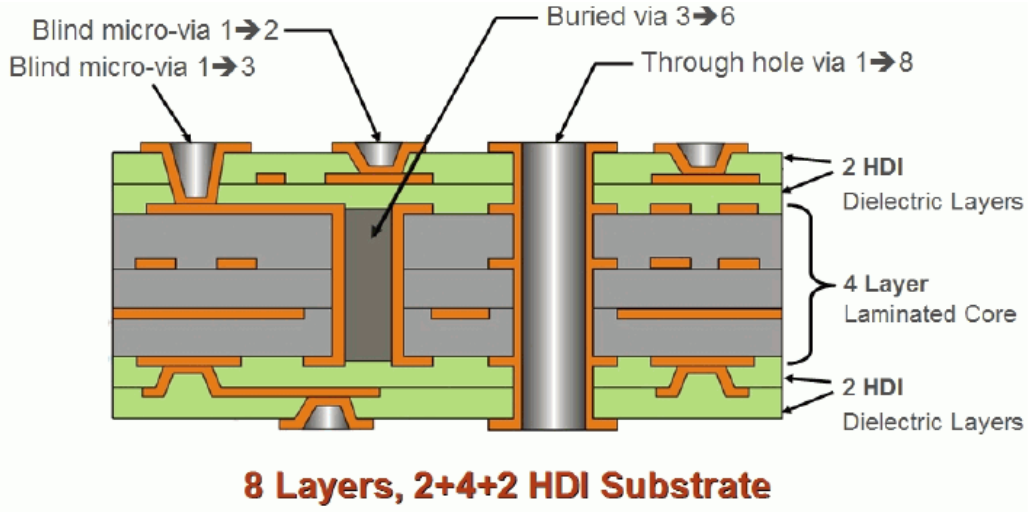
- This gives a space occupancy of 6.4 mm2 per channel

# Advantages of HDI (High Density Interconnect) technology

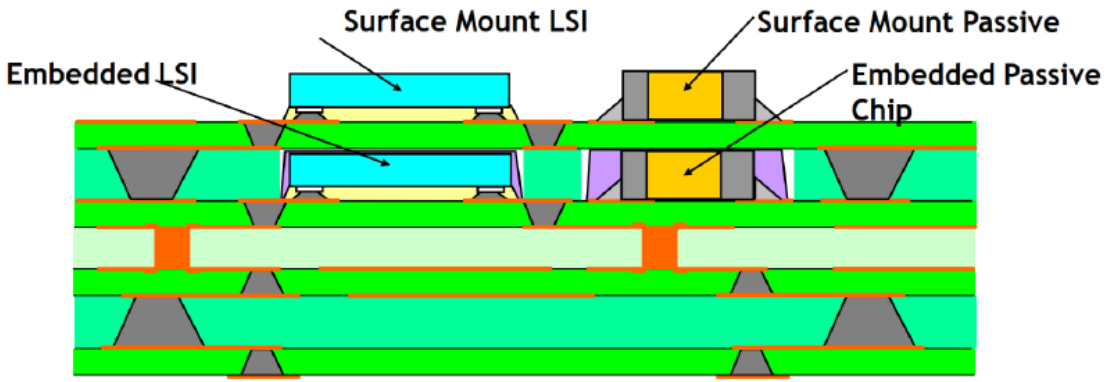
- Routing density higher both for signal and voltage supply
  $\Rightarrow$ number of layers can be decreased
- Laser drilling allows for a holes as small as 25 μm diameter with collars of 50 μm.
- The drilling can be performed to different depths depending on the energy in the laser beam.




- The core is a standard multilayer PCB.
- Onto this a thin prepreg layer (dielectrica +copper) is laminated.
- Together with sequencial laminate application vias can connect different layers.
- The prepreg layers can be as thin as 5 μm.
- Due to via-in-pad techniques all routing can be performed in the inner layers such that essentially the whole surface can be used for mounting of components.

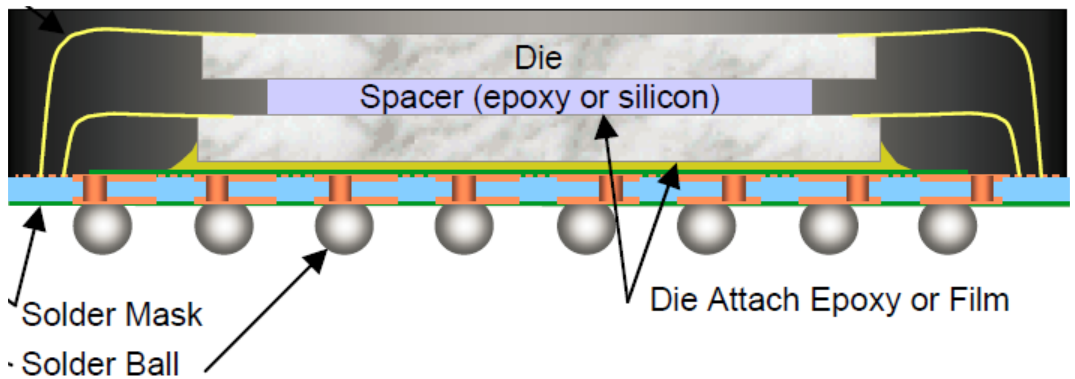



This technology also offers the possibility to create cavities in the PCB where electronic och mechanical components can be mounted and thus embedded into the PCB so that essentially the full surface is available for surface mounting of chips.

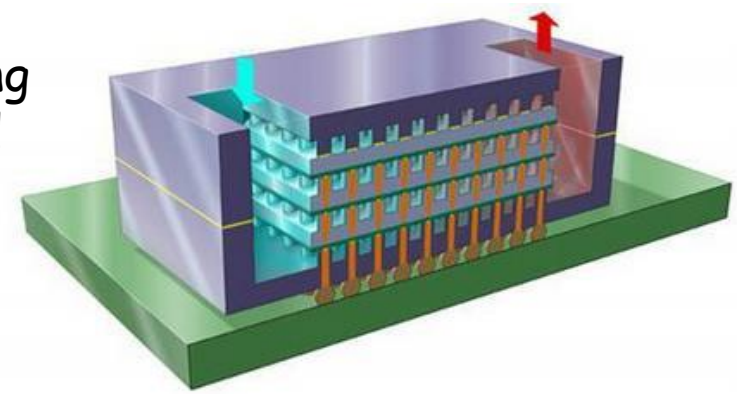


# Stacking of chips and micro-channel cooling

- In order to achieve even higher channel density it is possible to stack chips on top of each other
- This would require a new Carrier-board and MCM-board




- Micro-channel cooling, developed by the semiconductor community for cooling of IC-chips, offers an interesing option, which will be further developed by WP 9.2. We hope to profit from this development.



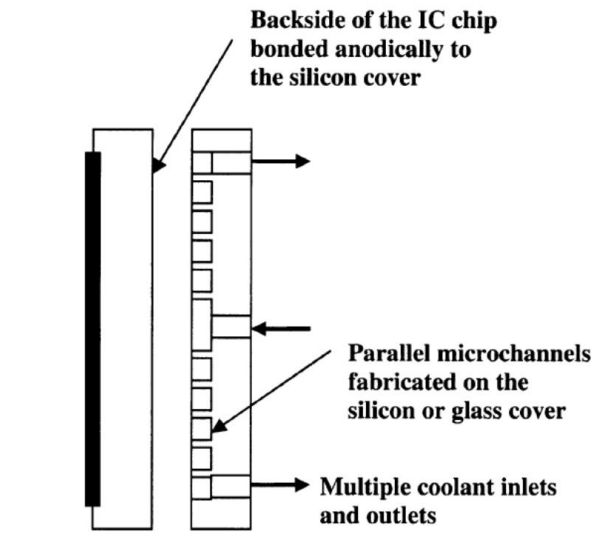



**Figure 2** Schematic arrangement of an IC chip cooled with microchannels fabricated on a silicon or glass cover bonded anodically or glued to the backside of the chip (not to scale).

## WP 13.3.3: Participants

CERN: Support for the use of the SALTRO16 chip (Lucie Linssen),
(micro-channel cooling)
Lund: Development of the MCM-board in HDI technlogy and stacking of chips

## Four-year planning

Year 1: design of the MCM-board in HDI-technology
Year 2: production, mounting and programming of the MCM-board
Year 3: debugging and tests of the MCM-board
Year 4: design of Carrier-board with stacked chips

## Planning for the first year

Month 1-8: Design of the 1st vesion of the MCM-board
Month 9-10: Prototyping and debugging
Month 11-12: Design of the 2nd version of the MCM-board

## Task 13.3 Tools to facilitate the detector development (CERN, ULUND)

**1. Interfacing FE-chips specific to gas detectors to the Scalable Readout System (SRS)**
The FE chip VMM128, GEMROC and TIMEPIX3 are interfaced to SRS by designing, prototyping and engineering in view of large production of chips.

**2. Development of cheap, standard MPGD dedicated laboratory instruments**
The development of MPGD dedicated laboratory instrumentation (remotely controlled compact HV power supply, picoamperometers and signal processing modules) proceeds through the following steps: collection of the user requirements, design, prototyping, prototype testing, final engineering and validation of the engineered instruments.

**3. PCB development using HDI-technology and 3D-mounting of chips for MPGD readout**
The development of MPGD dedicated PCB using HDI-technology and 3D chip mounting is performed by designing and prototyping followed by a test phase.

| Milestone number [18] | Milestone title | Lead beneficiary | Due Date (in months) | Means of verification |
|---|---|---|---|---|
| MS94 | PCB development using HDI-technology and 3D-mounting of chips for MPGD readout (Task 13.3) | 27 - ULUND | 44 | Prototype |

# Finances for Lund (WP13)

| | JRA1 |
|---|---|
| Person-months | 11.00 |
| Personnel cost | 66,000.00 |
| Non-personnel direct costs | 18,000.00 |
| Subcontracting | 0.00 |
| Direct costs (excluding access) | 84,000.00 |
| Indirect costs | 21,000.00 |
| Access cost | |
| Lump sum, flat-rate or unit cost | |
| **Total costs** | **105,000.00** |
| **Requested EC contribution** | **45,000.00** |

Lund has to contribute 60.000 Euro over 4 years

Current financial resources:
Lund Univeristy: ~30.000 Euro/year = ~120.000 Euro over 4 years