Contribution ID: **42**   Type: **WG5 - Characterization techniques - facilities**

Integrating Track Lab with Constellation for distributed DAQ of Timepix3 and Timepix4 detector networks.

Tuesday 3 December 2024 14:40 (20 minutes)

We propose to combine two existing DAQ programs: Track Lab and Constellation. Track Lab is a graphical application focusing on pixel detectors of the Timepix family, compatible with a diverse range of readout hardware such as Katherine and MiniPIX. Thanks to its modular architecture, Track Lab allows users to construct complex data processing workflows by interconnecting simple building blocks, and execute them efficiently in parallel within a scope of a single process. Constellation is a hardware-agnostic DAQ fabric that implements robust finite state machine over a (physically) distributed network of *satellites*, which use IP-backed communication to exchange data and receive commands from a single *controller*. With focus on high performance, Constellation represents a promising solution for interoperability of large detector networks. In this contribution, we will investigate potential benefits of harmonizing both programs to leverage their desirable properties. For instance, reinterpreting Track Lab's modules as satellites would allow them to be deployed beyond the scope of a single process, single platform or a single machine. This would enable data workflows to be effortlessly scaled up over many CPUs in high-flux environments, analysis to be partially offloaded directly to detector hardware, or distant detectors to be operated in concert as a single setup. Conversely, Track Lab could potentially assume the role of Constellation's controller, supplying a tested graphical interface that includes monitoring of the state machine, data flow accounting, backpressure tracking and real-time data visualization. A combination of Track Lab with Constellation could therefore give rise to a computationally powerful, yet lightweight and versatile family of DAQ tools, which would be particularly attractive for use with networks of data-intensive detectors such as Timepix4.

Type of presentation (in-person/online)

online presentation (zoom)

Type of presentation (I. scientific results or II. project proposal)

II. Presentation on project proposal

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Session Classification: WG5 - Characterization