

GPU Track Reconstruction Optimization Timeline

November 2024 – January 2026

2024.11–2025.1

- ● Established the traccc (GPU track reconstruction) environment

2025.2–2025.3

- ● Studied traccc code and algorithms (over 70,000 lines)
- ● Analyzed next steps and reported to parallelization meeting
- ● Revised the manuscript for YunChen's paper

2025.4

- ● Set up the Nvidia Nsight Systems (profiler) environment
- ● Profiled traccc to identify bottlenecks
- ● Created figures for YunChen's paper

2025.5

- ● Analyzed bottlenecks; attempted code modifications and debugging
- ● Split the fit kernel, increasing throughput by 10%
- ● Assisted YunChen with the **VLSICAD** (conference) submission

2025.6

- ● Replaced Kalman gain matrix (track fitting computation) operations with INT8 MLP
- ● Achieved 186% speedup but observed **physics accuracy degradation**
- ● Reported results to parallelization meeting
- ● Assisted YunChen with the **TJCAS** (conference) submission
- ● Attempted Nsight Compute (kernel profiler) setup (severe environmental issues)

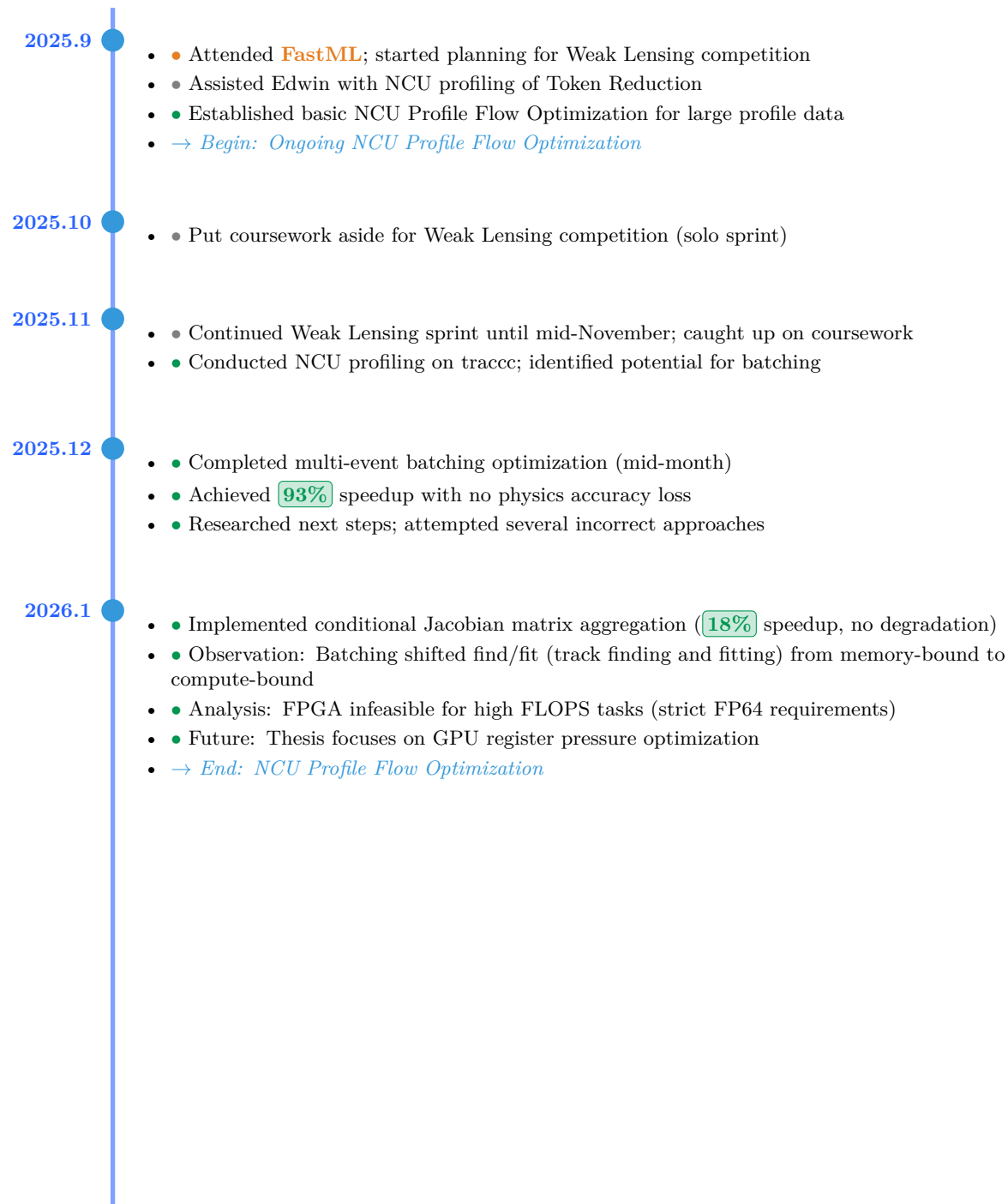
2025.7

- ● Prepared slides & scripts (EN/CN) for YunChen's **VLSICAD 2025** oral
- ● Prepared slides & scripts for the **TJCAS** oral presentation
- ● Successfully established the Nvidia Nsight Compute (NCU) environment

2025.8

- ● Created posters for **TJCAS** and **FastML** (workshop)
- ● Attended **VLSICAD** and **TJCAS**

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Legend

● Technical/Optimization ● Conference/Paper ● Collaboration/Other

Green Badge = Performance Achievement **Red Text** = Accuracy Concern **Blue Sidebar** = NCU Flow Optimization Period

Key Performance Achievements

10%	Fit kernel splitting	2025.5
186%	INT8 MLP replacement (with accuracy trade-off)	2025.6
93%	Multi-event batching (no accuracy loss)	2025.12
18%	Conditional Jacobian aggregation (no accuracy loss)	2026.1