# FCT Trainee program follow-up

Afonso Ferreira

Afonso Soares Canas Ferreira

- Masters degree in Electrical and Computer Engineering from the University of Porto

- Supervisor – Ana Henriques Correia

- Started 1st of April 2019

- EP Department

- Working for the ATLAS experiment

High Granularity Timing Detector - HGTD

- New sub-detector for the ATLAS detector

- Part of the High Luminosity LHC (HL-LHC) upgrade in 2025

- Increased Luminosity leads to increased pile-up leading to noise in measurements

- Forward region of calorimeter has lower spatial resolution

- Timing information of the particle minimizes noise introduced by pile-up

- Targeting initial $30ps$ timing resolution and $50ps$ timing resolution by the end of the HL-LHC run
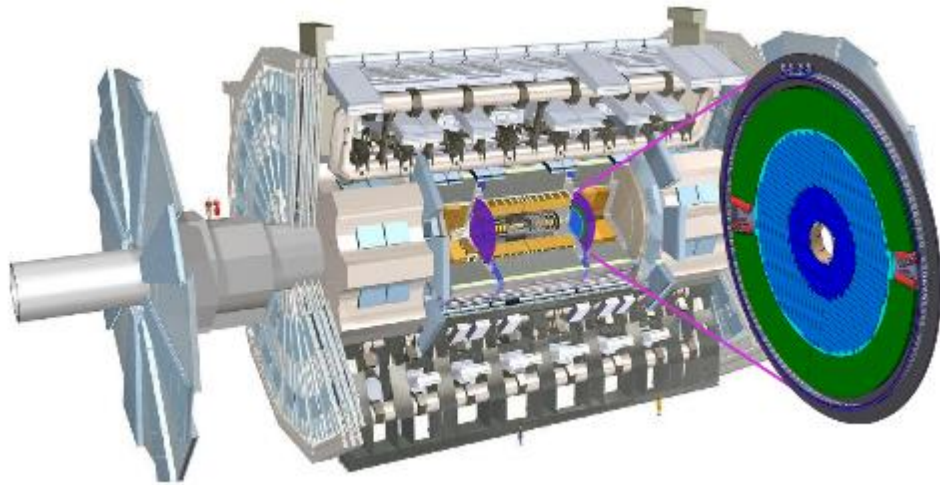
HGTD detector in ATLAS (picture taken from TDR)

Detector has a disk form and placed on endcaps of the Calorimeter

HGTD consists of many small Low Gain Avalanche Diodes (LGADs)

LGADs detect the passage of a particle

Groups of LGADs attached to electronics for readout

CERN group mostly focuses on sensor R&D and upcoming demonstrator development

Challenges of Sensor Development

- $\sim 50 ps$ per track and $\sim 1 mm^2$ granularity
- Must sustain radiation levels of $\sim 5\ 10^{15}\ neq/cm^2$
- Capability of generating a clear signal with low noise
- Power consumption as low as possible

Sensor R&D at CERN

- Multiple sensors from various providers
- For each determine
  - IV and CV curves
  - Timing resolution
  - Charge collection
- Determine the best sensors for future implementation
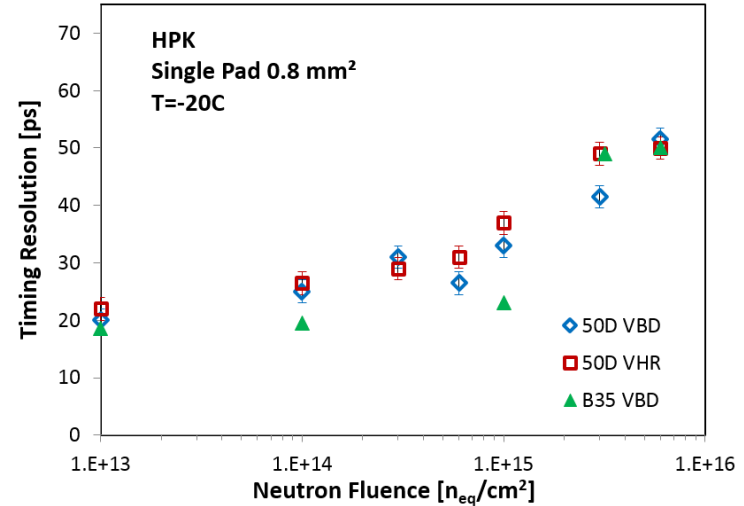
Plot of time resolution in function of the fluence. Source 2018 HGTD Technical Proposal

My Contributions to HGTD CERN Probe Station Setup

Helped establish and debug the setup

Made IV measurements of multiple LGADs

Upgraded the setup for CV capabilities

Presented results to other members and partners of HGTD

Heating Demonstrator

- Demonstrator necessary to showcase viability of the cooling
- Heaters simulate the heat generated by sensors
- PCB necessary to readout and control the heaters
- I am going to contribute to the PCB design
- PCB based on a demonstrator implemented by another group
- Initial development to start in September

Experience

- Collaborated with different people of various backgrounds
- Developed more experience with measuring equipment, software and procedures
- Integrating at CERN was very easy
  - Very welcoming team
  - Very good onboarding
  - Very welcoming people outside of the team