

ORIOMETER™

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Direct Optical Orientation from Incident
Radiant-Field Structure (non-imaging)

IP: Covered by issued U.S. patents: 10,698,067; 11,121,281; 11,150,318; 11,585,931. Additional filings planned.

Oriometer is an instrument-orientation sensor that reads how the radiant field changes across built-in micro-geometry to infer orientation. Using overlapping, rotated 1D angular response slices on-chip, it reports structured features of the incident radiant field immediately usable for estimation and control, with tiny SWaP, very low compute, and no moving parts.

Motion improves observability: as the platform moves, Oriometer's structured features provide temporal diversity ('motion-induced probing') that helps resolve the radiant-field condition more quickly than a stationary sensor (e.g., disambiguating lobes/structure as the platform moves).

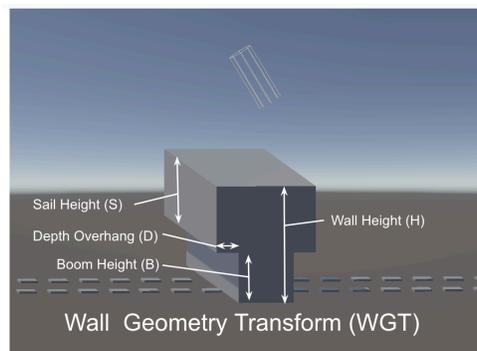
Outputs

- **Direction:** 3D unit vector (azimuth + elevation)
- **Condition:** angular spread metric; multi-lobe radiant field signature features
- **Confidence:** redundancy / self-consistency metric (observability proxy)
- **Update rate:** kHz-class (photodiode-limited)
- **Pose-normalized irradiance proxy:** cosine-aware feature reduces orientation-induced intensity variation

Why geometry

- Ratio-based against fixed geometry (robust to intensity scaling)
- Overlapping slices provide redundancy near boresight and consistency checks
- No lens, no image formation, no scene reconstruction (low compute)

Wall Geometry Transform (WGT) is a compact parameterization of wall geometry that tunes slice slope/overlap and sets the direction/condition sensitivity trade space.



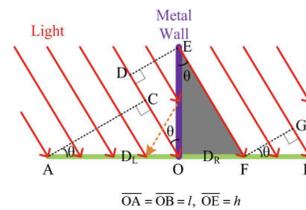
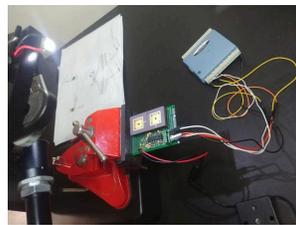
Wall Geometry Transform (WGT): H (height), D (overhang depth), S (sail height), B (boom height)

Spectral-agnostic architecture: demonstrated in VIS/NIR; adaptable toward SWIR/MWIR/LWIR with appropriate detector materials and packaging.

Distributed autonomy capability: Automatic Frame Unification — a shared orientation reference across platforms/structures/personnel for consistent reporting and coordination.

Evidence, validation plan, and limits (summary)

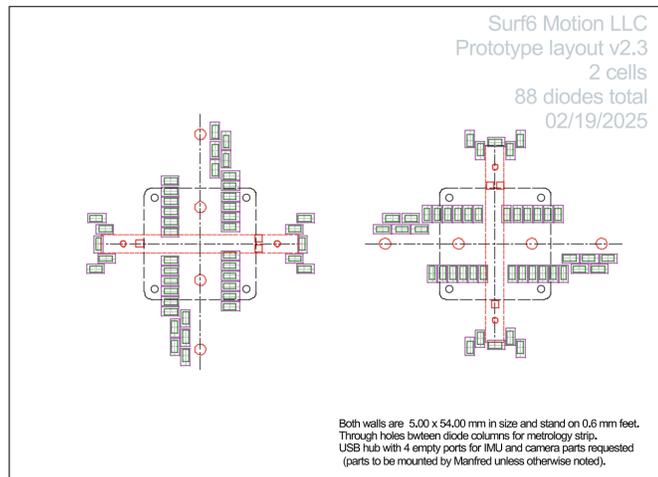
Hardware evidence: a 2019 bench prototype using two orthogonally mounted CMOS light-direction research chips demonstrated bilateral differential shading behavior and repeatable angular signatures in a four-LED environment; PCB pose was cross-checked against camera-based motion capture system ground-truth.



Bench prototype (2019): two orthogonally mounted CMOS light-direction chips (minimum viable 2D).

Validation plan (staged and performed using 2000x scale instrumented parts)

- Controlled angle sweeps → voltage-to-angle LUT; verify monotonic differential response
- Spread discrimination (near vs far apparent extent) → validate signal-floor behavior
- IMU fusion: quantify IMU-only drift vs Oriometer-referenced orientation; bias convergence
- Two-node frame alignment: demonstrate shared orientation reporting in a common radiant field



2000× instrumented PCB with two orthogonal sensing cells (VEMD8081 diodes). Each cell includes wall-end diodes that provide an orthogonal second-plane projection, enabling independent per-cell recovery of elevation (α) and obliquity (φ) and cross-validation for LUT & inversion stability testing.