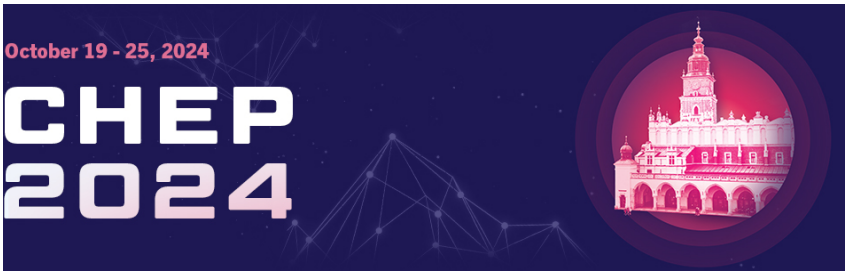

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Adoption of ROOT RNTuple for the next main event data storage technology in the ATLAS production framework Athena

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Since the start of LHC in 2008, the ATLAS experiment has relied on ROOT to provide storage technology for all its processed event data. Internally, ROOT files are organized around TTree structures that are capable of storing complex C++ objects. The capabilities of TTrees developed over the years and are now offering support for advanced concepts like polymorphism, schema evolution and user defined collections and ATLAS makes use of these features to handle its EDM. But some original TTrees concepts, like the POSIX file model and sequential writing, remain unchanged since the beginning and could be an obstacle to achieving the performance required for High Luminosity LHC.

With the HL-LHC performance goals in mind, the ROOT project developed a new storage format - the RNTuple. RNTuple, with its accompanying user API, is now in the final development stage and is planned to be production-ready at the end of 2024. Soon after that the TTree will become a legacy format.
ATLAS intends to have its main Event processing framework Athena ready to use RNTuple in the production environment as early as possible. The work on adopting RNTuple as another ROOT storage technology in Athena started already in 2021 and is now nearly complete. Although the initial goal was to focus on derived-AOD products (PHYS and PHYSLITE), with a little added effort all ATLAS data products: RDO, HITS, ESD, AOD and DAOD can be now stored in RNTuple format and transparently read back.

In this paper we will describe the current state of RNTuple adoption in the Athena framework and explain the ATLAS EDM requirements that had to be met on the ROOT side to successfully integrate both environments. We will demonstrate the ability to run standard ATLAS production workflows, based on RNTuple as the Event data storage technology, and point out key advantages of the new format.

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