

# DRONE CONFLICT ANALYSIS SUMMARY

## COMPREHENSIVE ANALYSIS SUMMARY

Report Generated: 2026-02-08 18:48:37

Analysis Type: Multi-threaded Parallel Processing

### MISSION STATISTICS:

- Total Drones Analyzed: 50
- Trajectory Segments: 100,000
- Safety Radius: 10.0 meters
- Parallel Workers: 8

### CONFLICT DETECTION RESULTS:

- Status: ⚠️ CONFLICTS DETECTED
- Total Conflicts Found: 264

### SEVERITY BREAKDOWN:

- Critical Conflicts: 42
- High Severity: 36
- Medium Severity: 64
- Low Severity: 122

### CONFLICT TIMING:

- Earliest Conflict: 28.3s
- Latest Conflict: 159.8s
- Average Time: 94.7s

### SEPARATION DISTANCES:

- Minimum Distance: 0.00m
- Maximum Distance: 19.36m
- Average Distance: 9.15m

### PERFORMANCE METRICS:

- Total Analysis Time: 100062.96s
- Data Loading: 1.06s
- Spatial Indexing: 1.93s
- Conflict Detection: 1.97s
- Segments per Second: 1

### GENERATED OUTPUTS:

1. drone\_conflict\_analysis\_report.pdf (This document)
2. detailed\_analysis.json (Complete conflict data)
3. Interactive 4D OpenGL visualization

### ALGORITHMS & OPTIMIZATIONS:

- 4D Continuous Closest Point of Approach (CPA)
- Octree spatial indexing for  $O(\log n)$  queries
- Multi-process parallel conflict detection
- AABB culling for early rejection
- JIT compilation: ✓ Enabled (Numba)

### ⚠️ RISK ASSESSMENT: HIGH RISK

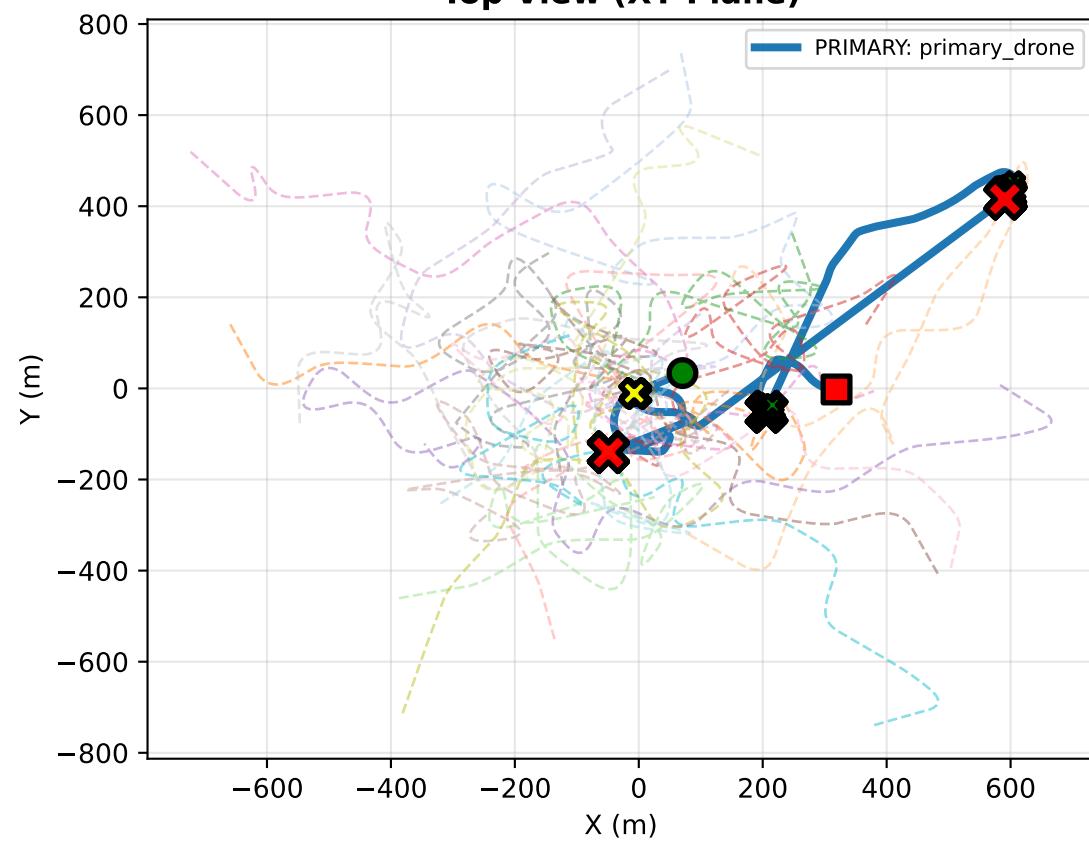
78 critical/high severity conflicts detected

### ⚠️ MISSION REPLANNING REQUIRED

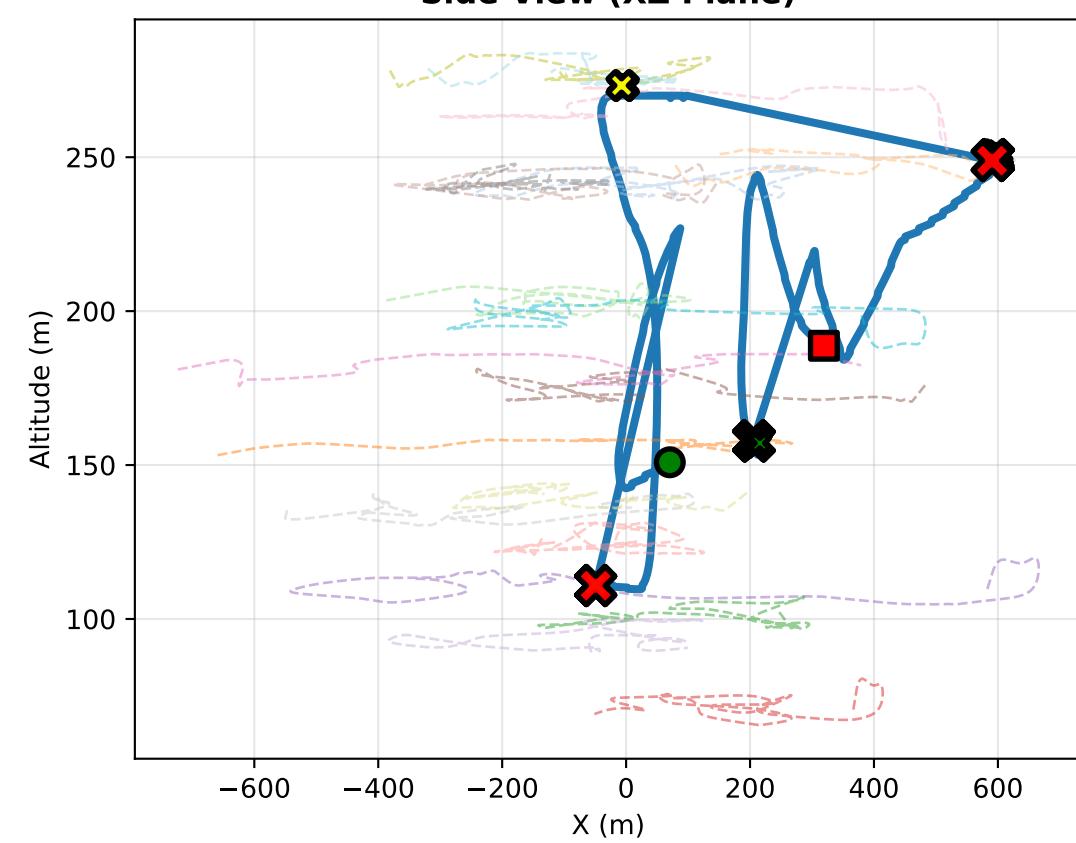
Recommend immediate trajectory adjustment

# 2D TRAJECTORY ANALYSIS

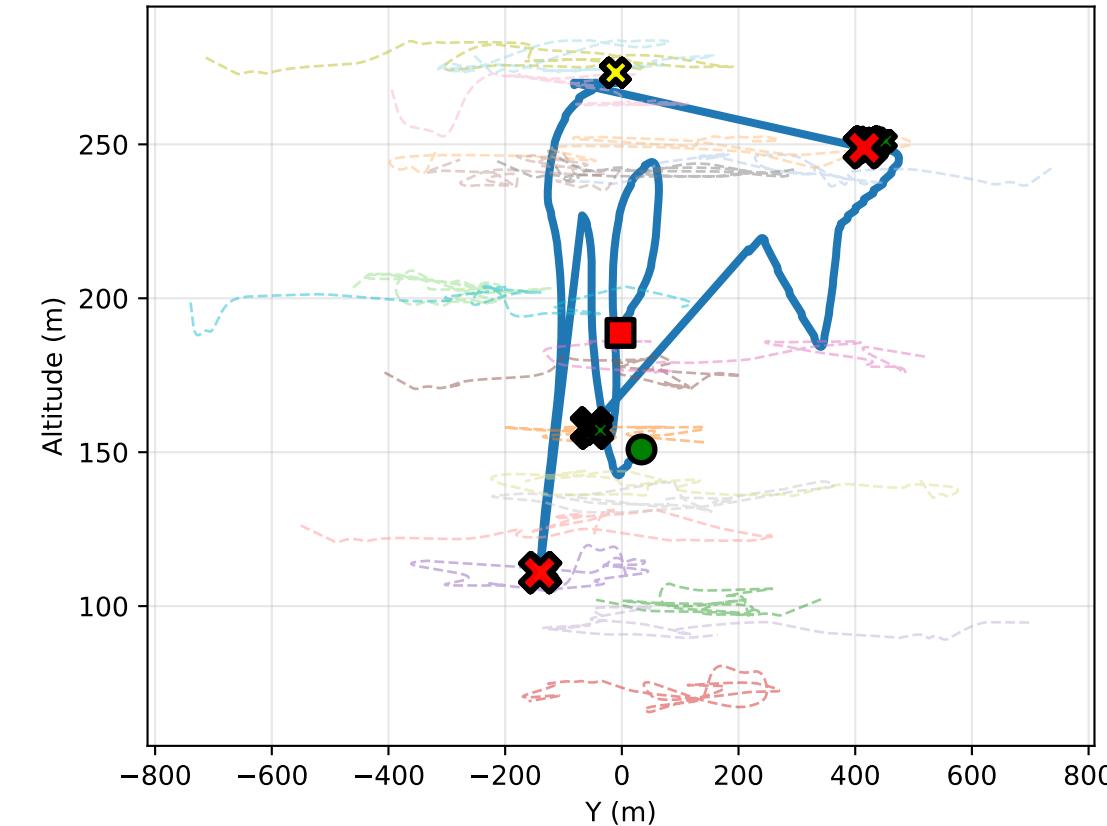
## Top View (XY Plane)



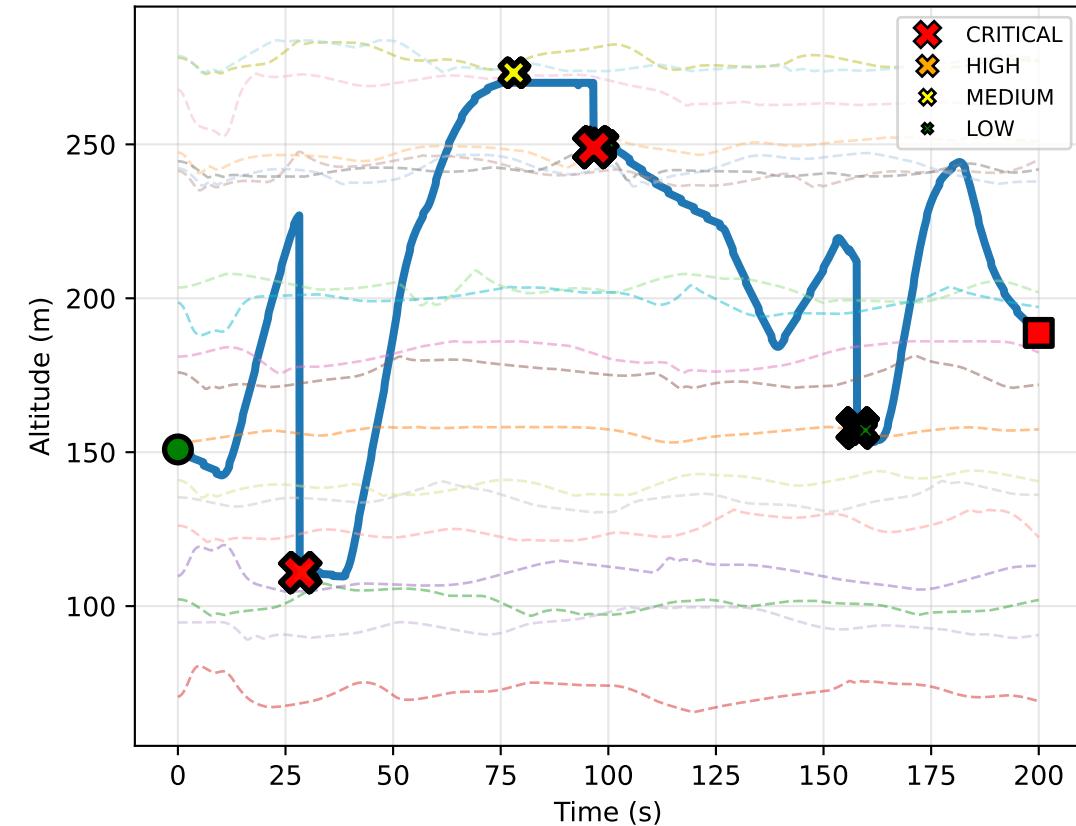
## Side View (XZ Plane)



## Front View (YZ Plane)

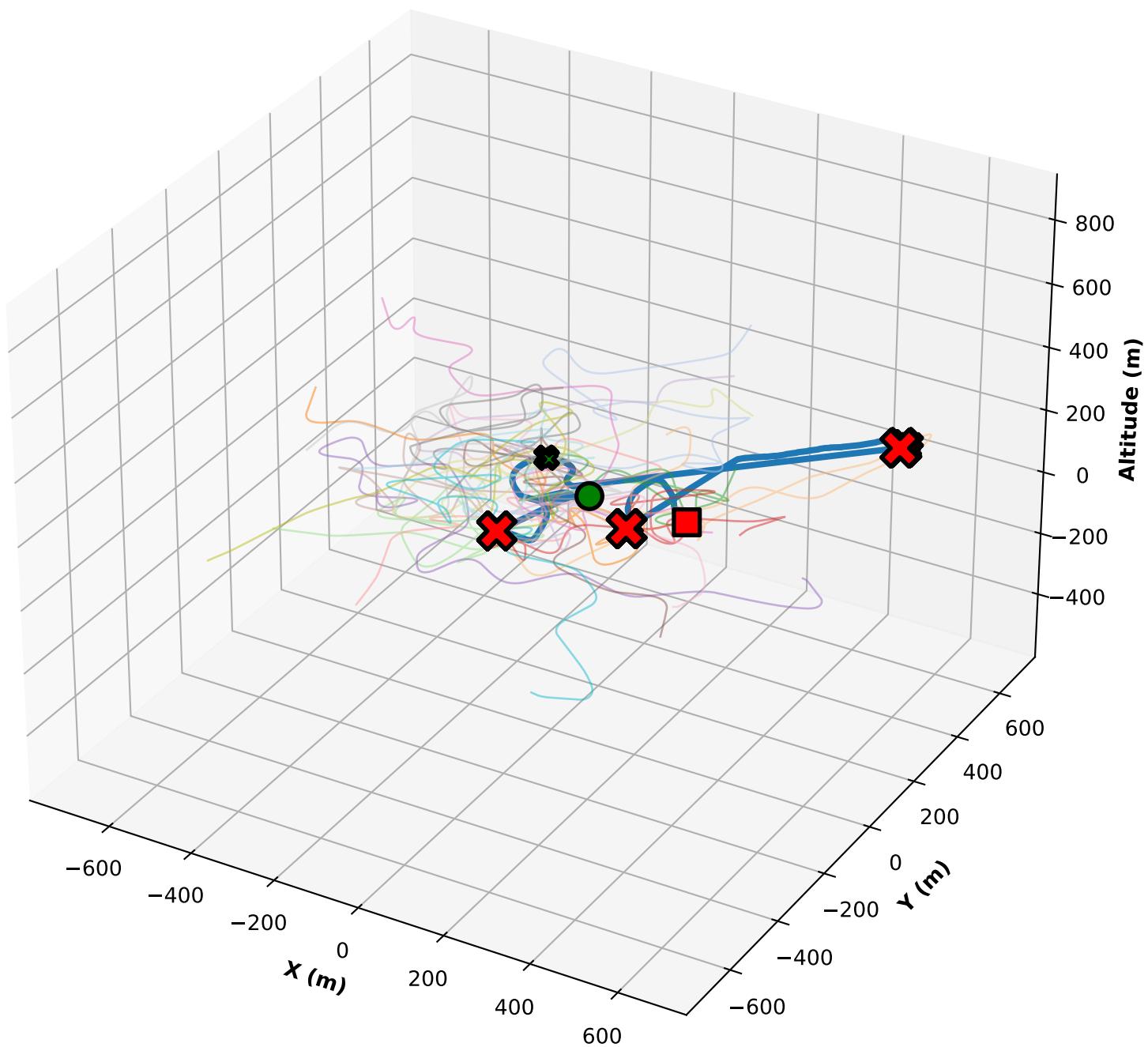


## Time-Altitude Profile



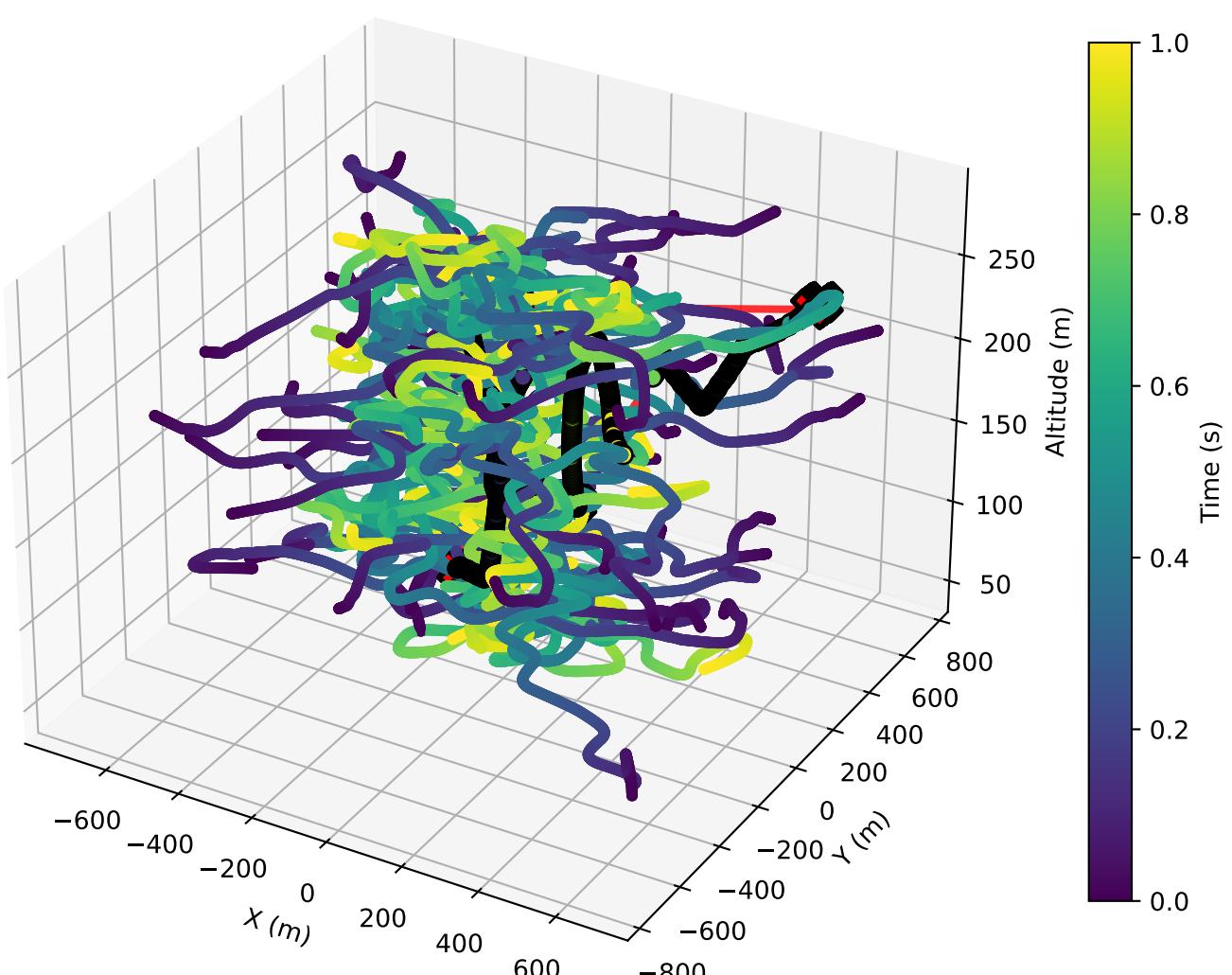
# 3D TRAJECTORY VISUALIZATION

PRIMARY: primary\_drone

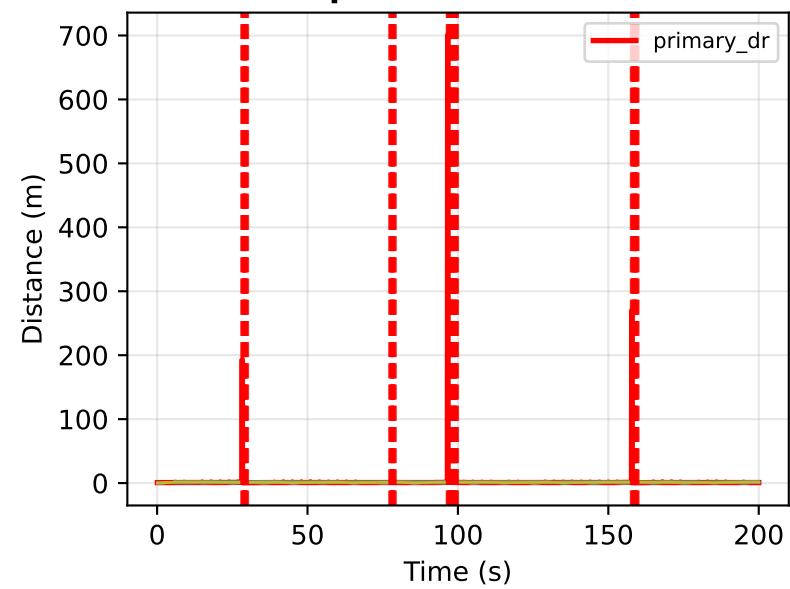


# 4D SPATIO-TEMPORAL ANALYSIS

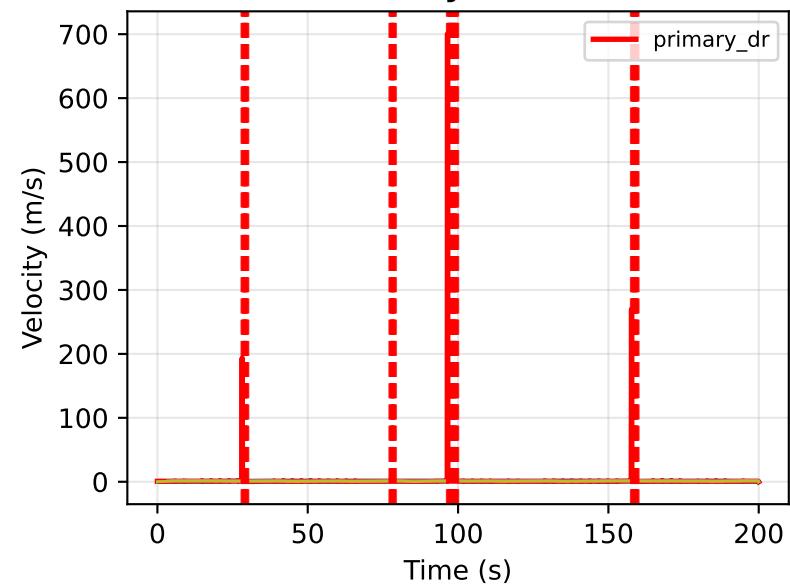
## 3D Trajectories (Time Gradient)



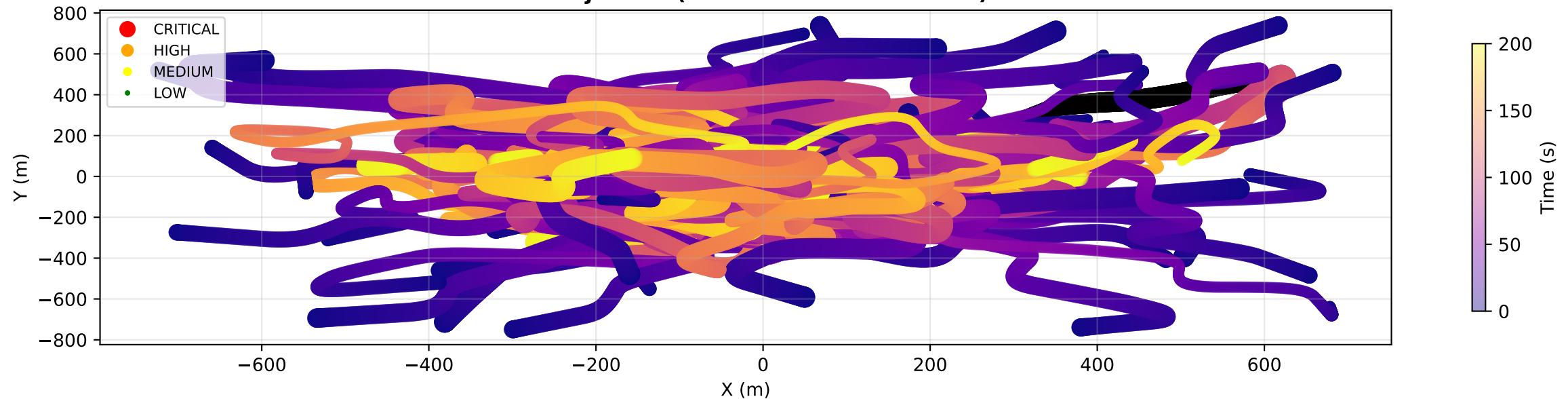
## Separation vs Time



## Velocity Profile

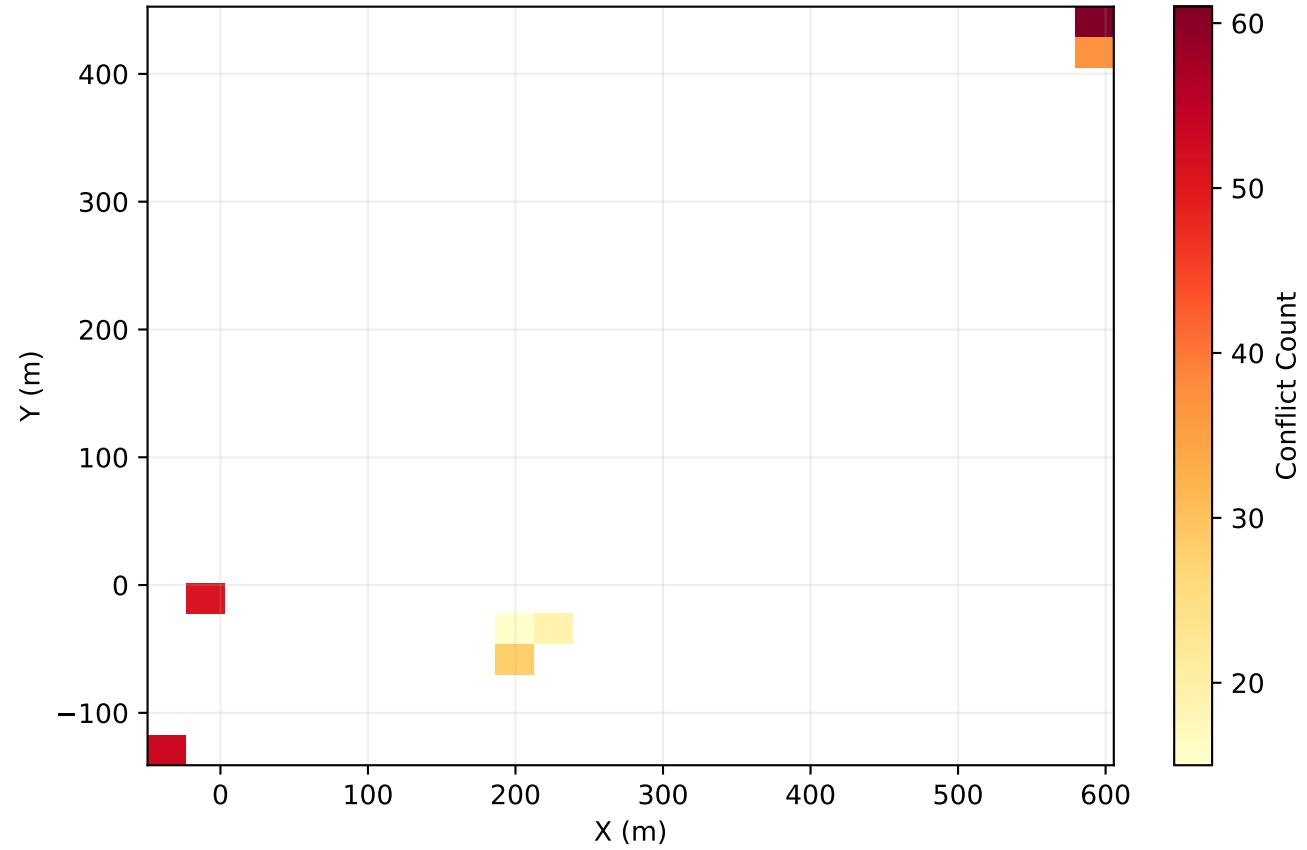


## 4D Projection (XY with Time & Altitude)

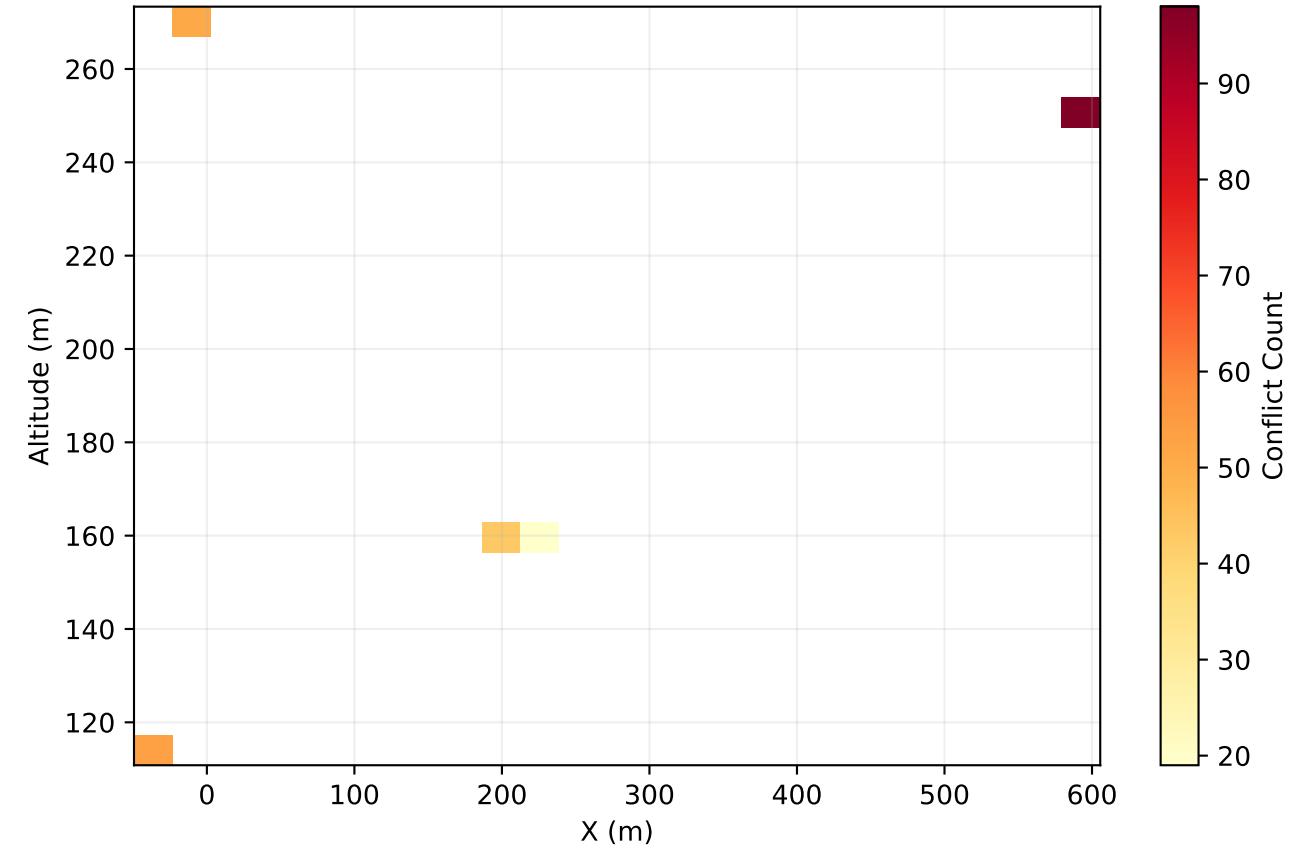


# CONFLICT DENSITY ANALYSIS

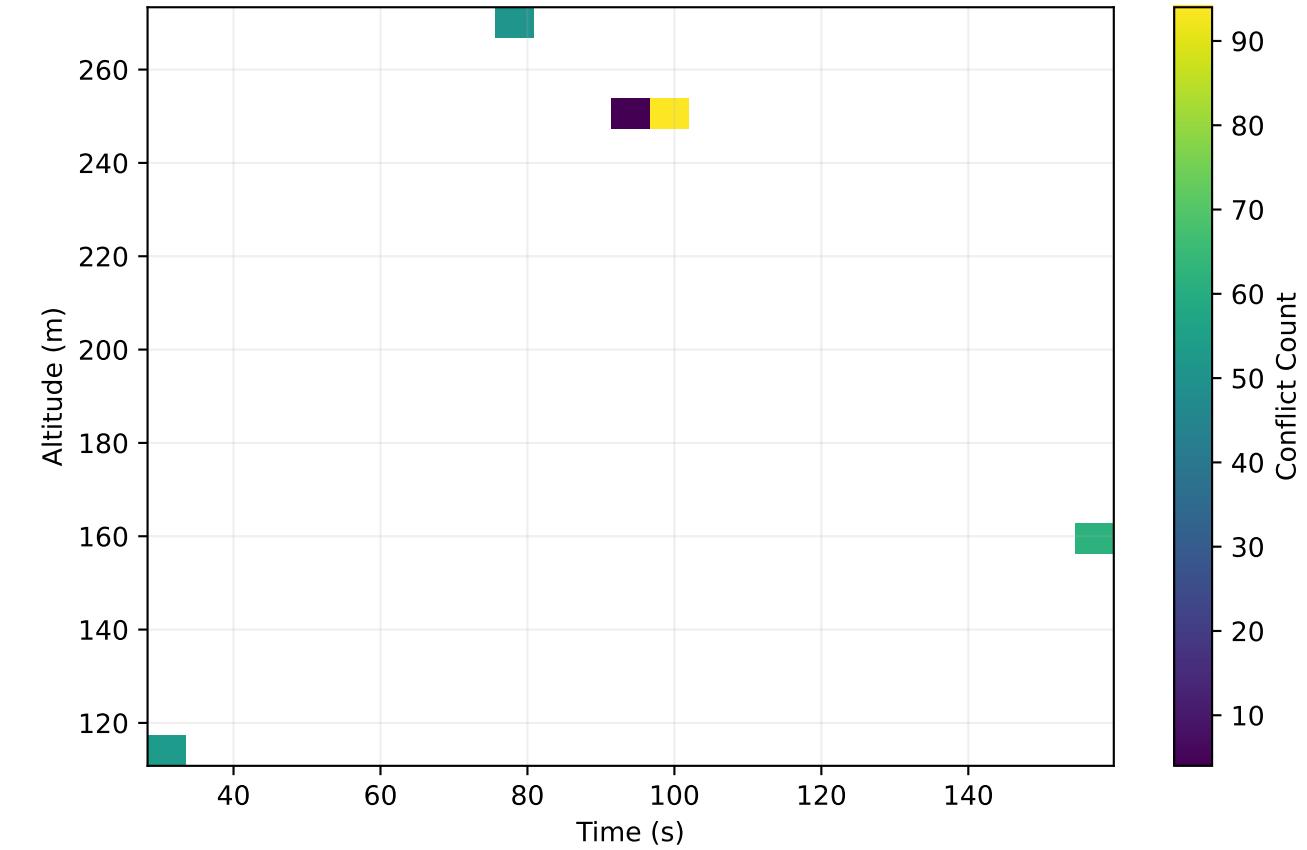
XY Plane Conflict Density



XZ Plane Conflict Density



Time-Altitude Conflict Density



Conflict Severity Distribution

