AIDA-2020
WP2: Innovation & Outreach

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This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 654168.
Objectives

- Scientific Coordination
- Communication, dissemination and outreach
- Industrial relations and technology transfer
- Management of the Proof-of-Concept (PoC) fund
- Pre-industrialisation of large area silicon detectors
• Academia meets Industry Symposium
• Why on Non-Destructive Testing?

• Market study:
  • 2016: 15 billions $
  • GR: 8-10 %

• Technologies used in NDT:
  • X-ray technologies (closed to HEP)
• Key elements

• 12 companies with a booth (+140%)

• 18 speakers:
  • 4 from academia (-60%)
  • 14 from industry (+100%)
Task 2.3 Industrial relations and technology transfer

• From academia:
Task 2.3 Industrial relations and technology transfer

• From industry:
• 87 participants (+45%) from 18 countries
  • 31 from industry
  • 56 from academia
• Academia meets Industry Symposium:

- Detectors
- Sources
- Integrators
- Producers
- End users
• Academia meets Industry Symposium

• B2B meetings:
  • 11 meetings organized industry-industry
  • 7 meetings organized industry-academic
  • 1 meeting organized Academia-Academia

• + All the discussions during coffee breaks and networking event
• How to measure the impact of an Academia meets Industry?

• Feedback:
  
  • Online survey available
  • Interview will be schedule with the industrial speakers in September as a follow-up.
  • Numbers of contract in discussion and /or signed thanks to the event

26 April 2018
• How to improve the KT/TT from AIDA2020 to Industry?
  • Prepare a value proposition of what is unique in each WP:
    • 1 slide to explain what is done or what is the specific know-how developed in AIDA2020, what is in it for Industry and the type of industry that might be interested
Why should we start this activity?

- To show EC that we understand the requirements to work closer to industries
- Having a set of slides to be presented to industry to partner for the next project
- Having a set of slides to be presented to industry during the next BSBF
Objectives of PoC:

- General field of detector development
- Collaborative project industry oriented
- Bringing technologies closer to the market

→ Impact beyond high energy physics
• 3 projects funded:

<table>
<thead>
<tr>
<th>Budget €</th>
<th>Title</th>
<th>Lead Institute</th>
<th>Partners</th>
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<tbody>
<tr>
<td>45,600 €</td>
<td>Silicon-based Microdosimetry System for Advanced Radiation Therapies</td>
<td>Instituto de Microelectronica de Barcelona</td>
<td></td>
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<tr>
<td>74,825 €</td>
<td>Advanced Through Silicon Vias for Pixel Detectors</td>
<td>University of Bonn</td>
<td>Fraunhofer IZM</td>
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<tr>
<td>66,641 €</td>
<td>RaDoM</td>
<td>CERN</td>
<td>Politecnico di Milano, Mi.am</td>
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</table>
• Silicon-based Microdosimetry System for Advanced Radiation Therapies

• Motivations:
  • 1 out of 2 persons born today will be diagnosed with cancer in their lifetime (SEER Cancer Statistics Review 1975-2013)
  • More than 50% of all cancer patients will receive radiotherapy for curative or palliative aims
  • Hadrontherapy is a fast-growing modality of radiation therapy

• Objectives:
  • Realization of a new microdosimetry tool optimized for clinical application for verification of hadron treatment plans.
Silicon-based Microdosimetry System for Advanced Radiation Therapies

The system consists of CSIC's novel silicon microsensors together with a multi-channel readout electronics and will be capable to provide detailed microdosimetric distributions in space and in time.

SEM image of wafer in production with microsensor unit cells defined, central contact visible

Finished unit cells: trenches filled with doped polysilicon to form the external electrode
• Silicon-based Microdosimetry System for Advanced Radiation Therapies

• Partner with Alibaba system

• Looking for other fields of application
• **RaDoM**

  • Radon gas is the most important source of ionizing radiation among those of natural origin.

  • Currently the dose is estimated by measuring radon and/or radon progeny concentrations.

  • In the dose estimation, lots of parameters are taken as default, such as the *aerosol size*, the *equilibrium factor*, *particle density* and shape, etc, leading to significant uncertainties.

• **Matching fund from CERN-MAPF**
• RaDoM: current status

- High resolution alpha particle spectrometer:
  - radon, thoron and actinium daughters
- External plug-in radon concentration probe
- 15-minute time resolution
- Embedded shock, temperature and humidity sensors
- Optional environmental sensors, e.g. CO₂
- Powered by Linux
- LoRa, WiFi, Bluetooth, LTE connectivity
- Cloud platform
- iOS and android apps
• RaDoM: starting the spin-off journey

• RaDoM project was selected from 450 applicants as one of the 75 finalists for the MassChallenge2017 Accelerator Programme in Switzerland and passed the VentureKick Phase 1 selection for funding

• 3 Pilot projects are running

• 30 pages business plan ready for investors
• Advanced Through Silicon Vias for Pixel Detectors
  ▪ **Goal:** establish high yield TSV + RDL process for pixel modules
    ▪ straight vias through ultra thinned FE-I4 wafers and chips: note 2x2 cm² chip size
    ▪ 80 - 100 µm thickness (to be optimized),
    ▪ aspect ratio = 2 : 1 (via diameter 60 µm)
    ▪ thin wafer backside process using carrier wafer
    ▪ complete development including flip-chipping process for the final pixel module

• **Challenges of the project:**
  ▪ reliable TSV fabrication ... yield hoped/expected to be much better than for project 2
  ▪ thin (100 µm) wafers are needed for the goal of “large yield” challenge is the handling of large and very thin wafers/chips
  ▪ surprises during flip-chipping can also be an issue
• Advanced Through Silicon Vias for Pixel Detectors

• Detectable breakdown voltage starting at 40V, max. 100V
• Process optimization possible → benchmark of 80V breakdown achievable but not required here
• Advanced Through Silicon Vias for Pixel Detectors

• Several Industrial projects started based on this development
• To have (at least) a second option which can immediately take over in case of problems is in principle not a bad idea
  • Imagine: quality issues, bankruptcy, earthquakes,...
• Market survey: Common MS CMS/ATLAS
  • Identify an EU company able to produce sensors on a large scale

• Step 1: Companies need to return the “Technical Questionnaire” document where the responses need to fulfil the requirements set in the “Qualification Criteria” document \(\rightarrow\) ADIA-2020 Milestone MS30 (2016)

• Step 2: Companies need to provide samples free of charge of functional devices of e.g. previous project \(\rightarrow\) 2nd annual meeting (2017)
  • ATLAS and CMS qualified samples developed by HEPHY-ÖAW as 8” proof-of-principle

• Step 3: CMS/ATLAS orders (and remunerates) a batch of prototype sensors according to CMS layout and specs \(\rightarrow\) ongoing 2018
  • ATLAS and CMS ordered close-to-final prototypes as described in the TDRs
• **HGCAl sensors:**
  • Infineon: production of Si pad sensors for HGCAl
  • Quality constantly improving
    • One remaining problem: premature IV breakdowns, scaling with sensor size
    • Addressed now by thicker backside implantation

• **Full probe card development**
Milestones since last annual meeting:

- **MS45**: 1st AIDA-2020 “Academia meets Industry” event (M24)
- **MS71**: Progress review of the selected projects(s) for the PoC Fund (M34)
- **MS79**: 2nd AIDA-2020 “Academia meets Industry” event (M36) - in progress
• Follow-up PoC projects
• Prepare value proposition with WP leaders and TTO