DEEP UNDERGROUND NEUTRINO EXPERIMENT

CERN

University of BRISTOL

Upstream DAQ Technology Review

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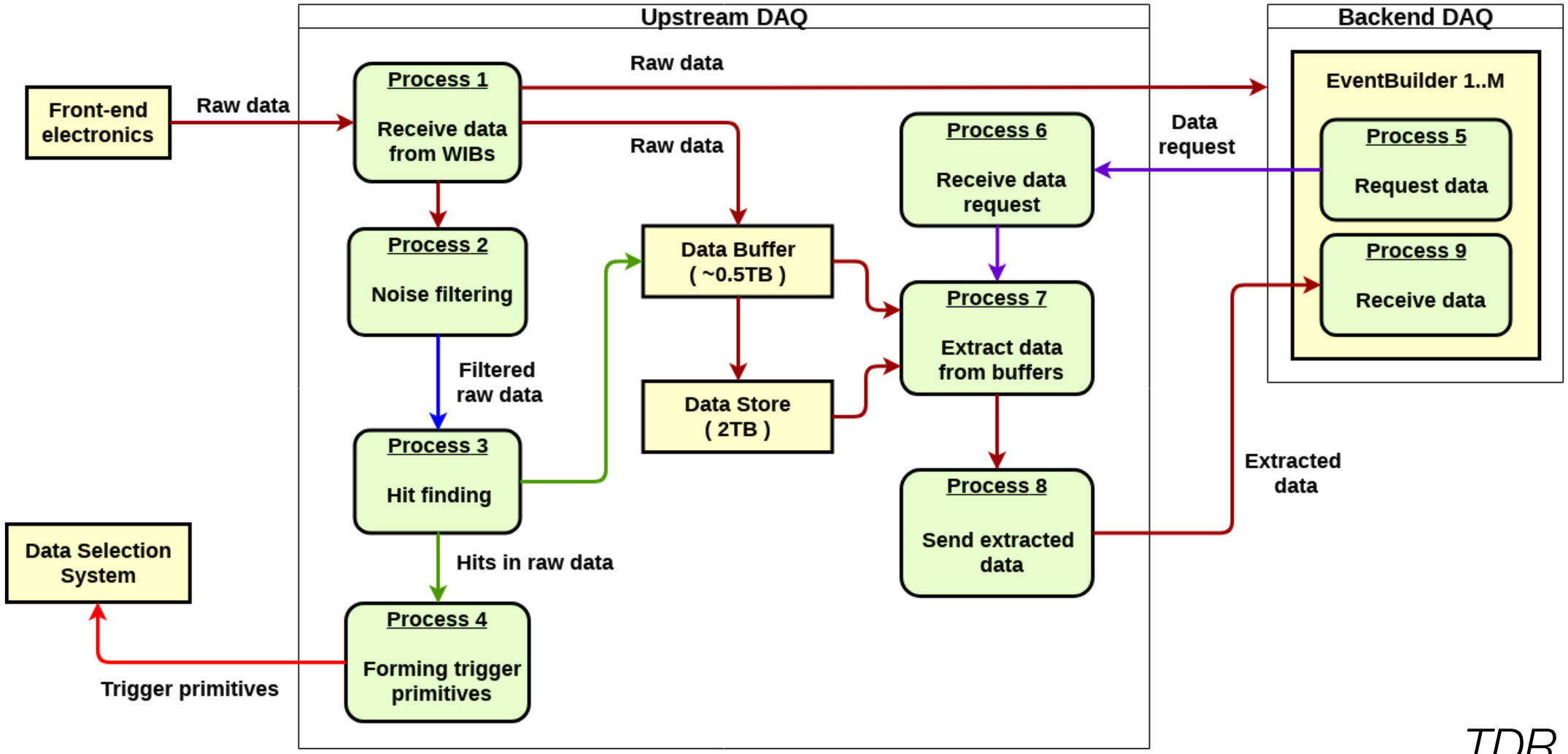
High-Level Upstream DAQ Design



TDR

Goals

1. Review progress on implementation of Upstream DAQ components:
   - Trigger primitive generation
   - Latency (10s) buffer
   - SNB (100s) buffer
   - Data request handling

- A great deal of impressive work has been done !

2. Identify/revise baseline design for each component
   - Starting with technical review in this workshop
   - Followed by discussion with stakeholders & DUNE DAQ coordination team before concluding

Readout Infrastructure (per FD module)

- 1 barrack underground (max 125 kW, 16 racks)
- Approx 80 servers (at least 2U) to readout 150 APAs + PDS
- Each server will readout 2 APAs using *1 or 2* FELIX PCIe cards
  - TDR includes additional co-processors hosted on PCIe cards
  - Now anticipate all processing to be on the PCI card itself
- Triggered data sent to storage & high-level filter on the surface

Readout System Variants

Combination	*HitFinding*	*10s buffer*	*SNB store*
A	Host	Host	Host
B	FPGA	Host	Host
C	FPGA	FPGA	FPGA

- Viable combinations of FW/SW implementation of the functional elements
  - (In order to maintain un-directional data flow between PCI board and host)

Readout Modes

1. **Standard trigger requests**
   - Time window variable on event-by-event basis: few us to few s
   - Not time-ordered
2. **Debug/calibration streams**
   - Stream full bandwidth from single link to output based on headers
   - Configurable streaming
3. **Supernova burst**
   - Stream all inputs to local storage following SNB trigger
     - TDR foresees latency of 10s, time window of 100s

Readout Failure Scenarios

1. **Low-level FE failure**
   - Single link failure
2. **Link alignment errors**
   - Missing data blocks/non-consecutive timestamps
3. **Uncompressable data**
   - Data from an FEB cannot be compressed

- This list is incomplete; should be treated as a starting point for understanding resilience

Criteria

- Broad categories
  - Features
  - Adaptability
  - Reliability
  - Long term support
  - Resource requirements

- Detailed questions on the review document
  - **https://indico.fnal.gov/event/44240/attachments/131513/161079/DUNE_Upstream_DAQ_-_Readout_Technology_evaluation.pdf**

Physics Performance

- Physics performance not included in criteria

- A ***single*** trigger primitive algorithm has been implemented in both FW and SW
  - Physics performance expected to be ***identical***
  - Modulo bugs etc.

- Amount of ‘spare’ resources may have an impact in future
  - ***If*** these resources can be successfully deployed in a way that increases physics impact

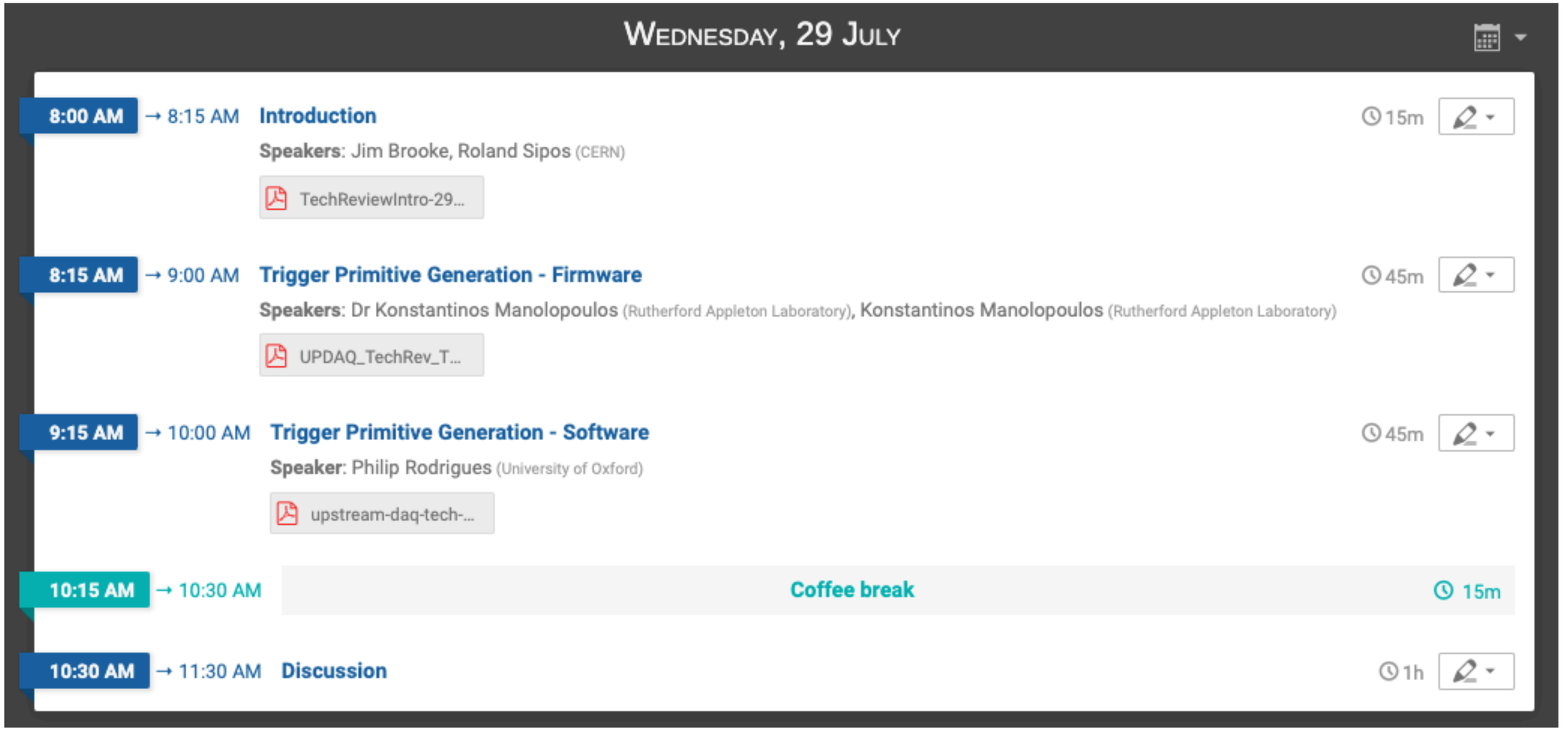
Cost

- Cost not included in criteria
  - Clearly, the ***design must be implemented with available funding***
  - However, information to consistently cost the options is not currently available

- One goal of the review is to understand requirements in terms of ***resources*** and ***specifications***

- This should (we hope) allow a full costing after the review workshop
  - Will organise this with representatives from funding institutes/countries, ie. UK, CERN, Canada

Workshop Agenda



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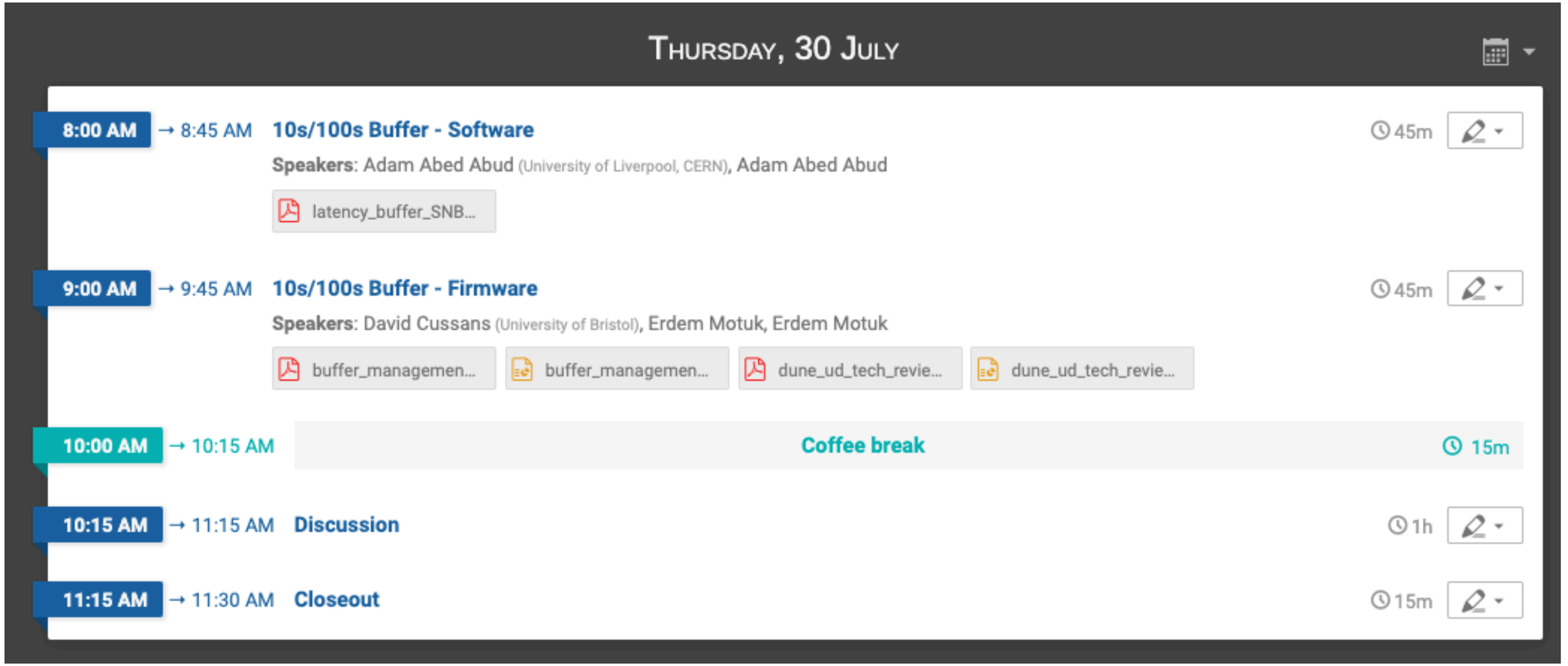

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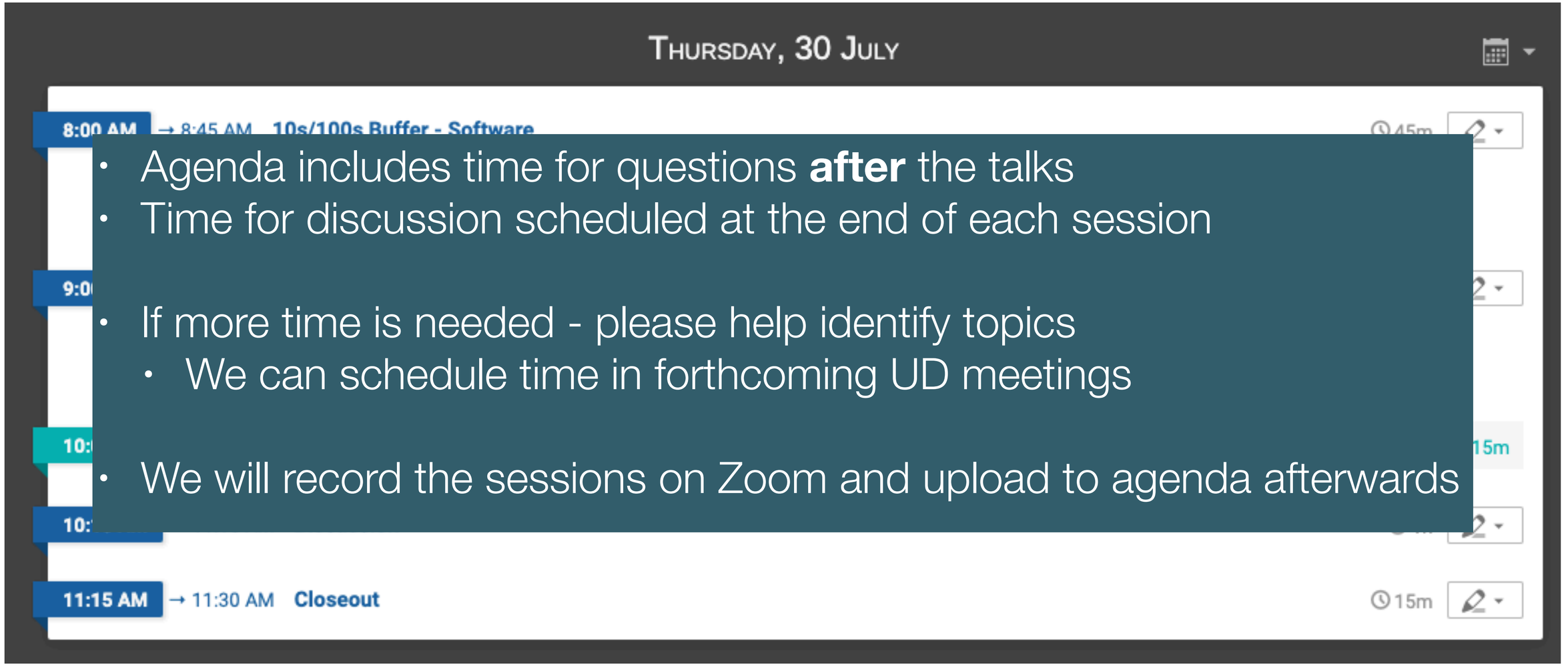

- Agenda includes time for questions **after** the talks
- Time for discussion scheduled at the end of each session

- If more time is needed - please help identify topics
  - We can schedule time in forthcoming UD meetings

- We will record the sessions on Zoom and upload to agenda afterwards