

Welcome



LightWatcher Data Recorder

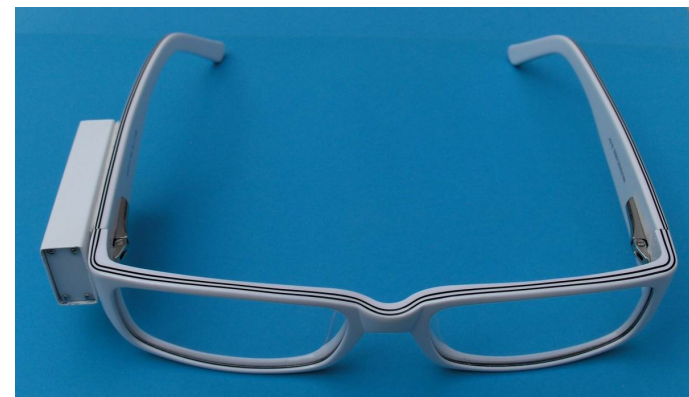
Luzian Wolf

Wolf Technologieberatung (Object-Tracker)
Vienna, Austria



LightWatcher Data Recorder

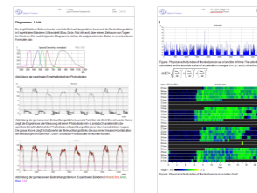
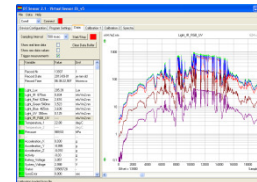
- Small, portable instrument for lab- and field measurements
- Measures 12 important ambient variables of the working environment of test subjects
- Application areas: Studies of biological rhythms, sleep-wake cycles, level of activity and well-being, work medicine, shift work, light therapy, architecture, design of work places.



LW – Components

The LW system consists of the following components:

1. LW Data Recorder
2. LW anatomical mounts
3. LW software (OT-Sensor)
4. LW analysis und reporting tool





LW Data recorder – Characteristics 1

Measures 12 important ambient variables:

- Illuminance (Lux),
- Irradiance (IR-, red-, green-, blue-, UV-light),
- Accelerations (x,y,z – directions)
- Temperature, barometric pressure, rel. humidity



- 20 x 50 x 10 mm
- 12 grams
- 256.000 data records
- USB interface
- Li-polymer battery



LW Data recorder – Characteristics 2

- Recording interval: 0.5 seconds to 30 minutes
- Acceleration: 30 measurements per second
- Measurement interval 1 second → 3 days
- Measurement interval 10 seconds → 1 month
- 1-button operation, scheduler
- Charge time 1.5 hours, standby time 3 months





LW Data recorder – Characteristics 3

- Dynamic gain adjustment
- Range for light measurements: 5 – 6 decades
- Spectral width of optical filters : 70 - 100 nm
- Optical axis : longitudinal direction of housing
- Aperture : Cosine, half-angle ~ 75 deg
- PTFE (Teflon) window





LW Data recorder – Characteristics 4

- Class 1 medical device
- Housing: polished aluminium, Teflon
- Desinfection with, e.g.:
- Mikrozid AF Liquid TM ,
- Antiseptica Kombi TM 0.5 %,
- Antiseptica Kombi TM Liquid / Spray)

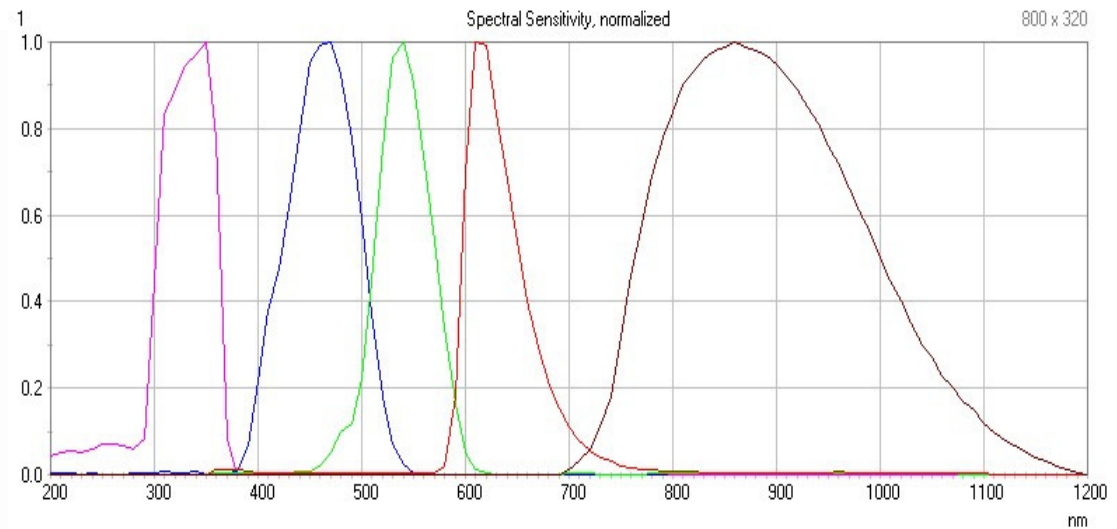
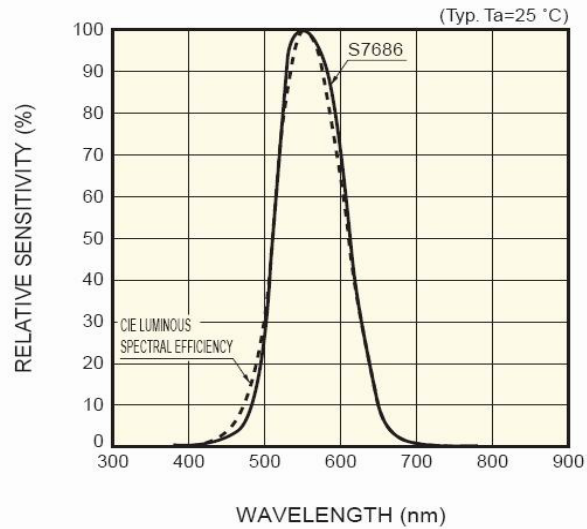
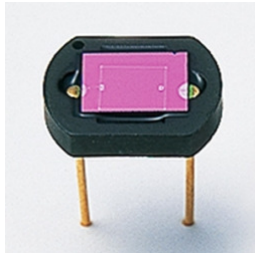




LW Data recorder - Specifications 1

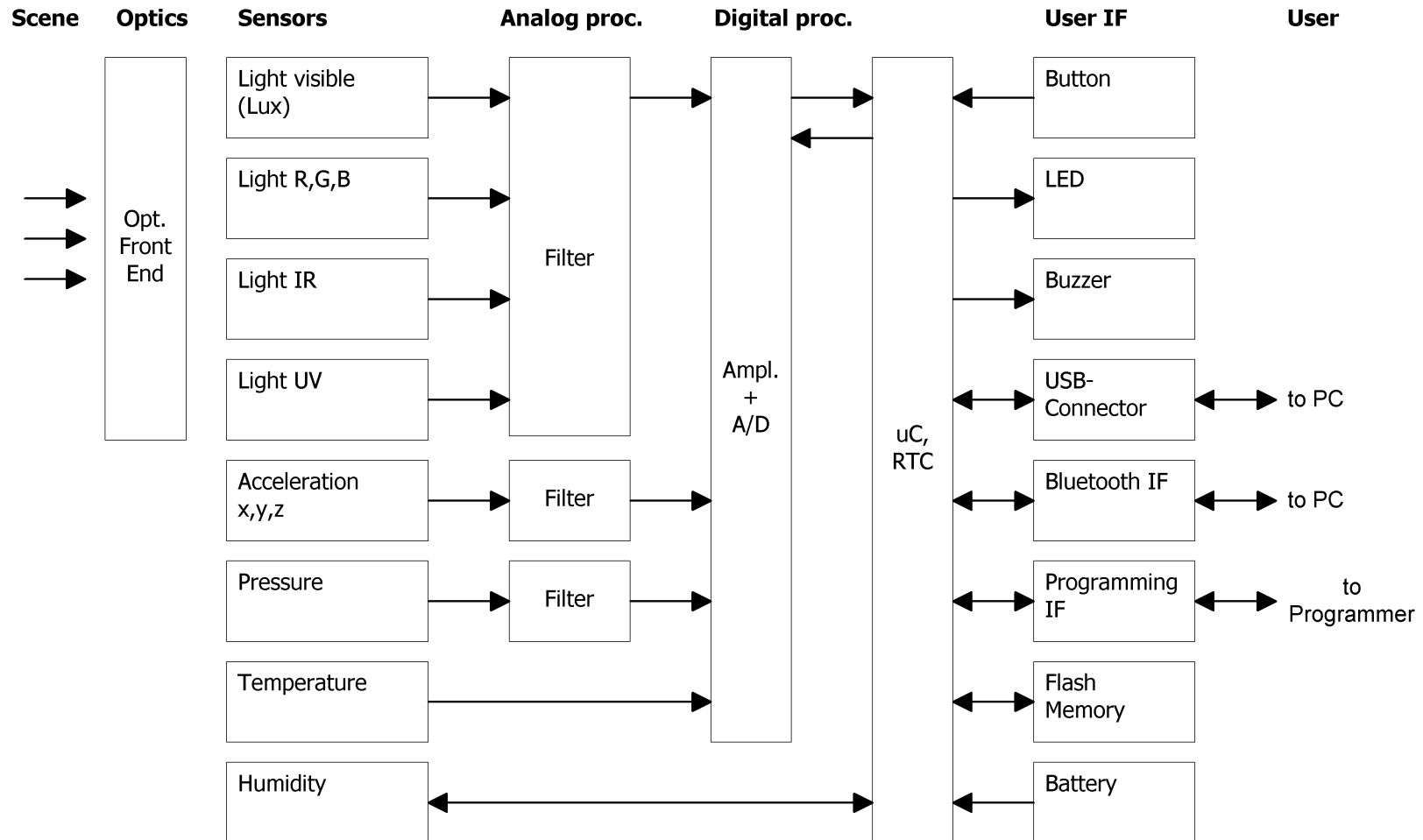
| Nr | Variable | Range | Res. | Unit |
|----|-------------------------------|---------------|------|-----------------------|
| 1 | Illuminance | 0.0 to 100000 | 0.1 | Lux |
| 2 | Irradiance IR light 860 nm | 0.0 to 2000 | 0.01 | mW/m ² .nm |
| 3 | Irradiance red light 620 nm | 0.0 to 3000 | 0.01 | mW/m ² .nm |
| 4 | Irradiance green light 540 nm | 0.0 to 3000 | 0.01 | mW/m ² .nm |
| 5 | Irradiance blue light 460 nm | 0.0 to 3000 | 0.01 | mW/m ² .nm |
| 6 | Irradiance UV light 350 nm | 0.0 to 2000 | 0.01 | mW/m ² .nm |
| 7 | Temperature | -50 to +80 | 0.01 | deg C |
| 8 | Barometric pressure | 0.0 to 1500 | 0.1 | hPa |
| 9 | Rel. humidity | 5 to 98 | 0.3 | % |
| 10 | Acceleration X | -3.0 to +3.0 | 0.01 | g |
| 11 | Acceleration Y | -3.0 to +3.0 | 0.01 | g |
| 12 | Acceleration Z | -3.0 to +3.0 | 0.01 | g |
| 13 | Activity index | 0.0 to 10.0 | 0.01 | g |

LW Data recorder - Specifications 2





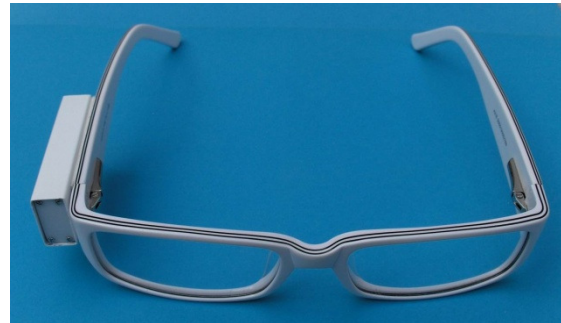
LW Data recorder – Functional diagram





LW – Anatomical mounts

Eyeglas



Headset



Badge
Necklace

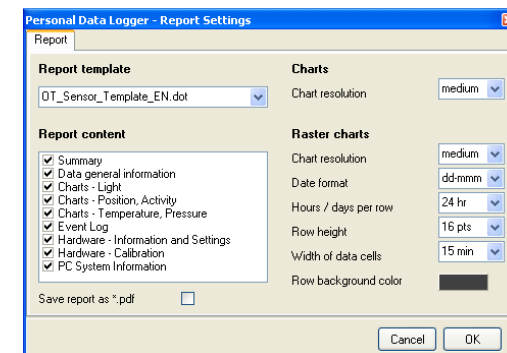
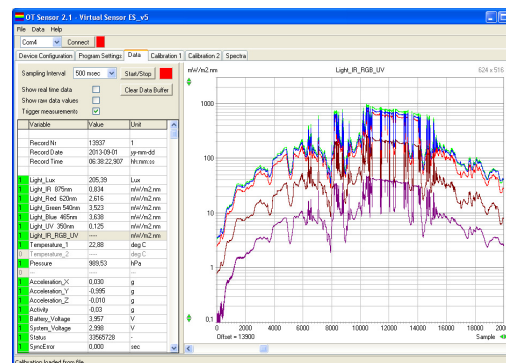
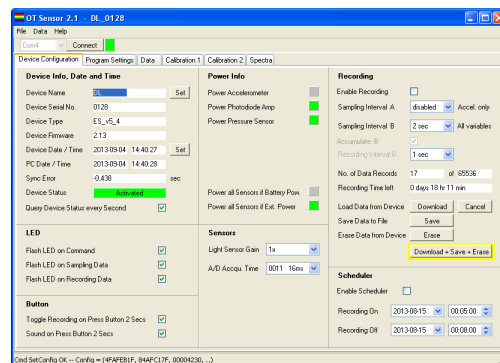




LW - Software

Many useful functions:

- Configuration of the data recorder
- Calibration of sensors
- Online check of correct function
- Download of recorded data to PC
- Display, processing, editing, and archiving of data
- Statistical analysis and reports (.doc, .pdf)



LW - Software

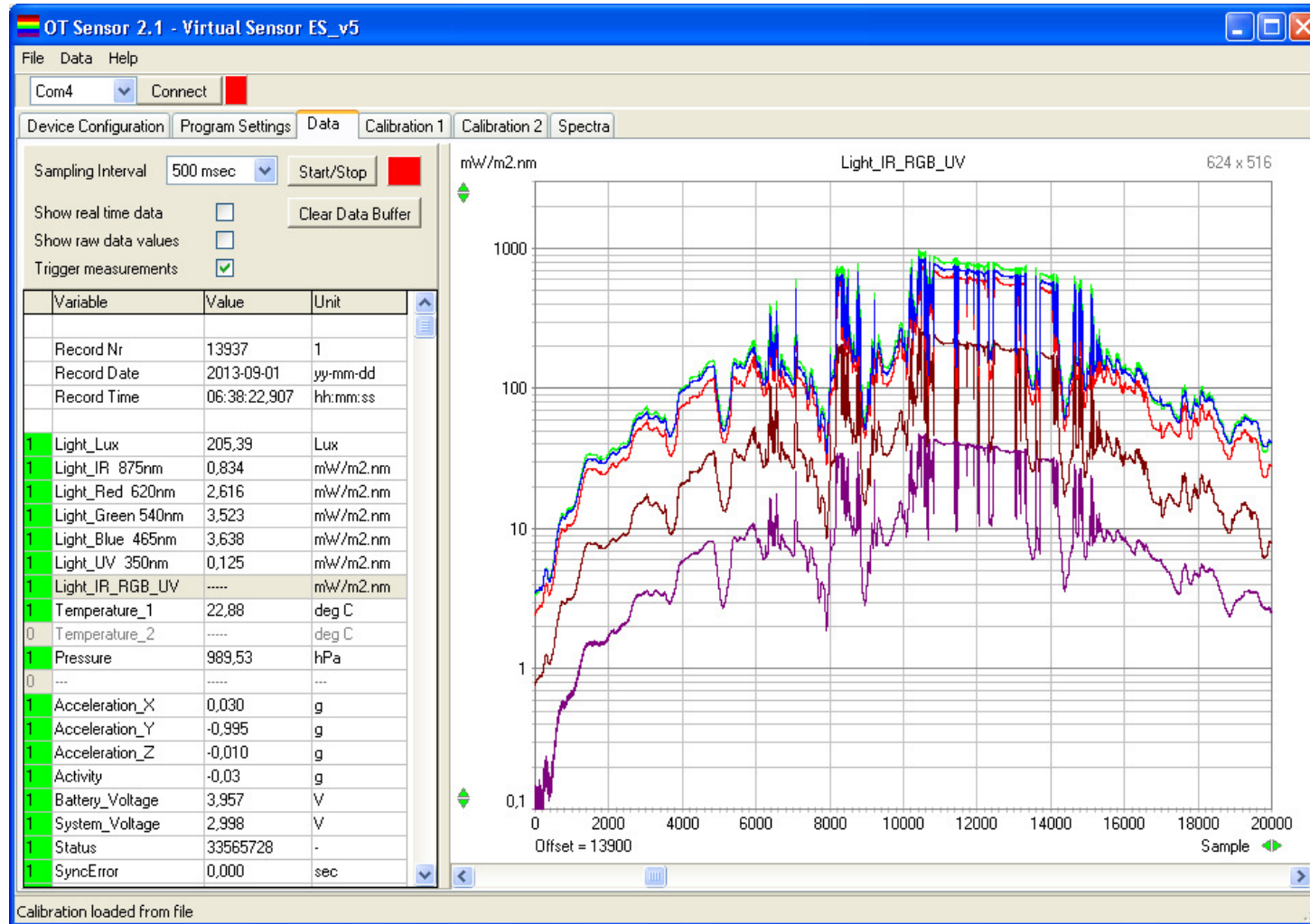


The screenshot shows the 'OT Sensor 2.1 - DL_0128' software window. The interface is divided into several sections:

- Device Info, Date and Time:** Fields for Device Name (DL), Device Serial No. (0128), Device Type (ES_v5_4), Device Firmware (2.13), Device Date / Time (2013-09-04 14:40:27), PC Date / Time (2013-09-04 14:40:28), Sync Error (-0.438 sec), and Device Status (Activated).
- Power Info:** Checkboxes for Power Accelerometer, Power Photodiode Amp, Power Pressure Sensor, Power all Sensors if Battery Pow., and Power all Sensors if Ext. Power.
- Recording:** Enable Recording checkbox, Sampling Interval A (disabled), Sampling Interval B (2 sec), Accumulate B (checked), Recording Interval B (1 sec), No. of Data Records (17 of 65536), and Recording Time left (0 days 18 hr 11 min). Buttons for Download, Cancel, Save, Erase, and a highlighted 'Download + Save + Erase' button.
- Sensors:** Light Sensor Gain (1x) and A/D Accqu. Time (0011 16ms).
- LED:** Checkboxes for Flash LED on Command, Flash LED on Sampling Data, and Flash LED on Recording Data.
- Button:** Checkboxes for Toggle Recording on Press Button 2 Secs and Sound on Press Button 2 Secs.
- Scheduler:** Enable Scheduler checkbox, Recording On (2013-08-15 00:05:00), and Recording Off (2013-08-15 00:08:00).

At the bottom, a status bar shows: 'Cmd SetConfig OK -- Config = (4FAFEB1F, 84AFC17F, 00004230, ..)'

LW - Software





LW – Data analysis and reporting tool 1

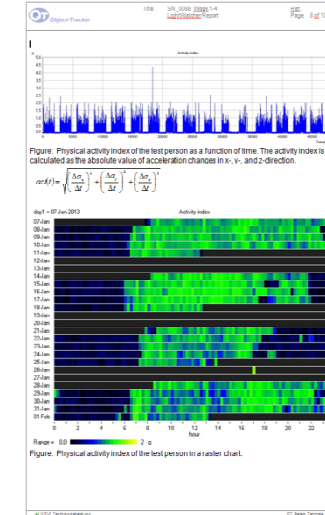
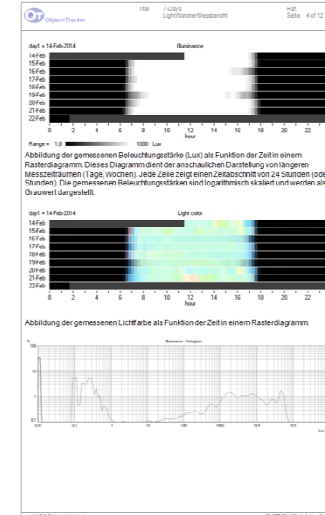
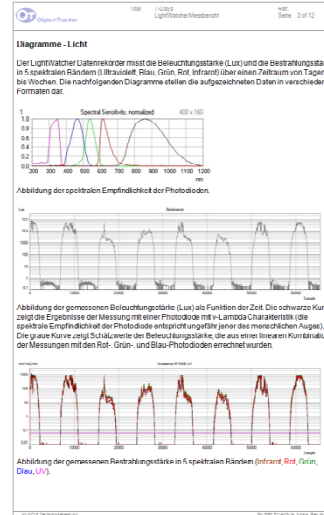
- Free configurable, generated automatically
- Meta data
- Statistical analysis
- Charts and graphical representations of data
- .doc and .pdf format

LightWatcher Messbericht

Hierzu gehört das mit der Programmiersprache Visual Basic entwickelte spezialisierte Messprogramm. Die Datenerhebung wurde mit dem LightWatcher Personal-Datenspeicher des Unternehmens Objekt-Tracker durchgeführt und mit dem Programm "OT-Sens" ausgewertet.

Zusammenfassung

| Name | Beschreibung |
|-----------------------|--|
| Name: Jea Denilda | 7-Days - LightWatcher Messbericht |
| Datum des Messens | 17. Feb. 2014 17:15 |
| Nummernummer | 111001 |
| Auftraggeber E-Mail | h.van.waaij@kapsl.be |
| Auftraggeber Telefon | 0661-731-9967 |
| Durchführung | LW01 |
| Versuchsperson Name | xxxx |
| Versuchsperson Nummer | |
| Versuchsperson Alter | |
| Messgerät Nummer | 00007 |
| Messgerät Hersteller | PHOTON |
| Messgerät Ausrichtung | Zug |
| Einsatzort | Perotolidsdorf |
| Anmerkungen | Das Messgerät war horizontal in S-Richtung ausgerichtet. |



LW – Data analysis and reporting tool 2



OT Object-Tracker Titel /-Days LightWatcherMessbericht Ref. Seite 1 of 12

LightWatcher Messbericht

Dieser Bericht beschreibt die Ergebnisse der im nachfolgenden Abschnitt näher spezifizierten Messaufgabe. Die Datenaufnahme wurde mit dem 'LightWatcher Personal Datenrekorder' des Unternehmens Object-Tracker durchgeführt und mit dem Programm 'OT-Sensor' ausgewertet.

Zusammenfassung

| Name | Beschreibung |
|----------------------------|---|
| Name des Berichts | 7-Days - LightWatcher Messbericht |
| Datum des Berichts | 2014-03-10 12:15 |
| Auftraggeber Name | L.Wolf |
| Auftraggeber Email | luzian.wolf@object-tracker.com |
| Auftraggeber Telefon | 0664-73449967 |
| Durchführung | L.Wolf |
| Versuchsperson Name | BORE |
| Versuchsperson Nummer | |
| Versuchsperson Alter | |
| Messgerät Nummer | 0092 |
| Messgerät Tragevorrichtung | Plattform |
| Messgerät Ausrichtung | Z-up |
| Einsatzort | Perchtoldsdorf |
| Anmerkungen | Das Messgerät war horizontal in S-Richtung ausgerichtet |

IG WOLF TechnoLogikentwicklung SL_2014_03_14_7-days_R40.doc

OT Object-Tracker Titel /-Days LightWatcherMessbericht Ref. Seite 3 of 12

Diagramme - Licht

Der LightWatcher Datenrekorder misst die Beleuchtungsstärke (Lux) und die Bestrahlungsstärke in 5 spektralen Bändern (Ultraviolett, Blau, Grün, Rot, Infrarot) über einen Zeitraum von Tagen bis Wochen. Die nachfolgenden Diagramme stellen die aufgezeichneten Daten in verschiedenen Formaten dar.

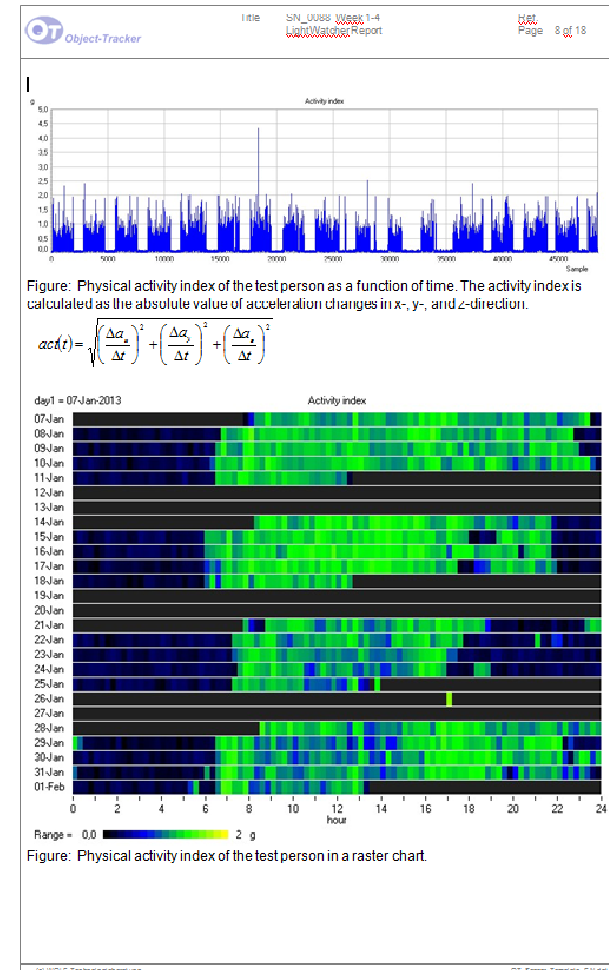
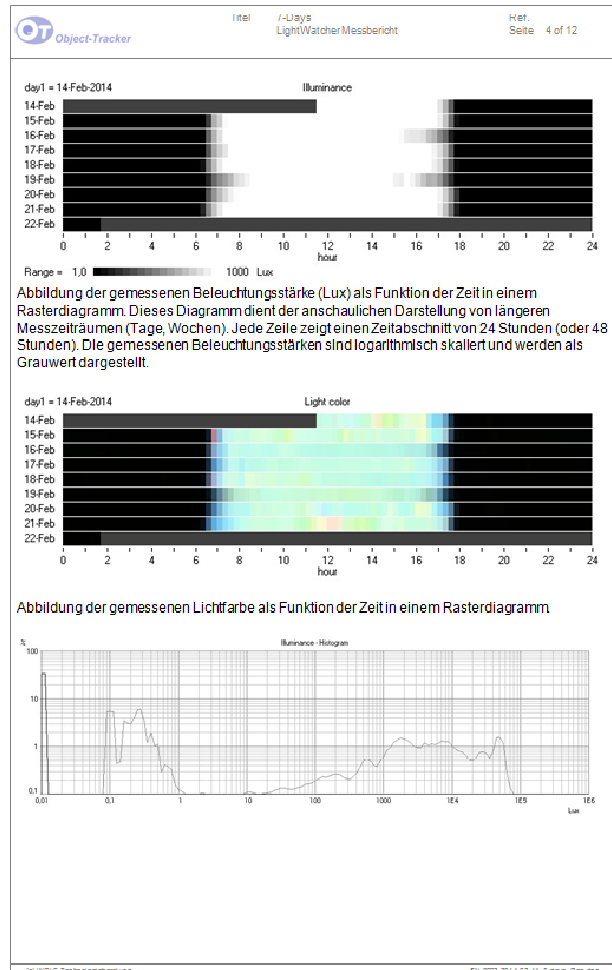
Abbildung der spektralen Empfindlichkeit der Photodioden

Abbildung der gemessenen Beleuchtungsstärke (Lux) als Funktion der Zeit. Die schwarze Kurve zeigt die Ergebnisse der Messung mit einer Photodiode mit v-Lambda Charakteristik (die spektrale Empfindlichkeit der Photodiode entspricht ungefähr jener des menschlichen Auges). Die graue Kurve zeigt Schätzwerte der Beleuchtungsstärke, die aus einer linearen Kombination der Messungen mit den Rot-, Grün-, und Blau-Photodioden errechnet wurden.

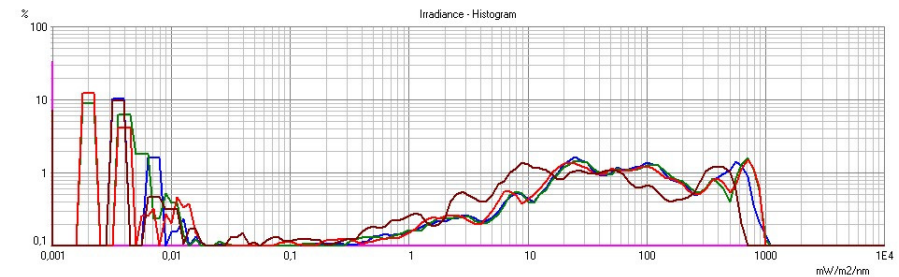
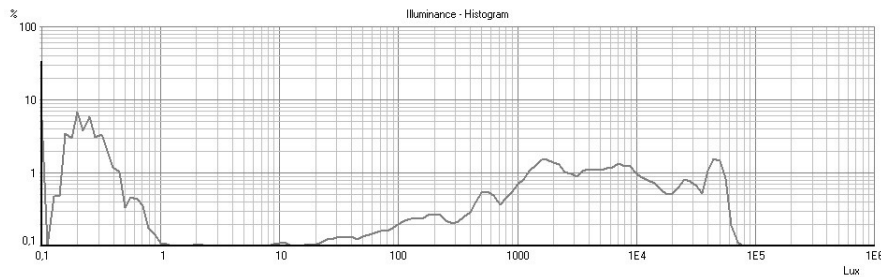
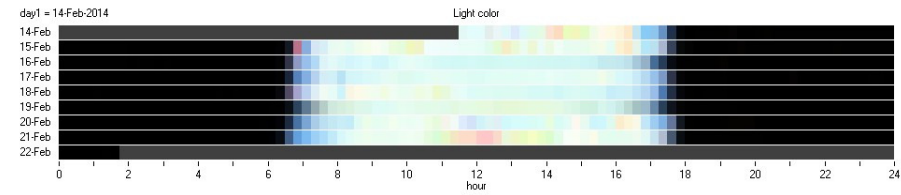
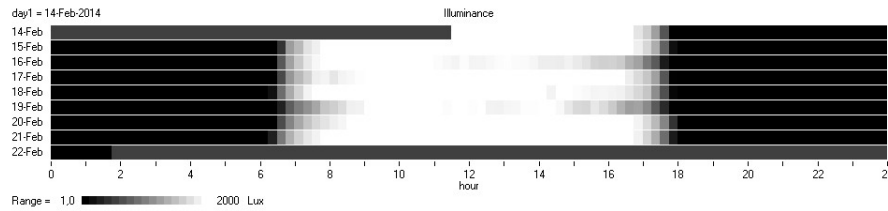
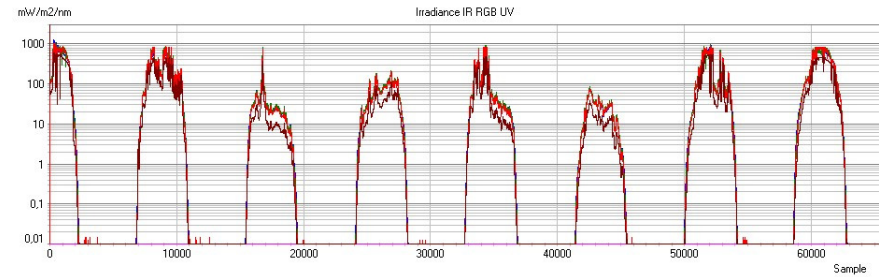
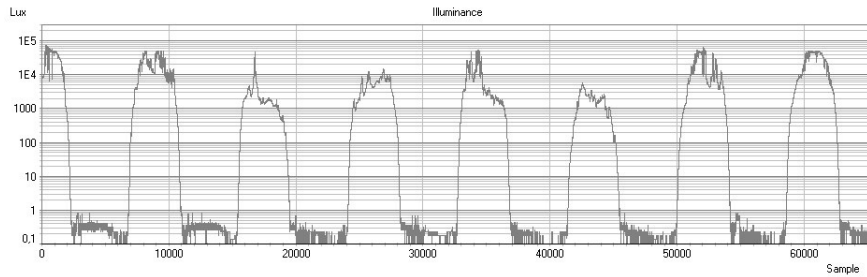
Abbildung der gemessenen Bestrahlungsstärke in 5 spektralen Bändern (Infrarot, Rot, Grün, Blau, UV).

IG WOLF TechnoLogikentwicklung SL_2014_03_14_7-days_R40.doc

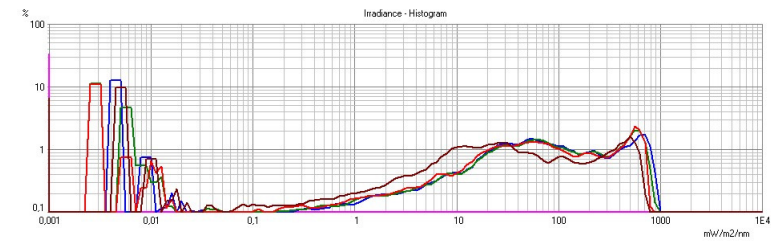
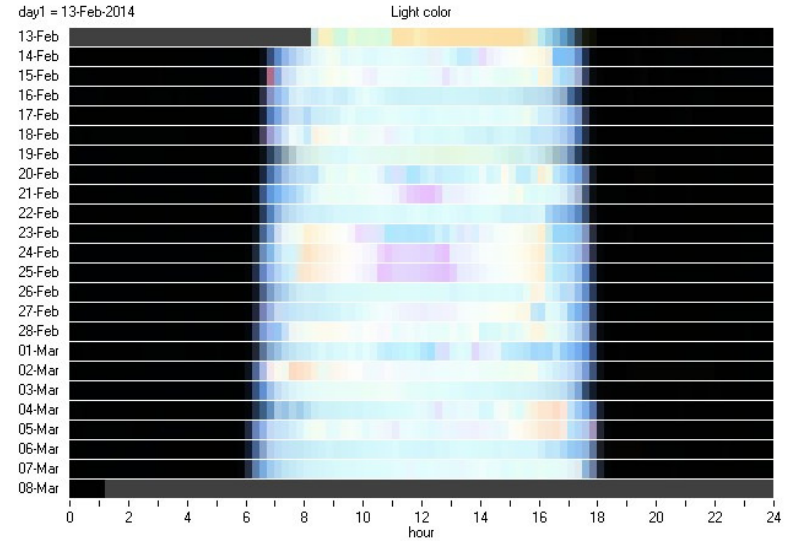
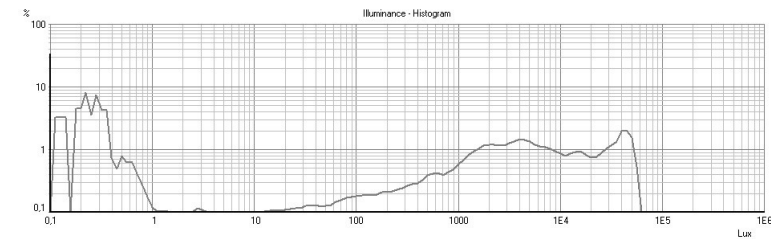
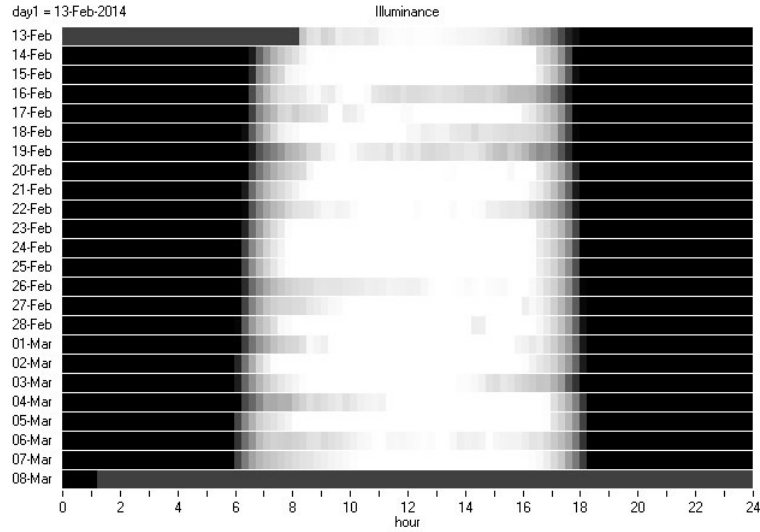
LW – Data analysis and reporting tool 3



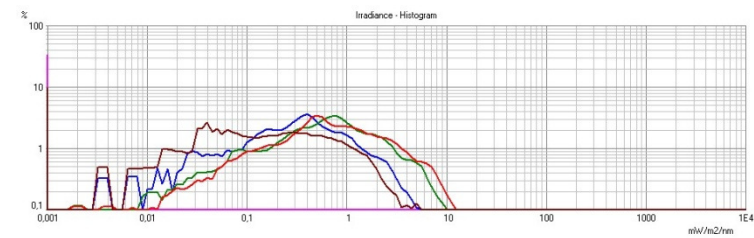
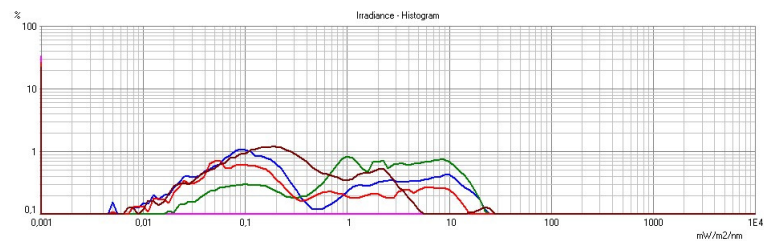
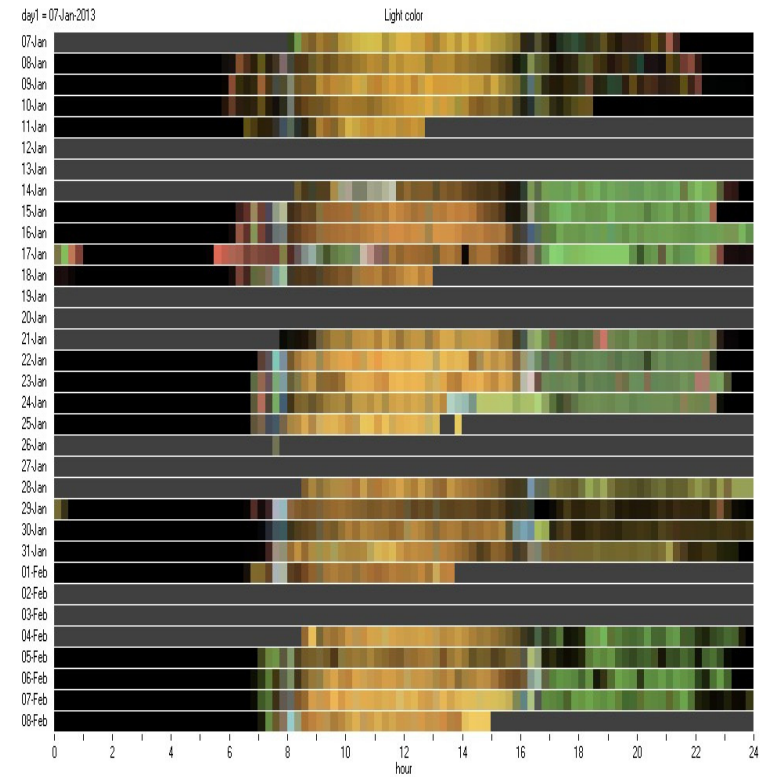
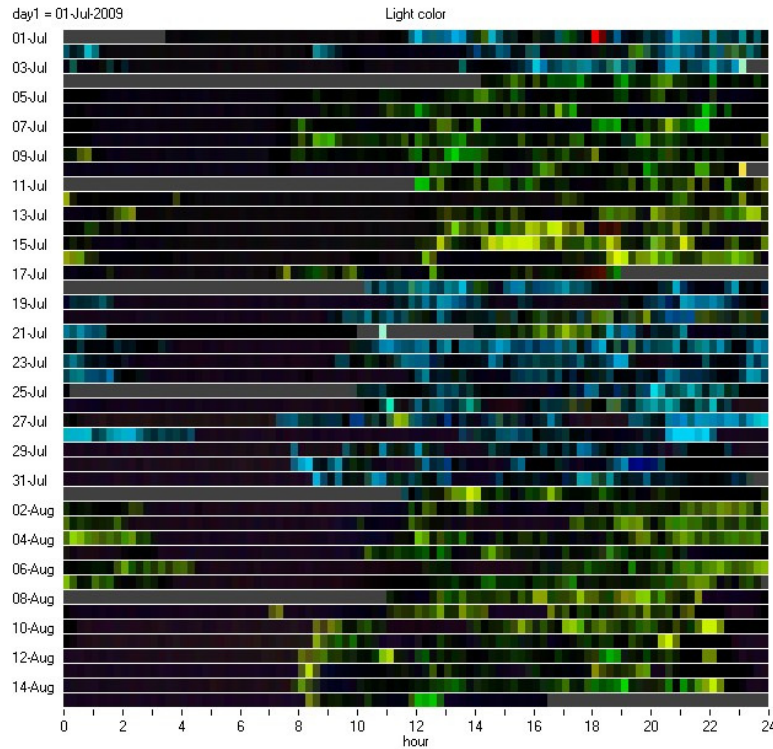
LW – Data analysis and reporting tool 4



LW – Data analysis and reporting tool 5



LW – Data analysis and reporting tool 6





LW – Application areas

- Studies of biological rhythms,
- Studies of sleep-wake cycles,
- Studies of level of activity and well-being,
- Studies on the effect of shift work,
- Light therapy of seasonal depression,
- Architecture and light design,
- Work medicine, design of work places,
-

Projekt partners, Thank you very much !



- **LMU München** (Prof. Till Roenneberg, Dorothe Fischer, Joana Mehlmann, Celine Vetter, ...)
- **Univ. Groningen** (Dr. Marijke Gordijn, Dr. Maan van de Werken, Dr. Marina Gimenez, Dr. Thomas Kantermann)
- **Univ. Basel** (Prof. Anna Wirz-Justice, Prof. Christian Cajochen, Dr. Vitaliy Kolodyazhniy, ...)
- **Univ. Lyon** (Dr. Howard Cooper, Dr. Claude Gronfier)
- **Osram München** (Dieter Lang)
- **Philips NL** (Luc Schlangen)
- ... Numerous users



Information



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