

Semiconductor sensors development and applications WG-5.2

First General Meeting

Part II - Actions for next months

FAPESP Thematic 2020/04867-2

March 3rd 2023



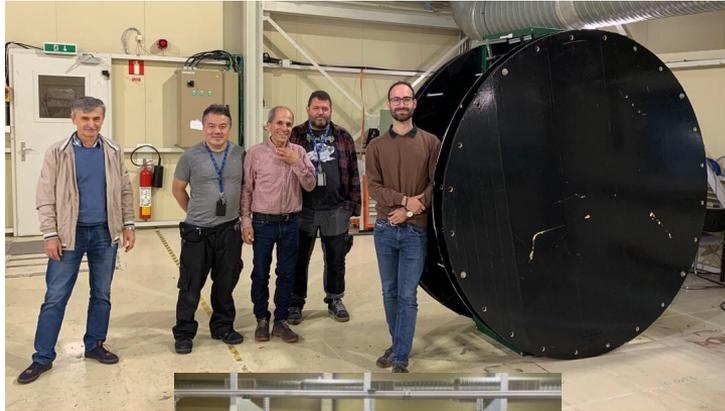
WG-5.2.1 & WG-5.2.2 : Recap

- WG-5.2.1 : ATLAS High Granularity Timing Detector (HGTD)
- WG-5.2.2 : Low Gain Avalanche Detectors (LGADs) for low energy applications

Details on August [kick-off meeting](#)

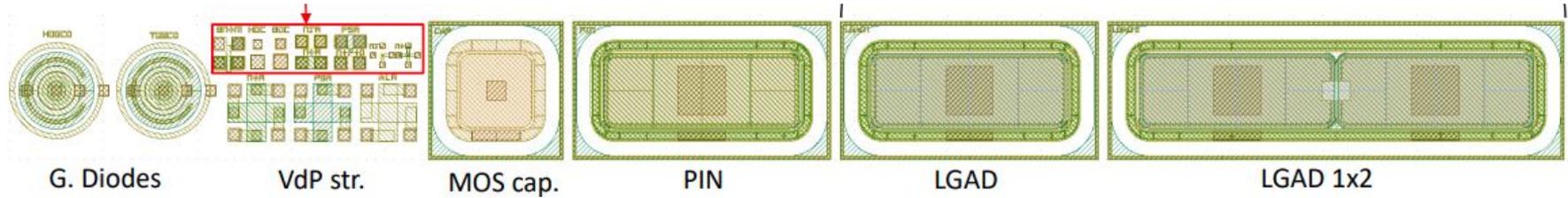
WG 5.2.1 : ATLAS HGTD - Infrastructure @CERN

- **R. Menegasso & M. Kuriyama @ CERN (3 Months Starting ~July 2023)**
 - Clean room and metrology setup for HGTD assembly @ B180
 - Demonstrator construction and thermal test system support
- **Effort will intensify during construction and integration years !**

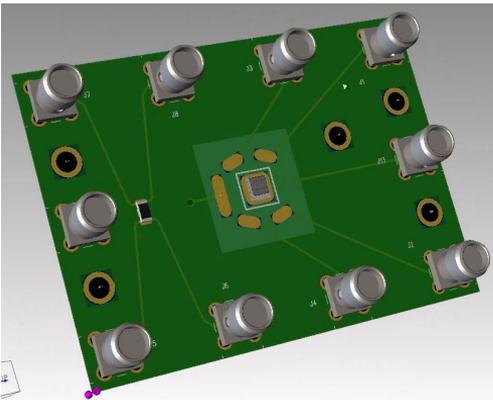


WG 5.2.1 : ATLAS HGTD - Sensor tests and infrastructure

- Integrated DAQ System for Sensor QC
- Sensor and control structures
- Part of the commitments for HGTD (forever ...)



- Characterization structure for sensor production



- Reference board with sensor for DAQ development
- Integrate with Hdaq

WG 5.2.1 : ATLAS HGTD - Infraestructure @USP

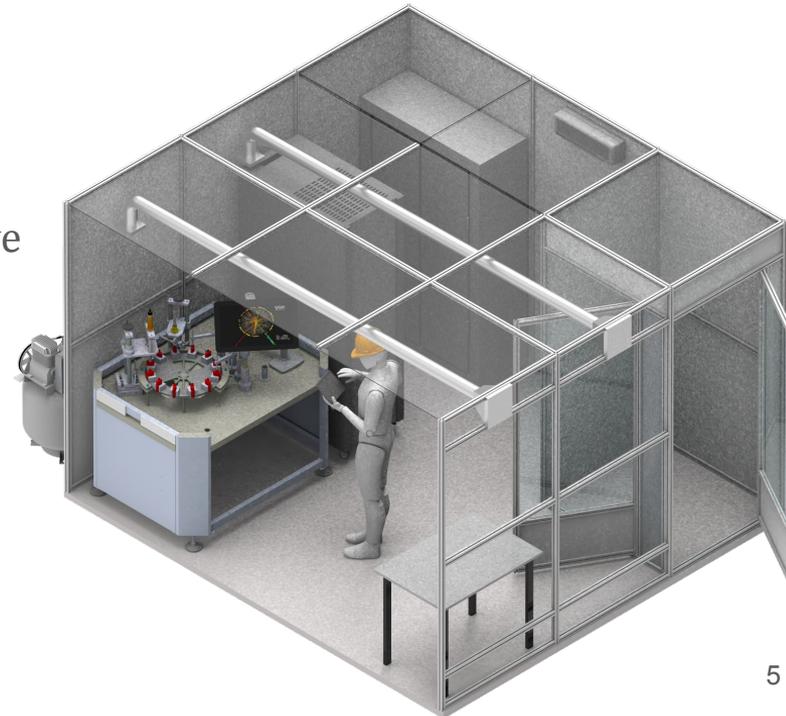
- Participate in DAQ development for QA/QC sites
 - USP- CERN-IHEP-USTC-JSI
 - Very long lead time for T&M (over 1 year in some cases)
 - Must plan carefully !
 - Measurement of sensors and test structures
- Lab infrastructure on going (
 - We master the technical aspects
 - But there are significant non-technical aspects we have to deal
- ~~Needs to settle in 2022~~; finalize in April 2023 ..
- Clean room with modular Aluminum profile system (Bolt) and ACM
- Quick assembly, low cost, high quality
- Environmental control (air quality, dew point for CA etc.)
- Anti-static control measurements

Critical



Very Critical

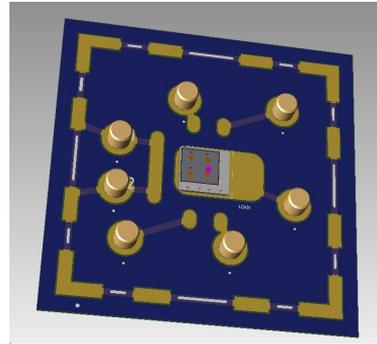
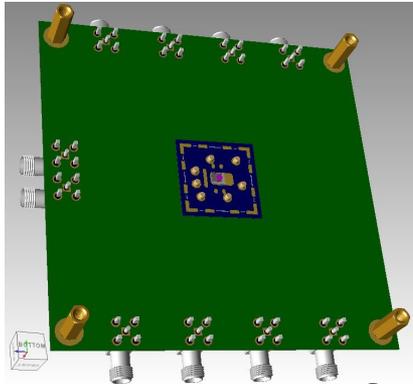
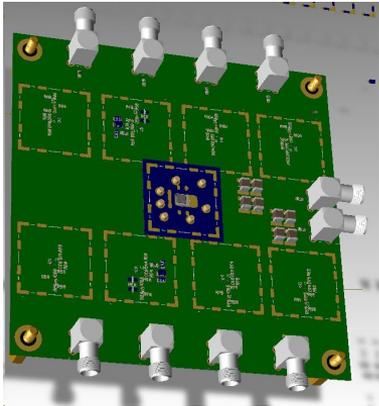
Highest priority, large effort



WG 5.2.2 : Sensor testing and simulation

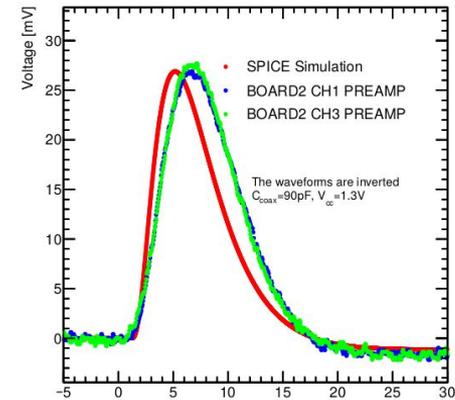
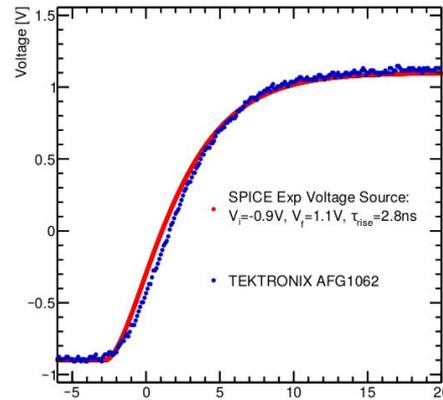
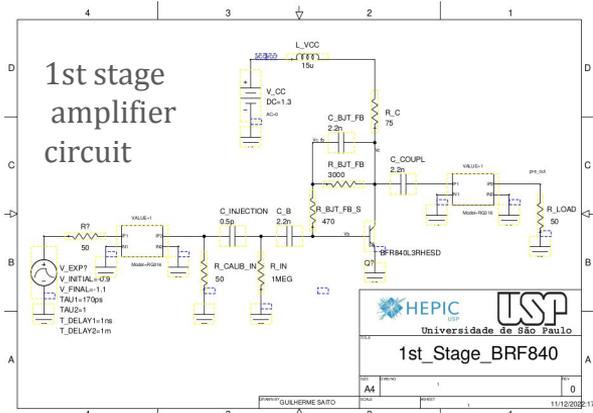
1. LGAD carrier board Simulation

Circuit and Layout simulation (ELDO, Spice, Hyperlinx) (G. Saito)



- LGAD + LGAD Carrier board with interposer
- Discussion with Eldorado on fabrication and assembly
- ELDO 1st + 2nd stage simulation on-going
- Hyperlynx signal integrity simulation next

Simulation in Eldo an comparison with measurement



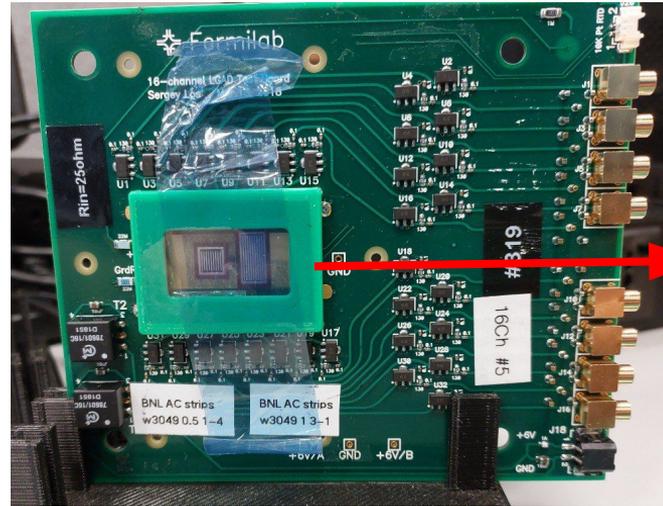
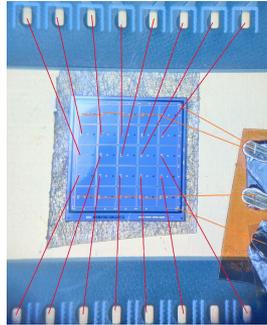
WG 5.2.2 : AC-LGADS and LGADS for X-rays

LGADs/AC-LGADS for picosecond time-resolved X-ray testing

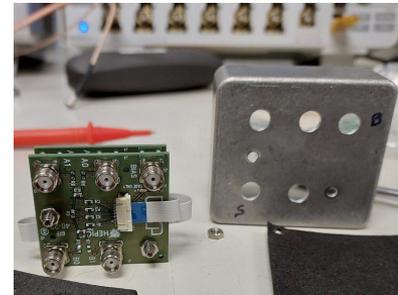
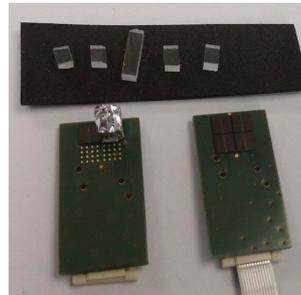
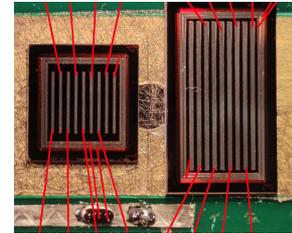
4. Radiation testing of *available* LGAD, AC-LGAD
 - 4.1. X-Ray testing
 - 4.2. Charged particle testing (electrons, protons, ions)
 - 4.3. Time Resolved X-Ray testing (**M. Leite & UCSC**)

Tested at Stanford SLAC SSRL test beam with UC Santa Cruz in November 2022

- Energies from 5keV to 53 keV (70 keV with harmonics)
- “Flat” beam (BL 11.2) : 12.6mm x 2.14mm
- Several intensities and bias voltages
- LGADs :
 - HPK 3.1 Single (1.3mm)
 - HPK 3.2 single (1.3mm)
 - HPK 3.2 5x5 (1.3mm)
 - BNL 20 μ m Single (1mm)
- AC-LGADs :
 - BNL strips



Strips
AC-LGAD



Compton Box
(SiPM + LYSO)

Long range and continuous effort - also discussion with Sirius detector group

WG 5.2.1 & WG 5.2.2 : ACTION ITEMS FOR NEXT MONTHS

ATLAS
HGTD

- Move ahead with USP infrastructure
 - Most critical item
 - Involves space, import and equipment purchase
 - Needs to prepare lab infrastructure while space discussion is on-going
- DAQ development and DB integration @ USP (in sync with CERN/IHEP/USTC/JSI)
- Infrastructure (baby demo and mockup) @ CERN
- Build the laser system with motorized stages + position measurement

New
applications

- Validate first functional TCAD and Geant4 simulation
- Add Ad-hoc simulation code for multiplication mechanism
- Analyze data from TB @SLAC, resume discussion with Sirius (more people involved...)
- Understand irradiation needs and prepare infrastructure/tests at local facilities
- Explore/Converge designs for fabrication (WG 5.2.3 - see next presentation)

on track

critical

new

WG5.2 Workshop early 2023 (January ?)

- All members with EOI in project will have the opportunity to present their plans/schedule
- follow up through indico working meetings during 1st term of 2023 as preparation for the 1st report to FAPESP