

GRUPO IMB-CNM (CSIC)

Radiation Detectors Group (RDG)

Centro Nacional de Microelectrónica (IMB-CNM, CSIC)

The group is dedicated to R&D on advanced technologies and applications of radiation detectors with activities in layout design, TCAD simulation, fabrication and characterization of semiconductor radiation sensors, microelectronics devices and interconnections. Also R&D activities in radiation effects on components and systems, implementation of complete systems, new materials, advanced geometries and material engineering.

6 staff, 3 postdocs, 4 students, 1 engineer, 1 technician



ATLAS

Inner Tracker (ITk) Upgrade (Strip detector)

- CNM is committed to make all the Pre-irradiation Quality Assurance (QA) tests with the ATLAS test chip for all the produced batches during the whole production period. Preparation of Automatic probing to measure all the different tests structures, automatic parameter extraction and data upload to Data Base. CNM is responsible of the QA implementation in the collaboration.
- Miguel Ullán is Strip Sensors Activity Coordinator and will have to manage the Production of the ~22000 large area strip sensors, the QA and QC tests, the technical validation, formal acceptance and payment, and the distribution to Module assembly sites according to the schedule to finish production in 2024.
- Detector R&D work to keep up in the state of the art of new detector technology developments which is the base of our contributions in HEP experiments (strip detectors on 6" substrates, embedded pitch adapters, advanced slim edge, acceptor removal studies, microchannel cooling,...)
- Project in collaboration with IFIC-Valencia, **PID2019-110189RB-C22**.

Inner Tracker (ITk) Upgrade (Pixel detector)

- CNM pre-qualified for the production of 3D detectors for the Barrel L0. We have to produce 384 single sensors compatible with the RD53b chip and a pixel geometry of 25x100um². Project in collaboration with **IFAE, RTI2018-094906-B-C22**.
- The preproduction of 3D sensors is already started together with the first production run. We plan to start a new run of 12 wafer every month (total 10 runs) to accomplish with the deadline of the production in 2023 .

High Granularity Timing Detector

- CNM proposed the LGAD technology which is the baseline for the timing sensors. New technologies to improve the radiation hardness of the detectors are investigated. Project in collaboration with **IFAE, RTI2018-094906-B-C22**. Extra funding from **RD50** and **AIDA2020** EU project.
- CNM has carried out various productions of LGAD sensors for the R&D phase of HGTD. Full size R&D sensors are currently being produced at CNM.

CMS

Inner Tracker (IT) Module Production

- CNM pre-qualified for the production of 3D sensors for the innermost layers of the future CMS vertex detector. We have to produce 66 single sensors compatible with the CROC chip and a pixel geometry of $50 \times 50 \mu\text{m}^2$ and/or $25 \times 100 \mu\text{m}^2$ (it will be defined at CMS next year). Project in collaboration with **IFCA** and **ITAINNOVA (FPA2017-85155-C4-2-R)**.
- The preproduction of 3D sensors is already started. After CMS decision, we will perform 4 runs (12 wafer/run) to accomplish with the deadline of the production in 2023.

End-Cap Timing Layer Module Production

- CNM proposed the LGAD technology which is the baseline for the timing sensors. New technologies to improve the radiation hardness of the detectors are investigated. Project in collaboration with **IFCA** and **ITAINNOVA (FPA2017-85155-C4-2-R)** with extra funding from **CERN-RD50** and **AIDA2020** EU project.
- CNM has carried out various productions of LGAD sensors for the R&D phase of ETL. Full size R&D sensors are currently being produced at CNM.

Future Research Work

- In this moment, we are writing a new proposal for the Spanish Research National Plan with two targets: end the production of the 3D sensors for the Inner Detector, and qualified (and start) the LGAD production for the ETL. This project will be executed in collaboration with **IFCA** and **ITAINNOVA**.



LHCb

VELO and Tracker detectors

- CNM is started the application to become technical associate of the experiment with the IGFAE/USC as the host institute. The next membership committee will be held the 19th of November 2020.
 - Many synergies with timing applications of ATLAS and CMS.
 - 3D detectors good candidates for timing applications at extreme fluences, new design in production.
 - Developments of Timepix4 detectors in 150mm wafers.
 - LGAD technologies for fine pixels pitches (AC-LGAD, trenches, inverse LGAD).
 - R&D funded trough RD50 projects and in the future from the AidaInnova Eu project.
 - CNM and IGFAE/USC may apply to coordinate funding project in the future (> 2021).
-
- Giulio Pellegrini has been selected as convener of Solid State Detectors of RECFA (Detector R&D Roadmap Panel to assist ECFA to develop & organise the process and to deliver the document)