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Tobii Pro Spectrum

Capturing the fastest eye movements for extensive behavioral research

Tobii Pro Spectrum

Is our most advanced eye tracking platform, designed for extensive studies of human behavior and the mechanics of fast eye movements. Tobii Pro Spectrum is a powerful system that ensures superior, reliable data quality — opening up new possibilities in fields like psychology, developmental studies, neuroscience, reading research, and ophthalmology.

Data you can trust

Tobii Pro Spectrum platform has been designed to ensure the highest data quality and reproducibility. We have evolved our patented eye tracking algorithms, developed a sophisticated hardware design as well aspremium hardware components. The system is accurate and precise with unparalleled tracking robustness, making it possible to study a very large portion of the population in real-life conditions.

- The 3D eye model delivers superior gaze data, including wide gaze angles and all corners of the screen.
- Two eye tracking cameras, both taking up to 1200 images per second of both eyes.
- Demonstrates extremely robust tracking capabilities, regardless of ethnicity, age, or corrective lenses.
- Detects eyes instantly with minimal data loss during blinks or when subjects look away.
- Maintains high accuracy, precision, and tracking robustness as the subject moves their head and in varying lighting environments.
- Allows precise synchronization of gaze information with data from other sources, such as EEG, GSR, or ECG.
- Captures pupil data at the same sampling rate as the gaze data.
- Provides eye images to help researchers understand the events that affect the data.

Unmatched freedom of movement

Tobii Pro Spectrum tolerates more head movements than any other high-frequency screen-based eye tracker on the market. The system provides saccadic event resolution and extremely precise data.

This unique combination of capabilities allows researchers to explore human behavior and cognitive processing, as well as the mechanics of the fastest eye movements (such as saccades, tremors, and micro-saccades), without interfering with the behavior of the subject. With its ability to track free-moving subjects, Tobii Pro Spectrum facilitates research with children and other participants who would otherwise need a chin rest to control their movement.

- Very high tolerance for both large and rapid head movements in all directions.
- Tracking resumes quickly if the subject moves in and out of the track box.Flexible setup and sync options

Tobii Pro Spectrum provides flexibility to accommodate a wide array of research scenarios and study designs.

The system can be used with or without the provided screen, enabling you to track both on-screen and real-world stimuli. Multiple sampling rate options accommodate everything from fixation-based research to studies with more intense requirements on data granularity and time-based measurements.

The TTL port and precise timing enable seamless synchronization capabilities with external biometric data sources, providing a holistic view of behavior.

- 8-bit TTL port receiving sync events from external systems.
- Easily removable 24" screen.

Simple, ingenious design

The simple setup, configuration, and automation of Tobii Pro Spectrum allow you to add advanced eye tracking to your research with little effort. Researchers at all levels of expertise can use the system without extensive training.

The eye tracker comes fully assembled in the supplied travel case and doesn't require manual configuration such as the setup of cameras and lenses. Researchers can rely on quick, stable calibrations of subjects and productively track the subjects they have attained for their study.

- Software for the standalone configuration accommodates studies that involve real-world stimuli.
- VESA mounting available for fixed table or wall installation.
- Handle allows for smooth adjustment when accommodating subjects of different heights.

Software options

Tobii Pro Spectrum works with Tobii Pro Lab — our versatile software platform designed to meet the high demands of research scenarios with exact timing accuracy. Tobii Pro Lab offers an efficient workflow, making it easy to design experiments, record data, analyze and visualize eye tracking data, and sync this data with other biometric data streams.

Tobii Pro SDK offers a broad set of tools that makes it simple to develop niche applications or scripts across multiple platforms, using a wide range of programming languages. The dev kit gives researchers access to the full set of eye movement data streams relevant to their research, such as 3D eye coordinates, raw data, and pupil data.

Tobii Eye Tracker Manager is a compliment to Tobii Pro SDK and has been designed to facilitate the configuration of the eye tracker, such as setting the sampling rate or configuring the display area.

Transparent product quality methods

The high data quality of Tobii Pro Spectrum has been confirmed through extensive testing. We use well-documented test methods that span from systematic variations of the environmental conditions to a general assessment of the eye tracker performance with a large population of individuals. Consistent reproducibility in studies is guaranteed with quality control procedures throughout the entire production process, including camera focus and the calibration of each unit. Multiple product certifications ensure that quality and user safety requirements are met.

Technical specifications

Eye tracking specifications

Eye tracking technique	Video-based pupil- and corneal reflection eye tracking with dark and bright pupil illumination modes. Two cameras capture stereo images of both eyes for robust accurate measurement of eye gaze and eye position in 3D space, as well as pupil diameter
Eye tracking mode	Three modes for tracking different groups of primate species: Human, great ape, monkey, small monkey
Sampling frequency	60, 120, 150, 300, 600, or 1200 Hz (max. frequency depends on hardware version)
Precision[1]	0.01° RMS at optimal conditions2 0.06° RMS at optimal conditions (raw signal)
Accuracy[1]	0.3° at optimal conditions
Binocular eye tracking	Yes
Eye tracker latency[3]	Mean latency < 2 ms at 1200 Hz (SD < 0.2 ms)
Blink recovery time	1 frame (immediate)
Gaze recovery time	Less than 150 ms
Data sample output[4]	Timestamp, gaze origin, gaze point, pupil diameter
Eye openness stream	Eye openness stream has the same frequency as the gaze stream and will have the same timestamps. Eye openness data is provided in millimeters for each eye individually.
Eye image data stream	Eye image stream frequency is approximately 10 Hz (one image with both eyes) Zoomed-in eye images available in tracking mode Full-frame camera images are available in gaze recovery mode
TTL input stream	8–bit timestamped data (256 event codes. Event-driven detection with a timestamp accuracy of 50 µs
Tracker and client time synchronization	Integrated between the eye tracker time domain and the client computer time domain with an accuracy of 100 µs

[1]Tobii uses an extensive test method to measure and report performance and quality of data. For more information, the approproate data quality test report is available on our customer portal: https://connect.tobii.com.

[2]Applying Savitzky-Golay filtering (settings in Tobii Pro data quality test report).

[3]Visit Tobii Connect for more information on how to optimize your Tobii Pro Spectrum setup. Note: FW v.2.6.1 and Tobii Pro SDK v.1.9 or later are required to obtain the stated performance.

[4]For the complete list of available data and the supplementary data stream, Tobii Pro SDK documentation is available on our customer portal: https://connect.tobii.com.

Software and framework compatibility

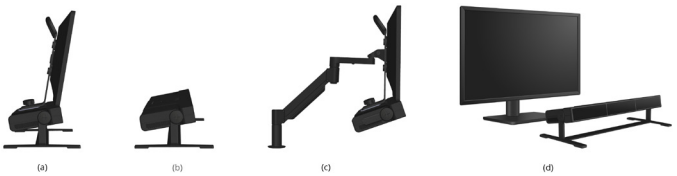
Software and framework compatibility	Tobii Pro Lab, Tobii Pro Eye Tracker Manager, Tobii Pro SDK Any application built with Tobii Pro SDK
Operating system	Windows, macOS, Linux

Hardware versions

	300 Hz, 600 Hz, 1200 Hz

Setup

Head movement tolerance	Excellent — dual-camera system delivers more images than a single camera system, enabling a more accurate data calculation and the best level of precision and robustness for head movement
Freedom of head movement[5] (at 65 cm distance)	Width x height: 34 cm x 26 cm (13.5" x 10") (at least one eye tracked)
Freedom of head movement5 (at 75 cm distance)	Width x height: 42 cm x 26 cm (16,5" x 10") (at least one eye tracked)
Operating distance (mounted on screen)	55 to 75 cm (22" and 30") from the eye tracker
Optimal screen size	24" (16:9 aspect ratio)
Tracker setup options	Various setup possibilites to support different ways of presenting stimuli



(a) Screen and eye tracker mounted together
(b) Standalone eye tracker
(c) Tracker and screen mounted on any standard VESA mount
(d) Eye tracker used with external monitor

Recommended monitor	Supplied 23.8" monitor

[5]Describes the region in space where the participant can move their head and still have at least one eye within the eye tracker's field of view (track box) at the specific distance.

Eye tracker unit

Dimensions (L x H x W) in cm/inches	55 x 18 x 6 (22" x 7" x 2") the eye tracker is mounted on a stand, which raises it from the surface by 9 cm (approximately 4")
Weight	5.1 kg (11.4 lbs.) or 5.7 kg (12.9 lbs.) including power supply unit
Connectors	TTL input: 8-bit (DB-9 connector) Communication: Ethernet (RJ-45 connector) Power supply: 24 VDC (5.5 mm connector)
Data processing	Fully embedded
Eye tracking cameras	2
Illuminators	Dark pupil Illumination Modules, Bright pupil Illumination Modules
User camera mount	Standard 1/4" thread
Power consumption	Typical power consumption: 60 W Max. rated power consumption: 96 W
Power options	Input: 100-240 VAC 50/60 Hz; Max. rated power consumption: 120 W; No load power consumption: <0.15 W; Energy efficiency level: VI; Complies with EISA 2007/DoE, NRCan, AU/NZ MEPS, EU ErP, and CoC Version 5

Monitor

Monitor model name	EIZO FlexScan EV2451
Panel type	IPS, LED backlight
Screen size (diagonal)	23.8"
Weight	3.8 kg (8.4 lbs), incl. mounting
Aspect ratio	16:9
Resolution	1920 x 1080 pixels
Screen response time	5 ms (gray-to-gray)
Built in speakers	1.0 W + 1.0 W
Power supply	100-240 VAC 50/60 Hz
Connectors	DVI, VGA, HDMI, Display port, 1 port for monitor control (USB 3.0), 2–port USB hub (USB 3.0), C13 power connector, Audio input connector: 3.5 mm, headphone jack: 3.5 mm
Power	Max. rated power consumption: 42 W, typical power consumption: 13 W, Power Save Mode: 0.5 W, Power Management: Power Save (VESA DPM, DisplayPort 1.1a, and DVI DMPM)

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