

Automatic tile/SiPM placement on the HBU boards

21.3.12 - Calice Collaboration Meeting
DESY Hamburg

Phi Chau

Bruno Bauss, Volker Büscher, Reinhold Degele, Karl Heinz Geib, Sascha Krause, Yong
Liu, Lucia Masetti, Uli Schäfer, Rouven Spreckels, Stefan Tapprogge, Rainer Wanke,
André Welker

Need for an automatic placement

- Hadron tests (2014)
 - 60 HBU boards → 8.500 tiles with SiPM have to be placed on HBU boards
- Full prototype (2015)
 - 160 HBU boards → 23.000 tiles with SiPM have to be placed on HBU boards
- AHCAL (final design)
 - About 8.000.000 tiles have to be placed on HBU boards



Need for an automatic placement

That means with an effort of 20 seconds for a manual placement per tile you will need for

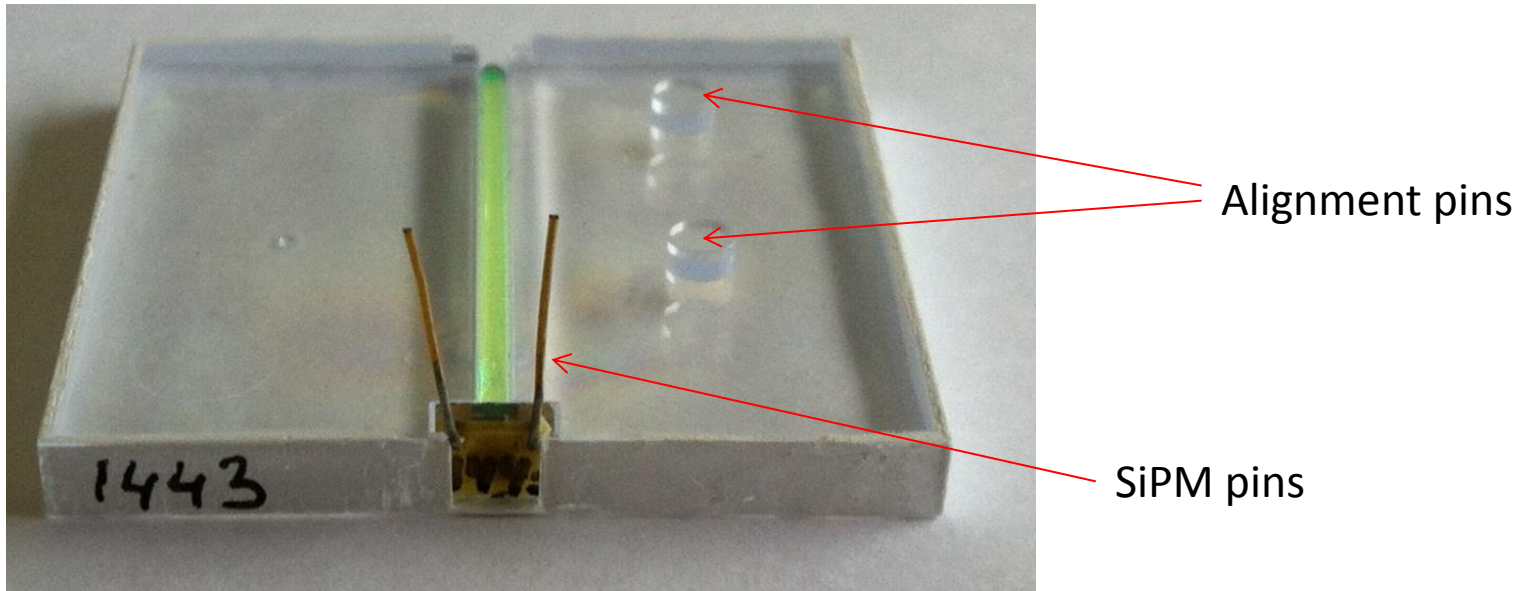
- One HBU board: ~ 1 h
- Hadron tests (2014): ~ 1 week
- Full prototype (2015): ~ 1 month
- AHCAL (final design): ~ 15 years

Need for an automatic placement

→ pick-and-place machine



Present design



Possible drawback of automatic placement to design → Alignment and SiPM pins need to be considered



Alignment pins

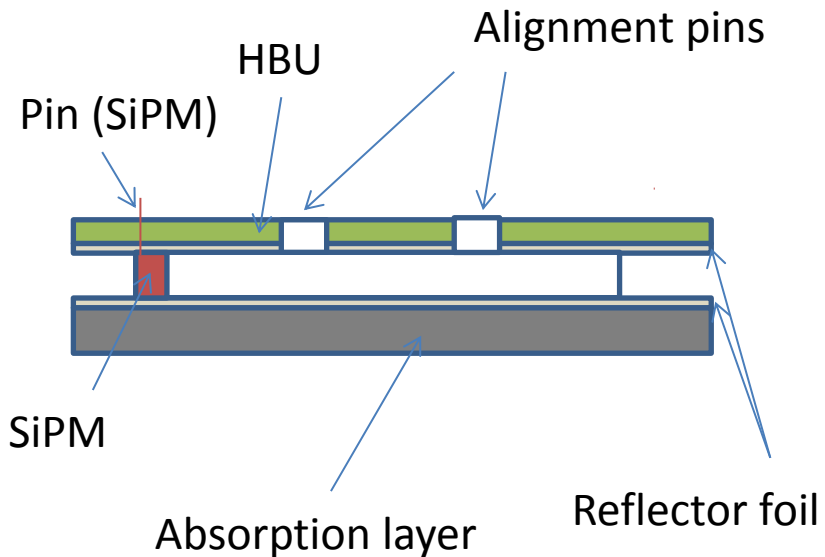
- Automatic pressing of tiles in the alignment pin connectors of HBU board is problematic. Possible problems:
 - Force has to be applied to connect alignment pins with the connectors
 - Other possible problems:
 - The alignment pins may have too much space -> tiles aren't fixed
 - They may not fit

Alignment pins

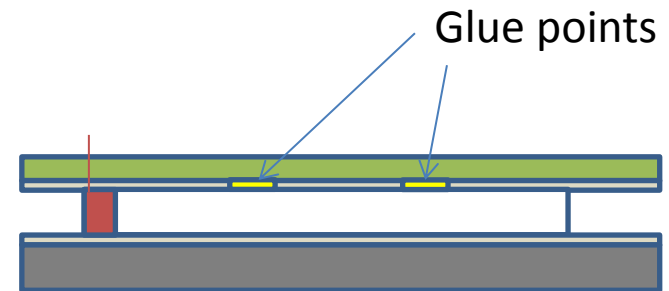
- Idea
 - Fixation of tiles without alignment pins by glueing on reflector foil/HBU board

Alignment pins

Present design:



Possible new design:



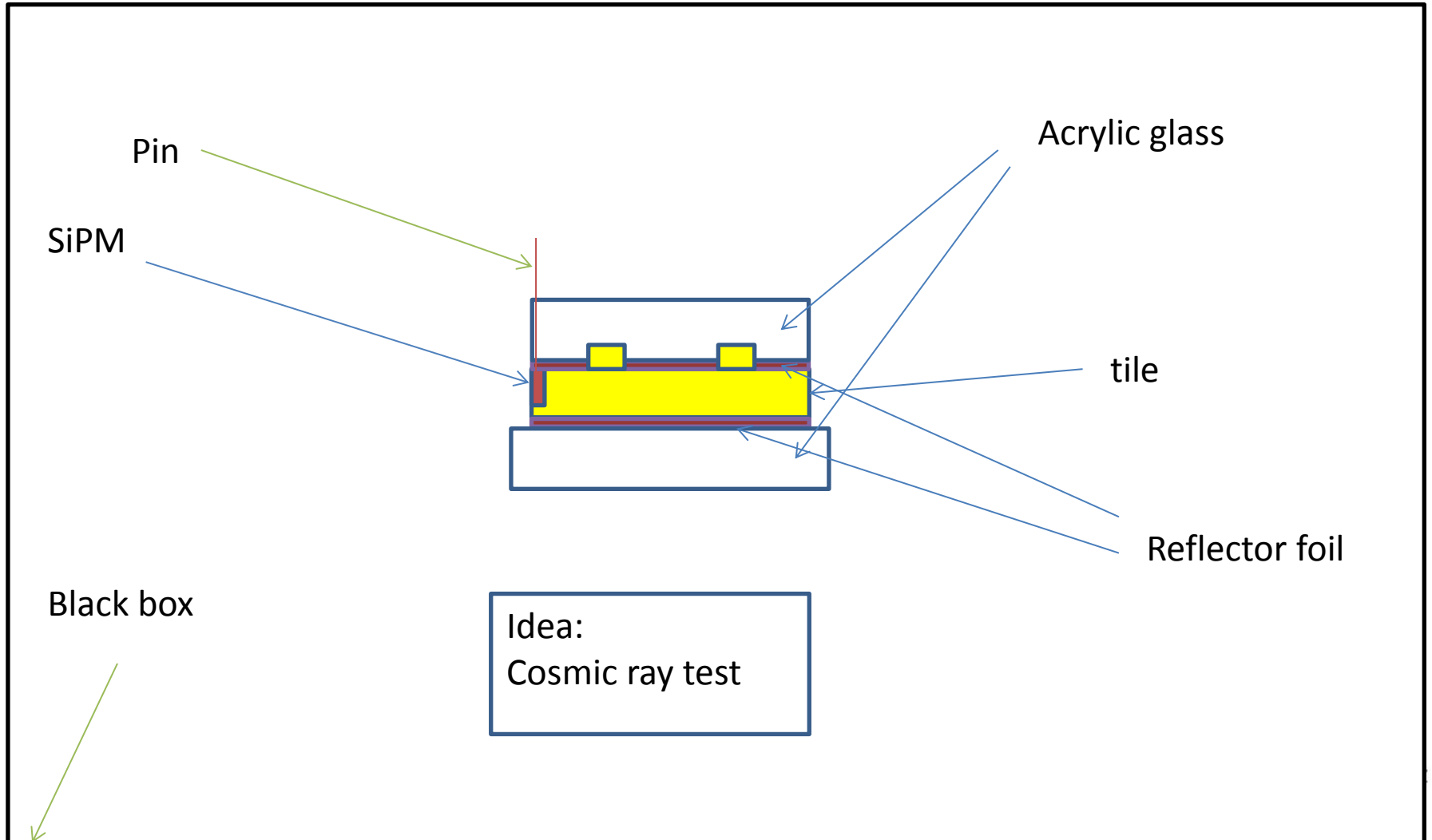
→ Tile without alignment pins

→ Tile fixation with optical glue

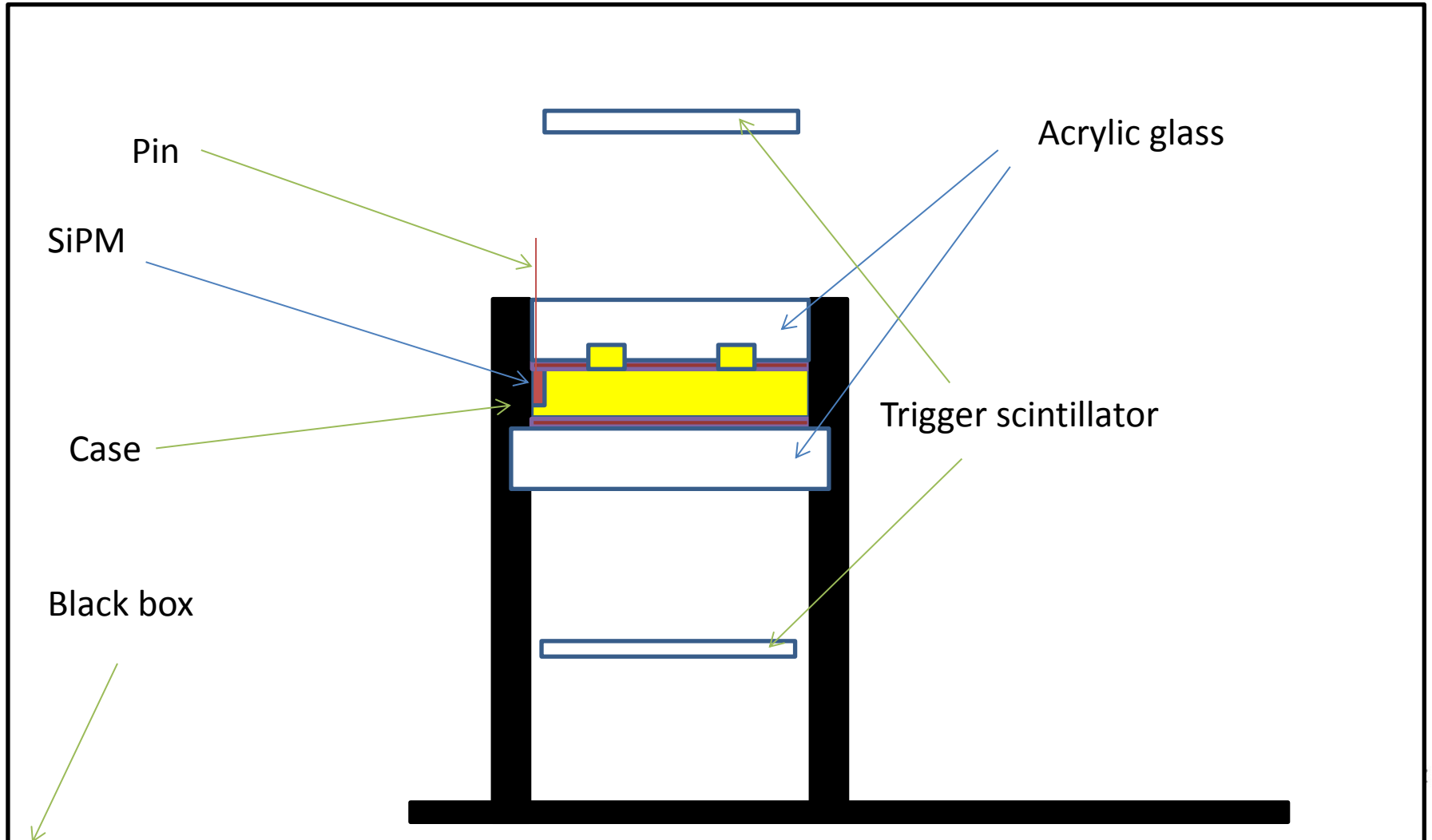
Alignment pins

- Possible influence of glueing to optical properties?
 - Test measurements
with BC-600 (Bicron)

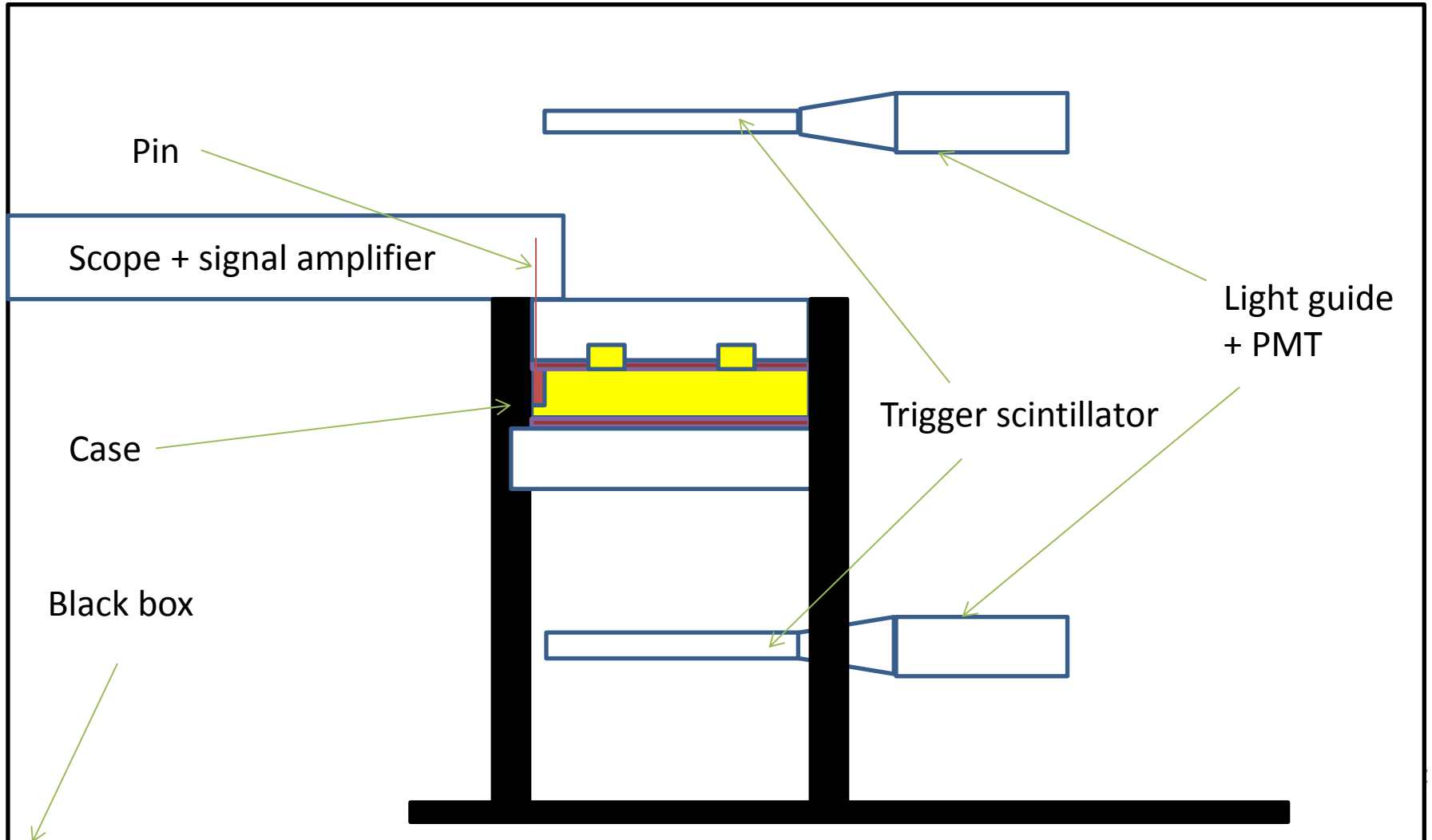
Measurement Set-up



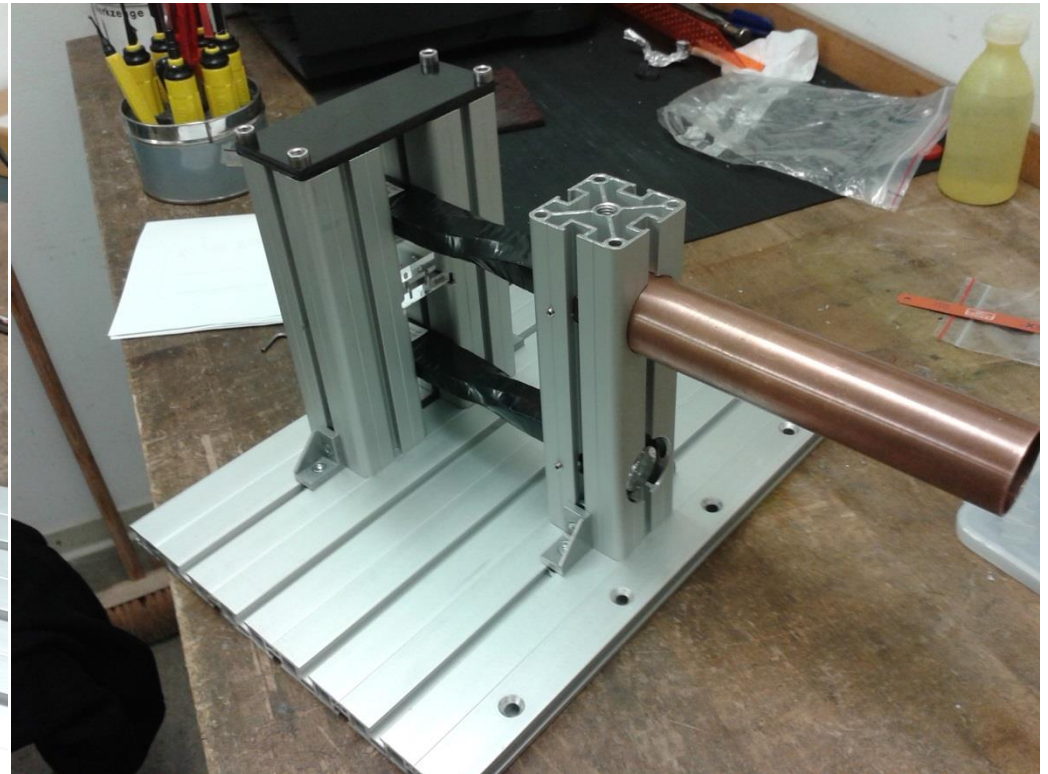
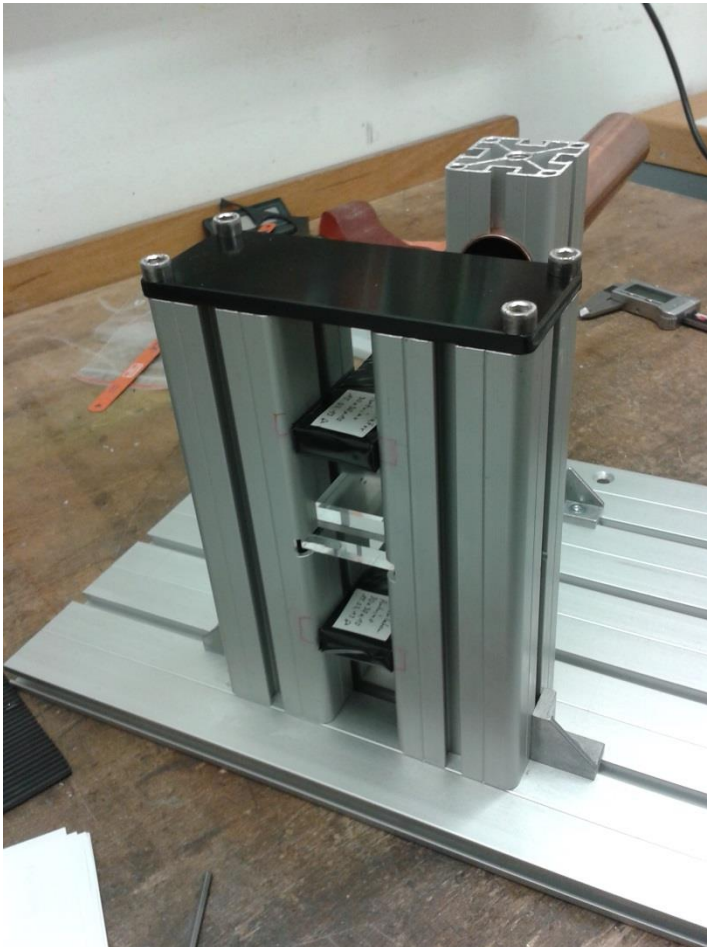
Measurement Set-up



Measurement Set-up



Measurement Set-up



21.03.2013

Automatic tile/SiPM placement on the HBU boards



JOHANNES GUTENBERG
UNIVERSITÄT MAINZ

13

Measurement of optical properties

Four different measurements

- Measurement according to original concept
- Direct contact between tile and reflector foil without alignment pins (without glue)
- Measurement with one or two glue points on tile (without alignment pins)
- Tests with glue on whole surface of tile (without alignment pins)

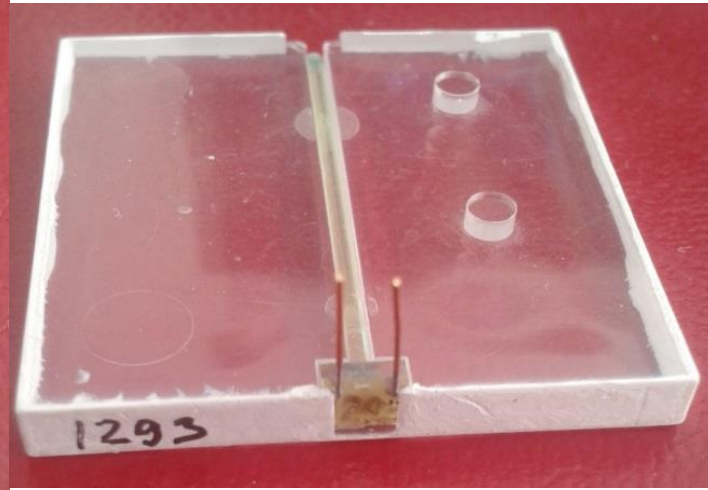
Test configuration



Replica tile with alignment pins



Replica tile without alignment pins



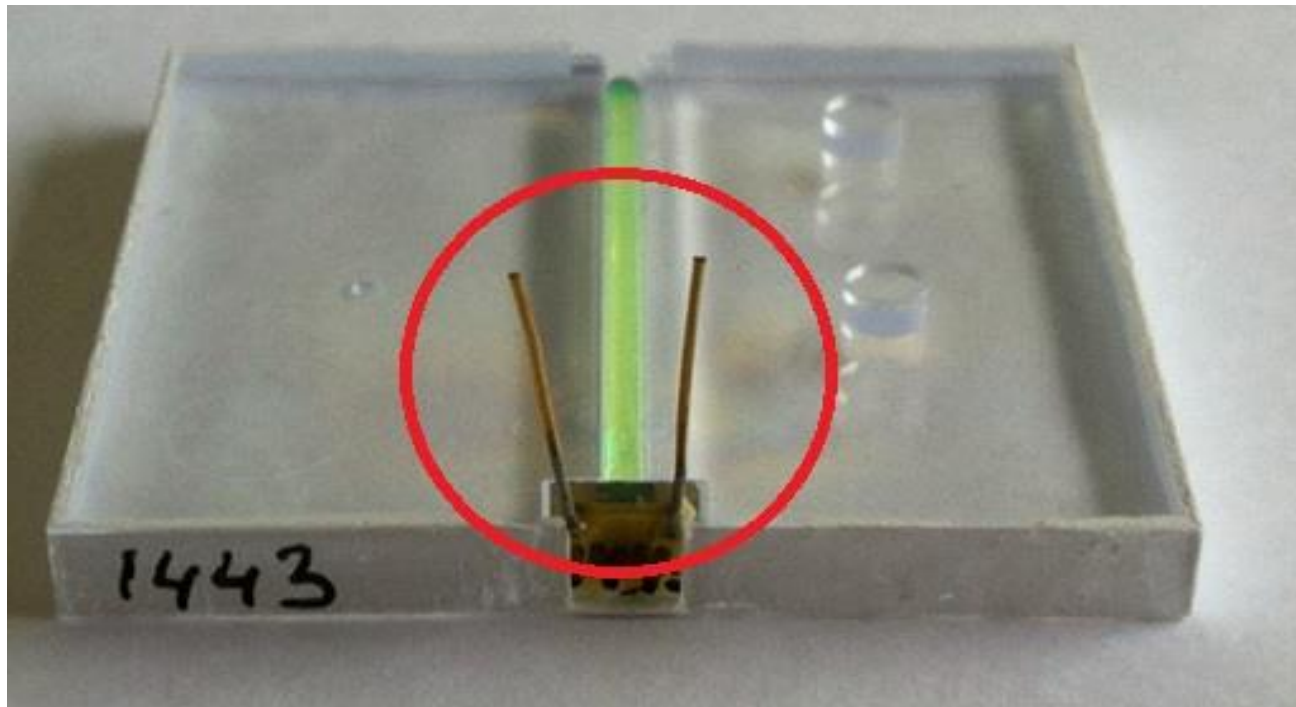
Original tile with SiPM

Test configuration

- Configuration of test tiles
 - Borders of test tiles are painted with white reflecting color
- Is the painting comparable?
 - Test original ITEP tile and CPTA SiPM
 - Then remove etched borders und paint white reflecting color on

SiPM pins

- To guarantee a reliable automatic placement
 - Robust and linear pins of the SiPM are needed



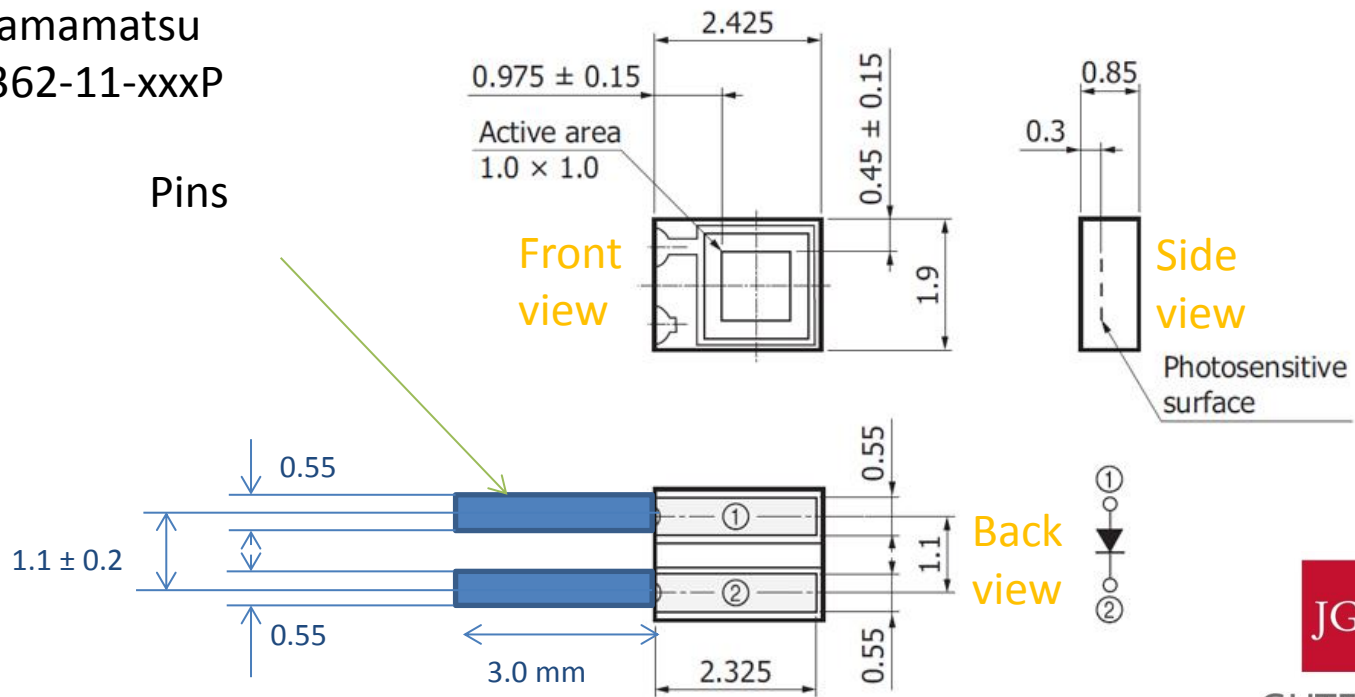
SiPM pins

- Exact positions in the space of tolerances are absolutely necessary for automatic placement
- SiPMs have to fulfill definit specifications
- Example: SiPM pins with Hamamatsu MPPC

SiPM pins

- Exact positions in the space of tolerances are absolutely necessary for automatic placement

Example: Hamamatsu
MPPC S10362-11-xxxP



General schematic of pick-and-place machine

Assembly line transports
HBU boards

1. Glue points on
reflector foil/HBU
board

2. tiles are
set on
foil/HBU

3. SiPM
pins are
soldered
on HBU

4. Deposit
station –
glue can
dry

5. Test of
functionality for
tiles and SiPMs
with LEDs on
HBU

We will obtain a test machine for the automatic placement
→ Price for a used machine: 10.000 – 20.000 €

Forecast

- April SMT Hybrid packaging fair in Nürnberg



16. - 18.04.2013
Nürnberg

smthybridpackaging

Systemintegration in der Mikroelektronik

http://www.mesago.de/de/SMT/Fuer_Besucher/Willkommen/index.htm

21.03.2013

Automatic tile/SiPM placement on the HBU
boards



JOHANNES GUTENBERG
UNIVERSITÄT MAINZ

21

Thank you for your attention!