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MUSE ToK: the research point of view

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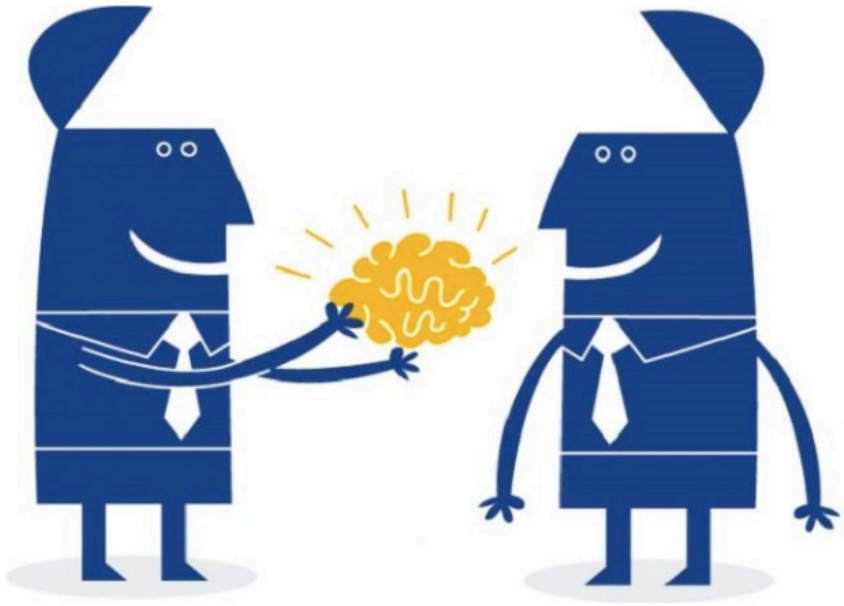
MUSE Mid-Term Meeting
Frascati, 11 May 2017

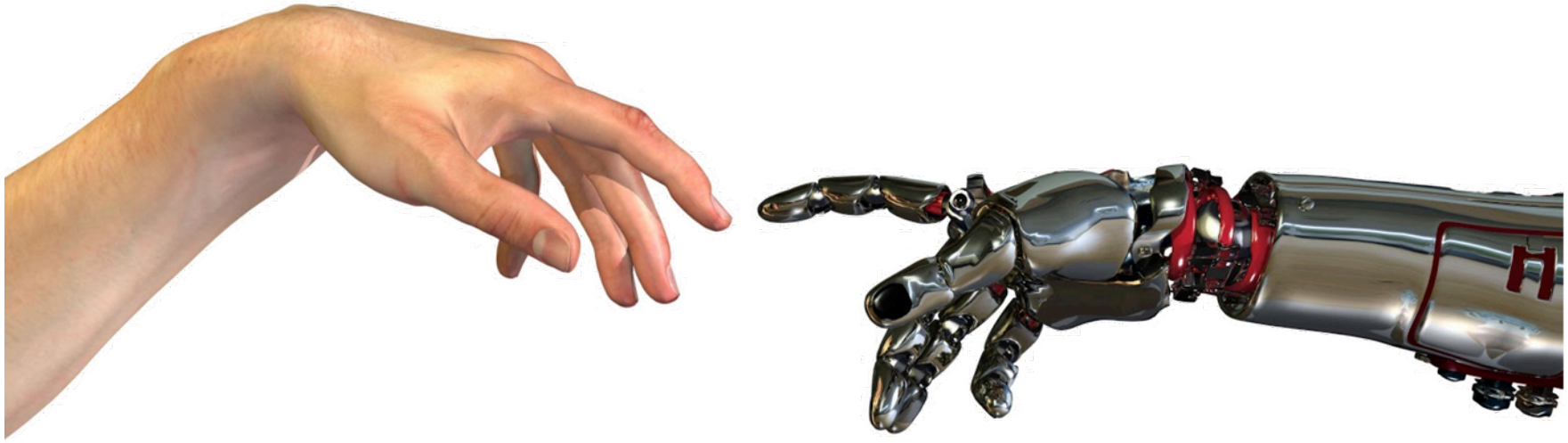
Outline

- ✗ Introduction to ToK principles
- ✗ ToK in MUSE
- ✗ PRISMA skills
- ✗ Activities performed with PRISMA
- ✗ Additional values of ToK for partners
- ✗ Conclusions



Introduction to ToK principles

- ✗ In the framework of H2020 program, “Transfer of Knowledge” means a precise and **mutual** exchange between parties with different aims.
- ✗ This offers the possibility to “*couple research and innovation […] removing barriers to innovation*” (from EU commission).



Introduction to ToK principles

- ✗ The MSCA objective will provide excellent and innovative research training as well as attractive career and **knowledge-exchange opportunities** through cross-border and cross-sector mobility of researchers to best prepare them to face current and future societal challenges.

MUSE partners:

4 research institutes: HZDR (DE), INFN (IT), Univ. of Liverpool (UK), UCL (UK)

3 SMEs: ADVANSID (IT), CAEN (IT), PRISMA (GR)

1 hosting institute: Fermilab (US)

Introduction to ToK principles

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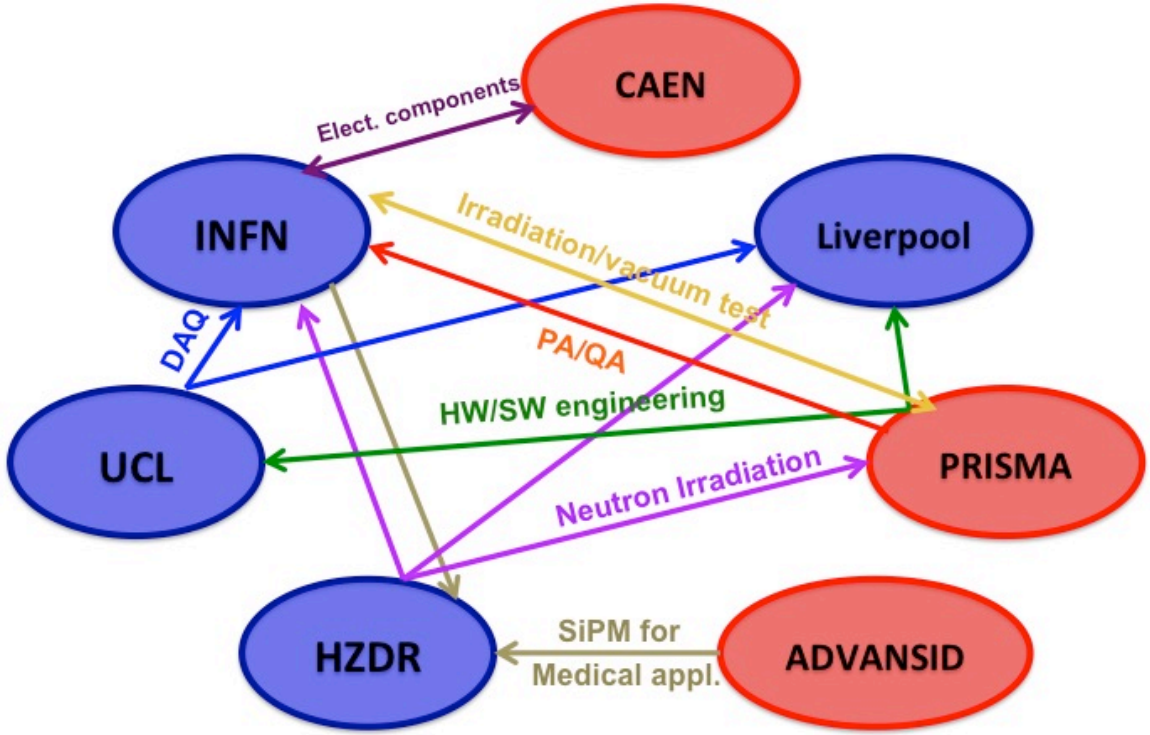
Every arrow in this picture offers important opportunities of knowledge transfer between research institutes, SMEs and between research and application



ToK in MUSE

Objectives

The objective of this work package is to coordinate all the activities dedicated to the training of research and industry personnel, to achieve a substantial transfer of knowledge among network participants and to increase the quality of the research and the competitiveness of the partners. Our final goal is to provide the trained personnel with enough capabilities to become independent in their new competences.

Description of work and role of partners

WP6 - Transfer of knowledge [Months: 1-48]
HZDR
Task 6.1: Research-industry transfer of knowledge (INFN,HZDR,LIV,PRIS)
Maximization of the knowledge transfer among research institutions and companies inside the network. SMEs can be in contact with last developments in fundamental science, acquiring new capabilities. PRISMA will acquire expertize in irradiation damages. Research institutes will acquire new competences from industry expertise in electronic and software engineering.
Task 6.2: Medical applications (INFN, HZDR, ADV)
Transfer of the INFN and AdvanSiD expertize on SiPMs to the HZDR group working on medical applications, both in PET nuclear imaging and for in-vivo-dosimetry at proton and ion beams.
Task 6.3: Training courses (ALL)
Organization of special training courses in connection with MUSE general meetings. A special half day session will be devoted to dedicated training on specific advanced topics from research developments in HEP or companies.

This work package foresees secondments between academia and industry: 4 p.m. from INFN to PRISMA and 6 p.m. from PRISMA to INFN/HZDR for electronics development and quality assurance; 8(1) p.m. from(to) HZDR to(from) AdvanSiD for medical applications.

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HOW THIS WILL BE POSSIBLE?

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PRISMA skills

- PRISMA is an important Greek SME organized into three main divisions:
  - ✓ R&D
  - ✓ ICT
  - ✓ Electronics

- PRISMA has an important success stories on research collaboration with:
  - ✓ More than 100 universities worldwide;
  - ✓ Industrial research centers (FIAT, Volvo, Thales, Kleeman, etc.)
  - ✓ National research centers (CERN, ESA, NL, Intracom, etc.)

- **During last years PRISMA was capable to offer solutions to research while acquiring new capabilities to increase its competitiveness on market**

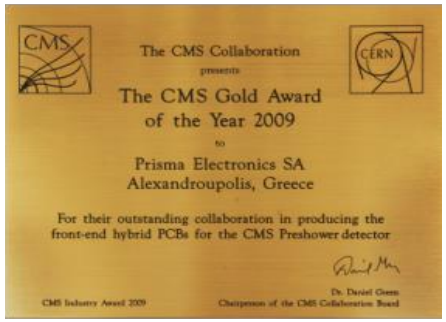
- **This fully represents the aim of ToK in H2020 project!**

PRISMA skills

Why ToK with PRISMA is very promising for MUSE?

Research ask for:

- Construction of detectors for severe environments (radiation, vacuum)
- Medical applications



PRISMA experiences on:

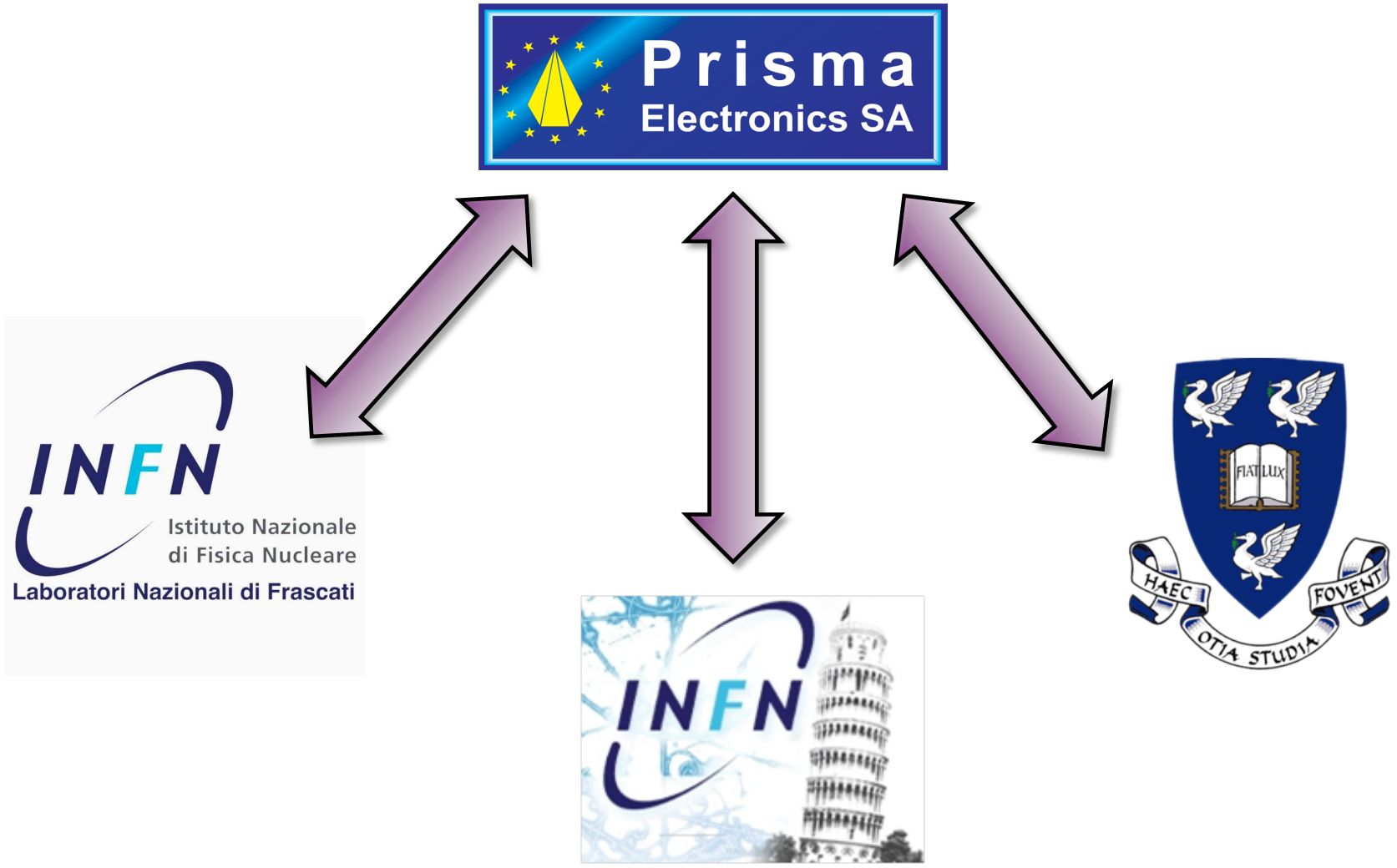
- ICT and large industrial production
- Space and defense applications
- Electronics for LHC, CMS and ATLAS

Research institutes experience on:

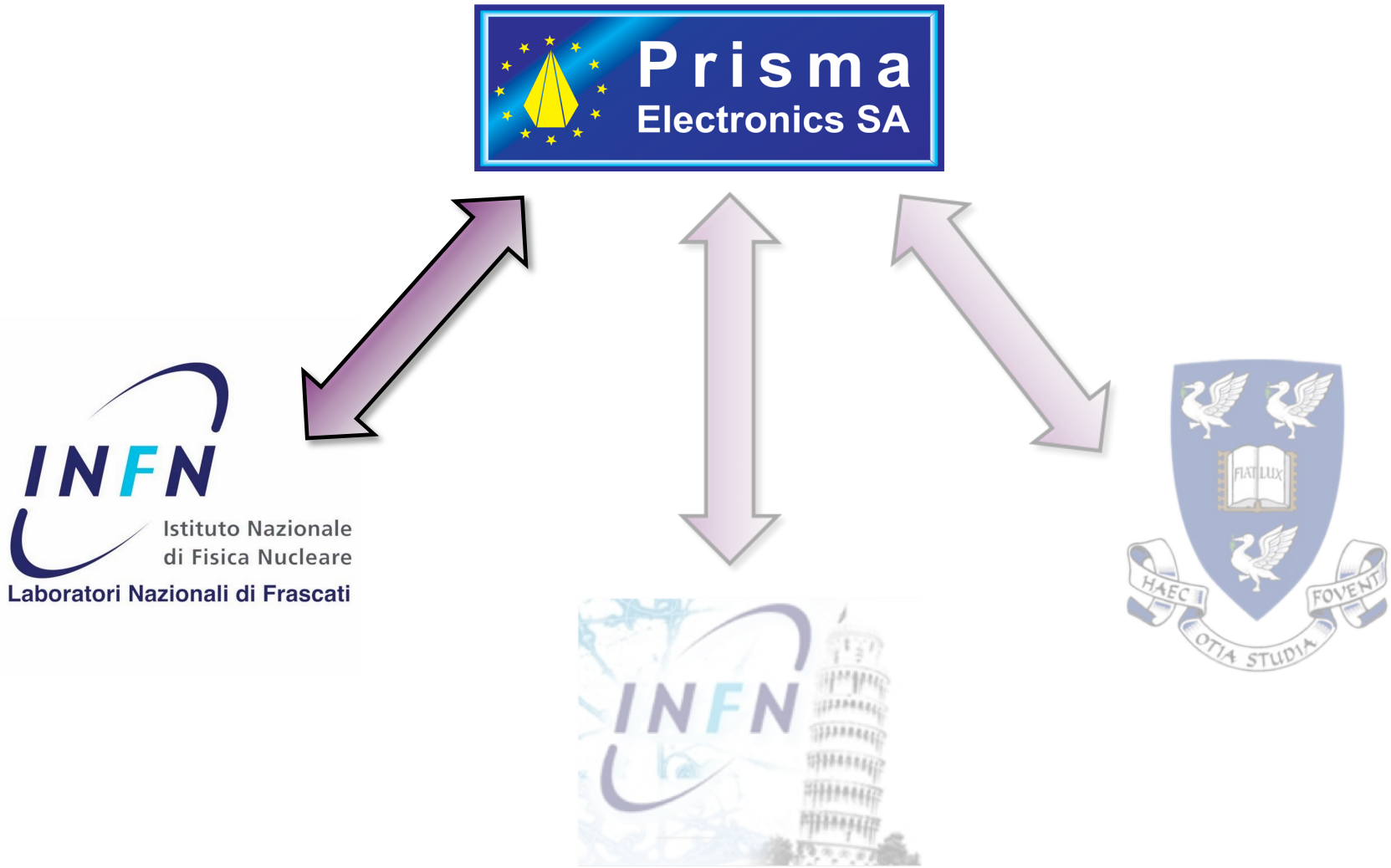
- Medical applications
- Detectors technology
- Discovery approach

These are the basis for a mutual growth that open also new market sectors for SME

Activities performed with PRISMA



Activities performed with PRISMA



Activities performed with PRISMA

Exploiting their experience on ICT and large production, PRISMA researchers gave a fundamental contribution to:

1) **QA procedure for crystals with the inclusion of traceability and storage**

The entire cycle of the crystals for mu2e calorimeter implies various steps also in different countries.

List of Procedures

Procurement		
PROC01	Procurement	Ensure that all procurement activities are controlled so that all procured items and services conform to requirements.
PROC02	Quality Assurance	Ensure that all materials supplied conform with the requirements. (In quantity and quality)
PROC03	Handling - Storage - Packing -	Ensure safe handling, storage, preservation of items during all phases of testing and operation. Address principles and actions to ensure that safe packaging and transportation activities
Configuration and Data management		
CDM01	Traceability	Define the method and means for controlling the traceability of all items used for the implementation of a project.
Non-Conformance		
NC01	Non-Conformance	Determine the approach to the identification and processing of non-conforming materials and products.
Production		
PROD01	Metrology & Calibration	Define the method and means for controlling the accuracy of all inspection, measuring and test equipment to ensure that measurements and product inspections have the desired accuracy and reliability.
Human Resources		
HR01	Training	Define the requirements for the training of the personnel involved.
PA Management		
PA01	PA Management	Define the management requirements to be implemented throughout the phases of the project and address the relevant actions to fulfill these requirements.

The definition of a well precise “approach”, together with a QA procedure is of fundamental importance for the construction of the calorimeter!

Activities performed with PRISMA

Exploiting their experience on ICT and large production, PRISMA researchers gave a fundamental contribution to:

2) Database architecture for pre-production crystals

Directly connected with the QA, the use of a DB to store all crystals information is fundamental given the high number of crystals.

PRISMA researchers created in Frascati a PHP-based database used to store information on every crystals permitting information retrieval and traceability in a user friendly architecture. This DB was used during crystals pre-production and will be replicated for final production.

Activities performed with PRISMA

Activities performed with PRISMA

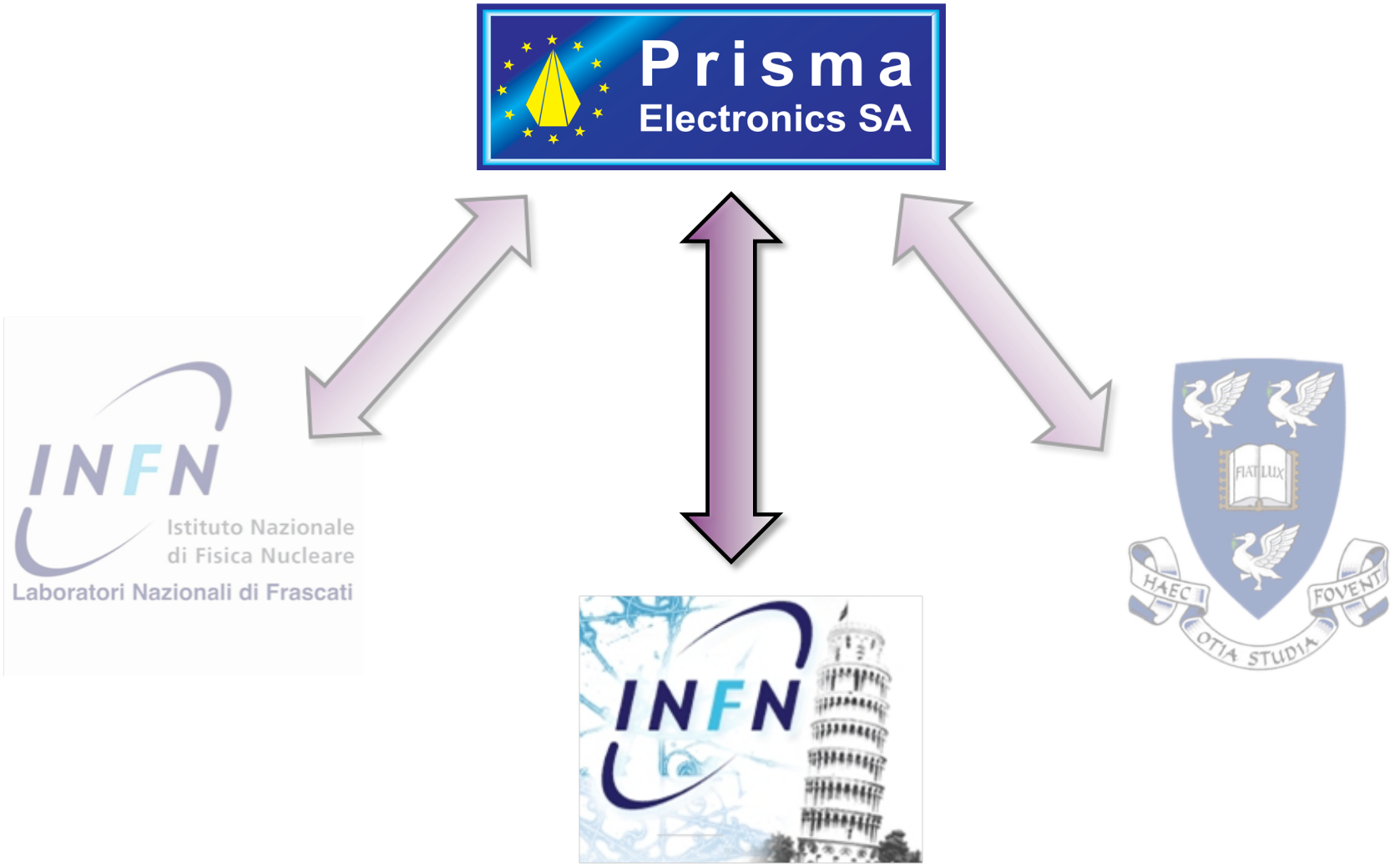
- Even if the crystals database can be considered part of the calorimeter project, its creation implied an important ToK between the two partners;

- PRISMA researchers have not only created the database but have transferred to INFN the right approach and the experience-based tips and tricks in this field;
- During WP-6 secondments, INFN researchers built a similar database for photosensors exploiting knowledge transferred from PRISMA (completion during this summer);
- **MUSE gave an important opportunity to "research" to acquire knowledge out of physics background!**

Activities performed with PRISMA

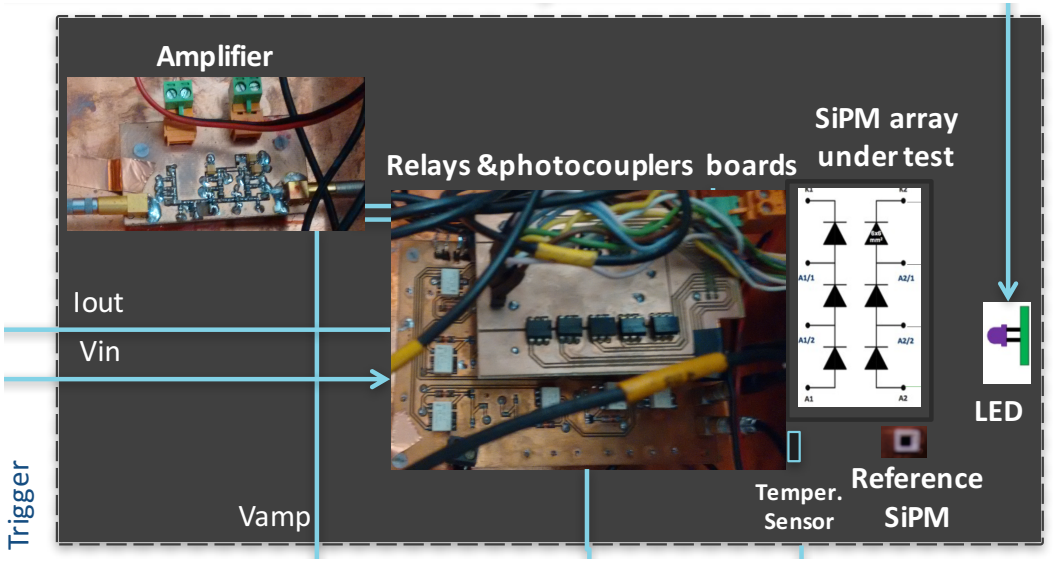
- The other important activities in the framework of ToK are relative to the mutual experiences on high precision electronics
- Specific seminars were organized to explain INFN solutions for mu2e electronics. The very precise (and difficult) goal of mu2e implies challenging and advanced solutions that were transferred from INFN to PRISMA
- Thanks to MUSE, PRISMA researchers acquired important knowledge increasing their competiveness on market
- Moreover, thanks to the experiences acquired with ESA and CERN in developing electronics for severe environments, PRISMA researchers offer us important solution for:
    - FEE reliability
    - FEE operating in vacuum
    - Calorimeter cooling

Activities performed with PRISMA



Activities performed with PRISMA

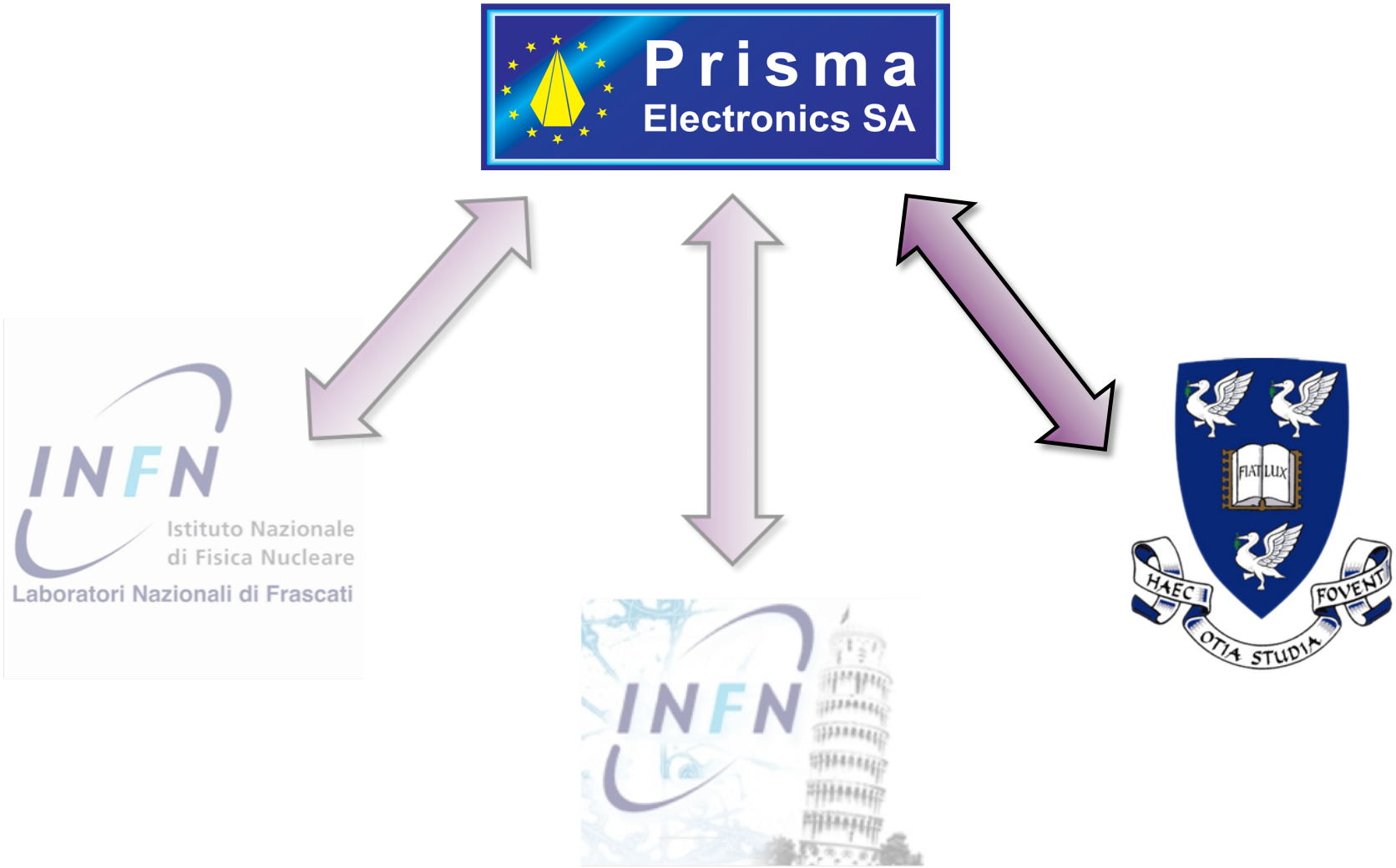
- Still telling about mutual electronics experiences, PRISMA researchers gave important contribution to the construction of the SiPM test station in PISA



- Test station is of fundamental importance for the QA of the SiPMs of the mu2e calorimeter

- During MUSE secondments:
  - Important contribution from PRISMA;
  - ToK from PRISMA to INFN on electronics design;
  - ToK from INFN to PRISMA on silicon devices.

Activities performed with PRISMA



Visit of PRISMA to Liverpool

- The last activity related to ToK between “research” and PRISMA is the experience of this SME in Liverpool;
- This activity is related to g-2 experiment and anymore represents a good example of knowledge transfer between parties with different skills;
- Thanks to Barry King for the following summary slides.

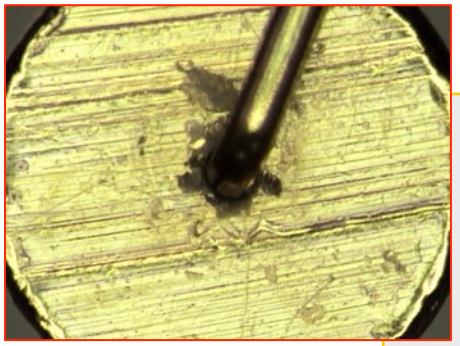
Visit of PRISMA to Liverpool

First visitor was Despoina Xafi: arr: 14.02.17 Dep: 15.03.17

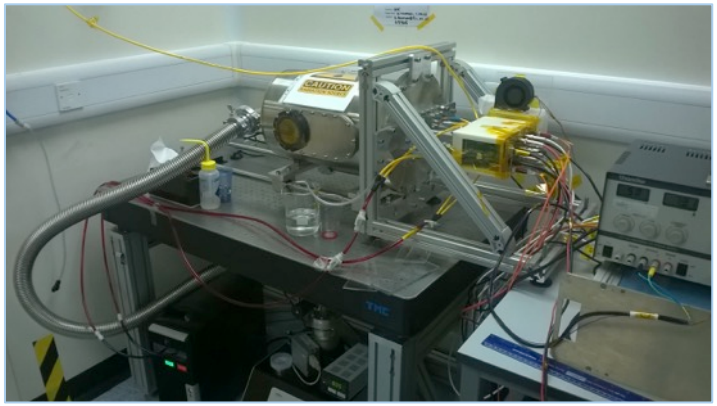
✗ **Worked on several areas in the Liverpool Clean Rooms.**

Leak testing of straws to verify they could be used.

✗ **Microscopic examination of the pins through which wires threaded.**



Data taking with completed modules prior to shipment to Fermilab.

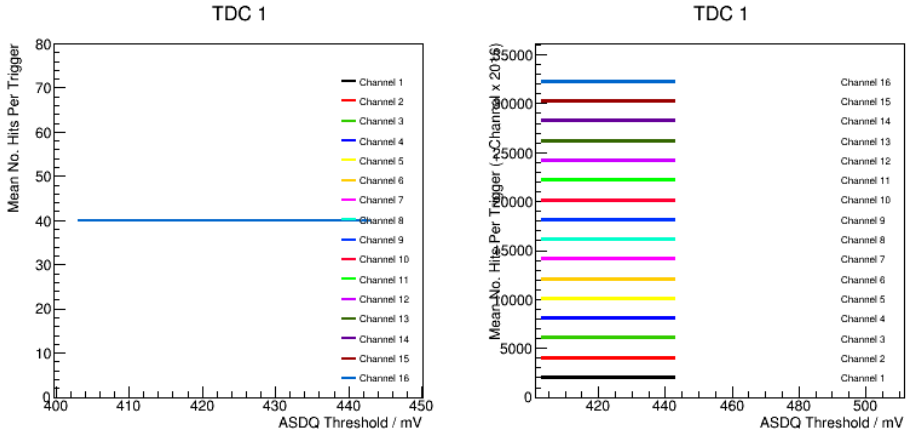


Visit of PRISMA to Liverpool

Second visitor was Kostantinos Tsourapas: arr: 14.03.17 Dep: 15.04.17

✗ **Worked on various aspects of electronics needed for the g-2 tracker.**

HV cables for module manifolds

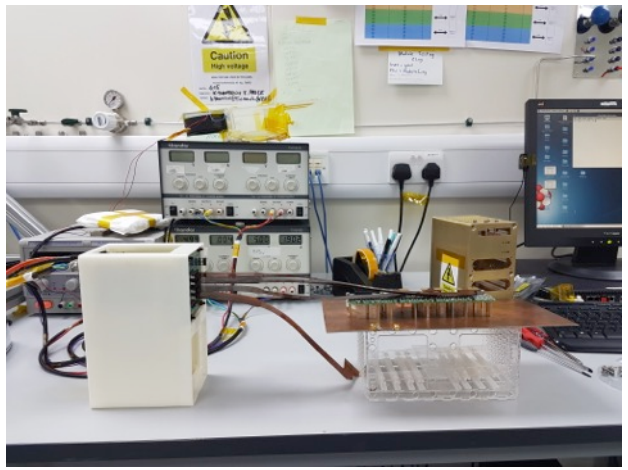


✗ **Addition of electronics to manifolds.**

✗ **Tested the grounding.**

✗ **Designed a PCB board.**

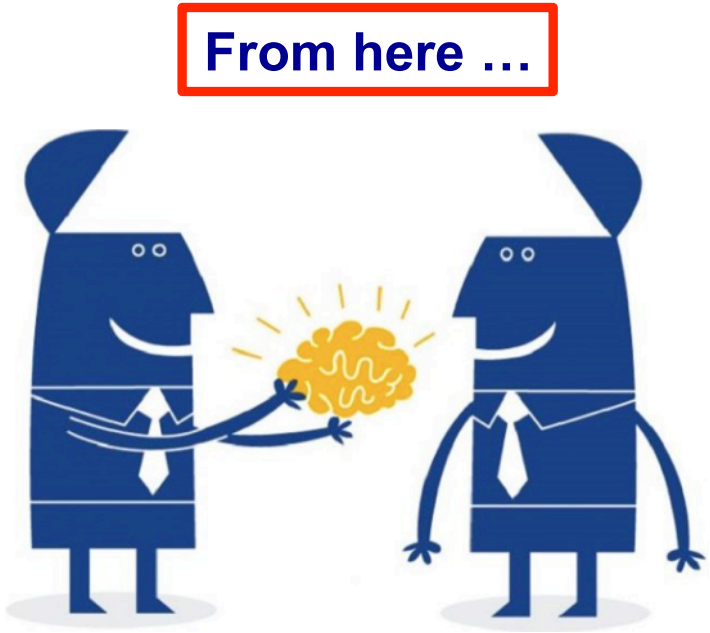
Pulse testing of ASDQs prior to use in modules.



Additional values of ToK

The activity (finished and in progress) performed during MUSE permitted an important ToK from research to SME and vice versa.

An always important aspect to be considered is the creation of professional network with partners with similar (or transversal) activities.



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An always important aspect to be considered is the creation of professional network with partners with similar (or transversal) activities.

This network can be exploited in the future for:

- New co-financed projects
- Joint activities both in research and/or private sectors
- Create new opportunities

Invaluable added value:
Passage from "Knowledge Transferring" to "Knowledge Sharing"

Conclusions

- ✗ ToK represents a fundamental aspect of MSCA increasing quality of research and SME competiveness
- ✗ Focusing on PRISMA-Research interaction, different activities have been established with concrete results
- ✗ Previous experiences of both parties important to transfer knowledge out of traditional skills
- ✗ These relations will offer important new opportunities in a near future
- ✗ **MUSE is an extraordinary opportunity of career and knowledge growth for everyone of us!**