PreciLabs

Absolute Direct
2D to 6D position sensing
Micrometer precision “GPS”

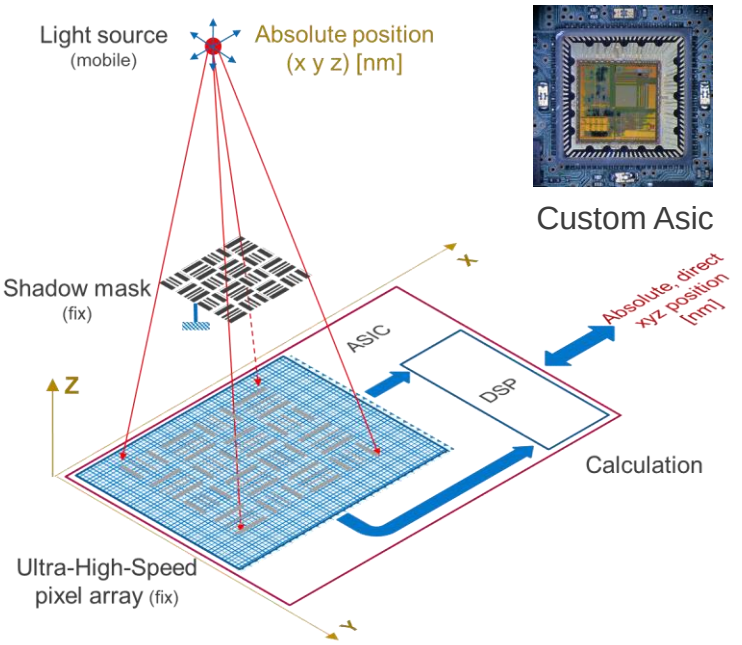
With **Direct, Absolute Multi-Dimensional, Multi-Axis position sensing,** PreciLabs patented technology

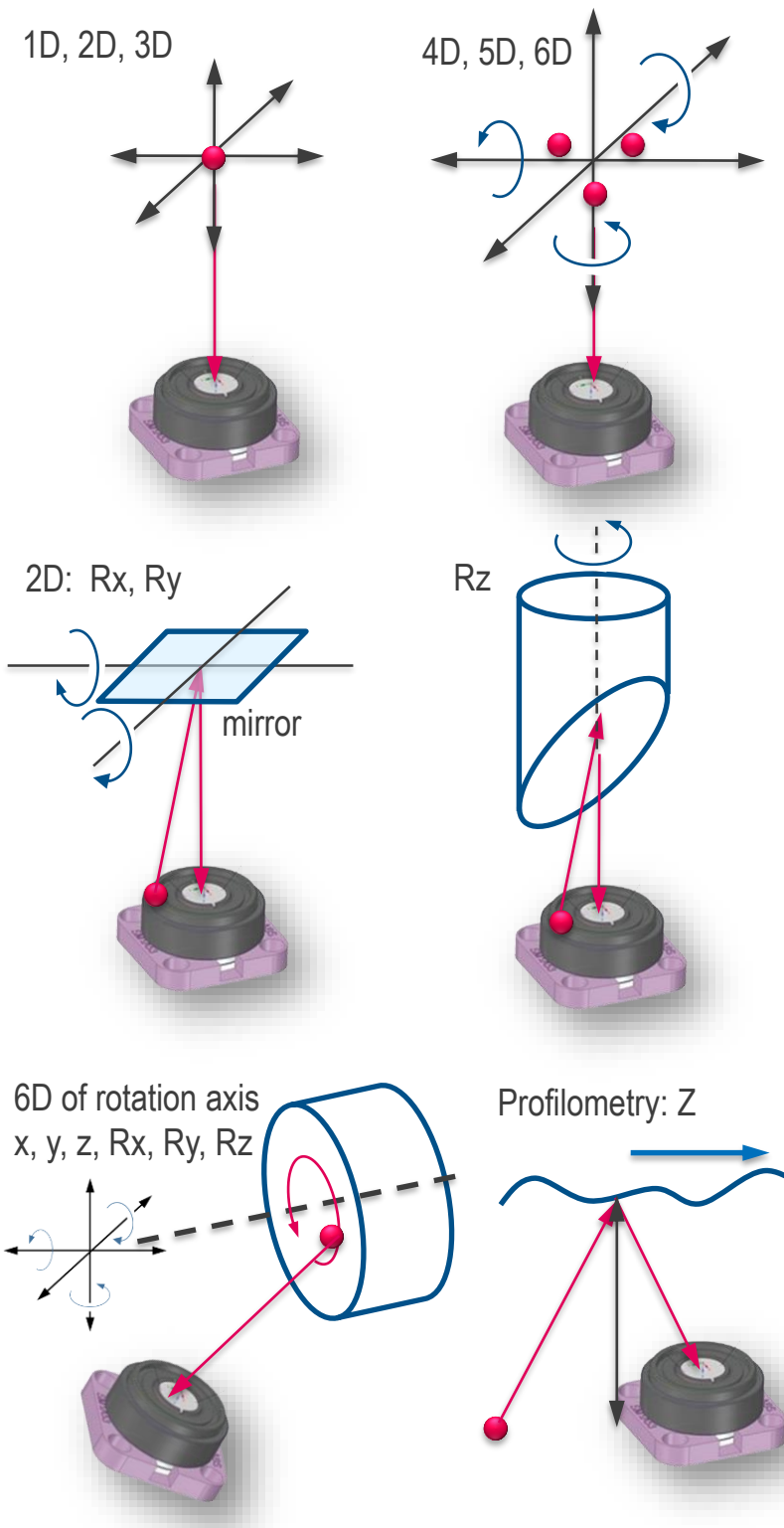
- is the **first industrial, multi-dimensional encoder** solution on the market
- **increases resolution and accuracy** of absolute position sensing thanks to the direct, contactless approach and goes beyond the fundamental limits of todays 1D linear and rotary encoders,
- **enables high speed** up to **100kHz**
- and **improves reliability, safety** thanks to scalable redundancy of the patented 2D absolute codes
- Compensates static assembly tolerances and dynamic tolerances due to thermal and mechanical load variations in operational environment

PreciLabs’ position sensing allows high-speed calculation of **2D absolute position** up to **100 kHz** with better than **0.01 um resolution** and with **sub-micrometer accuracy**. The position sensing enables also multi-dimensional measurements, e.g. **3D position of a light source by triangulation**.

PreciLabs provides a new paradigm for the encoder and position sensing markets with its one-fit-all 2D to 6D direct absolute position sensing, offering higher performance alternative in the operational environment, new features at lower cost than indirect multiple 1D encoder measurement in existing systems.

PreciLabs Advanced Position Sensors are offered as PreciLabs branded products for system integrators or White Label product to sensor manufacturers. The modularity of the design offers different connectivity protocols and the option to design custom enclosure around the PreciLabs sensor module hardware. For higher volume application, PreciLabs provides a reference design based on PreciLabs position sensing components and firmware.





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Technical advantages of PreciLabs technology:

- ✓ Offering **one-fit-all solutions,** nanometer-precision, **1D to 6D contactless absolute position measurement** in working volumes from <1 cm^3 up to >1 km^3 and beyond
- ✓ **100-1,000 times higher frame-rate** than existing imager-based solutions up to few 100 kHz, **10-100 times larger resolution** in 1D to 6D position than COTS-based Multi-D encoders today.
- ✓ Sufficient **redundancy** for error detection and error correction up to 50% scale damage, and Safety Integrity Level certifications (SIL2,3)
- ✓ **Single-sensor compensation** of static and dynamic tolerances
- ✓ Miniaturization of the sensor down to **6x6x1 mm^3** (size of the sensor ASIC)
- ✓ Advanced ASIC design and process with **operating temperature up to 150°C**
- ✓ Can be interfaced also **with incremental encoder-based systems**

Parameters	Units	Perf.
max. Resolution (linear)	bits/m	27
max. Resolution (rotary)	bits/turn	24
Position refresh rate	frames/s	100’000
Scale speed (linear)	m/s	200
Scale speed (rotary)	rev./min (rpm)	50’000

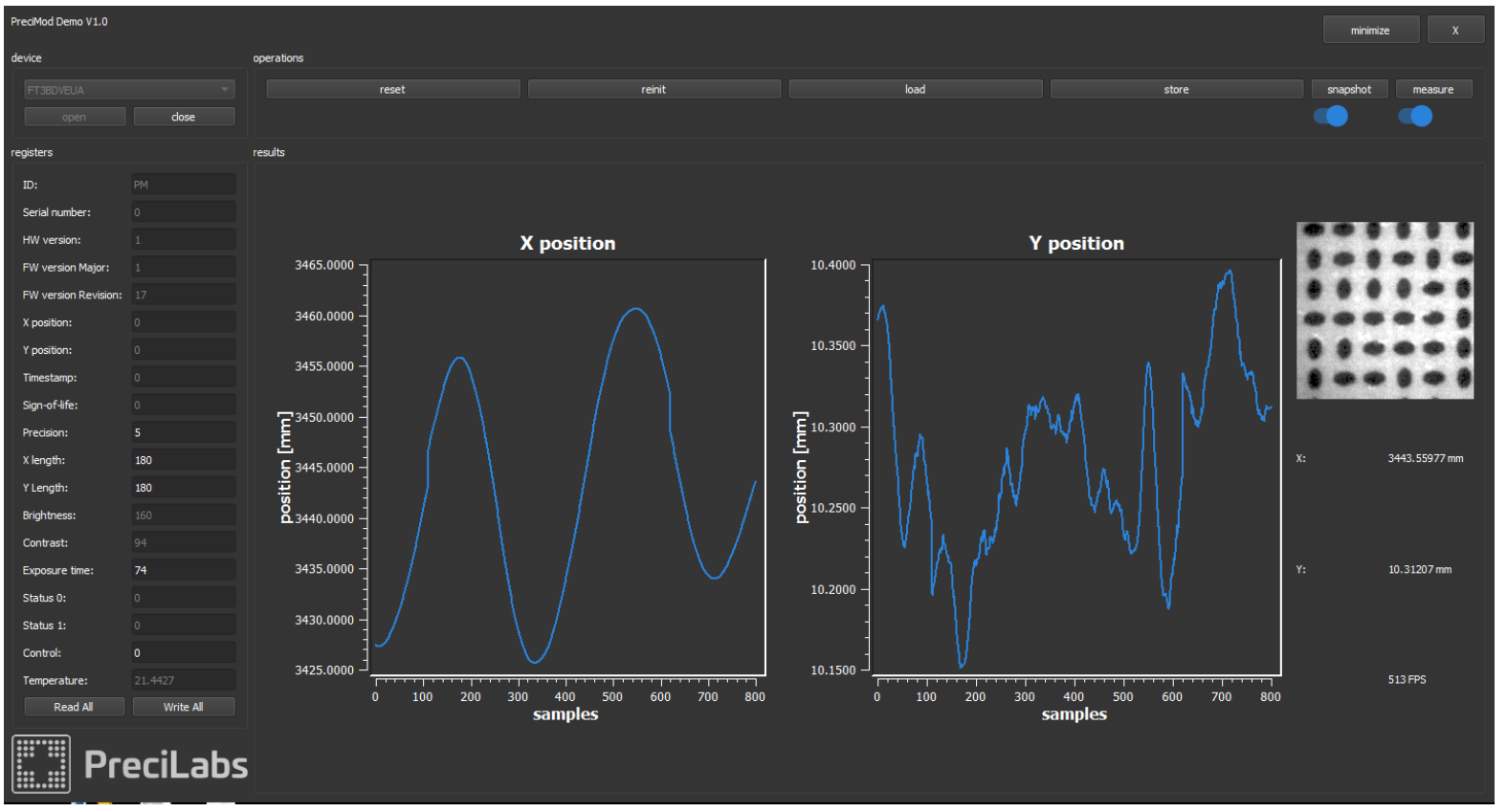
Measuring 3D position, x, y, z of a light source in space:

Range: ~10mm ~100mm ~1000mm
Resolution: 1-10nm 10-100nm 0.1-1 um

Measuring the angular position of a shaft using Hollow Shaft (HS) or End of Shaft (EOS) encoder, performance up to:

22bit/rev and 1’000’000 rpm @ ø2mm, 26bit/rev and 100’000 rpm @ ø20mm, 27bit/rev and 50’000 rpm @ ø40mm, 29bit/rev and 9’000 rpm @ ø200mm

Measuring the 6D position of a Rotation Axis (e.g. turning, grinding machines) with better than 0.1 um (x,y,z) 0.1 urad (Rx,Ry,Rz) precision



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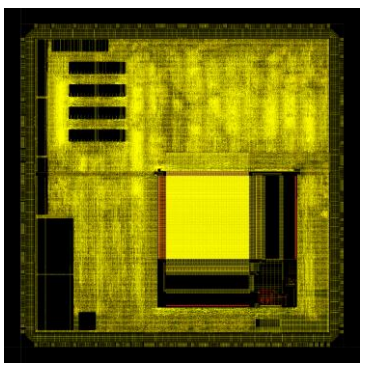
Application examples:

- Innovative rotary encoders, End Of Shaft (EOS) and Hollow Shaft (HS) with high mounting tolerances
- LiDAR for autonomous vehicles, using beam-deflection, beam-steering, sub-urad precision 2D mirror position, compensating dynamic variations in challenging operational environment
- 2D-6D AR/VR control units or other instruments position sensing
- Medical robot assisted surgery, at very high-precision and reliability
- Miniature precision motors, e.g. BLDC, robotics
- CNC (Computer Numerical Control) machines (grinding, milling, turning,…) sub-micrometer, sub-micro-radian precision 6D rotation axis measurement
- Precision linear, rotary, 3D to 6D stages for laboratory or electronics, semiconductor manufacturing
- Hexapods, delta robots for precision assembly & metrology
- Industrial metrology, 3D scanning, CAD manufacturing verification, deflection monitoring, 3D trackers, walk-around scanners, inclinometers, touch trigger probes, scanning probes
- LASER displacement sensors
- Factory automation, 3D LASER profilers
- 2D, 3D printers
- Camera motion mechanisms
- 3D scanning and profilometry
- MEMS based accelerometers, gyroscopes
- Micro-radian precision sun-tracking
- Range finder with orientation
- 6D force sensor
- Torque sensor
- Systems for military and sports applications



5x5mm PreciSen Asic Floorplan

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