

# SEAL and POOL in LHCb

**Strategy**

**Integration of SEAL**

**Integration of POOL and Status**

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# Motivation

- **LHCb has invested significantly in LCG**
- **It's payback time!**
- **Retire parts of the Gaudi framework**
  - Decrease long term maintenance load
- **Test SEAL and POOL in the LHCb environment**
  - Give feedback to SEAL and POOL



# Strategy

- **Adiabatic adaptation of Gaudi to SEAL/POOL**
  - Slow integration according to available manpower
  - Time estimate roughly 1 year for full migration
  - Take advantage for face-lifting of “bad” interfaces and implementations
- **Minimal change to interfaces visible to physicists**
- **Integration of SEAL in steps**
  - Dictionary integration and plugin manager
  - Use of SEAL services later

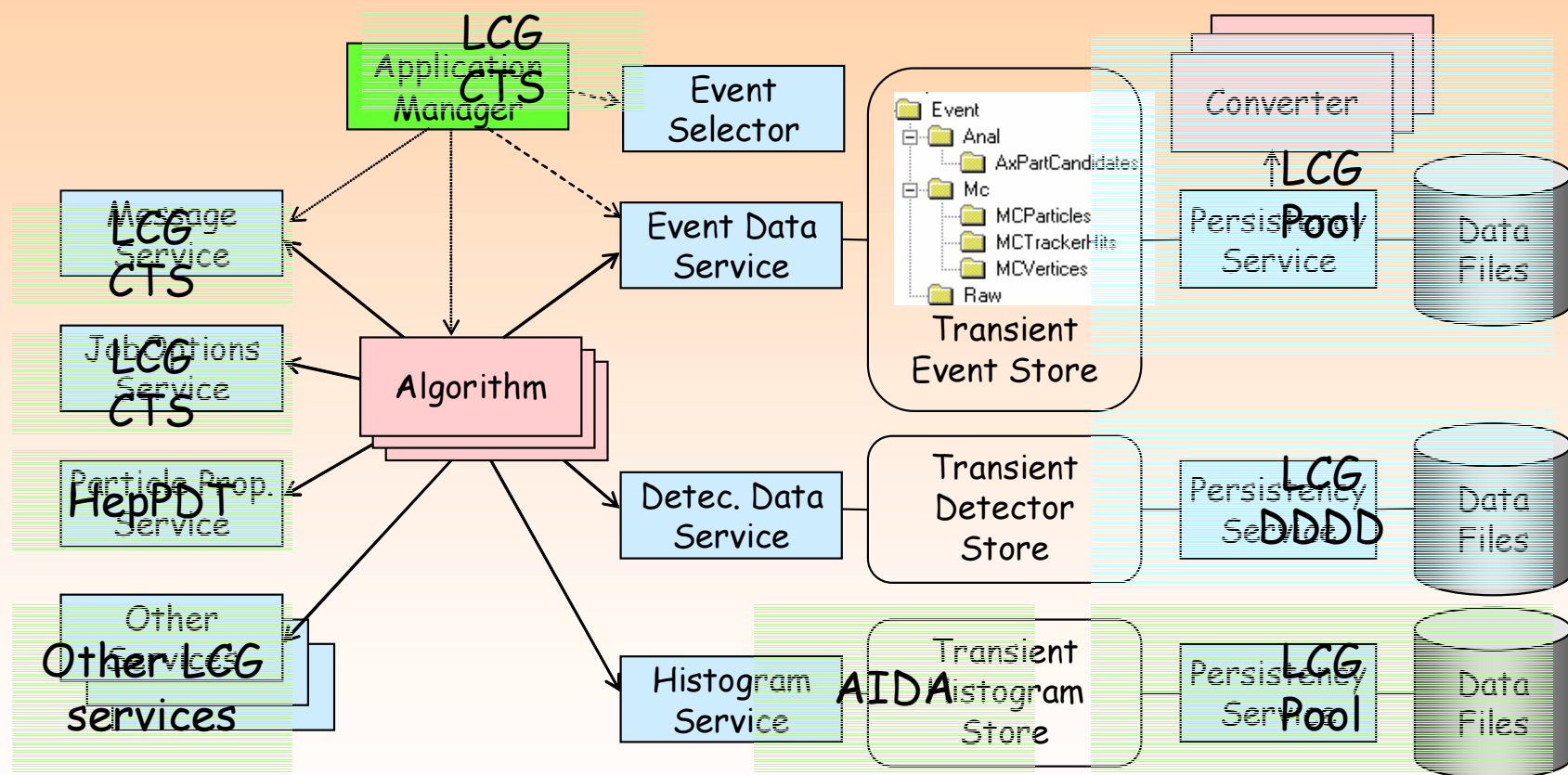


# Other Constraints

- **Integration of POOL earlier than SEAL**
  - Plan to have a fully working prototype by end of the year
- **Necessity to read “old” ROOT data**
  - For roughly 1 year
  - Consider data reformatting from Gaudi ROOT to POOL
- **Keep the LHCb event model as is**
  - Event model classes/objects are transient
  - **May, but not must** have a 1:1 persistent correspondence



# Standard View of LHCb Software



# Seal Integration Status

- Dictionary
- Plugin Manager
- Component model



# Seal Dictionary

- **LHCb has it's own approach**
  - Generate code from object model described with XML
- **SEAL dictionary is mandatory for POOL integration prototype**
- **Code generator is missing**
  - Work will start [very] soon



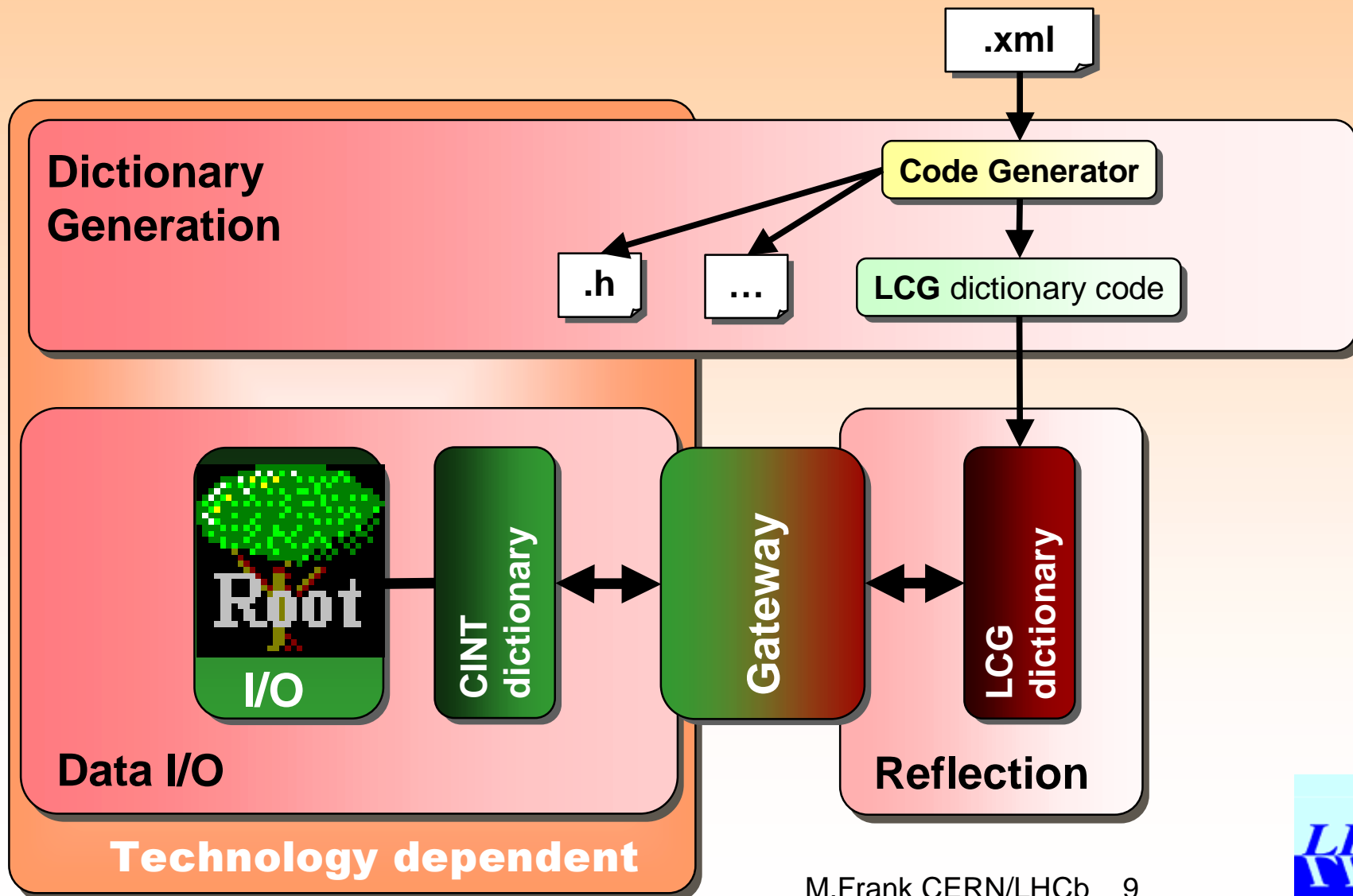
# Dictionary: Population/Conversion

- **Event model is described in XML**
- **Generator delivers**
  - LCG dictionary
  - C++ Header files
  - ...Whatever the future brings
  - Limited need GCCXML: external libraries like CLHEP
- **Much simpler/shorter description**
- **Homogeneous header files with one style**
- **Not all is good what C++ offers**





# Dictionary: Population/Conversion



# Seal Component Model

- **We will not jump immediately on what is present**
  - SEAL is evolving and we cannot constantly follow
- **SEAL is used through POOL**
  - Well encapsulated
  - Limited visibility to end users
- **No replacement of Gaudi services foreseen before component model is not mature**

# Seal Foundation Libraries

## ➤ Concerns regarding modularity

➤ SEAL foundation libraries depend on many external libraries

➤ Example:

To use the plugin manager the regular expression library (libpcre) must be loaded, which is needed by the SEAL regular expression wrapper

e.g. also boost has a regular expression wrapper

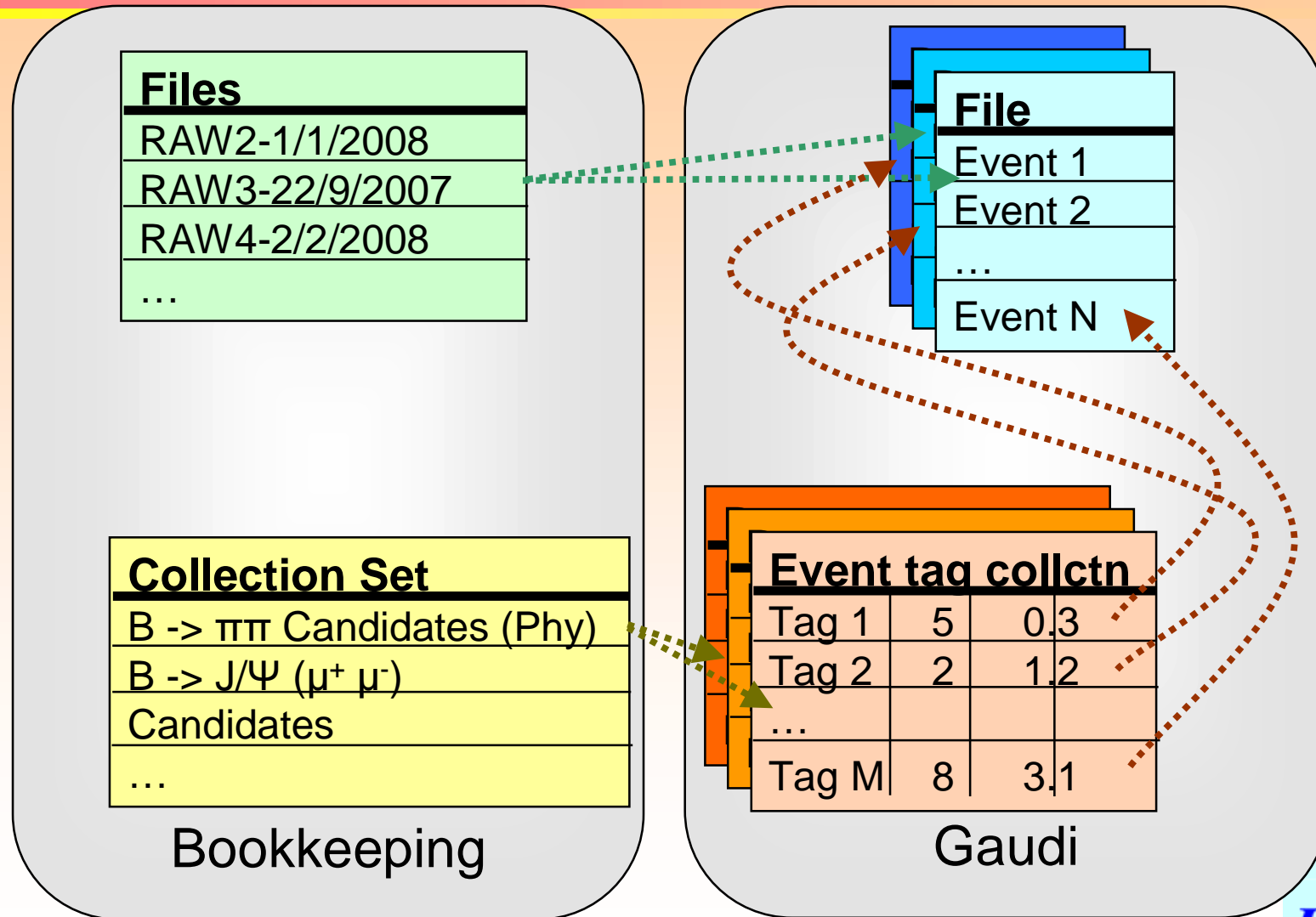


# POOL Integration: Goals

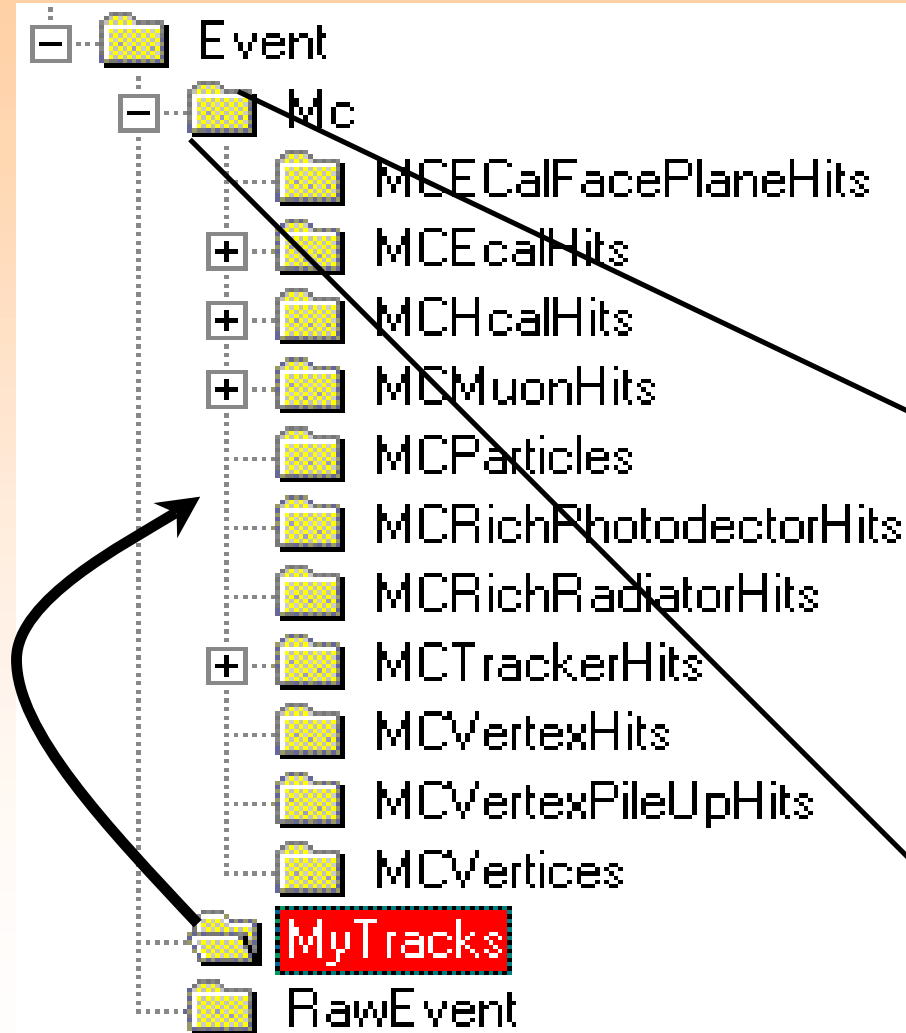
- **Save and read the LHCb event model**
- **No more serializers, let ROOT do the job**
  - Object can keep personality in ROOT
- **Emphasis on some aspects of the LHCb event model**
  - Stress on object relationships
- **Dictionary generation for the LHCb event model**
- **Event tag collections: POOL & Gaudi**
- **Integration of POOL event tag collections**



# Event Data Access



# Events in the Gaudi Data Store



➤ Tree - similar to file system

➤ Identification by logical addresses:  
"/Event/MC/MCEcalHits"

DataObject

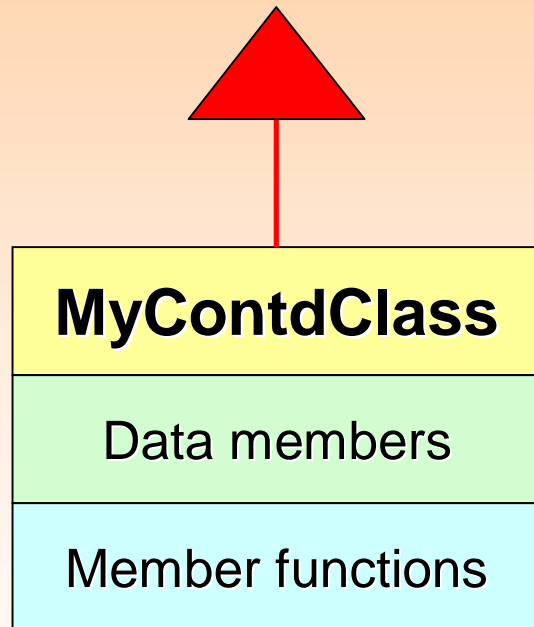
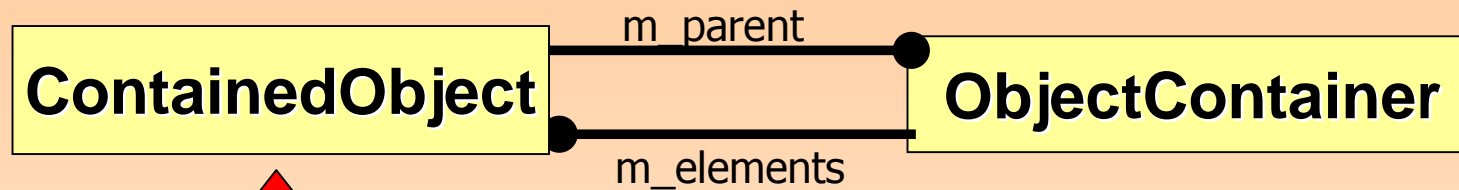


MCEvent

➤ Store item = directory + attributes

➤ Browse capability

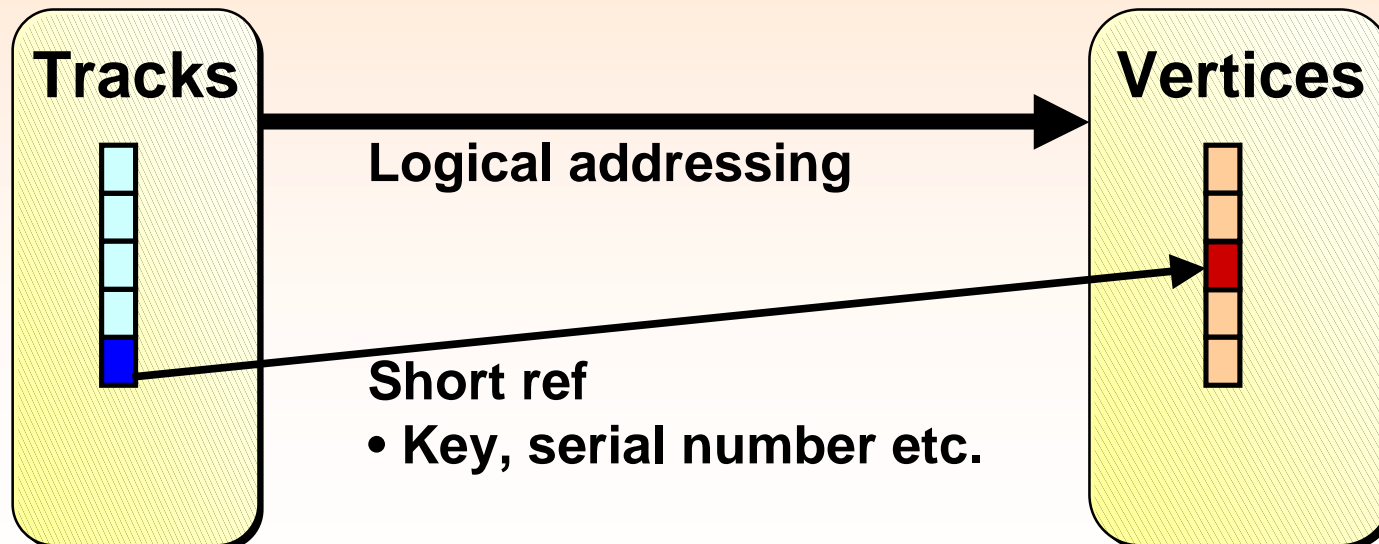
# Object Collections (Hits, Tracks etc.)



- Object container is identifiable
- Hits and Tracks are only identifiable within container
  - Identification by “key” (=short ref)

# References between Contained Objs

- Most objects are aggregated in containers
- Identify containers using “logical addressing”
- Internal links between contained objects (Short refs)

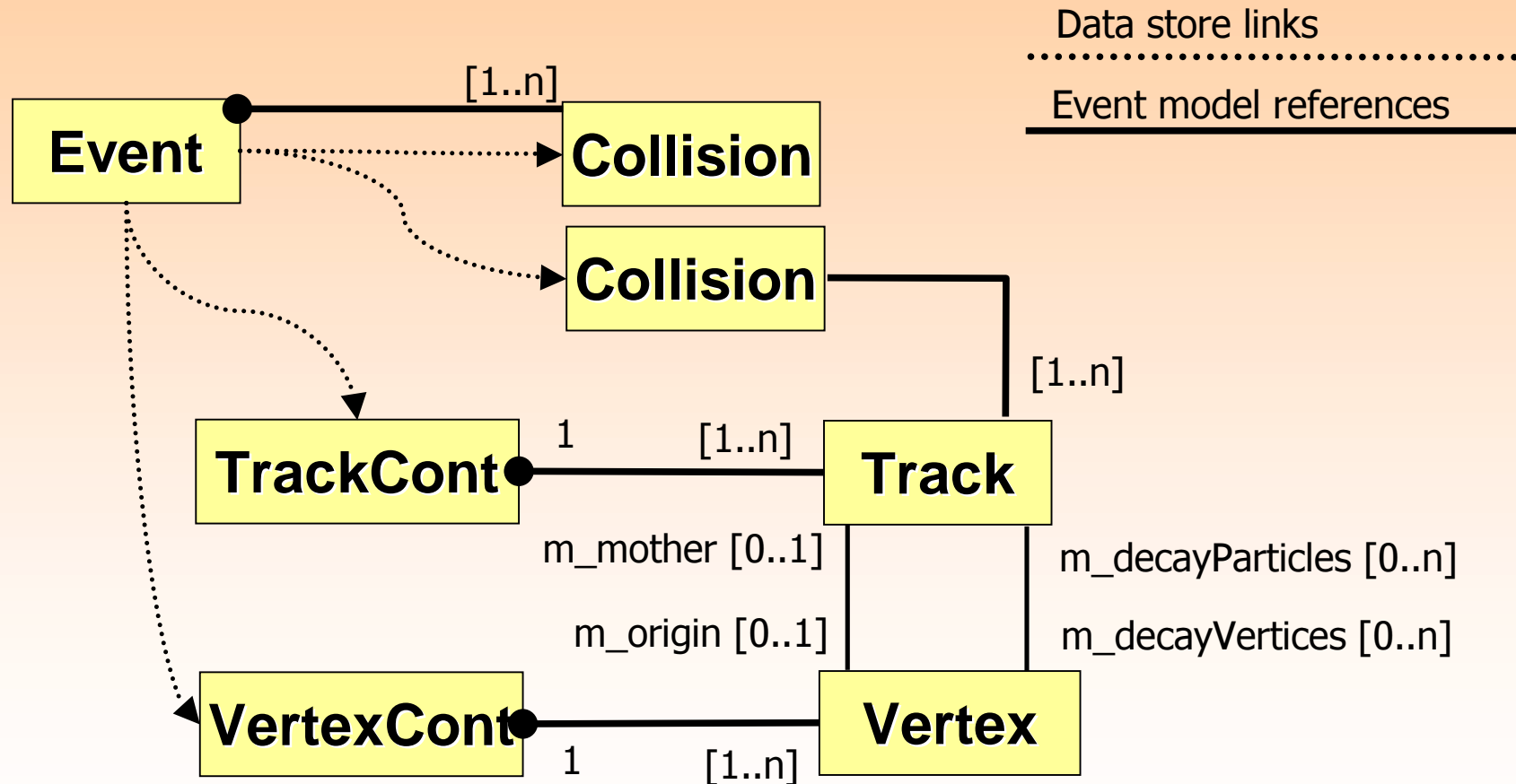




# Toy Event Model

- **Identifiable objects** (DataObject)
- **Non-identifiable objects** (ContainedObject)  
**hosted by “Keyed Containers”**
- **0..1 Associations**
- **0..n Associations**
  
- **All combinations of these relationships must work**

# Toy Event Model



# Status of Event Data Storage

- **Mechanics for data persistency of event data is partially implemented**
  - New Gaudi Plugin created: package GaudiPoolDb
  - New Gaudi “conversion service” capable of dealing with POOL technologies: Root Tree
  - New EventSelector service to access implicit POOL collections for reading files
  - One converter class for all object types



# Status of Event Data Storage

- **Dictionary generation is missing**
  - Use generated dictionaries for the time being
- **MC truth relationships still missing**
  - Remove MC truth information completely from data
  - Objects containing arrays of reference pairs

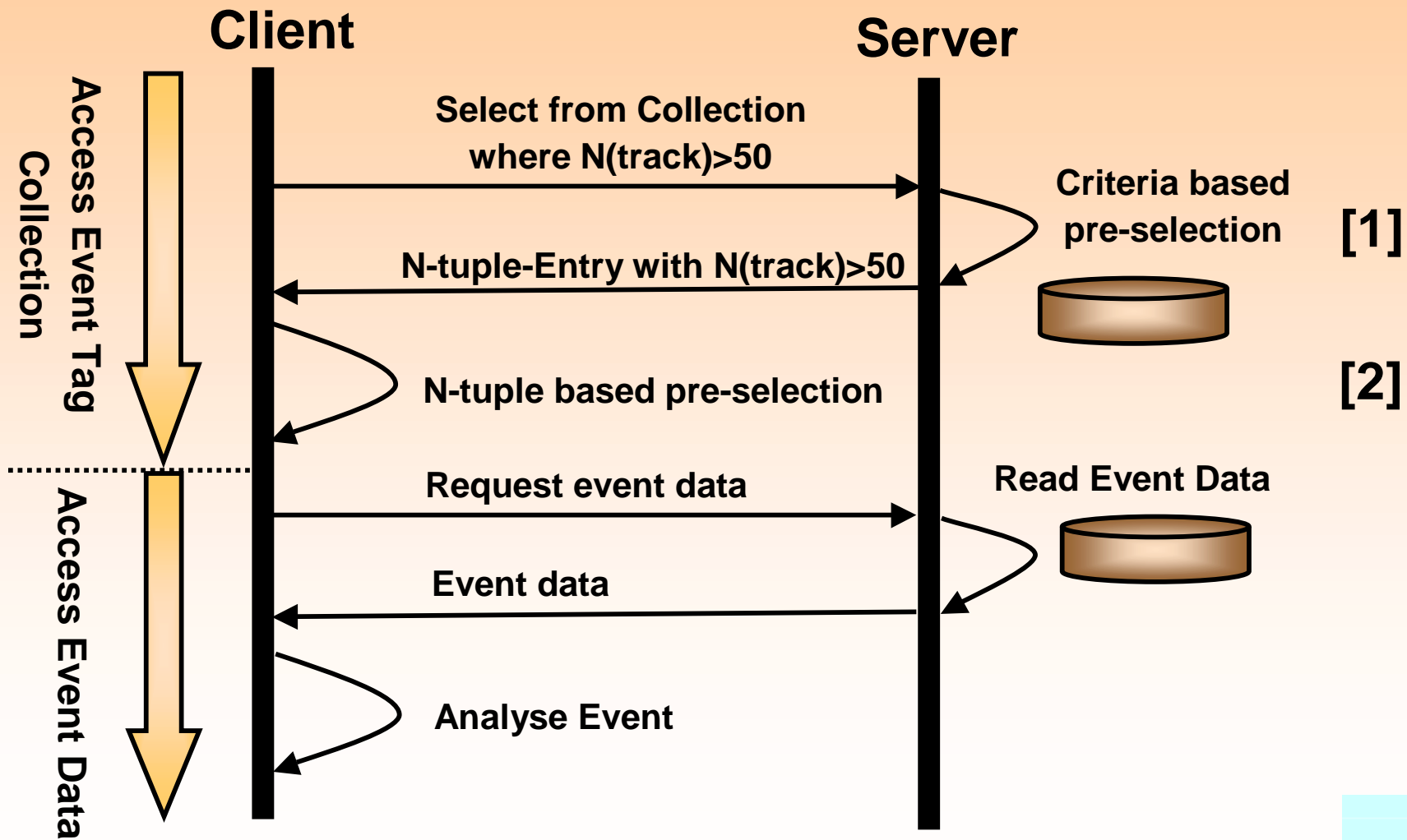


# Event Tag Collections: LHCb view

- **N-tuples, but with references to external objects**
- **Data content as for column wise N-tuples**
  - Scalars, arrays, matrices
- **Writing is equivalent as for N-tuples**
  - Simple, intuitive, fast
  - Interface identical to N-tuples
  - The physicists, which used them are enthusiastic



# Data Access For Event Processing



# Gaudi Event Tag Collections

- **Note the subtle difference:**
  - Gaudi event tag collections using POOL
  - POOL event tag collections in Gaudi
- **Implemented Gaudi Event Tag Collections**
  - Backwards compatibility with existing implementation
  - Use POOL as a mechanism to populate Gaudi N-tuple structures with data
  - Usage of lower level POOL interface
  - Can also be used to store pure N-tuples
- **Required some interaction with low level interfaces**
  - Access to pool::IPersistencySvc interface



# POOL Event Tag Collections

[Carmino Cioffi LHCb/Oxford]

- To be used by the “EventSelector” component
- Take advantage of interface redesign
  - Interface proposal is out
  - Waiting for implementation
- Use POOL explicit collections for the implementation
  - No major technical obstacles foreseen





# Conclusions

- **SEAL dictionary will have to be fully integrated**
- **SEAL services can only be integrated when manpower is present**
- **POOL will soon be integrated in Gaudi**
  - Event data storage *~working*  
[dictionary generator missing]  
[MC truth relationships missing]
  - Gaudi event tag collections *working*
  - POOL event tag collections *coming*

