

# Technology Transfer by Techtra



Techtra did the first and only technology transfer  
from CERN to Polish industry

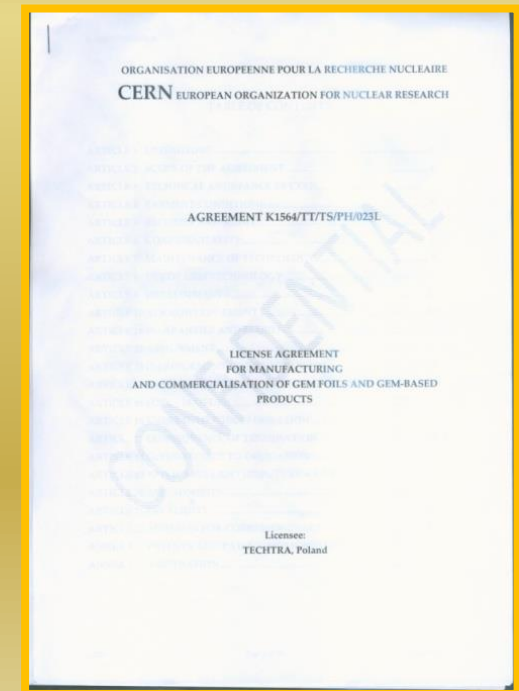
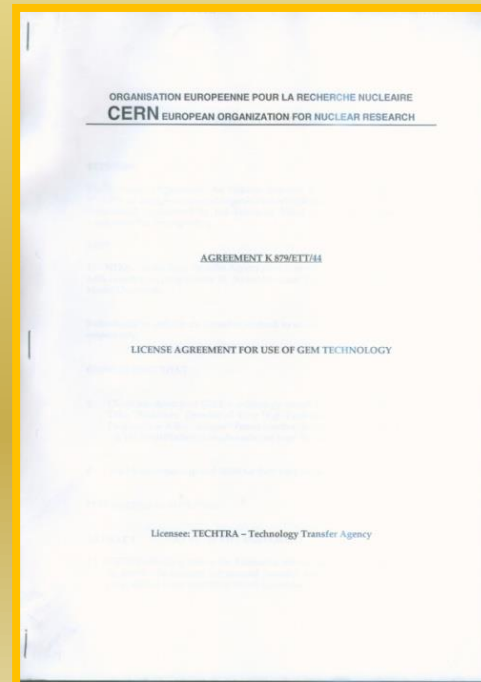


On the basis of signed  
license agreements,  
Techtra is the only  
European company  
producing Gas Electron  
Multipliers (GEM).



## Technology Transfer Step 1: Legal issue

1. Licence for Micro-Chemical-Vias - for „kapton etching” technology in PCB
2. Licence for Microvia technology - for internal GEM R&D
3. License for Manufacturing and Commercialisation of Gem Foils and Gem-based products





## Technology Transfer Step 2: Cooperation with **existing industry**

Eldos – PCB producer



Techtra was responsible for Kapton etching  
Eldos was responsible for all the rest

### Problems:

- it is hard to separate production steps especially during R&D!
- production regime of big PCB producer

### Benefits for Techtra:

- „experience transfer” from Eldos to Techtra



## Technology Transfer Step 3: Starting **the business**



Techtra decides to assemble the whole GEM production line. The machinery was installed in Wrocław Technology Park. Techtra got UE support within the „Intelligent Development” project. We had two rooms of about 50m<sup>2</sup>.



Laboratory scale workshop to have everything under control.



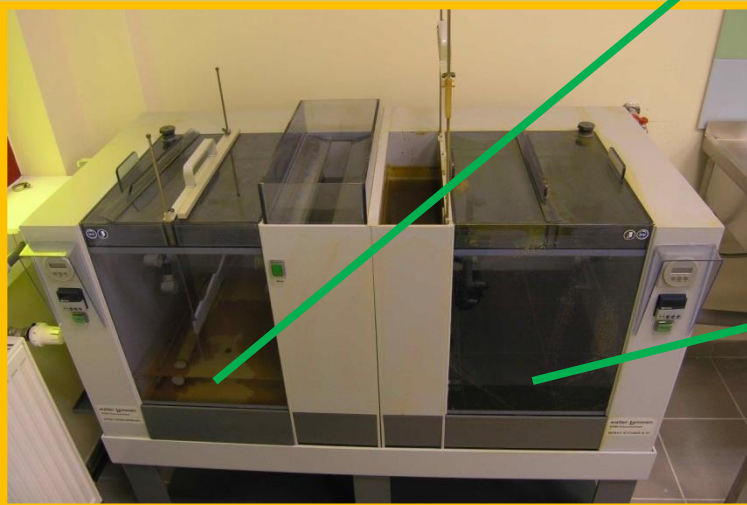


## Technology Transfer Step 4: Dedicated infrastructure for GEMs were based on CERN experience.

The choice of machines and workshop layout were consulted with Rui.  
Machines were produced by „Wise“ company, Parma.



New developer

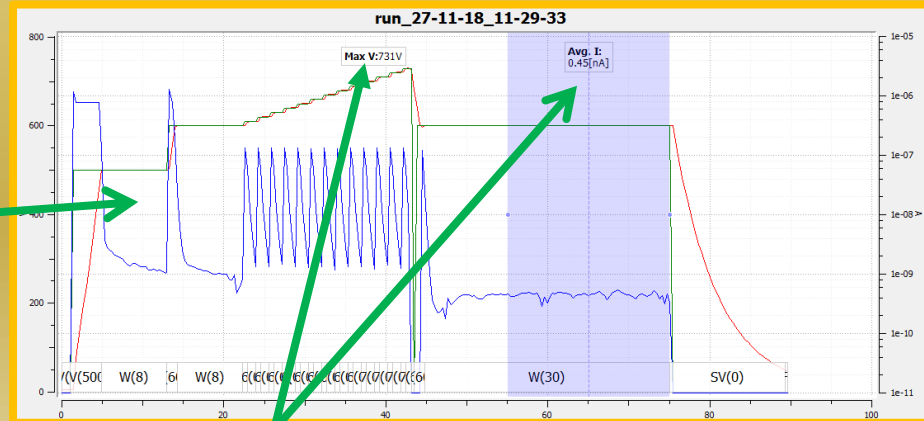
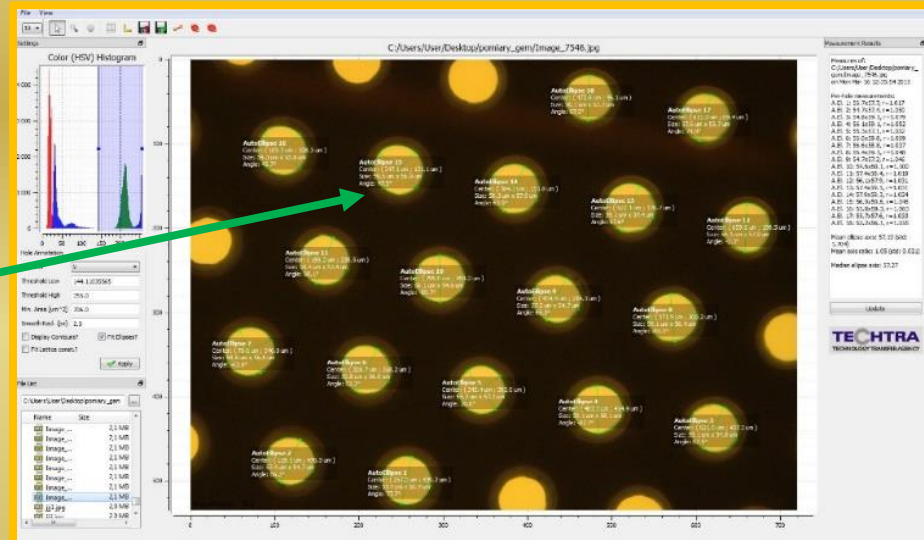
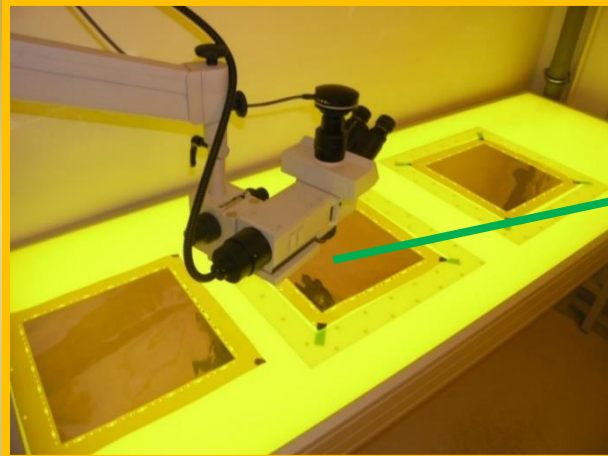


Old developing and etching set



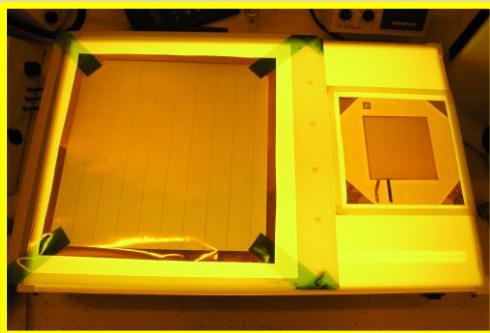
New Cu etcher

## Technology Transfer Step 5: Quality control: **define parameters!**



Leakage current below 1nA@100cm2 @600V @30 %HR

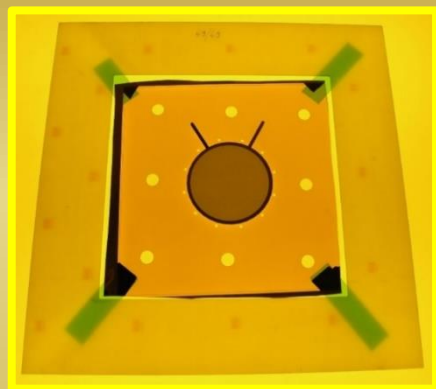
HV testing stand



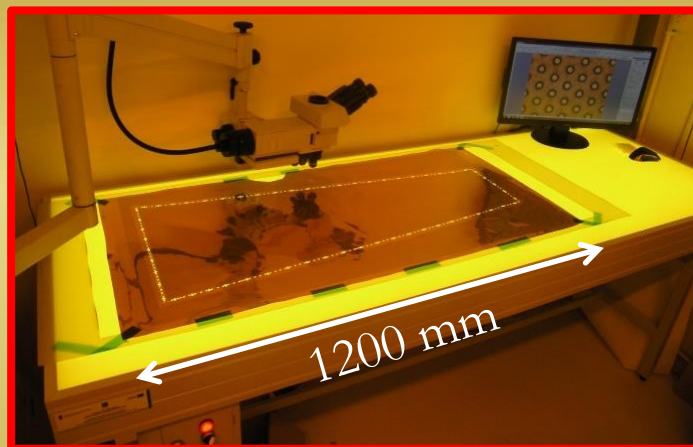
Typical 30x30 and 10x10cm GEM foils



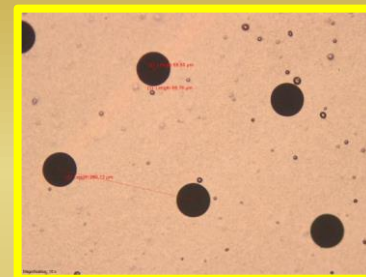
Since 2010, Techtra has supplied over 3,500 GEMs for High Energy Physics laboratories



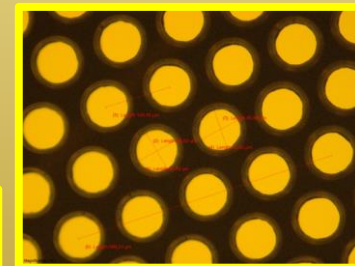
Round GEMs  $\varnothing$  5cm



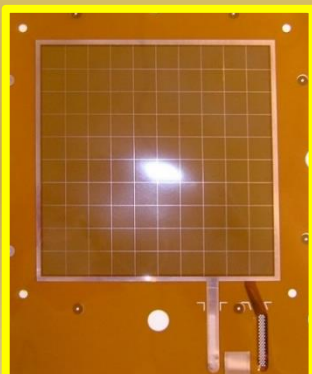
GEM prototype for the CMS experiment, CERN



$\varnothing 70\mu\text{m}$ , pitch  $280\mu\text{m}$



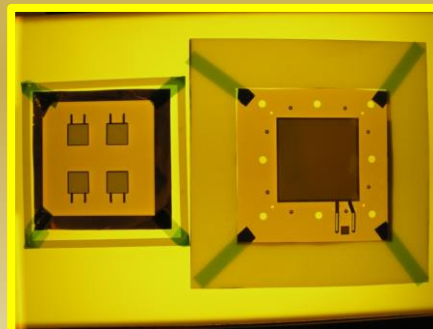
$\varnothing 90\mu\text{m}$ , pitch :  $140\mu\text{m}$



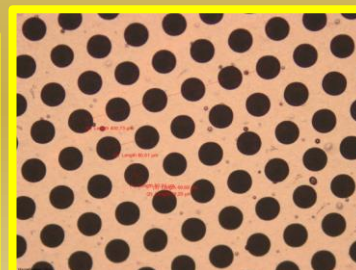
Chromium GEMs



Round  $\varnothing$  12cm



Different shapes and sizes



$\varnothing 50\mu\text{m}$ , pitch :  $80\mu\text{m}$



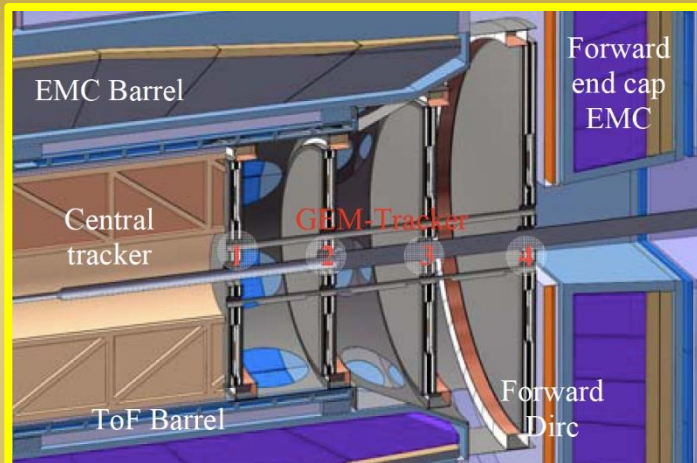




## Techtra's clients for GEM foils



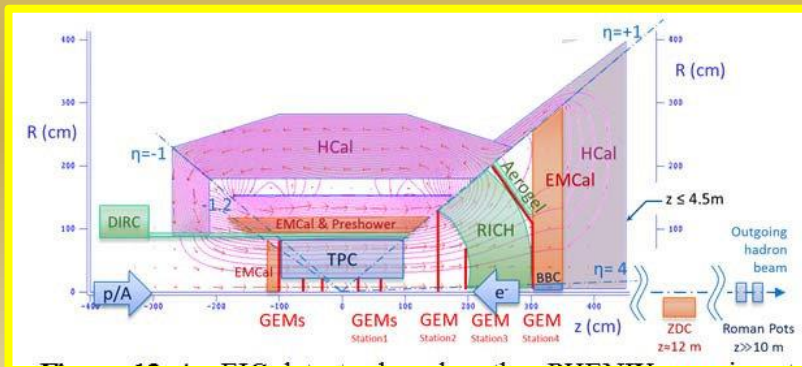
Experiment KLOE-2, INFN, Italy



Experiment PANDA, Germany



Experiment CMS,  
CERN, Switzerland



Electron Ion Colider detector, USA



Experiment BESIII, Chiny

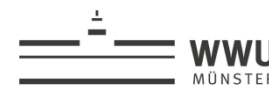


Techtra cooperates with European research centers as part of research projects and deliveries.

- Istituto Nazionale di Fisica Nucleare (Italy)
- Johannes Gutenberg-Universität Mainz (Germany)
- Ruhr-Universität Bochum (Germany)
- University of Sussex (UK)
- Uppsala University (Sweden )
- Westfälische Wilhelms-Universität Münster (Germany)
- CERN - European Organization for Nuclear Research (Switzerland )
- CAEN - Costruzioni Apparecchiature Elettroniche Nucleari Caen-S.p.A (Italy)
- ELTOS S.p.A (Italy)
- Institute of High Energy Physics(China)

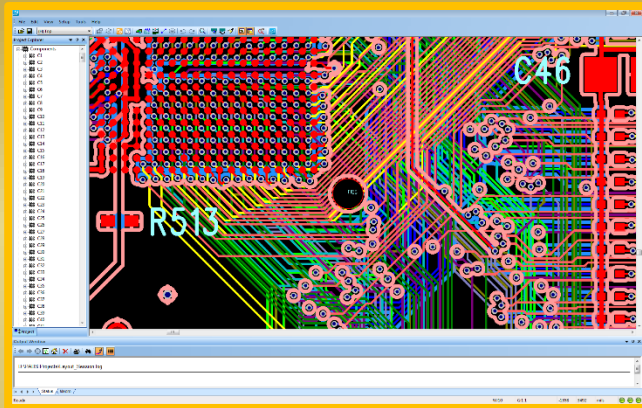


Institute of High Energy Physics  
Chinese Academy of Sciences





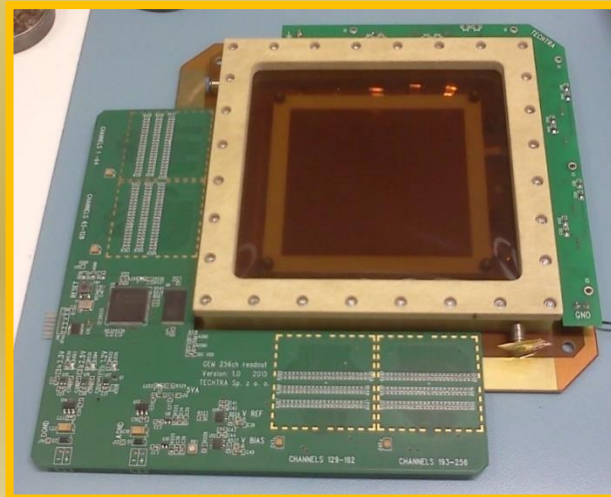
## Technology Transfer Step 6: Look for **new applications:**



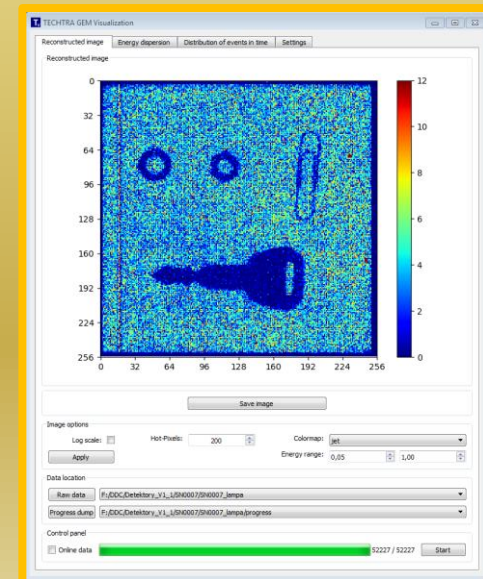
Techtra is the only commercial producer of GEM detectors



Design and prototyping



Commercially available product

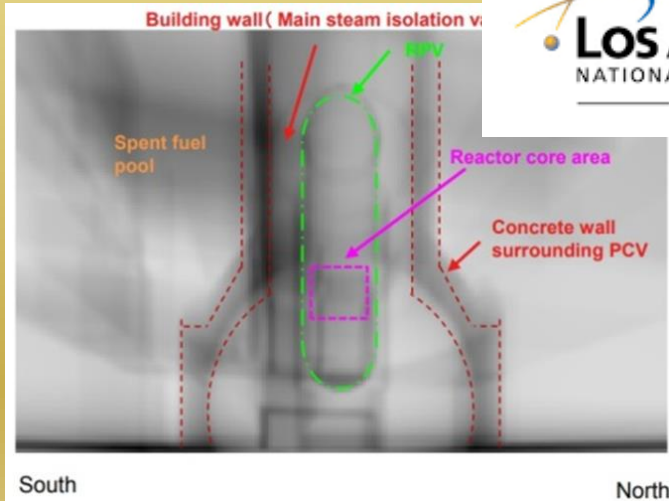




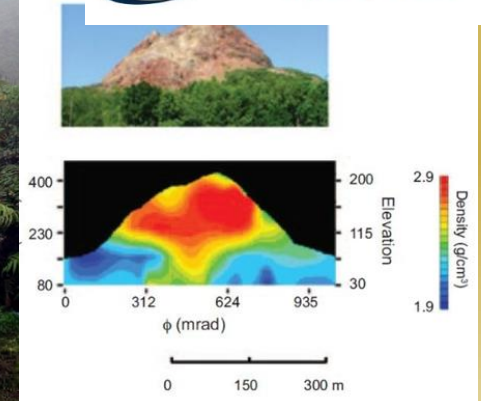
# Cosmic rays for industrial radiography



Cosmic rays (muons) can be used for radiography.



Scanning the Great Pyramids in Giza.



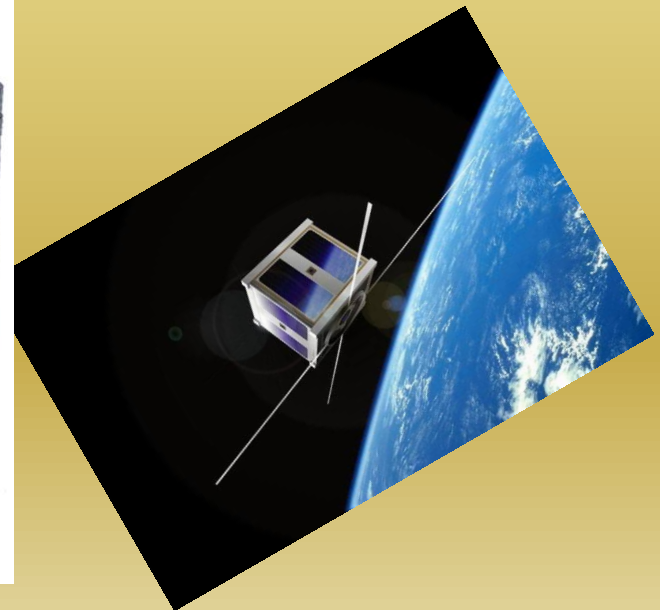
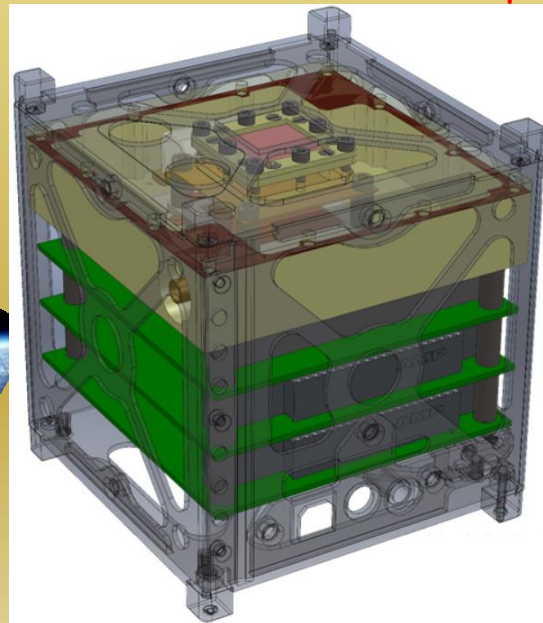
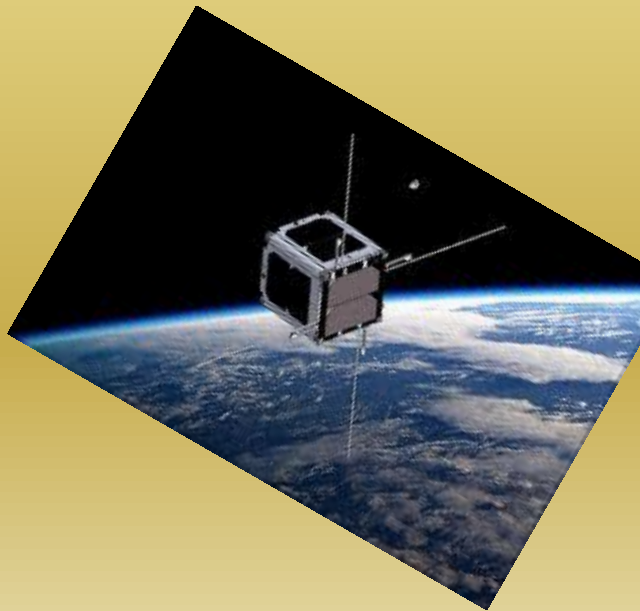
Nuclear Reactor in Fokushima - muon tomography showed that nuclear fuel was released from the reactor into an external tank

Scanning a volcano in Italy.

R&D project aims to build a microsatellite for forecasting solar weather.

Project is cofinanced state budget

The POIR.04.01.02-00-0080/17 project is co-financed by the National Centre for Research and Development selected under the Smart Growth Operational Programme in Competition No. 1 - 4.1.2/2017\_RANB



Cubesat micro satellite

# Summary:

## Technology Transfer issues:

### Pros:

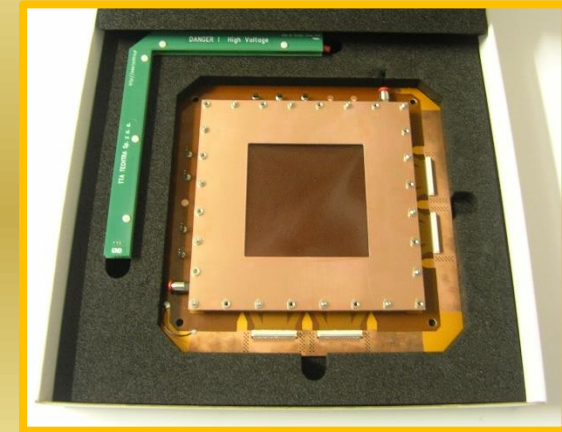
1. Support of Industrial Liaison Officer for Poland
2. Great support of CERN ETT
3. Excellent support from engineers and technicians – interpersonal contacts are crucial.

### Cons:

1. Legal issues are critical for companies. That needs time !
2. The technology was not ready for transfer.
3. One needs to ask good questions.
4. Look for external funding..... everything costs more than you expect
5. Competitors:
  1. CERN itself !!!!
  2. „In-kind” contributing partners



# Our Core GEM-team



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