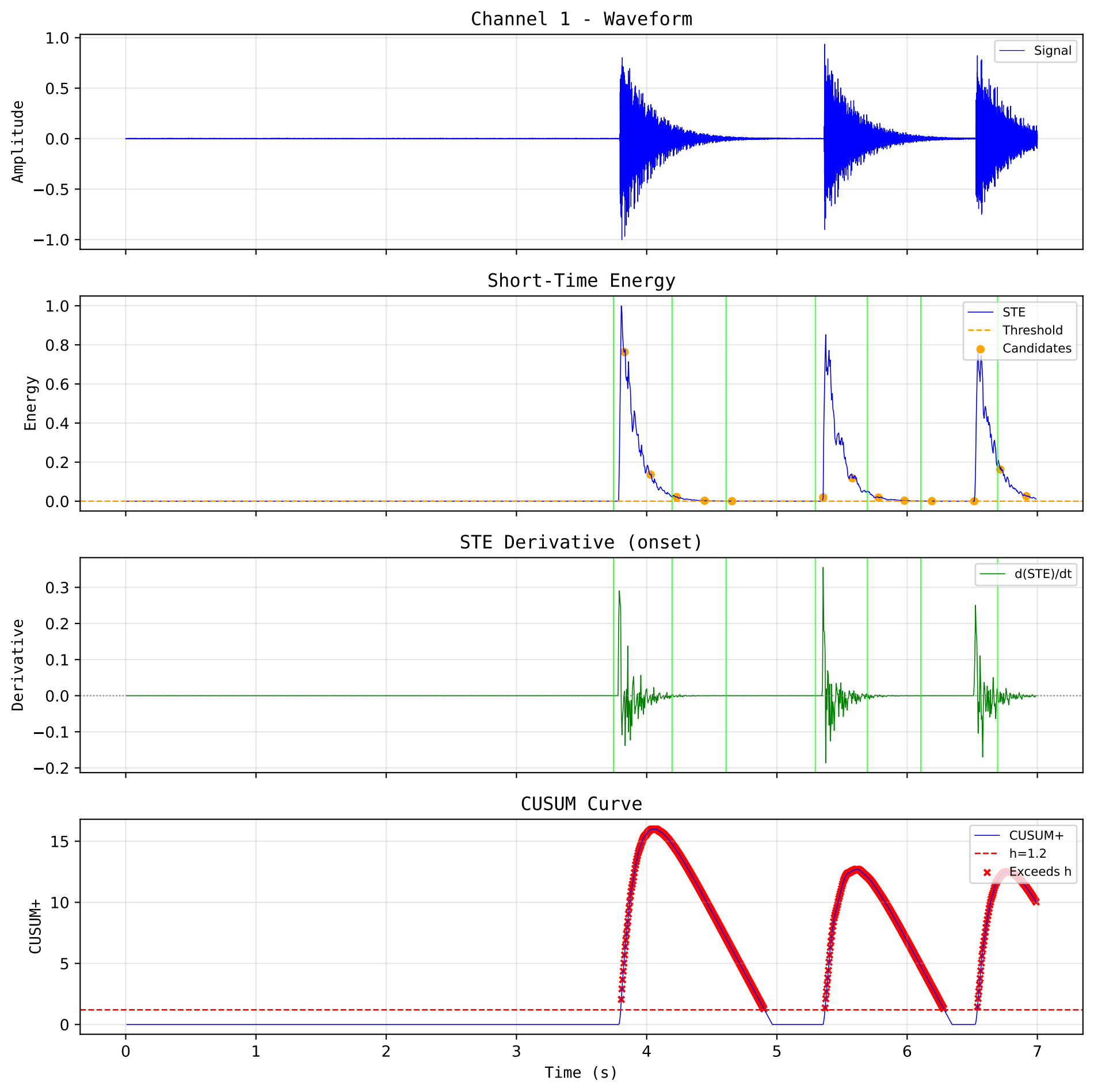
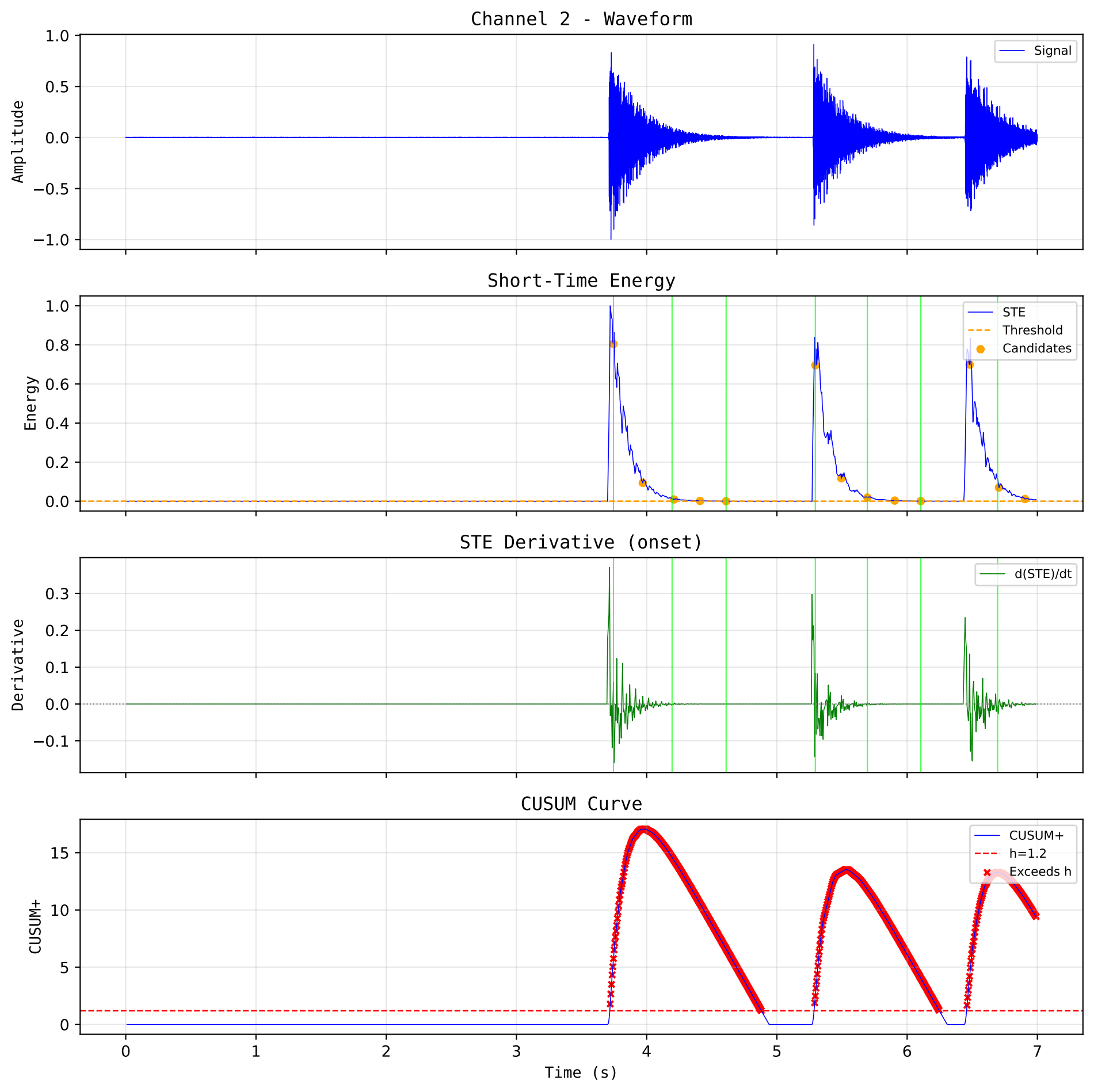
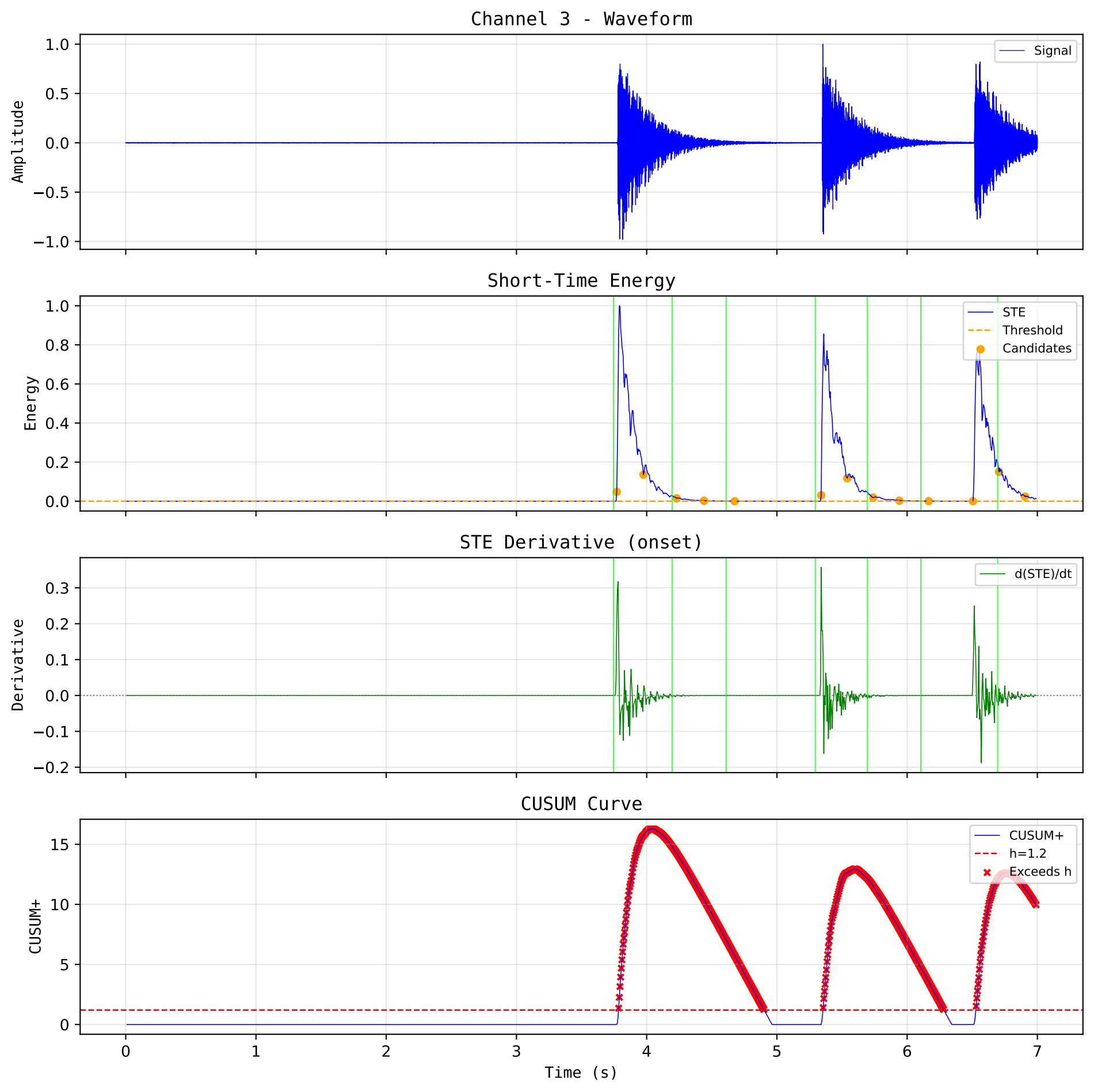
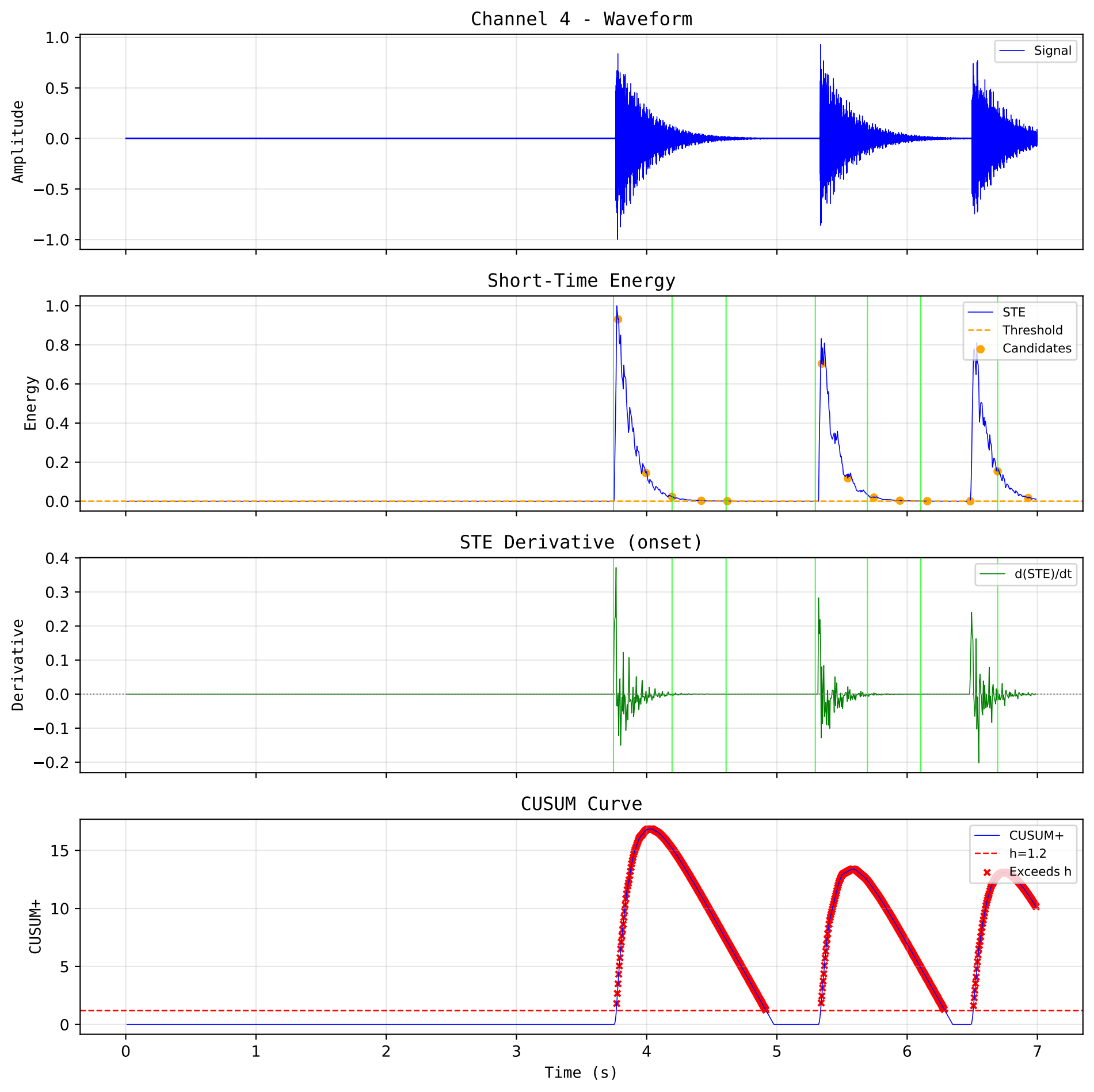
Part 1: Gunshot Detection (energy + CUSUM, per-event chunk extraction)


Channel 1 - Waveform
Amplitude
Signal
Short-Time Energy
Energy
STE
Threshold
Candidates
STE Derivative (onset)
Derivative
d(STE)/dt
CUSUM Curve
CUSUM+
h=1.2
Exceeds h
Time (s)


Channel 2 - Waveform
Amplitude
Signal
Short-Time Energy
Energy
STE
Threshold
Candidates
STE Derivative (onset)
Derivative
d(STE)/dt
CUSUM Curve
CUSUM+
CUSUM+
h=1.2
Exceeds h
Time (s)

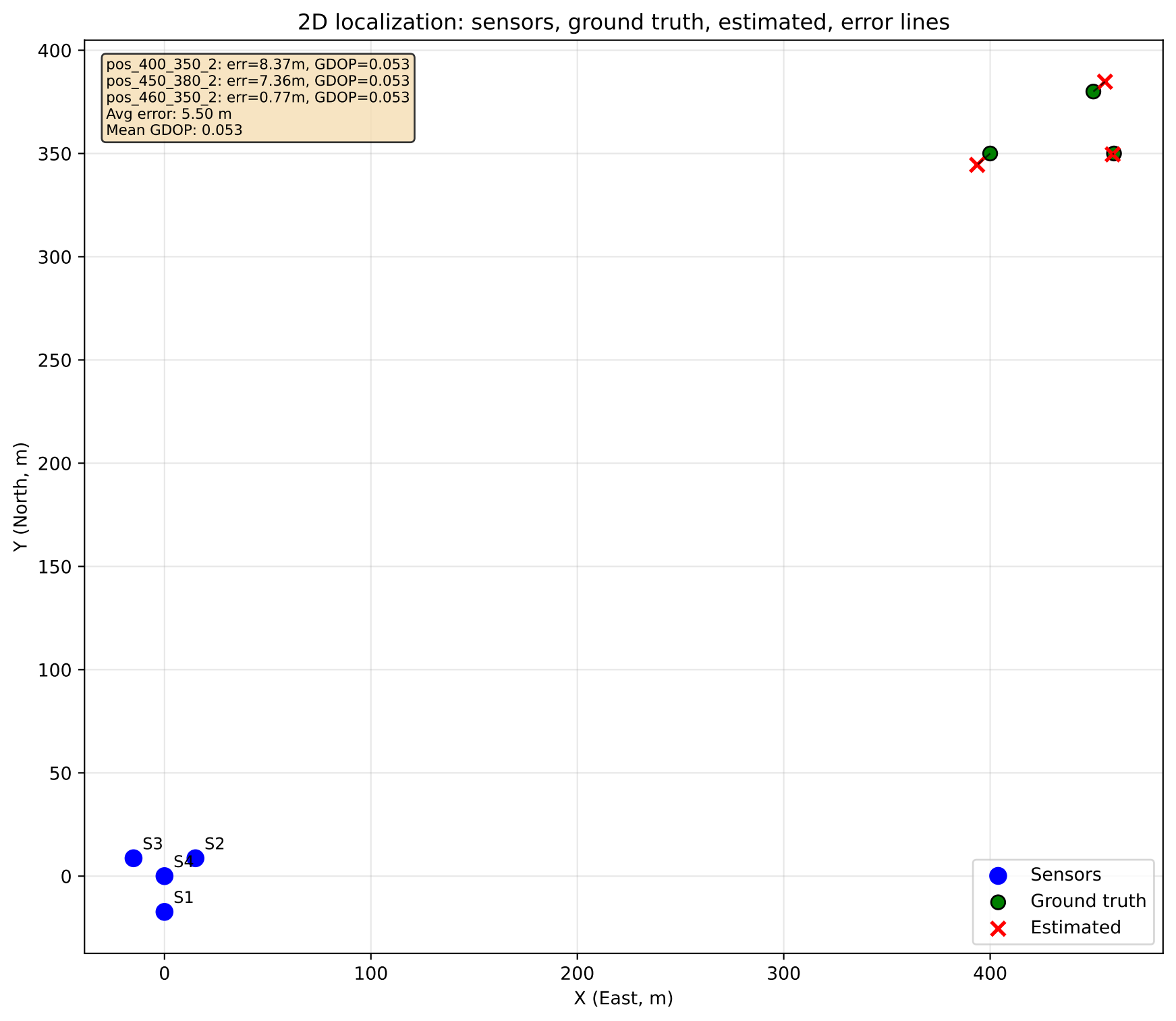

Channel 3 - Waveform
Amplitude
Signal
Short-Time Energy
Energy
STE
Threshold
Candidates
STE Derivative (onset)
Derivative
d(STE)/dt
CUSUM Curve
CUSUM+
h=1.2
Exceeds h
Time (s)

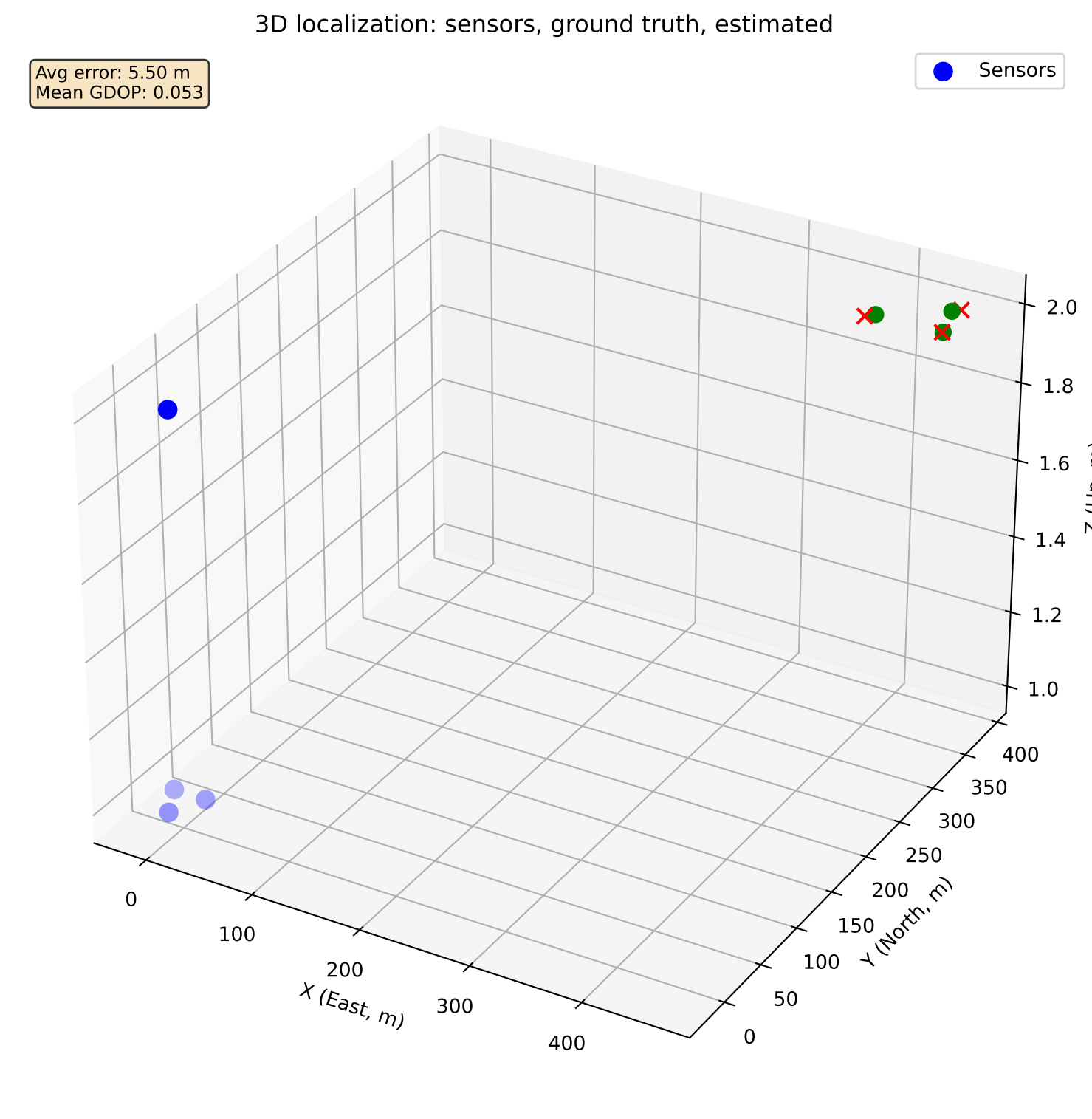

Channel 4 - Waveform
Amplitude
Signal
Short-Time Energy
Energy
STE
Threshold
Candidates
STE Derivative (onset)
Derivative
d(STE)/dt
CUSUM Curve
CUSUM+
h=1.2
Exceeds h
Time (s)

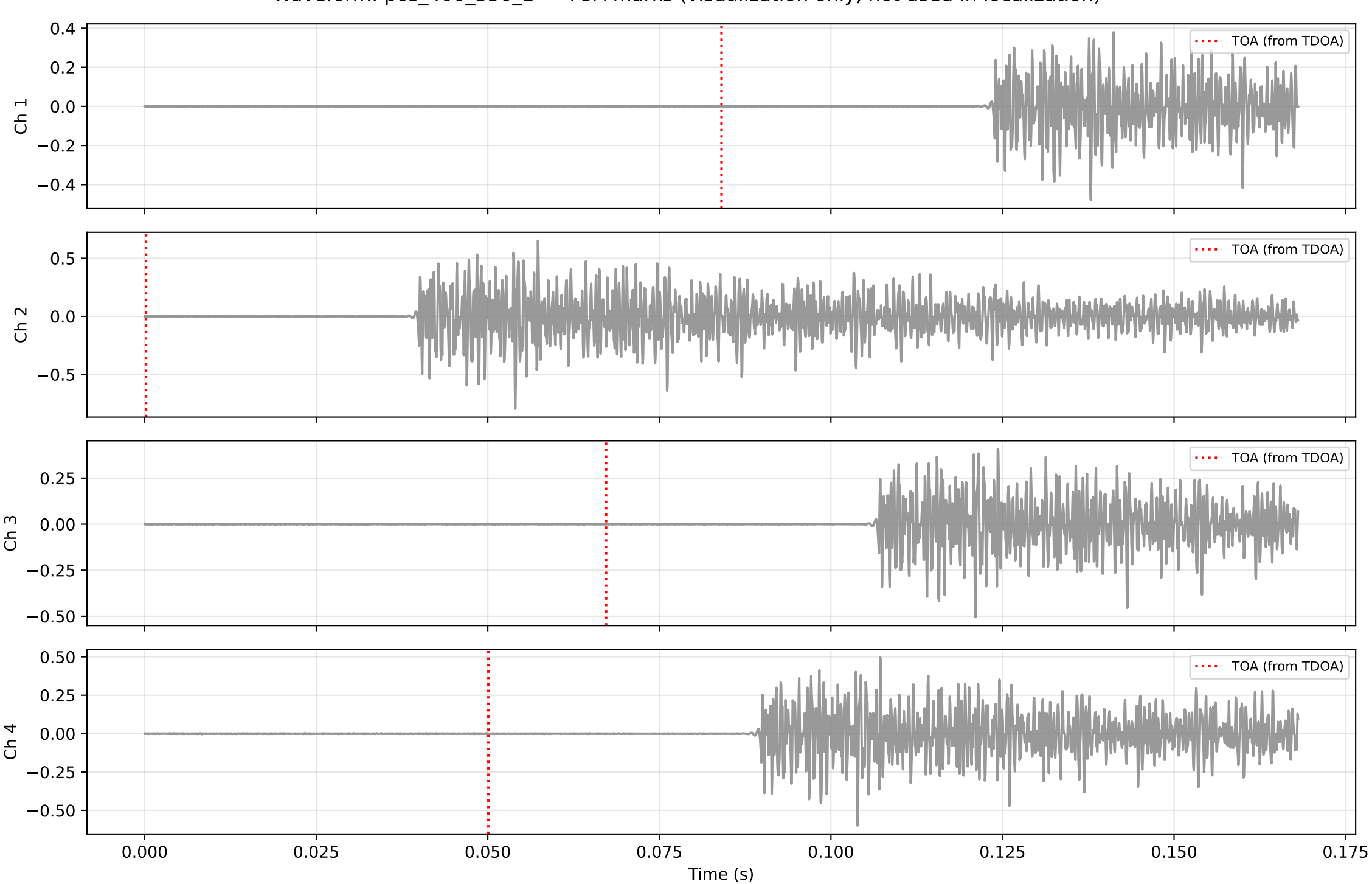
Part 2: TDOA Localization (GCC-PHAT on per-event chunks, no TOA)

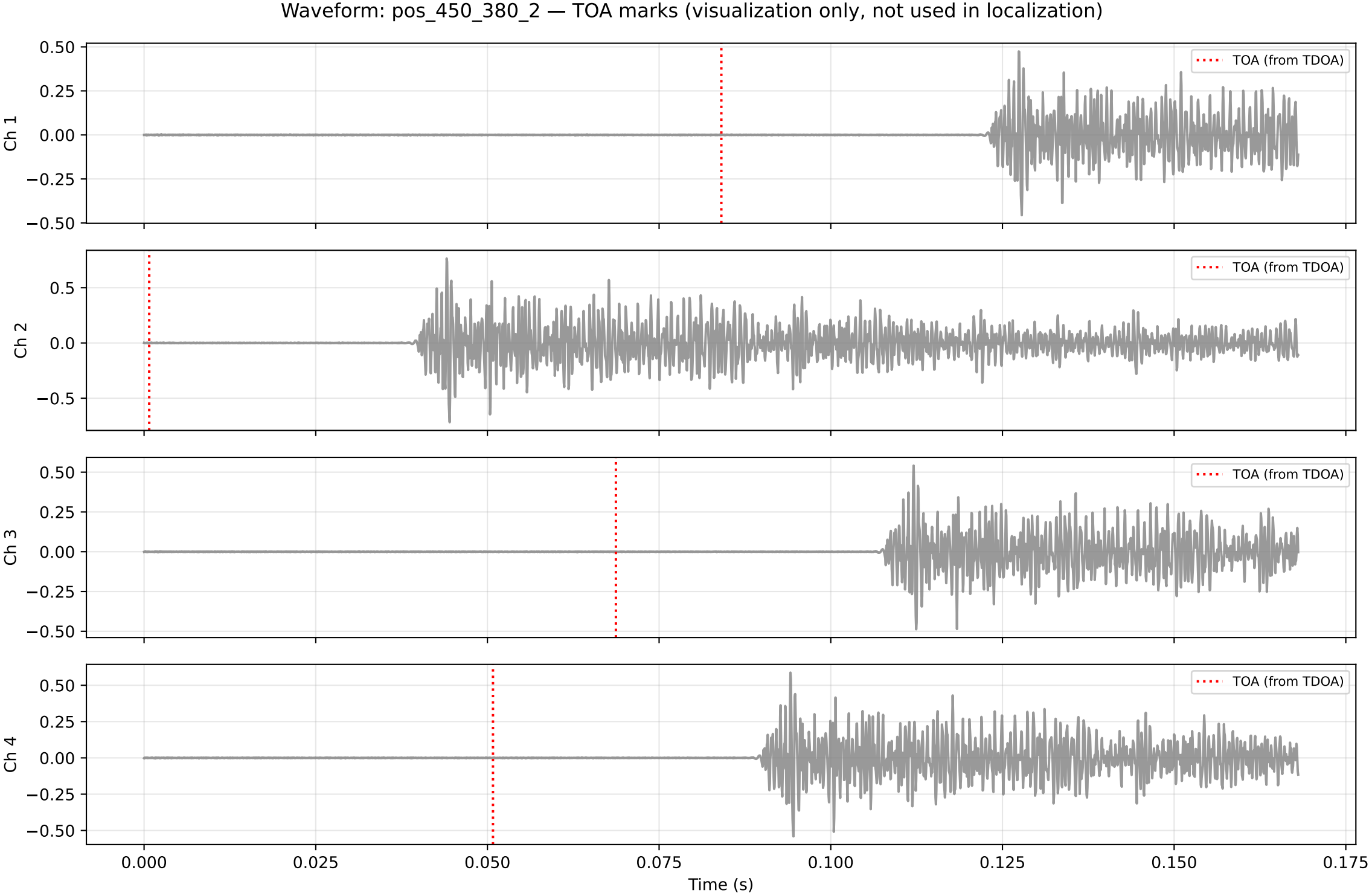
Localization results: error, avg error, GDOP

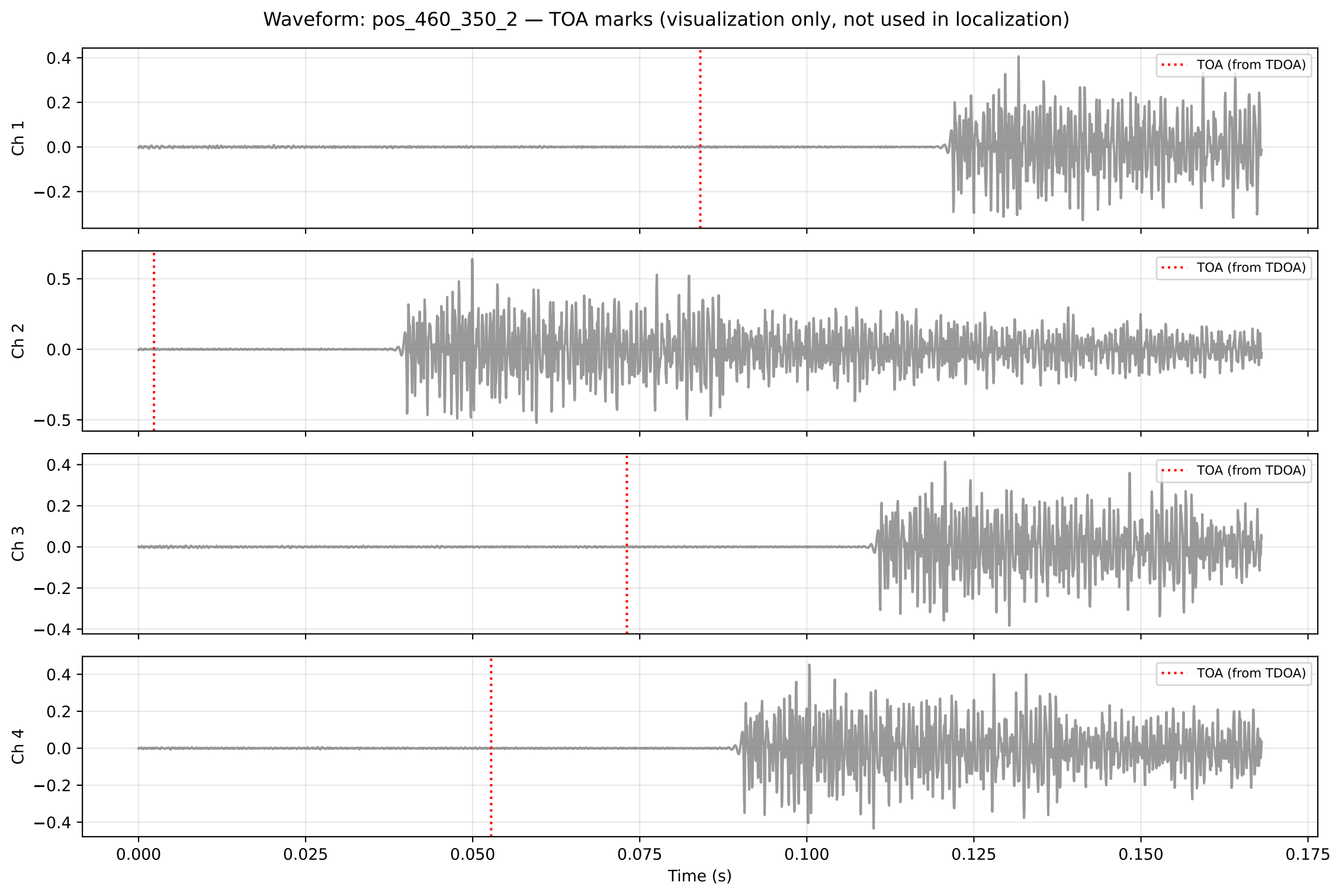
Position name	Ground truth (x,y,z) m	Estimated (x,y,z) m	Error (m)	GDOP	Uncertainty (m)	Confidence
pos_400_350_2	(400.00, 350.00, 2.00)	(393.70, 344.49, 2.00)	8.371	0.053	(3.19,1.67,0.00)	0.950
pos_450_380_2	(450.00, 380.00, 2.00)	(455.61, 384.77, 2.00)	7.364	0.053	(3.20,1.67,0.00)	0.950
pos_460_350_2	(460.00, 350.00, 2.00)	(459.36, 349.58, 2.00)	0.769	0.053	(3.24,1.69,0.00)	0.950
Summary			Avg error: 5.501 m	Mean GDOP: 0.05		Mean conf: 0.950


2D localization: sensors, ground truth, estimated, error lines
pos_400_350_2: err=8.37m, GDOP=0.053
pos_450_380_2: err=7.36m, GDOP=0.053
pos_460_350_2: err=0.77m, GDOP=0.053
Avg error: 5.50 m
Mean GDOP: 0.053
S3
S2
S4
S1
Sensors
Ground truth
Estimated
Y (North, m)
X (East, m)
400
350
300
250
200
150
100
50
0
0
100
200
300
400


3D localization: sensors, ground truth, estimated
Avg error: 5.50 m
Mean GDOP: 0.053
Sensors
X (East, m)
Y (North, m)
0
100
200
300
400
0
50
100
150
200
250
300
350
400
1.0
1.2
1.4
1.6
1.8
2.0


Waveform: pos_400_350_2 — TOA marks (visualization only, not used in localization)
Ch 1
Ch 2
Ch 3
Ch 4
TOA (from TDOA)
Time (s)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175


Waveform: pos_450_380_2 — TOA marks (visualization only, not used in localization)
Ch 1
Ch 2
Ch 3
Ch 4
TOA (from TDOA)
0.50
0.25
0.00
−0.25
−0.50
0.5
0.0
−0.5
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
Time (s)


Waveform: pos_460_350_2 — TOA marks (visualization only, not used in localization)
Ch 1
Ch 2
Ch 3
Ch 4
TOA (from TDOA)
Time (s)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175