CNM Activities related to AIDA-WP3

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Participation in AIDA project

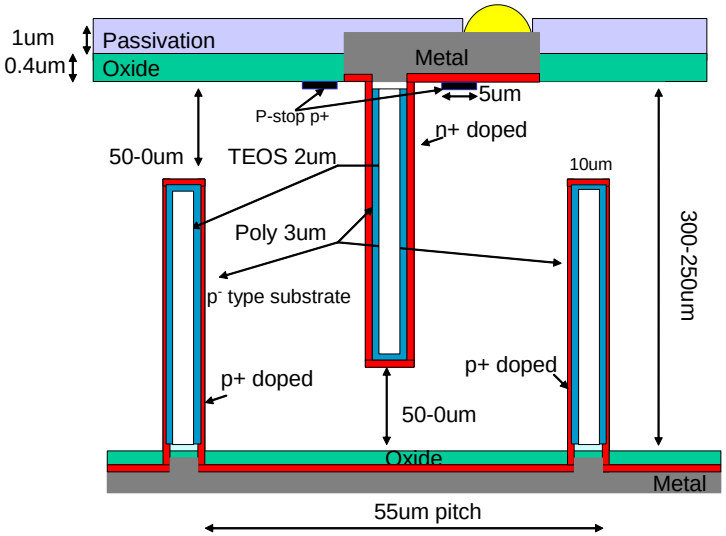
- **Procurement of test structures and detectors suitable for 3D integration**

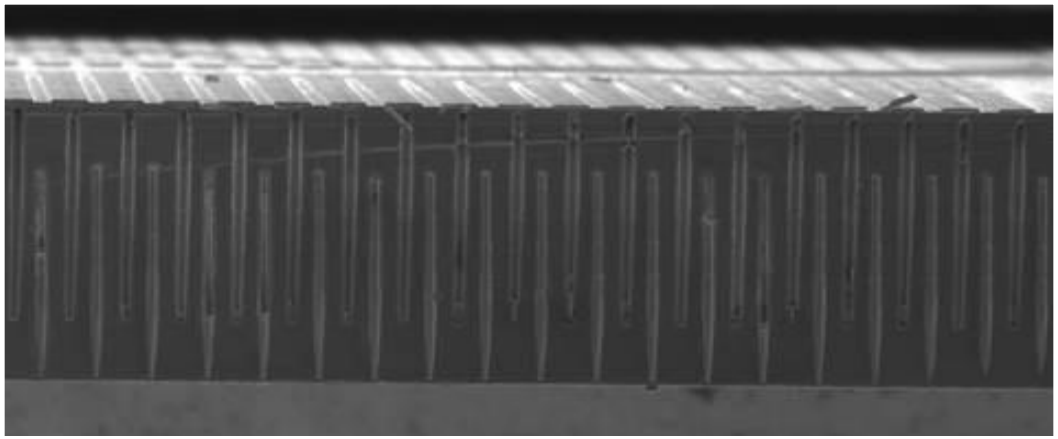
- **3D sensors**
- **Active edge ("slim edge") devices for seamless tyling**
- **Full wafer pixel detectors**
- **Bump bonding**
- **Testing**

- **Budget**:
  - **WP3.2: 50,000 €**
  - **WP9.4: 22,000 €**

3D pixel technology

- **3D pixel technology developed at CNM**
- **CNM was the first institute in the world successfully producing 3D pixel detectors with double side etching technology**
- **This technology was invented at Glasgow (Giulio Pellegrini), fully developed at Glasgow, and now adopted by ATLAS-IBL**

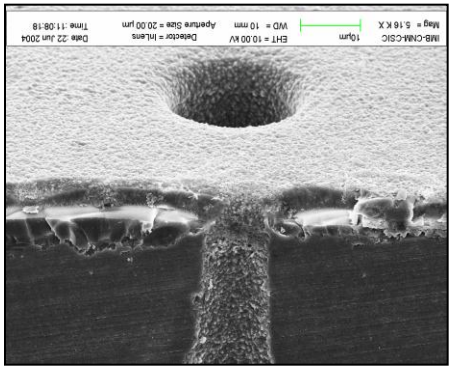


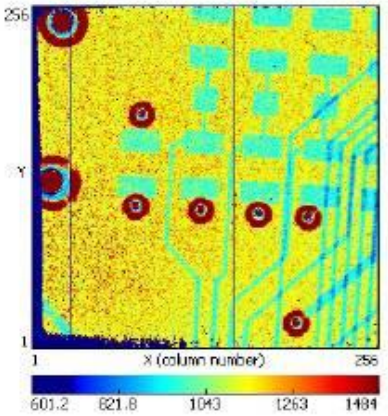


3D pixel detectors for IBL

- 3D pixel detectors for Insertable B-layer for ATLAS
- Double side configuration

- October 2009 common layout (compatible)
- February 2011 end pre-series fabrication
- March 2011 started pre-production for IBL
- 2012 fabrication -> 8 months -> Finished
- Manufacturers: FBK (Trento) and CNM





3D pixel detectors for AIDA

- **Masks for 3D pixel fabrication already made**
  - **FE-I4**
  - **Medipix**
- **Devices manufactured, and tested. Very satisfactory behavior**

- **Collaborations with**
  - **ATLAS-IBL: sensor FE-I4**
  - **CMS: sensor ROC (at this moment being characterized at CNM)**
  - **LHCb: preliminary tests with sensor Medipix2**
  - **Diamond Light Source: sensor Medipix2**

- **More wafers can be processed for AIDA. Reduced cost as the masks are available (*asking for permission*)**

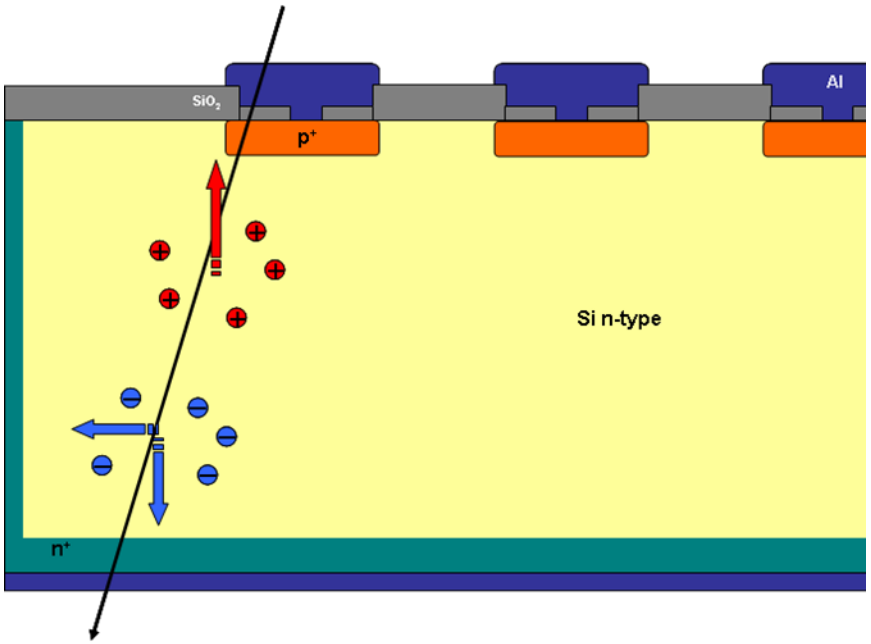
- **3D devices are intrinsically *edgeless***

Slim edge detectors

- **Three approaches:**
- **1.- Active edge (sidewall same doping as backplane)**
- **2.- Trench isolation**
- **3.- Cleaving and passivation**

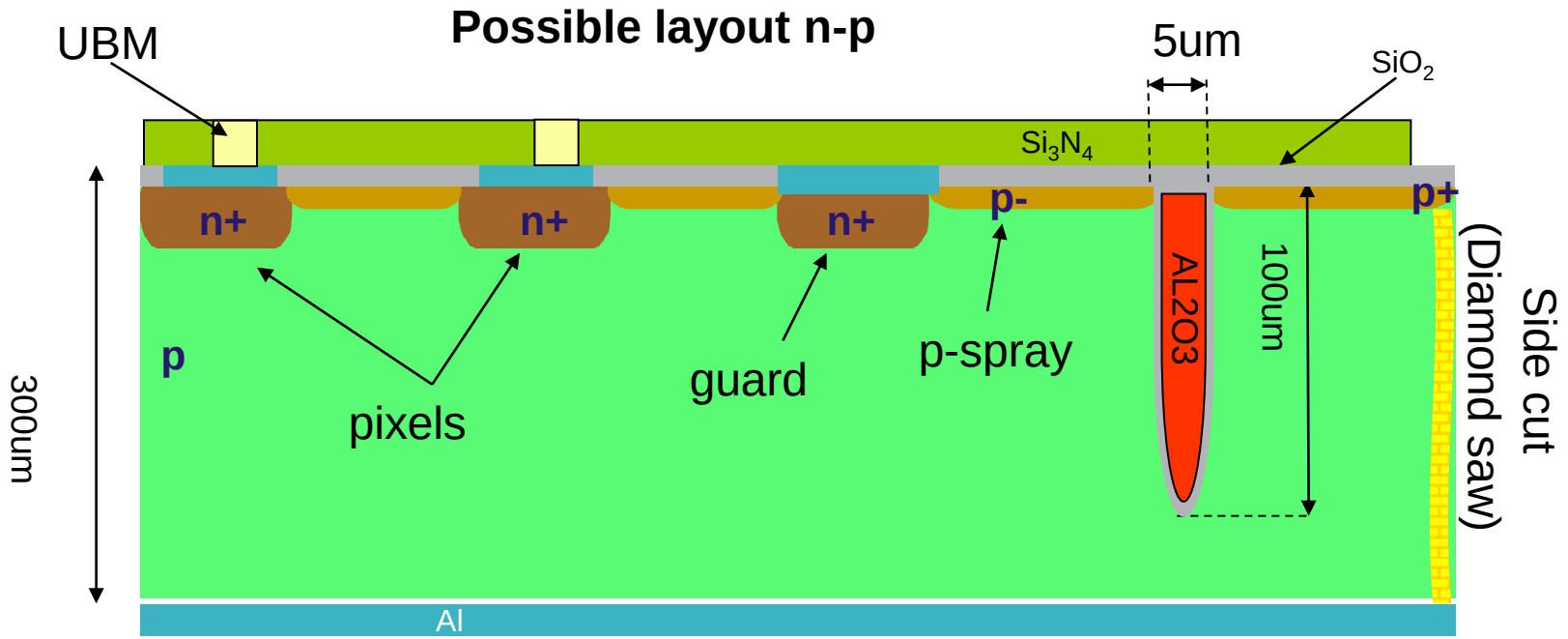
1.- Active edge

- **CNM developed the technology, but currently are not working on it**
- **Problems:**
  - **Need support wafer**
  - **Fragile structure**
  - **Early breakdown**
  - **Difficult to deplete the corner close to the ohmic contact**



2.- Trench isolation

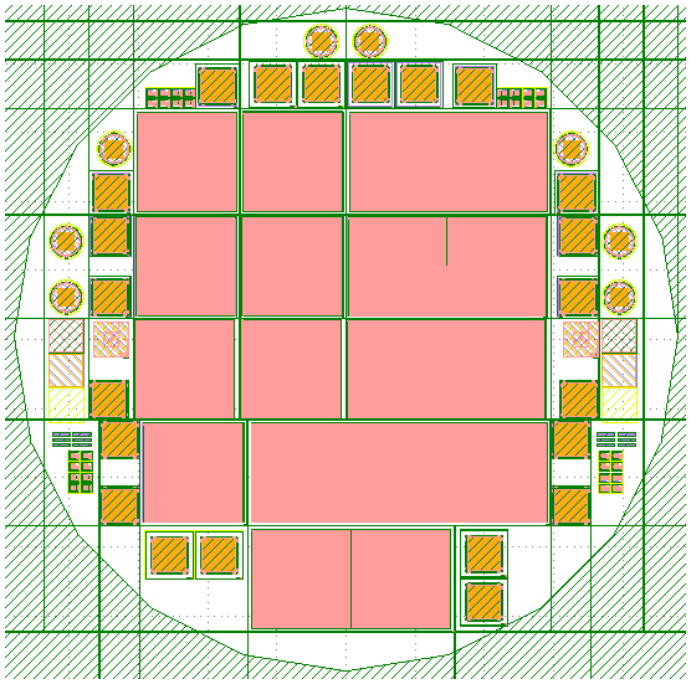
- **The idea is to separate the electric field from the edges.**
- **The cutting could be done in any way (saw, plasma, laser, cleaving)**

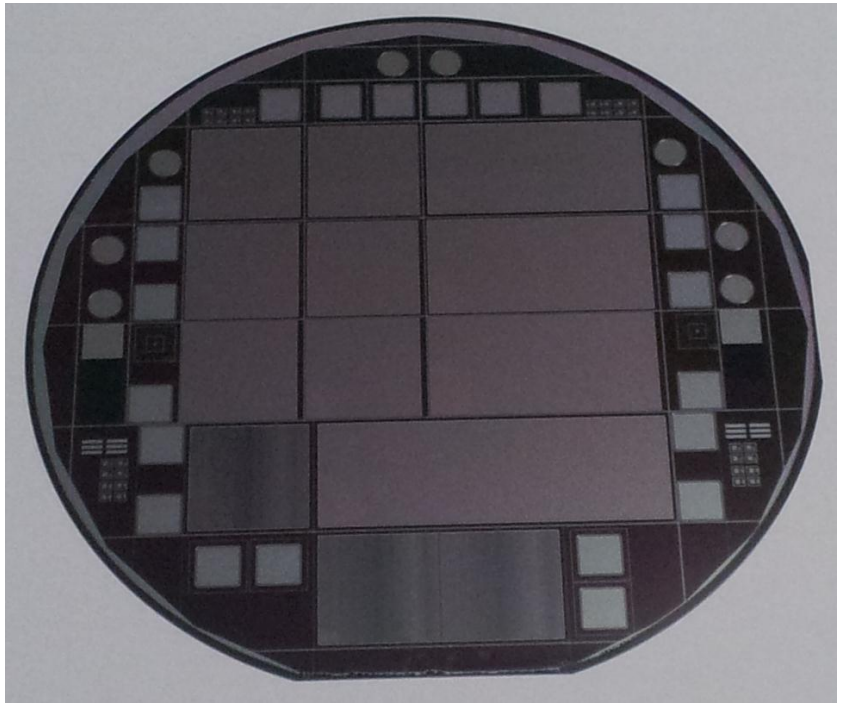


300um wafers

2.- Trench isolation

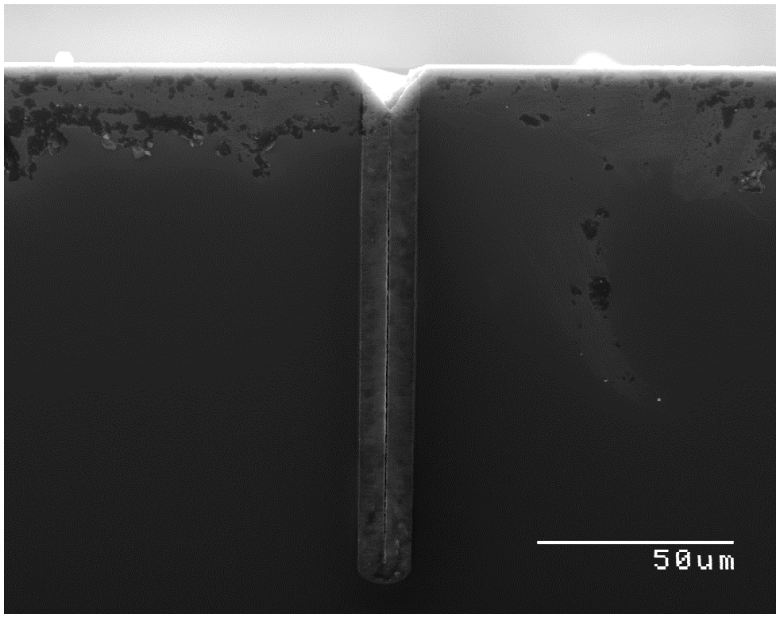
- **We are working in this approach for LHCb collaboration**
- **The technology is ready**
- **The masks are designed, Medipix3 sensors**
- **Preliminary run finished (without trehnches)**

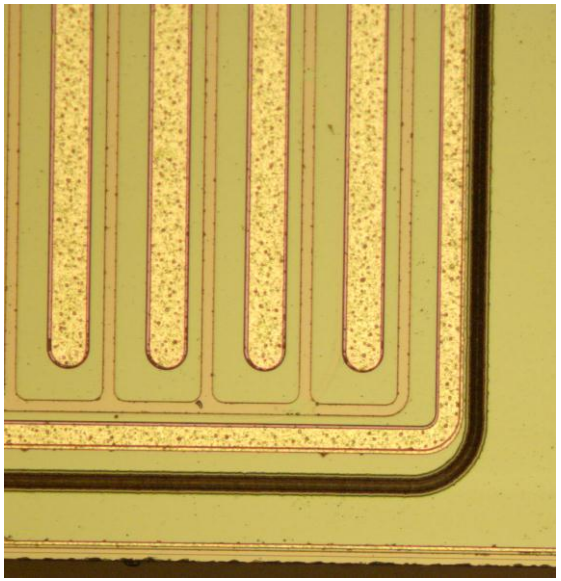




2.- Trench isolation

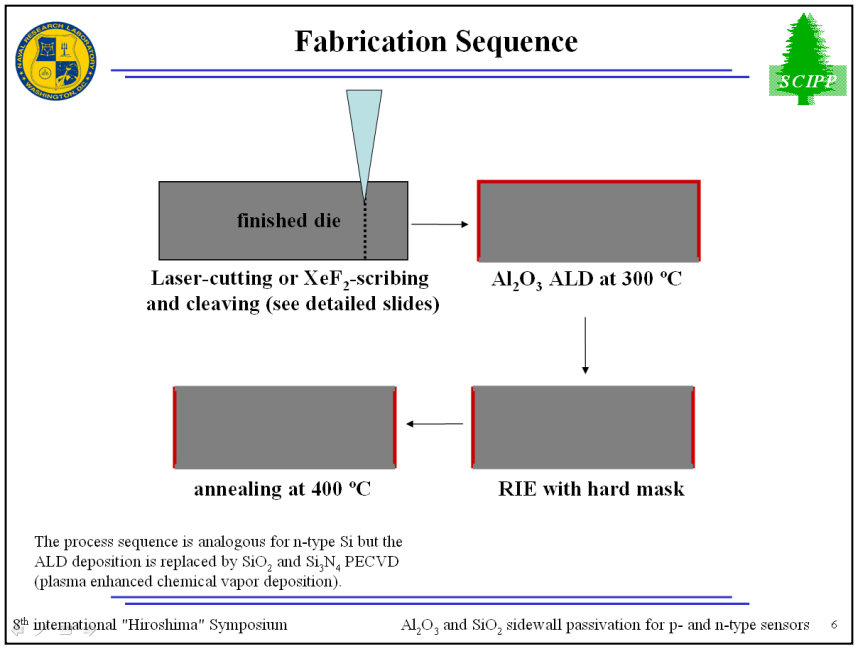
- **The final run with trenches currently in process at the Clean Room**
- **The trenches isolate, but the sidewall cuts have to be passivated**
  - **If not, the leackage current is too high**
- **We are passivating the sidewall with nanolaminate**

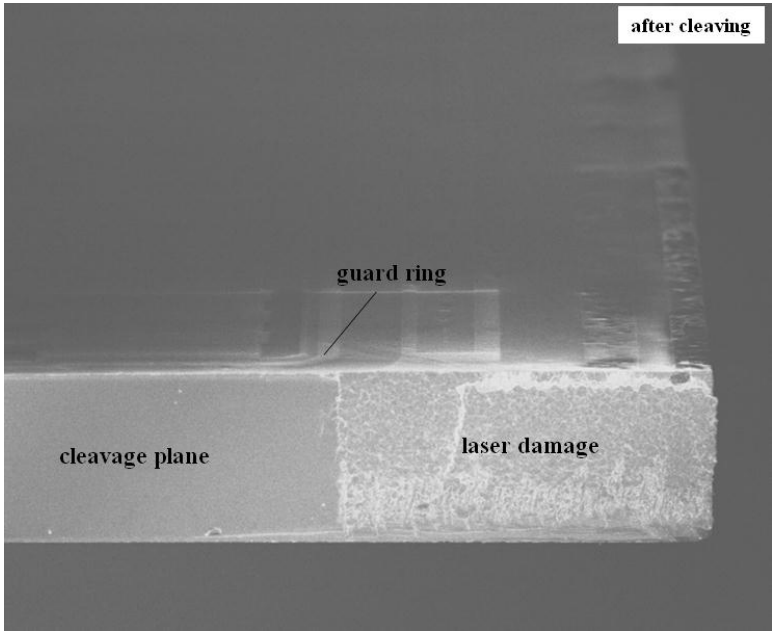




3.- Slim edge cleaving detectors

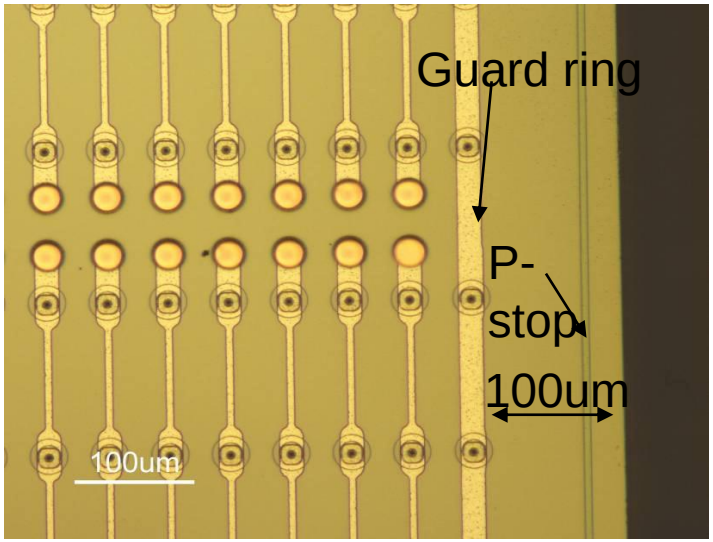
- **New approach: trench wall passivation by Al_2O_3 deposited by ALD (Atomic Layer Deposition)**
- **Experiments conducted in the framework of RD50 collaboration**
- **Laser cleaving and passivation at Naval Research Laboratory**



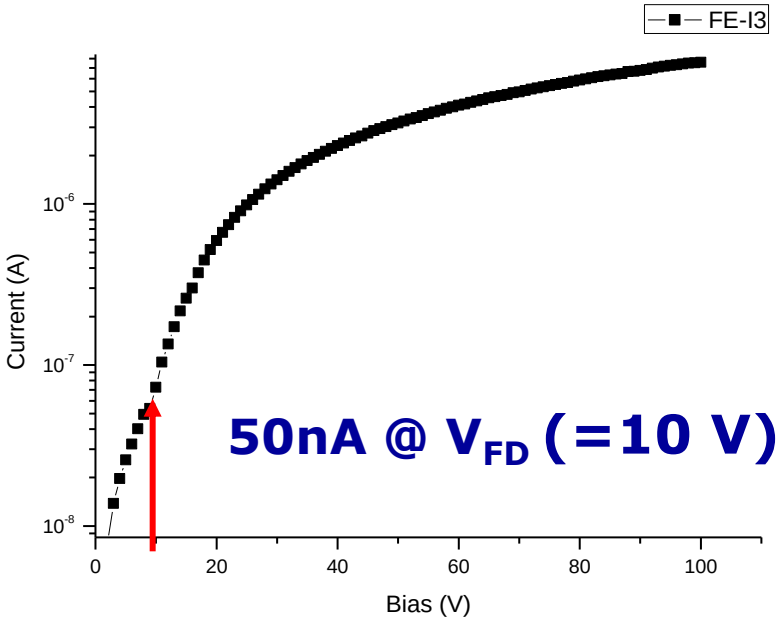


3.- Slim edge cleaving detectors

- **In this common project CNM has provided 3D FE-I3, FE-I4, and microstrips and planar Medipix3 detectors**
- **The cutting and passivation is made at NRL**
- **First devices are under test with promising results**
  - **CNM is trying another approach, plasma cutting and ALD passivation, all available in our Clean Room**



FE-I3 3D pixel detector



Other possible activities

- **Fabrication on 6 inches:**
  - **N-on-P technology in process**
  - **Pixel sensors**
  - **Dummy devices for flip chip or wafer bonding tests**
- **Flip chip of Medipix or FE-I4 chips**
- **Final option:**
  - **Transfer all or part of money from WP3 to WP9**
  - **5.4 % of WP3 (0.6 % of all project)**
  - **WP9.4 Silicon Tracking (advanced deliverable)**
  - **At WP9.4 CNM is providing strip sensors with advanced technologies and our budget there is too low**