Lancaster University

ATLAS B-physics Analysis Model

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HSF Data Analysis Working

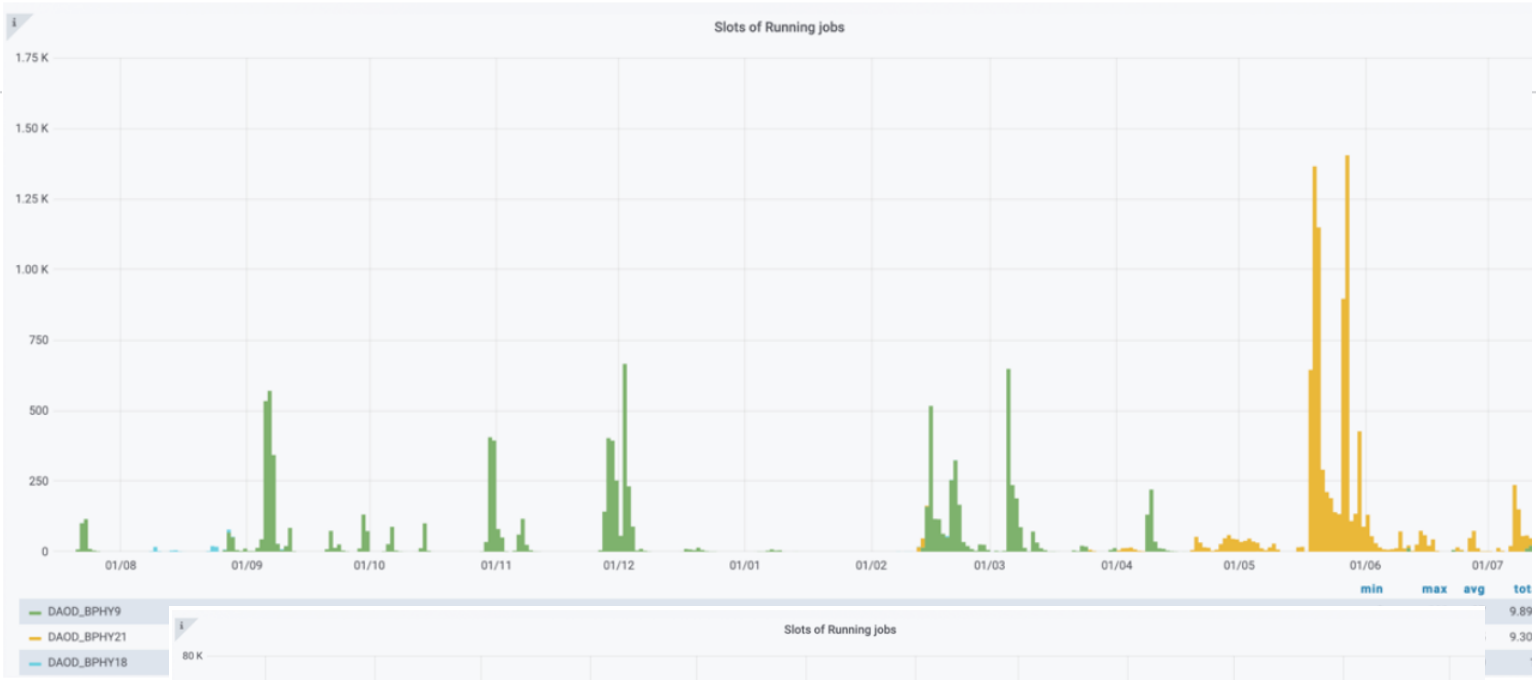
BLS-Physics at ATLAS

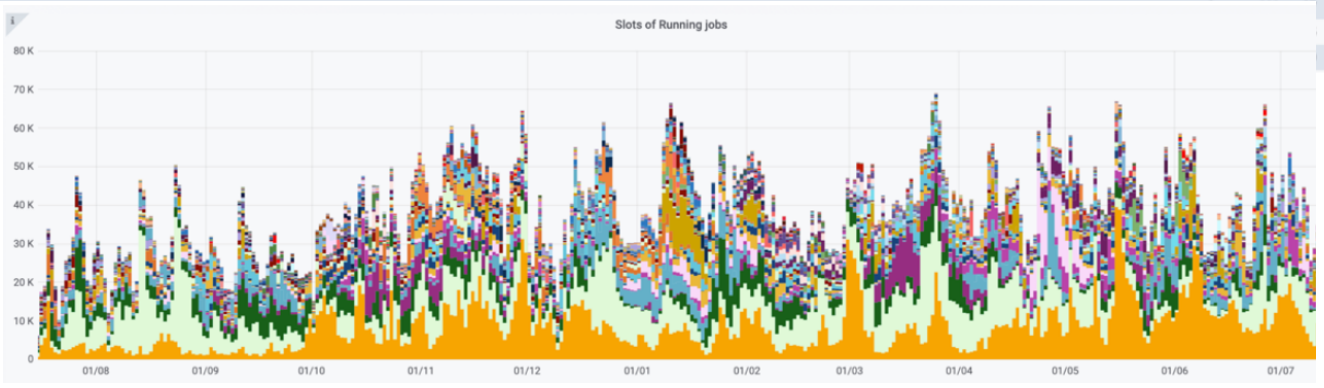
- The BLS group in ATLAS looks at rare processes and precise measurements of common processes:
  - $B_s0 \rightarrow J/\psi\phi$, $\lambda_b \rightarrow J/\psi\lambda$, $B_{(s)}0 \rightarrow \mu+\mu-$
- Lepton Flavor Violation: $\tau \rightarrow 3\mu$, $B0 \rightarrow K^*_0$ e+e- / $B_0 \rightarrow K^*_0$ μ+μ-
- Heavy Flavor Production:
  - B-hadron, Quarkonia production

BLS Workflow

- In run-1 BLS groups would run analysis code directly upon muon stream AODs.
- In run-2 the muon stream was retired so the work flow became:
  - Main xAOD →(Derivation step) DxAOD → (Analysis Code)
  - Mostly one format per analysis → 21 BPHY formats (some overlap)
  - This added man power required to manage DAOD software, production and monitor resource usage

Analysis jobs using B-physics DAOD as input

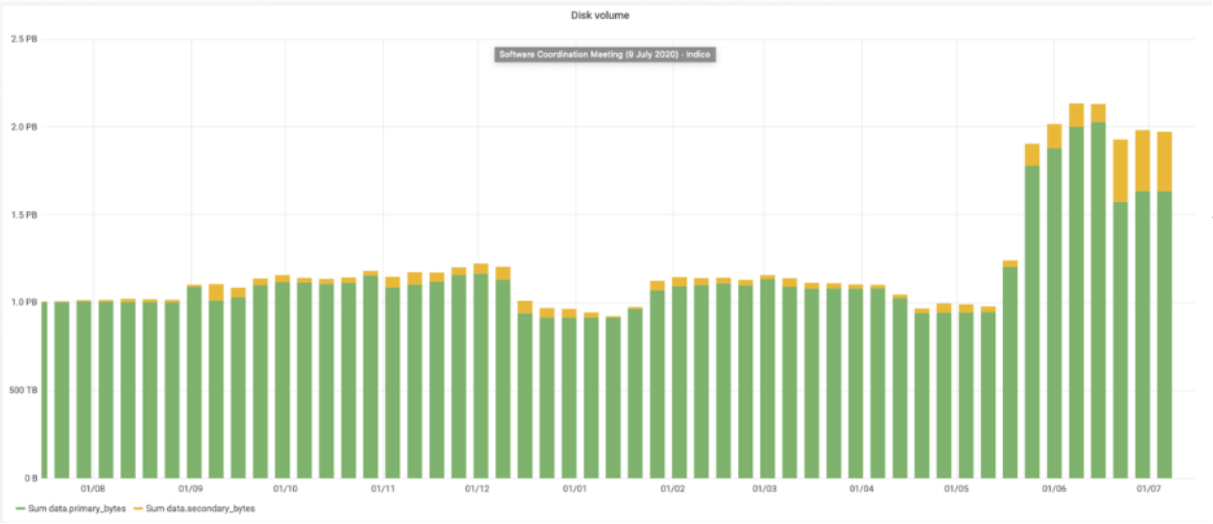




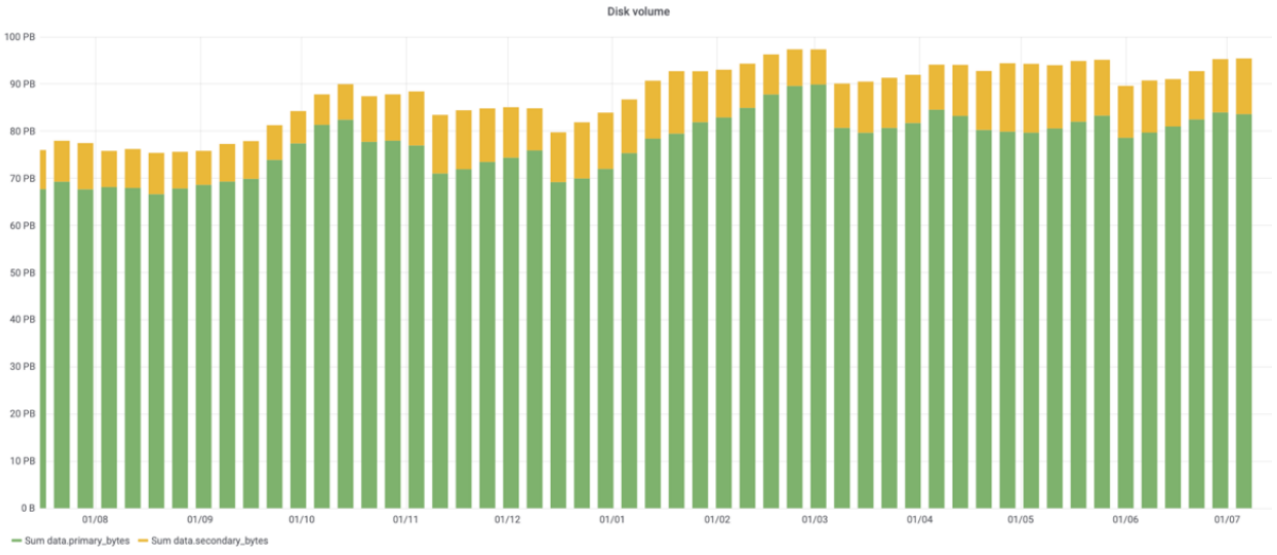
All Analysis jobs

BLS DAODs Needs Disk Size/CPU

- Unlike many other groups BLS analyses often rely on calculating secondary vertices, refitting primary vertices and vertex cascades:
  - Requires full covariance matrices of tracks, limits size reduction technique possible
  - VKalVrt vertex software requires relatively high CPU usage
    - Increases with pileup as more possible candidates arise.
- Many analyses want to look at backgrounds so often tracks cannot be stripped out.
- Many analyses rely on low-pT tracks that other groups would strip out.
- Most size/cpu reduction comes form being able to skim out all events with no muons or signal candidates – signal MC does not benefit.



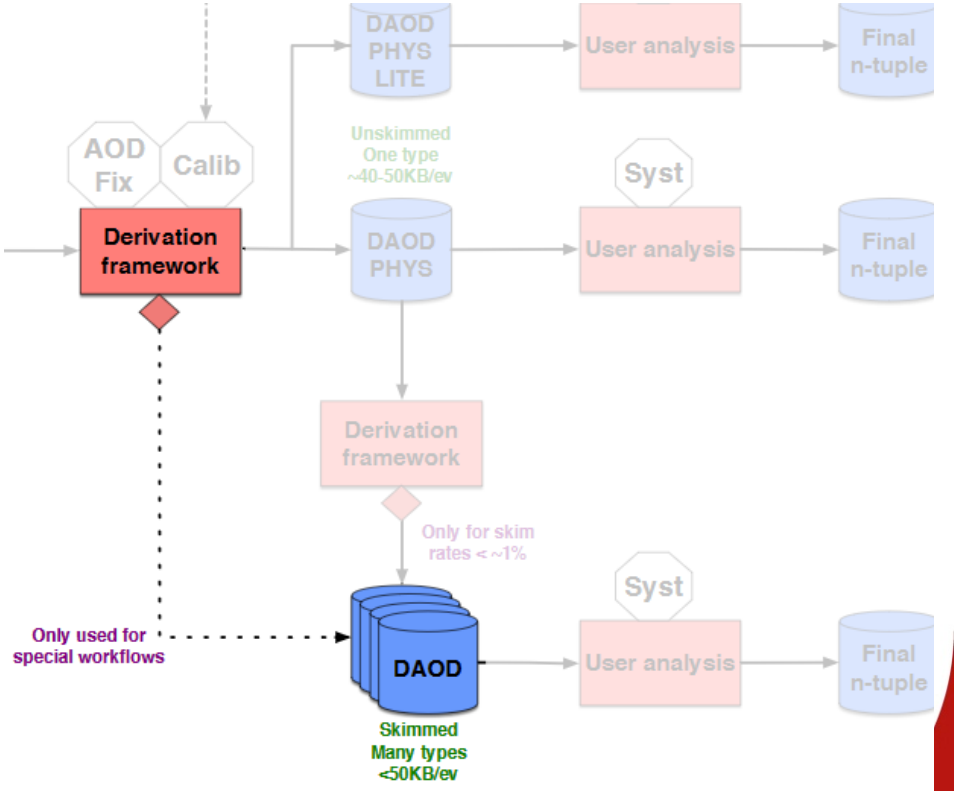
B-Physics DAODs
1 to 2 PB



All DAODs
70 to 90 PB

Run–3 formats: DAOD_PHYS

- The run-3 analysis framework plans to add two new data formats for most analyses.
- Neither of these are appropriate for BLS analyses.
- BLS DAODs may have to run from tape carousels at specific times in the year – very inconvenient for BLS analyses.



Special Reconstruction

- BLS events are plentiful and we often make use of “delayed streams” to gather more events.
  - These low-threshold trigger events are stored on disk and reconstructed during shutdown periods.
  - Provides extra data to analyses that do not need to be published promptly.

Wide reconstruction

- Tracking group are pressured by high pile-up environments into applying low D0 cuts during reconstruction.
- BLS relies on finding vertices far from the interaction point, we may have to diverge from the default reconstruction settings for accurate measurements of long lived particles.

Conclusion

- As the analysis model becomes more constrained it starts to necessitate special measures to keep B-physics competitive.
- Advice is welcome on how to accomplish this from HSF.