Second Project Review Meeting

Thursday 20 June 2024

CERN

WP3

Test beam and DAQ infrastructure

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Tasks and task leaders

- Task 3.1 Management
  - ➡ Marcel Stanitzki (DESY), Matthew Wing (UCL)
- Task 3.2 Upgrading the EUDET-style beam telescope infrastructure (DESY, CERN, CNRS-IPHC)
  - ➡ Adrian Herkert (DESY)
- Task 3.3 Sub-ns timing capabilities for the EUDET-style telescopes (NWO-I/ Nikhef, UNIVBRIS, CSIC-IFCA, DESY, UCL, USC)
  - ➡ Martin van Beuzekom (Nikhef), David Cussans (Bristol)
- Task 3.4 Development of DAQ software for next generation beam tests (UCL, DESY, UOS)
  - ➡ Lennart Huth (DESY)
- Task 3.5 Development of common DAQ hardware (CERN, DESY)
  - ➡ Dominik Dannheim (CERN)

Objectives

Objectives

Task 3.1 Coordination and Communication

See introductory section on page 29.

Task 3.2 Upgrading the EUDET-style beam telescope infrastructure

- Upgrade of the EUDET-style beam reference telescopes with the more recent ALPIDE sensor
- Integration of new AIDAinnova next generation sensors into current telescopes
- Development of a common cold-box for test-beam facilities

Task 3.3 Sub-ns timing capabilities for the EUDET-style telescopes

- Integration of a TimePix4 plane into EUDAQ2
- Picosecond timing support in the AIDA trigger logic unit (TLU)
- Include a plane based on low gain avalanche detectors (LGAD) in the EUDET-style telescopes

Task 3.4 Development of DAQ software for next generation beam tests

- Development of EUDAQ2 software to support picosecond timing of next generation sensors
- Development of versatile online monitoring for EUDAQ2

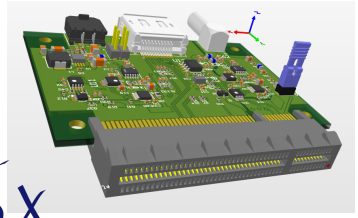
Task 3.5 Development of common DAQ hardware

- Development of a Caribou-based common readout board to support sensor R&D
- Development of the VMM3 common readout board to support gas detector R&D

Task 3.2: Beam telescopes

ALPIDE-based prototype

Tests expected this summer to complete the milestone



6x

Custom chip board interface PCB

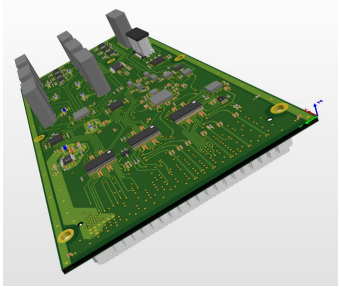
ALPIDE

Bonded to chip board by ALICE

Enclustra System on module (SoM), e.g. ME-XU1-15EG-2I-D12E

Enclustra base board

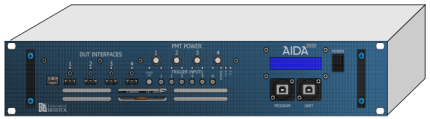
Convenient solution for connecting SoM



Custom hub PCB

Interface between SoM and sensor layers/TLU

PC running EUDAQ2

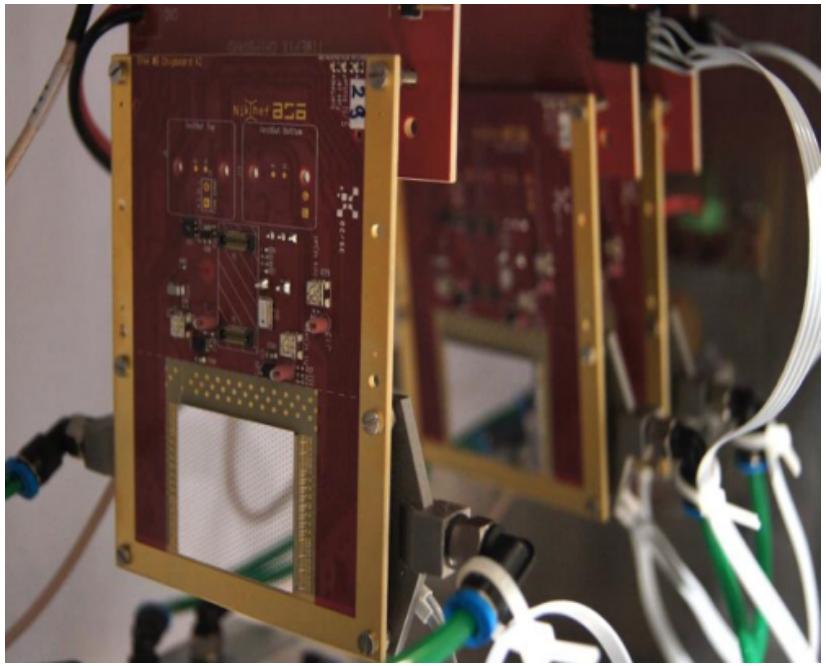


TLU sending clock and triggers

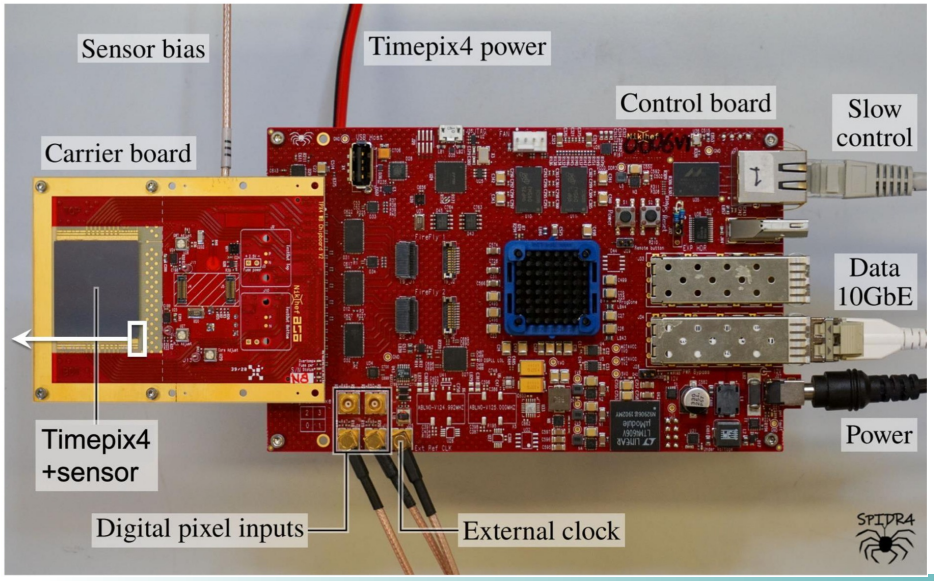
Strong overlap with WP3.5, Caribou DAQ system

Task 3.3: Timepix4 timing layer

- Main objectives:
  - Sub-ns timing capabilities for the EUDET-style telescopes
  - Integration of a Timepix4 plane into EUDAQ2
- Milestone MS9 [M36]: Timepix4 timing layer for telescopes



Timepix4v2 sensor assemblies at SPS beam test



- Borrowed sensors used in tests so far.
- Expect delivery of final sensors soon and then completion of this milestone.

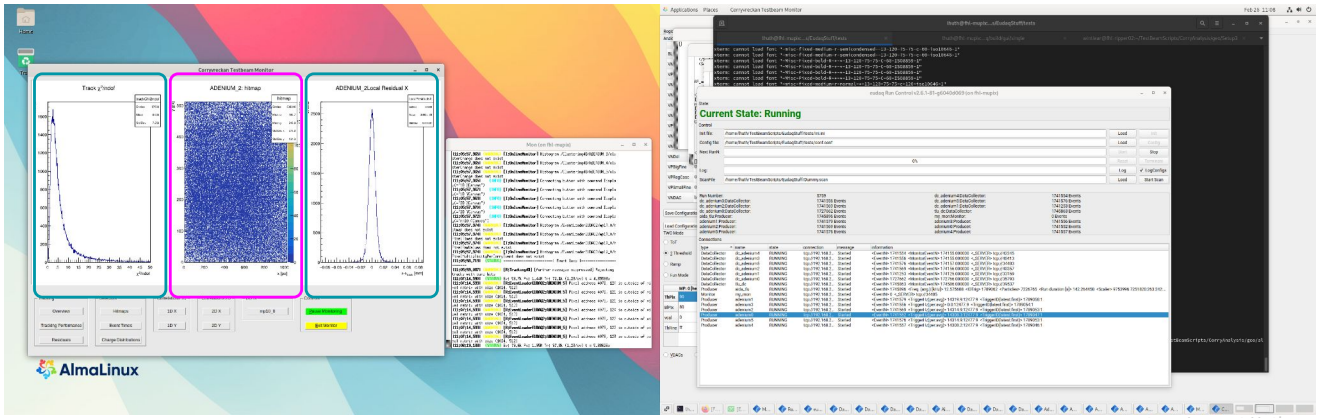
Task 3.3: Picosecond TLU

- A trigger logic unit (TLU) provides a common interface to beamline telescopes.
- A new TLU needed to provide picosecond timing compared to the current 1 ns time-stamping.
- Provide more trigger inputs.
- Backward compatibility with current TLU.
- Development and production this year.
- Then move to mass production for the user community.

Task 3.4: Common DAQ software

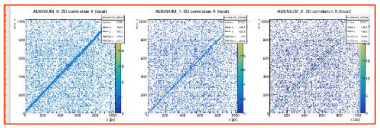
- Task 3.4: Development of DAQ software for next generation beam tests:
  - Development of versatile monitoring for EUDAQ2.
- MS10 delivered on time; report completed

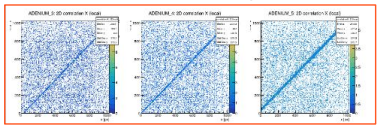
- Software in use and tested:
  - Telescope at DESY
  - AHCAL test beam
  - Dual Readout Monitoring



courtesy: Lennart Huth

- Hitmaps
- Tracking
- Correlations





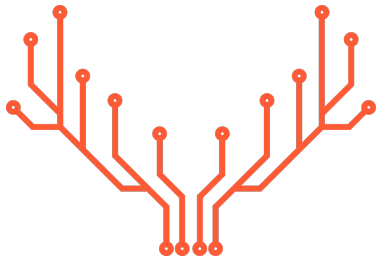
- Deliverable report written and under review

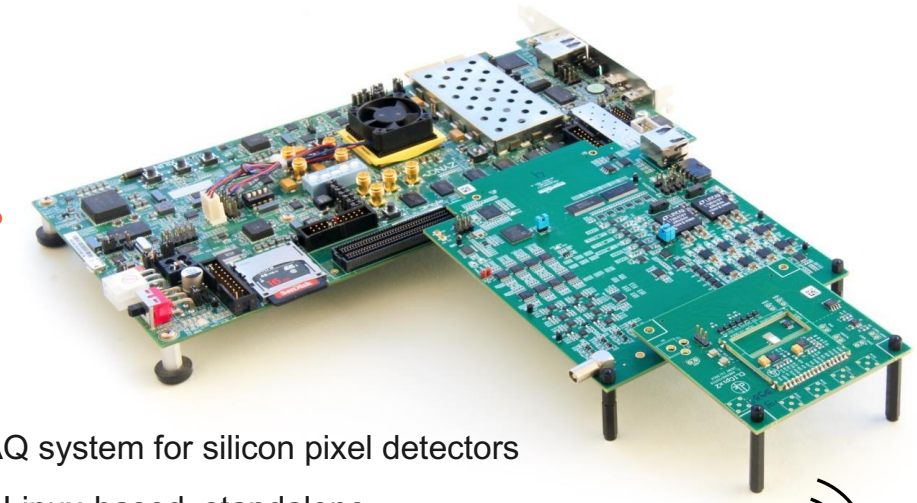
Task 3.5.1: Common Caribou DAQ

- Caribou flexible DAQ system for testing silicon detectors.
  - Based on modular hardware, firmware and Peary software.
  - Successfully used by several AIDAinnova / RD50 (DRD3) institutes.
  - AIDAinnova milestones and deliverable combined with VMM3.

Summary

- Milestone finished on time.
- Deliverable on track.



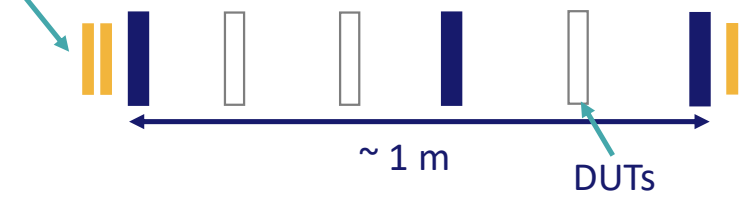


- Caribou is:
  - A versatile DAQ system for silicon pixel detectors
  - Open source, Linux-based, standalone
  - Proving excellent operation on many detector prototypes
  - Ongoing upgrade phase with many improvements to come

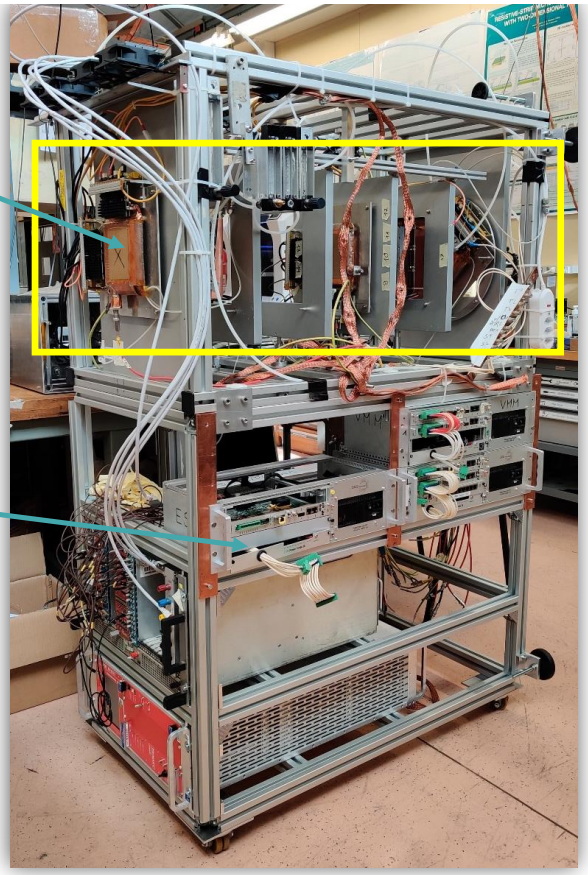
Task 3.5.2: Common VMM3a DAQ

- Development of SRS/VMM3a common readout board to support gas detector R&D.
  - Based on RD51 scalable readout system and ATLAS/BNL VMM3a front-end ASIC, scalable from lab test bench up to beam tests and medium-sized experiments.
- Again: Milestone finished on time; deliverable on track.

- 3 reference tracking detectors
  - 256 + 256 x-y-strips, 10 x 10 cm² active area
  - Triple-GEM detectors (established technology)
- 3 timing scintillator/PMTs + NIM-logic



- Everything read out with SRS/VMM3a
- Current system size: ~4k channels
  - Limited by available hardware (30 hybrids in 6 FECs in Minicrates)
  - Clock synchronization via CTF allows max. 8 FECs
- Production for deliverable ongoing to provide it to more users



WP3 milestones and deliverables

Milestones

MS8	Telescopes upgraded with ALPIDE sensor	3.2	M27	New telescope in test-beam facilities	Delayed
MS9	Timepix4 timing layer in telescopes	3.3	M36	Upgraded telescope in all beamlines	Delayed
MS10	Monitoring software developed	3.4	M30	Use in beam tests	✓
MS11	Common readout boards designed	3.5	M23	Prototype developed	✓

MS8 is delayed because we are “doing the right thing”:

- In-house to guarantee control and flexibility as well as long-term solution.
- Development took longer, but long-term gains justify delay.
- Prototype testing expected in summer.

MS9 has a small delay:

- Final tests and verification ongoing. Need final sensors.

WP3 milestones and deliverables

Deliverables

D3.1	Common cold box delivered	3.2	CERN	DEM	PU	M30	Delayed
D3.2	New TLU produced	3.3	UNIVBRIS	DEM	PU	M39	Delayed
D3.3	Telescopes upgraded with new layers	3.2,3.3	DESY	DEM	PU	M46	
D3.4	New software developments available for use	3.4	UCL	R	PU	M39	Under review
D3.5	Common readout boards delivered	3.5	CERN	R	PU	M42	

D3.1: delayed due to demands on effort for other projects. Progress now good.

D3.2: delayed due to expert leaving group. Work recently picked up and expect M46 for delivery.

D3.4: WP happy with progress and approved report of work done which is under review with AIDAinnova management.

D3.3 & D3.5: on schedule.

Summary

- WP3 has seen progress in all tasks, contributing vital infrastructure.
- On our milestones:
  - Two have been completed.
  - Two have been delayed, but progress is good.
- On our deliverables:
  - One is under review and should be completed on time.
  - Two are delayed, but good recent progress.
  - Two are on track.

Spares

Common cold box D3.1

- Deliverable
  - An adapted cold box for use with the beam telescopes at CERN (DESY later stage)
  - Submitted an extension to EU of deliverable 30 June 2024
  - Much progress made in last 6 months (see next slide)

- **cold-box design for CERN telescopes finalised**
  - procurement of parts completed
  - construction in progress at UZH.
  - **expected date for delivery: mid July 2024**
- Chiller candidates analysis selected the HUBER P815w
  - chiller order placed internally (already pre-approved by CERN procurement office). delivery time: mid October 2024
- Translation-stage order placed internally; delivery: end July 2024

AIDA innova

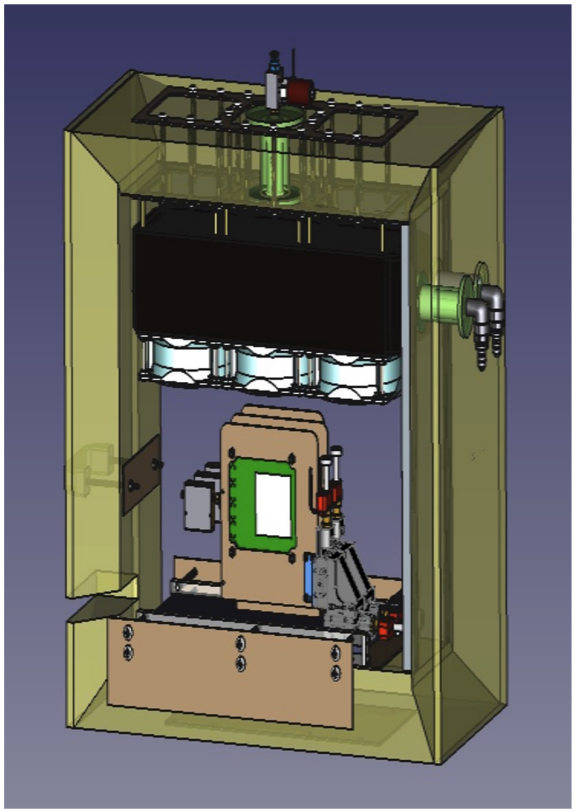
29th September 2023

Delay on:	**D3.1 Common cold box delivered**
Delivery Date in Annex 1:	M30 (30th September 2023)
Expected Delivery Date:	30.06.2024

Common cold box D3.1

Main features

- Interior size min. 38 cm x 34 cm x 30 cm
- x/y positioning by heavy duty linear stage, low precision
- Control software for position, chiller and nitrogen/dry air flow with eudaq option
- Temperature <~-50°C with pre-cooling
- Universal cable feedthroughs
- Independent single axis plane plane rotation 2-axis x-y plane positioning though precision piezo stages (optional)
- Compatibility with ethanol cooling



Links with WP3

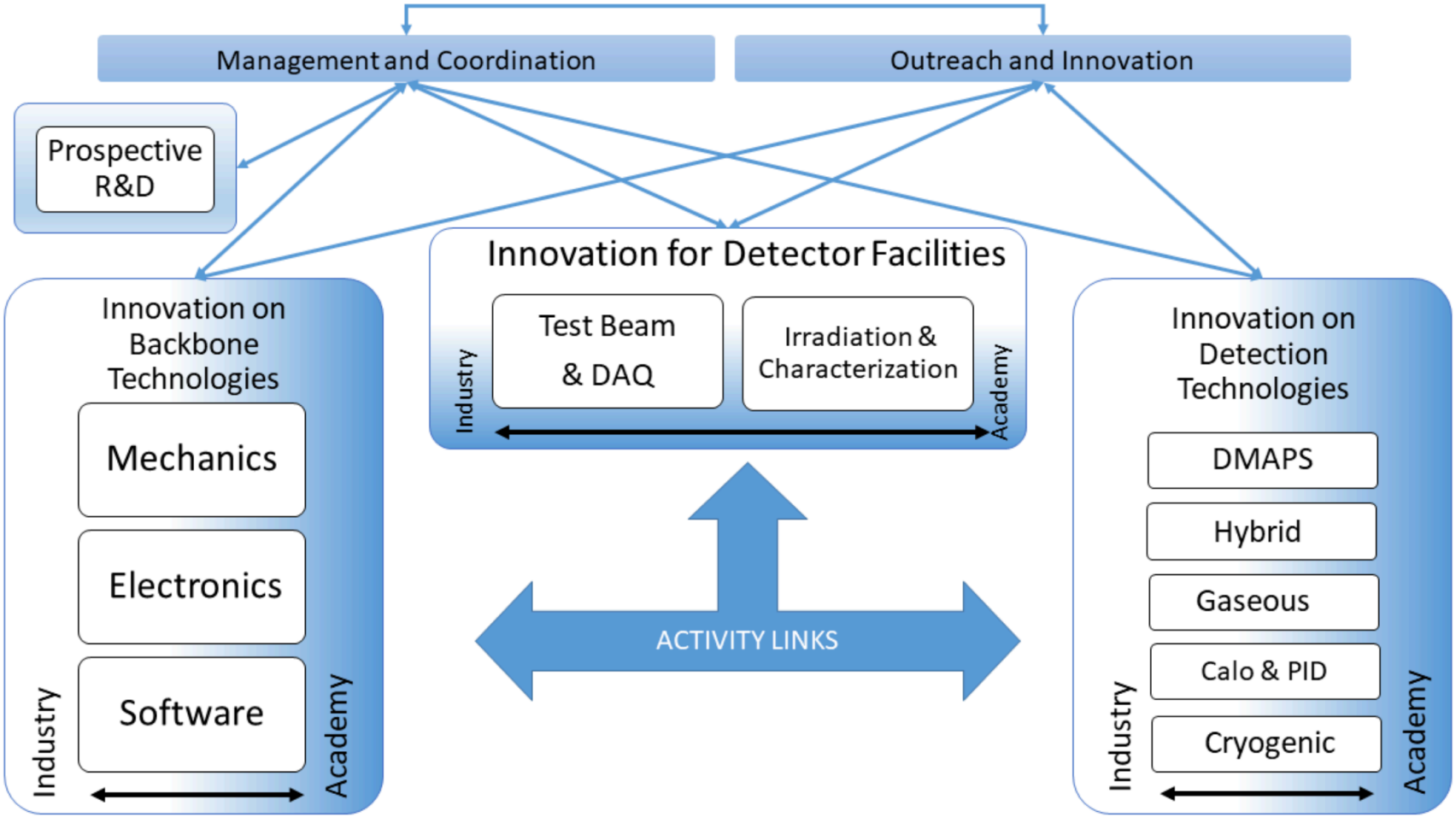


Figure 5: Work Package structure and interactions (Pert chart)