Innovative Algorithms Summary

David Lange and Heather Gray

Defining Scope of Innovative Algorithms

- Algorithms for real-time processing of detector data in the software trigger and offline reconstruction
  - Novel techniques
  - Novel architectures
- Generally doesn't include **hardware trigger algorithms**
- Does include machine learning as used for **software triggers** and **reconstruction**
- Not sure about the boundary for **simulation**: we have one project looking into machine learning for fast simulation

Projects in Innovative Algorithms

- Tracking: Cornell/Princeton/UCSD
  - slides
- Tracking (ACTS): Berkeley/Stanford
  - slides
- ML for primary vertexing, PID for autoencoders: Cincinnati/MIT
  - slides
- Fast simulation for jets: NYU
  - slides
- Machine learning for FPGAs (hls4ml): MIT/UIUC
  - slides

General feedback from the Discussion/Slides

- Add milestones identifying areas for cross-pollination
  - e.g. LHCb vertexing project+ACTS
- Consider hosting Connecting the Dots in 2020
- Do we want to define common metrics for tracking?
- Can the institute support challenges like kaggle/RAMP?
  - Need to identify who would be interested in doing this as it is significant work
- Some milestones need to be phrased more generally, e.g. to avoid tying ourselves to a specific technology that might become obsolete
- In many cases (e.g. where we collaborate) we need to clearly define the role and impact of IRIS-HEP
- Credit? e.g. for IRIS-HEP or collaborators outside IRIS-HEP
- Blueprint workshop around tools/algorithms for accelerated computation on FPGAs/GPUs?

Finalising the PEP & Next Steps

- Upload new slides with updated deliverables taking into account the feedback received (deadline: early next week)
  - We plan to meet with project areas to re-discuss deliverables
- Schedule talks at IRIS-HEP discussion meetings to explore the projects in more detail
  - Would like to use this slot rather than adding an additional Innovative Algorithms meeting time
- See the need for an IA workshop-like event once the projects are all going
  - Possibility to discuss more of the technical details

- **Ideas for IRIS Discussion Meetings**
  - Machine learning in the LHCb Trigger System: Mike Sokoloff/Mike Williams
  - hls4ml: Phil Harris