Global CFF Extraction: what we achieved

Key new development: Closure tests

- We now generate pseudo-data from the KM15 model, which:
  - satisfies BMK kinematic restrictions by construction,
  - has a known subtraction term and D-term.
- This allows a controlled validation of the non-DR and DR-based NN frameworks.

Critical issue identified:

- Initial pseudo-data generation did not fully respect the BMK kinematic constraints.
- This introduced inconsistencies in DR-sensitive observables, especially at: small ξ, and -t.
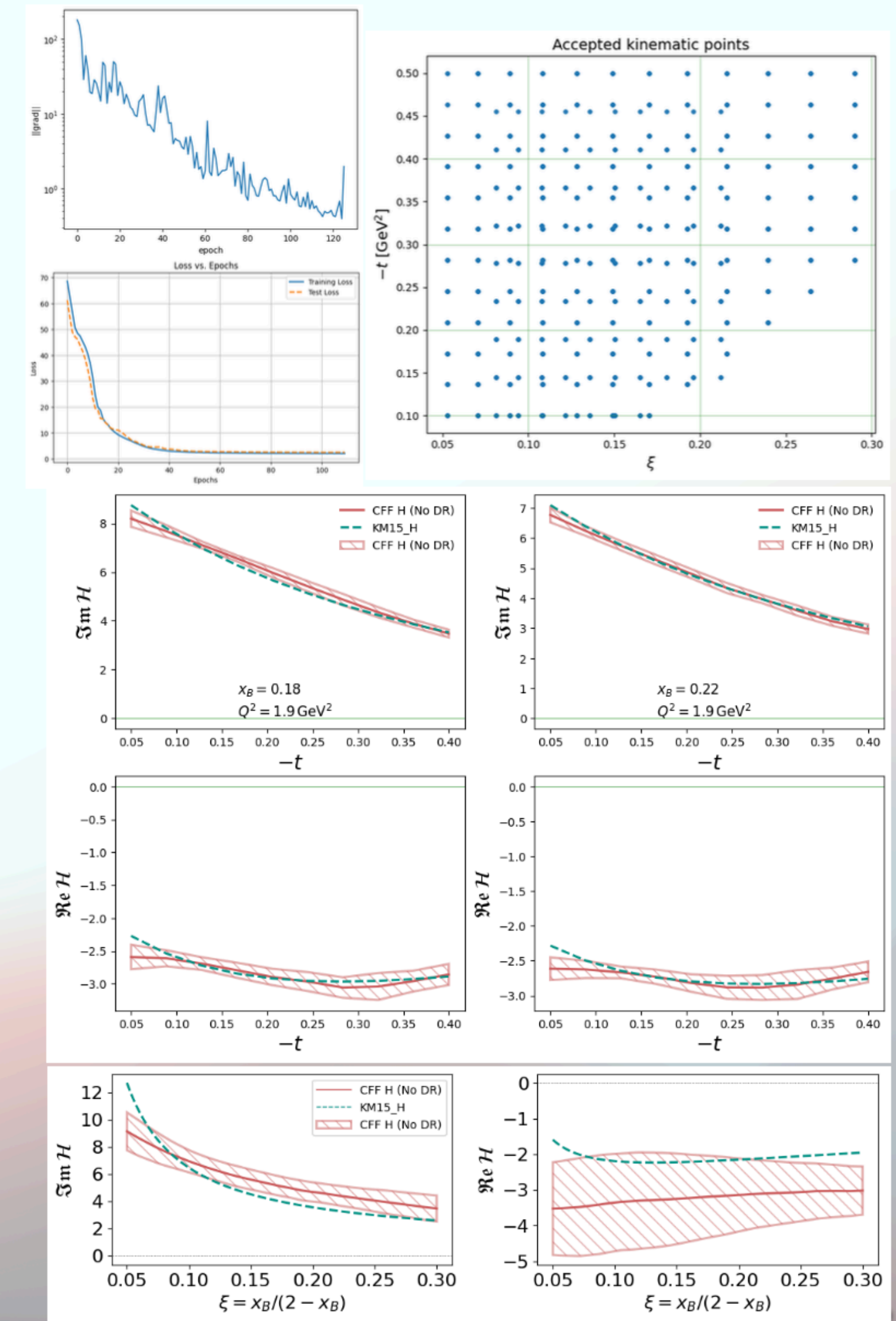
What this explains:

- Large χ^2 values in fits.
- Unphysical behavior of Re H, despite correct subtraction terms.

Current status:

- **Pseudo-data generation has been corrected and extended in kinematic coverage.**
- **Non-DR NN fits now successfully reproduce KM15 (baseline cross-check).**
- **DR NN model is being retested under controlled closure conditions.**
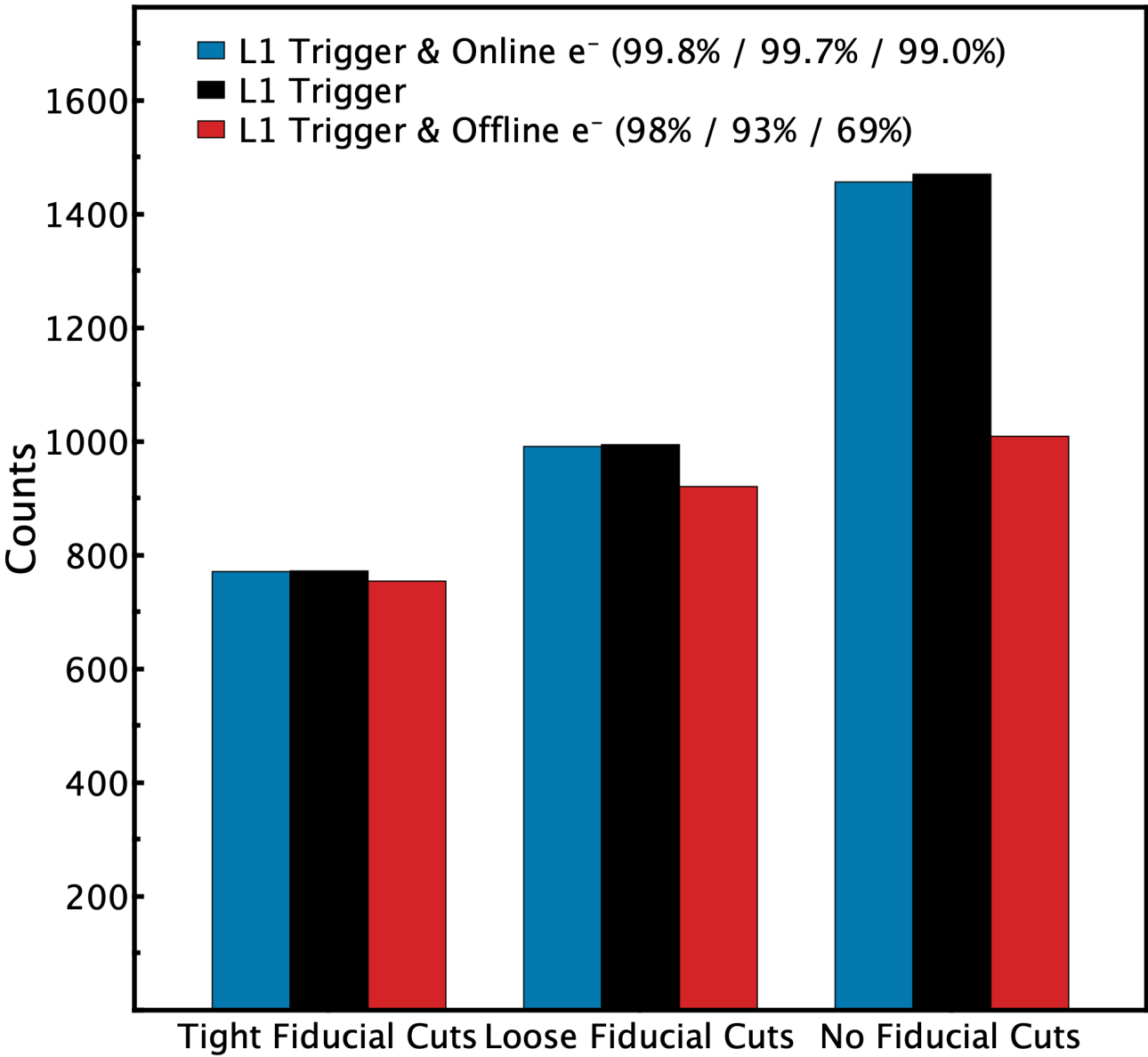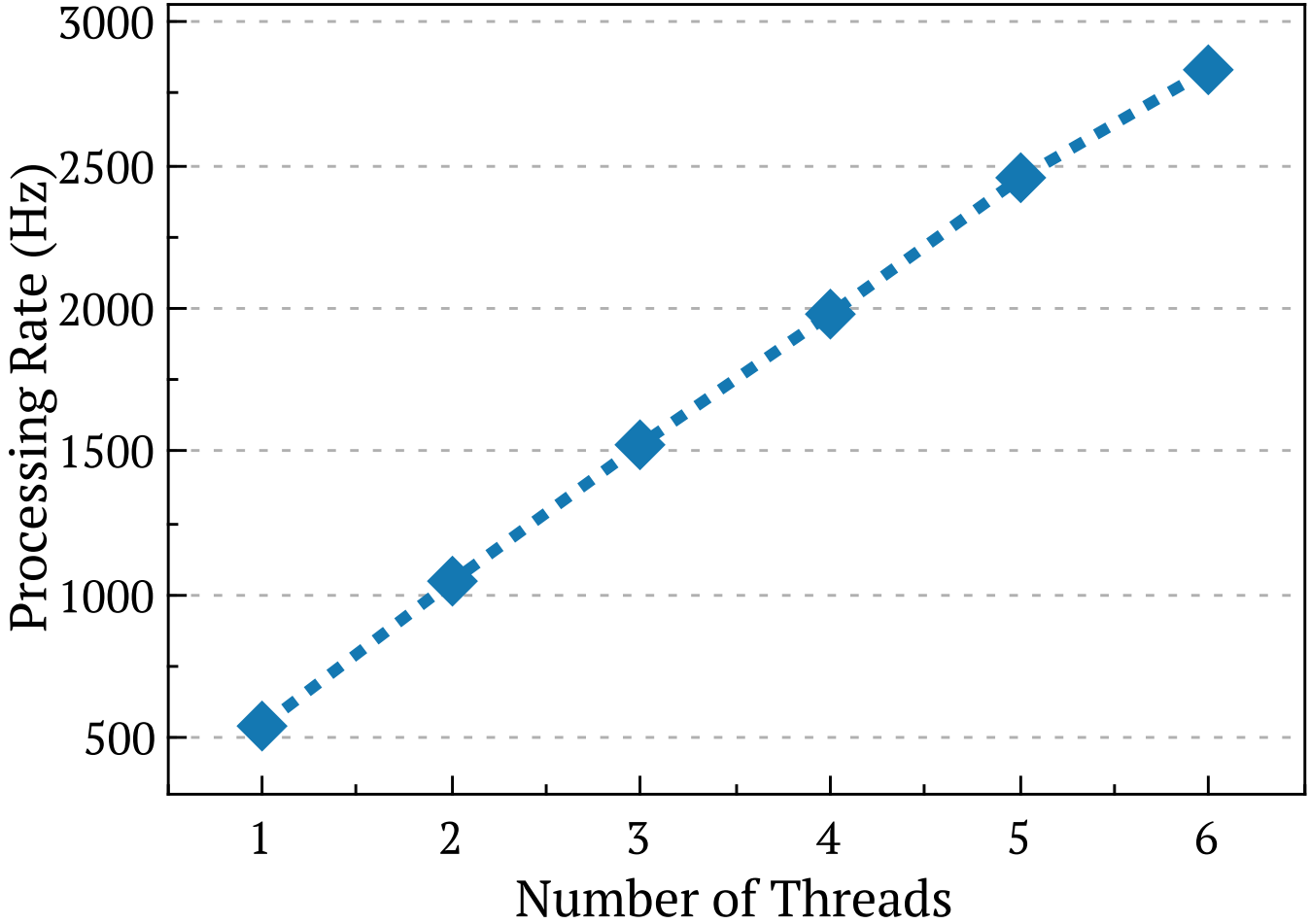
Next steps:

- Finalize closure tests for DR with clean pseudo-data.
- Quantify stability using different random seeds and ensemble training.
- Move toward a fully NN-driven D-term extraction (no fixed parametrization).
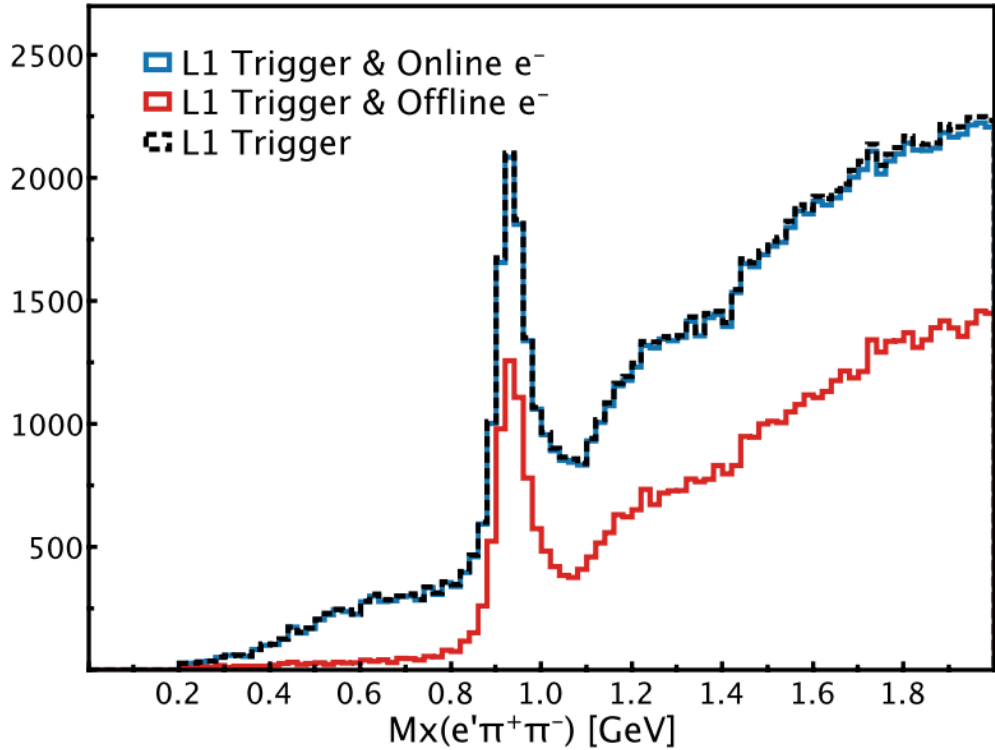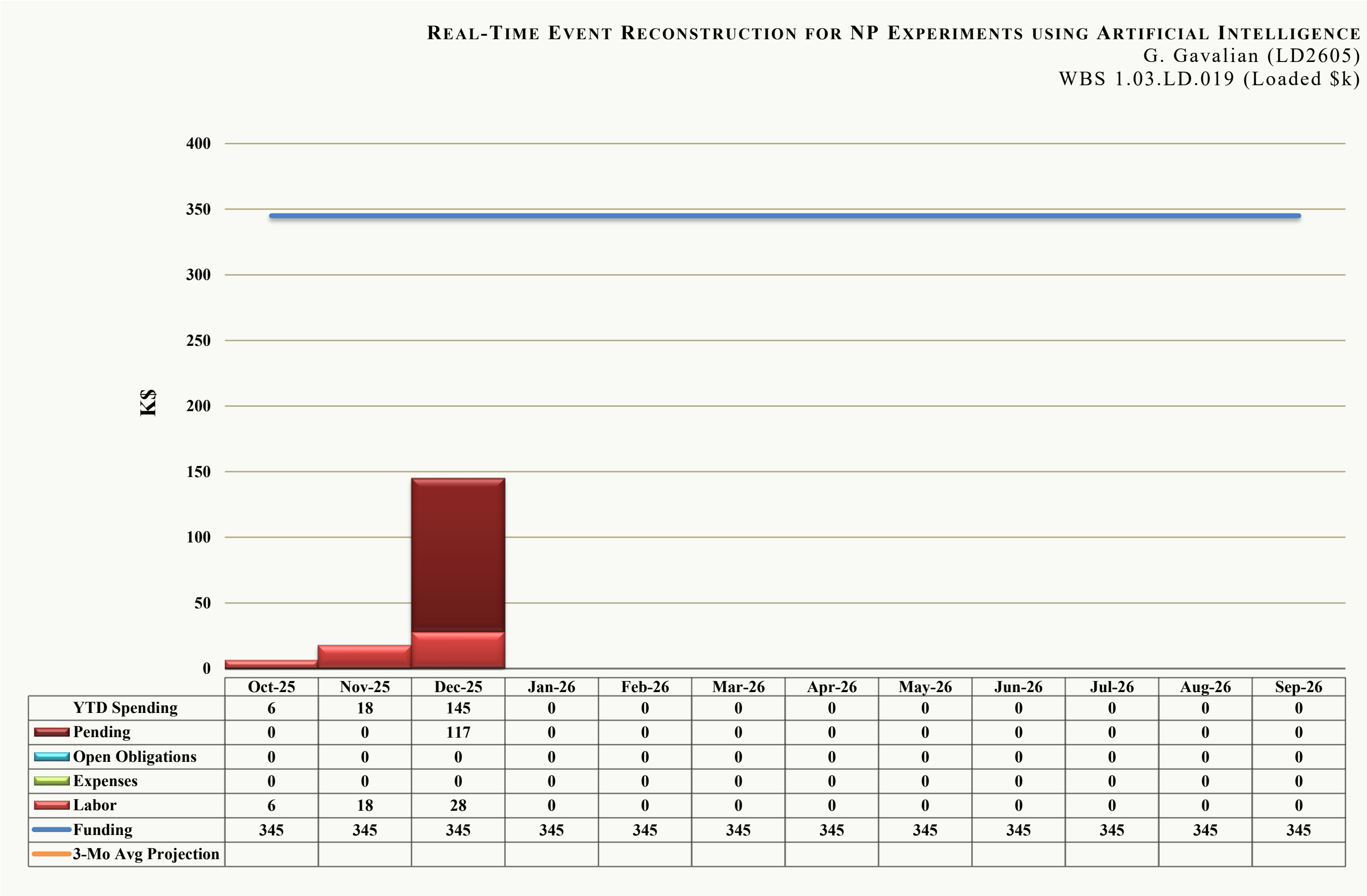
- Completed the work on all components of the workflow

- Combined them into a multithreaded data processing environment. (CLARA would not work due to data transfer latency from service to service ~1ms)

- Runs ~500 Hz on a single core (needs ~32 cores to process DAQ data), scales linerly with cores.

Service	Rate (kHz)
Decoding	12.9
Translating	3.94
De-Niser	0.85
Segment Finder	3.21
Track Classifier	2.12
Electron ID	14.32

- The reconstructed tracks from fast reconstruction are combined with information from ECAL (Electromagnetic Calorimeter) to train a neural network to identify electrons.

- Within the Fiducial region (used for physics analysis), the efficiency matches the reconstruction efficiency.

- Outside of the fiducial region, the efficiency is higher than reconstruction and matches the Level-1 trigger

- This demonstrates that this can be used as a Level-3 trigger.

- Currently working on extracting the luminosity dependence of track finding efficiency. (Comparison with conventional tracking)

- 4 conference talks, 4 proceedings (1-publication accepted, 1-being prepared)

- The article for "Electron Identification using AI in CLAS12", was accepted for publication in "Computer Physics Communications."

Real-Time Event Reconstruction for NP Experiments using Artificial Intelligence
G. Gavalian (LD2605)
WBS 1.03.LD.019 (Loaded $k)

	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26
YTD Spending	6	18	145	0	0	0	0	0	0	0	0	0
Pending	0	0	117	0	0	0	0	0	0	0	0	0
Open Obligations	0	0	0	0	0	0	0	0	0	0	0	0
Expenses	0	0	0	0	0	0	0	0	0	0	0	0
Labor	6	18	28	0	0	0	0	0	0	0	0	0
Funding	345	345	345	345	345	345	345	345	345	345	345	345
3-Mo Avg Projection												

The Spending Includes :

- **One post-DOC from the GPD Extraction Project.**
- **0.25 FTE PI (Gagik)**
- **Post-Doc (hired through ODU)**