

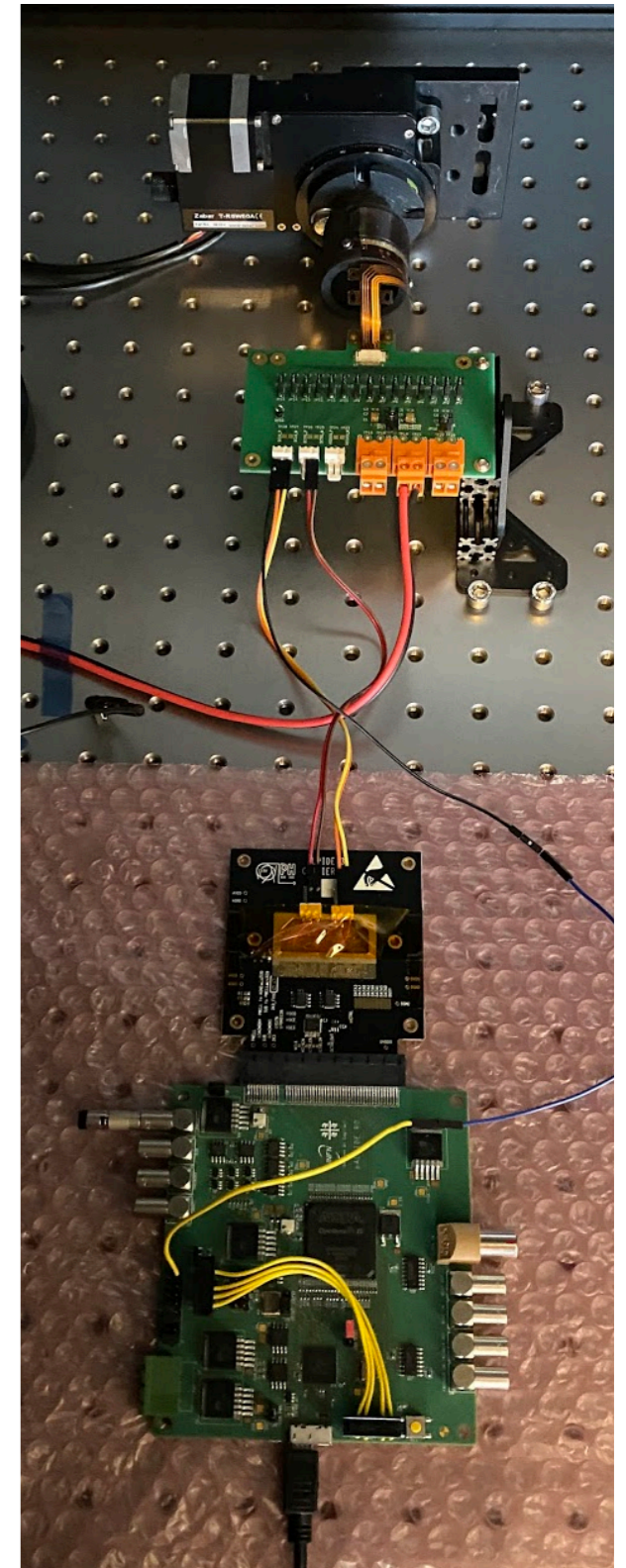


# **ITS3 activities in Bari**

# NEWS - 12/03/2021

## SINGLE CHIP TEST

1. ALPIDE 50 um received
2. FPC single chip production request submitted
  - Order submitted on March 1
  - Delivery time 10 working days
  - Expected March 15
3. Rotary motor adapter under design (Vincenzo)
  - Connect the rotary motor to the cylinder hosting the bended chip
  - Needed to perform the bonding over bent chip
4. Bending procedure
  - Simplify as much as possible → No tool development
  - Use Mylar foil sandwich to keep side-by-side chip and FPC
5. DAQ board
  - Connector fixed
  - Instructions for FW loading available
6. FPC to DAQ connection
  - Flex2DAQ connector in production (two weeks more for delivery) → One could be sent to Bari
  - Alternatively, adaptor+carrier board → To be requested at CERN





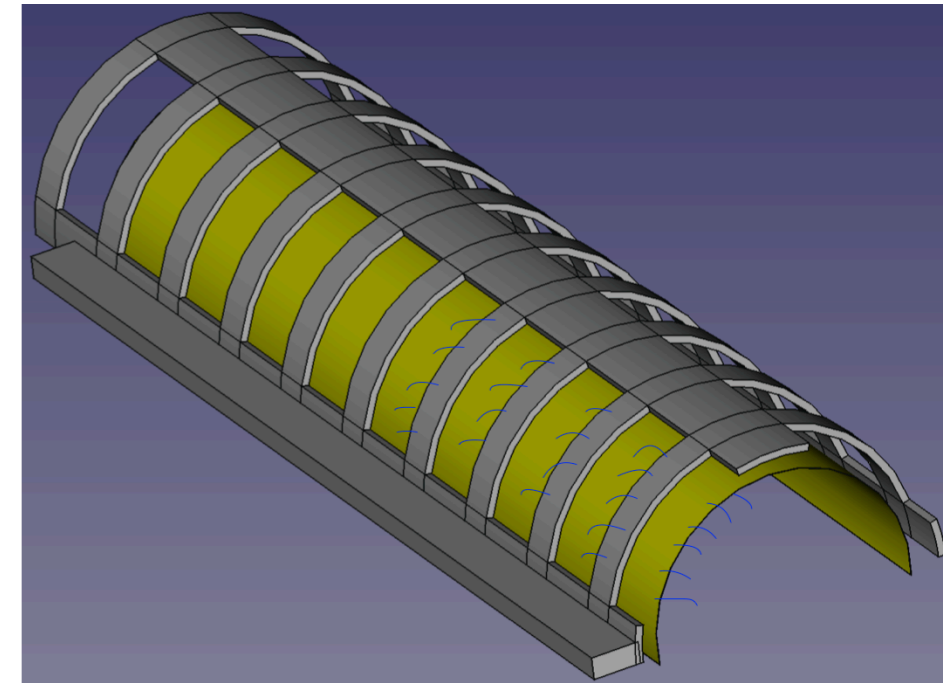


# NEWS - 12/03/2021

## SUPER-CHIP

### 1. Skeleton FPC

- Skeleton
  - Scalable design by Magnus
  - Good material for the production to be identified
- Wire-bonding
  - First tests performed by Pasquale (next slide)
  - More tests during next week
- FPC
  - designed by Magnus, under G. De Robertis revision



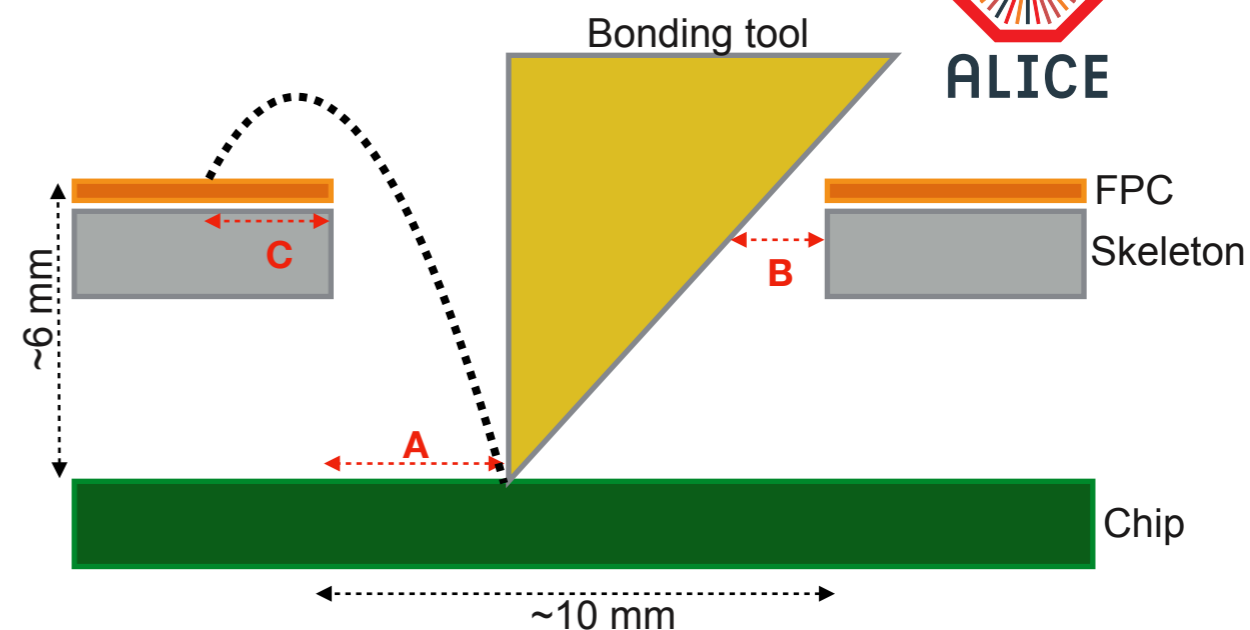
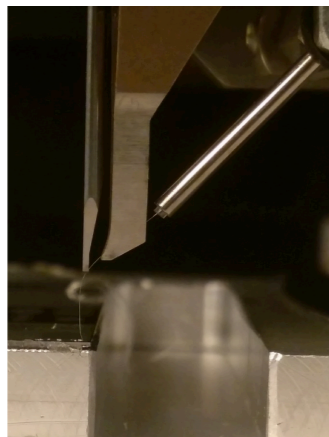
### 2. Edge FPC

- FPC design requires minimal geometrical limitations from mechanical support → Vincenzo and G. De Robertis
- Mechanical support design requires actual dimensions of the full detector mechanical support → Gabriele and Vincenzo
- Mechanical support design also requires to take into account the full object assembly sequence → Gabriele and Vincenzo

### 3. General observation

- Magnus agreed that a mockup of the chip bending tool is needed in Bari to exercise the bonding and actually study the mechanics for the edge FPC support → Gabriele, Vincenzo and Cosimo

# NEWS - 12/03/2021



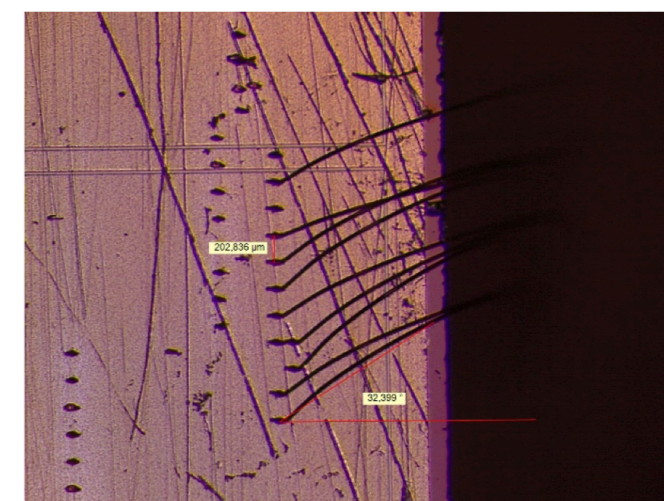
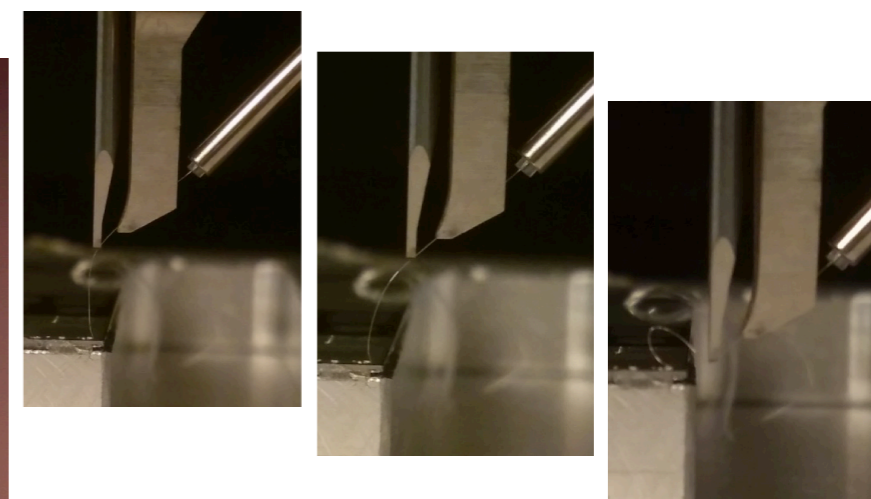
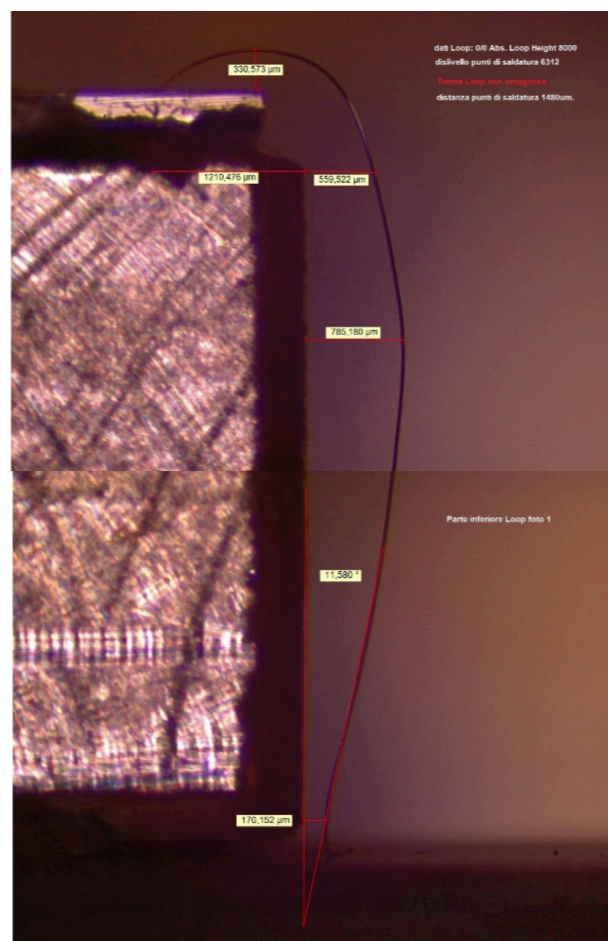
Two configurations explored

## 1. FIRST CONFIGURATION

- $h = \sim 6,3$  mm and  $C+A = \sim 2.5$  mm
- bonding from top to bottom
- Results
  - Very low pull-force: 3,5 grams
  - Deviation angle  $\sim 32$  degrees
  - High wires touching probability
  - Not homogenous loop shape

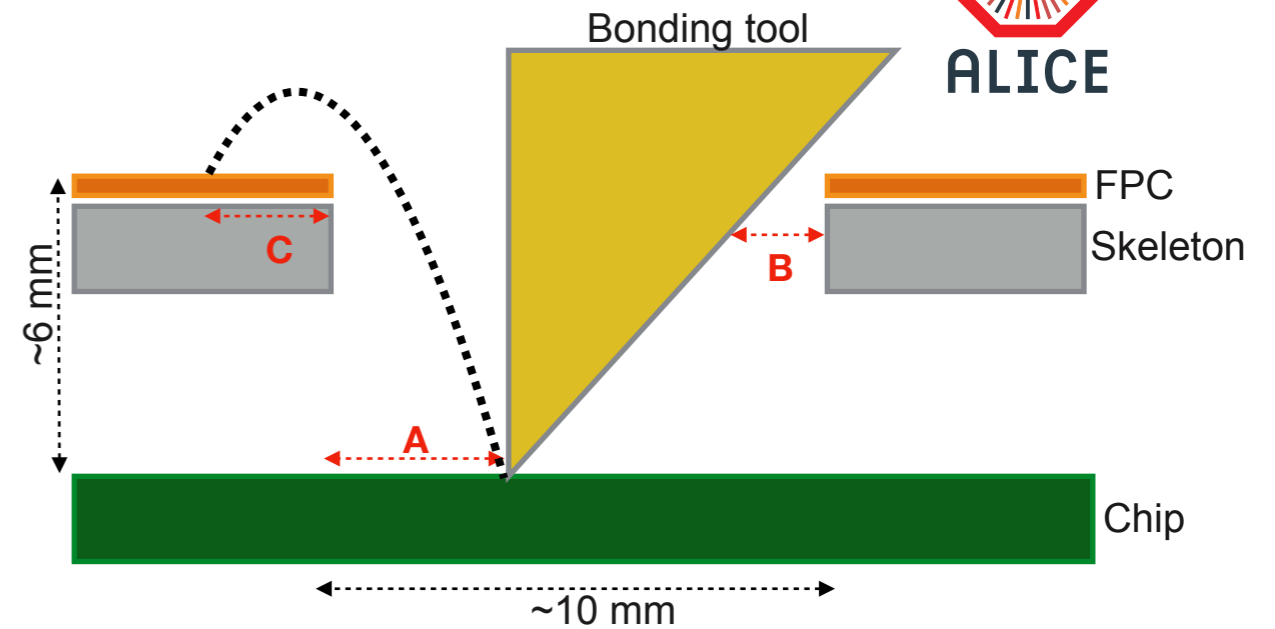
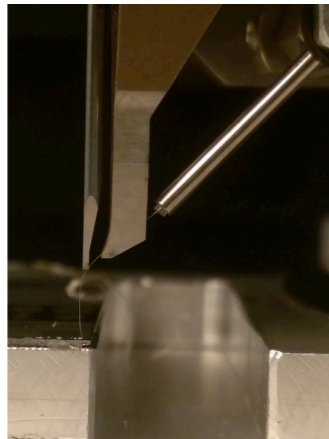
## 2. SECOND CONFIGURATION

- $h = \sim 6,6$  mm and  $C+A = \sim 4.6$  mm
- bonding from top to bottom
- Results
  - Decent pull-force: 8,55 grams
  - Deviation angle  $\sim 2$  degrees
  - Reduced wires touching probability
  - Loop shape improved





# NEWS - 12/03/2021



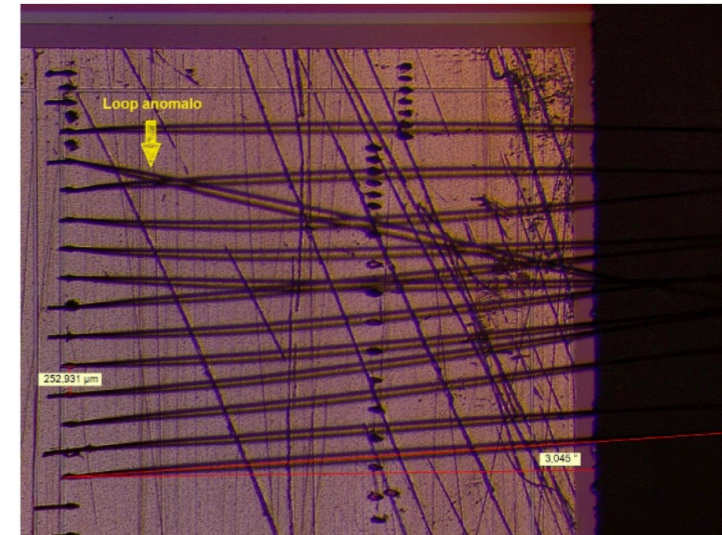
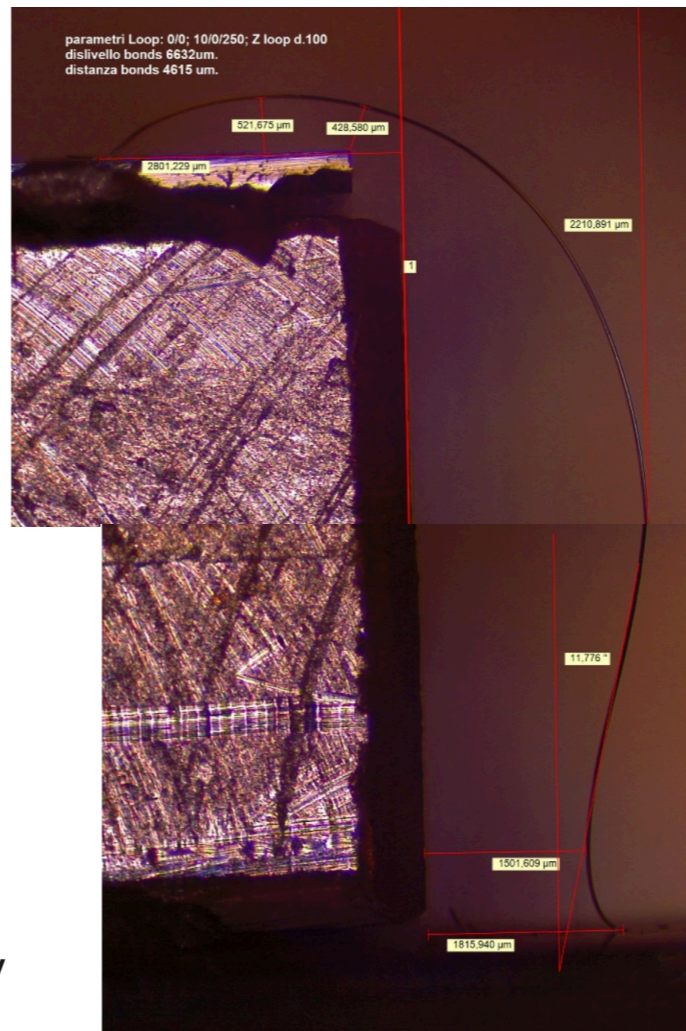
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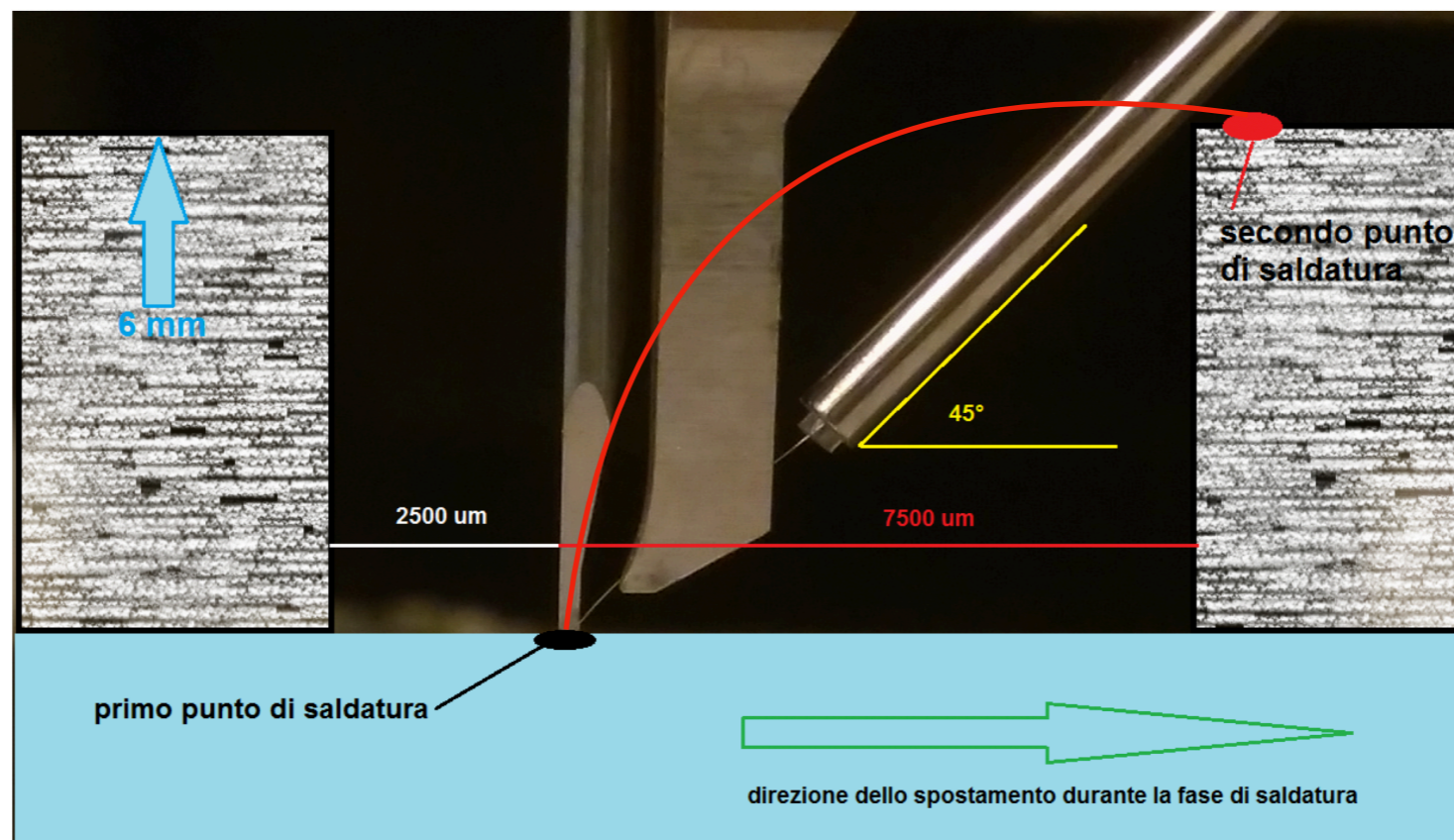




# NEWS - 12/03/2021

## Next tests

1. Try bonding from bottom to top with large distance from skeleton edge
  - the 45 degrees wire dispenser tool allow a minimal distance from the skeleton edge of  $\sim 7,5$  mm
  - here the wire is released while the head is moving reducing uncertainty on the wire positioning and reducing the stress on the bonding feet
  - limitation from the maximal wire extension of 10 mm (is this still true??)
2. Procure a 60 degrees wire dispenser tool
  - would allow to reduce the minimal distance from the edge
3. Try to increase the height to  $\sim 8$  mm
  - Magnus desire to stay as close as possible to the real detector mechanical support dimensions





**NEXT SLIDES ARE  
FROM PREVIOUS MEETINGS**

# NEWS - 25/02/2021

## SINGLE CHIP TEST

1. ALPIDE 50 um received
2. FPC single chip production request submitted
3. Cylinder for bending under design (Vincenzo)
4. No specify tool for bending, but Mylar foil as done in Strasbourg
5. DAQ board connector purchase submitted

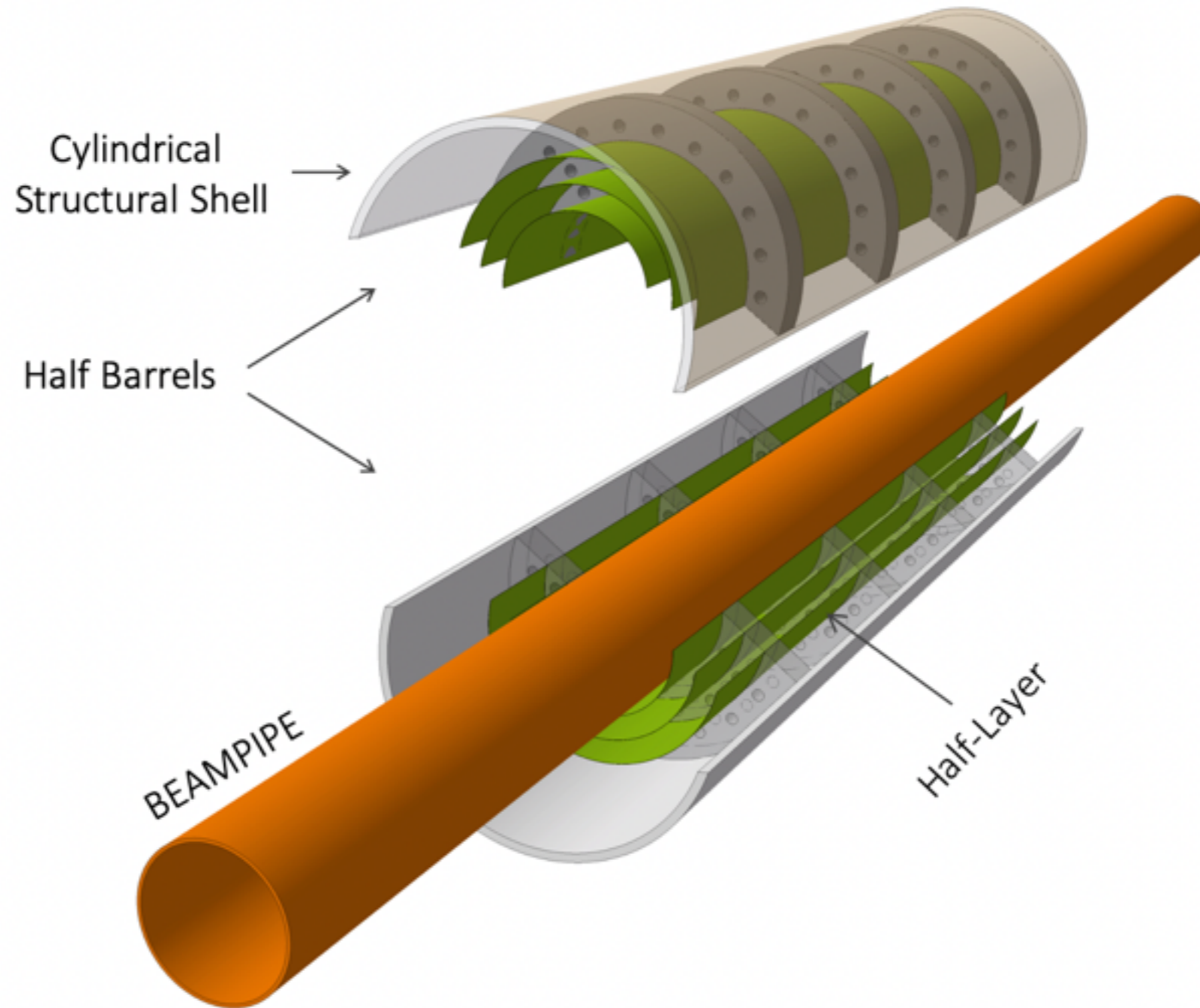
## SUPER-CHIP FPCs

7. First internal meeting on Friday
8. New bonding test from Monday (Pasquale)
9. Skeleton FPC
  - A. Large pads usage preferable
  - B. Doubts reported to Magnus → No reply
10. Focus more on the edge FPC





# NEWS - 16/02/2021



# NEWS - 16/02/2021

## 1. WP3

- August 2020 Test beams data analysis
- Single chip (ALPIDE 50 um) verification

## 2. WP4

- Single chip bendable FPC
- Pull-force study for wire-bonding
- Super-chip (ALPIDE) mechanics/FPC design
- Final chip mechanics/FPC design

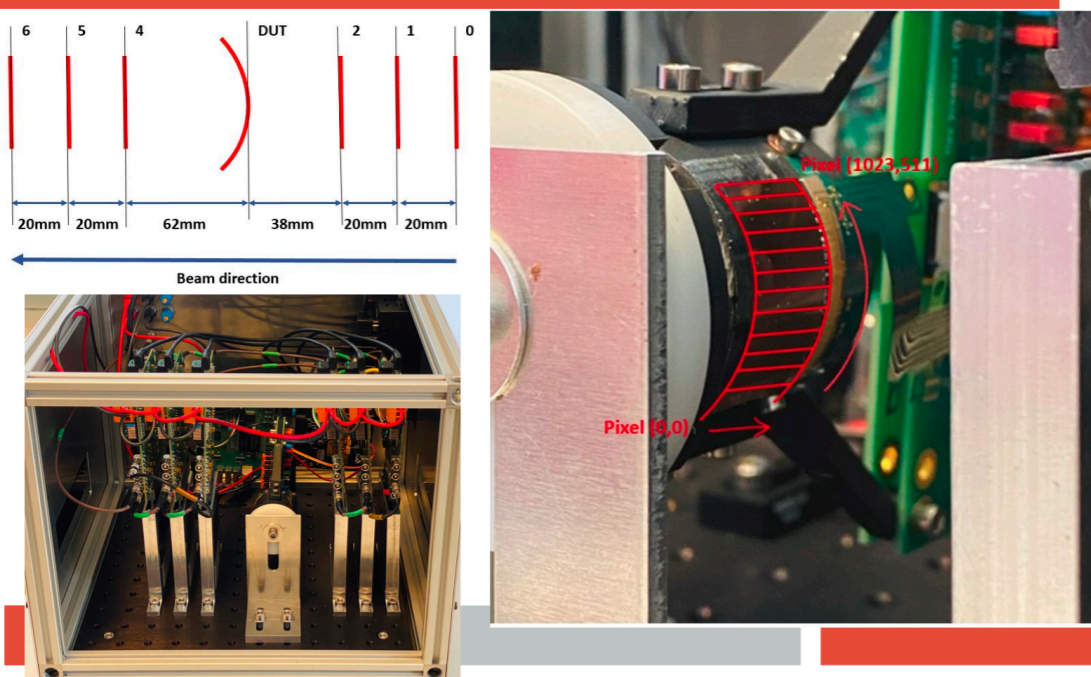
# NEWS - 16/02/2021

## WP3 - Test beams analysis

Presentation by Arianna at WP3 meeting on 12/01/2021:

[https://indico.cern.ch/event/991234/contributions/4175356/attachments/2169191/3662129/preliminary\\_analysis\\_v3.pdf](https://indico.cern.ch/event/991234/contributions/4175356/attachments/2169191/3662129/preliminary_analysis_v3.pdf)

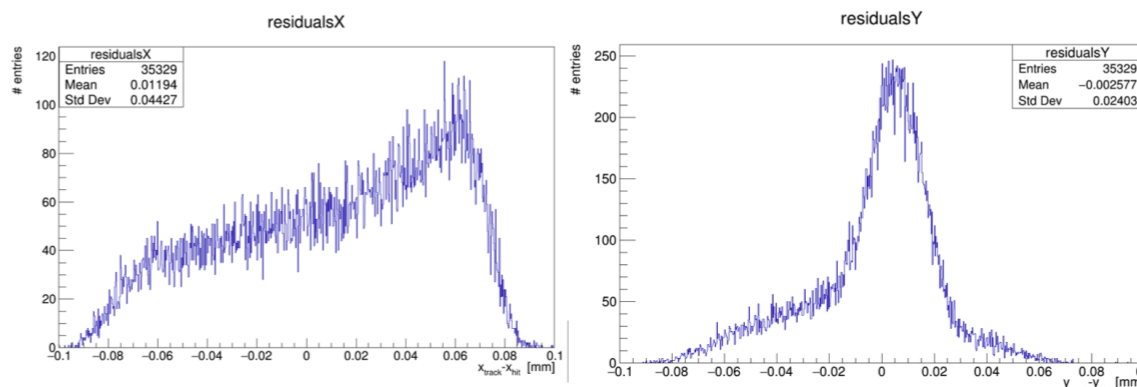
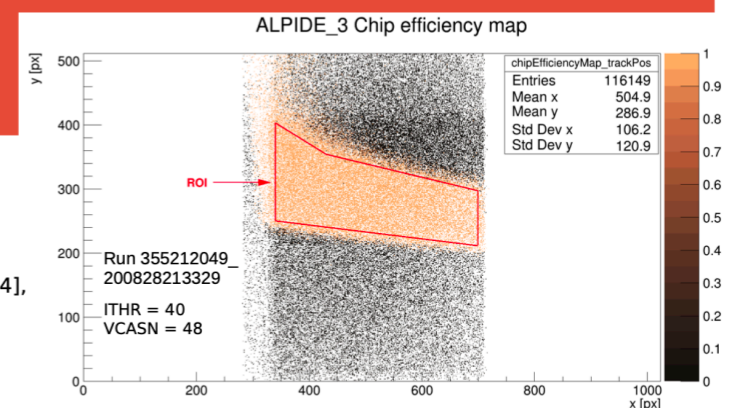
### Setup and DUT orientation



### Region of Interest

- Polynomial R.O.I.

3REF-C7-3REF.conf  
[ALPIDE\_3]  
roi = [340, 250], [340, 403], [430, 354], [699, 297], [699, 211]



### Conclusions:

- geometry/alignment description not enough good
- software (Corryvreckan) needs modification in the management of the geometry (bent chip)
- CERN/Bologna/GSI team will take care of this

<https://twiki.cern.ch/twiki/bin/view/ALICE/ITS3WP3>



# NEWS - 16/02/2021

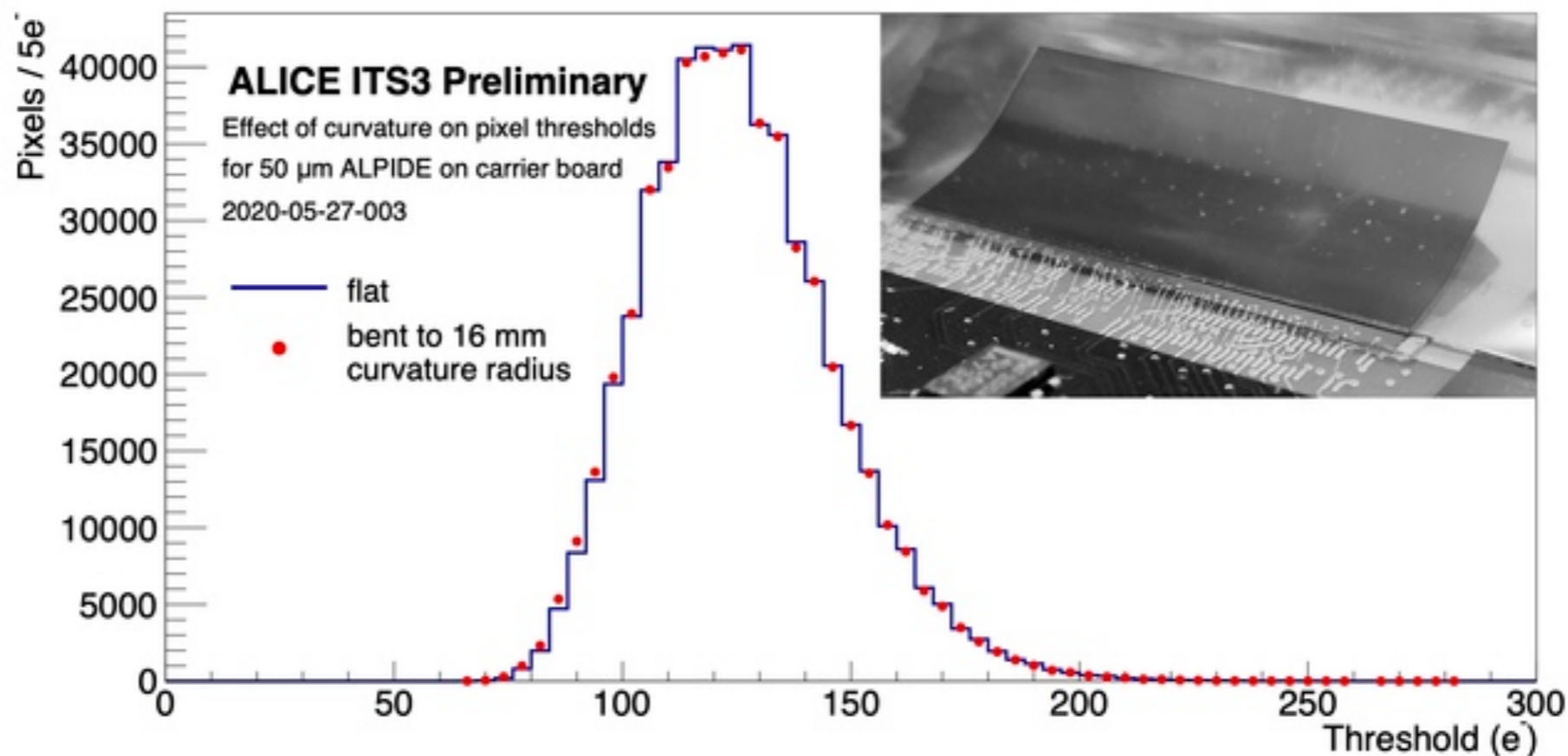
## WP3 - Single bent ALPIDE characterisation

### Goal

- repeat threshold flat/bent chip characterisation
  - useful for Arianna thesis
  - useful for larger chip characterisation

### Material

- 50  $\mu\text{m}$  ALPIDE chips  $\rightarrow$  **Requested**
- Bendable FPC  $\rightarrow$  **Not available** (To be produced, next slide)
- DAQ board (or MOSAIC)  $\rightarrow$  **Partially available**
- Cables and adaptors  $\rightarrow$  **Requested**
- Tool for bending + cylinder to hold bent chip  $\rightarrow$  **Production in Bari under investigation**



# NEWS - 16/02/2021

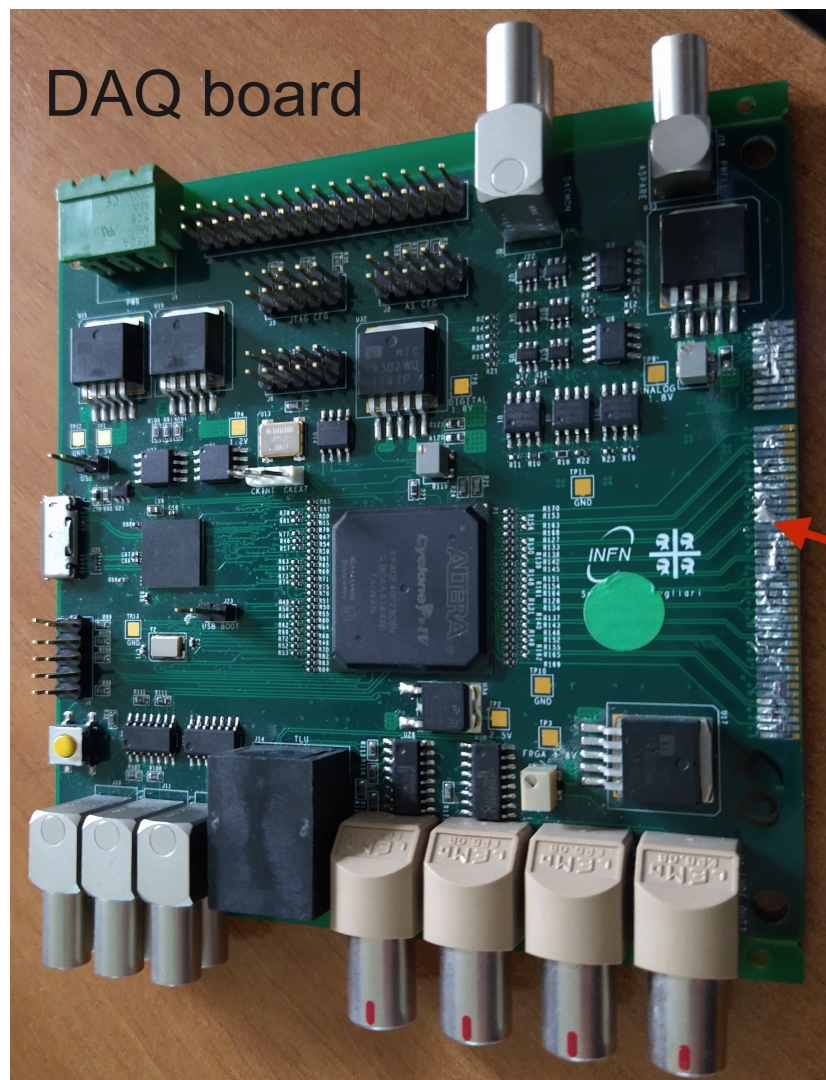
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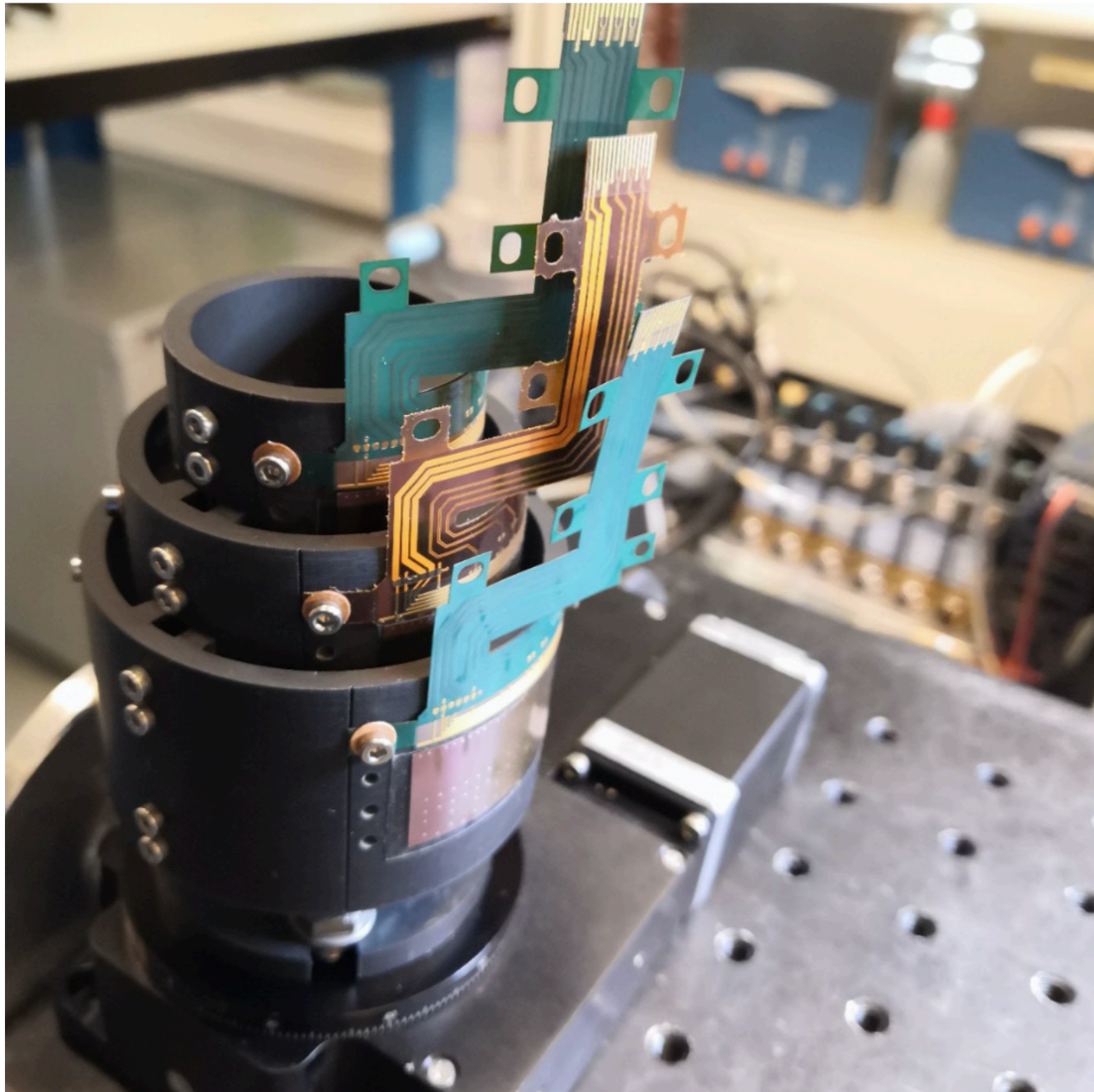
### DAQ board:

- Missing connector → G. Usai contacted
  - Firmware/Software to be installed
- (Alternatively) MOSAIC board:
- Used for single chip usage (Fabio)
  - Connectors to be adapted (?)

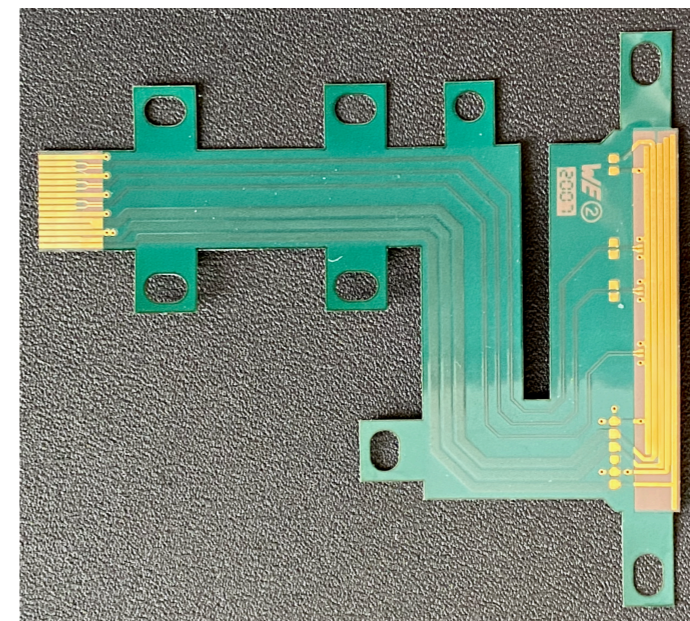
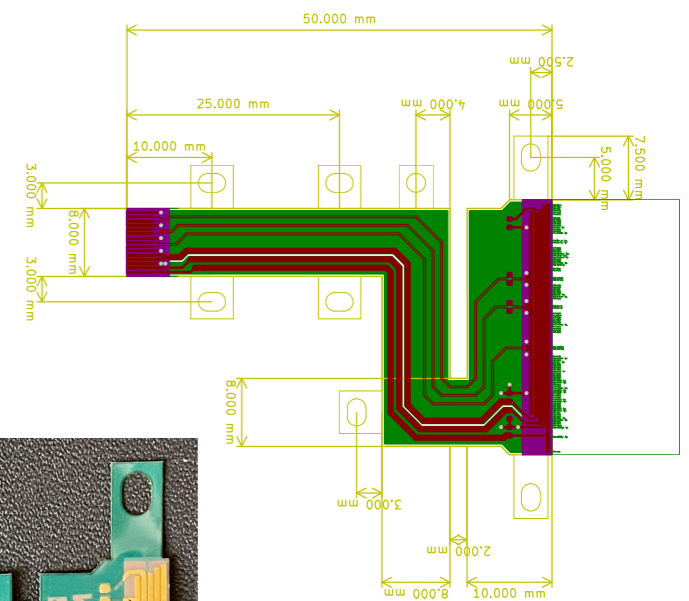


# NEWS - 16/02/2021

## WP4 - Single chip FPC production



- Used for single chip connection in test beams and lab characterisation
- Not available → to be produced
- Arranging purchase...





# NEWS - 16/02/2021

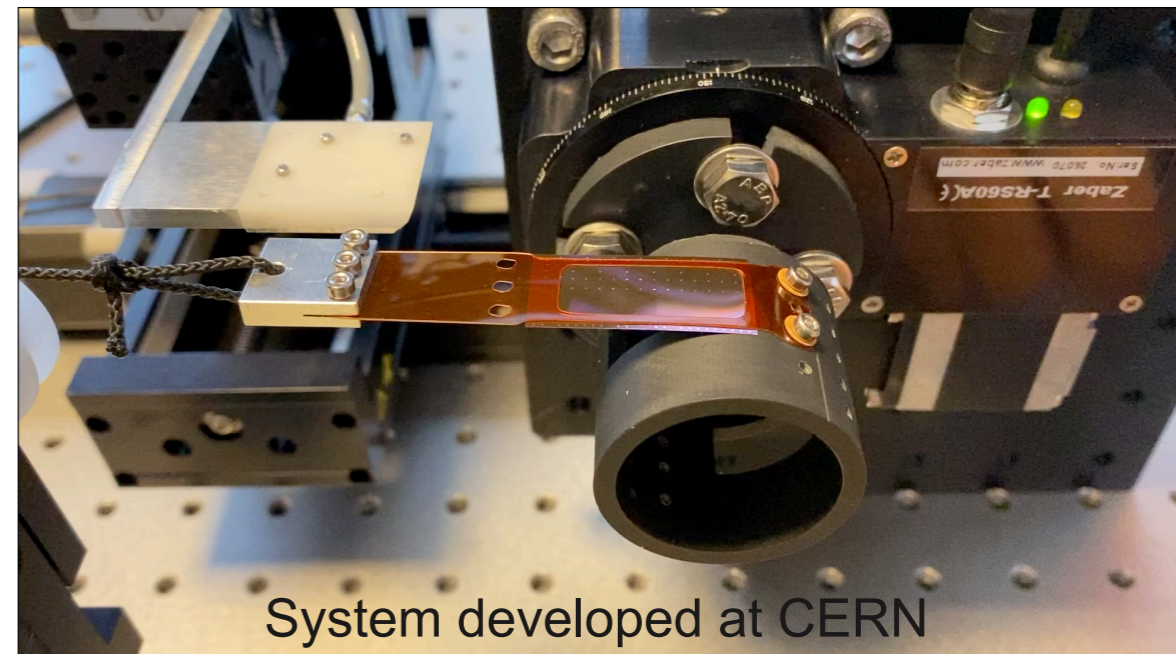
## WP4 - Pull force measurement campaign

### Goal

1. Systematic study of the wire bonding through pull-force and failure mechanism measurement campaign
  - ▶ Bonding after bending
  - ▶ Bending after bonding
  - ▶ After multiple bending

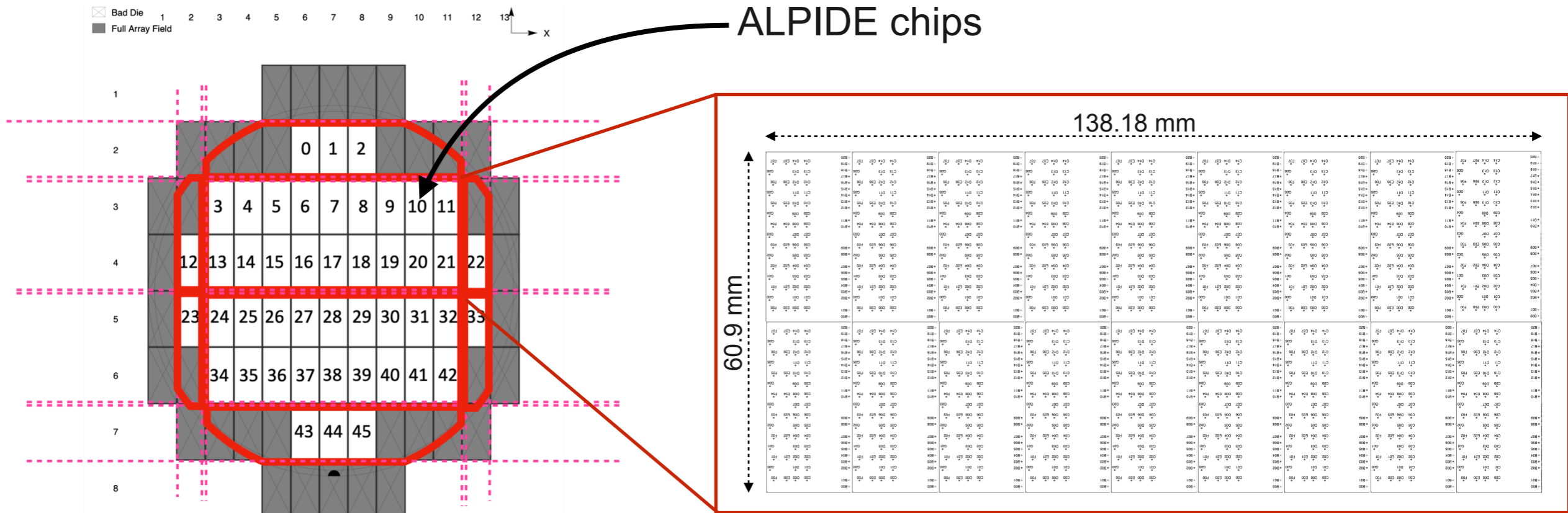
### Tools

1. Bonding machine → Available
2. Supporting tool for bonding that allow to → Under study
  - ▶ bend after bonding
  - ▶ bond after bending
  - ▶ bend multiple times
3. Pull-test machine → Available
4. Chips (50  $\mu\text{m}$ ) [NOT working and working] → Requested
5. FPC → Not available (To be produced, next slide)



# NEWS - 16/02/2021

## WP4 - Super-chip mechanics/FPC design and production

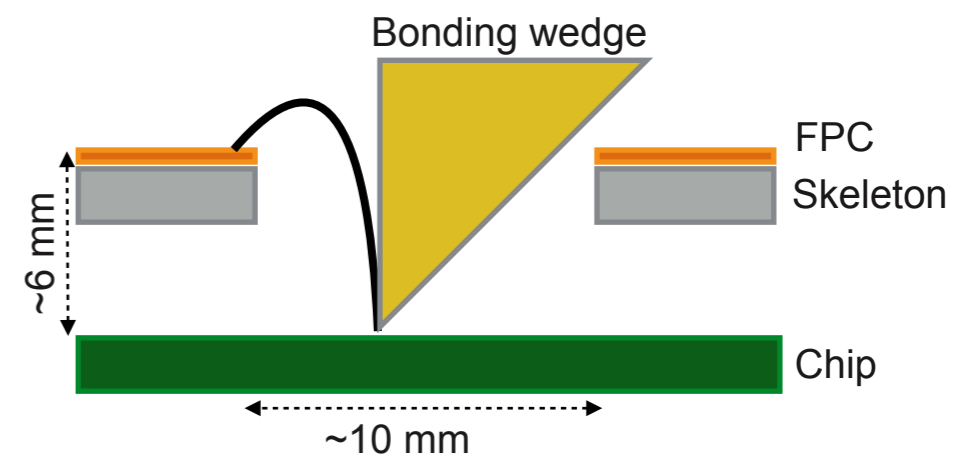
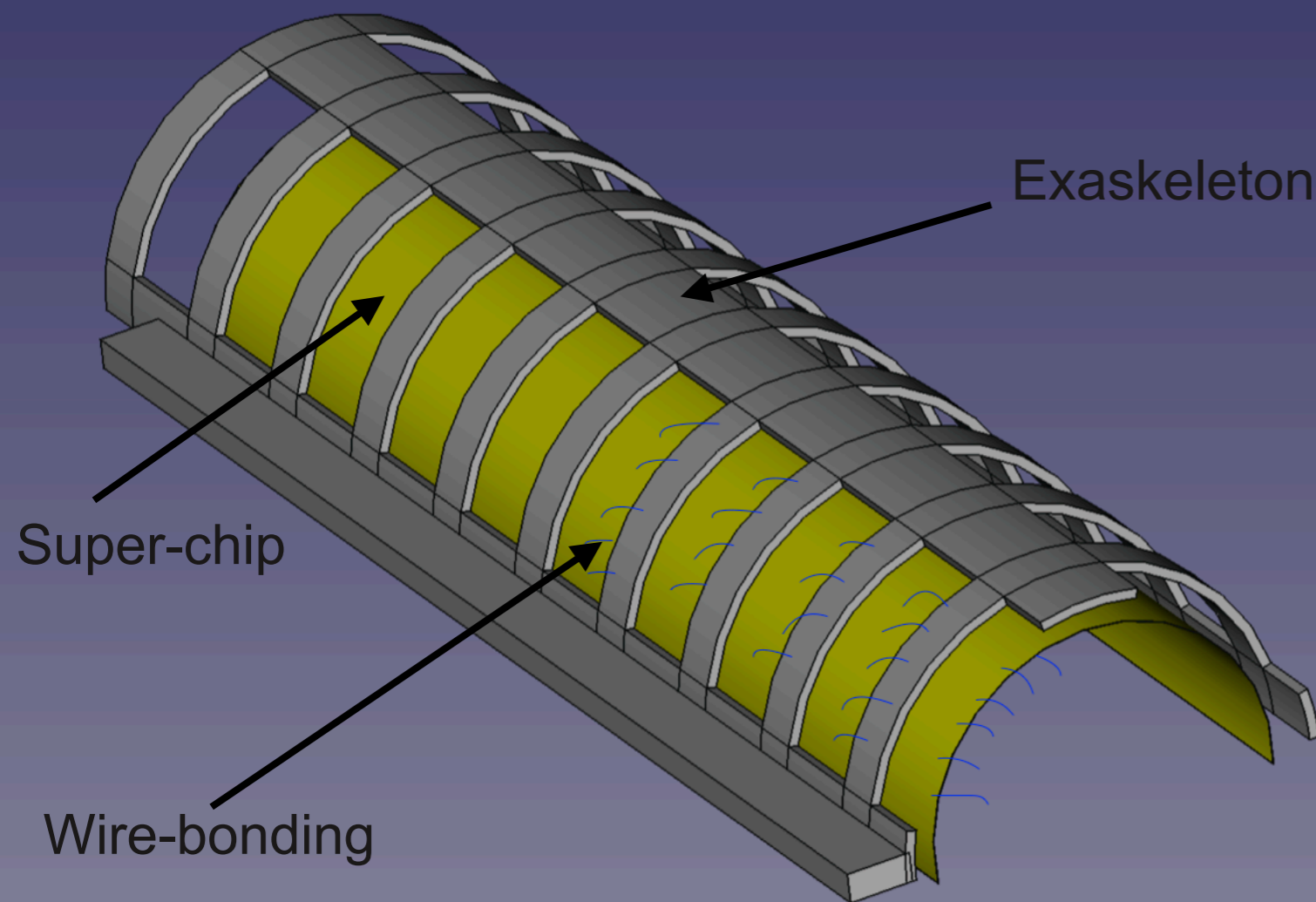


18 ALPIDE chips, as in 2 Inner Barrel ITS2 staves, but different chip orientation

# NEWS - 16/02/2021

## WP4 - Super-chip mechanics/FPC design and production

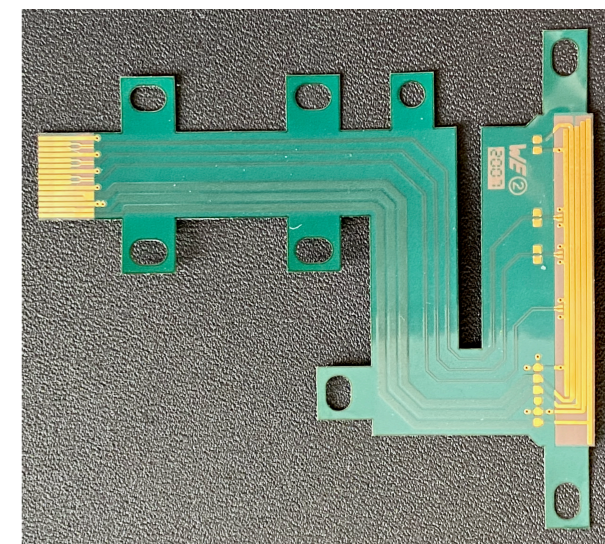
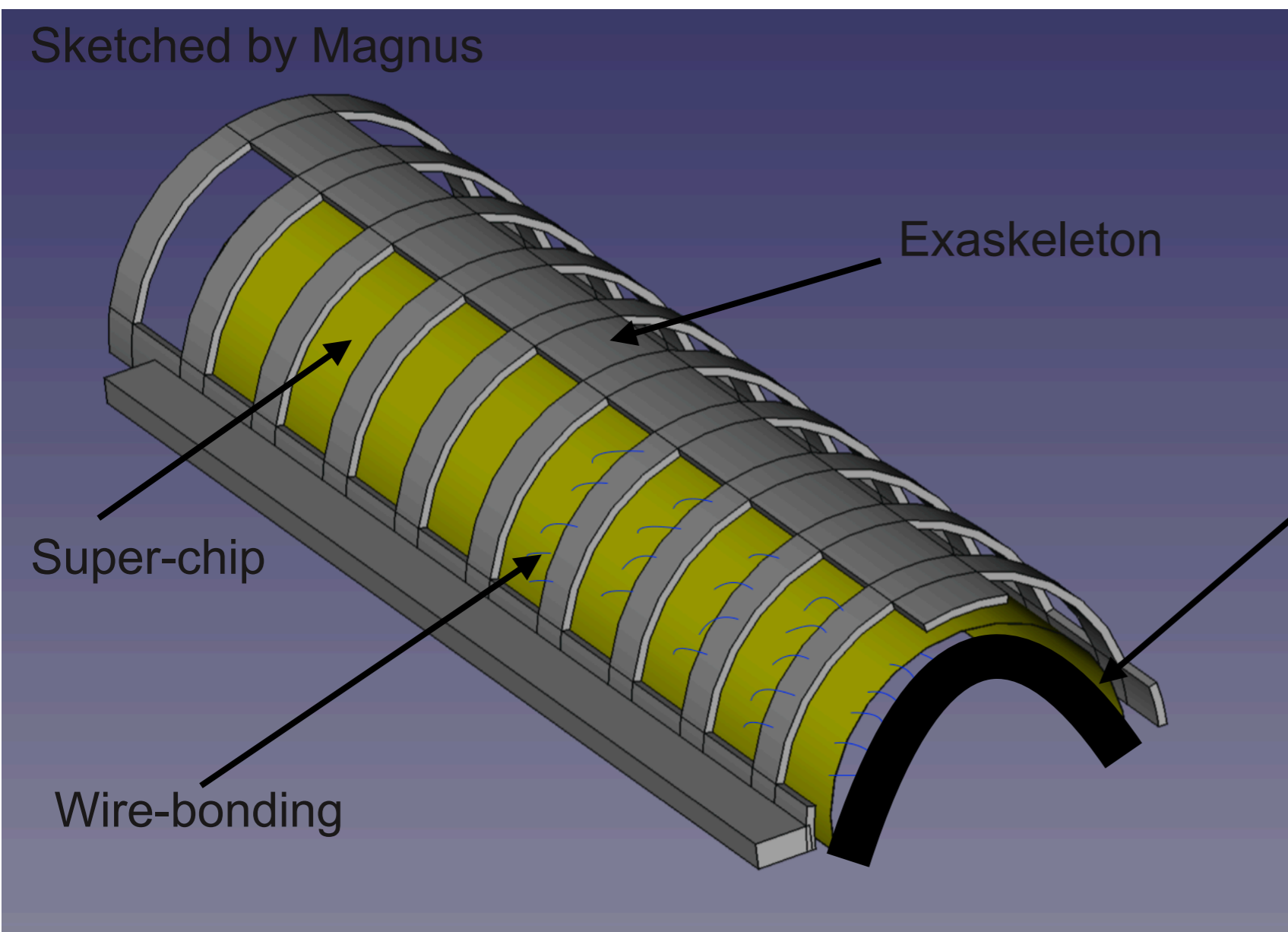
Sketched by Magnus





# NEWS - 16/02/2021

## WP4 - Final-chip mechanics/FPC design and production

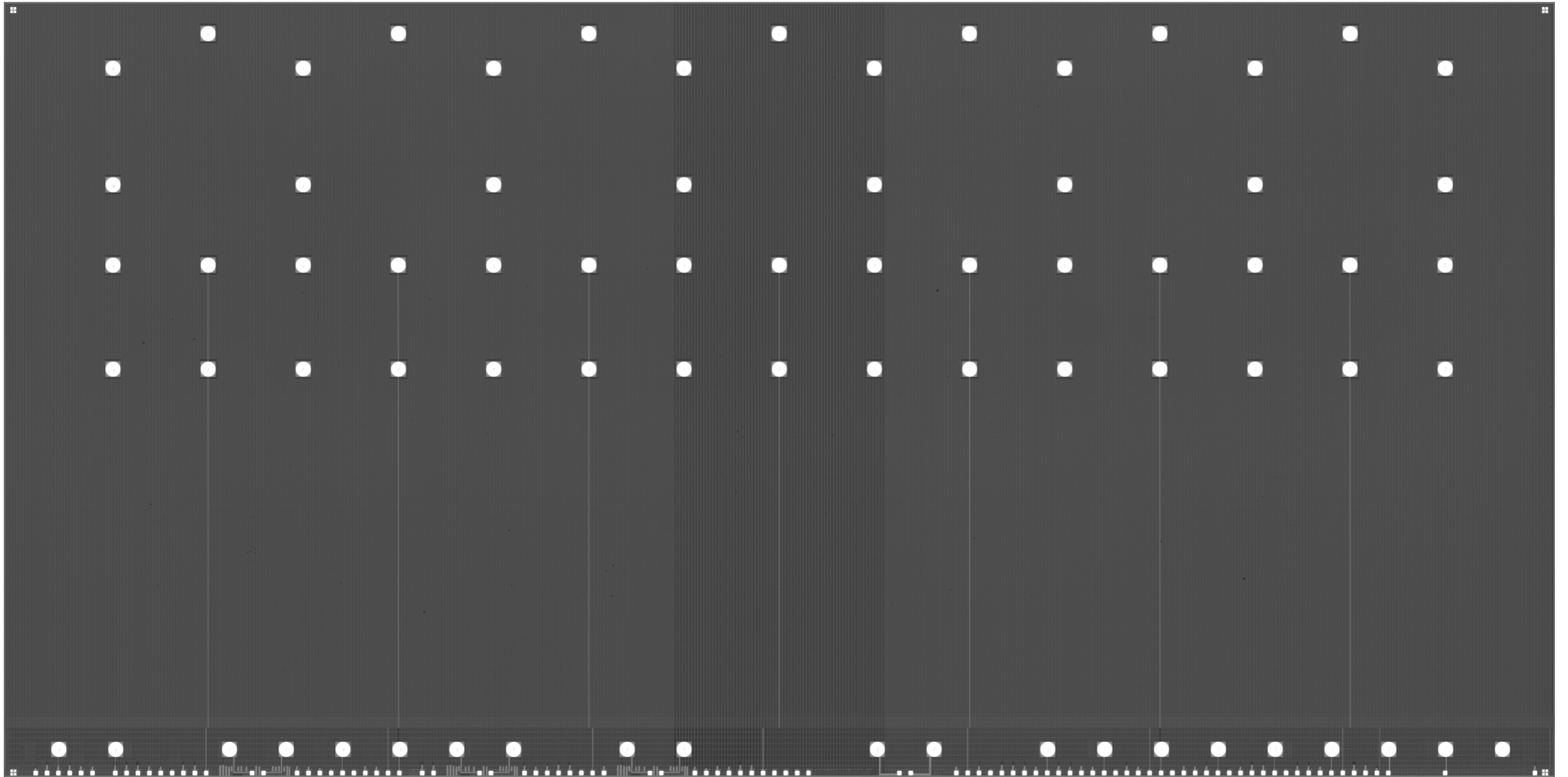


- Edge FPC/mechanics
- For the last two chips of the super-chip
  - Toward the final chip configuration (only end-of-chip connection)
  - Support mechanics design
  - Starting design, single-chip FPC



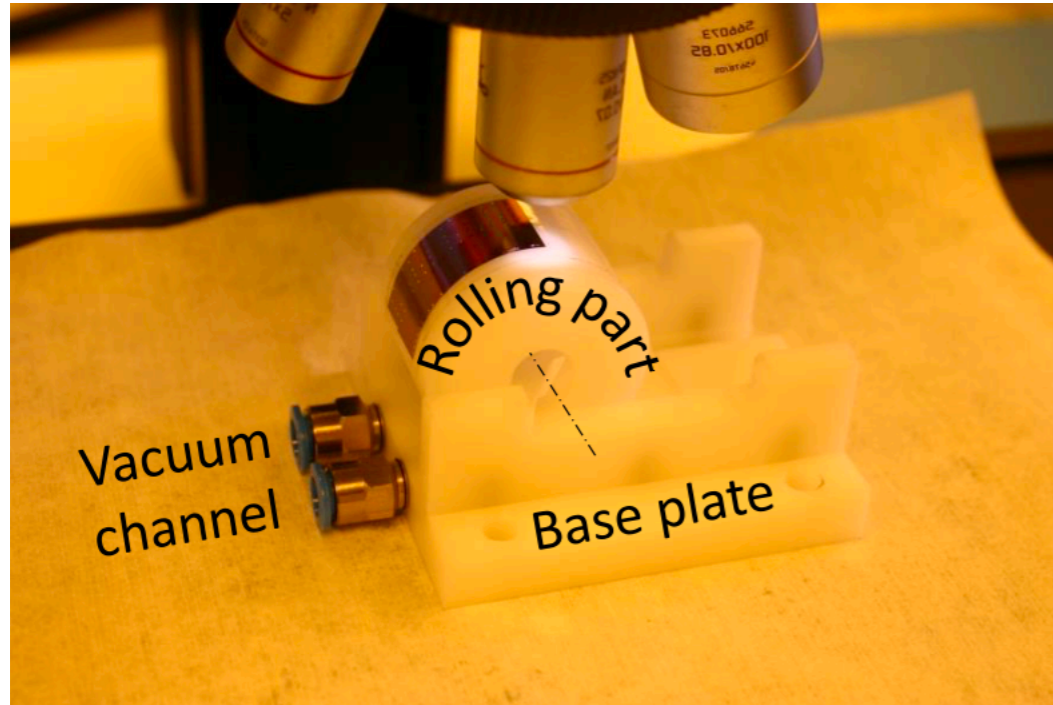
# BACKUP



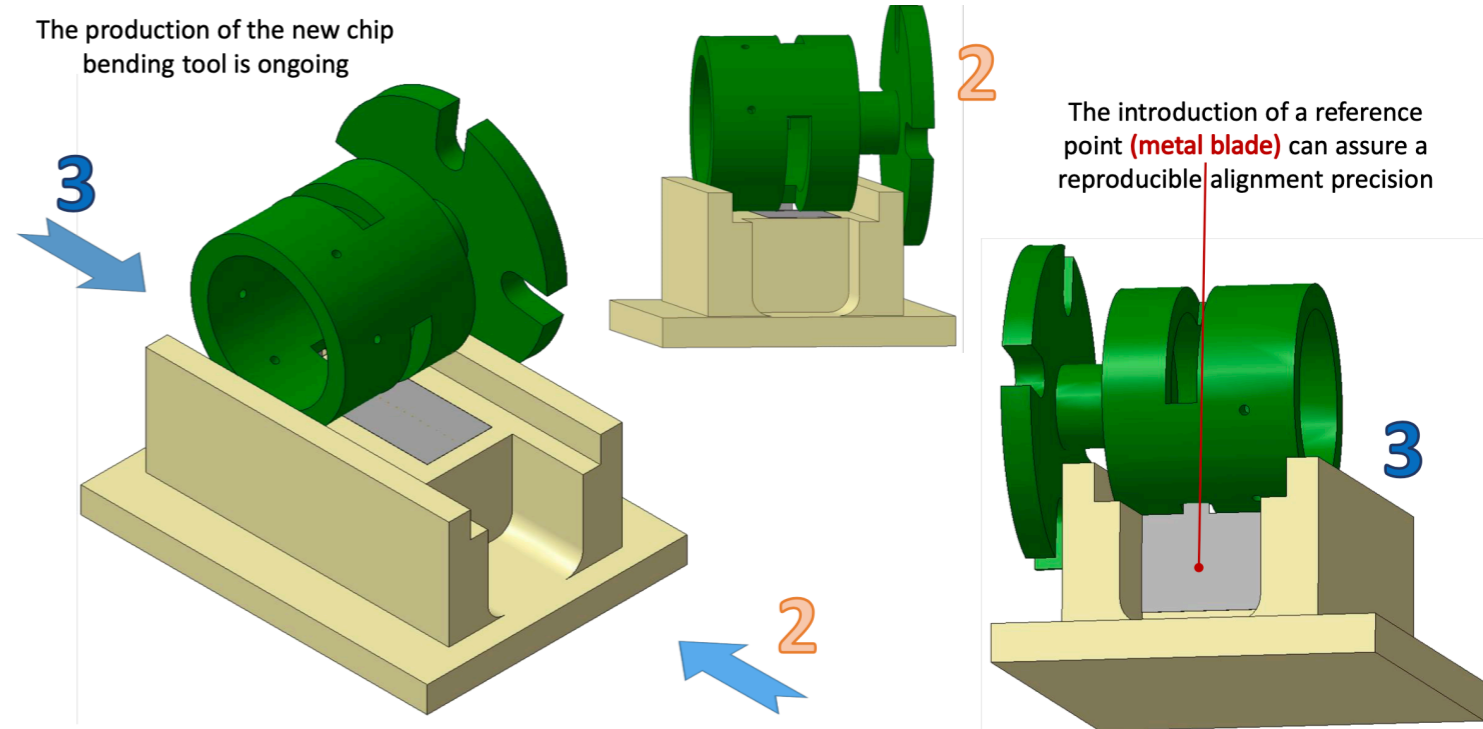


~95 mini-pads





The production of the new chip bending tool is ongoing



The introduction of a reference point (**metal blade**) can assure a reproducible alignment precision

