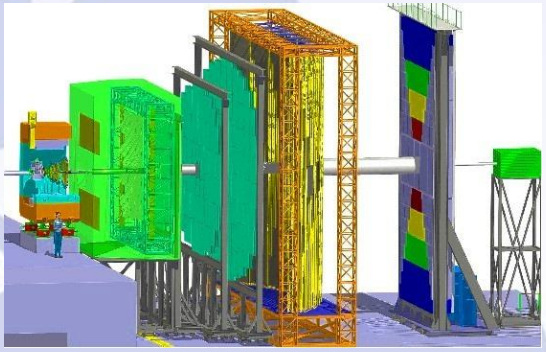
The Micro Channel Project



M. Deveaux, 25th CBM Collaboration Meeting, Apr. 2015, GSI

Project Motivation

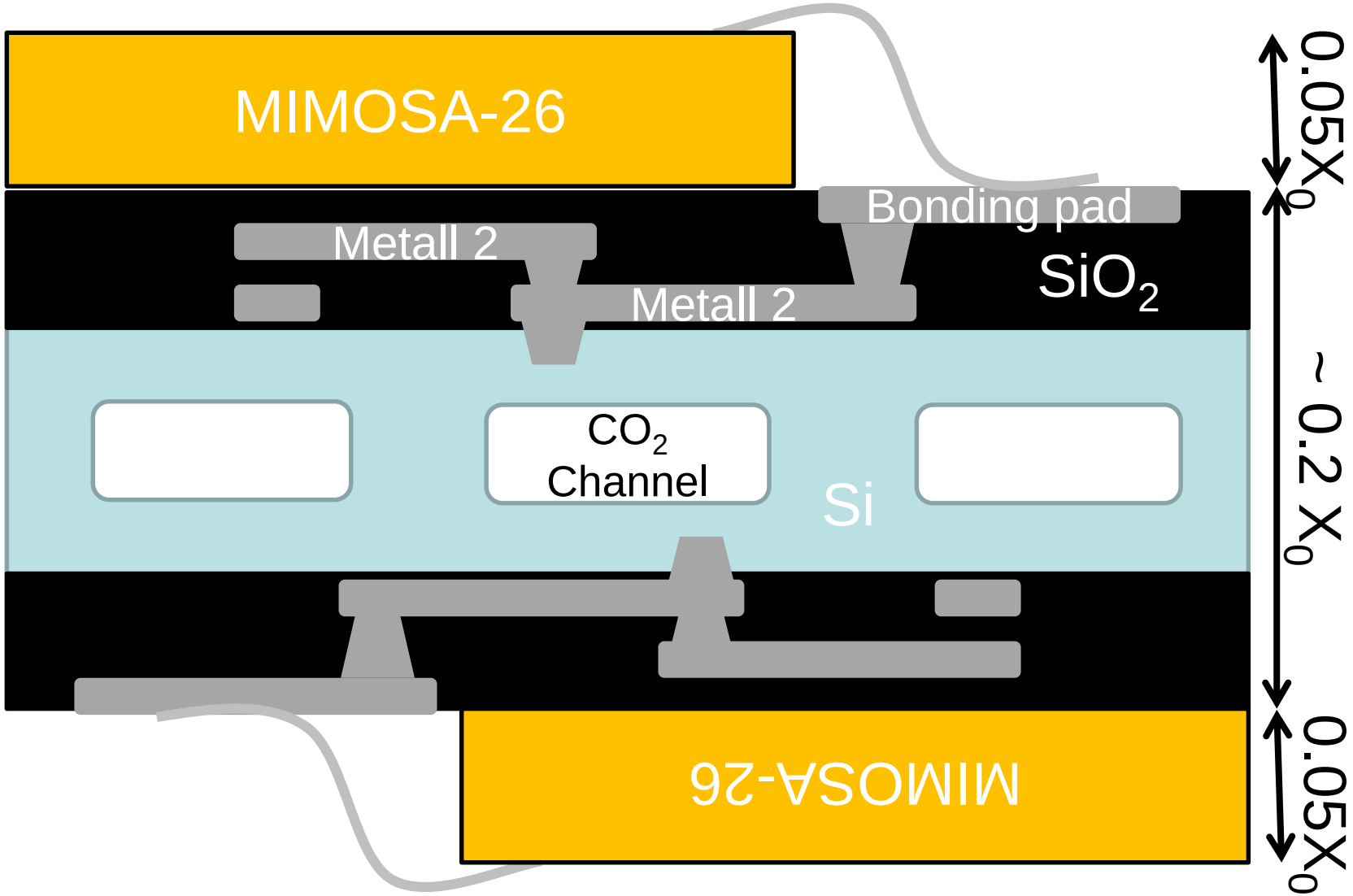
The situation

- MAPS provide a very light material budget
- The material budget of vertex detectors is dominated by:
  - Cables
  - Support
  - Cooling
- Support and cooling were integrated:
  - CVD-Diamond – IKF
  - Micro-Channel Cooling - CERN

The Idea

- Use lithographie to integrate cables and cooling into a vacuum compatible support.

How could it look like?



Project partners

CiS Forschungsinstitut für Mikrosensorik und Photovoltaik GmbH

Konrad-Zuse-Straße 14

D-99099 Erfurt

Contact person: Dr. T. Frank (Manager Business unit MEMS) (Lithography)

IKF Frankfurt/M (Integration)

The CBM-STS collaboration, J. Heuser (CO_2 – Cooling)

IPHC Strasbourg (Sensors, more?)

Project History

Vertex 2013 (Sept. 2013) – Started as a „beer idea“ aiming for a solution for the 2nd – 4th station of the generation CBM-MVD.
$\Rightarrow$ Financement idea: CBM – BMBF.

Late Sept. 2013 – Not part of the MVD- mainstream.
Try to find financement via EU – Horizon (Deadline 1st October).

Feb. 20th 2014 – Cost estimate from CiS (82kEUR)

March 2014 – Request 356kEUR from EU-Horizon including budget for IPHC.

June 2014 – Proposal rejected. Request to IPHC is willing to join the project despite not funding available => No interest.
$\Rightarrow$ Project abandoned

2015 – CiS proposes to provide deliverables for free. IPHC willing to join in. Restart aiming for DFG-Funding.

Design rules

Metall lines: 2 per side, vias and substrate contacts possible

Material of the traces: AlSi (equivalent to Al).

Thickness of the traces: 1,8µm (standard), 3µm feasible.
Minimum width of the traces: 20µm
Minimum distance of the traces: 20µm

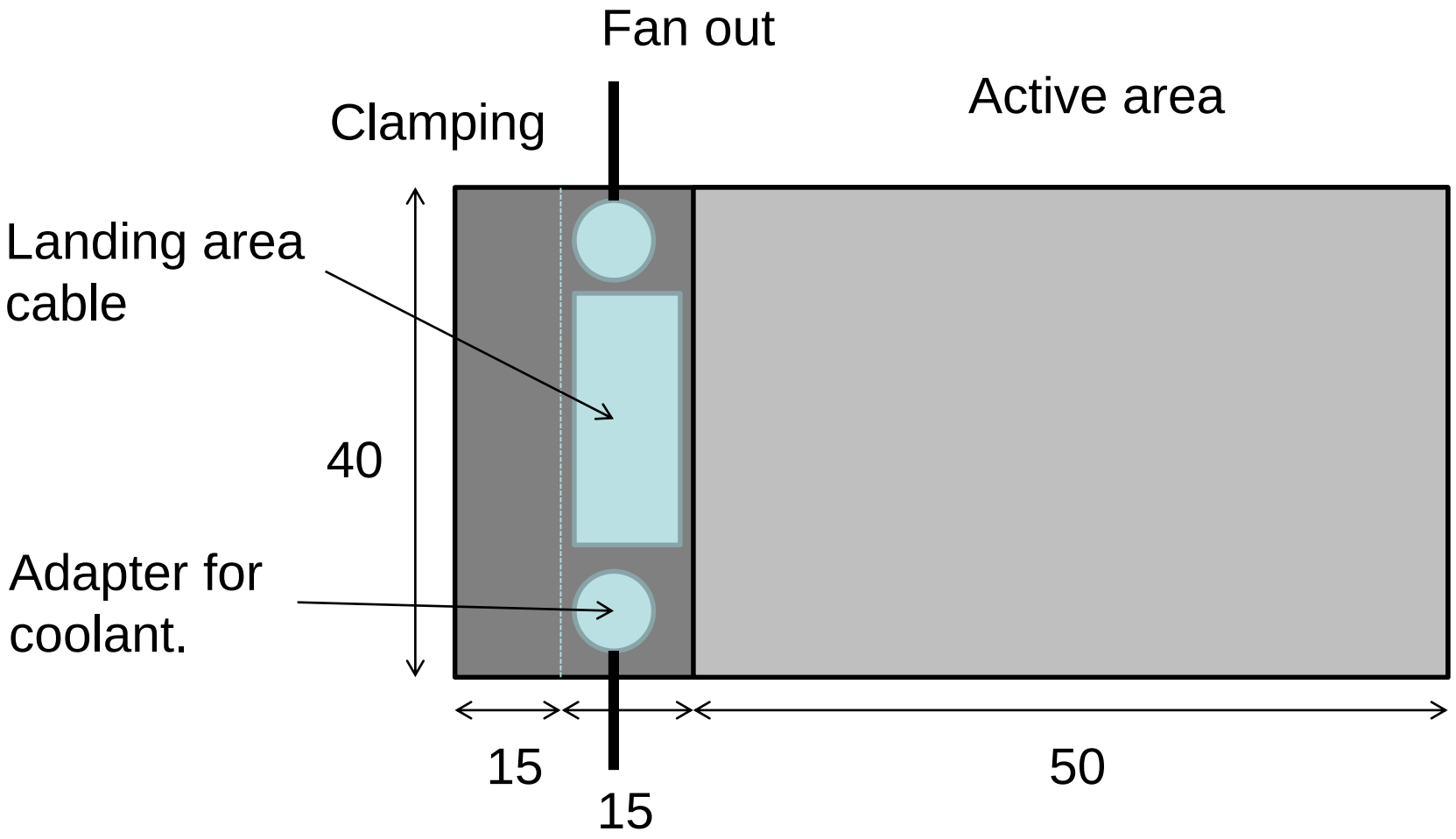
Passivation: Between traces and at surface.

Bonding pads: AlSi

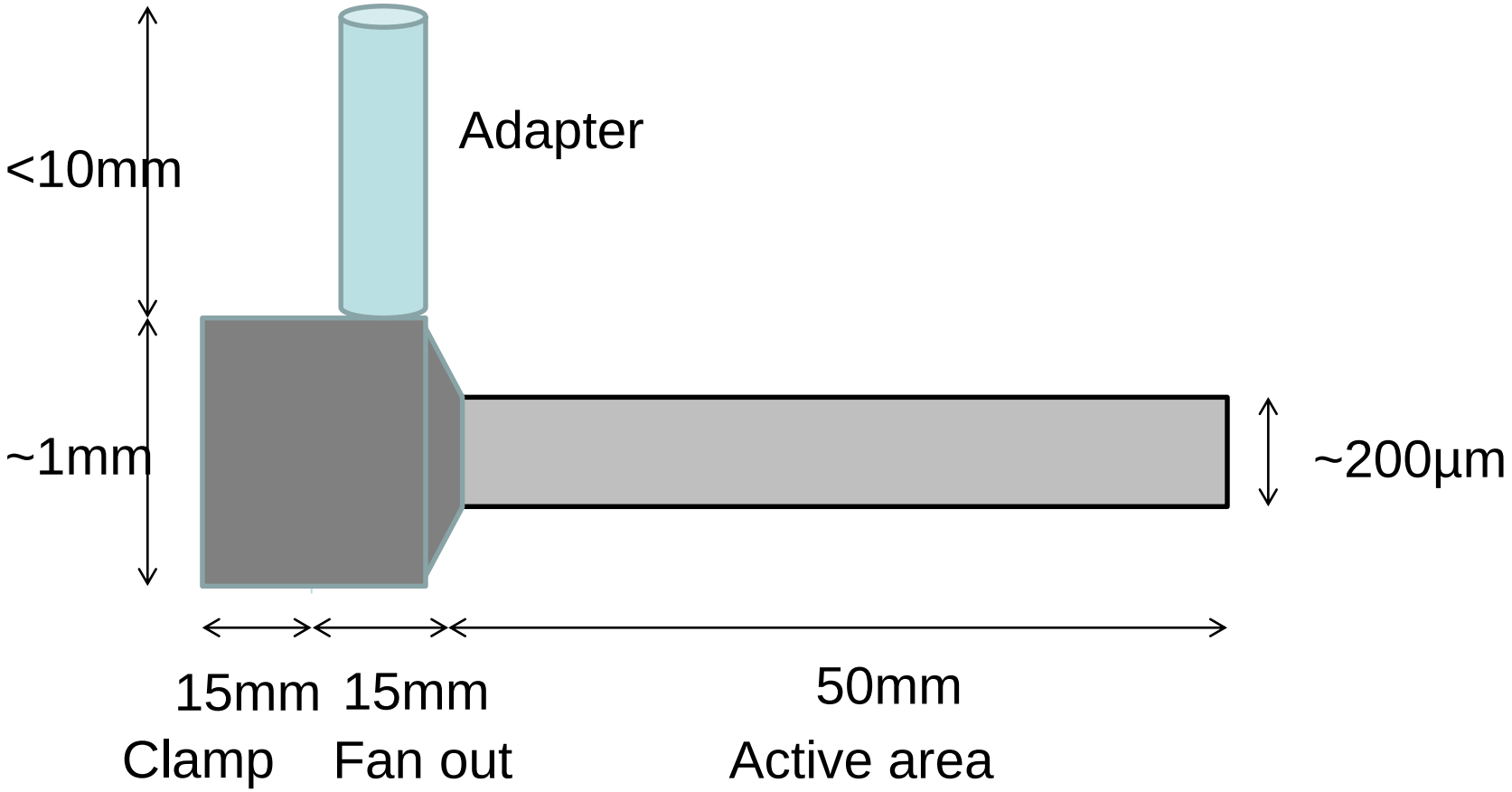
Thinning of silicon:

- A local thinning of the wafer is possible by etching. The borders are diagonal (54.7°).
- Borders may be crossed by metal lines

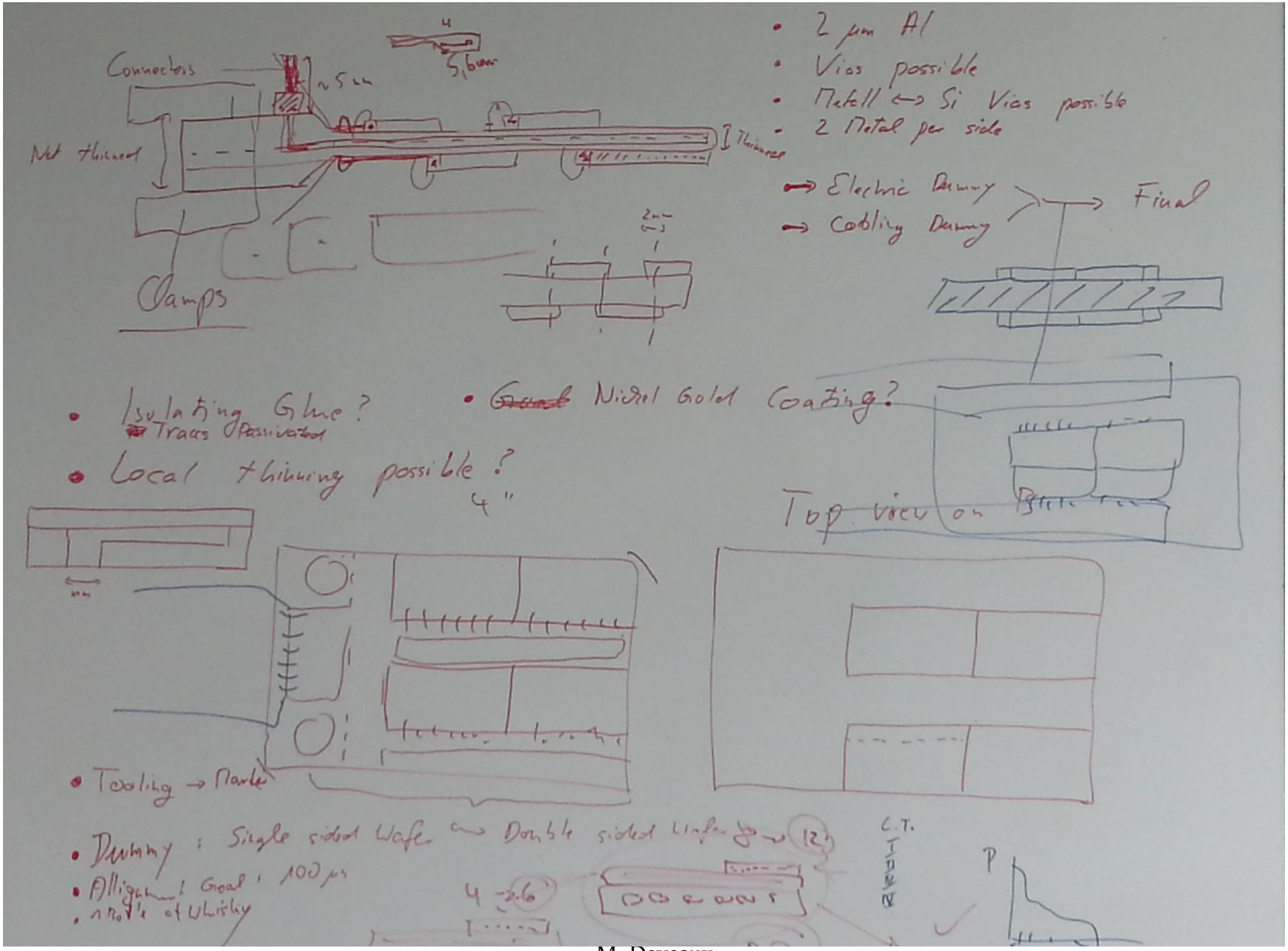
Design of the object (draft, top view)



Design of the object (draft, side view)

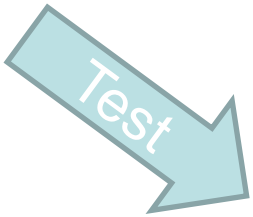


Sensor arrangement (draft)



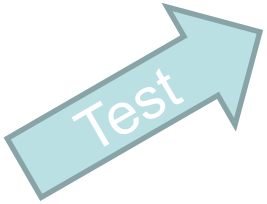
Global Strategy

Mechanical Demonstrator
(Cooling channels only)



Fully integrated device

8 Sensors



Electrical Demonstrator
(Traces only)

8 Sensors

Global strategy

TASKS/Subtasks	**2015**				**2016**				**2017**			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TASK 2: Development of an actively cooled support with integrated electrical circuits												
2.1 Technology development of a micro-integrated support												
2.1.1 Design and construction support with cooling channels	4		6a									
2.1.2 Design and construction support with aluminum traces	5		6b									
2.1.3 Integration of sensors				7								
2.1.4 Intermediate test					8							
2.2 Development of actively cooled, fully integrated support												
2.2.1 Design based on results of task 2.1						9						
2.2.2 Construction of supports								10				
2.2.3 Integration of sensors									11			
2.2.4 Test of the system											12	

Delayed by ~6 month

Decision DFG proposal

Submission DFG proposal