ePIC Software & Computing Weekly Meeting: Software News, Test-Beam Support

📅 水曜日 2025/12/03 11:00 → 12:15 US/Eastern

👤 Dmitrii Kalinkin (Brookhaven National Laboratory) , Markus Diefenthaler (Jefferson Lab) , Torre Wenaus (BNL) ,
Wouter Deconinck (University of Manitoba)

Interfacing NestDAQ and JANA2/EICrecon

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Contents

- Interfacing NestDAQ and JANA2/EICrecon
- Outlook and timeline

Interfacing NestDAQ and ARTEMIS

ARTEMIS: software framework to analyze the physics data

- ✓ CERN ROOT base
- ✓ Parallel processing
- ✓ A lot of convenient routines
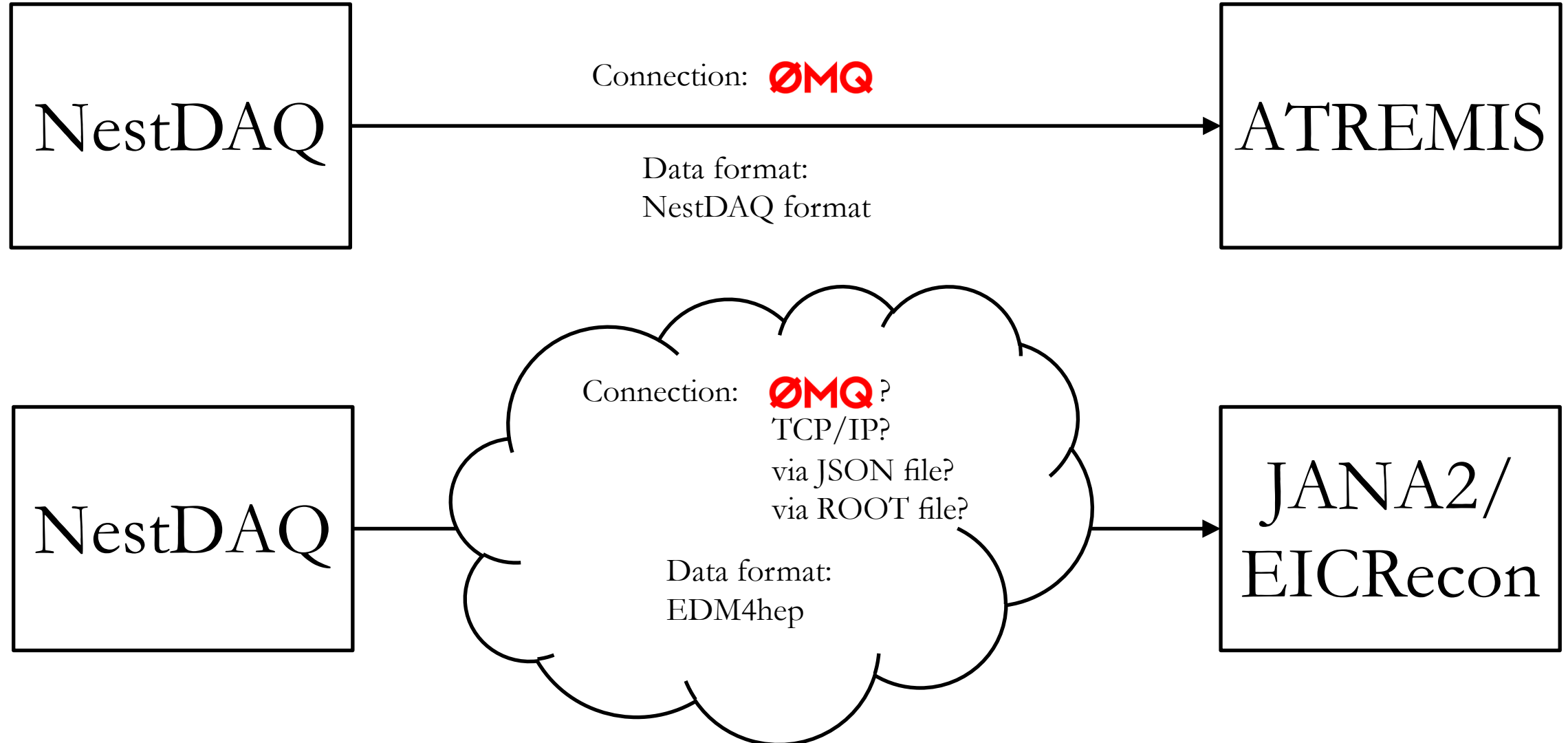
NestDAQ provides FairMQ (ZeroMQ) interface　**ØMQ**
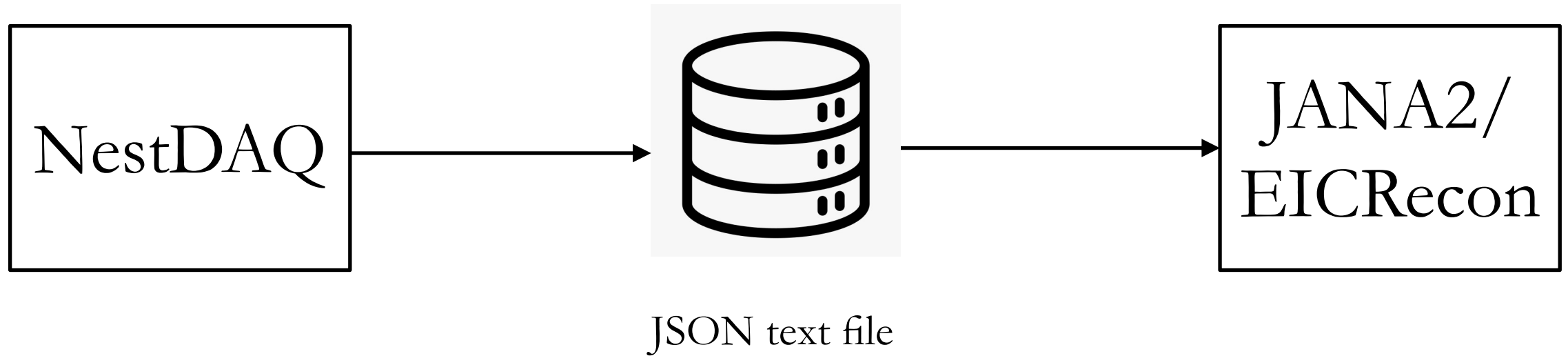
- ► ARTEMIS was easily connected

Towards Interfacing NestDAQ and JANA2/EICRecon?

- ► If the data format and protocols are decided, JANA2/EICRecon would be naturally connected
- ► RCNP group plans to have discussion with Kumaoka-san from QNSI/U-Tokyo, who is working on the streaming reconstruction using JANA2/EICrecon.

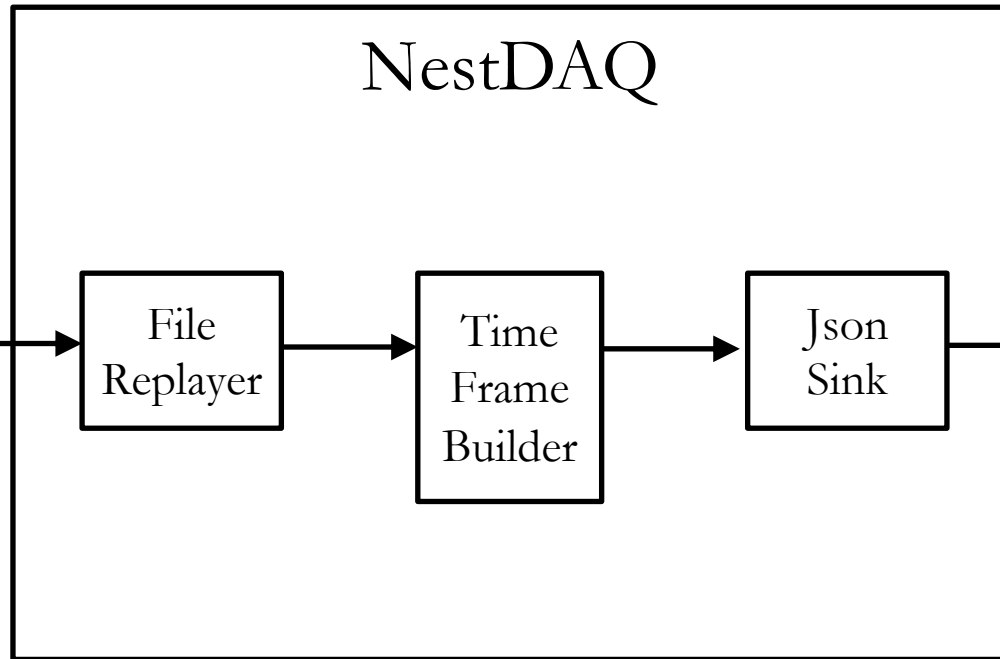# Interfacing NestDAQ and JANA2/EICRecon?

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First trial: Via JSON file

NestDAQ → JSON text file → JANA2/ EICRecon

Via JSON file → worked.

```
jug_dev> kobayashi@aino-3:~/JANA2/src/example/JANATestReader$  jana -Pplugins=JANATestReader run000032.json
16:34:40.653  [warn] Setting signal handler USR1. Use to write status info to the named pipe.
16:34:40.653  [warn] Setting signal handler SIGINT (Ctrl-C). Use a single SIGINT to enter the Inspector, or
16:34:40.653  [info] Initializing...
16:34:40.653  [info]
16:34:40.653  [info]      _ _    _   _   _    _____
16:34:40.653  [info]     | | |  / \ | \ | |  / _   \
16:34:40.653  [info]  _  | | | / _ \|  \| | | |_| | |
16:34:40.653  [info] | |_| | |/ ___ \ |\  | |  _   <
16:34:40.653  [info]  \___/|_/_/   \_\_| \_| |_| |_|
16:34:40.653  [info]
16:34:40.653  [info] JANA2 version:  2.4.2  (unknown git status)
16:34:40.653  [info] Install prefix:  /opt/software/linux-x86_64_v2/jana2-2.4.2-bcli2n3ue57omzwg53viijr7jw
16:34:40.653  [info] Optional deps:   Podio ROOT
16:34:40.675  [info] Loading plugin 'JANATestReader' from '/home/kobayashi/JANA2/build/JANATestReader.so'
16:34:40.675  [info] Created event pool with level=PhysicsEvent and size=1
16:34:40.675  [info] Arrow topology is:
16:34:40.675  [info] --------------------------------------------------
16:34:40.675  [info]     Arrow         Parallel  Direction  Place   ID
16:34:40.675  [info] --------------------------------------------------
16:34:40.675  [info]  PhysicsEventSource    0      Input     Pool    1
16:34:40.675  [info]                               Output    Queue   0
16:34:40.675  [info]  PhysicsEventMap2      1      Input     Queue   0
16:34:40.675  [info]                               Output    Pool    1
16:34:40.675  [info] --------------------------------------------------
```

NestDAQ

NestDAQ
Raw data
obtained at
RCNP/
Osaka Univ.

File Replayer → Time Frame Builder → Json Sink

JSON text file

JANA2/ EICRecon

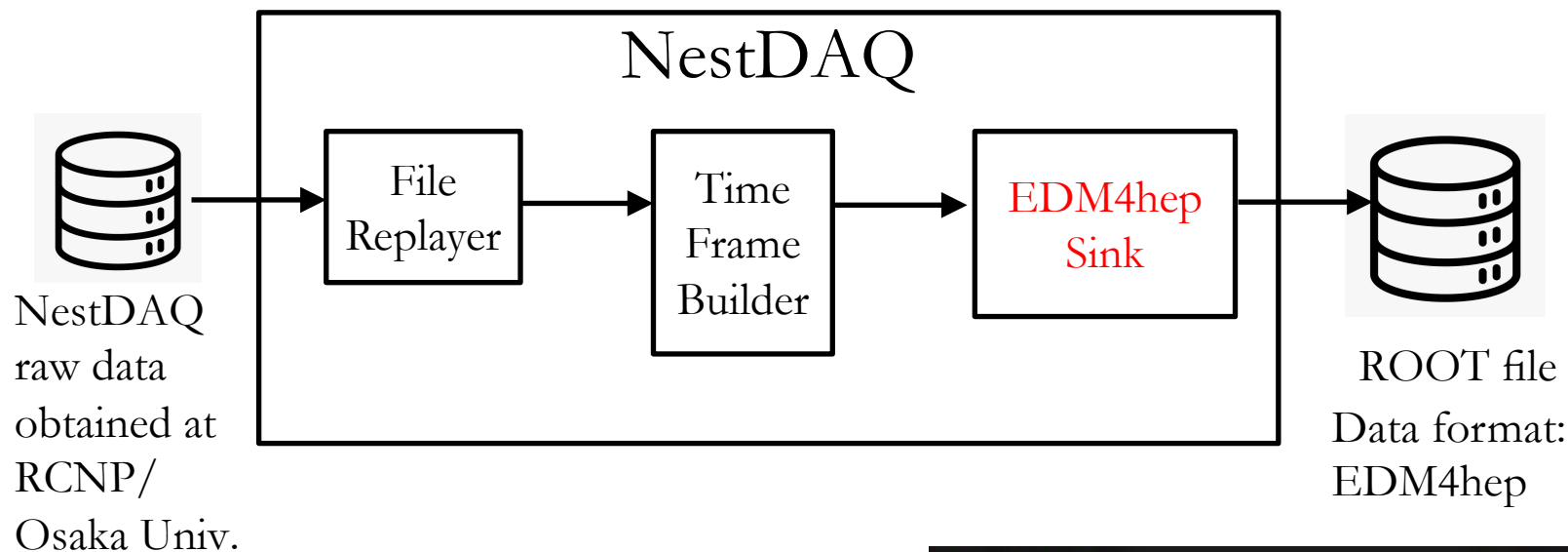Kumaoka-san's simple program

ROOT file

JSON file

```
{"SimTrackerHits":[{"cellID":13,"eDep":57079.0,"time":513845.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
{"SimTrackerHits":[{"cellID":9,"eDep":60965.0,"time":513489.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
{"SimTrackerHits":[{"cellID":3,"eDep":58900.0,"time":528746.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
{"SimTrackerHits":[{"cellID":8,"eDep":125280.0,"time":506854.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
{"SimTrackerHits":[{"cellID":8,"eDep":9955.0,"time":805262.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
{"SimTrackerHits":[{"cellID":8,"eDep":18137.0,"time":842870.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
{"SimTrackerHits":[{"cellID":8,"eDep":14539.0,"time":917396.0,"pathLength":0.0,"quality":0,"position":[0.0,0.0,0.0],"momentum":[0.0,0.0,0.0]}]}
```

ROOT file by JANA2

```
root [4] events->Scan("SimTrackerHits.cellID:SimTrackerHits.eDep:SimTrackerHits.time")
************************************************
*   Row    * Instance * SimTracke * SimTracke * SimTracke *
************************************************
*       0 *        0 *       13 *     57079 *     513845 *
*       1 *        0 *        9 *     60965 *     513489 *
*       2 *        0 *        3 *     58900 *     528746 *
*       3 *        0 *        8 *    125280 *     506854 *
*       4 *        0 *        8 *      9955 *     805262 *
```
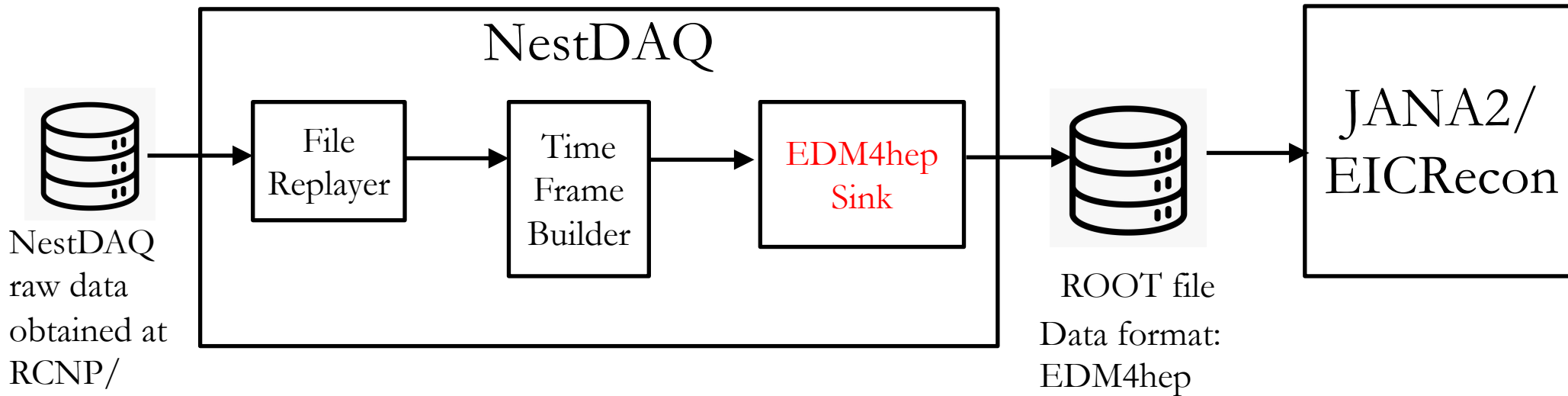
EDM4hep ROOT file

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NestDAQ

File Replayer → Time Frame Builder → EDM4hep Sink

NestDAQ raw data obtained at RCNP/ Osaka Univ.

ROOT file
Data format: EDM4hep

✓ EDM4hep and podio were installed
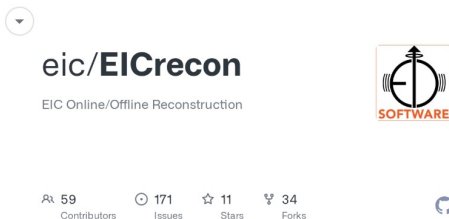✓ EDM4hep and podio were included in NestDAQ

```
root [4] .ls
TFile**         output.root
 TFile*         output.root
  OBJ: TTree    podio_metadata  metadata tree for podio I/O functionality : 0 at: 0x37a2dc0
  OBJ: TTree    events  events data tree : 0 at: 0x2f4f3d0
  KEY: TTree    events;1         events data tree
  KEY: TTree    podio_metadata;1         metadata tree for podio I/O functionality
root [5] events->Print()
******************************************************************************
*Tree    :events    : events data tree                                        *
*Entries :    971350 : Total =           208769234 bytes  File  Size =   29802799 *
*        :          :  Tree compression factor =    7.01                      *
******************************************************************************
*Br    0 :SimTrackerHits : vector<edm4hep::SimTrackerHitData>                 *
*Entries :    971350 : Total   Size=    76042923 bytes  File Size  =   13839800 *
*Baskets :      2498 : Basket Size=       32000 bytes  Compression=    5.49    *
*..........................................................................*
*Br    1 :_SimTrackerHits_particle : Int_t _SimTrackerHits_particle_          *
*Entries :    971350 : Total   Size=     7838785 bytes  File Size  =    1252768 *
*Baskets :       366 : Basket Size=       32000 bytes  Compression=    6.23    *
```

EDM4hep ROOT file. Nest Step?

NestDAQ

File Replayer → Time Frame Builder → EDM4hep Sink

NestDAQ raw data obtained at RCNP/ Osaka Univ.

ROOT file
Data format: EDM4hep

JANA2/ EICRecon

✓ EDM4hep and podio were installed
✓ EDM4hep and podio were included in NestDAQ
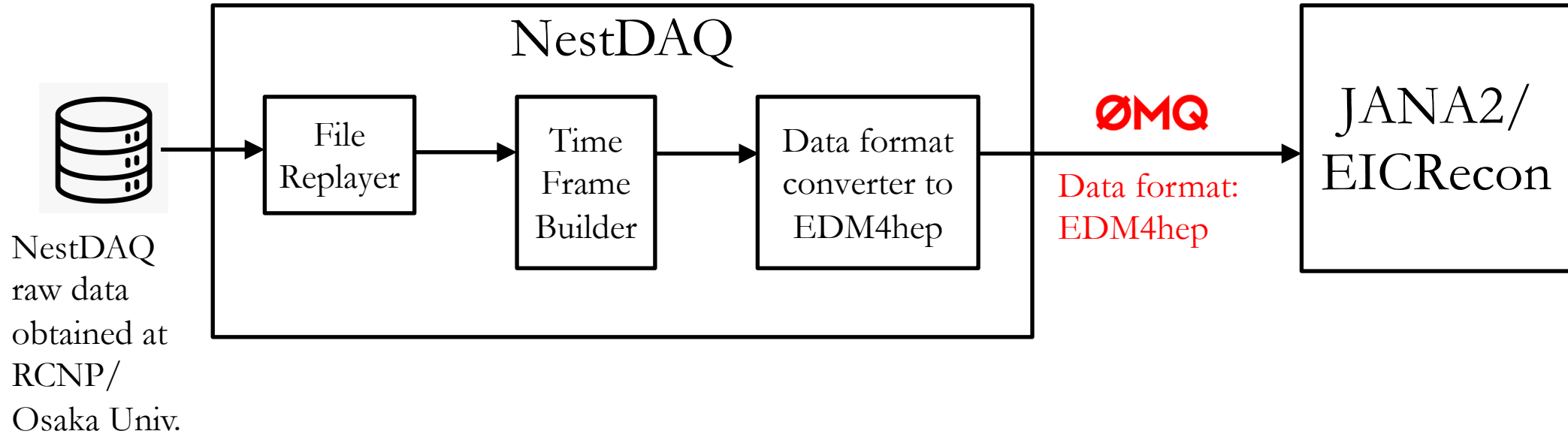• I will check if the ROOT file can be processed by JANA2/EICRecon framework

GitHub
EICrecon/src/services/io/podio at nbrei_file_streaming · eic/EICrecon
EIC Online/Offline Reconstruction. Contribute to eic/EICrecon development by creating an account on GitHub.

eic/**EICrecon**
EIC Online/Offline Reconstruction

ﾑ 59 Contributors   ⊘ 171 Issues   ☆ 11 Stars   ⅄ 34 Forks

```
root [4] .ls
TFile**          output.root
 TFile*          output.root
  OBJ: TTree     podio_metadata  metadata tree for podio I/O functionality : 0 at: 0x37a2dc0
  OBJ: TTree     events  events data tree : 0 at: 0x2f4f3d0
  KEY: TTree     events;1         events data tree
  KEY: TTree     podio_metadata;1        metadata tree for podio I/O functionality
root [5] events->Print()
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*Tree    :events    : events data tree                                      *
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******************************************************************************
*Br    0 :SimTrackerHits : vector<edm4hep::SimTrackerHitData>               *
*Entries :   971350 : Total  Size=   76042923 bytes  File Size  =   13839800 *
*Baskets :     2498 : Basket Size=      32000 bytes  Compression=    5.49   *
*............................................................................*
*Br    1 :_SimTrackerHits_particle : Int_t _SimTrackerHits_particle_        *
*Entries :   971350 : Total  Size=    7838785 bytes  File Size  =    1252768 *
*Baskets :      366 : Basket Size=      32000 bytes  Compression=    6.23   *
```

Next step?
→ ZeroMQ?

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NestDAQ

File Replayer → Time Frame Builder → Data format converter to EDM4hep

ØMQ

Data format: EDM4hep

JANA2/ EICRecon

NestDAQ raw data obtained at RCNP/ Osaka Univ.

We plan to test interfacing NestDAQ
and JANA2/EICRecon via ZeroMQ

→ Realizing streaming processing

What's next?

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- Requirements on NestDAQ?
  - Perfomance?
  - Rubustness?
  - Usability?
- Perfoemance test using NestDAQ and JANA2/EICRecon?
  - Multi processes and threds?
- Test beam support?
- NestDAQ in Echelon 2?
- What is the goal?

Timeline

- In Dec. 2025, ZeroMQ implementation would be completed and tested
- In 2026, NestDAQ performance test with real detector system?
- Etc…?

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Interfacing NestDAQ and JANA2/EICRecon?