# Research Timeline: November 2024 – January 2026

**2024.11–2025.1**
- Established the traccc environment

**2025.2–2025.3**
- Studied traccc code and algorithms (over 70,000 lines)
- Analyzed next steps and reported to the European team
- Revised the manuscript for YunChen's paper

**2025.4**
- Set up the Nvidia Nsight Systems 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 submission

**2025.6**
- Replaced Kalman gain matrix operations with INT8 MLP
- Achieved **186% speedup** but observed physics accuracy degradation
- Reported results to the European team
- Assisted YunChen with the TJCAS submission
- Attempted Nsight Compute 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 environment

**2025.8**
- Created posters for TJCAS and FastML
- Attended VLSICAD and TJCAS

**2025.9**
- Attended FastML; started planning for Weak Lensing competition
- Assisted Edwin with NCU profiling of Token Reduction
- Established basic NCU Profile Flow Optimization for large profile data
- → *Begin: Ongoing NCU Profile Flow Optimization*

**2025.10**
- Put coursework aside for Weak Lensing competition (solo sprint)
- *Ongoing: NCU Profile Flow Optimization*

**2025.11**
- Continued Weak Lensing sprint until mid-November; caught up on coursework
- Conducted NCU profiling on traccc; identified potential for batching
- *Ongoing: NCU Profile Flow Optimization*

**2025.12**
- Completed multi-event batching optimization (mid-month)
- Achieved **93% speedup** with no physics accuracy loss
- Researched next steps; attempted several incorrect approaches
- *Ongoing: NCU Profile Flow Optimization*

**2026.1**
- Implemented conditional Jacobian matrix aggregation (**18% speedup**, no degradation)
- Observation: Batching shifted find/fit from memory-bound to compute-bound
- Analysis: FPGA infeasible for high FLOPS tasks (strict FP64 requirements)
- Future: Thesis focuses on GPU register pressure optimization
- → *End: NCU Profile Flow Optimization*

**Legend:** Green = Performance gains  Orange = Conferences/Papers  Red = Accuracy concerns  Blue = NCU Flow Opt. period