



INFIERI

Intelligent Fast Interconnected and Efficient devices for Frontier Exploitation in Research and Industry

<http://infieri-network.eu>

INFIERI is an inter-disciplinary and multi-national **network, aimed to train young physicists and engineers** in developing, designing and managing intelligent devices and tools for cutting-edge applications in the fields of **Astrophysics, Particle Physics, Medical Physics, and Telecommunications**, also exploiting their technological spin-offs and cross-field synergies.

The **network** gathers leading academic institutes, European laboratories (NIKHEF, RAL), high-tech companies (PHILIPS, THALES) as full partners. Associated partners in Europe (CERN, several leading companies and Universities), the USA (FNAL, Purdue University, Tezzaron Semiconductor) and Korea (Seoul National University, SAMSUNG SAIT) bring advanced and complementary scientific and technological expertise.

The **Research & Training program** is focused on specific case applications, which require **innovative technical solutions** for an **extremely fast on-instrument signal processing, a proficient event selection phase, an efficient transmission** and a **final step of high-level data filtering**: these are the goals of the Research & Training of INFIERI.

The three main applications on which the INFIERI program is focused are:

1. The **new ways to exploit the tracking system information in real-time trigger filters** for exploring New Physics in the harsh environment of the **Large Hadron Collider (LHC) at CERN**, running at the highest luminosity in the next decade.
2. The **next largest terrestrial telescopes array data systems**, made of numerous detectors spread over kilometres, for **Astrophysics**.

3. The use of **advanced Silicon sensors and Silicon photomultipliers technology** with **advanced data processing** for **Astrophysics, Particle Physics and Positron Emission Tomography in Medicine**.

The research and R&D are arranged around Workpackages WP's among which:

- **WP1 on Intelligent Front-End (on-instrument) Processing,**

For developing advanced signal processing on the Front End Readout Electronics (FEE) on-detector for Astrophysics, High Energy Physics (HEP) and Medical Imaging Instruments for performing, in sometimes very harsh conditions, an **efficient data reduction and selection**, based on a **real time** understanding of the **Physics and diagnoses**.

This early stage decision making implies major technological breakthroughs, in the Front-End Electronics circuits based on advanced microelectronics that process the signals from **Silicon PM's (SiPMs) and Silicon sensors all based on most advanced technologies**.

- **WP2 on R&D and Applications of New Interconnect Technologies** with the development of **3D vertically interconnected** devices, enabling **extreme compactness** and **very high speed** for future CMOS architectures. **3D Integration** can create intelligent detectors and data processing elements with unprecedented capabilities.

A new intimate mixing of technologies, achievable only within 3D integrated circuits, permits **per-pixel processing** and evaluation circuitry that **reduces power and increases detector sensitivity**.

Entirely new advances in detector

technology are made possible. **Key to success is:** strong collaboration among partners from Academics and High-Tech Institutes and Firms

- **WP3 on New Data Transmission Technologies** for the transfer of data from detector modules to the far-end processors, with high-rate and high speed data transfer conditions, in harsh environments, are vital to future experiments and a number of real-life applications:

WP3 targets unprecedented transfer rates with low mass, radiation hard devices, novel optical wireless communication, and, given the large number of data links, their interconnectivity.

- **WP4 on Massive Parallel & High Performance Computing**

The High Level Trigger of a **large area telescope system** will combine and appropriately handle the information from all the individual components (telescopes) of the network. Innovative aspect for the **Medical application** includes a high level processing to treat the information delivered by the highly pixelated Imaging device. **HEP Level 1 Trigger** will require matching the charged tracks with the calorimeter or the muon system information for identifying peculiar features of interesting Physics processes. It implies developing and testing the use of new advanced technology for processing **in real time huge amount of data**.

This WP is closely related to **Massive Parallel Computing developments (hardware & firmware)** and to **Advanced Telecommunications Computing Architecture (ATCA)**.

The INFIERI project aims maintaining Europe leadership, at the forefront of the top research fields and high technology domains it addresses. ●