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# Persistifying the complex Event Data Model of the ATLAS Experiment in RNTuple

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The ATLAS experiment at CERN's Large Hadron Collider has been using ROOT TTree for over two decades to store all of its processed data. The ROOT team has developed a new I/O subsystem, called RNTuple, that will replace TTree in the near future. RNTuple is designed to adopt various technological advancements that happened in the last decade and be more performant from both the computational and storage perspectives. On the other hand, RNTuple has limited/streamlined data model support compared to TTree.

The ATLAS Event Data Model (EDM) must support functionality arising from the vast complexity of the underlying detector and the constraints of the computing model. It takes advantage of C++ (object oriented) language features that allow efficient processing of highly complex algorithms that produce physics objects from various different sub-detectors. To encapsulate this complexity needed for transient processing, ATLAS had introduced a separation between the transient and the persistent (T/P) representations of the EDM. This approach simplified the adoption of TTree as the main event data format at the time. It also allows us to embrace different technologies and storage backends more easily while keeping the reconstruction and simulation software stack as complex as it needs to be.

In this presentation, we will discuss all the foundational work that allowed ATLAS to persistify all its processed event data, including complex simulation and reconstruction data, in the RNTuple format. We will discuss the key elements of ATLAS' core EDM and I/O software and how encapsulation via T/P separation can guide other (future) experiments in designing their own models and future-proofing their I/O and storage infrastructure.

## Significance

This will be the first public presentation on the foundational work that allowed ATLAS to persistify all its upstream event data, including complex simulation and reconstruction data, in the RNTuple format.

## References

## Experiment context, if any

The ATLAS Experiment

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