

LMU München - Excellence Cluster Universe

## PS & Services

**Stefan Rummel**

**9<sup>h</sup> Belle II VXD Workshop**

**13.01.16-15.01.16**

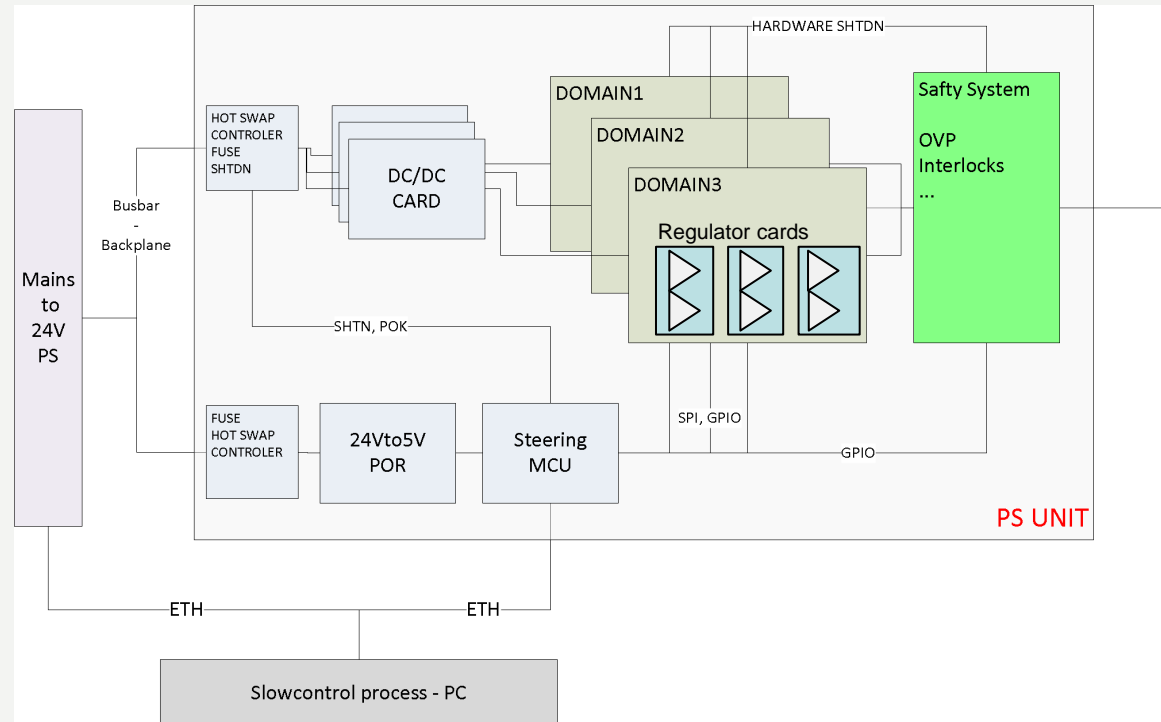
**Valencia**





- Main production
- Status of Kapton development
- Status of Cables

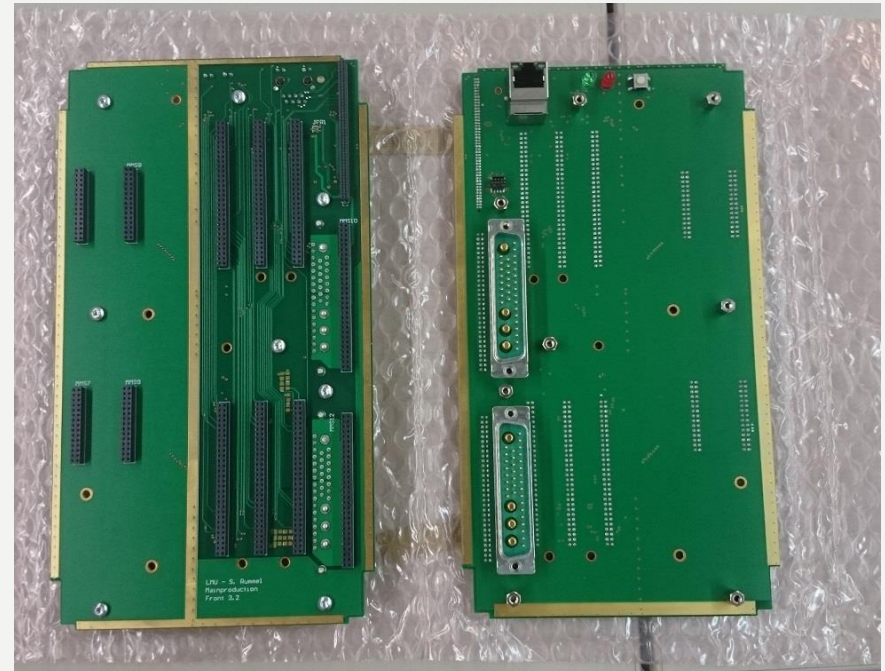
- PS is a modular design consisting out of 12 different modules
  - MCU-card Steering
  - 5 flavors of regulator cards
  - 2 DC/DC converter cards with Step-Down converter
  - OVP card
  - Front- and Back card for interconnections and external interfaces



- Mechanics of cassette has been optimized
- Full batch of 70 has been ordered
- 20 arrived



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



# Main Production – Stepdown converter



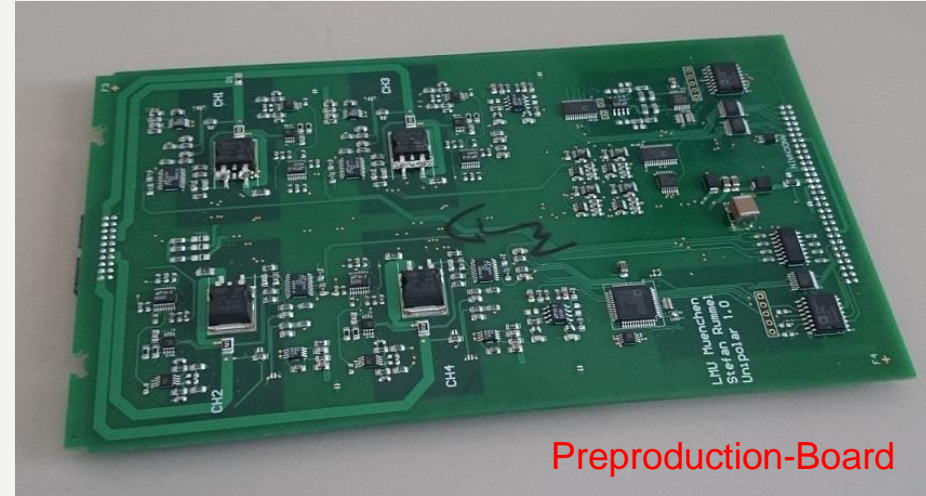
- Full batch has been produced
- Random samples have been tested without any issues
- Peak to peak noise has been reduced from 20mV to 3mV
- Test board for QA available



## 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

→ Delivery expected within January



## Bipolar – Cards:

- Reminder: 4 quadrant operation
- 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

→ Delivery expected within February



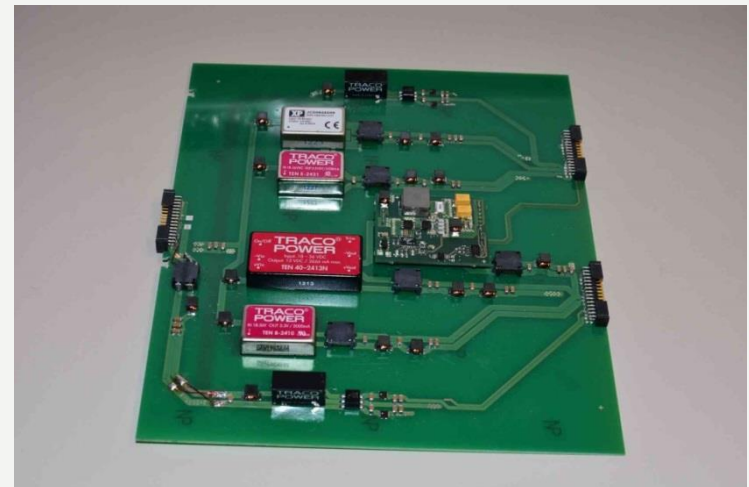
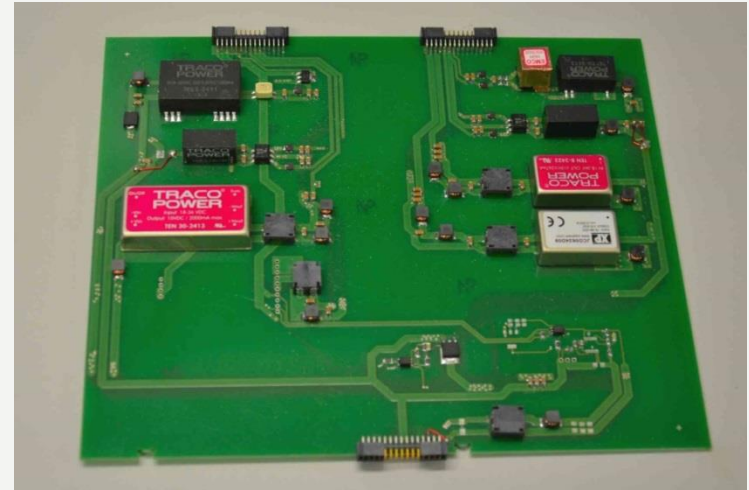




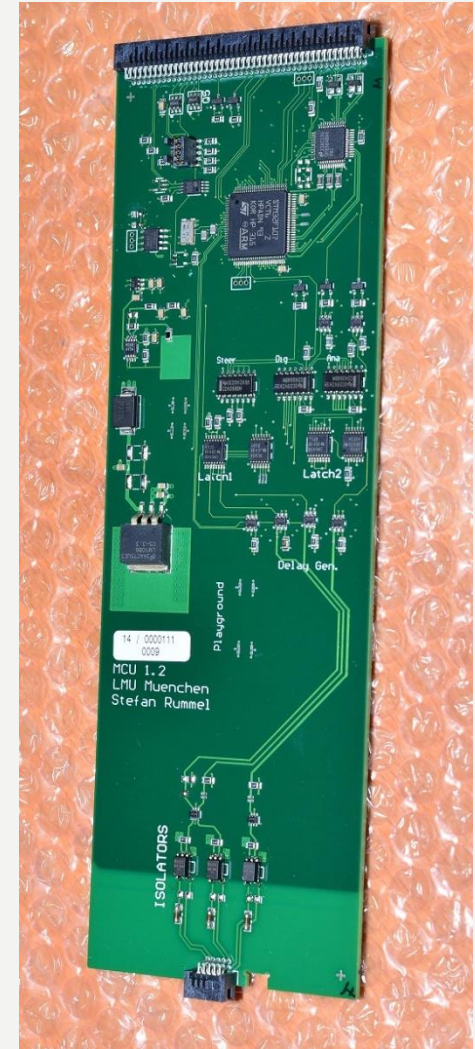
## HV – Card's & CCG Channels:

- Received new feature request just before Christmas
- Monitoring with 20nA resolution for various channels (CCG's, Bulk, HV, Drift)
- Challenge: Measurement of small voltages with high common mode
  - New circuitry for measurement necessary
  - Old circuitry stays there 'dual gain' .1mA / 20nA resolution
- 2 regulator cards affected – additional design variant
- Design is ongoing, 1 additional week required to finish the design

- 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
- Design is in good shape, preparation of production ongoing
  - Quotations requested
  - Order can be placed soon



- Bugs from previous designs fixed
  - MCU watchdog
  - Various smaller issues which were fixed with wires
- Possibility for remote controlled reset
- Design finished, first PCB's arrived
- First batch of 20 ordered



## OVP - Over Voltage Protection status



**50 Over Voltage Protection boards are ready for hardware tests after assembly.**



## Status of the Over Protection Module



- ❑ 50 Over Voltage Protection were assembled in September 2015
- ❑ Tests have shown that Xilinx (XC95144XL) are properly programmed but outputs stay in high impedance permanently
- ❑ Optocouplers ACPL-061L and ACPL-064L are not exactly what was ordered !
- ❑ Both components (Xilinx and optocouplers) must be replaced !
- ❑ Our dealer replaced faulty components
- ❑ Using Infrared Welding System we start replacing components
- ❑ One OVP board should be ready soon !



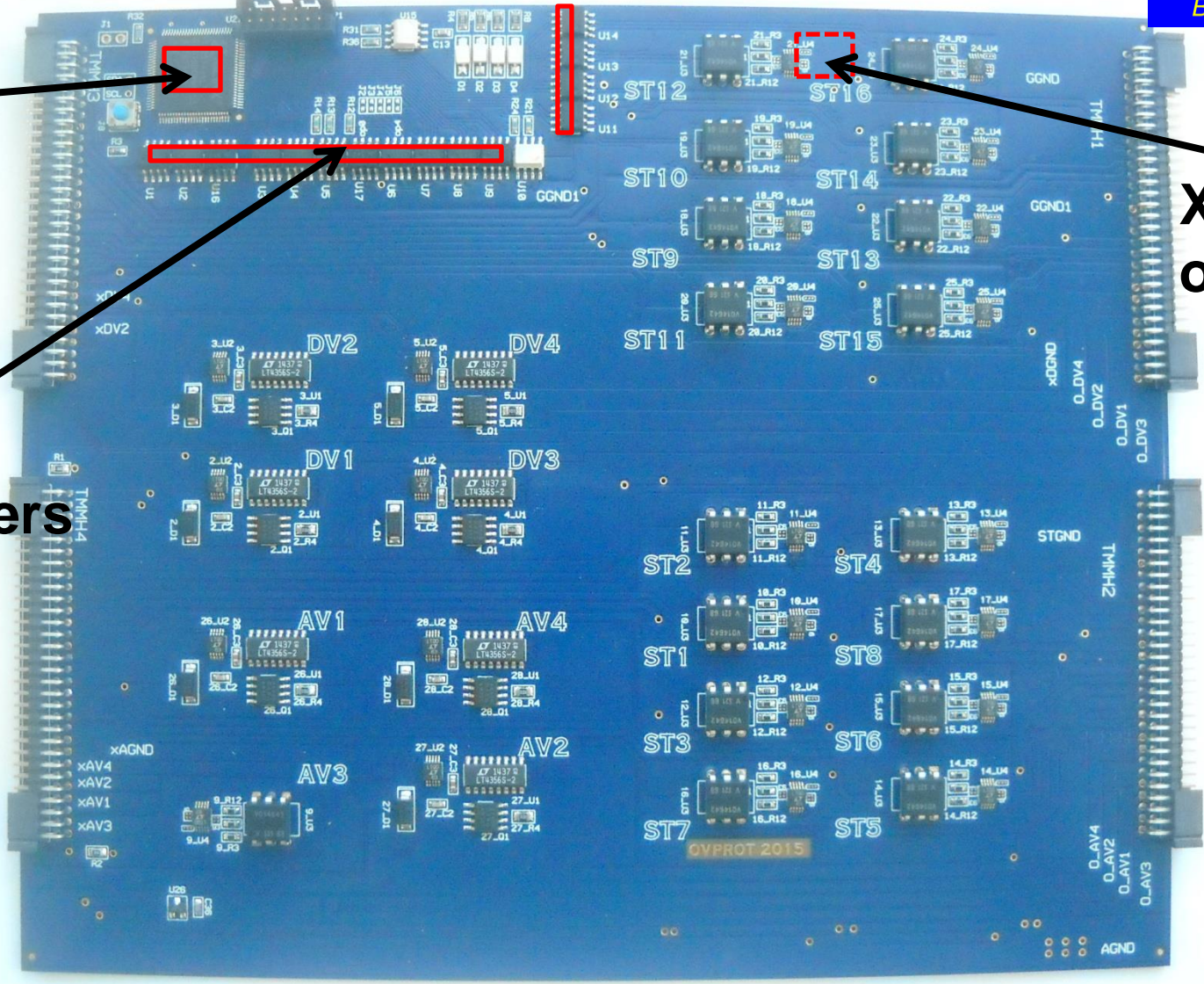
# components to be replaced



Xilinx



optocouplers



Xilinx  
on rear

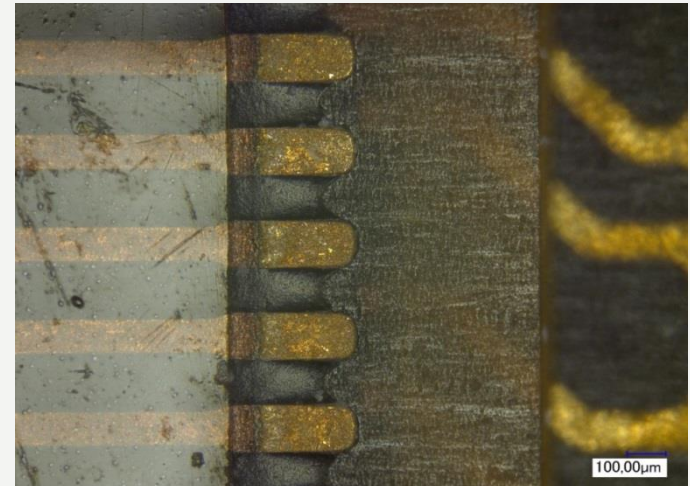
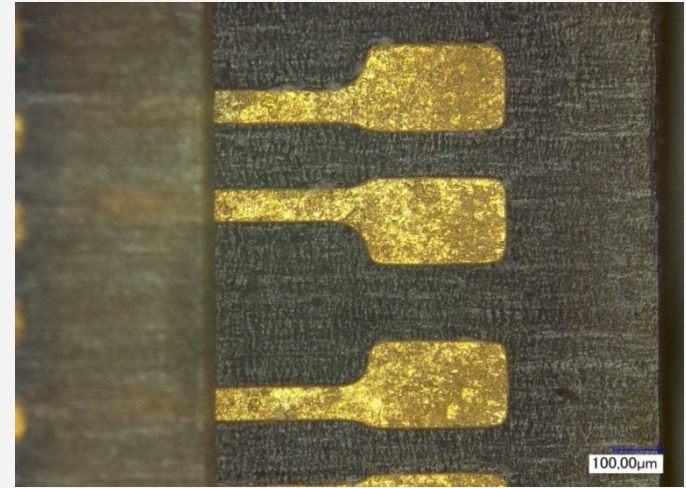
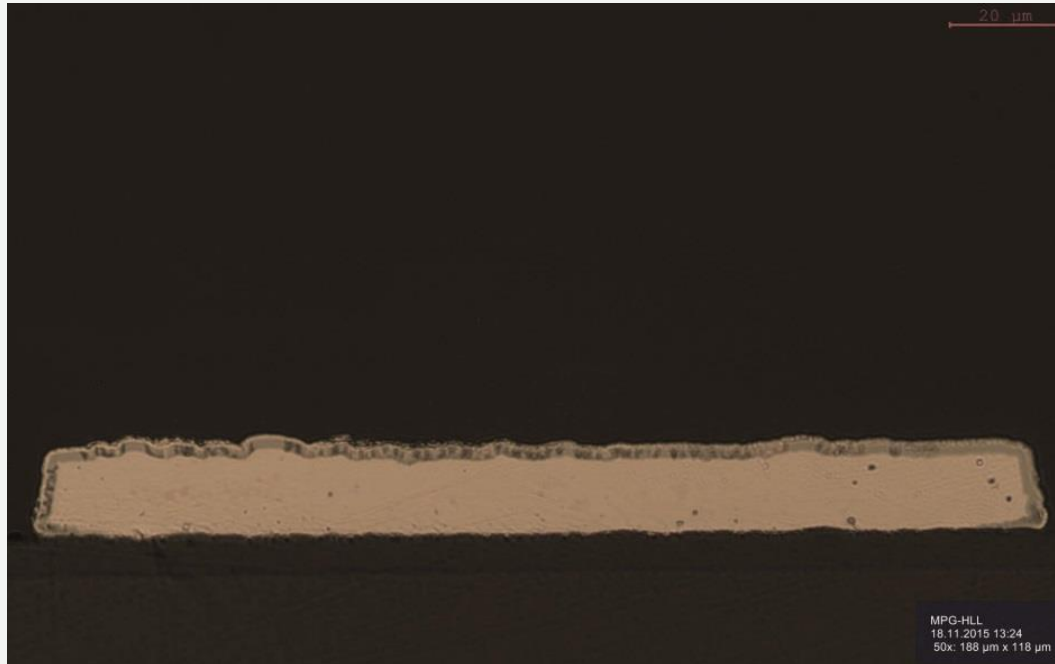
# Services

- First assembly of L2Bwd Kapton and Pilotrun module has been performed
  - MPI technicians found a significant reduction in pull strength on this batch
  - To establish a connection pressure while bonding has been significantly increased
  - On one pad they failed to place a bond
  - Compared to the IV-Schaltungen Kaptons pads the Taiyo Kaptons look brownish and dull
- Surface quality of the Kaptons not satisfactory
- Further investigations done at HLL and Siemens CT





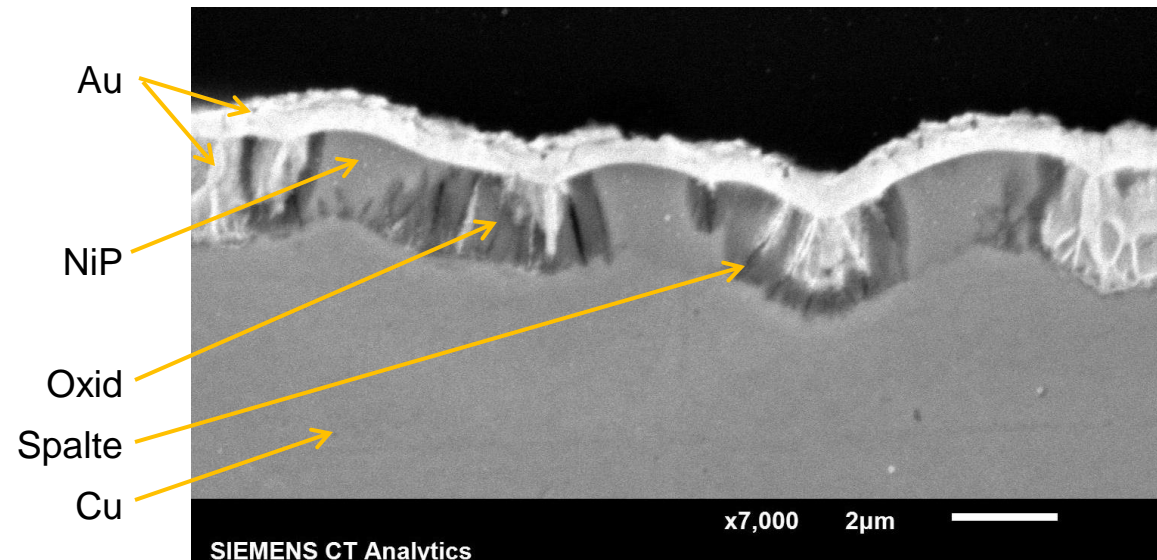
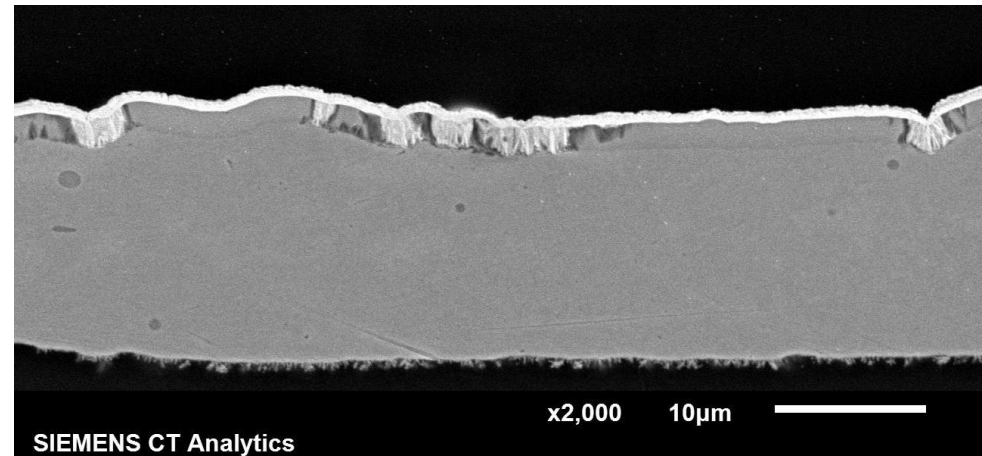
- Inhomogeneous gold surface
- Brownish cast
- Slice shows defects of Ni-Layer



## 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.

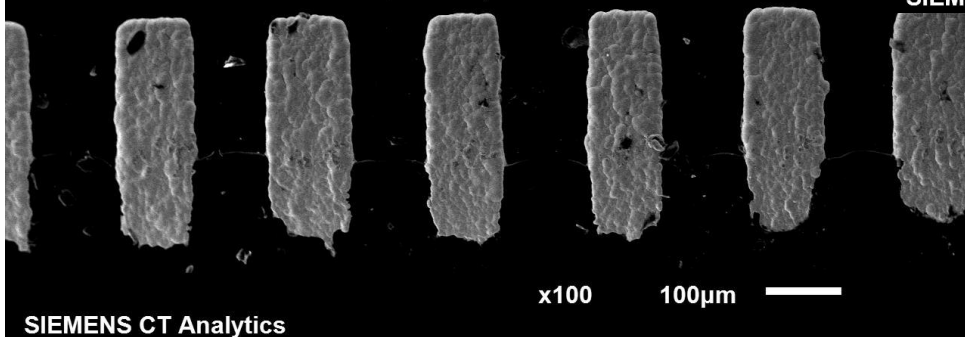
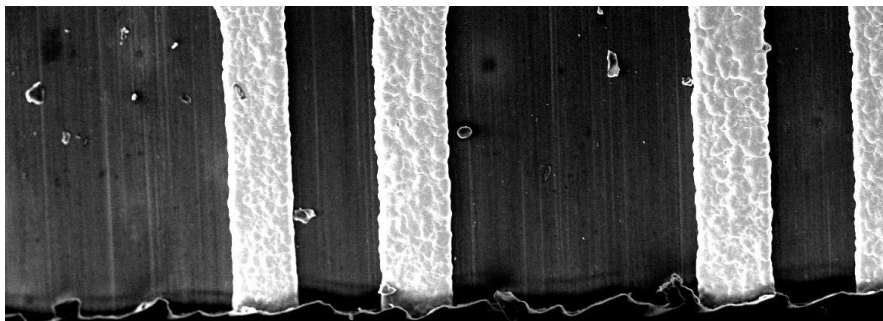
NiP layers shows voids and gaps filled with oxide, Gold penetrated into the Ni Layer



# Taiyo, Oberfläche

Die Goldoberfläche zeigt Spalte (Pfeile).

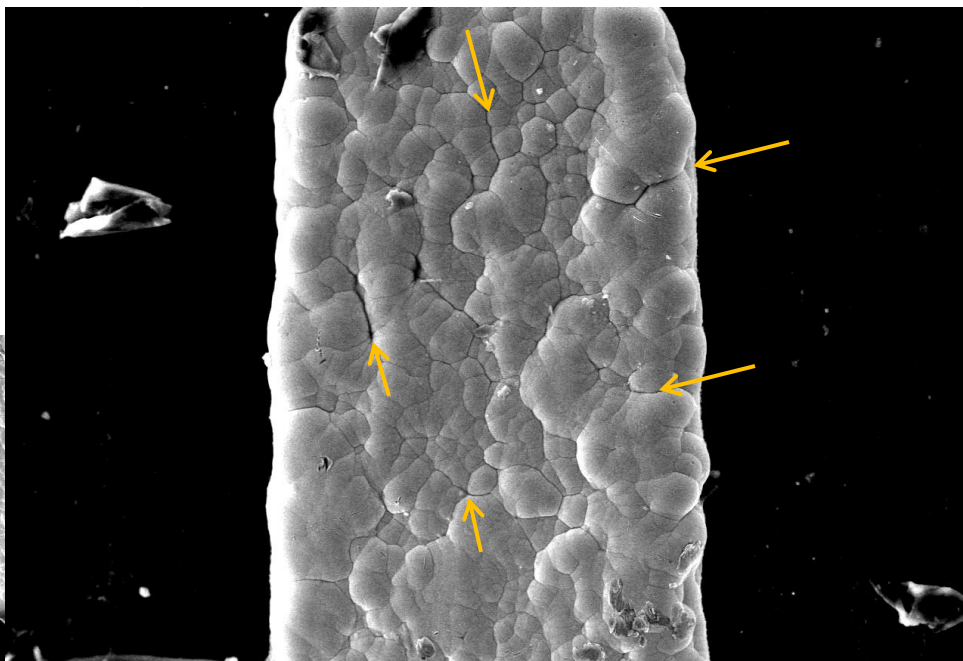
Surface shows gaps.



SIEMENS CT Analytics

x100

100µm



x500

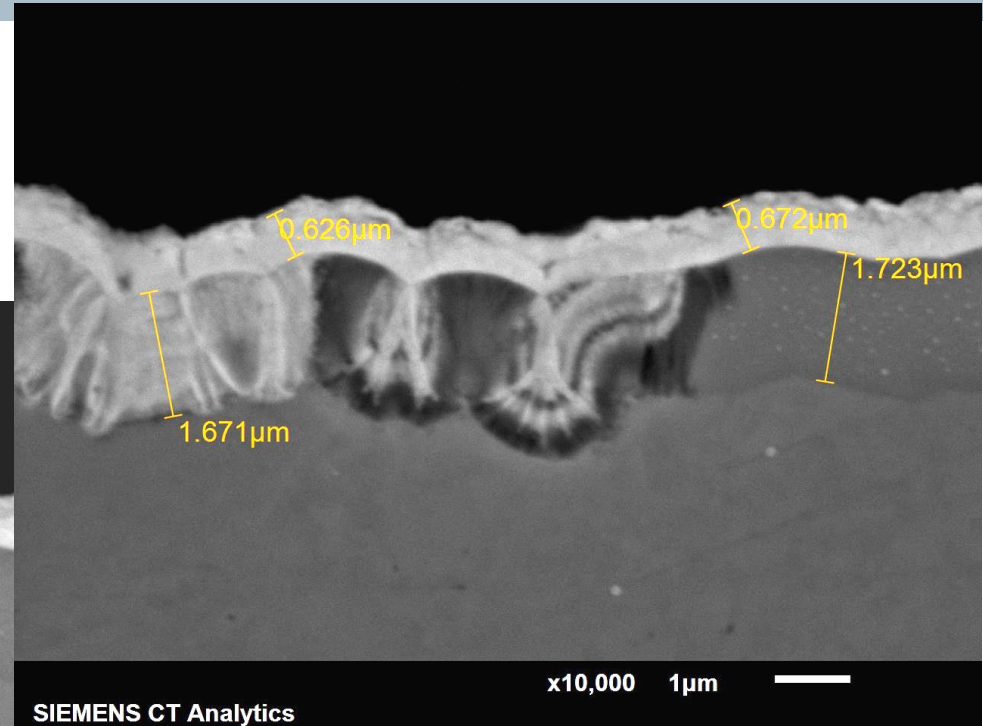
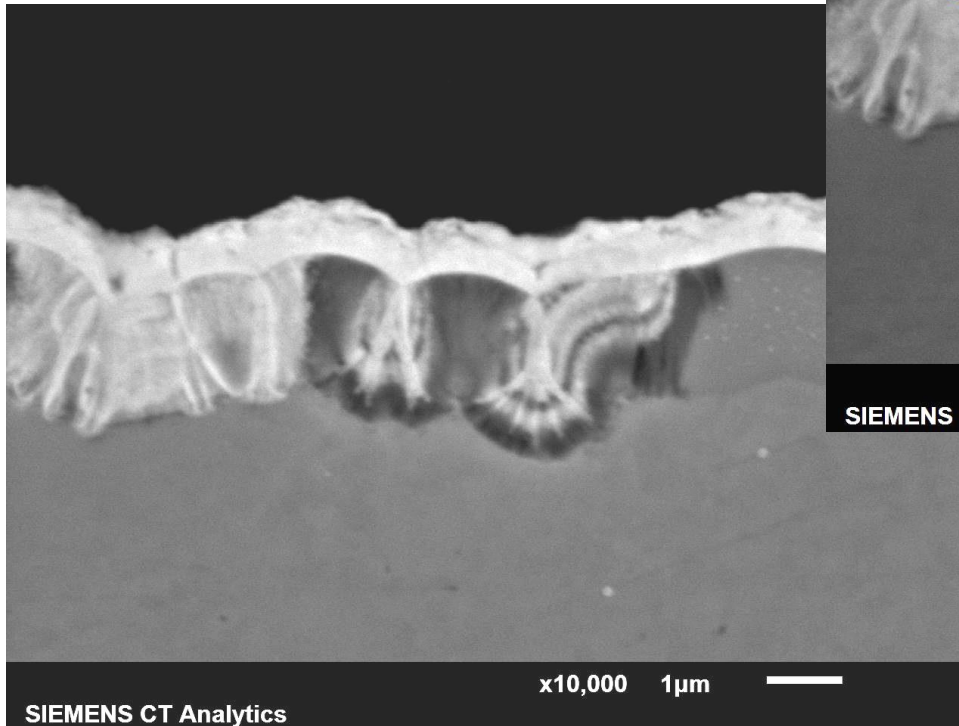
50µm

SIEMENS CT Analytics

## Taiyo, Querschnitt

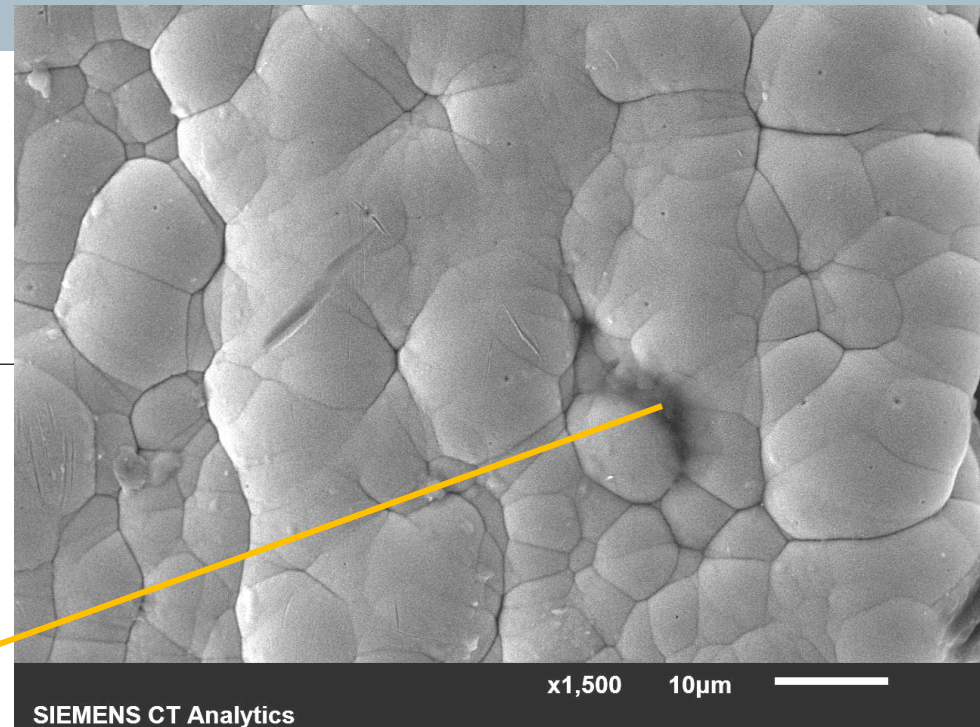
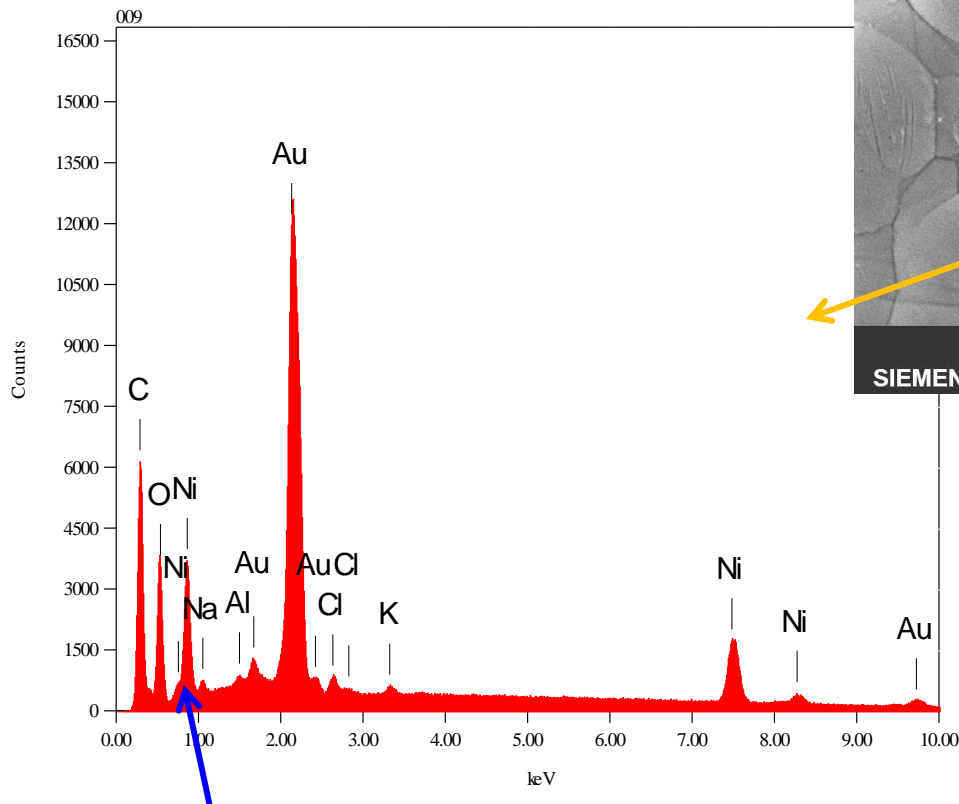
Die Goldschicht ist gut 600 nm stark, die NiP-Bariere 1.67 bis 1.73  $\mu\text{m}$ , die Dicke schwankt auffallend.

Gold thickness deviates significantly from QA



## 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.

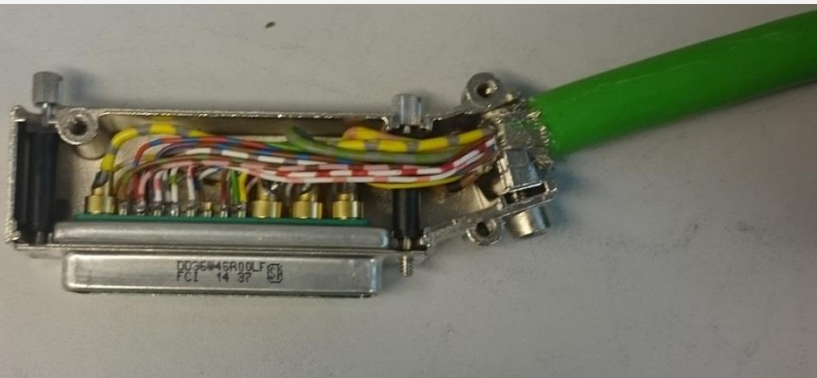
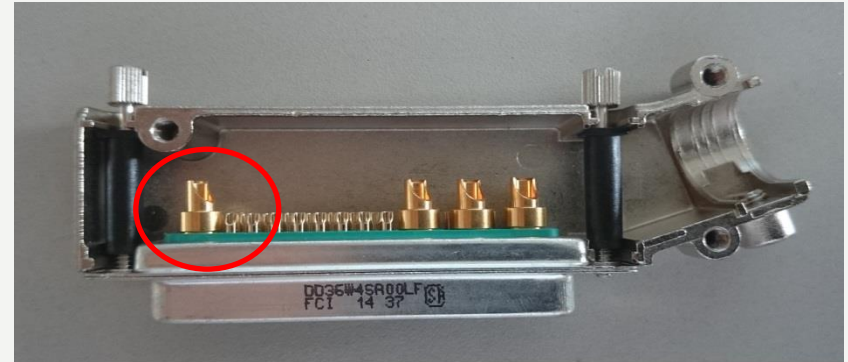


## Next steps:

- Quality of the surface must be assured
- Production of two panels of the old L2Bwd design with a new Ni/Au specification Ni 4-12 $\mu$ m and Au 30-90nm
  - No setup costs – cheap and fast
  - Kaptons available within 15 WD – latest's by end of January
- Based on the results of the test production we can decide on the surface finish of the DESY TB Kaptons
- New Kapton designs for the DESY TB are finished, incorporating:
  - AGND-DGND connection close to module
  - GND connection for local grounding
  - Cover layer variations to prevent shorts on the module edge
  - Order placed yesterday

- 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





- Main production is progressing
  - Step Down converter available
  - Front- and Back Board available
  - OVP is available, rework ongoing
  - Unipolar Regulator delivery this week
  - MCU-Card ordered
  - Bipolar cards ordered
  - Design to incorporate new features for HV, Drift ... ongoing
  - All orders will be placed within January
  - First units available till end of February
- To mitigate the bonding issue a test production with a new Ni/Au layer specification is in work
- Kapton designs for DESY TB ordered
- Power cables are ready for procurement, waiting for green light from the mechanics



# Backup