# Neurologger® with 3D animal tracking!

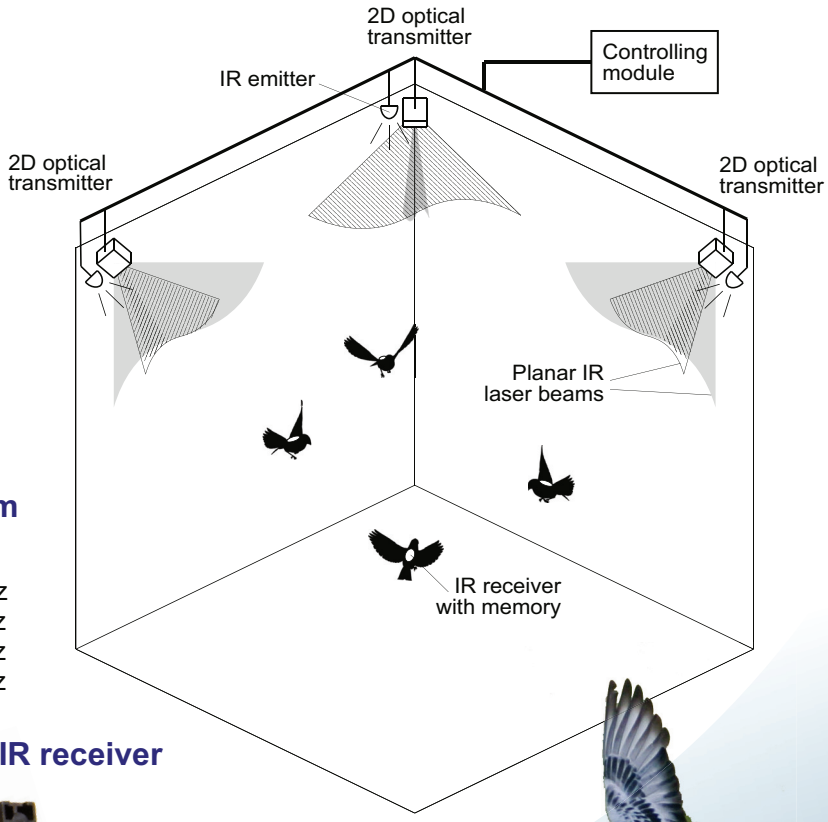
## Records neuronal brain activity and indoor positional data

*Invented by Evolocus®*

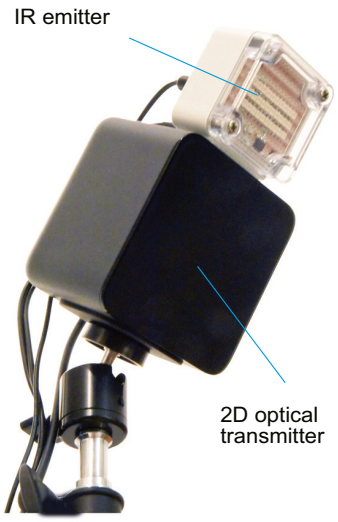
Neurologger with 3D tracking can be used for position measurement with a sub-centimeter accuracy of terrestrial and avian species in the laboratory. It can be attached to a collar, to a backpack, or to an animal head.

The position measurement is based on the detection by the Neurologger of a planar infrared (IR) laser beam moving through the experimental environment with constant angular speed. The precise time of this detection serves as a measurement of the angular coordinate.

### 3D tracking system

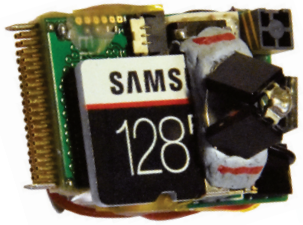



### Components of 3D tracking system




*Scanning rates*
1 transmitter: **60** Hz
2 transmitters: **30** Hz
3 transmitters: **20** Hz
4 transmitters: **15** Hz

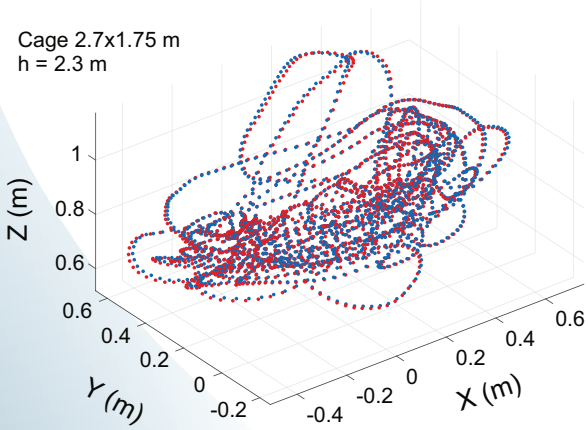
### Neurologger 3 with IR receiver



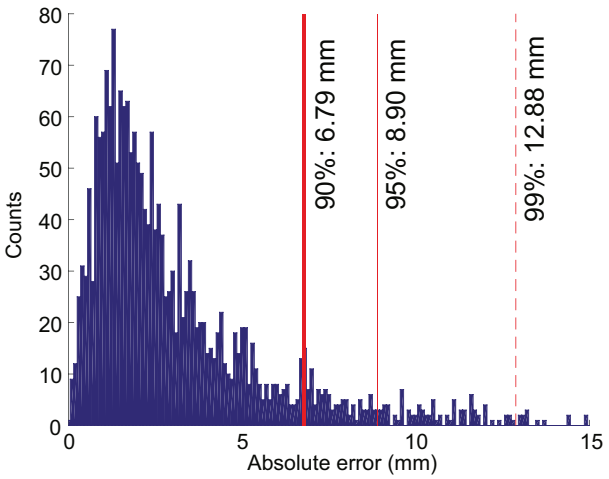

Weight with 50 mAh battery – **3.5** g
Weight with 50 mAh battery and **32**-ch neuronal headstage – **4.4** g (shown)

### 3D optical tracking achieves sub-centimeter accuracy 3.1 ± 2.7 mm (Mean ± SD)

Blue track – Optical transmitters 1, 2;
Red track – Optical transmitters 3, 4
Continuous movement during ~ 2 min




### Euclidian distance between a point of one track and spline-interpolated second track




Tracking accuracy data from Neuroscience 2017 poster 235.22, with permission

Simultaneous tracking of multiple animals is possible. A typical application is investigation of social interactions.In addition to optical tracking capabilities Neurologger 3 has an inertial tracking subsystem. It consists of 3D accelerometer, 3D gyroscope and 3D magnetometer (magnetic compass). All these 9D motion sensors have 16-bit resolution and can be polled with frequencies up to ~700 Hz.

The inertial tracking subsystem complements the optical tracking providing relative animal position at a higher sampling rate. It also helps to reconstruct animal path in case of challenging conditions, when optical transmitters are temporarily occluded. If the logger is attached to the animal head, the inertial tracking subsystem provides precise, drift-free 3D head orientation. In conjunction with a high-accuracy 3D tracking, head orientation can give additional information about animal behavior that can be especially important for studying of social interactions.

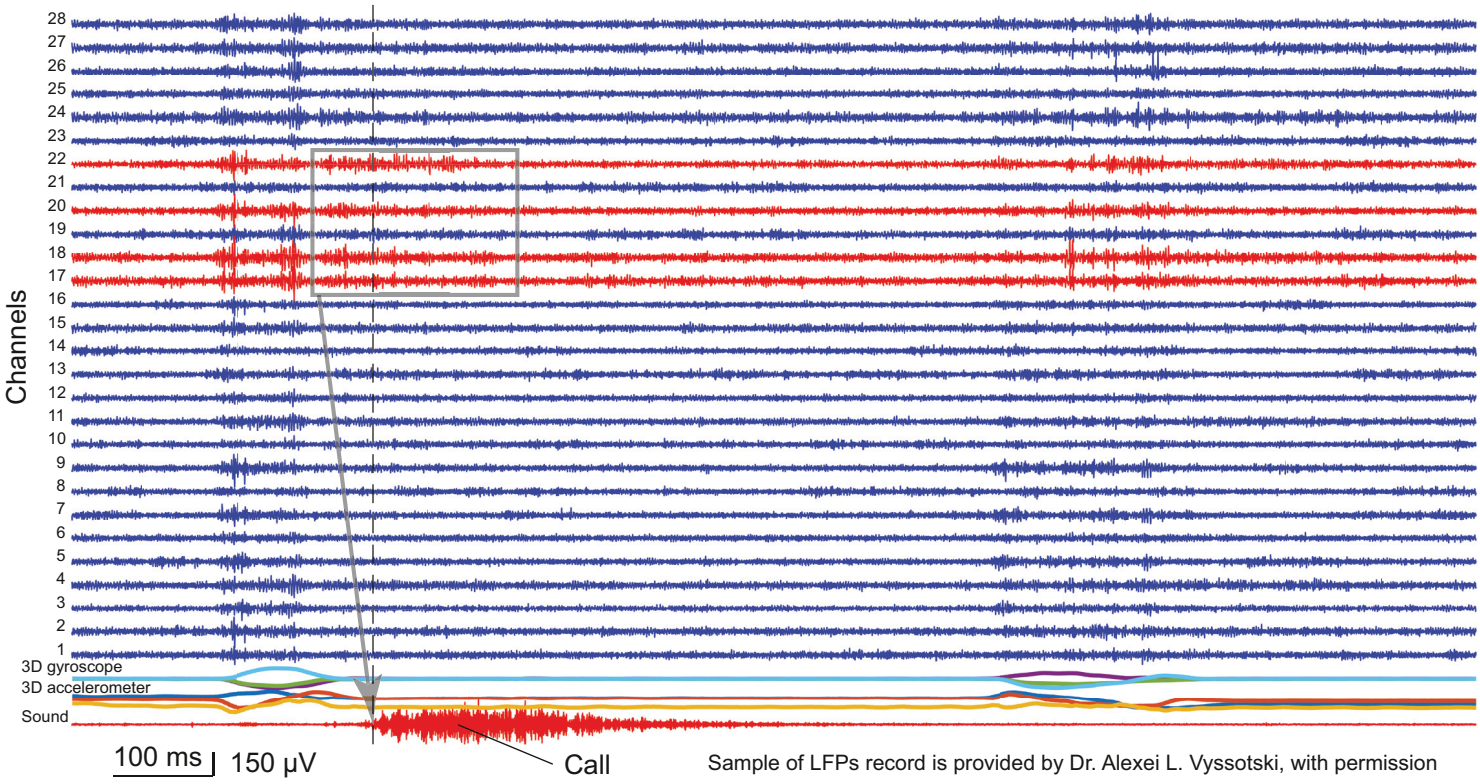
Notably, all tracking sensors can gather information simultaneously with neuronal data (or EEG/LFPs) and animal vocalization. For instance, 32 neuronal channels can be sampled with frequency 15.625 kHz, microphone – 125 kHz, 9D motion sensors – 625 Hz.

Low current consumption (6.5 mA) of Neurologger 3 in EEG mode (32 channels, 250 Hz) allows longitudinal (> 24 h) experiments with small animals (e.g. in sleep research).

3D tracking Neurologger 3 at the head of a jackdaw

2D optical transmitter, IR emitter and video camera for observation mounted behind protective organic glass in the aviary

An example of 28-channel record of brain surface local field potentials (LFPs) in a jackdaw during head movements and a call. Electrophysiological signals were band-pass filtered (0.3-3.0 kHz) to reveal multiunit activity. Note detection of vocal premotor activity in a set of posterior electrodes shown in red (in a gray rectangle).




Sample of LFPs record is provided by Dr. Alexei L. Vyssotski, with permission

Neurologger is a registered trademark
Protected by U.S. patents #8,160,688: #9,492,085. Other patents pending.

Evolocus

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