

STaRS

Space-Time Tracker with Resistive LGAD Sensors

Titolo: **STaRS - Space-Time Tracker with Resistive LGAD Sensors**

Area di ricerca: **PE2-3**

Responsabile nazionale: **ROBERTA ARCIDIACONO**

Unità partecipanti:

INFN - Sezione di Torino (2.2 FTE)

INFN - Sezione di Firenze

INFN - Sezione di Perugia

TIFPA

STaRS

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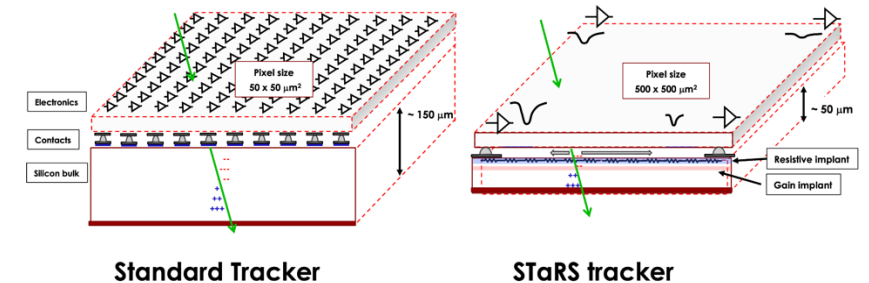
First demonstrator of a **4D tracker system** based on DC-RSD sensors delivering a resolution in space and time of **15-20 μm** and **35 ps** per plane and radiation resistance up to fluences **$2.5\text{-}3 \cdot 10^{15} \text{ n}_{\text{eq}}/\text{cm}^2$**

The demonstrator:

- 6-layer telescope, low power consumption (between 0.5 and 1 W/cm²), featuring movable planes and 100% of geometric efficiency
 - Sensors: DC-Resistive Silicon Sensor (DC-RSD) based on LGAD technology (1 cm²)
 - Read-out: four custom made ASIC (first ever developed for DC-RSD)

Key tasks of the project:

- Simulation, design, and production of optimized DC-RSD sensors
- Design and production of the read-out ASIC optimized for DC-RSDs.
- Development of the mechanics and cooling of the telescope frame, to be equipped with hybridized sensor-ASIC modules.
- Implementation of the DAQ system, and the reconstruction algorithms, also Machine Learning based, for performance assessment.



Organizzazione e fasi del progetto

➤ **Phase 1 (12 months):**

- Sensors simulation and design.
- testing of existing ASICs with existing DC-RSDs will provide valuable inputs to the design of the first ASIC prototype (ASIC_v1).
- ASIC_v1 design and production.
- Development of the module PCB, cartridge/cooling block

➤ **Phase 2 (8 months):**

- Characterization and testing of the ASIC_v1 with existing DC-RSD sensors.
- Production of the sensors.
- Development of plane/telescope DAQ system

➤ **Phase 3 (7 months):**

- characterization of hybrid DC-RSD+ASIC_v1
- ASIC_v2 design and production.

➤ **Phase 4 (9 months):**

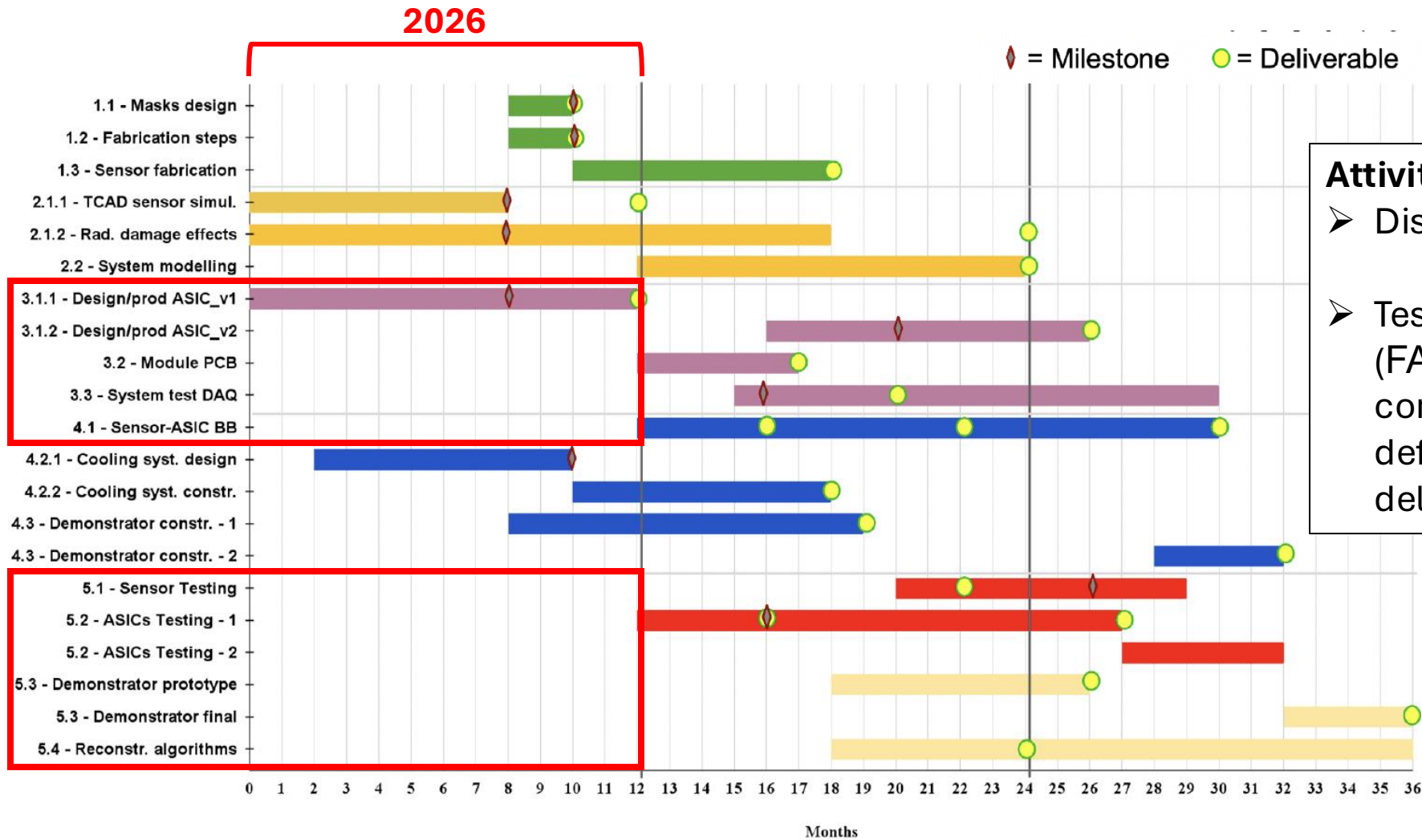
- testing of the ASIC_v2
- Building of the final demonstrator with all components.

	Work-package		Tasks		
WP1	Sensor design and production	1.1	Mask design		
		1.2	Definition of fabrication steps		
		1.3	Sensor fabrication		
WP2	Sensor simulation and modelling	2.1	TCAD sensor simulation (radiation damage effects, inter-pad resistance, layout)		
		2.2	System (sensor and electronics) modelling (TCAD+Allpix2)		
WP3	Electronics and DAQ development	3.1	Design and production of the front-end ASIC		
		3.2	Design and production of the module PCB		
		3.3	System test DAQ development		
WP4	Demonstrator development	4.1	Sensor-ASIC bump-bonding		
		4.2	Thermal simulation, cooling system design and production		
		4.3	Demonstrator frame design and construction		
WP5	Performance evaluation	5.1	Sensors testing		
		5.2	ASICs testing		
		5.3	Demonstrator testing		
		5.4	reconstruction algorithms (analytics/ML)		
		2026	2027	2028	Total FTE
TOTAL STaRS		7.1	10.4	5.4	22

Attività a Torino

GANTT chart del progetto

Attività a Torino



Attività a Torino nel 2026:

- Disegno dell'ASIC_v1
- Test di ASICs esistenti (FAST/ALCOR/DENEB) connessi a DC-RSD esistenti per definire le specifiche di disegno del prototipo ASIC_v1

Richieste in sezione

Servizio in cui si richiede l'attività: Laboratorio di Elettronica

Richieste:

- Attività di wire-bonding per ~ 200 sensori
- Attività di wire-bonding per chip FAST3 (200 bonds/chip, circa 3 chip al mese), possibile utilizzo della wire-bonder automatica
- Supporto in attività di “piccola elettronica”: ~ 10 cavi, connettori al mese.
- Due mesi di un tecnico elettronico per collaborare al disegno/test della PCB per l'ASIC DENEb (da unire col sensore STaRS)