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New TCT setups at CERN and Louvain

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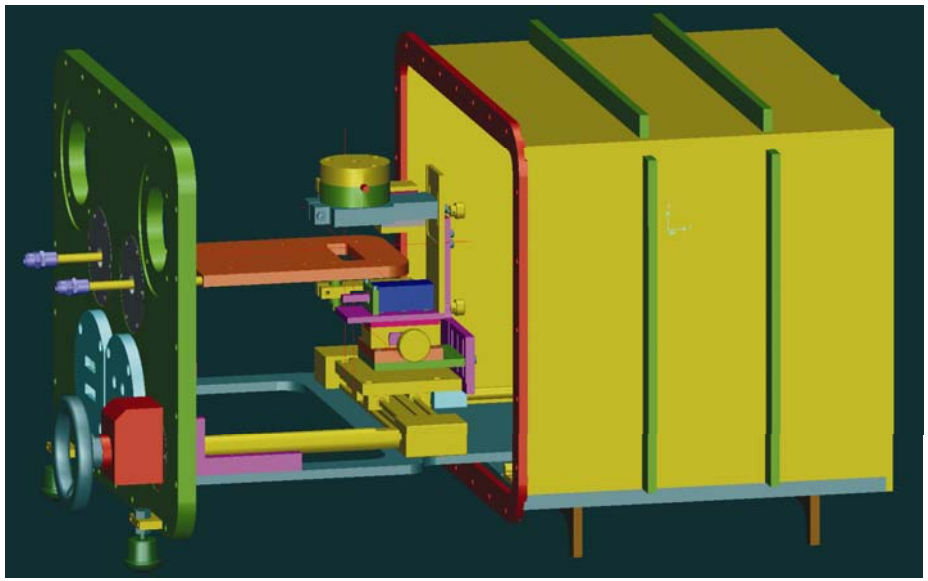
--- Joint activity of Louvain and CERN leading to two similar setups ---

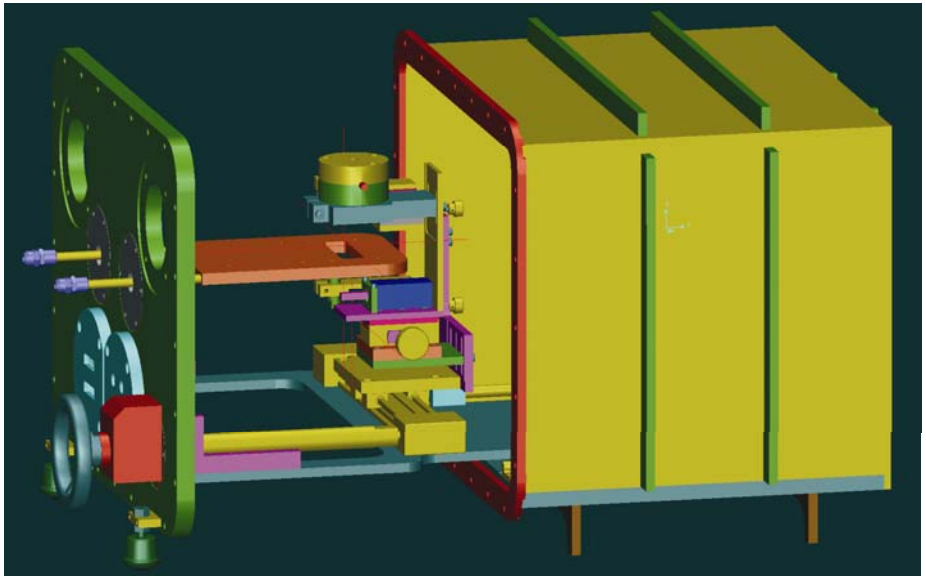


- Methods
- Instrumentation
  - Setup
  - Optics
  - Alibava
  - Environment
  - *Electronics*
- *first Signals*
- *Discussion*

Methods

Characterization Methods

- **TCT**
  - strip & pad sensors can be mounted
  - laser illumination from both sides
  - red & IR laser (ps pulses)
- **CCE**
  - → ^{90}Sr (3.6 MBq; tested to be vacuum proof!), also for laser calibration
  - → IR laser: fast CCE measurements
- **CV / IV**
  - parasitic usage



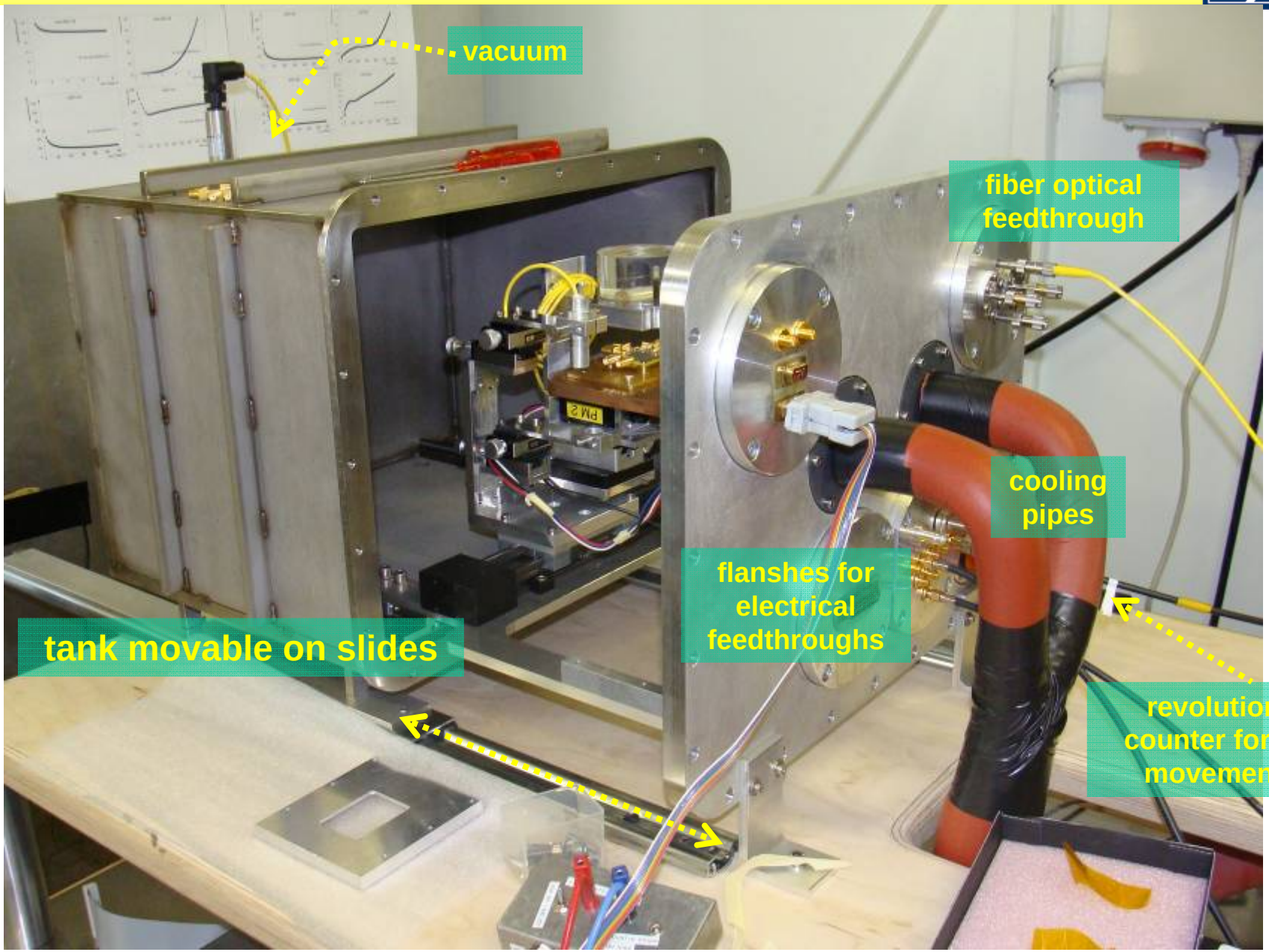
Mechanics

- **Cooled with silicon oil**
  - vacuum to avoid formation of ice
  - most of equipment in closed box
- **Movable from outside**
  - scan laser and source over DUT
- **Modular with flanshes**
  - allows for easy mounting of additional feedthroughs

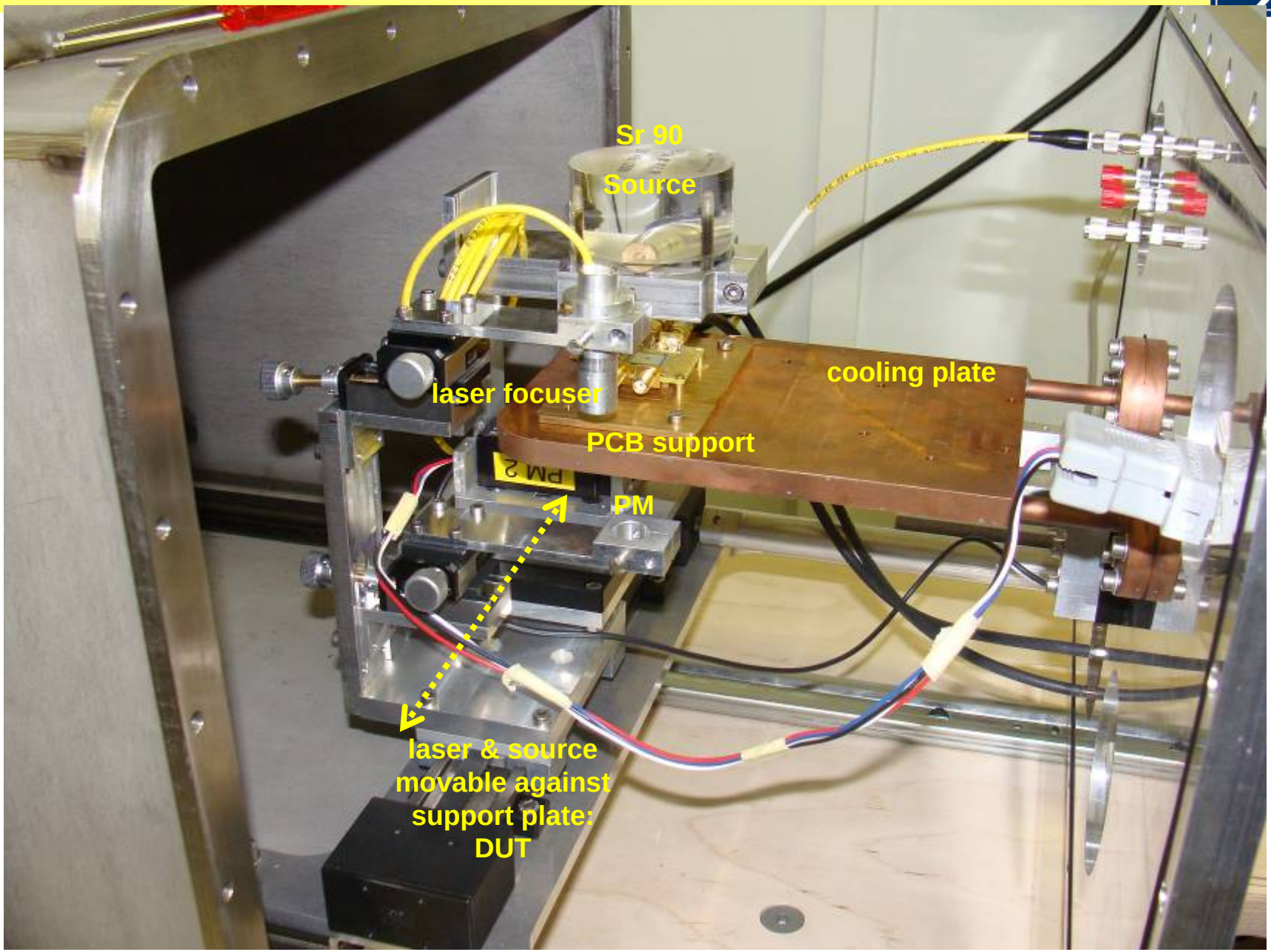
Electronics

- **using SMA connectors (HF)**
  - signals: strips and diode
  - bias
- **Support PCB**
  - detectors to be bonded
  - good thermal contact & HF properties
  - relatively cheap (~30Eur fully equipped)
  - should stand up to 80°C (for annealing studies)
- **Amplification**
  - commercial solutions (single channel)
  - Alibava (LHCb Beetle, 25ns, 256 channels)

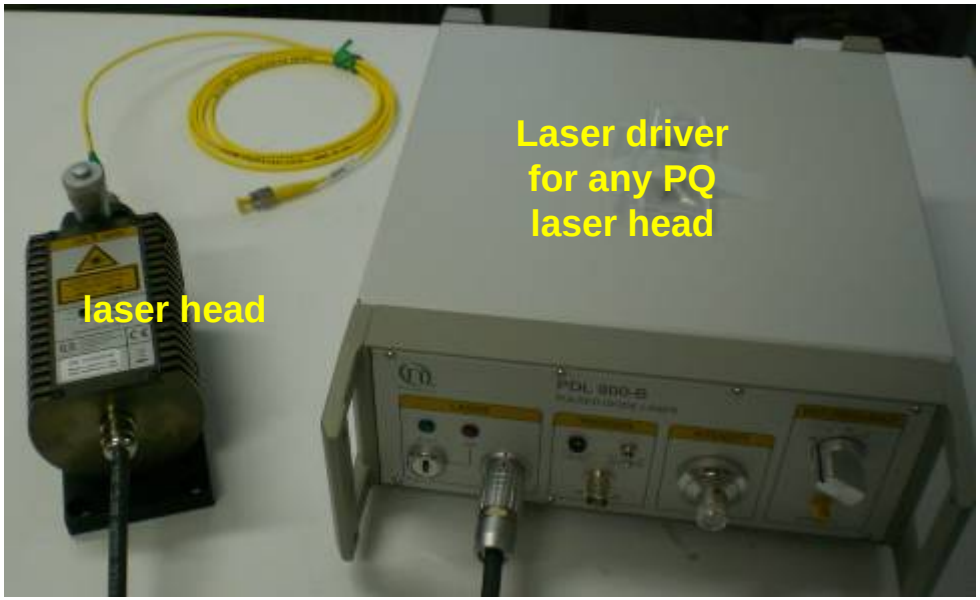
Instrumentation: Setup



Instrumentation: Setup



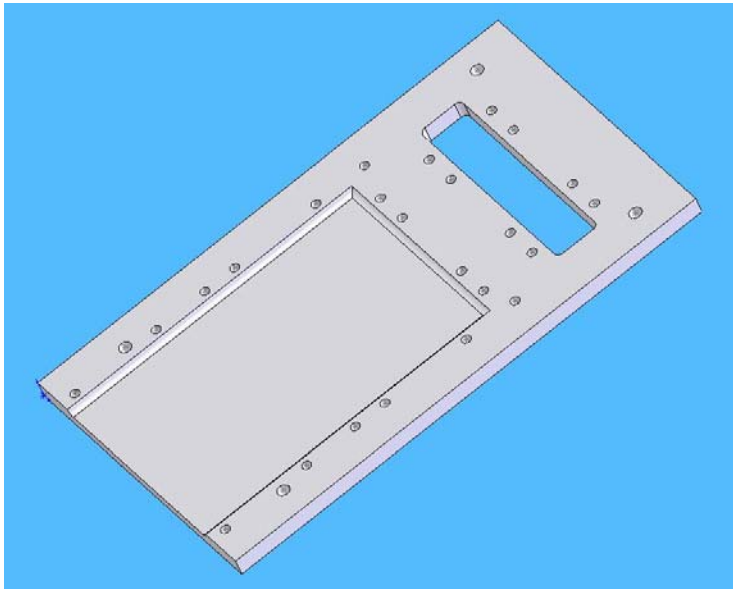
Instrumentation: Laser & Optics



- ps-Laser from PicoQuant
- two heads: 661nm and 1055nm
- low energetic pulses around 10pJ at lasing threshold most interesting
- attenuated by micro screw directly at coupling
- full and closed fiber solution with splitters and shutters
  - no manual intervention to fiber path during measurements
  - allows for reliable and reproducible measurements
- focusing spot ~ 12µm on DUT at working distance of 23mm

Instrumentation: Alibava

- arrived
- in operation
- chuck for usage in cold setup in preparation



Instrumentation: Environment

Huber chiller

- down to -40°C

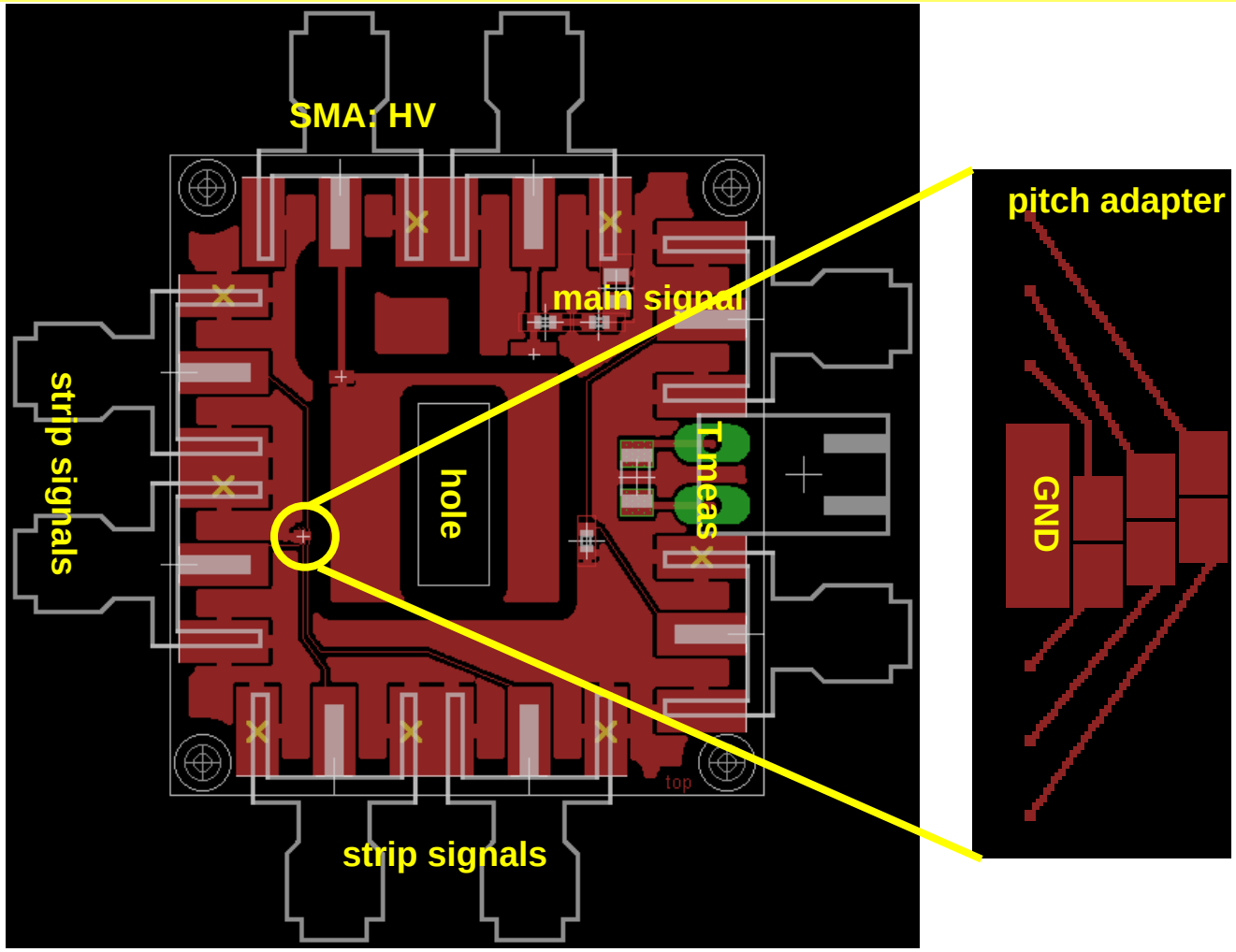
Varian vacuum pump

- down to 0.06 mbar

Agilent 34980A

- multifunctional DAQ & control
- T,H & other analog signals
- low voltage
- clock

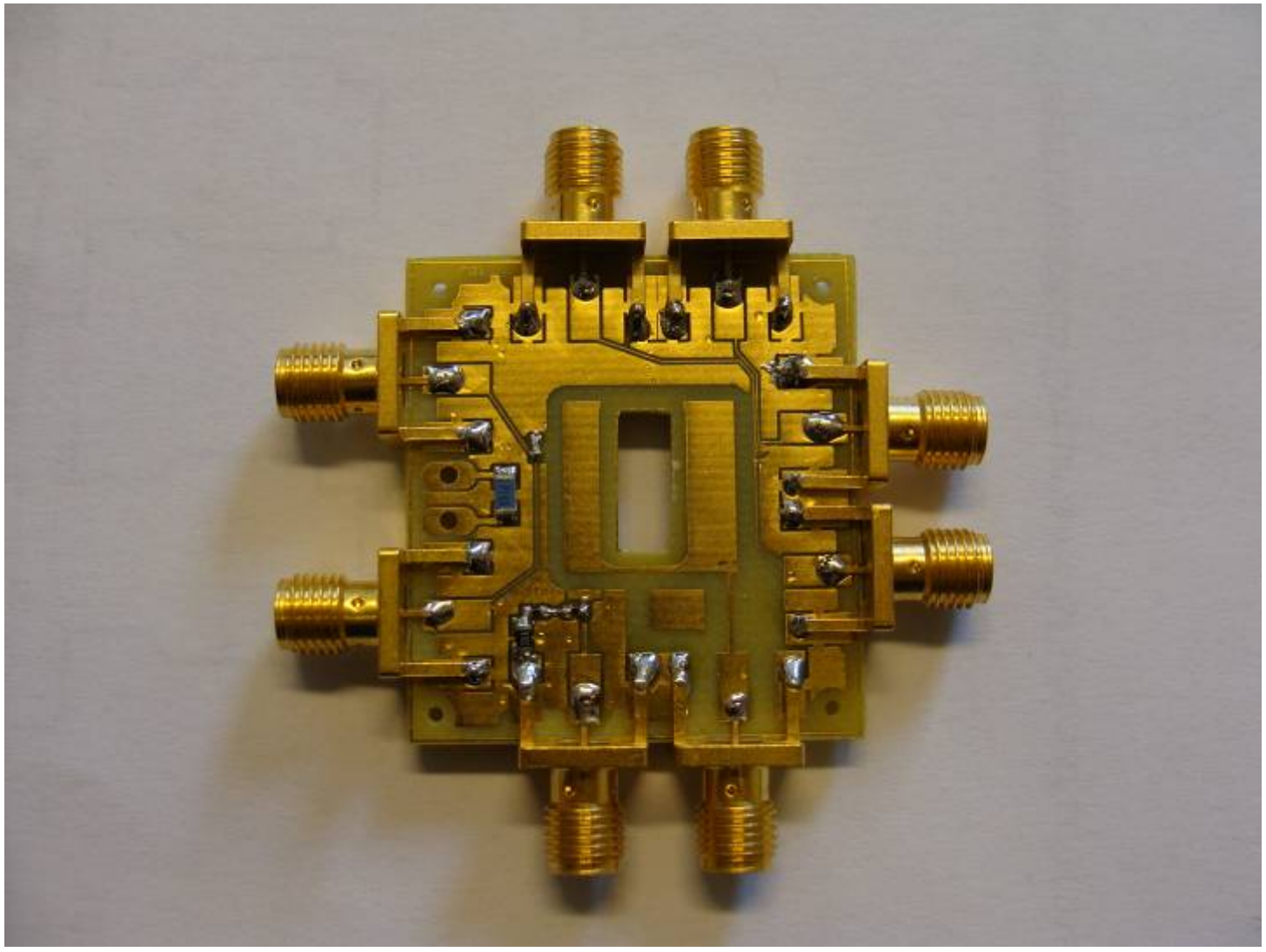
Instrumentation: "Electronics"



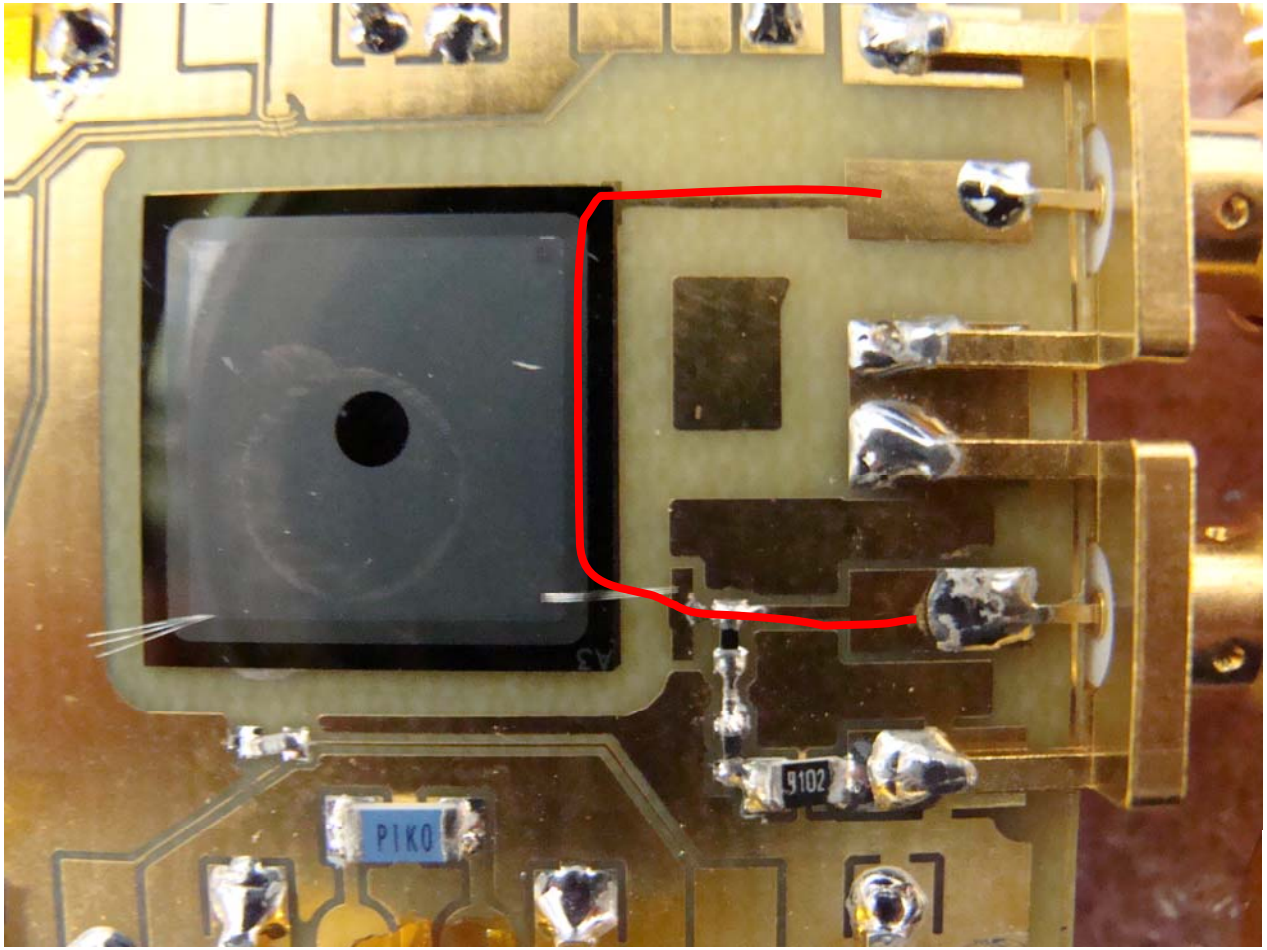
Prototype PCB

- Not yet optimized for HF
- external bias board for filtering and line matching
- thus allows CV measurements as well
- Gold-nickel plated
- Roger's PCB material for HF and good thermal conductivity

Instrumentation: “Electronics”

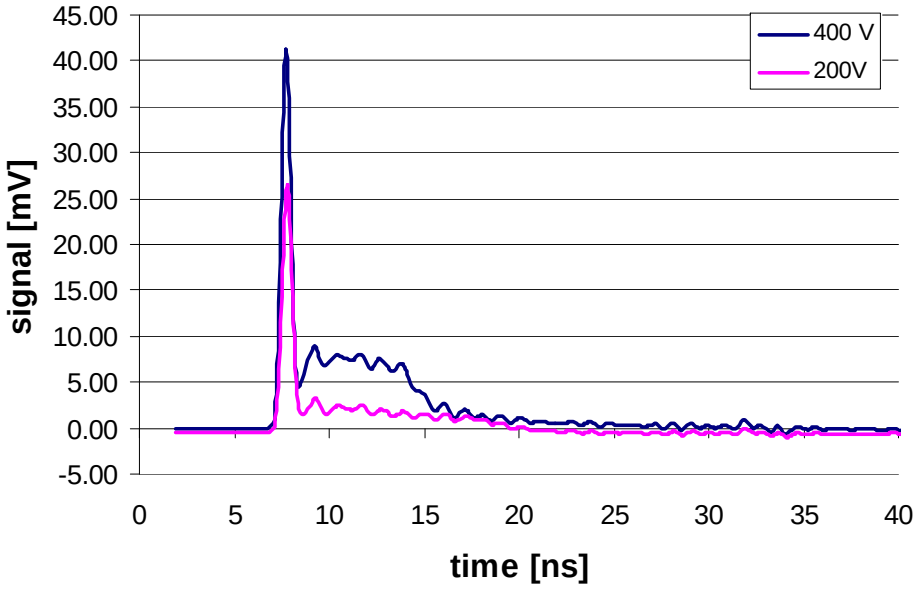


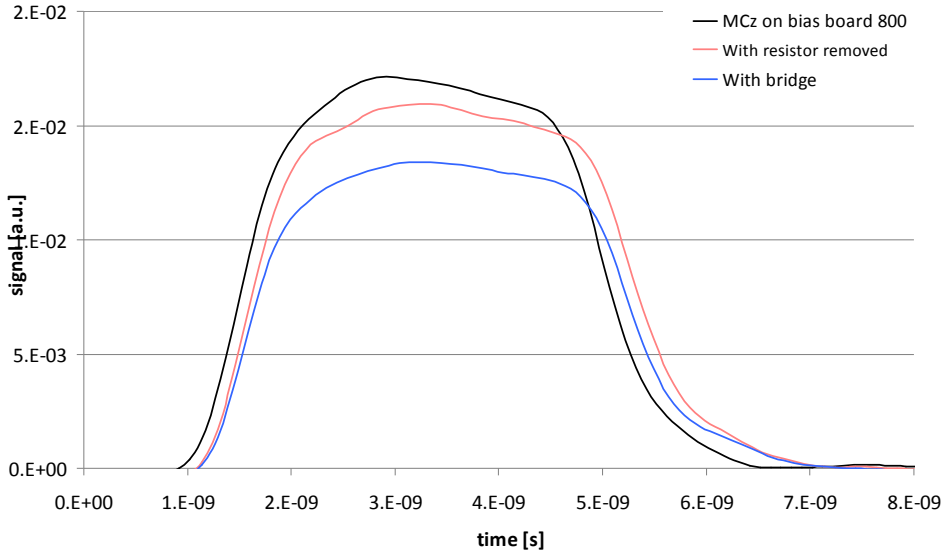
Instrumentation: “Electronics”



- equipped board with bonded detector
- narrow loop in signal path?

First Signals



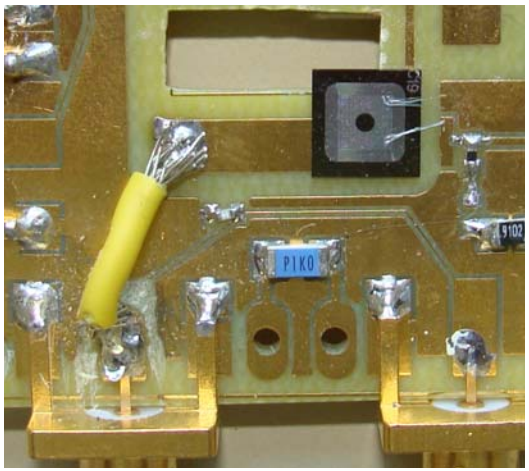


Strip detector

- **strip signal at two voltages**
- **oscillations! (~ 1GHz)**
- **rise time is ~ 0.7ns**
- overall signal observed as well

Diode

- **improvement observed when opening loop**
- **rise time is ~ 0.7ns, as well**



Discussion

Rise Time

- 0.7 ns observed on both strip and diode signals on detectors of 0.5mm x 0.5mm size

→ limit confirmed by other groups (e.g. Hamburg)

- rise time seems to scale proportional to surface (detector capacitance)
- but corresponding resistance of more than 50Ω is not understood yet

→ simple calculation like this correct?

→ SPICE simulation to be done

Oscillations & Reflections

- opening loop reduced oscillation
- avoid narrow and thin lines and sharp curves in new design as well
- line matching does not seem to be such important, since reflections can be moved away

→ but keep this option anyhow

Any other hints?