FRIBDAQ Experience and Requirements

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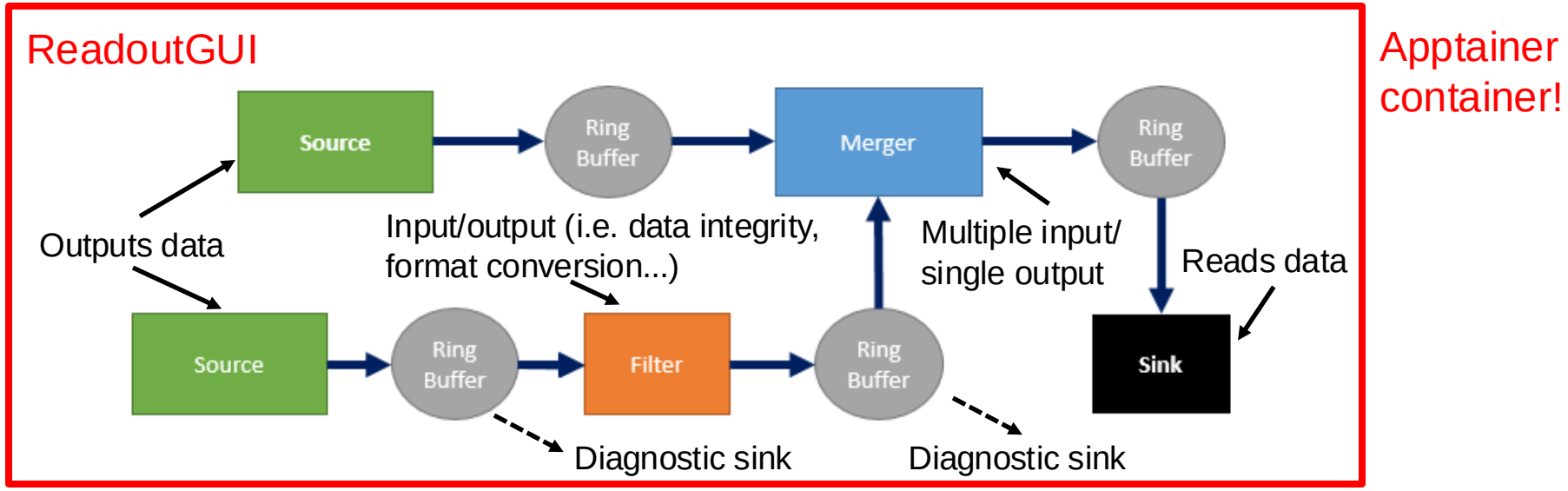
FRIBDAQ Readout Architecture

- Software suite (C++, Tcl – being replaced by PyQT5, Python) that provides a flexible and extensible framework for handling the data flow produced by nuclear physics experiments
- Support for a wide variety of electronics: VME, CAMAC, CAEN and XIA digitizers, GET, SRS
- Manage the data stream by breaking it into smaller pieces
- ReadoutGUI is the “conductor” of the system
  - Pipeline management, data recording, consolidation of data to output, …

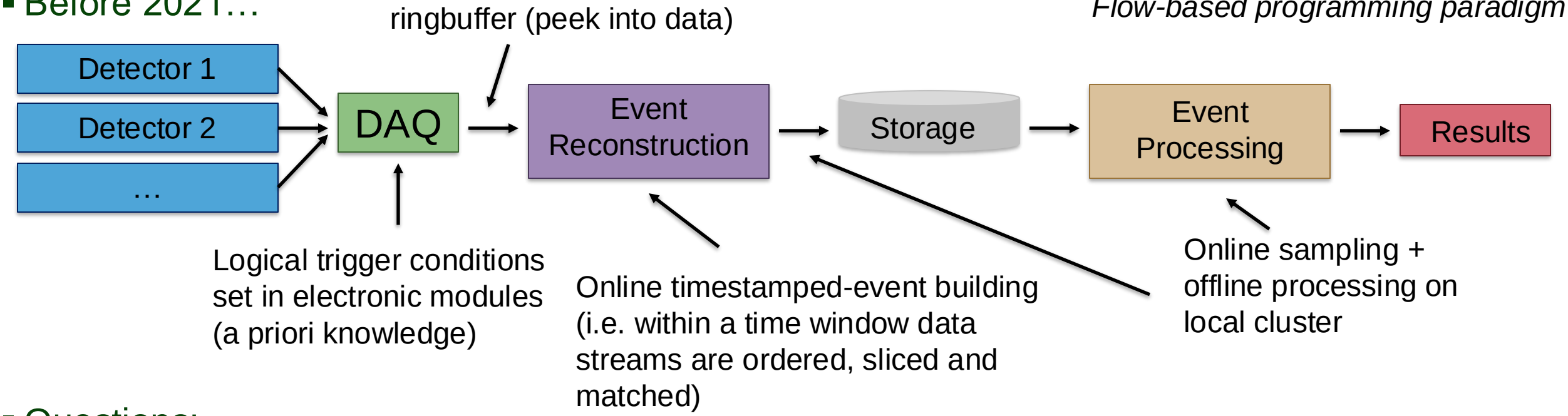


Apptainer container!

FRIB Approach to SRO

- Before 2021…

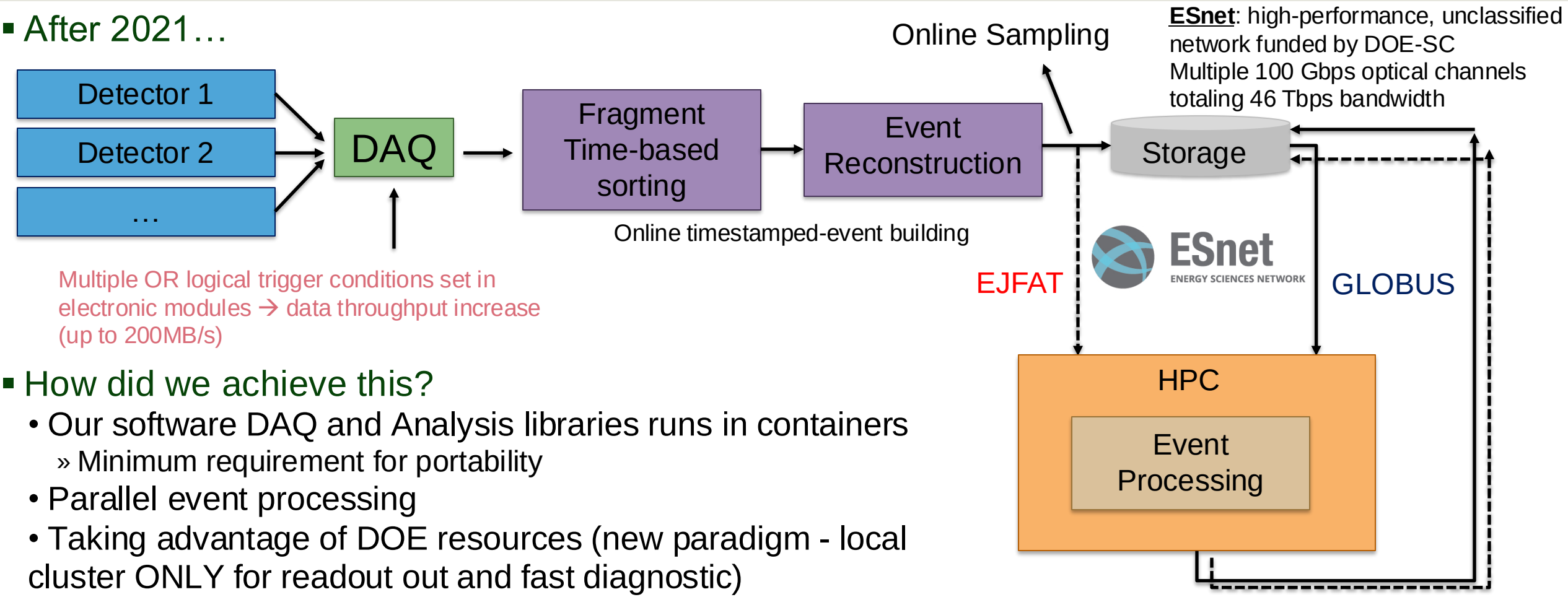
Flow-based programming paradigm



- Questions:
  - Can SRO electronics and global timing synchronization improve data taking and data analysis efficiencies with very rare isotope beams? (FYI 1h beam is ~20k$)
  - Where should we put efforts considering the limited resources in hardware R&D?
  - How do we manage the continuous increase in data rates?

FRIB Approach to SRO

- After 2021…



- How did we achieve this?
  - Our software DAQ and Analysis libraries runs in containers
    - » Minimum requirement for portability
  - Parallel event processing
  - Taking advantage of DOE resources (new paradigm - local cluster ONLY for readout out and fast diagnostic)
- Did it work? Spoiler: yes ☺

Shopping List

- New VME controller
  - Wiener VMUSB obsolete and out of production
  - MVLC possible candidate but we need to access the API to control it – closed software…
  - We would prefer list mode readout but block mode is fine, ethernet data throughput
- Global timing distribution system (resolution needed ~10-30ps at 200m)
  - MIKUMARI (SPADI-Alliance) – HRTDC (Triggered/SRO)
    - » Good cost/channel, 64 channel, good resolution ~20ps, open source → actively collaborating with API software
  - WhiteRabbit
    - » DOE SBIR digitizer with WR timing (ongoing evaluation)
      - High cost/channel, limited number of channel per board, limited sampling frequency
  - CTS (Clock timing station): clock translator board for VME (WR, MIKUMARI, …) → actively collaborating with RIKEN/SPADI-A in firmware development
- General SRO electronics
  - TDC, ASICs chips for TPC, QDC/ADC/waveform digitizer
    - » Some solutions have been developed by the SPADI-A and seem to fit our needs