LMU München - Excellence Cluster Universe

PS & Services

Stefan Rummel

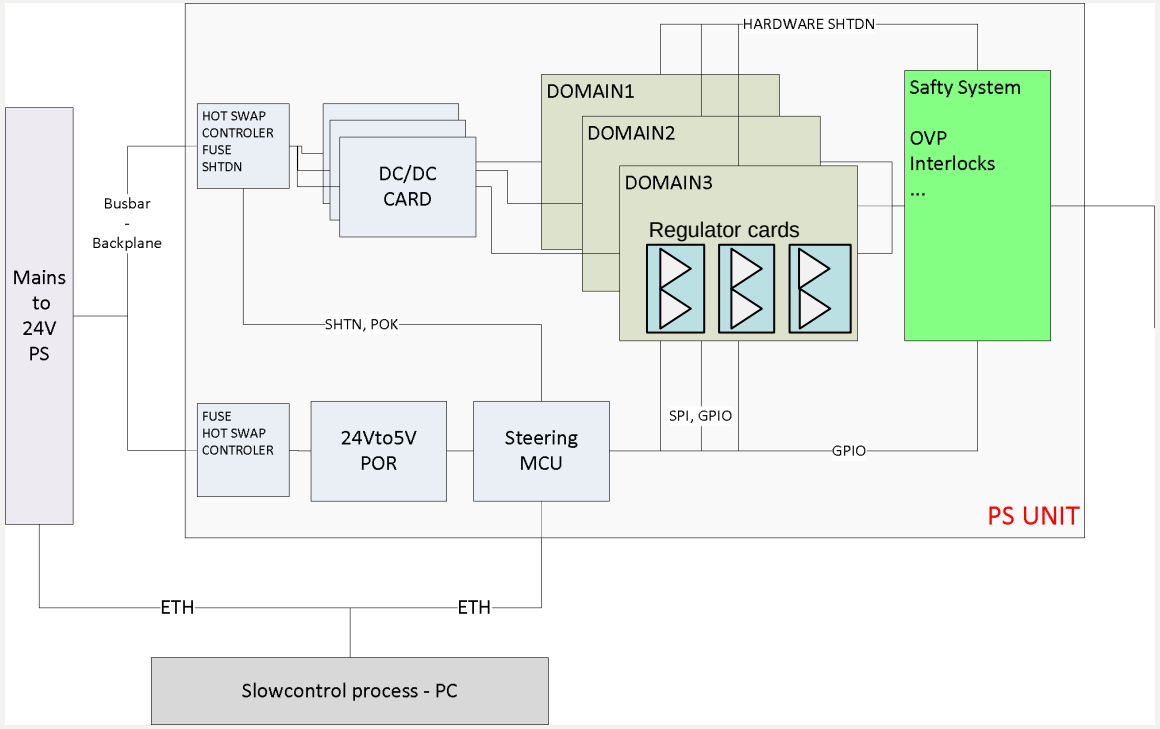
20h International Workshop on DEPFET Detectors and Applications
11.05.16-14.01.16
Seeon

Overview

- Main Production
- Status of Kapton development
- TB experience

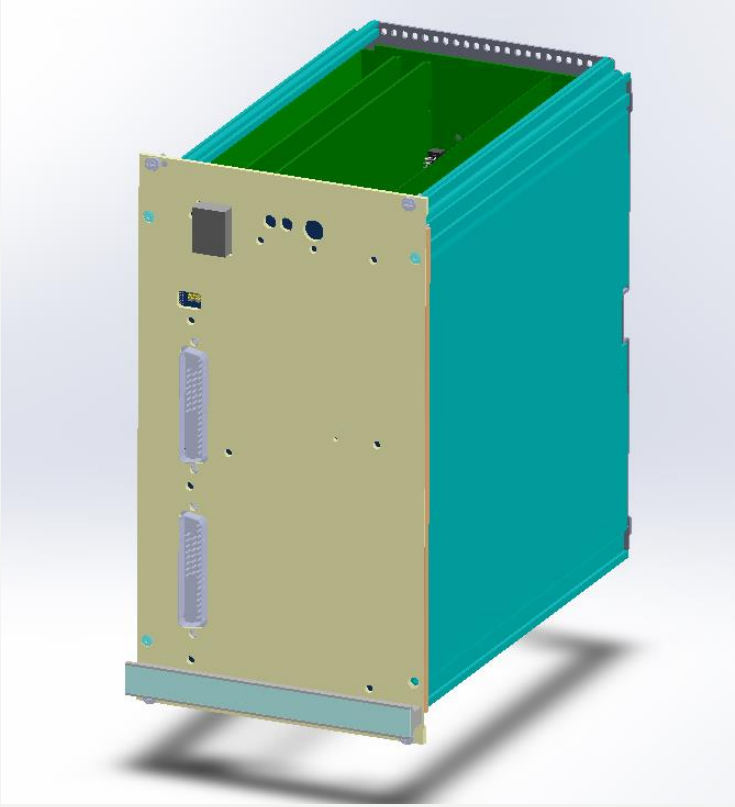
PS Main Production

- PS is a modular design consisting out of 12 different modules
  - MCU-Card Steering
  - 5 flavors of Regulator cards
  - 2 DC/DC converter cards with Step-Down converter
  - OVP card
  - Front- and Back card for interconnections and external interfaces



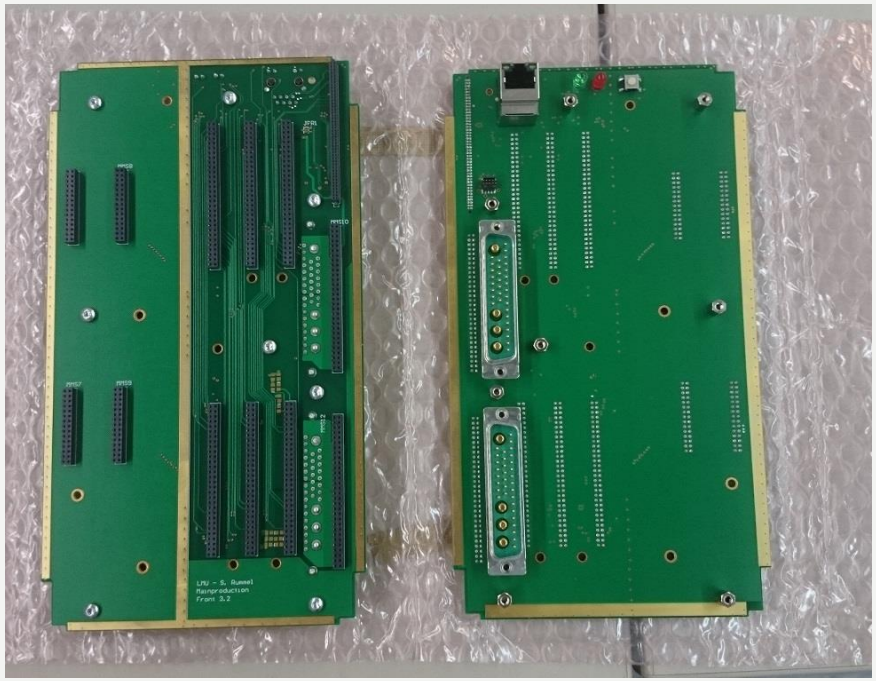
Main production - Cassettes

- Completely available



Main production

- Full batch of Front and Back boards is available
- Boards are fully assembled including spacers



Main production – Regulator cards

Unipolar – Cards:

- PCB design has been finalized
- Relaxed via diameters
- Ratings of all components has been crosschecked
- Passives: High quality, thin film resistors, automotive qualified capacitors
- Base material High Tg FR 4

→ Full set, 140 boards available

Main production – Regulator cards

Bipolar – Cards:

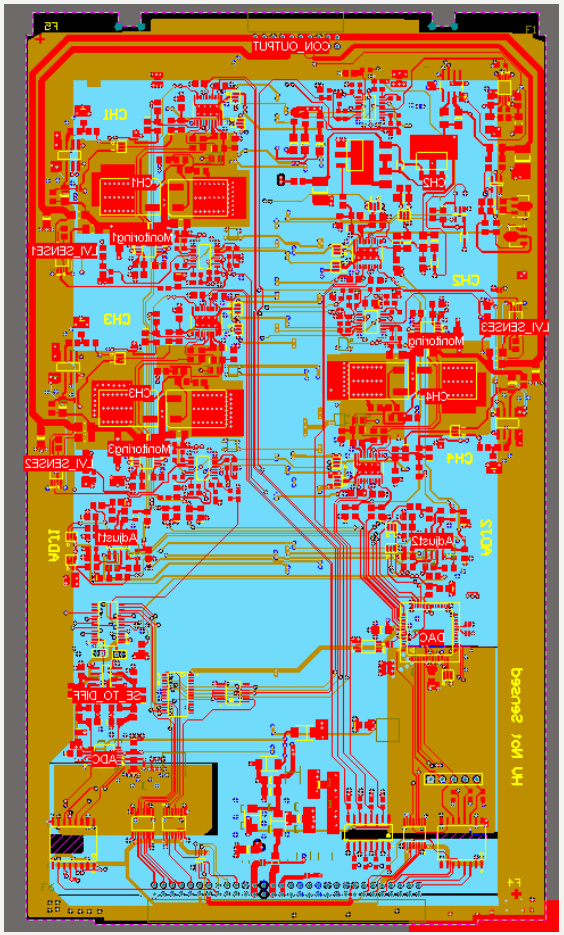
- PCB design has been finalized
- Relaxed via diameters
- Ratings of all components has been crosschecked
- Passives: High quality, thin film resistors, automotive qualified capacitors
- Order is placed

→ 80% delivered end of April
→ First boards tested, flawless behavior

Main production – Regulator cards

HV – Card's & CCG Channels:

- Received new feature request just before Christmas
- Monitoring with 20nA resolution for various channels (CCG's, Bulk, HV, Drift)
- New circuitry for measurement necessary
- Design finished
- First orders placed



Main production – DC/DC converter cards

- PCB design has been finalized
- Additional feature:
  - Voltage supervisor as additional safety measure
  - Failure at DC/DC converter level can be mitigated before it has impact on output voltages
- First batch available
- First set successfully operated

Main production – MCU Card

- Bugs from previous designs fixed
  - MCU watchdog
  - Various smaller issues which where fixed with wires
- Design finished, PCB's available
- First batch of 20 ready

OVP - Krakow

- 50 boards available
- Rework of boards successfully

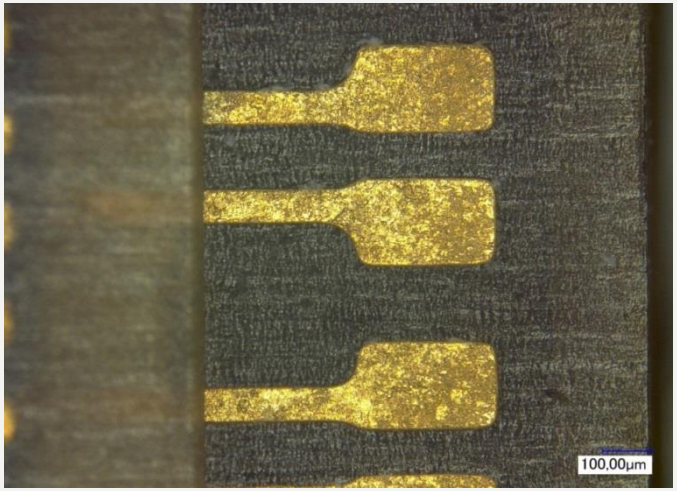
→ Boards will be available soon

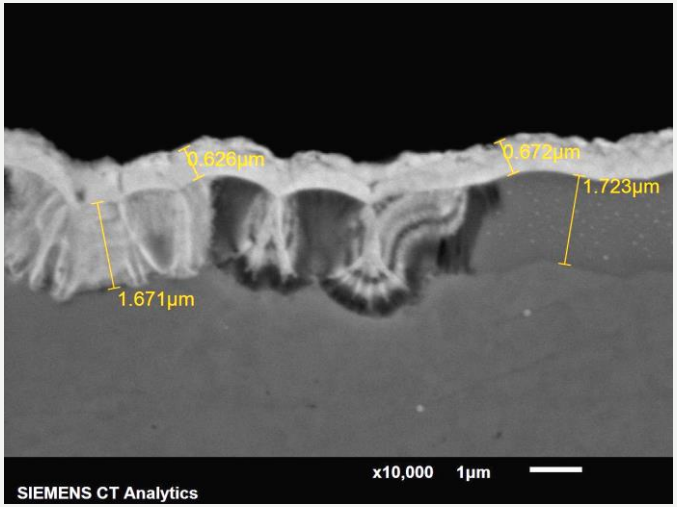
Services

Kapton – Taiyo prototypes

Reminder:

- Taiyo Kaptons showed some issue with surface quality
  - New layer specifications slightly better
- Bond strength acceptable
  - Underlying issue rigidity of layer stackup
- Cost of productions exploded for the last production
- Looking for second vendor



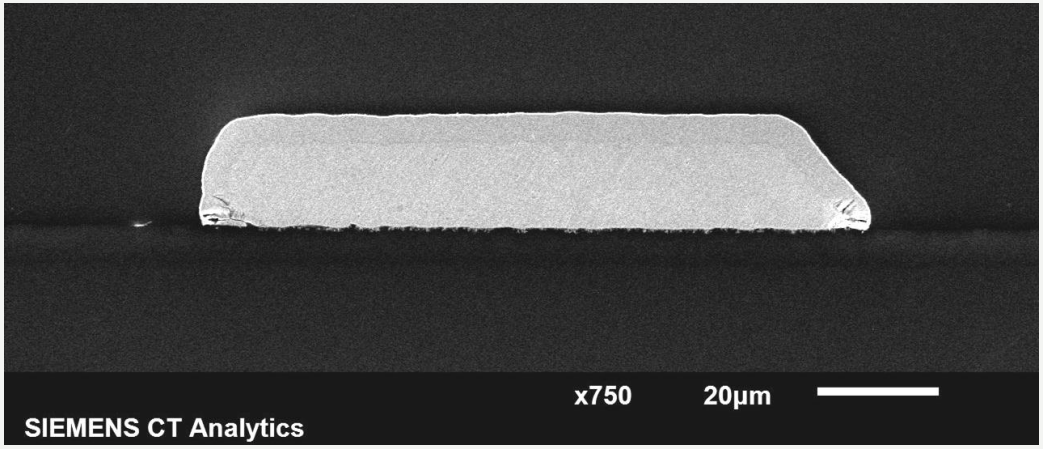


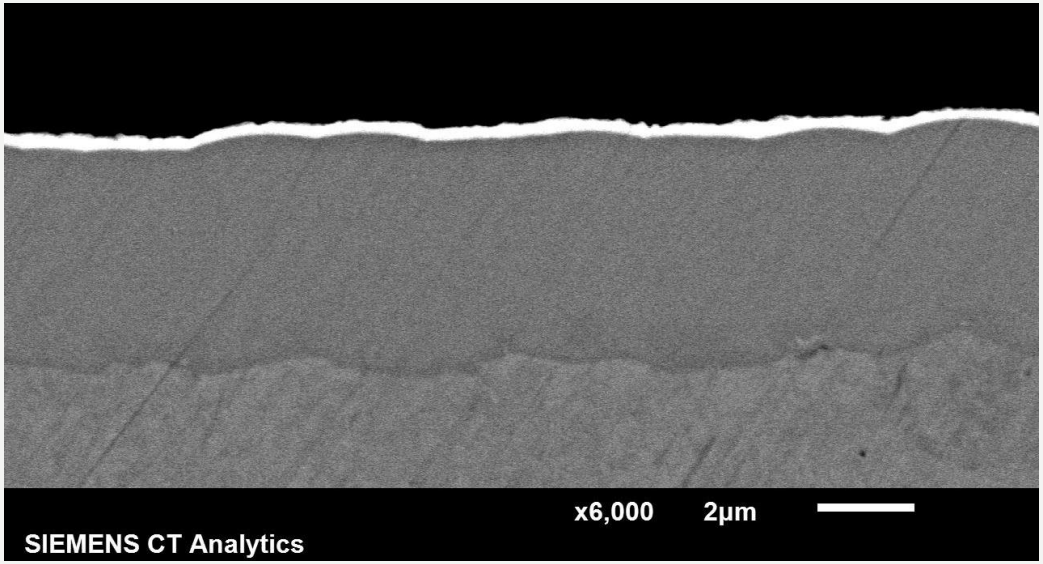
Kapton – Kaupke

- Kaupke a service provider was able to establish a new contact to “MOS Electronic”
  - Located south Germany
  - First face to face meeting mid April

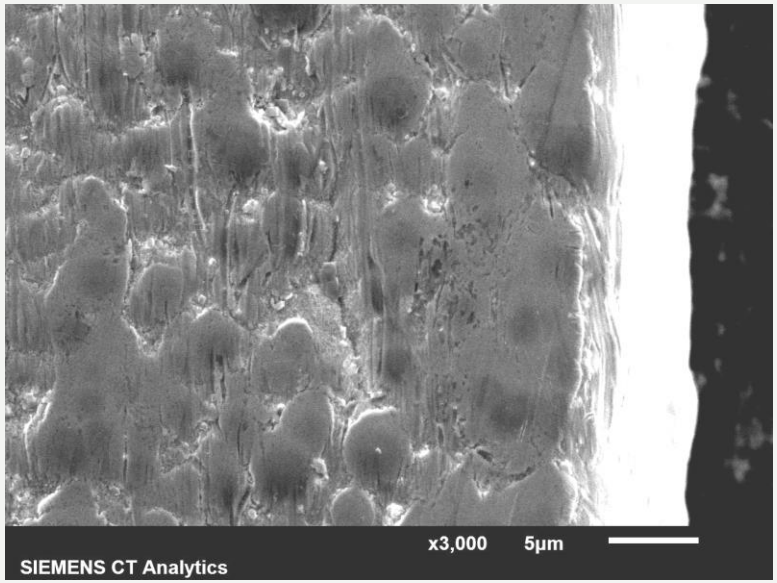
- First Prototype L1Bwd available
  - Surface quality significantly improved
  - Bond stregth noticeably improved
  - Some minor issue with underetching on the edges of the pads
  - Bending successfully tested
  - TDR under way

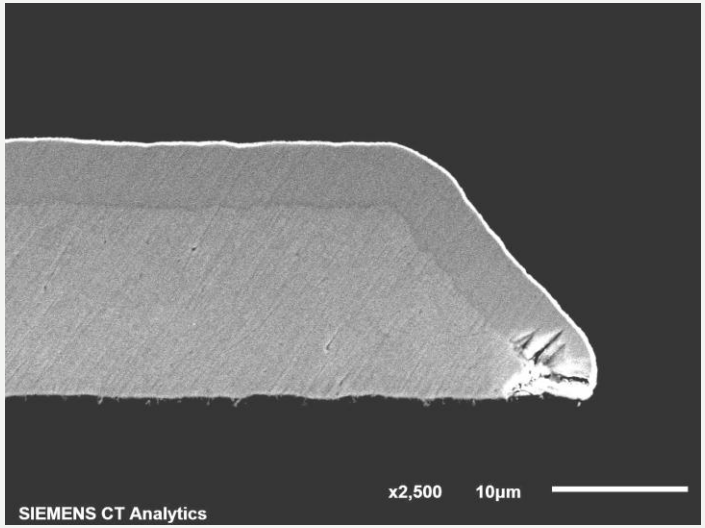
Kapton – Kaupke prototypes



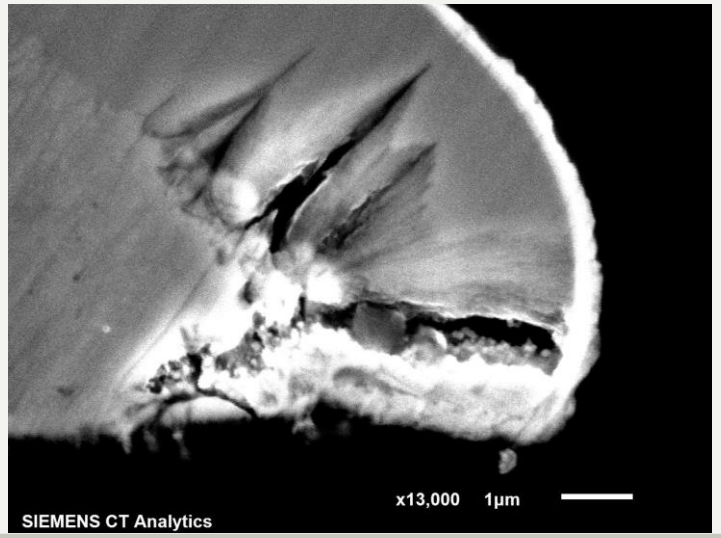


Kapton – Kaupke prototype





Results: [Siemens CT]
Die Pads haben unten an der Seite Bruchzonen, deren Ursache wohl eine starke (ca. 10 µm) Unterschneidung des Kupfers ist. Das NiP weist in dieser Unterschneidung Hohlräume auf und ist lokal oxydiert. **Davon abgesehen wurden keine Fehler gefunden**, die Goldschicht ist 150 – 200 nm stark.



Kapton – Next Steps

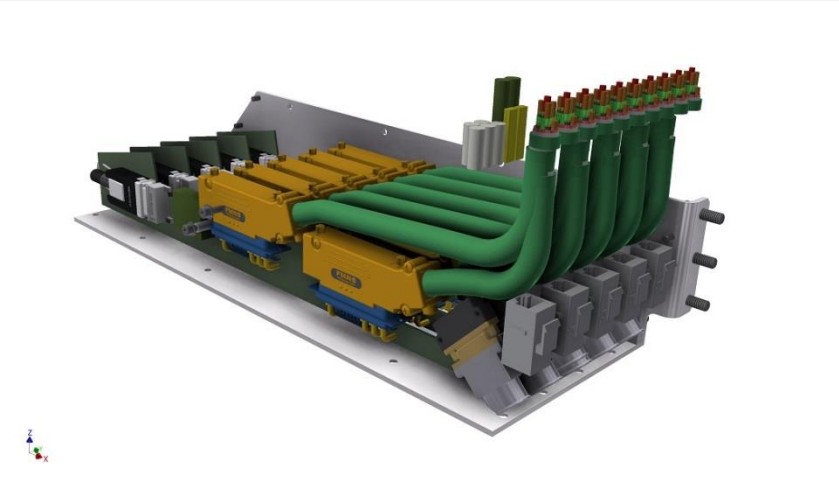
- Kaupke Flex superior in terms of
  - Bond strength
  - Surface quality
  - Price

- Communication easy and direct

→ MPI ordered 4 x 5 sets, this should satisfy our initial need for module production

Dock Box

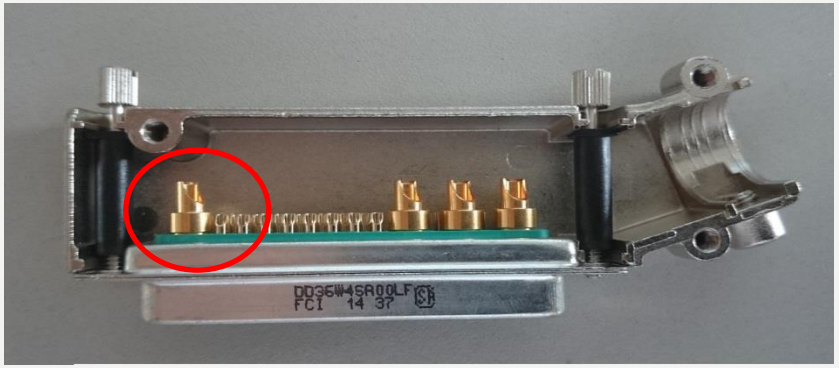
- TB decided to go for optical transmission in February
- Significant impact on Dock-Box design:
  - Transmitter
  - Powering
  - Handling of remaining signals
- Proposal from TU to use Displayport cable
  - Can house all non data steering signals
  - Pins for power available
- Last minute change just before we have to raise new money from BMBF

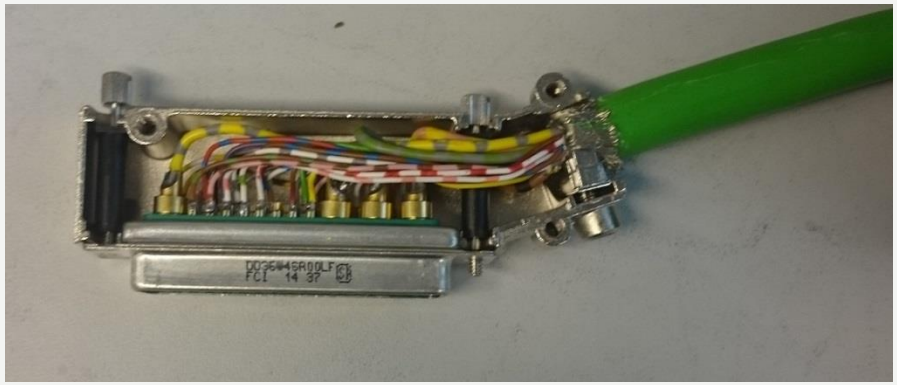


Power Cable

- *Prototype is successfully used in most test setups using the LMU-PS*
- Investigation within the grounding project showed promising results
- Prototype with final connectors has been produced

→ *Ready to start procurement of power cables*





Test Beam Experience

We went into the TB with high confidence – many setups showed stable operation for weeks and month

However we faced issues with:

- Power cables tailored with subpar quality
  - 3 pairs were faced with shorts or close to shorts
- “Glenaircable” (Dock-Box to PP connection) with radiation hard wire
  - Used for the first time – people where reluctant to use it
  - Aim for complete isolation including the solder joint using transparent shrink tubing
- Looking for vendor with more experience and better QC
  - E-Test of each cable
  - Asked our power cable manufacture for quotation

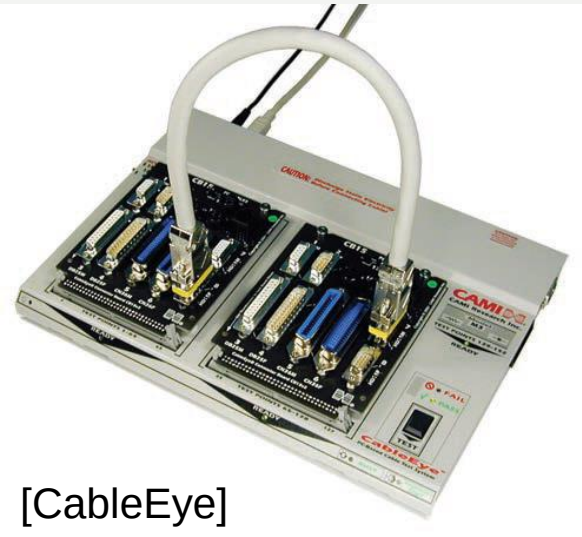
Test beam Experience

- Reliability of PS Operation
  - Esp. Unit 3 showed issue with execution of commands
  - After power down / power up voltages were still on
- Lab investigation was able to reproduce a subset of issues
  - Fixed after installing a set of missing pull up resistors
- First enhanced test done with of Unit 15
  - Moderate timing
  - 10k write-compare cycles

  → worked flawless
- Aim for increased stress while testing
  - Higher command frequency
  - More units in system

Cable Quality Control

- Possibility to check cables/services (PP) after handling, installation
- Check for open, short, resistance
- Test cases:
  - PP : Samtec - MicroDSub, RJ45, Infiniband
  - Power cables
- Considering two solutions:
  - “Modular” – NI Switchcards + SMU + Glue Boards
  - “Dedicated” Cable Tester + Glue Boards
    - Inc. Software for operation
    - Report generation
- Funding available from LMU


[CableEye]

Summary

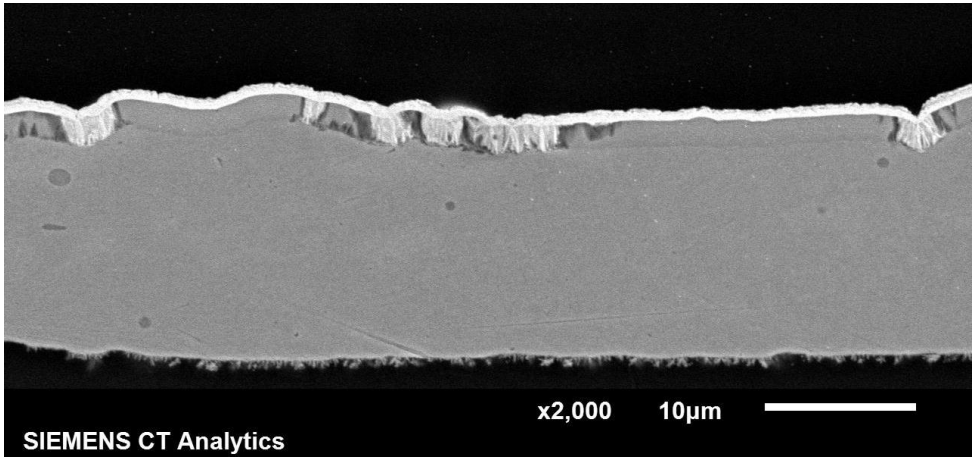
- Main production all cards available except those with last minute changes
  - Step Down converter available
  - Front- and Back Board available
  - Unipolar Regulator available
  - OVP is available, rework ongoing
  - MCU-Card , first batch available
  - Bipolar cards, available
  - HV, CCG ordered
- New vendor for Kapton identified a set of 20 Kaptons ordered
- Improving QC of services

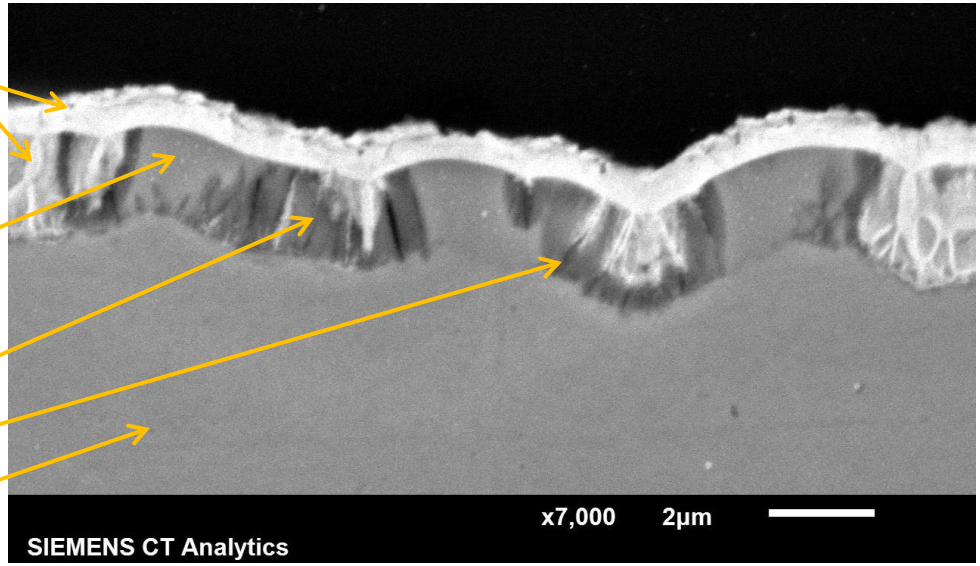
Backup

SIEMENS

Taiyo, Querschnitt

Die NiP-Schicht weist sehr viele Fehlstellen auf mit Spalten und Oxid. Bei der Abscheidung von Gold ist Au dort eingedrungen (helle Strahlen). Das Oxid hat sich stellenweise ins Kupfer hineingefressen.



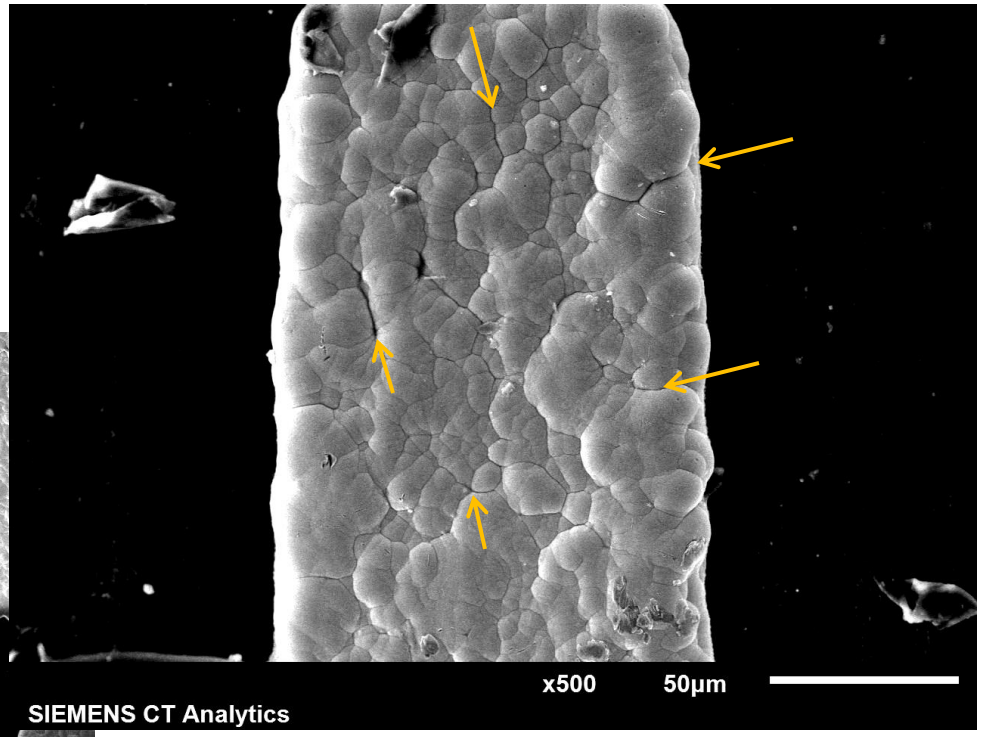


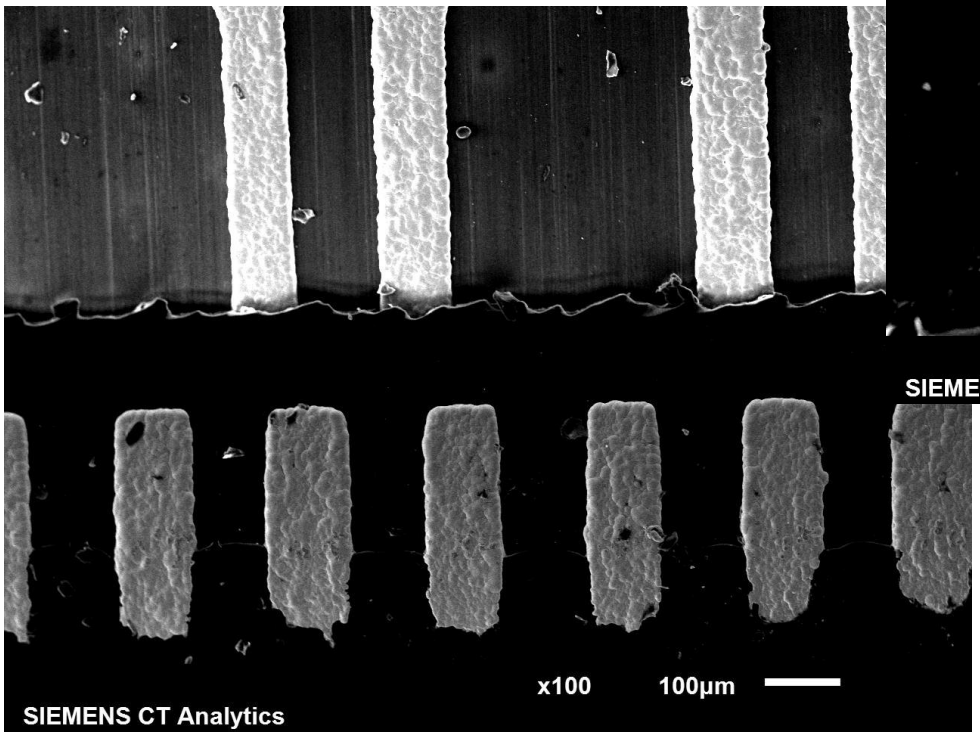
Die Skalierungsbalken in den Bildern sind für exakte Messungen ungeeignet

SIEMENS

Taiyo, Oberfläche

Die Goldoberfläche zeigt Spalte (Pfeile).





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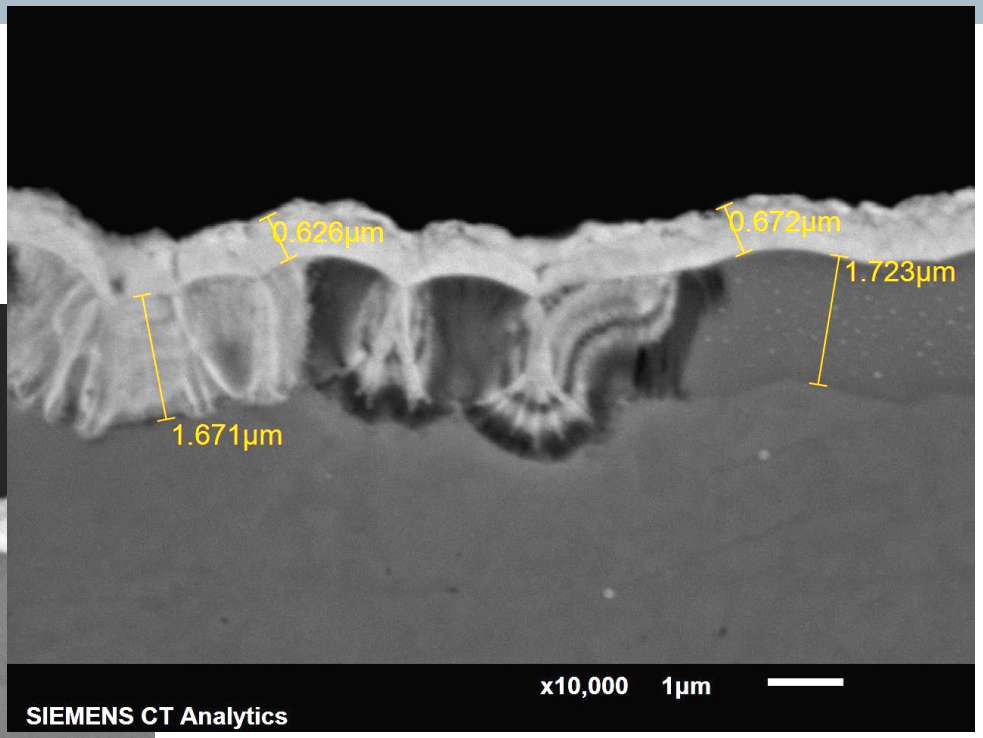
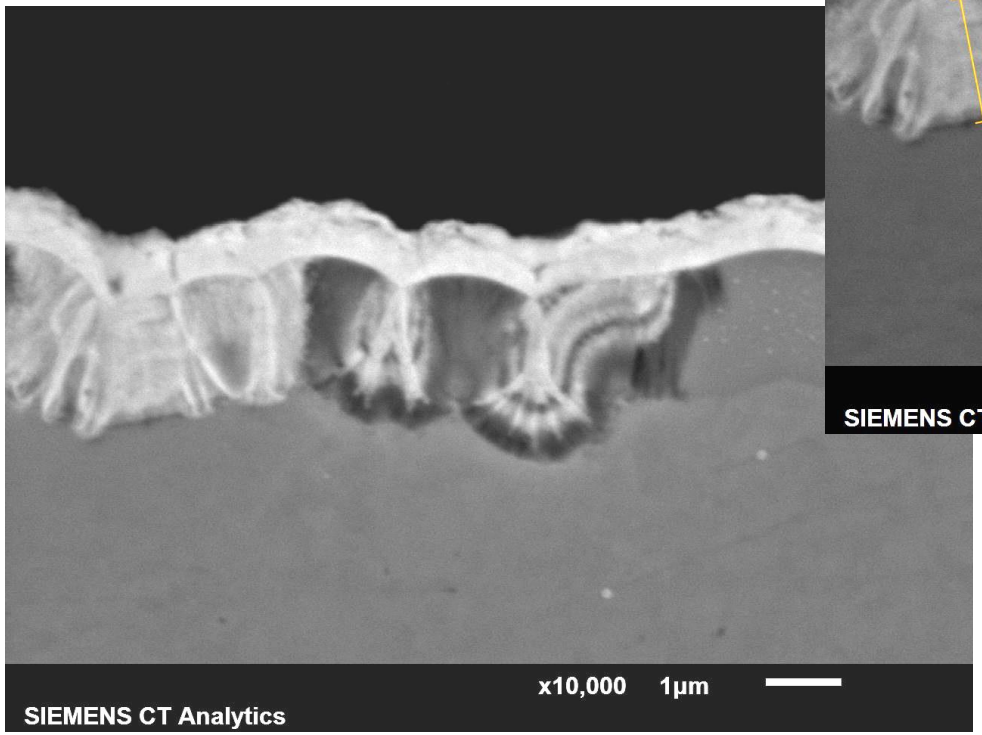
SIEMENS

Taiyo, Querschnitt

Die Goldschicht ist gut 600 nm stark, die NiP-Barriere 1.67 bis 1.73 µm, die Dicke schwankt auffallend.





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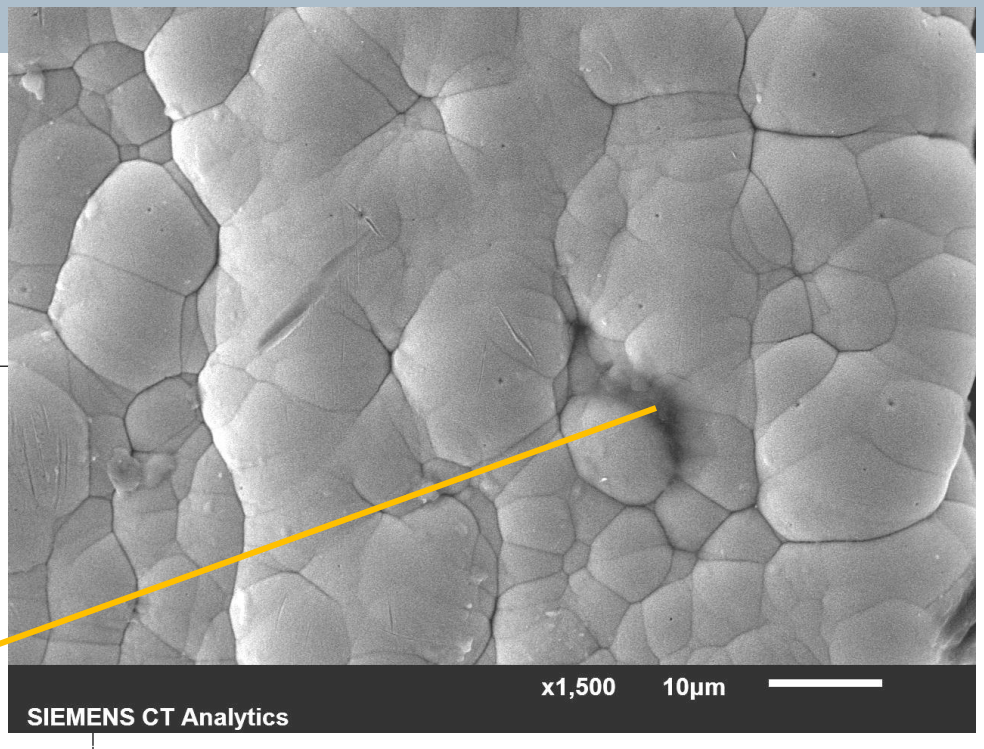
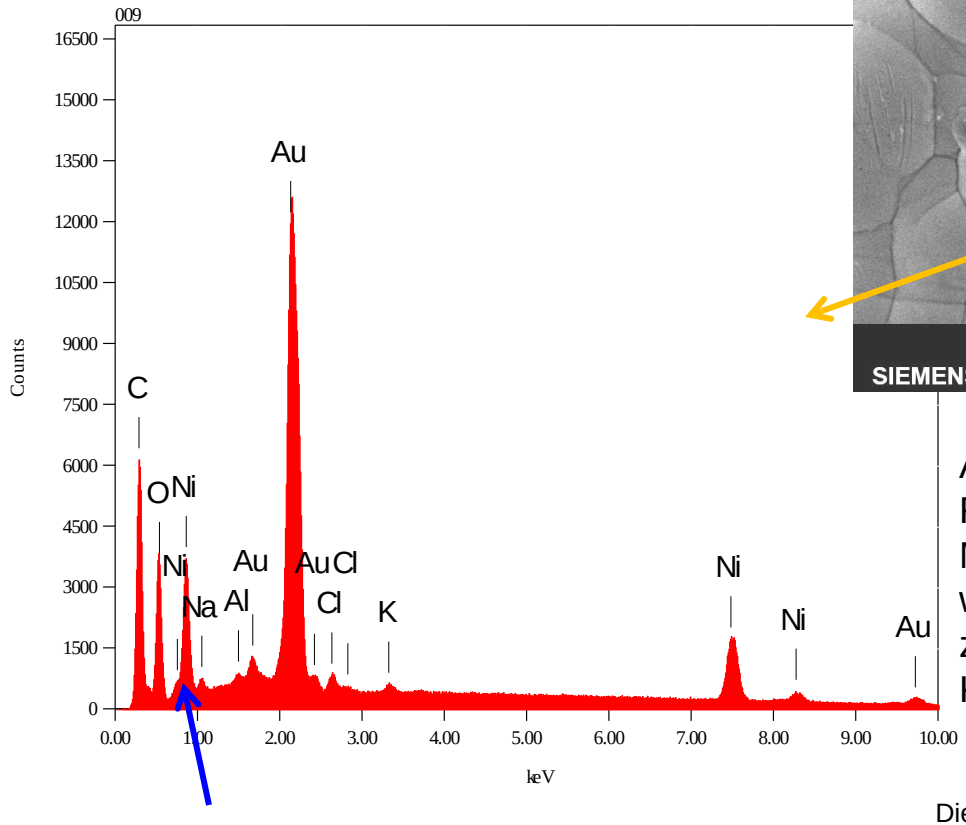
SIEMENS

Taiyo, Oberfläche, EDX

EDX-Analyse von einem Fleck auf der Oberfläche. Der Fleck liegt in einer Mulde, ist also nicht aufgeschmiert, das Material ist wohl aus einem Spalt ausgetreten.

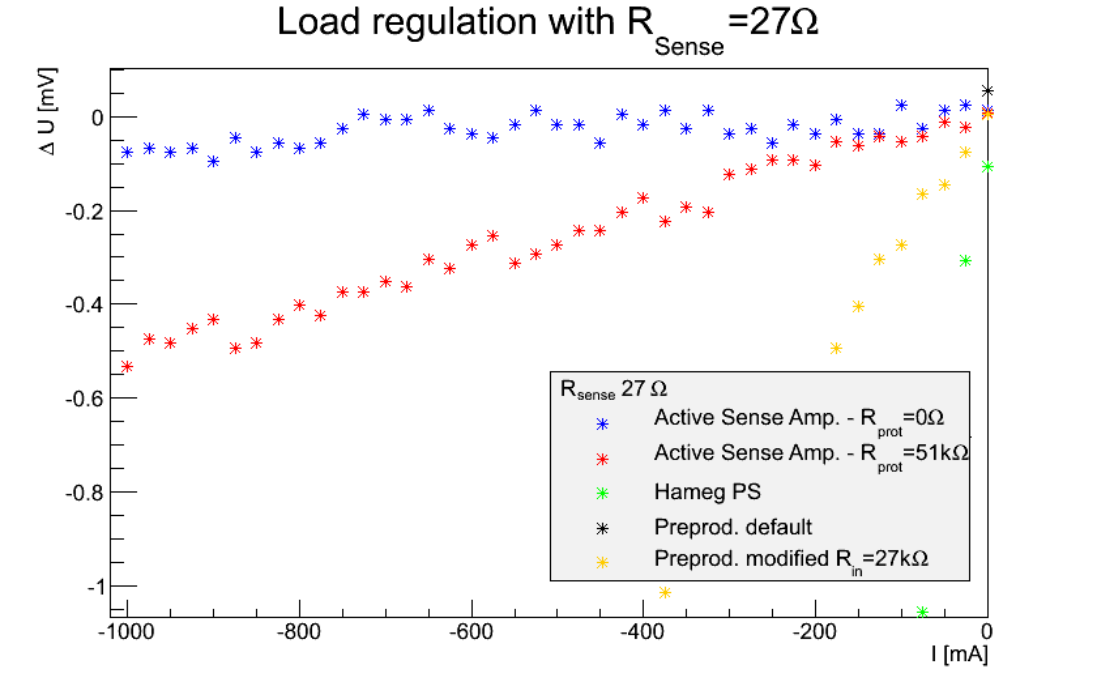




Auffallend ist die hohe Konzentration an C, der Fleck besteht im Wesentlichen aus organischem Material. Ni liegt ebenfalls an der Oberfläche, das weiche Ni-L Signal (blauer Pfeil) wäre sonst nicht zu beobachten gewesen. Die Elemente Na, Cl und K stammen von Fingerabdrücken.

Die Skalierungsbalken in den Bildern sind für exakte Messungen ungeeignet

Load regulation



- Preproduction in modified configuration significantly improves output DC impedance to 2.5mW significantly better than commercial unit
- Baseline for main production: Active sense amplifier with 51k protection resistor