

# Persistent Data

## A History of (some) HEP software

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# 1 Introduction to the data persistence problem



# Introduction to the data persistency problem

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The opposite of this is **transactional data**.

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## What is data **serialization**?

**Serialization** is the process of translating data structures or object state into a format that can be stored (for example, in a file or memory buffer, or transmitted across a network connection link) and reconstructed later in the same or another computer environment

– google

## Quick note on context

Here persistent data means the data that is used **between each** step of simulation/tracking/reconstruction. Thus it facilitates the development of simple or complex single purpose libraries.

There is a larger type of data persistence, of the data archiving type, which we are not talking about there.

We want a **quasi-persistent** data model, which from the view of the entire software chain, seems to be used in a transient way.

## Let's look at some HEP projects

- **SIO** (1999) - serial IO library
- **AID** (1999-2003?) - tool that generates code based on data model
- **LCIO** (2003) - A fixed but flexible persistent data model. Uses **AID** to define data structures and **SIO** for serialization.

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### LCIO is still in heavy use. Why has it successfully lasted this long?

- Is it really fast? ... Not really
- Does it have the best compression? ... No
- Are the data structures optimized for speed? ... No
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- Has it been modernized with changing/improving language features? ... No
- Has it been well maintained? ... **Yes.**
- Was it adopted by the community? ... **Yes.**
- Was it accessible with a variety of languages? ... **Yes.**

## Looking at LCIO's Success

- LCIO was successful because it was **flexible, maintained, and adopted by the developer community** (not the users).
- User community overwhelmingly adopted ROOT for everything (but no persistent data model).
- ROOT and LCIO do not work together!
- ROOT is clearly the tool of choice and will remain so.

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### We need a library for the future!

It needs to

- Use ROOT IO for serialization layer.
- Develop tools for creating persistent data, making maximal use of ROOT tools as well.
- Read and write LCIO files to provide backward compatibility so we can use all the tools developed over the past 15 years.

# This is the most immediate software problem

We need to solve this problem ASAP!

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Fortunately, the FCC community is already working on it:

- PODIO - Plain-old-data IO (analog of AID) but uses ROOT and treats python as first class language.
- PLCIO - LCIO data model implementation with PODIO

Both of these projects are at an early stage but can be easily completed with more support from the community.



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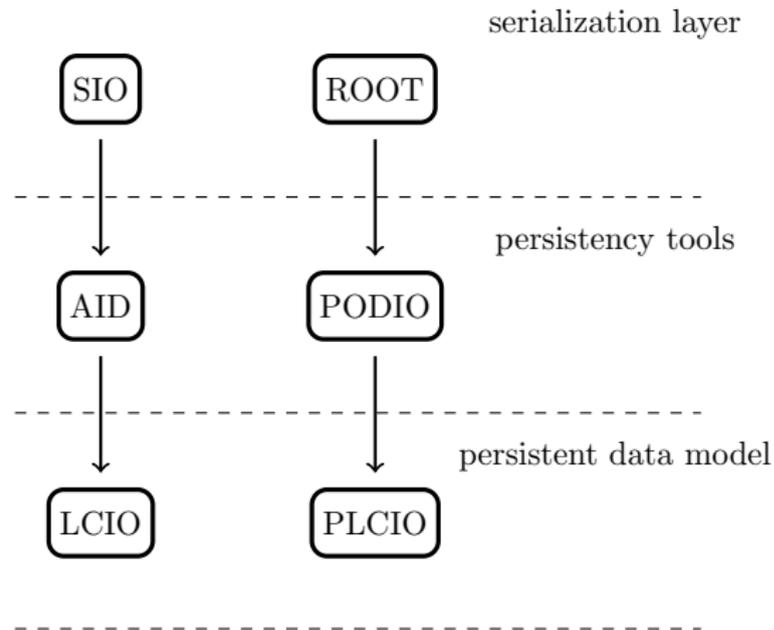
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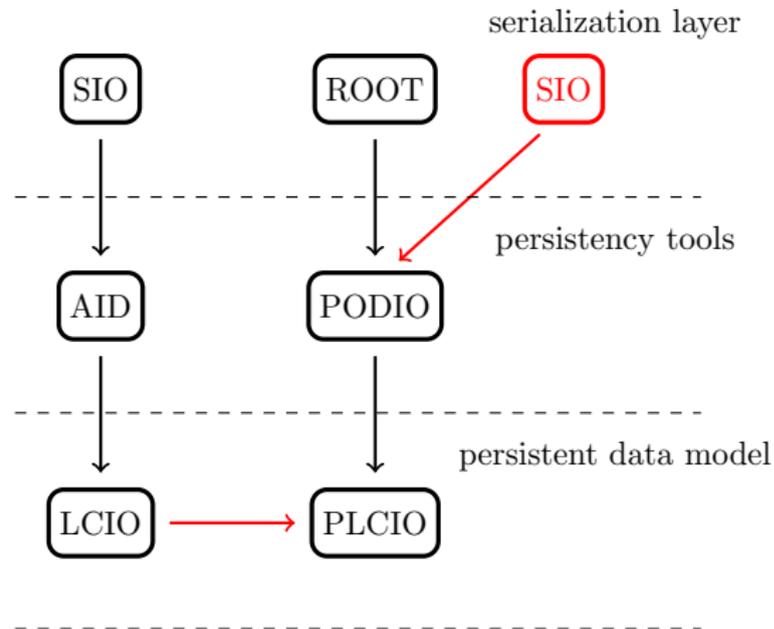
## The real challenge...

**Getting library/toolkit/framework developers to agree to using the same event data model.**

# Data Persistence for the near future



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# Conclusion

- Can we do it?
- This decision has direct impact on how the tracking/geometry/detector objectives will proceed.

## Some useful links

- <https://github.com/hegner/podio>
- <https://stash.desy.de/projects/IL/repos/plcio/browse>
- <https://github.com/iLCSoft>
- <https://github.com/HEP-FCC>
- <http://ilcsoft.desy.de/v01-17-09/DD4hep/v00-15/doc/html/index.html>