

# ATLAS Upgrade Activities

S. Terzo and S. Grinstein

## Outline:

- Inner tracker upgrade: ITk Pixel Detector
- High Granularity Timing Detector (HGTD)
- R&D of “new” technologies towards future accelerators (FCC and CEPC)

Indico for event:

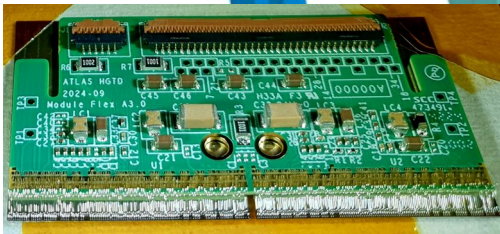
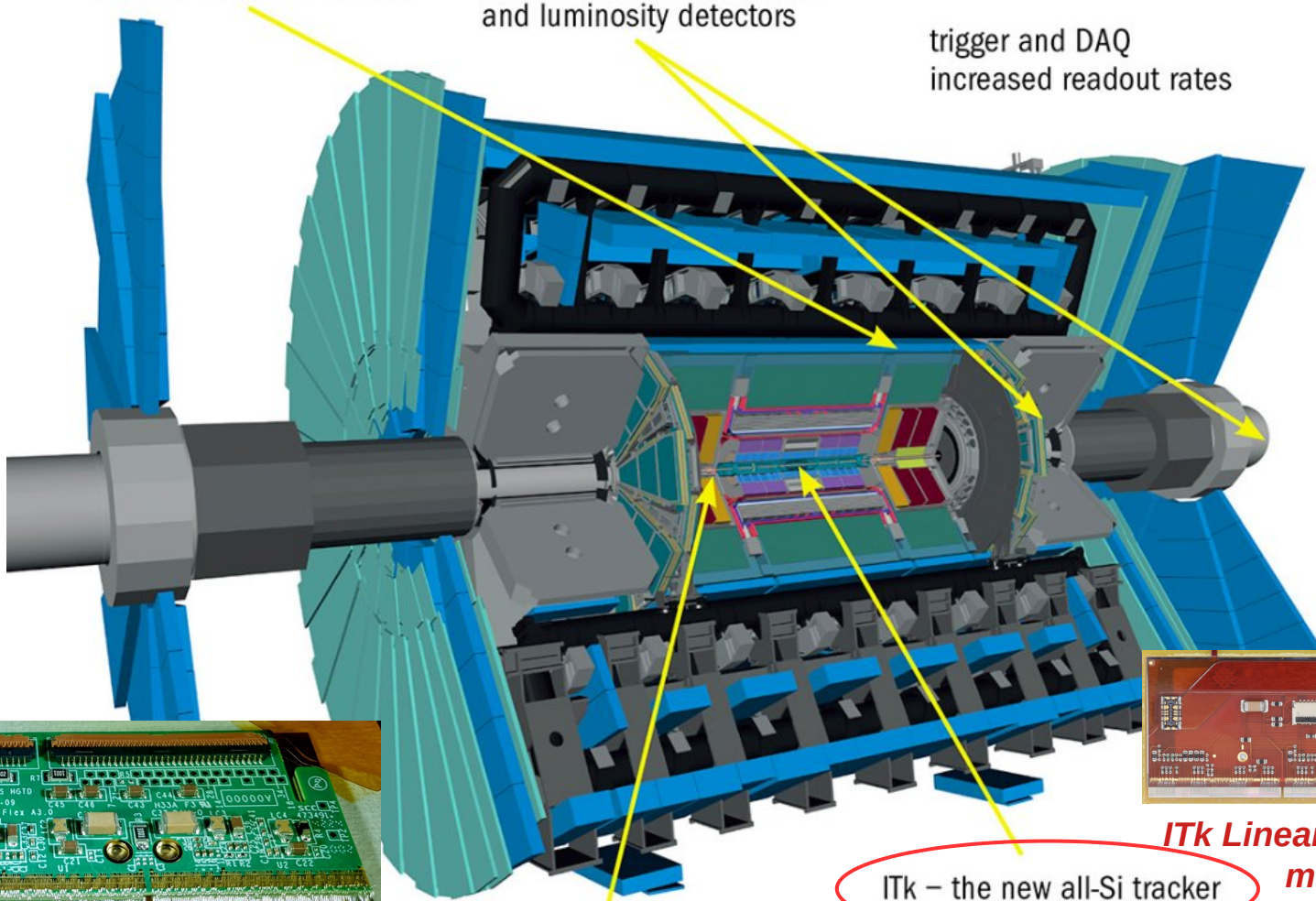
<https://indico.ifae.es/event/2560/>

# Current Activities

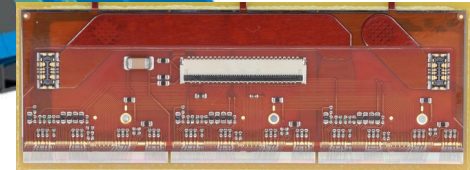
improved muon coverage

new and upgraded forward and luminosity detectors

trigger and DAQ  
increased readout rates



**HGTD Module**  
*Have to build ~1000*



**ITk Linear Pixel Triplet module**  
*Have to build 150*

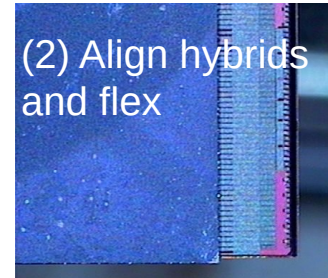
new High-Granularity  
Timing Detector (HGTD)

ITk – the new all-Si tracker

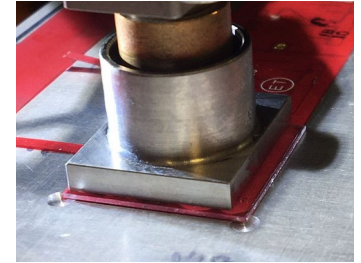
TileCal improvements  
towards HL-LHC

# ATLAS ITk Pixel

- ITk 3D hybrid
- 25x100  $\mu\text{m}^2$  for linear triplet
- Triplet flexible PCB
- (5) Wire-bond



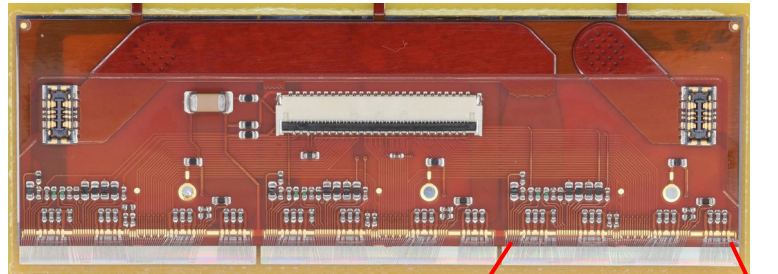
(3) Place hybrid on flex



## Several metrology steps

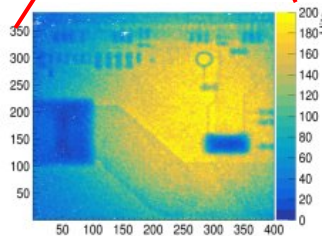
- Length, rotation, Flatness, Glue coverage

(6) Metrology



(7) Testing...

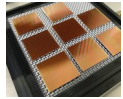
Threshold tuning,  
Detection with Sr90,  
Climate chamber, etc



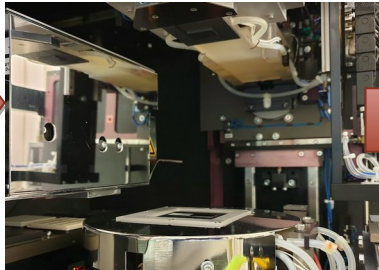
Building ~150 triplet modules for the innermost barrel pixel layer  
Collaboration with Italian and Norwegian institutions

# ATLAS Timing Detector (HGTD)

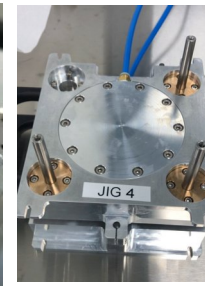
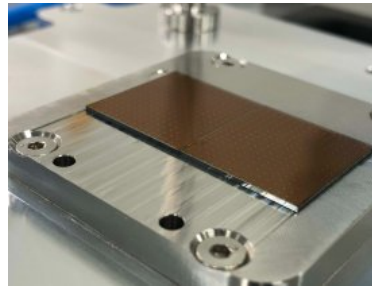
Hybridization (in house)



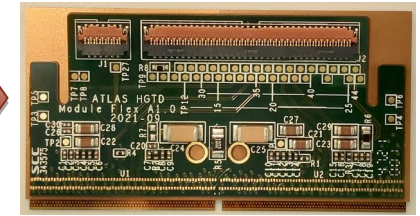
ASIC design (RC) and LGAD development



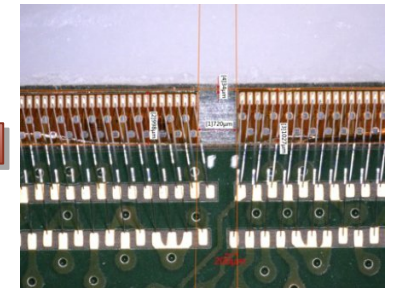
Flex/hybrid alignment and gluing



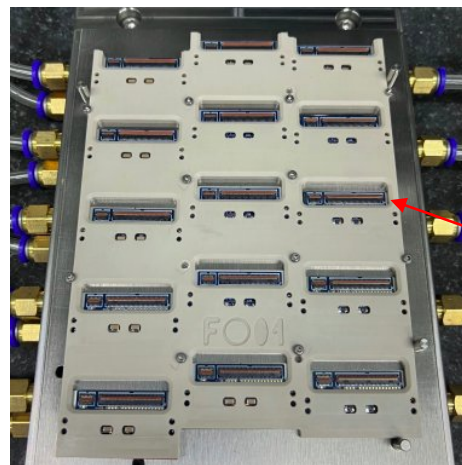
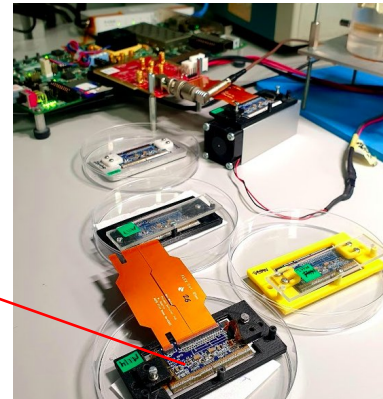
Metrology



Wire-bonding and pull tests



Final module testing



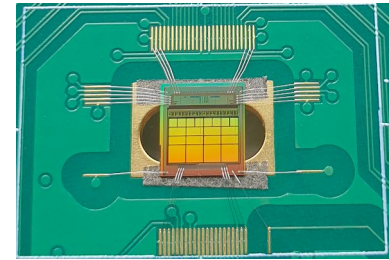
Module loading

IFAE readout system

Build (incl hybridization) and load ~1200 modules for the ATLAS Timing detector  
Collaboration w/ Chinese institutions (IHEP: J. Guimaraes, Z. Liang and USTC: Y. Liu)  
TD Lee part of HGTD Chinese cluster (?)... possible framework for collaboration

# Towards Future Accelerators

- IFAE working on **DMAPS**, **3D**, **LGAD** and **SiC** sensors towards future accelerators
- **DMAPS** is the future of HEP experiments
  - IFAE working on DMAPS design, fabrication and characterization since ~2014
  - Possible targets:
    - HGTD upgrade (CACTUS)
    - FCC (CACTUS like 4D tracking)
    - CEPC (Taichupix, fast DMAPS)
- **3D timing** (with CNM)
  - Rad hard counterpart of DMAPS (but needs ASIC...)
- **SiC** (with CNM)
  - New materials...



Testing in the lab and at CERN with beam  
→ **50 ps achieved!**

[Y. Gan et al 2025 JINST 20 C04013](#)

J. Pinol (TRENTO 2026)

Group currently focused on Upgrade activities, but R&D towards FA on-going  
Participated in the design and characterization of Taichupix2 (publication and theses)  
Also, with CCNU (Guangming Huang), shared two PhD students: T. Wu (now a professor at NCU) and Y. Gan (with EU+Chinese (CSC) funding)

# 2025 CEPC Meeting in Barcelona organized by IFAE



<https://indico.ifae.es/event/2054/>

**Back Up**