Queen Mary
University of London

Hardware training experience perspective from UoL: past, present and future

Adrian Bevan

PPTAP
2nd June 2021

a.j.bevan@qmul.ac.uk

University of London has a set of intercollegiate lectures

- Brunel, RHUL, QMUL, UCL
  - Share training for graduate students in particle physics
    - More rigorous training opportunities
    - Lower teaching load on a given group
    - Students learn together, richer learning environment
  - Some MSci/advanced undergraduate courses embedded in this portfolio

https://www.hep.ucl.ac.uk/postgrad/teaching/

Past / present

- Used to have a dedicated detectors course that focused on a number of relevant technologies for students in the field.
- This was removed from the intercollegiate portfolio - no hardware training is centralised anymore
- Students still get software training:
  - Computing and Statistics
  - Software carpentry

Present (QMUL)

- We have a number of hardware track PhD students focused on:

Current detector builds:
- ATLAS ITk
- DUNE

Generic R&D
- Zero Mass (low mass Future Collider R&D):
  - Silicon strips and pixels
- Organic Detectors
- Perovskite and other emerging material detectors
- Simulation and radiation environments

- These students are funded by STFC, EPSRC, QMUL, other scholarship and commercial partners; we currently have between 2-4 hardware students starting each year.

Present (QMUL)

- Training is ad-hoc, covering topics on the job as required:
  - Basic skills (e.g. coding)
  - On the job training (e.g. smart scope usage, wire-bonder usage)
- Pandemic has added to the challenge of managing training while having limited numbers in laboratories
- Group seminars expanded to formally include detector / technology talks
- Dedicated detector development group meetings each month with focus sessions on specialised topics
- … working on improvements for autumn 2021 to roll out a new training model to fit our needs (built from the ground up)

Future (QMUL)

- Balanced portfolio of courses including:
  - Software:
    - Carpentry
    - Python
    - Simulation codes (e.g. GEANT, FLUKA etc.)
  - Background skills:
    - Radiation interaction with matter, detection and effects
    - Electronics
    - Using lab equipment
    - HEP experiments (and builds)
  - Topical subjects (semiconductors, trackers, wire-bonding etc.)
  - Commercial Awareness (IP etc)
  - + topical literature reviews

Future (QMUL)

- Tap into a wider ecosystem of training, including:
  - advanced undergraduate courses,
  - the UoL intercollegiate programme
  - interdisciplinary training (e.g. organic electronics, materials, infrastructure usage: Raman/XPS)
- Industry led training sessions
- Innovation team led training sessions
- Dedicated training on equipment (e.g. DAQ, test equipment, wire-bonders, smart-scope, bond pullers)
- Delivery mode options under consideration to understand how we can reach as wide an audience as possible

Other aspects

- Engage early career researchers in delivery as part of their professional development
- Engage apprentices with projects through activities wherever possible
  - Need physicists, technicians, engineers etc. to build the future infrastructure - we can't do this in isolation
  - Need to work across the disciplines to ensure the next generation of detector builders can work effectively with the engineers and technicians that will be essential for our field to continue
- Where necessary and appropriate also provide training to ECR's
- Most of our hardware track students are at least part industry funded
- Could do much more with dedicated funding from STFC (e.g. DTCs)

Summary

- We have an increasing number of PhD students who are hardware track, or involved in aspects of detector construction
- Expanding efforts in this area
- Moving from an ad-hoc training approach to a more measured programme covering core and optional skills to equip a next generation of detector physicists for the challenges that lay ahead
- Mindful that we play a role in skills pipeline that feeds UK industry - where possible choose to use industry relevant technology, and engage with industry in training programme
  - This guides us in our industry partner selection