Argonne
NATIONAL LABORATORY

SOFTWARE EXPRESSION OF INTEREST FOR EIC

Jean F. Hall, 1953

SYLVESTER JOOSTEN
sjoosten@anl.gov

WHITNEY ARMSTRONG
warmstrong@anl.gov

EICUG Meeting, July 2020

SOFTWARE NEEDS FOR EIC?

Central requirements and design considerations for EIC software

▷ **Enable users:** *making things easy*

    ✓ Minimize threshold to do real work with the data

    ✓ Keep the data model flat and simple (and framework-agnostic)

    ✓ Provide hooks and examples to leverage data-science tools

    ✓ Enhanced discoverability of data, simulation and tools

    ✓ Simplified interaction with HPC systems

▷ **Enable developers:** *emphasize simplicity*

    ✓ Easy pathways for containerization and testing through CI

    ✓ Focus on modular interoperable and generic tools

    ✓ Simplify task-based concurrency in heterogeneous environments

    ✓ Leverage web-based technologies to develop versatile tools

    ✓ Avoid technical debt: EIC great opportunity for a "fresh start"

S. Joosten

Argonne NATIONAL LABORATORY

SOFTWARE R&D FOR EIC

Moving NP into the era of heterogeneous computing and AI
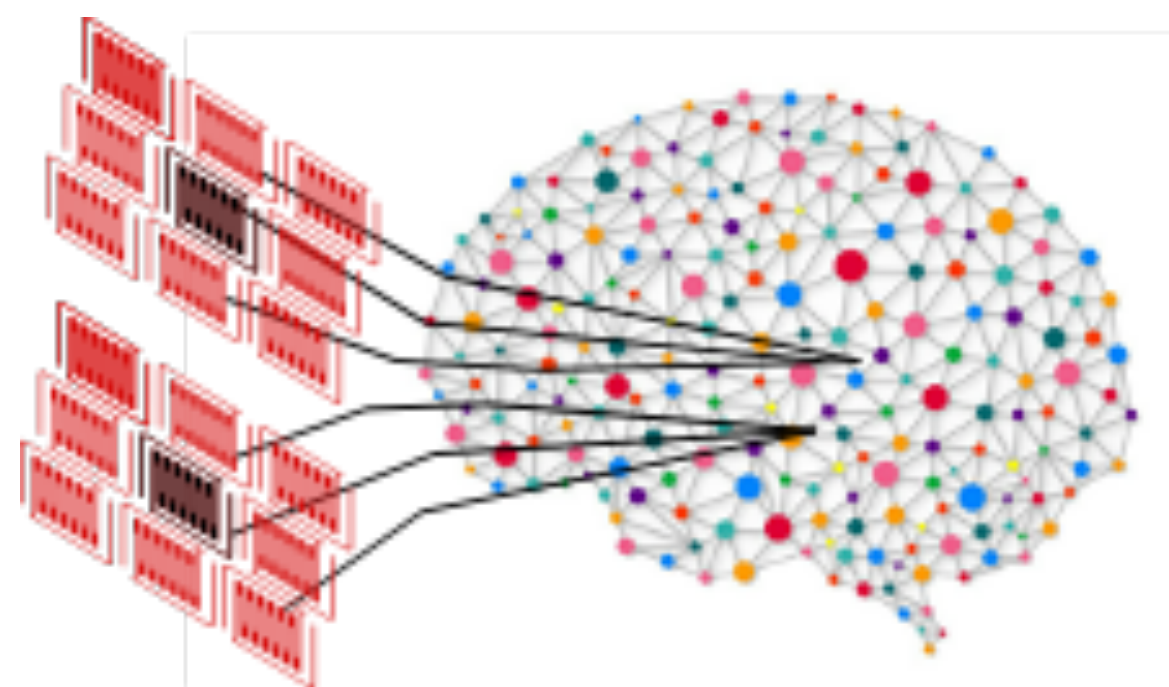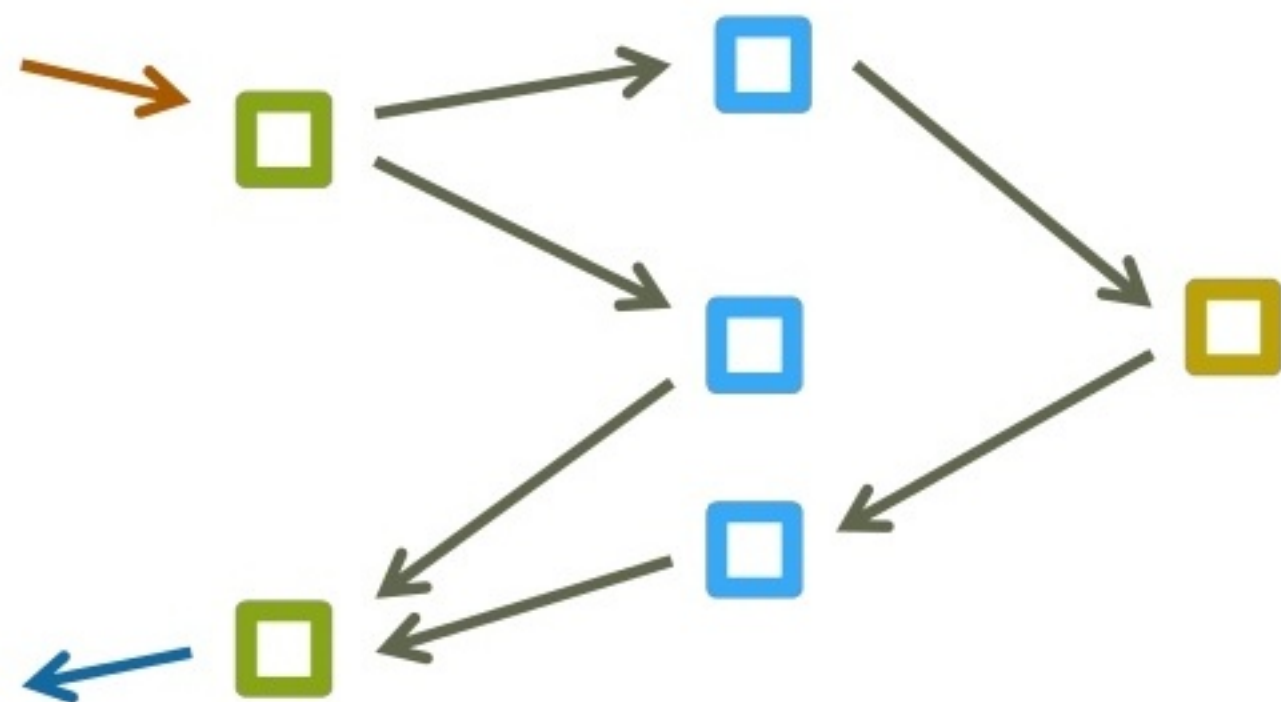
- Future of HPC in **heterogeneous environments** (CPUs, GPUs, TPUs and even FPGAs). Happening very quickly!
  - ▸ **Task-based concurrency** model ideal for heterogeneous environments; major paradigm shift for NP.
- Focus workflow around **modular interoperable tools**.
  - ▸ Integrate modern AI & data-science tools in workflow
  - ▸ Evaluate and leverage generic tools developed by HEP (DD4hep, ACTS, PODIO, …) while avoiding technical debt.
- Move towards **federated systems**:
  - ▸ Dispatch jobs to HPC through federated FaaS (eg. <u>funcX</u>)
  - ▸ Improved data sharing with <u>Science DMZ concept</u> (eg. <u>Petrel</u>)
- Close integration between sensors and AI: towards a **"smart" detector**.

S. Joosten **Argonne** NATIONAL LABORATORY

CURRENT FOCUS AND AVAILABLE RESOURCES

Leveraging a long history with high-performance computing.

- Enable and support EIC Computing

  ▷ Leverage exa-scale computing at Argonne for data processing and simulations

  ▷ High-performance distributed data storage and sharing, already deployed Petrel (ALCF service) allocation for EICUG as pilot

- Software development for EIC

  ▷ State-of-the-art simulation-reconstruction tools leveraging DD4hep and ACTS, aimed for future heterogeneous computing environment.

  ▷ Develop optimized AI techniques to deal with globally sparse/locally dense data unique to particle physics. Existing multi-disciplinary collaboration between Argonne and SLAC.

- Currently **10 people (staff + postdocs)** directly working on EIC software R&D, and our team is **rapidly growing**.

- Drawing on experience and resources across many divisions at Argonne (Computer Science, HEP, Laboratory Computing Resource Center, Argonne Leadership Computing Facility, …)

S. Joosten   Argonne NATIONAL LABORATORY

OUR SOFTWARE TEAM

S. Joosten Argonne NATIONAL LABORATORY