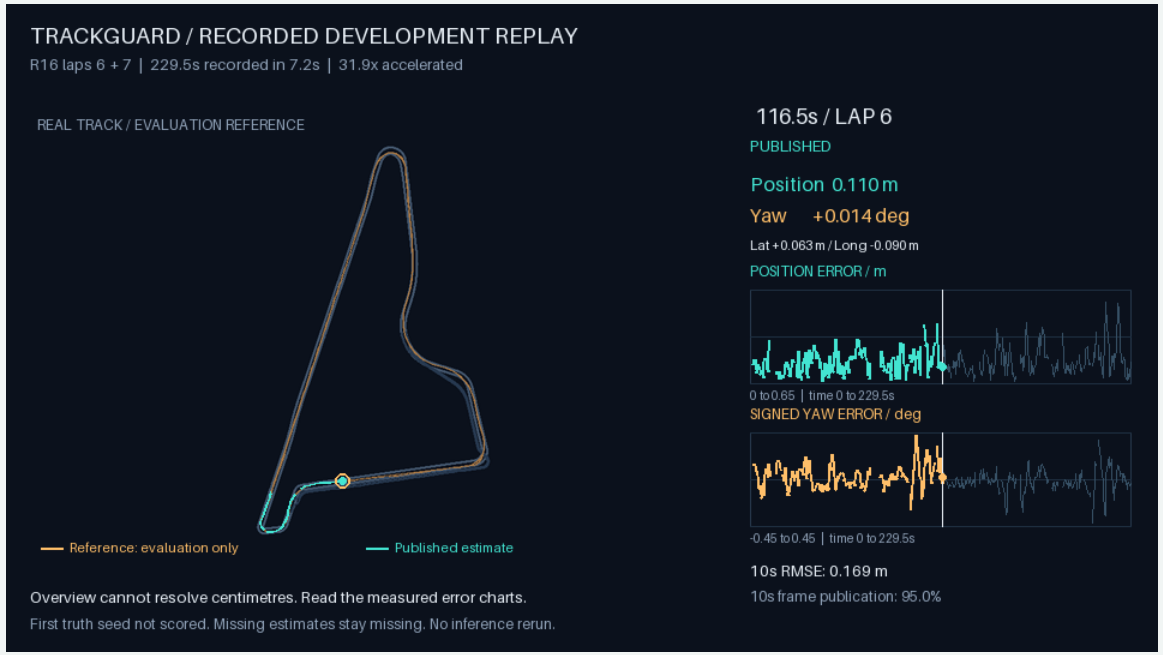
# Vehicle localization from the cameras you already run

Seven calibrated cameras, a reference map and motion signals produce one shared vehicle pose.

When geometric evidence is insufficient, the output is unavailable.

REAL TRACK / SEALED DEVELOPMENT REPLAY




**Laps 6 + 7. One seed. 49 unavailable outputs.**

| POSE AVAILABLE | UNAVAILABLE |
| --- | --- |
| `x` `y` `heading` | No pose published |

CUSTOMER DECISION

# An additional position signal for a mapped course

## Vehicle autonomy leads and track operators

When the existing position signal weakens, can camera evidence provide a useful second input?

THE PILOT DECISION

**Is the signal accurate and available often enough for our course and operating conditions?**

### Existing inputs

Compatible calibrated cameras and a reference map

### Proposed integration

A timestamped pose and explicit availability status

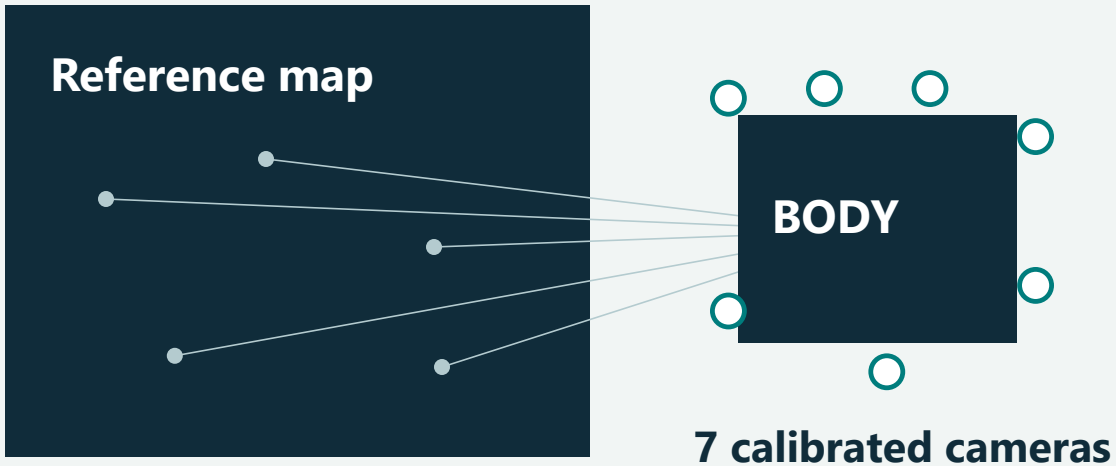
### Value to test

Useful supplementary coverage within the existing stack

SOLUTION

# One vehicle pose from map geometry and motion

SYNTHETIC ILLUSTRATIVE GEOMETRY




**7 calibrated cameras**
**1 shared body pose**

Map correspondences constrain camera poses.

Calibration ties cameras to one vehicle frame.
The quality threshold remains uncalibrated.

CAUSAL ESTIMATION

## 01 Geometry

Match the map and solve a consistent body pose.

## 02 Motion

Fuse motion signals with current and past evidence.

## 03 Quality gate

Publish an accepted pose or mark it unavailable.

VERIFIED AGGREGATE EVIDENCE

# Same-session development meets aggregate targets

Laps 6 + 7 / One continuous run / One initial truth seed / No lap 7 reset

**17.48cm**

**Position RMSE**

Target ≤20cm

**11.42cm**

**Lateral RMSE**

Target ≤20cm

**94.8%**

**One-second coverage**

Target ≥90%

| Metric | Observed | How to read it |
|---|---|---|
| Position error, p95 | 31.95cm | RMSE is not a per-output guarantee |
| Yaw / longitudinal RMSE | 0.107° / 13.23cm | Wrapped heading / along-track position |
| Within 20cm, all planned | 71.24% | 327/459 non-seed frames, unavailable = miss |
| Published / unavailable | 411 / 49 | 460 planned, 89.35% publication fraction |

Coverage counts occupied one-second bins. Development data is consumed, not untouched validation.

# Coverage and cold start remain the deployment blockers

## Original 131-second stress window

**18.48 / 9.95cm**

Position / lateral RMSE on published poses

**72% coverage: FAIL**

179/263 published, 84 unavailable.
Separate seeded window. Below 90% target.

## Blind day replay

**0 / 148**

Published / planned groups, all unavailable

**Never initialized**

No truth labels or initial seed. No RMSE.
No approved three-camera fix.

Next proof: independent day/night runs, reliable cold starts and calibrated confidence.
End-to-end latency is unproven. No production deployment or safety certification.

PROPOSED CUSTOMER PILOT

# One vehicle. One mapped course. A decision in four weeks.

## Offline replay, then shadow operation

Use compatible existing cameras and recorded motion signals. Keep the output outside vehicle control.

### Customer contribution

Course access, calibration, an independent evaluation capture and an agreed latency budget.

| Acceptance item | Proposed target |
|---|---|
| Independent day + night | Freeze map and parameters before capture |
| Position / lateral RMSE | ≤20cm each on published non-seed poses |
| One-second coverage | ≥90% in each agreed test condition |
| Cold start, no truth seed | ≥95% of agreed starts within 30s |
| Tail error + missing poses | Report p95 and all-planned within 20cm |
| Signal integrity + latency | 100% explicit unavailable states, measure p95 |

**Decision: extend the pilot only if the agreed gates pass.**