

# A high-precision "weightless" charged-particle tracker: ultra-thin and fast position-sensitive-detectors with wireless data transmission

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## INTRODUCTION - MOTIVATION

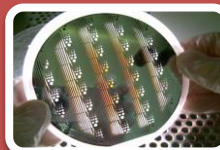
### Precision Tracking

- Tracker systems at future leptonic collider experiments require:
  - lighter sensors (reduction of the **multiple scattering**) with increased **intrinsic hit resolution**.
  - Reduction of bulky services: reduction of cooling, data and power links.

### Pile-up disentangling: Timing

- Future hadronic collider experiments require time stamping of individual primitive objects (vertex, tracks, jets, ...) for disentangling the different superposed hard interactions (pile-up events).

## THE PARTNERS



### Instituto de microelectrónica de Barcelona (IMB-CNM)

- Technological center belonging to the Spanish Council of Scientific Research (CSIC).
- Operating Integrated Clean Room for Micro and Nano fabrication.
- Pioneering innovative radiation detectors technologies: 3D pixels, LGAD sensors



### Instituto de Física de Cantabria (CSIC-UC)

- Research center belonging to the Spanish Council of Scientific Research (CSIC)
- Multi-decade experience on the developed of instrumentation for flagship particle physics experiments at major HEP laboratories (CERN and FERMILAB).



### Instituto Tecnológico de Aragón (ITAInnova)

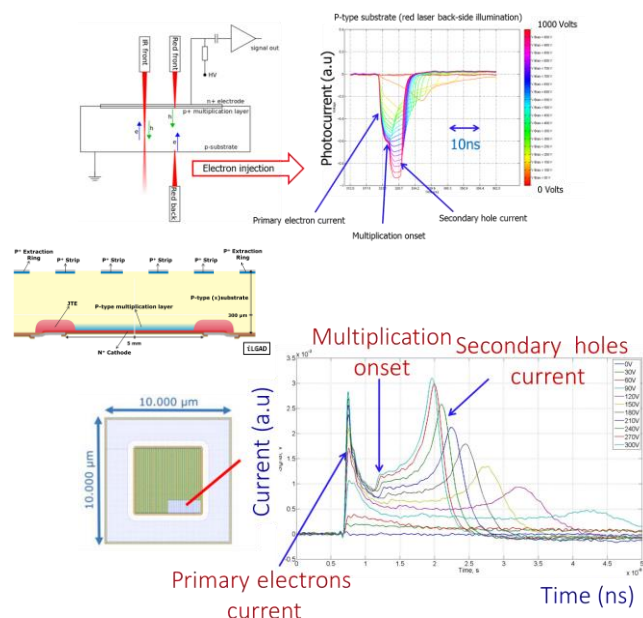
- A Technological Centre for guiding companies and institutions towards innovation
- Singular facility for diagnosis and testing in the field of electromagnetic compatibility
- Experience on the EMC and innovative power systems for HEP experiments.



### ERZIA TECHNOLOGIES S.L.

- SME company with strong background on rugged and high reliable electronic RF, microwave and communication systems.
- Expertise on development of Line-Of-Sight (LOS) wireless data link systems

## THE PROPOSAL



### Position Sensitive Detectors with Integrated signal gain

LGAD: Low Gain Avalanche Detectors (Reach-Through Avalanche Silicon Diodes)

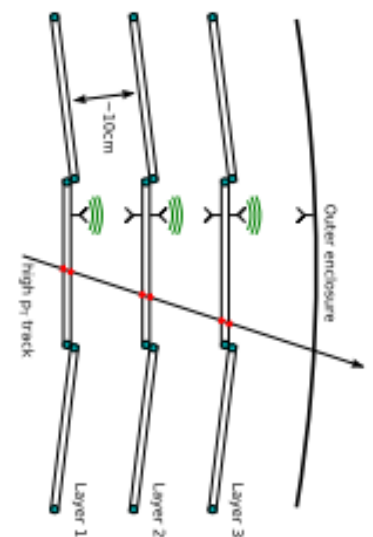
Increased SNR allows for sensor thinning (Material reduction) and increased hit and timing resolution.

R&D Challenges: uniformity response, radiation tolerance, large sensors area manufacturing

### Broad Band RF Wireless data-links

Short distance High Frequency RF wireless data links to eliminate the power and material limitation of electrical and optical data link

Challenges: achieve low error bit rates, suppression of crosstalk and parasitic reflections, antenna directivity and radiation tolerance.



## POTENTIAL IMPACT

PSD detectors with integrated signal gain based on the LGAD sensing technology (originally introduced by one of the submitters of this proposal) recently became one very promising technological candidate for future **high granularity timing detectors (including calorimetry) in hadronic experiments**. We are taking a step forward qualifying it as a low-material **high-precision tracking technology**. System-wise, in combination with the previous PSD technology, the **ultimate high-precision tracker system (as in lepton colliders)** can be achieved by the replacement of the bulky electrical and/or optical data-links by Broadband RF wireless links. These technologies may result on spin-off developments in the areas of **forward physics experiments, PID (ToF), hadron dosimetry, pCT scanners or space industry**.