Streaming Nuclear Physics at Scale

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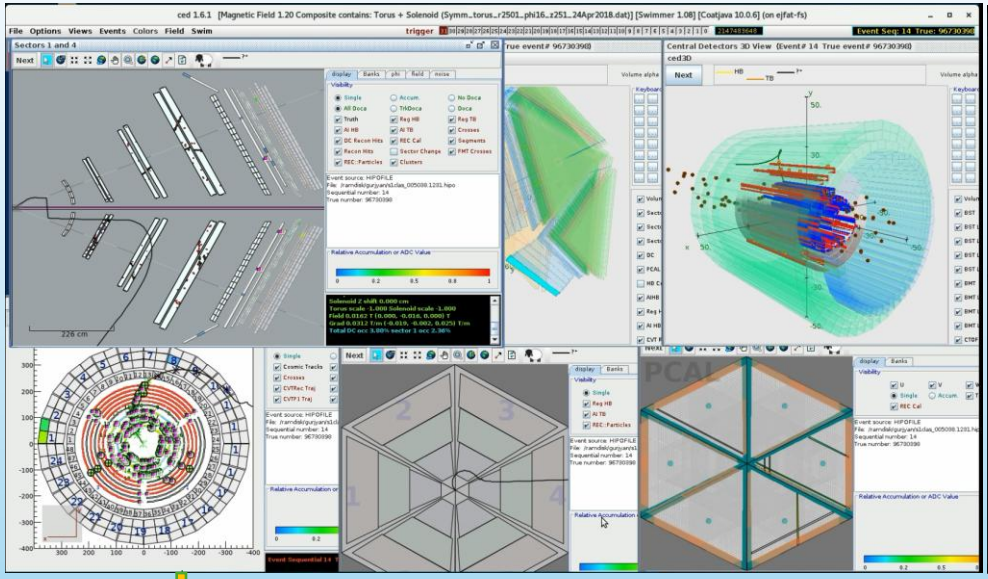
[1]Thomas Jefferson National Accelerator Facility (JLab)
[2]Energy Sciences Network (ESNet)



CLAS12 Detector

Software Stack

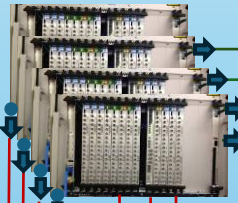
- **CODA** Data Acquisition
- **AFECS** Run Control
- **ERSAP** Data Processing
- **E2SAR** EJFAT Transport
- **JIRIAF** Resource Manager



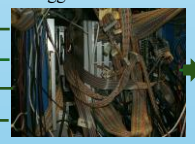
Streaming Data Validation and Persistence



Readout Controllers



Trigger Electronics



Event Builder

Traditional DAQ

Permanent Storage

Remote Data-Stream Processing

LB

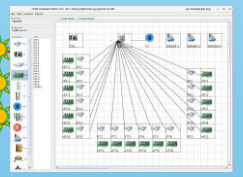
NERSC
CLAS12 Event Reconstruction

DPN_1 DPN_2 DPN_{100}

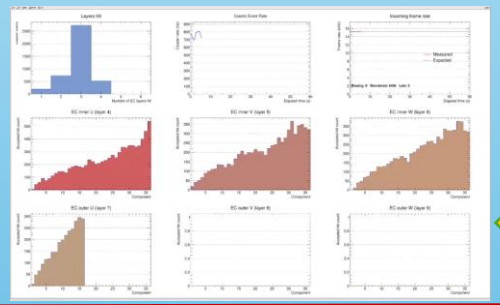
DPN_1 DPN_2 DPN_4

DPN_1 DPN_2 DPN_3

LB



Adaptive Experiment Steering



Online Data Validation

LB

Frame Builder

Frame Builder

Streaming Readout

Online Data Conditioning

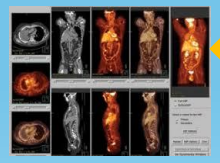
Real-Time Physics Event Identification, Calibration, Experiment Steering

LB

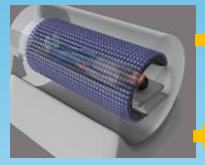
ORNL
Cosmic Muon Trigger
ECAL calibration

DPN_1 DPN_2

LB



Incremental (list-mode) Image Visualization



Singles-A

Singles-Z

LB

Frame Builder

Online PET Image Reconstruction

LB

NERSC
PET Geometry Processing

GPN_1 GPN_N

LB

Whole-Body PET Imaging

EJFAT ESnet

NERSC + ORNL

EJFAT ESnet

AmSC/Genesis Compute Infrastructure

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