



Bonn testbeam, QUAD development

Fred Hartjes
NIKHEF

Nikhef/Bonn LepCol meeting
May 22, 2017

Time schedule GridPix testbeam Bonn

- Monday June 5
 - Fred and Kevin arriving at Bonn with equipment
 - Unloading equipment in institute
- Tuesday June 6
 - 9:00 ?? Safety instruction by Stefan Goertz
 - 9:30 start installation until 15:00??
- Wednesday June 7
 - Jan T and Harry arriving
- Thursday June 8
 - Kees arriving
 - 10:30 ?? Safety instruction by Stefan Goertz
 - 15:00 start GridPix testbeam shared with Bonn silicon pixels
- Friday June 9
 - 15:00 continuing GridPix testbeam with Nikhef/Bonn as main user
- Saturday June 10
 - 9:00 end test beam
 - Removing equipment from area, returning home

*Daily: no beam between 9:00 and 15:00
(machine maintenance)*

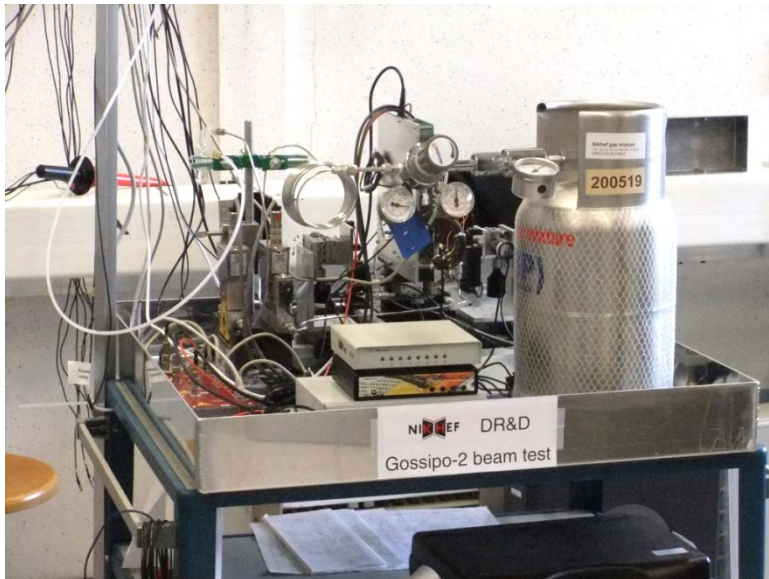
*Bonn people: please comment, I may
have understood things wrongly*

Equipment installed by Nikhef

- Complete mass flow controlled gas system using premixed Nikhef bottle
 - Gas: T2K (non flammable)
 - Temperature and atmospheric pressure are constantly monitored
 - Exhaust line into stairs: ~ 30 m of 6 mm Delrin tubing, shared with Bonn detector
- 4 PCs (DAQ, DCS, remote desktop (2x))
- HV system based on Nikhef miniHVs
- Mechanical detector support using
 - Y-Z stage remote controlled (no position reading)
 - Rotary stage remote controlled (angle reading)
 - Goniometer (manual operation)
- Single chip detector used for laser measurements
- Spare detector (not yet laser tested)
- NIM units (discr., timer, coinc. unit, NIM-to-TTL converter)
 - For shared trigger with Mimosa telescope
- Tools, laser aligner etc

- Using Bonn experimental table, 20 cm under beam
 - For detector 17 cm space in beam direction is needed
- Gas system, HV system, in leak tray 80 x 80 cm, placed on floor downstream of experimental table
 - Alternative: put leak tray on Bonn supplied office table
- DAQ and DCS PC on Bonn office table

Setup



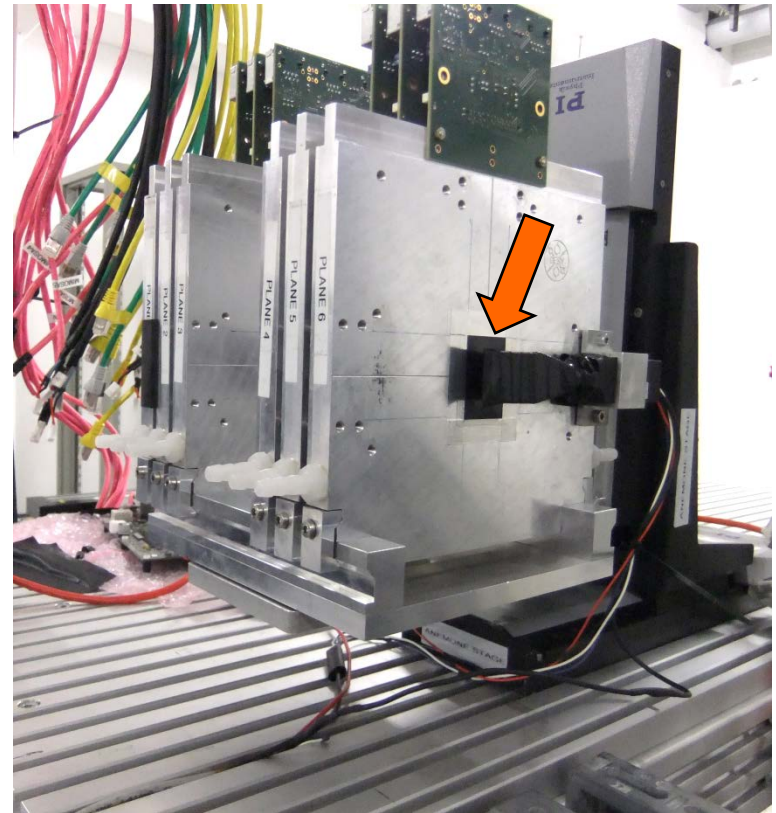
Control room

- 2 PCs placed to control DAQ and DCS
 - 3 Ethernet connections to exp. Area (1 for the X-Z stage control)
- Additional office tables needed (Bonn)
- Chairs needed (at least 4), (Bonn)



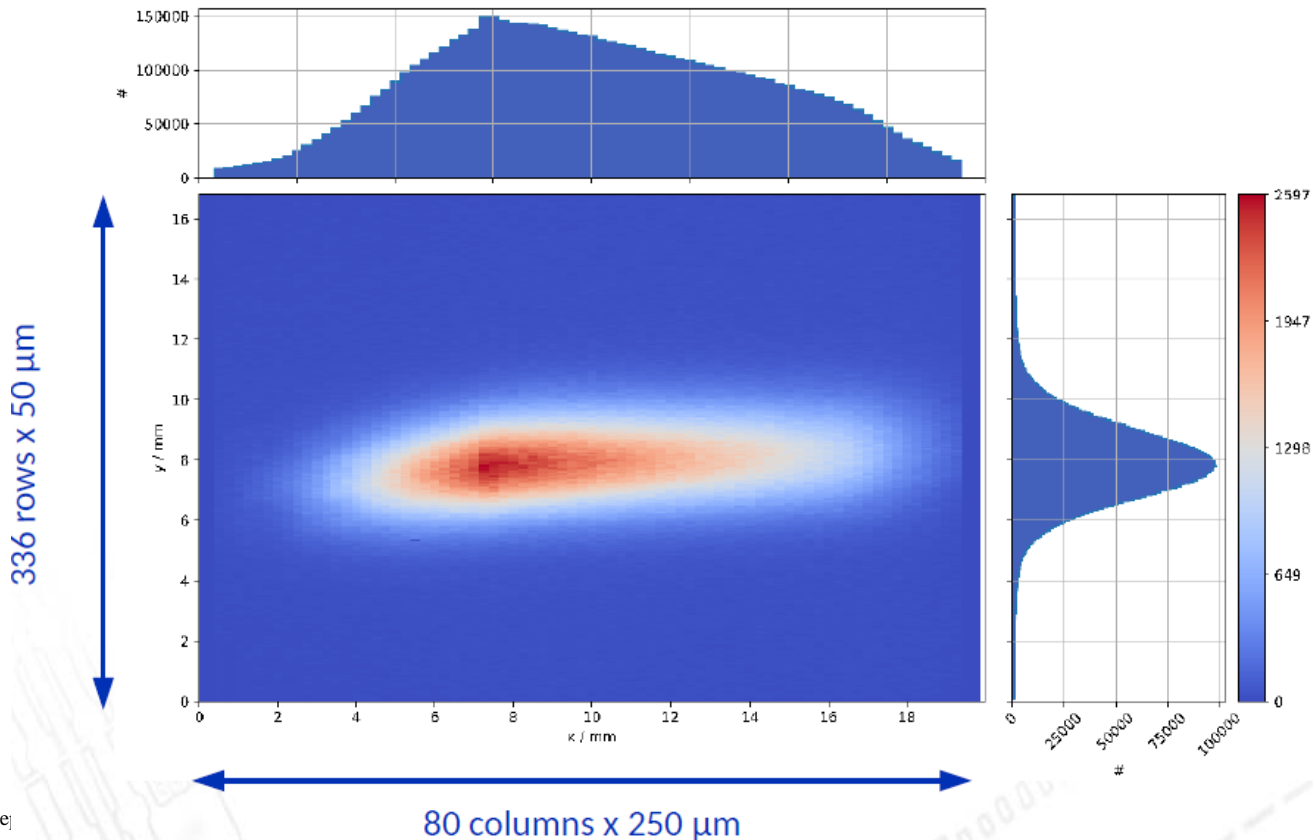
Telescope/triggering

- Resolution claimed as $5 \mu\text{m}$
- Acceptance $20 \leftrightarrow x 16.8 \updownarrow \text{ mm}$
- Synchronisation with Mimosa data not yet solved
- At present only one scintillator for triggering
 - $30 \leftrightarrow x 20 \updownarrow \text{ mm}$
- We need a dead time circuit avoiding close trigger pulses that may be missed by one of the DAQ systems
 - We can use space in the Bonn NIM crate



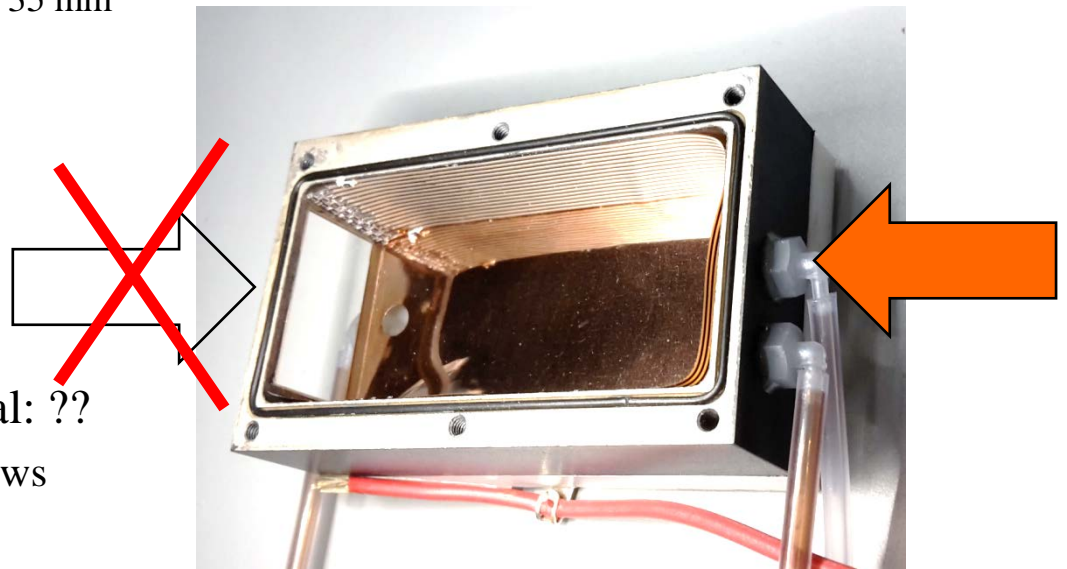
Beam parameters

- 7 s on, 2 s off
- Covers horizontally ~ 12 mm (drift direction)
- Energy 2.5 GeV electrons
- Vertically only 3 mm coverage
 - We have to scan the pixel chip in ~ 4 steps
 - But we have **no precise reading** of the stage position



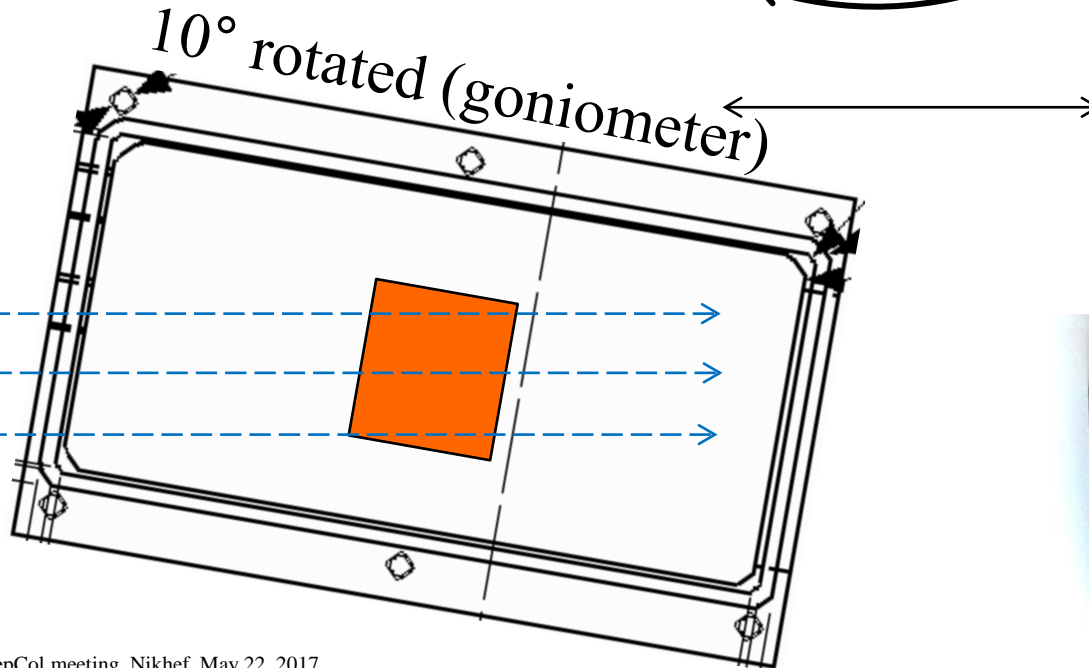
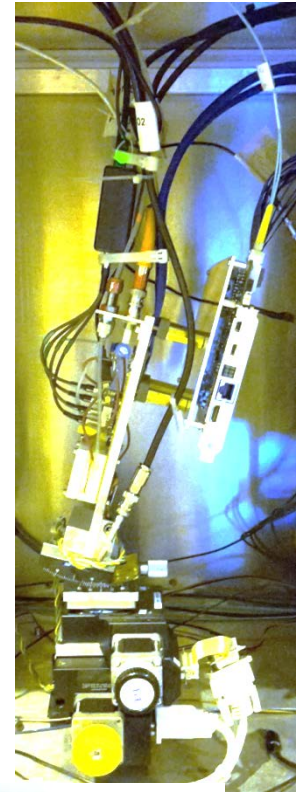
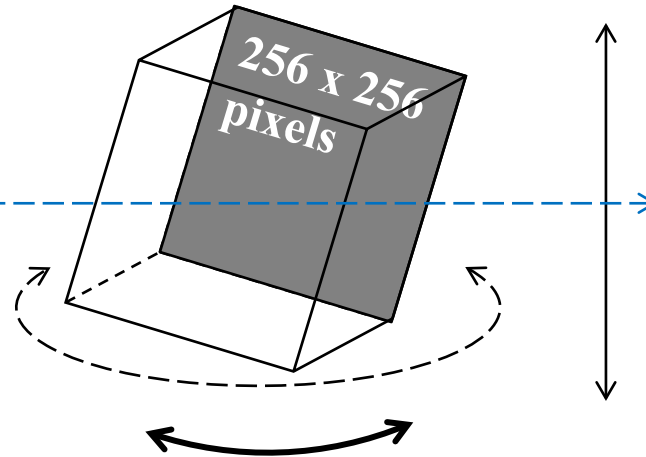
Multiple scattering

- Beam may enter by 2 side walls
 - 3.3 mm Semitron 490 HR + 50 μm Kapton + 15 μm copper
 - $\Rightarrow \sim 110 + 35 \mu\text{rad} = 115 \mu\text{rad}$
 - Distance side wall to detector: 35 mm
 - $\Rightarrow 4 \mu\text{m}$ in detector volume
 - 4 mm glass (laser window)
 - $\Rightarrow 2.5 \text{ mrad}$
 - $\Rightarrow 88 \mu\text{m}$ in detector volume
 - \Rightarrow **never enter by the glass**
- Contribution by Mimosa material: ??
 - Silicon detectors, plastic windows
- Claimed accuracy Mimosa: 5 μm
- **Conclusion:**
 - **Beam definition by telescope in detector $\sim 6.5 \mu\text{m}$**



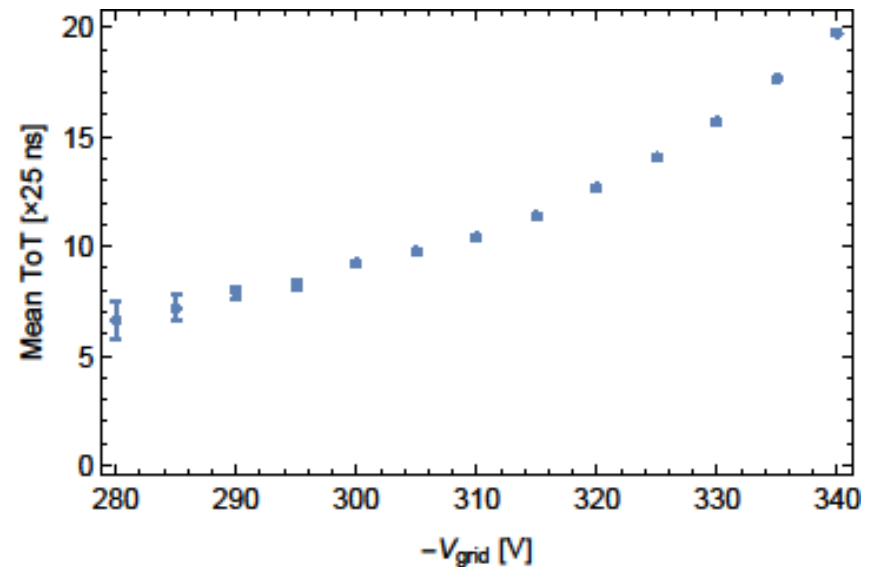
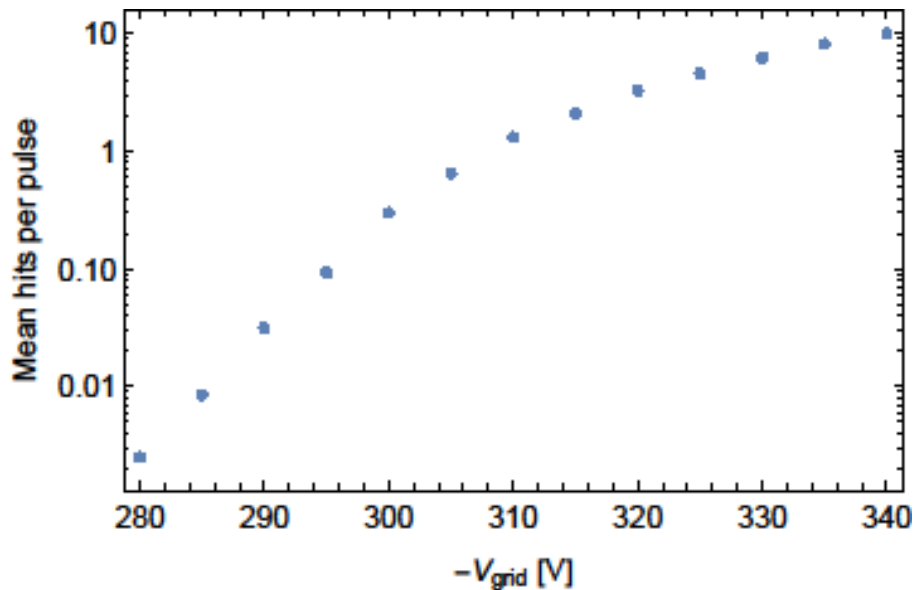
Measuring program

- Sensitive volume about cubic
 - 13.5 x 14 x 16.5 mm
- Do not modify the goniometer often
 - -10, 0, +10°
- Only a few rotation angles
 - High statistics (> 1 M tracks)
 - => possibility for elaborate cuts



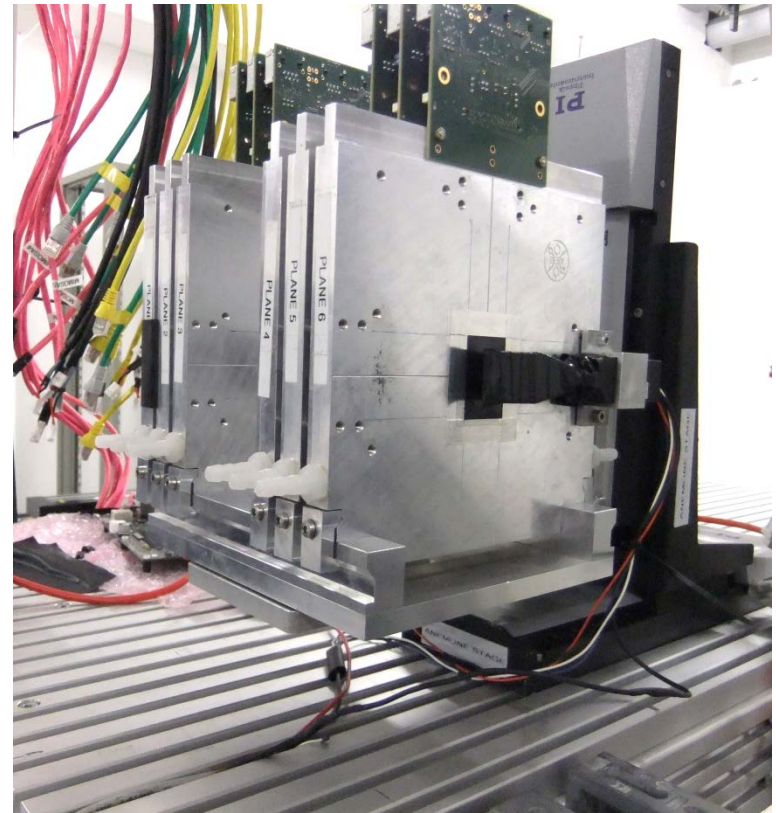
Grid voltage working point

- Tested with SE hits from laser
- Grid voltage
 - Use -340 V => good SE efficiency
- Correct V_{grid} for atmospheric pressure and chip temperature
 - NTC at backside
 - Logged every minute when gas control is active
- Continue voltage scan after testbeam
- Use the laser measurements to calculate the effective gas gain



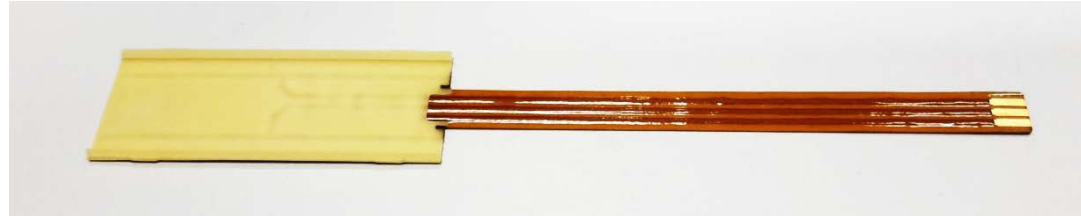
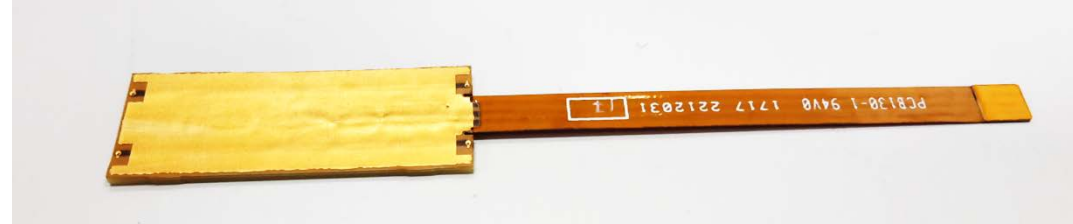
Analysis

- Synchronisation with Mimosa data not yet solved
- Do we have a proper event display operational?
- We do not yet have precise measurements of
 - Grid to cathode distance
 - Grid to guard distance
 - Flatness of guard and cathode
- To be measured at Nikhef after the testbeam

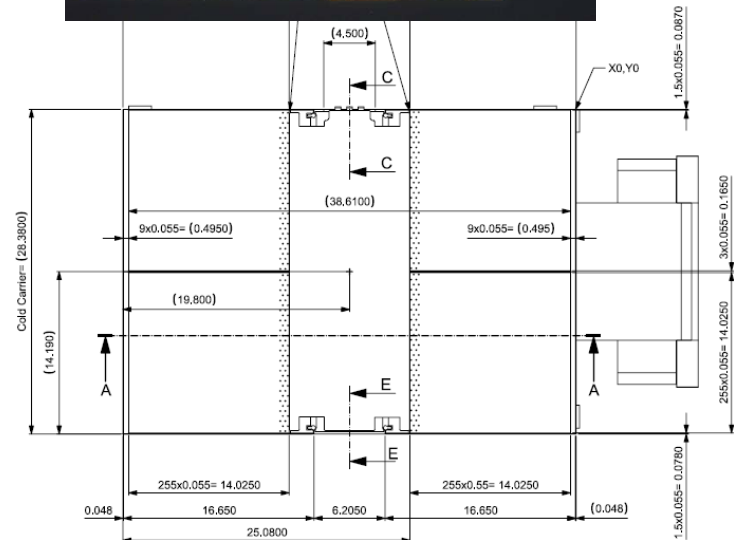
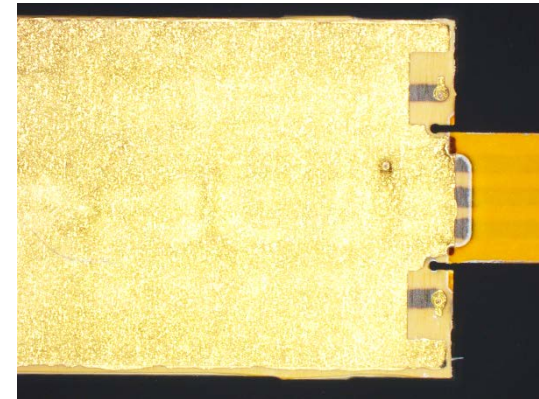


Quad assembly

- Most PCBs / flexes in house
 - HV board
 - To be assembled
 - Guard plate
 - Concentrator



- Bonding board + flexes + LV regulator scheduled on May 23
- Guard plate bend (hollow) with 100 μm sagitta.
 - May increase under elevated temperature
 - To be cured by gluing on chips??
- Final drawings coca and stump completed
 - 4 stumps produced
 - Coca in production



Fred Hartjes

Others

- Modified pickup blocks produced
 - Chip manipulation looks doable
 - Blocks being black anodized now

- Assembly jig for gluing coca onto stump still to be designed
 - Waiting for wire bond PCB

- QUAD development presently on hold (Bonn testbeam)
- To be resumed ~mid June

- QUAD housing with laser window needed
 - Modifying existing housing

- First QUAD end July?

