

# JANA2: Mutli-threaded Event Reconstruction

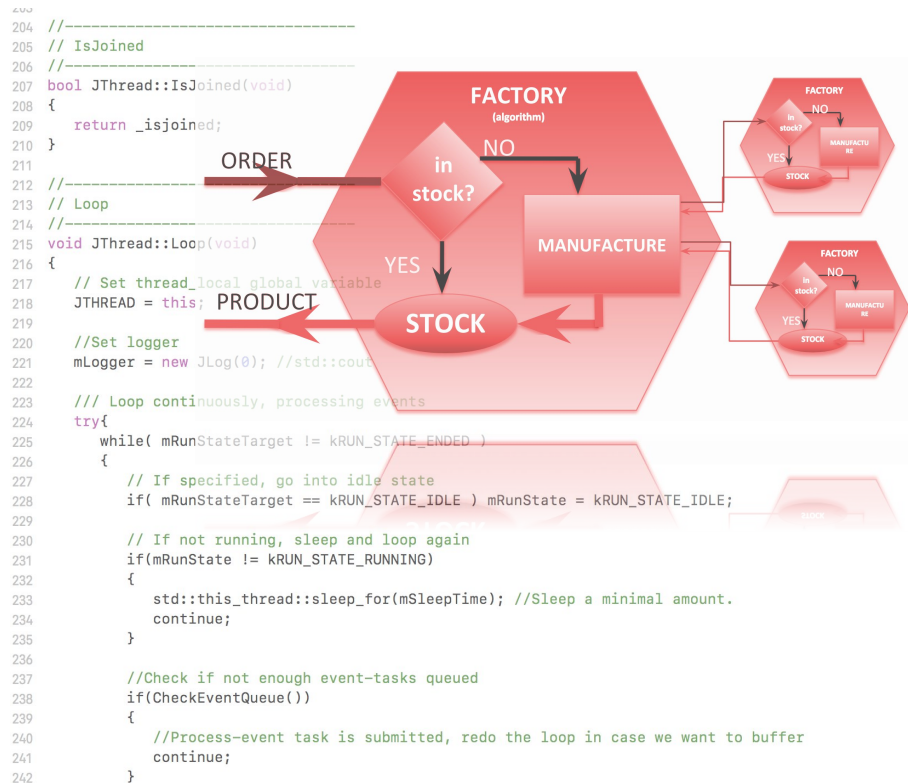
David Lawrence,  
Amber Boehnlein  
Jefferson Lab

July 10, 2018

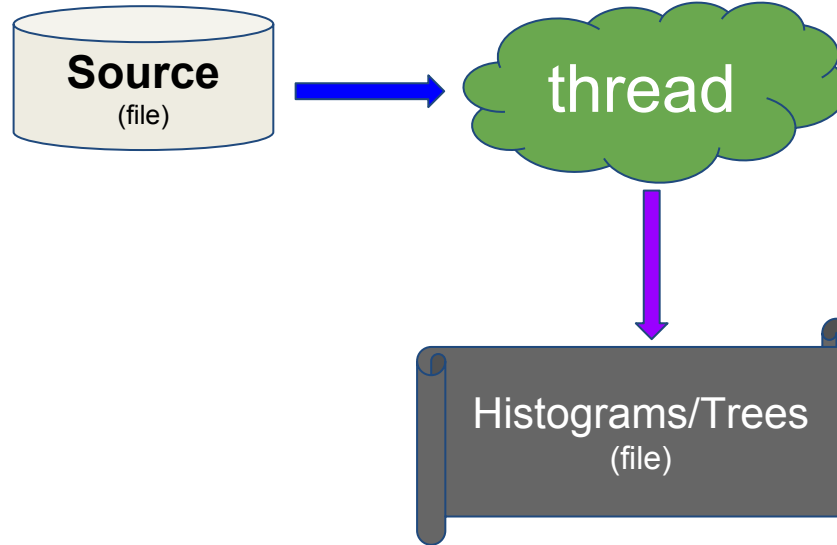
CHEP 2018

Sofia, Bulgaria

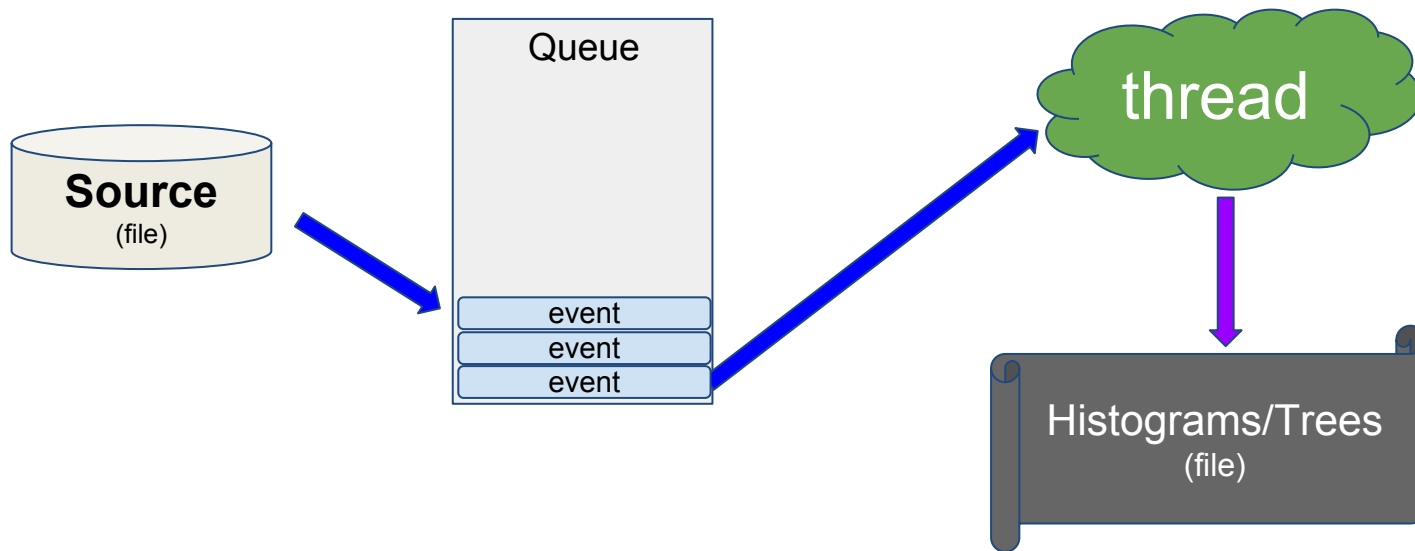
Jefferson Lab



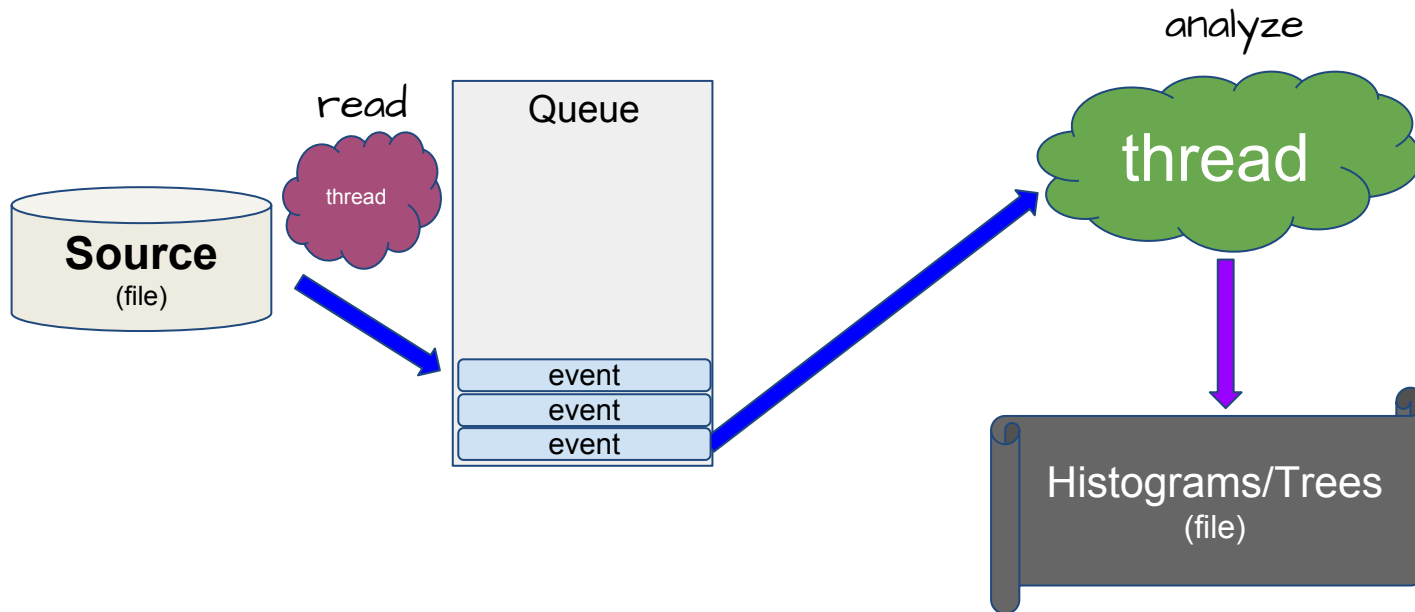
# basic model for single thread event reconstruction



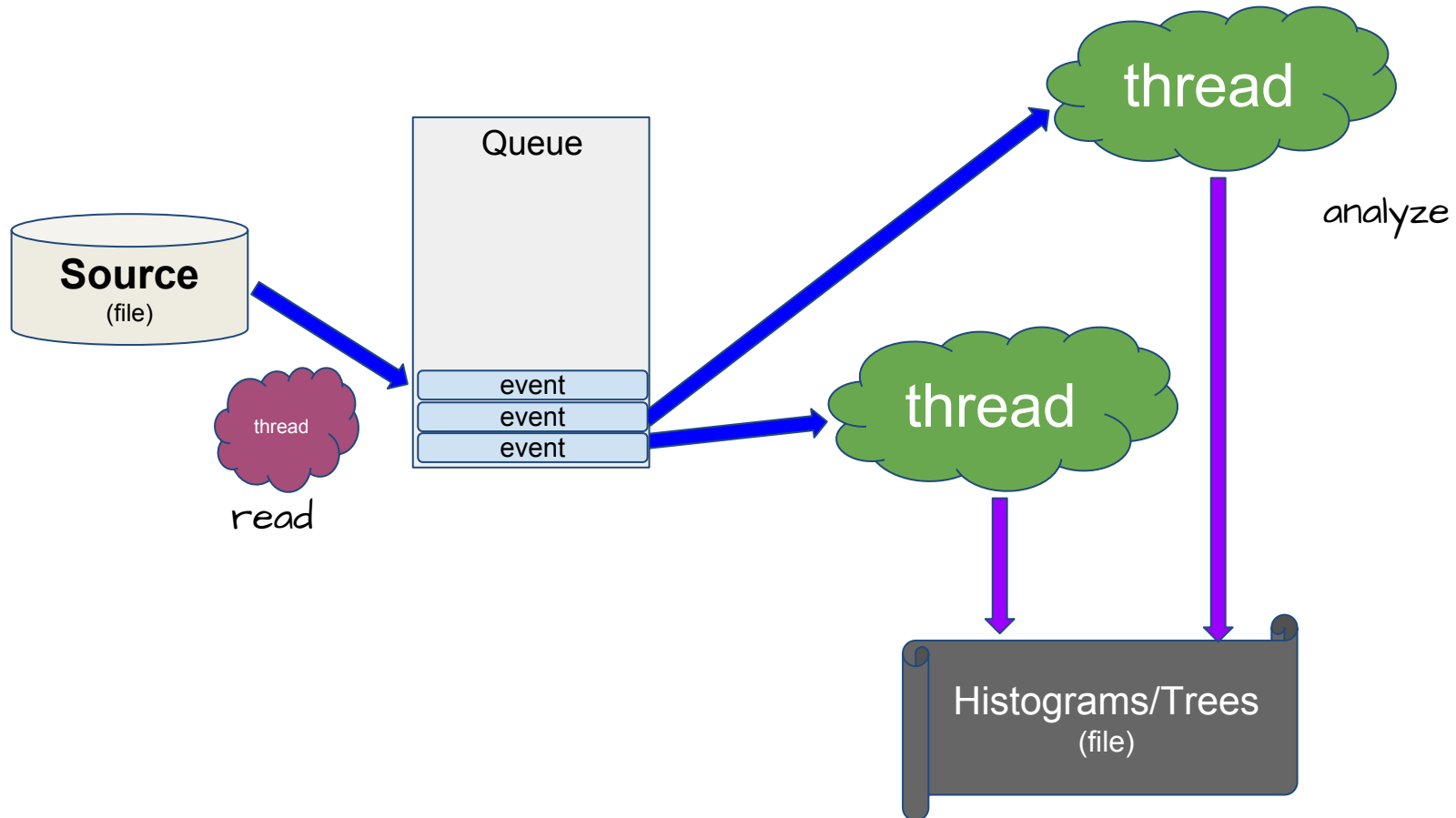
## Add queue to move towards multi-thread



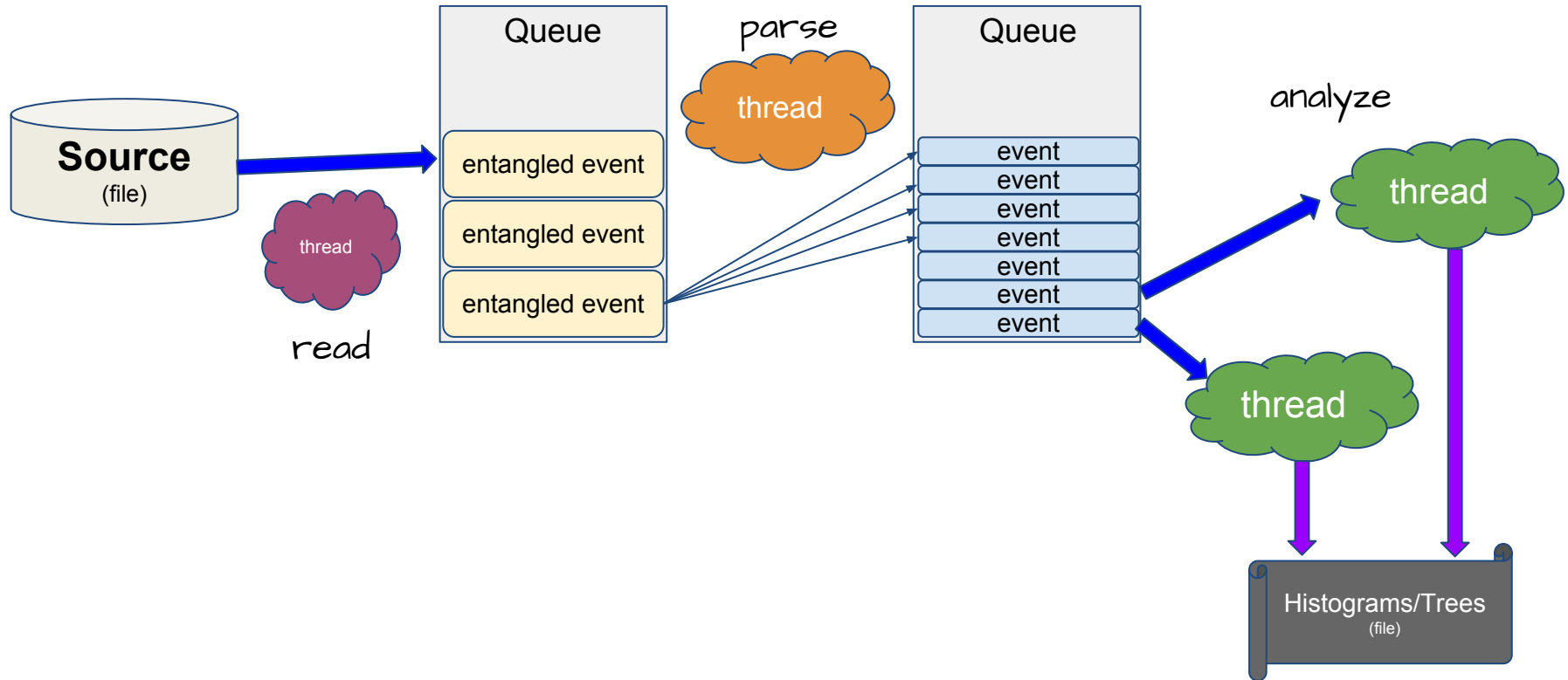
## Two flavors of thread required



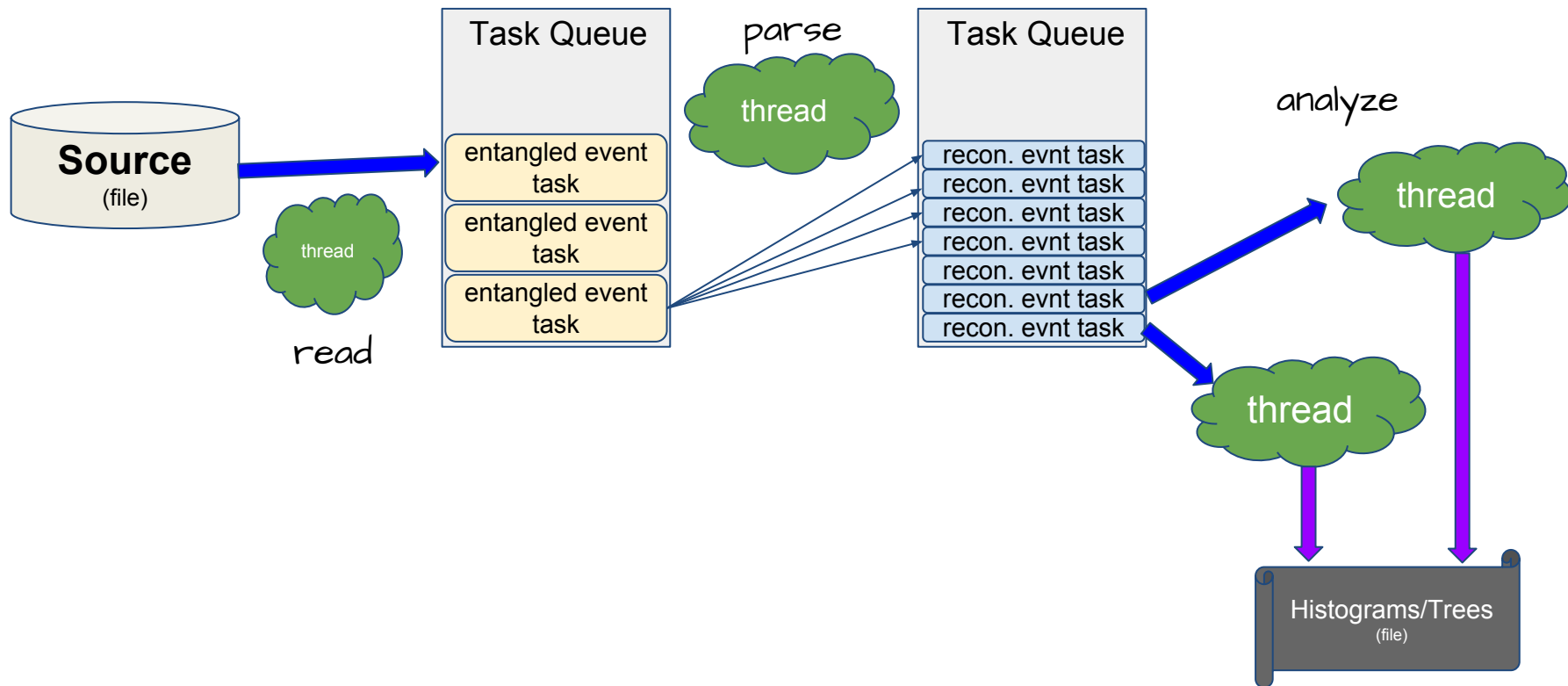
# basic model for multi-threaded event reconstruction

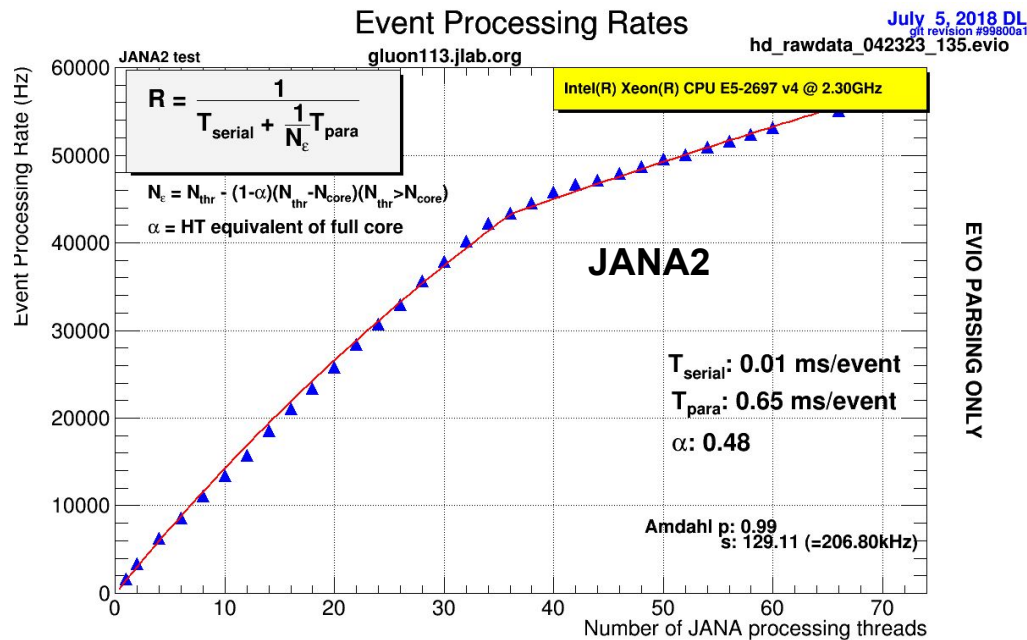


High event rate (100kHz) requires buffering in front end leading to entangled events “Event” changes meaning.

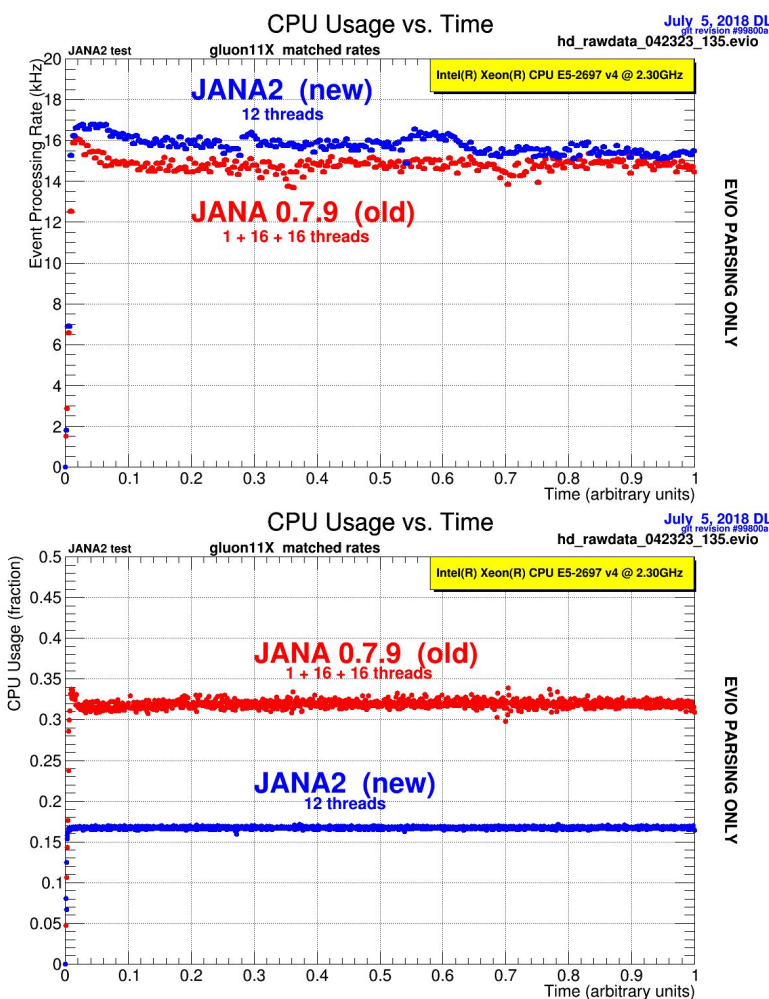


**`std::packaged_task<>`** combines data and algorithm into single objects allowing threads to be generic



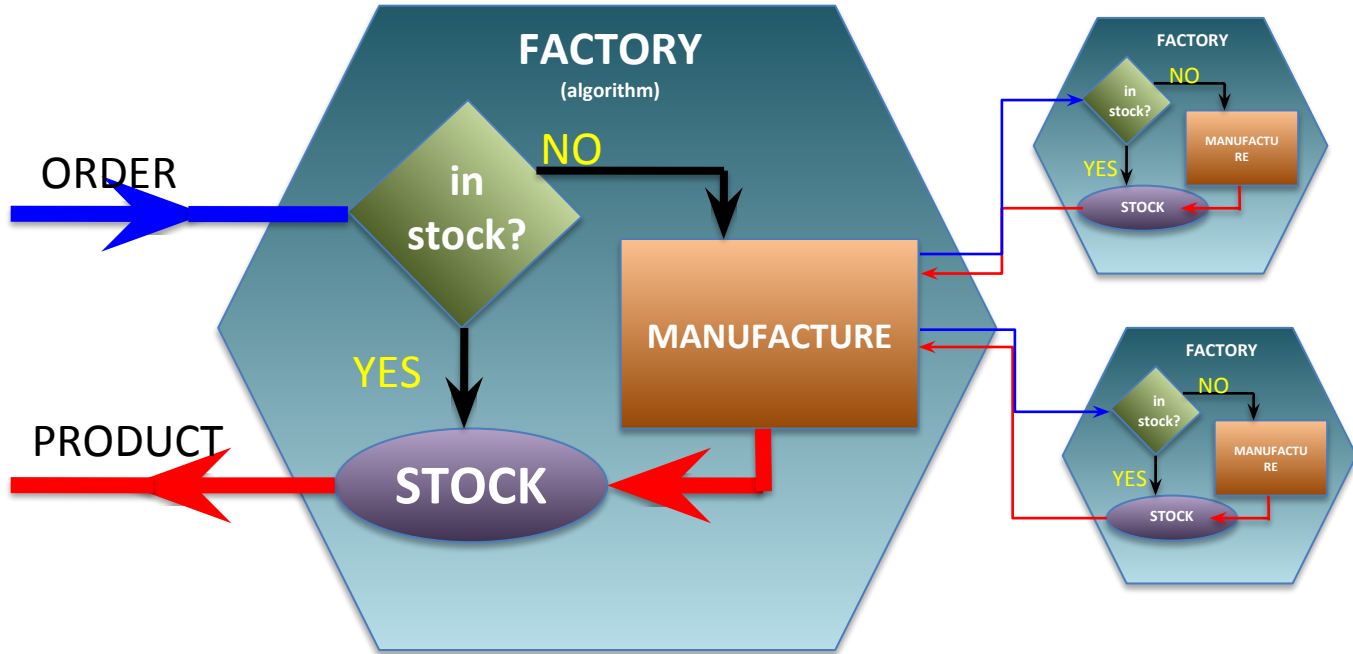


“Parsing Only” Job demonstrates more stable CPU usage with single flavor of thread





# Factory Model

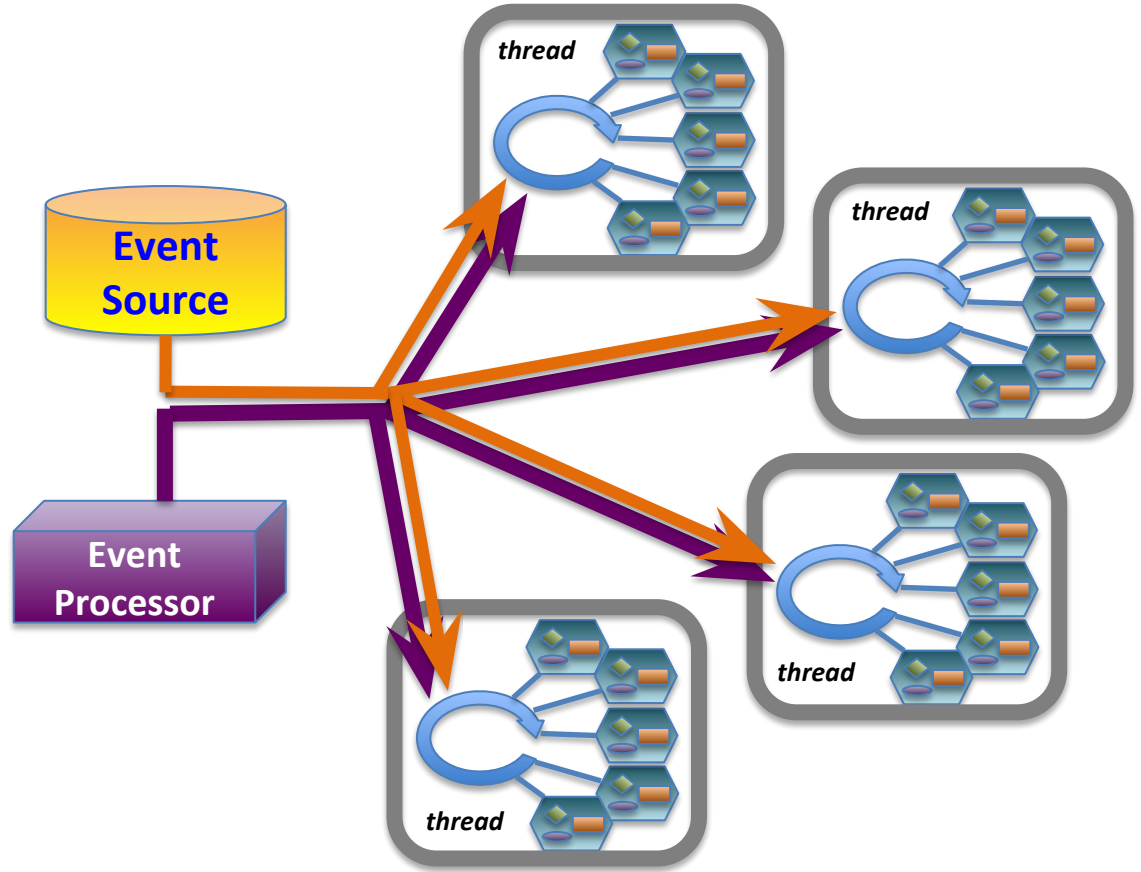


*Data on demand = Don't do it unless you need it*  
*Stock = Don't do it twice*

**Conservation  
of CPU cycles!**

# Multi-threading

- *Each thread has a complete set of factories making it capable of completely reconstructing a single event*
- *Factories only work with other factories in the same thread eliminating the need for expensive mutex locking within the factories*
- *All events are seen by all Event Processors (multiple processors can exist in a program)*



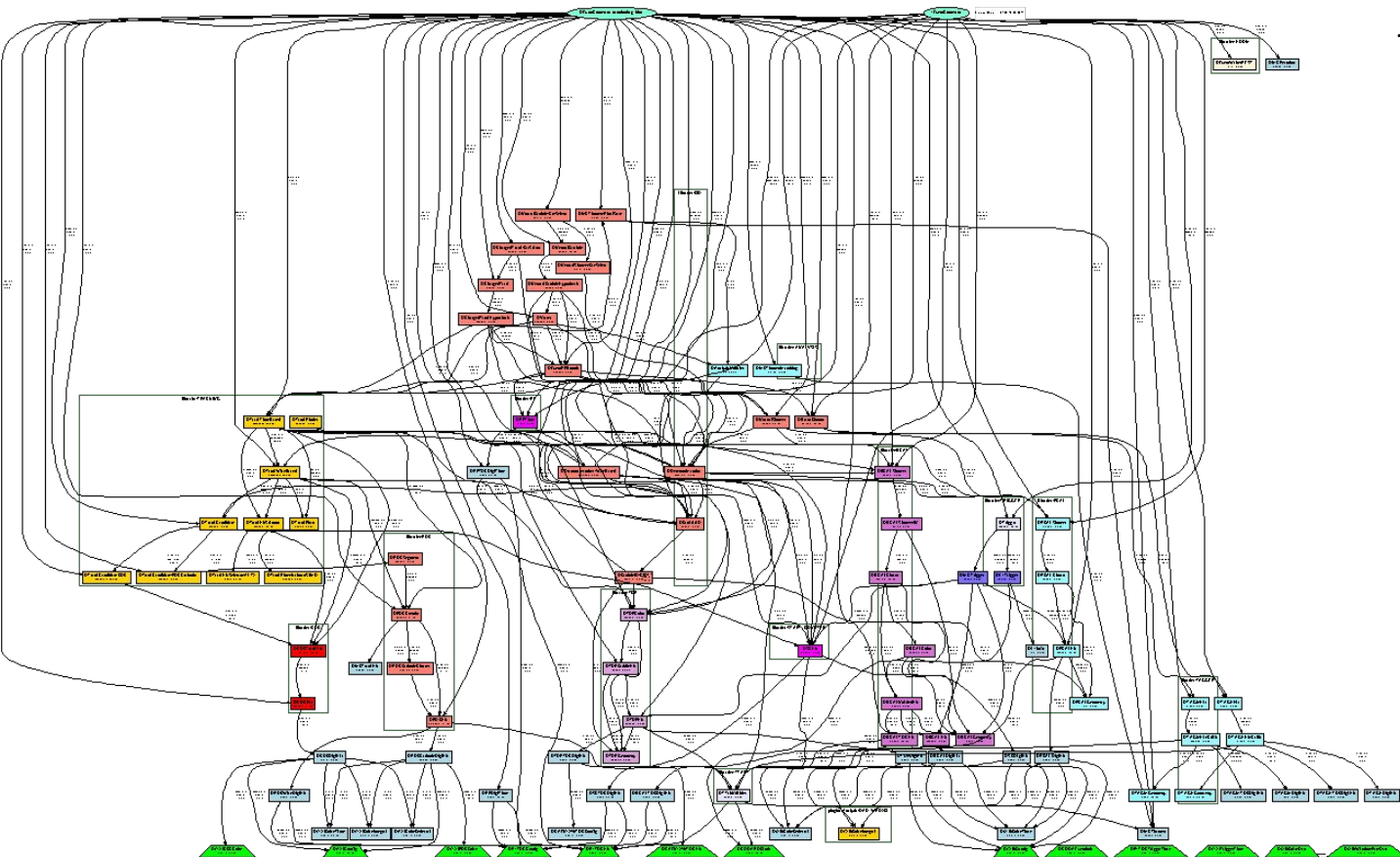
# What the reconstruction algorithm developer needs to know

```
auto tracks = jevent->Get<DTrack>();
```

```
for(auto t : tracks){  
    // ... do something with a track  
}
```

# GlueX Reconstruction Software

Automatic call graph  
generation using  
janadot plugin



# JANA2

## Website on

## GitHub

Secure | <https://jeffersonlab.github.io/JANA2/>

# JANA2

Multi-threaded HENP Event Reconstruction

[View project on GitHub](#)

[Home](#) [Getting Started](#) [Download](#) [FAQ](#)

## // Welcome to JANA!

JANA is a C++ framework for multi-threaded HENP (High Energy and Nuclear Physics) event reconstruction. It is very efficient at multi-threading with a design that makes it easy for less experienced programmers to contribute pieces to the larger reconstruction project. The same JANA program can be used to easily do partial or full reconstruction, fully maximizing the available cores for the current job.

It's design strives to be extremely easy to setup when first getting started, yet have a depth of customization options that allow for more complicated reconstruction as your project grows. The intent is to make it easy to run on a laptop for local code development, but to also be highly efficient when deploying to large computing sites like [NERSC](#).

JANA is currently undergoing a complete rewrite. The new version will be JANA 2. The code is not quite ready for actual use yet, but you are free to browse around to see how progress is going. The project is [hosted on GitHub](#)

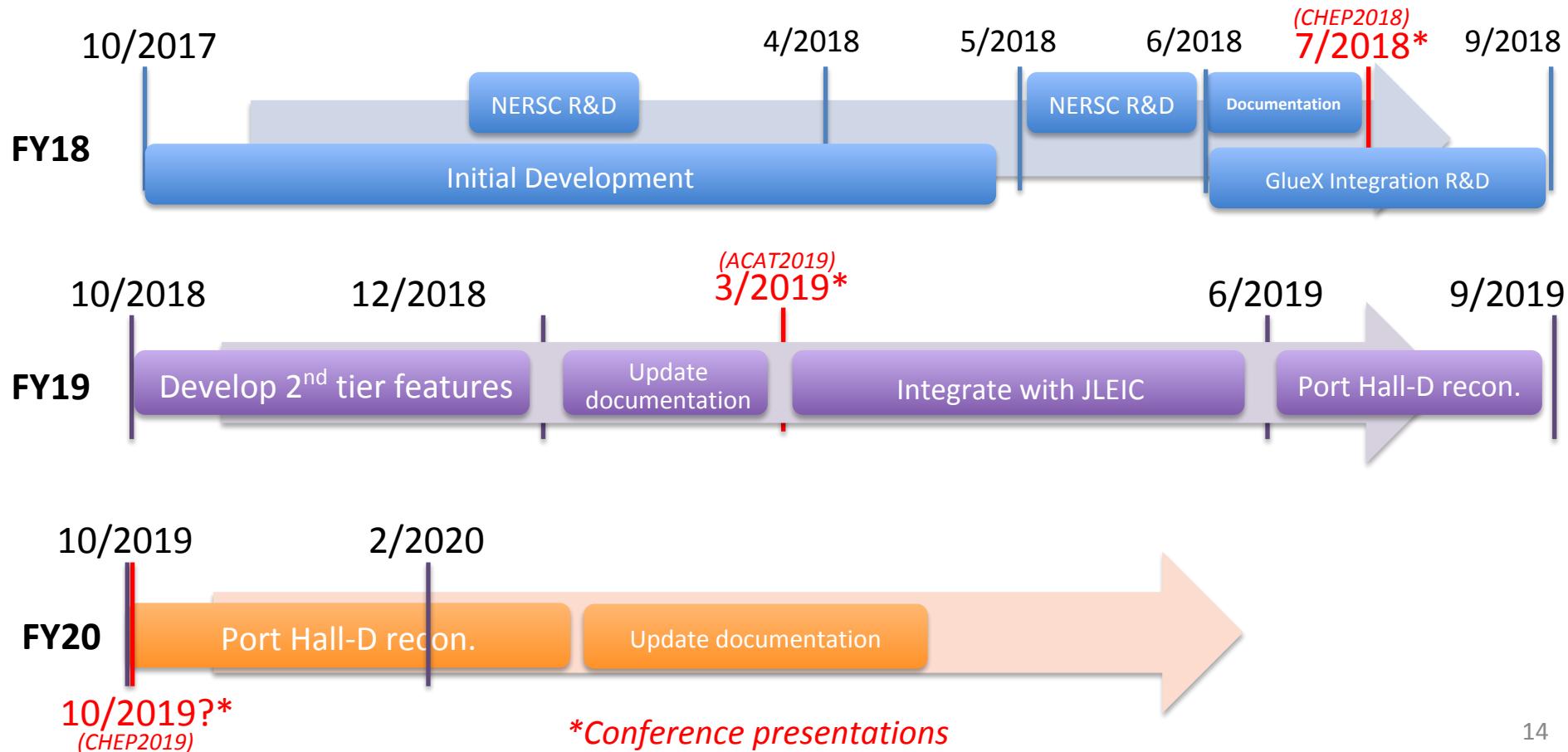
```
auto tracks = jevent->Get<DTrack>(tracks);

for(auto t : tracks){
    // ... do something with a track
}
```

JANA2 is maintained by [JeffersonLab](#).

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# Schedule for JANA2 LDRD Project at JLab



# Backups



# GlueX (JANA1) Jobs on NERSC Cori (I & II)

| Job ID  | Run       | Rate  | Wall Hours | CPU Hours | Threads      |
|---------|-----------|-------|------------|-----------|--------------|
| 9662111 | 30279.002 | 248Hz | 1.325      | 42.41     | 64 (Haswell) |
| 9654879 | 30279.002 | 104Hz | 3.230      | 103.36    | 256 (KNL)    |
| 9654892 | 31034.002 | 229Hz | 1.991      | 63.72     | 64 (Haswell) |
| 9667013 | 31034.002 | 95Hz  | 4.862      | 155.58    | 256 (KNL)    |

Run 30279: 150nA , JD70-100 58um 0/90 PARA 1.2M events (single file) 2/4/2017

Run 31034: 150nA , JD70-100 58um 45/135 PERP 1.6M events (single file) 3/8/2017

KNL jobs run about 2.4 times slower = cost **2.4** times  
as much from NERSC allocation



# Complete Event Reconstruction in JANA

