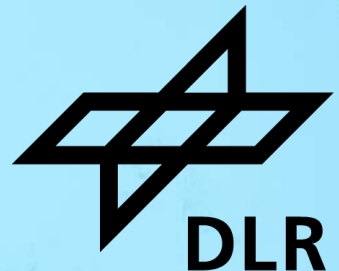


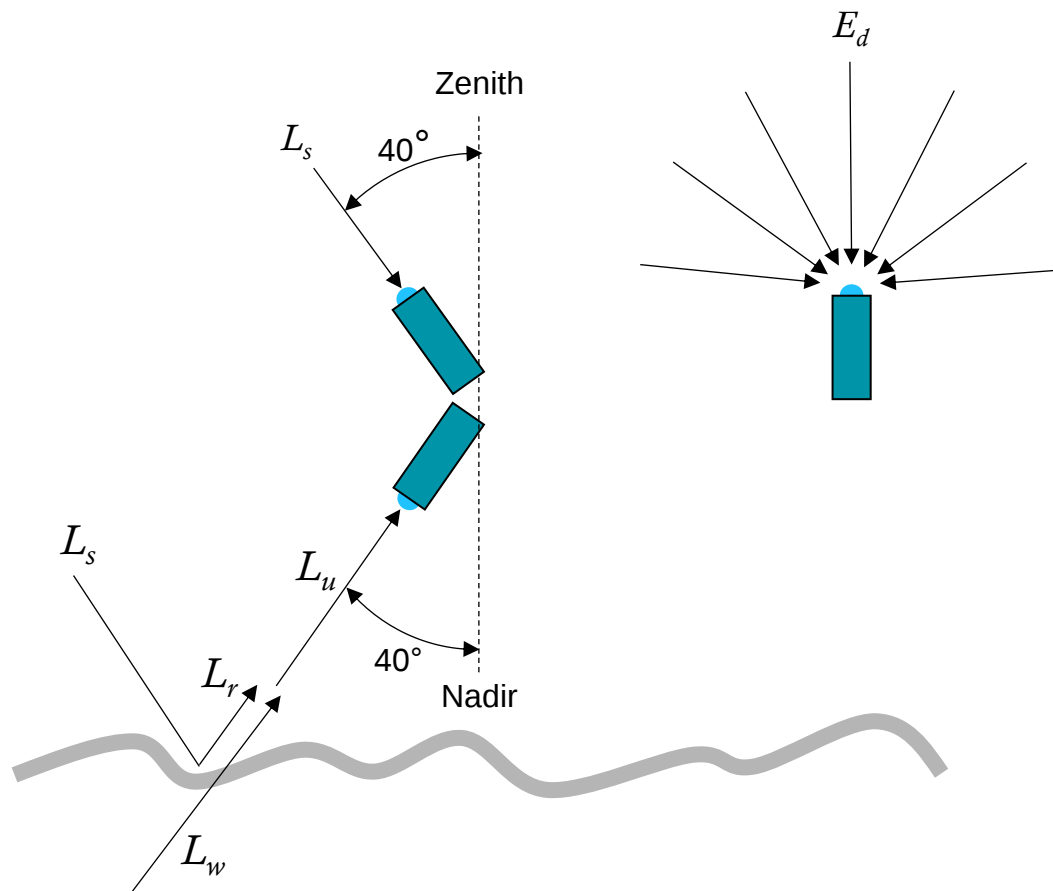
LIMNOVIS

A new platform for optimized in-situ validation measurements at inland water bodies

Stefan Plattner



Measuring R_{rs}



$$R_{rs}(\lambda) = L_w(\lambda) / E_d(\lambda)$$

$$L_w(\lambda) = L_u(\lambda) - L_r(\lambda)$$

$$L_r(\lambda) \sim L_s(\lambda) \cdot 0.028$$



Influence from Boat and Crew

Problem

The ship's hull and superstructures, including the persons on the boat ...

- ... may reflect a significant amount of light towards the measurement target or spectrometer
- ... may cast a shadow to the area measured
- ... may cover a significant part of the hemisphere seen by the E_d sensor when it is not mounted at the highest point

Solution

unmanned boat (USV) with a lower cross-section



Drift and Rotation

Problem

Due to wind and current, boats tend to turn or move. During a series of measurements, this can cause inconsistent results due to

- **unwanted rotation:** changing measurement geometry, casting shadows, sunglint
- **unwanted movement:** changing water body, changing bottom type, changing water depth

Solution

ship/boat capable of holding position and orientation simultaneously and **independently**



aqUAVis: Drone based reflectance measurements

Vehicle

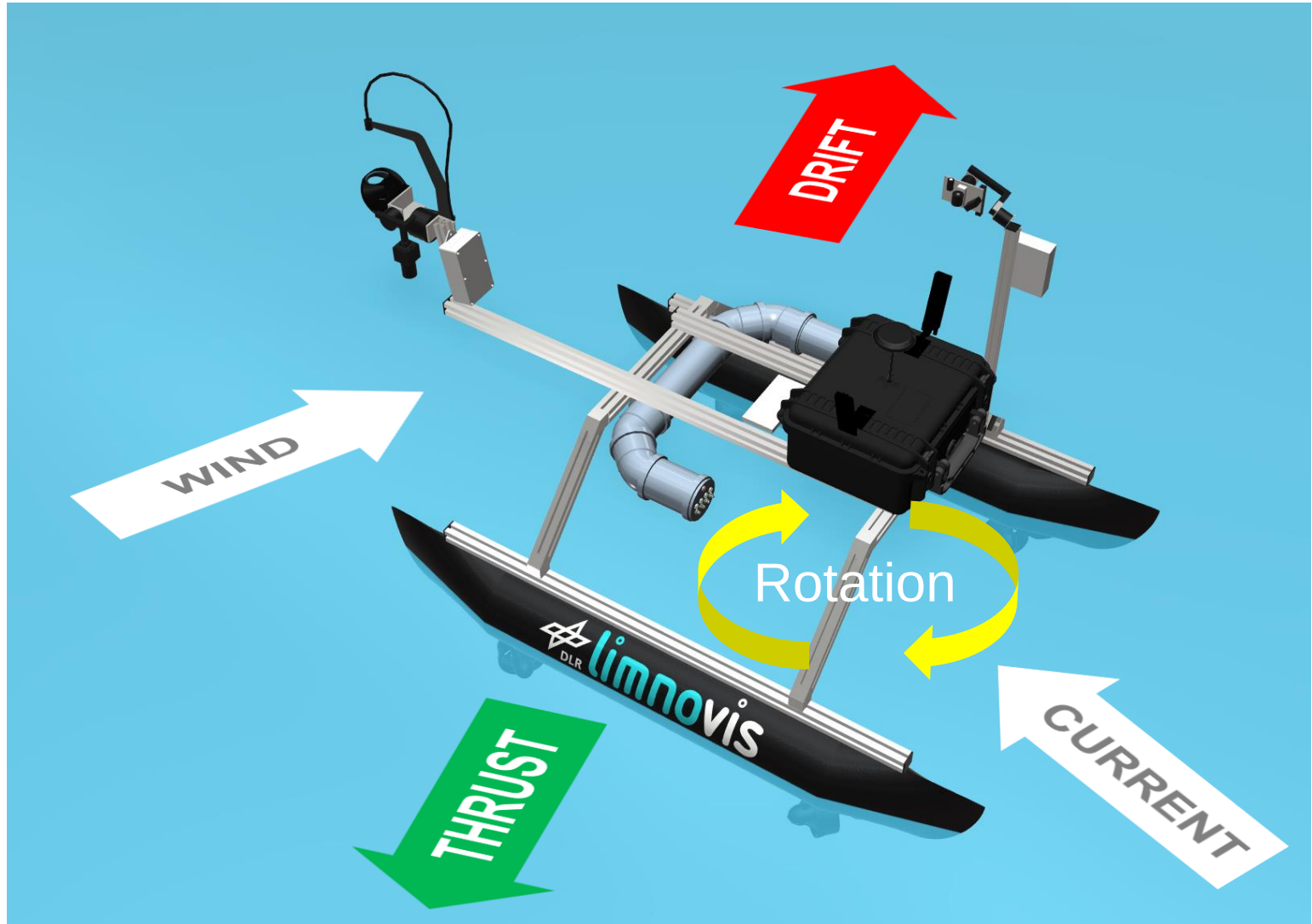
- DJI S900
- 2x Ibsen Freedom VIS
- $L_u + E_d$ simultaneous, gimbal stabilized



LimnoVIS: USV with Omnidirectional Maneuverability

Vehicle

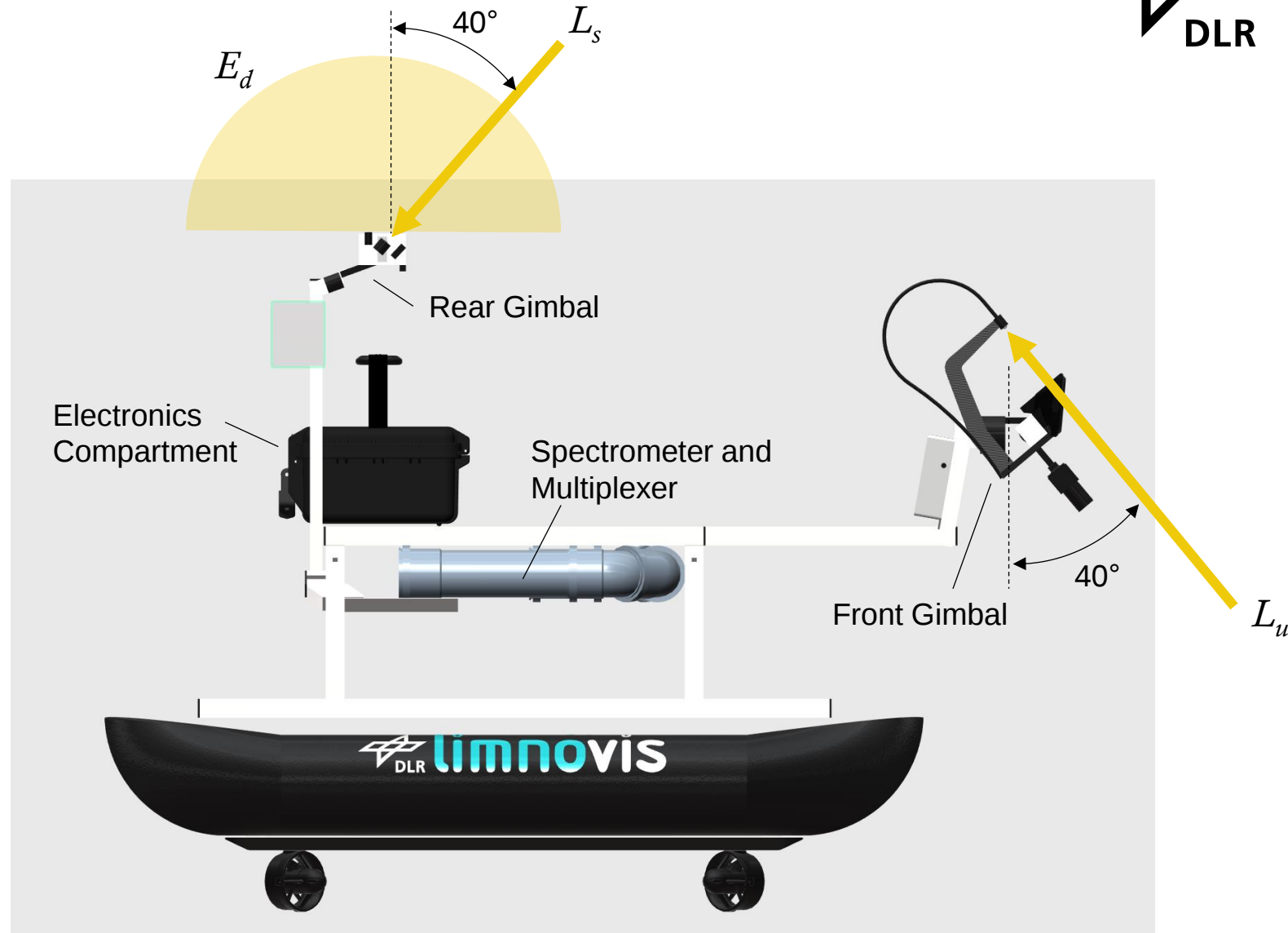
- operates remotely controlled or autonomously
- compact size:
approx. 1.5 m x 1 m
- precise RTK GPS
(acc. up to 1 cm)
- positioning accuracy ~10 cm
- can keep/change position and orientation **independently**



LimnoVIS: Measuring R_{rs}

Setup

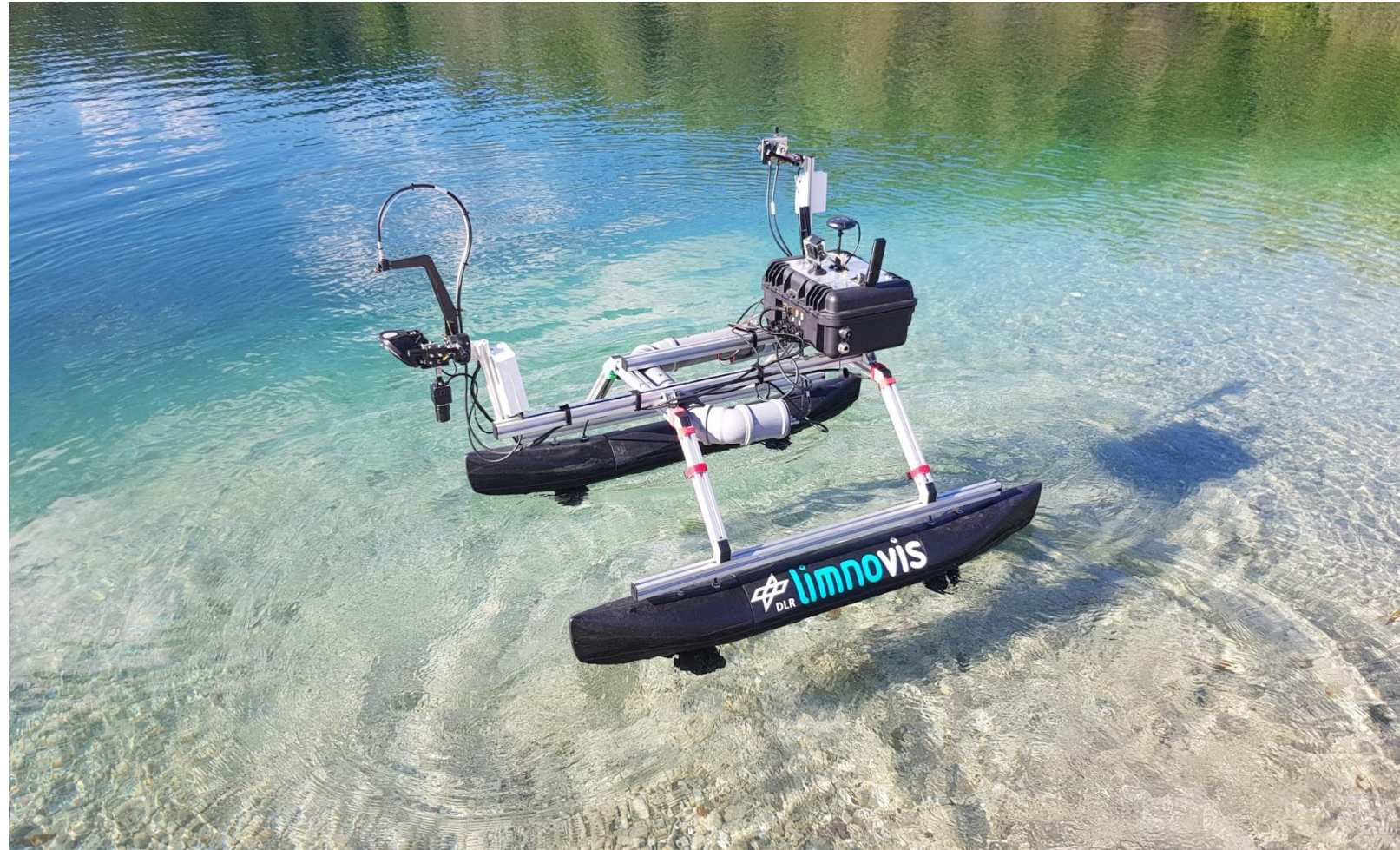
- optics for measuring L_u and L_s can be set to an arbitrary viewing angle
- optics are gimbal-stabilized to compensate for waves
- E_d can be measured by a dedicated optics with cosine corrector or via L_u optics and diffuse reflectance standard
- 3 different reflectance standards can be turned into the L_u light path



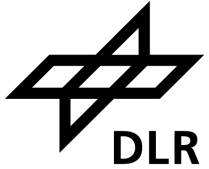
LimnoVIS: Measuring R_{rs}

Setup

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LimnoVIS: Measuring R_{rs}



Hold Position and Orientation

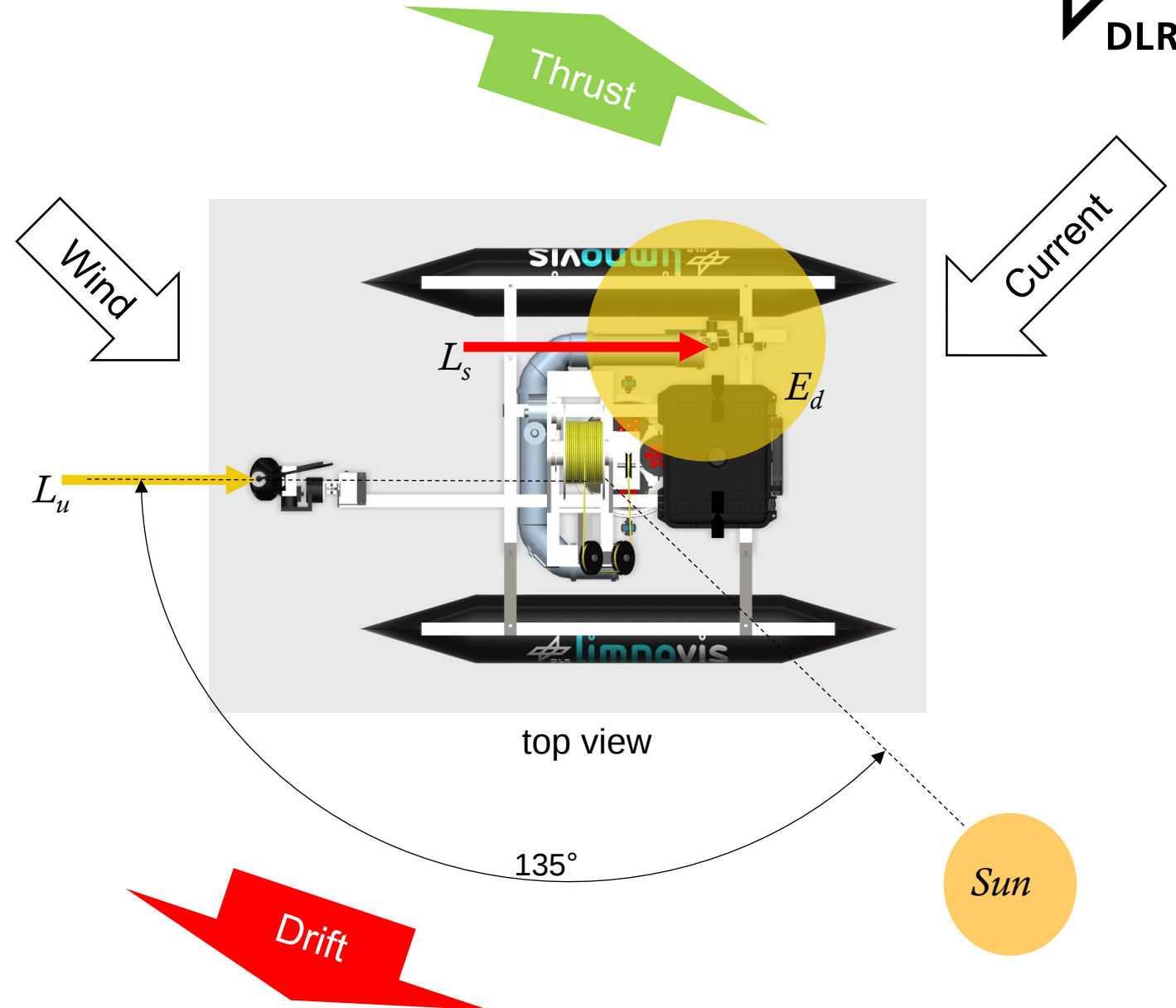
- stationary measurement with fixed position and orientation

Hold Position + Change Orientation

- BRDF Measurements

Change Position + Keep Orientation

- measuring transsects with constant orientation





Topic: **LIMNOVIS**
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