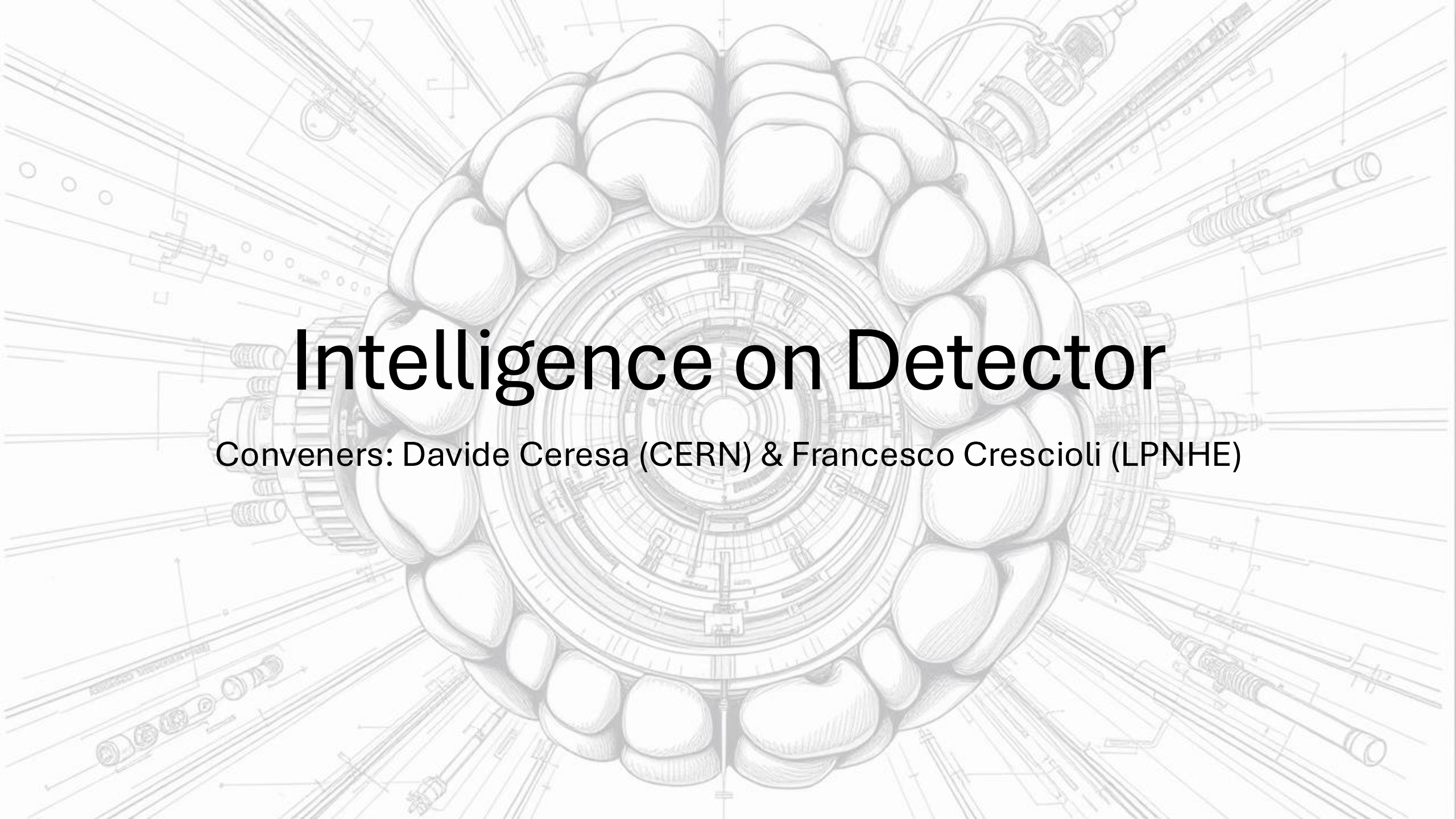

Intelligence on Detector

Conveners: Davide Ceresa (CERN) & Francesco Crescioli (LPNHE)

Radiation Tolerant RISC-V System-On-Chip (WP7.2b)

Project Description	Develop a radiation-hardened SoC based on the RISC-V ISA standard according to the roadmap defined in M7.2b.1. Topics: 1- SoC architectures 2- Radiation Tolerance design methodology, 3- Verification methodology, 4- SoC generator toolchain. Duration 5-6 years.
Innovative/strategic vision	Develop a technology and a design platform to anticipate and adapt the challenges and opportunities of the future Electronic systems and IC design.
Performance Target	The following targets will be defined in M7.2b.2: Processing Speed Power Consumption Radiation Tolerance Memory and Storage Communication Interfaces Scalability and Flexibility Verification and Testing

Multi-disciplinary, cross-WP content	Electronics Engineering - Digital Design Computer Science - Embedded Systems Systems Engineering - Integration and Testing
Contributors	DE: FH Dortmund BE: KU Leuven CERN UK: UKRI-STFC RAL UK: Royal Holloway University Of London UK: University of Warwick UK: University of Bristol US: Fermilab

Virtual Electronic System Prototyping (WP7.2c)

Project Description	Develop frameworks for high-level simulation of particle detectors. **Topics:** **1-** Signal generation in detector elements **2-** Digitization and Signal Processing **3-** Data readout architecture Topics 1. and 3. aim to create independent frameworks that can be used as a single toolchain. Topic 2. will be better defined during the project and might converge in one of the two frameworks or represent a third framework of the chain. Duration 3-4 years.
Innovative/strategic vision	Develop a toolchain for virtual prototyping to: **1-** model detector at high-level **2-** perform architectural studies **3-** provide a reference model for the verification
Performance Target	**Topic 1:** Cluster multiplicity: 1-10 Position resolution: $<10\ \mu m$ Time resolution: 10 ps to 100 ns **Topic 2:** to be defined in M7.2c.2 **Topic 3:** Accuracy: Event/Cycle-level Speed: hundred thousand transactions per second Scalability: readout components library Verification: integrate in verification environment User-Friendly: docs & support for user-only roles

Multi-disciplinary, cross-WP content	**Detector Technologies:** support various detector technologies **Particle Physics Models:** integration of comprehensive particle physics models **Geometric Configurations:** ability to define and customize the geometry **Data Formats:** support for common data formats **Monte Carlo Techniques:** implementation of Monte Carlo methods for simulating particle interactions and energy depositions, **Electronics Simulation:** accurate modeling of the readout electronics **Readout Architectures:** support triggered and data-driven systems
Contributors	CERN FR: IPHC Strasbourg *USER:* PSI (CH), UK Cons., INFN Cagliari (IT)

WG 7.2 Intelligence on the detector	Project 7.2.a (TBC)
Description	eFPGA – Programmable Logic Array IP
Innovative-strategic vision	The design of radiation-hard and SEU-tolerant programmable logic gate array IP block (embedded FPGA) will introduce programmability and reconfigurability by means of software updates.
Performance target	A parameterizable FPGA fabric will be developed and prototyped: ~1000 Configurable Logic Blocks, 2000 FF, 10 SRAMS, TMR protection, ECC protection for configuration RAM and SRAM.
Multi-disciplinary, cross WG content	Of great interest to any detector front-end. In-depth knowledge of radiation effects on digital circuits and mitigation technique is requested.
Contributors (preliminary)	**DE**: Dortmund **UK**: Imperial College

- Original proposal from Dortmund & Imperial
  - At that time it was flagged as very interesting but too thin in resources
- A second round of inquiry trying to attract new institutes was launched Q4/2023
  - Received more interest from many institutes
  - However most of the funding / actual start of the project was foreseen for late 2024 or later
  - Not enough momentum to enter into the Proposal
- We will launch a second round of inquiry soon to revive the project for inclusion next year