



# PPTAP Electronics and Integration Summary

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# Introduction

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- PPTAP process primarily took place over 2021
- Report published in [summer 2022](#)
- Electronics and integration was largely treated together
  - Significant overlaps with other areas, particularly silicon
- Dedicated [UK E&I workshop](#) at end of April 2021
- E&I sessions within the [PPTAP detectors workshop](#) in June 2021
- Summary of some of these discussions [here](#)
- Discussion primarily involved around how we should organise R&D and how it should be funded rather than what specific R&D should be done
- Today will go through broad outline of points discussed and pick up on some of the statements in the PPTAP report

# UK E&I Areas

Electronics	Integration
Board design	Cooling
Data acquisition	CFRP mechanics
FPGA design	DCS/monitoring
Interconnect & packaging	Detector integration
Micro electronics design	Integrated system design (incl. powering)
Optical transceivers	System testing
Triggering	
System design	

# E&I Headlines

- UK needs to reinvigorate E&I R&D efforts now in order to not be left behind
- Build up suite of IP from generic R&D which can be deployed to projects in the future
- Need reliable funding with which to seed non-project specific (generic) detector R&D efforts and create effort which is not tied to projects
- Look to build proto-collaborations to build medium-scale system demonstrators
  - Generic sub-system concepts for long-term projects
  - Roadmap including intermediate outputs which can be deployed for near-term experiments
- Need to maintain access to overseas facilities for testing and understanding how we can get more from existing facilities
- Increase number of dedicated hardware PhDs
- Consolidate efforts to hit threshold (2-3 designer critical mass?)
  - Long term (non-fixed term) design effort is required
  - Short term (fixed term) effort deployed to test/characterisation
  - Design effort not needed to be centrally located but must be coordinated
- Need R&D plans which include smaller-scale detector construction projects along the way
  - Cross-discipline synergy (eg. xray/electron microscopy) can be included in this
- Industrial contacts must be developed, particularly for interconnect
  - Much “next generation” interconnect is not feasible to develop ourselves – wafer fab level processes
  - Interconnect may need to become increasingly centralised given costs – ultra-thin 300mm becoming new standard?
- Offline suggestions to develop regular (at least annually) industrial expos and community meetings

# Facilities

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- Fair amount of thought within E&I around facilities
  - Availability within UK and access to international facilities
  - How access could be improved, overlaps minimised
- Irradiation facilities
  - Increasing dose, SEE?
- Testbeam facilities
- Large testing facilities
  - Metrology, thermal testing, testing of larger structures
- Expensive tests
  - High speed scopes
- Expensive simulation
  - TCAD?

# Some PPTAP Statements

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- *Exploitation of smaller and/or incremental projects that extended to mid-scale (cost) and high-risk activities is a funding approach currently missing from the landscape*
- *A different, broader approach to detector R&D to complement the construction project funding might be beneficial*
- *Roadmaps also allude to greater international coordination and the possible introduction of a hub-and-spoke concept. This fits well with the broadly applicable ADSC technology R&D areas, such as microelectronics, as its complexity, specialisation, and engineering and prototype requirements, favour the sharing of skills and resources*
- *The hub-and-spoke organisational concept could allow for this longer-term ecosystem, where laboratories and universities could appropriately scale their activities*

# Some Questions

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- How do we (the UK) want to contribute to the future detectors?
  - e.g. target a UK ASIC in the FE of future detectors?
- Should R&D projects be small, medium or large scale?
  - Particularly in E&I need to develop systems as a community
- How do we develop project-agnostic R&D projects which can develop into elements of projects if/when they come to fruition?
- What should the UK deliver?
  - Whole sub-detectors? Specific parts of sub-detectors?
- How should we distribute design effort?
  - Distributed effort can get more traction but long term efforts need a nucleus
- How/if to distribute testing facilities?
- Small fingers in a lot of pies, big hand in few pies
- How do we link efforts together as a community?