

功能性近紅外光儀器校正與安裝

fNIRS Instrumentation Setup

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2015/4/30 Lesson 9, Chia-Feng Lu

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本週課程內容

- NIRSport Hardware & Setup
- Signal Acquisition Software: NIRStar

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NIRSport硬體與設置

NIRSport Hardware & Setup

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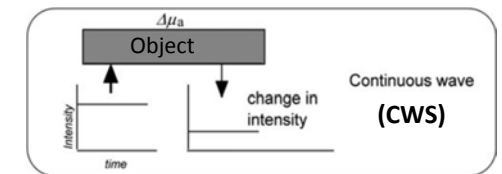
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Continuous-Wave NIRS

- The simplest NIRS technique.
- Only measure the changes in optical density.

$$\bullet \Delta OD = \ln \left(\frac{I_d}{I_d'} \right) = \Delta \mu_a \langle L \rangle$$



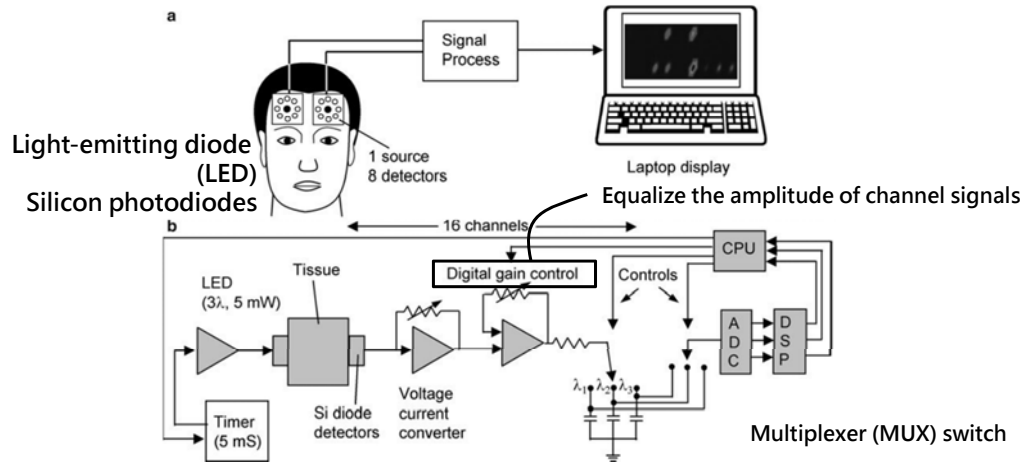
Assuming that the scattering coefficient does not change during measurement.

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Continuous-Wave NIRS



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Chance et al. Engineering in Medicine and Biology Magazine, IEEE 2007. 5

NIRSport 88, NIRx tech.



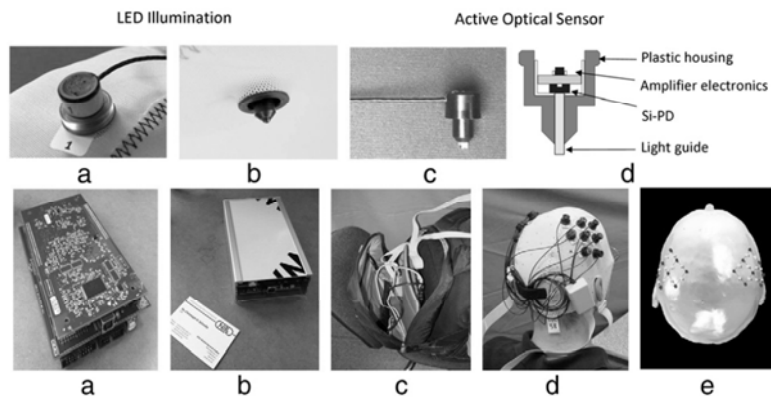
- NIRSport System Specifications**
- Dimensions: 105 mm x 170 mm x 40 mm (3.9" x 6.7" x 1.6")
 - Weight: 350 g
 - Power Consumption: 3 W
 - No. of Detector Channels: 8
 - Sensitivity: < 1 pW
 - Dynamic Range: 60 dBopt
 - Sensor Type: Si Photodiode, active sensor
 - No. of Illumination Sources: 8(Time-Multiplexed)
 - Wavelengths: 760 nm, 850 nm
 - Sampling rate: 62.5 Hz
 - Emitter Type: LED
 - Host Connection: USB 2.0 data + USB 2.0 power

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Si-PD Detectors



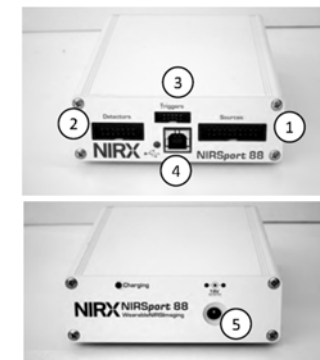
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Piper et al., Neuroimage 2014, 7

NIRSport 88

1. LED source port
2. detector port
3. Trigger port
 - Digital timing signals
4. USB port
 - Computer connection
5. Power supply connector



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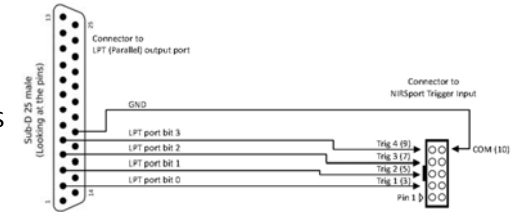
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Setup



Trigger Inputs

- Logic level
 - Positive edge triggered (low-to-high transitions)
- Minimum pulse duration
 - At least 10 ms long
- Maximum pulse duration
 - No restriction
 - Pulse separation at least 200 ms



Base plate

- Instrument fixation



Overheat Issue

For notebook



For NIRSport

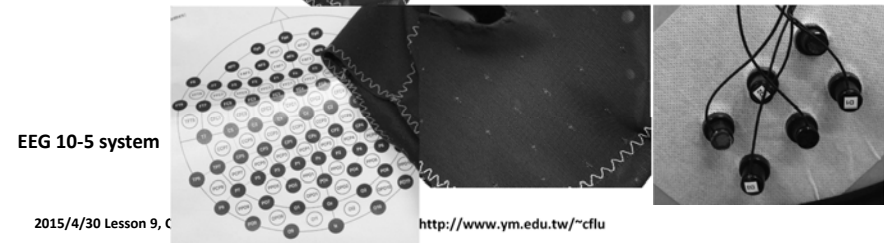
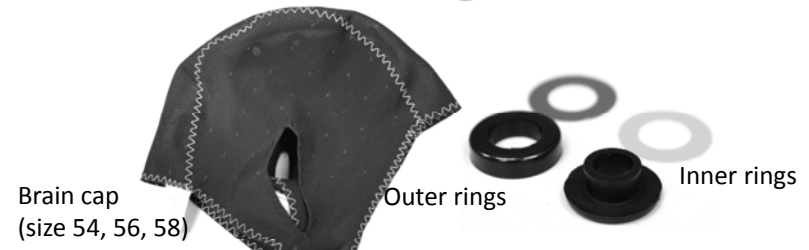


Poruus backpack

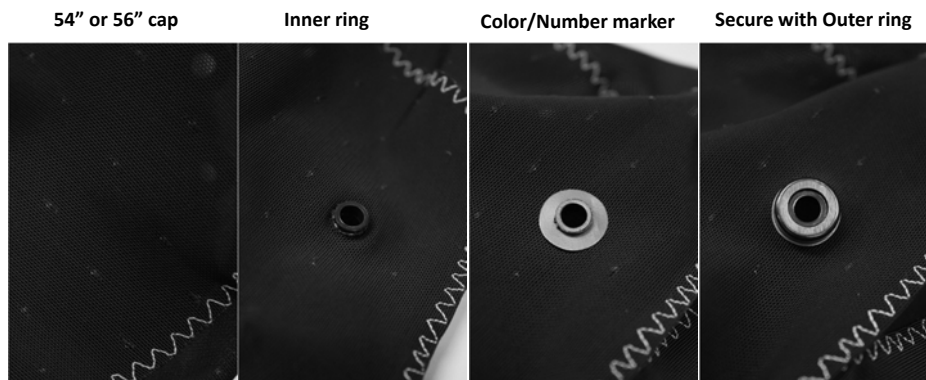
Backpack setup



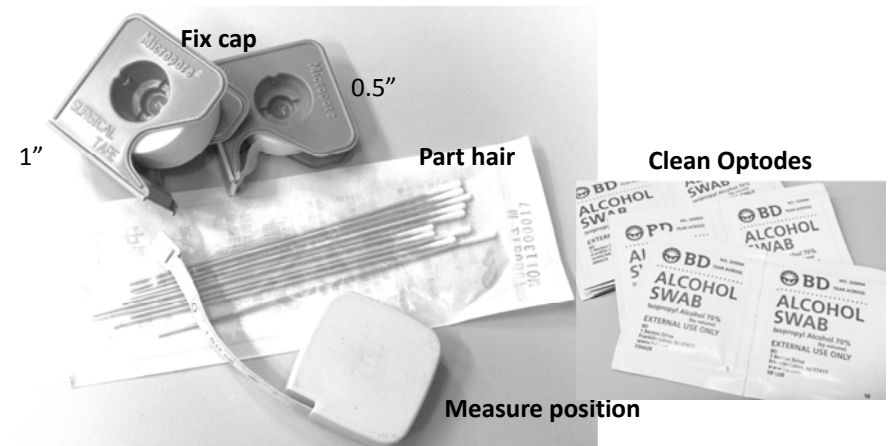
Optode holder rings



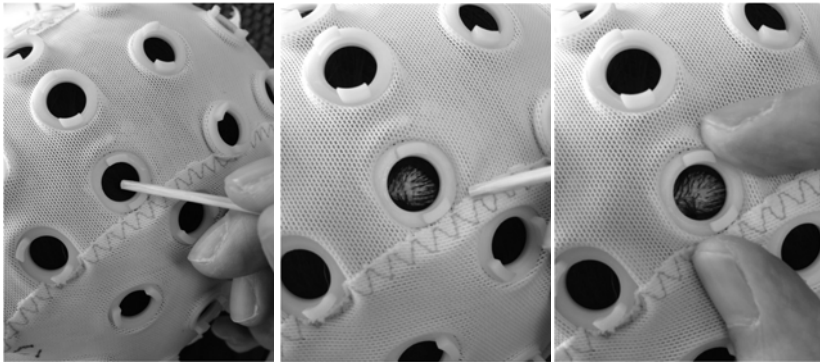
Optode holder rings



Preparation tools



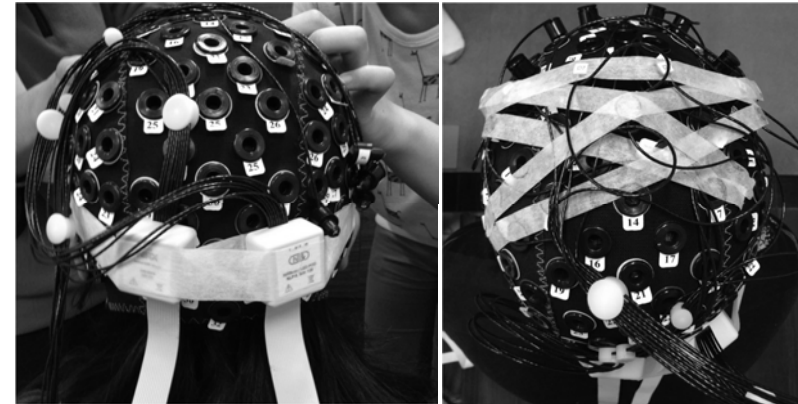
Part hair



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Cap and Optodes Setup



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訊號擷取操作介面 NIRstar Software

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Interface Overview

Menu Bar

Display Panel

- System setup
- Data visualization
- Advanced displays

Status and Options Bar

Main Functions

Operating Panel

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Status and Options Bar

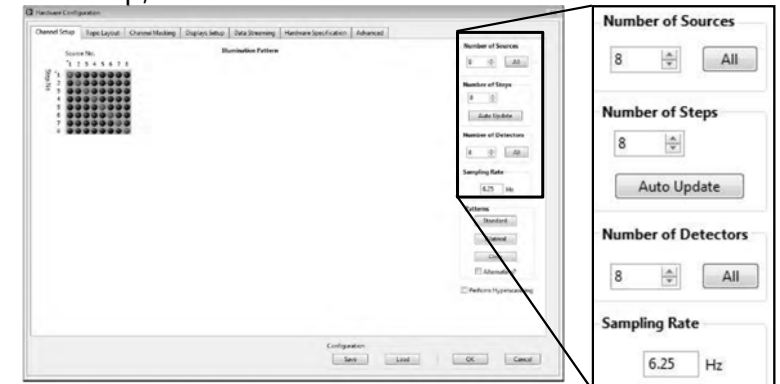
- Battery charge
 - Not less than 1/2
- Second Display
- LP Filter Cutoff (Hz)
- Topo view/labels



Step 1-1: Configuration

Menu bar → Configure Hardware

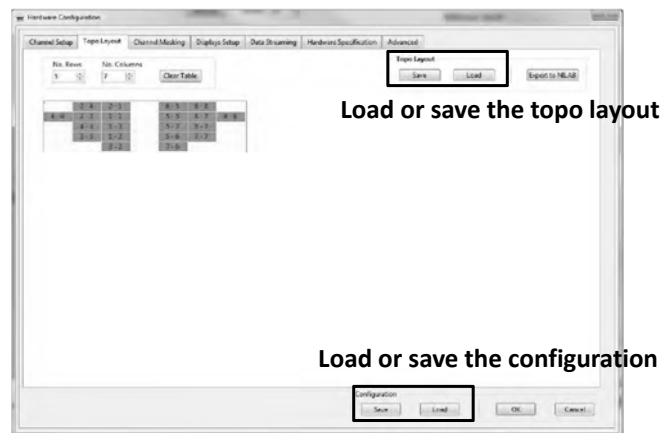
- Channel Setup, numbers of source and detector



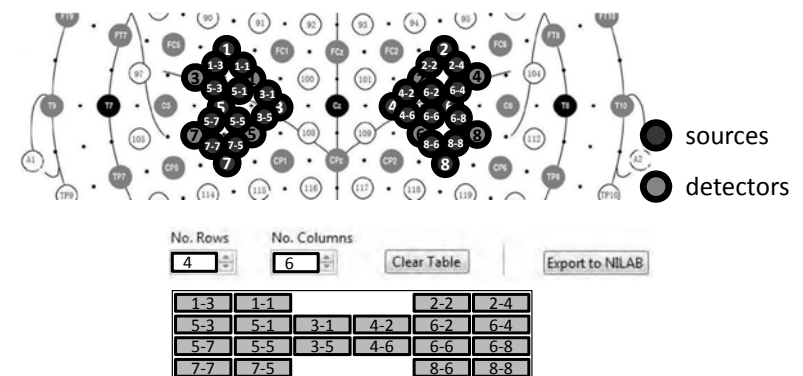
Step 1-2: Configuration

Menu bar → Configure Hardware

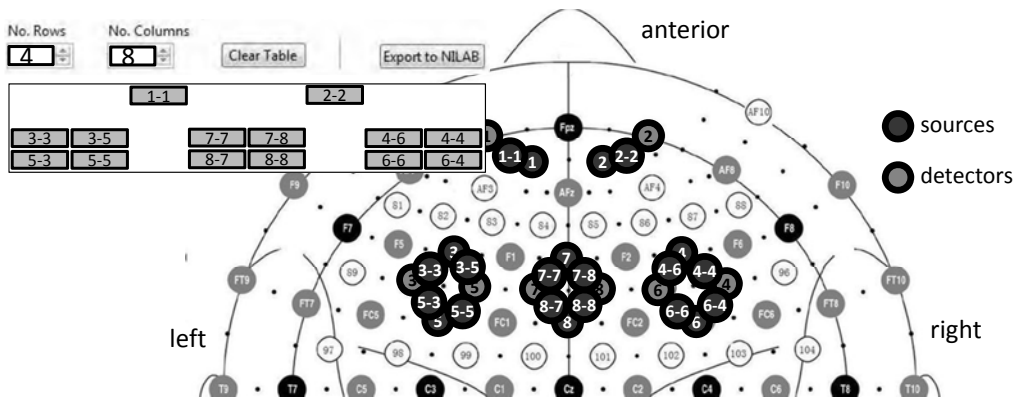
- Topo Layout



Topo Layout



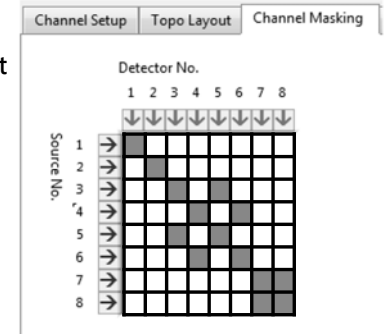
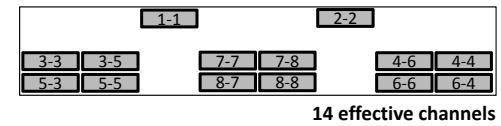
Topo Layout



Step 1-3: Configuration

Menu bar → Configure Hardware

- Channel Masking
 - Only for display
 - Automatically adopted from the Topo Layout



Step 1-4: Configuration

Menu bar → Configure Hardware

- Advanced
 - LED modulation

Password required !!

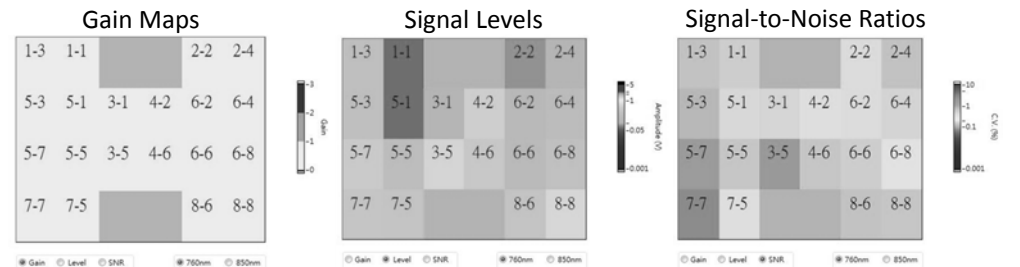


Inappropriate settings in the Advanced Setup may severely interfere with data quality or may cause damage to the instrument!

Step 2: Calibration

Operating Panel → CALIBRATE

- Reduce hair interference
- Attach optodes to scalp
- Adjust LED modulation (Configure Hardware → Advanced)

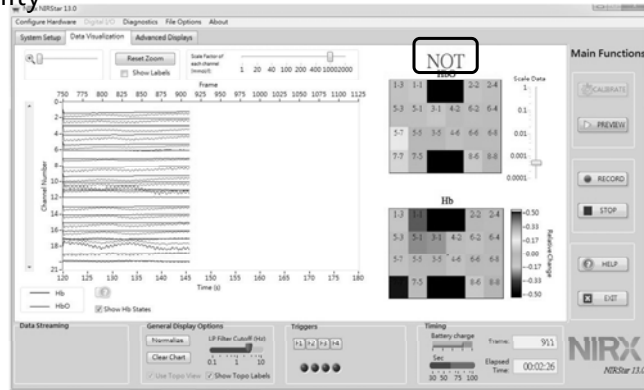


Step 3: Preview

Operating Panel → PREVIEW

Display Panel → Data Visualization

- Check signal quality
 - Heart beats
 - Baseline drifting
 - Amplitudes
- Not recording!!



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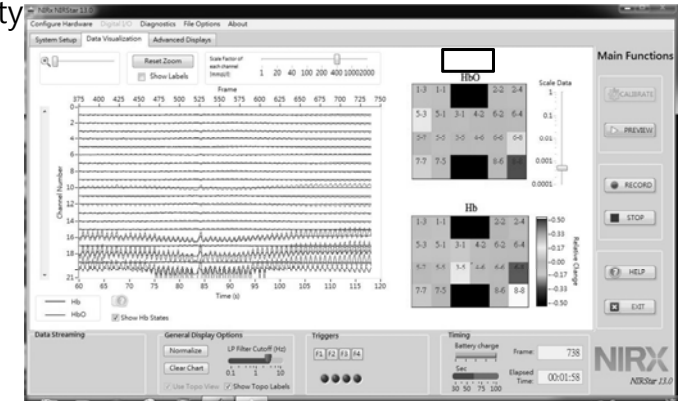
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Step 4: Record

Operating Panel → RECORD

Display Panel → Data Visualization

- Check signal quality
 - Heart beats
 - Baseline drifting
 - Amplitudes
- Normalize
- LP filter cutoff
- Event Triggers



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Step 5: Check Data

C:\NIRx\Data

- Automatically save data in a directory of the date

名稱	修改日期	類型	大小
NIRS-2015-03-20_001.evt	2015/3/20 下午 0...	傳統事件記錄檔	1 KB
NIRS-2015-03-20_001.hdr	2015/3/20 下午 0...	HDR 檔案	2 KB
NIRS-2015-03-20_001.set	2015/3/20 下午 0...	SET 檔案	1 KB
NIRS-2015-03-20_001.wl1	2015/3/20 下午 0...	WL1 檔案	3,785 KB
NIRS-2015-03-20_001.wl2	2015/3/20 下午 0...	WL2 檔案	3,785 KB
NIRS-2015-03-20_001_config.txt	2015/3/20 下午 0...	文字文件	1 KB

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Acquisition Steps

- Step 1-1: Configuration/Channel Setup
- Step 1-2: Configuration/Topo Layout
- Step 1-3: Configuration/Channel Masking
- Step 1-4: Configuration/Advanced
- Step 2: Calibration (Take screenshots)
- Step 3: Preview (Take screenshots)
- Step 4: Record
- Step 5: Check Data

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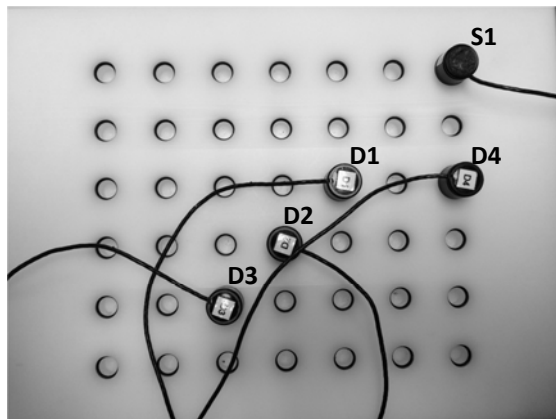
Trouble shooting

Error / Warning / Problem	Potential Cause	Recommended Action
Power LED does not light up	No power to instrument	Check if power switch is turned on Check if AC line is properly connected. Check fuses and replace if necessary
Status LED does is off or on continuously	No data connection to PC	Reconnect USB cable Try different cable or different port Make sure software and drivers are installed
Software error message: 'Device may not be connected'	No data connection to PC	Check presence and function of device in 'National Instrumentst Automation Explorer.' If device is shown but not active, remove the device from the list, restart PC, and re-connect the NIRSport.
Large number or all channels go to highest gain setting	Low or no signal in all channels	Check connection of LED POD Check if LEDs are blinking during scanning Check connection of the fiber optic bundles Check proper placement of probes on subject's head Check for damage on LED illuminator or fiber optic cable

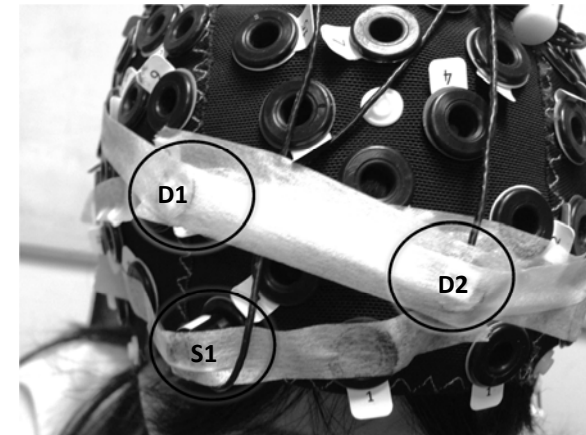
Trouble shooting

Error / Warning / Problem	Potential Cause	Recommended Action
All detectors show maximum gain for the same source	Low signal from the source	Check optical coupling of the affected source to the skin, if needed part hair, apply coupling gel, apply gentle pressure through outer cap or bandage
No or low reading for one source, at one wavelength	Damage to LED driver or LED optode	Restart instrument, and without performing performing calibration start scan and point affected LED directly into a detection fiber tip or detector channel port. If OK there should be a stable reading for both wavelength plots in the scan screen (display set to raw data)
All sources show maximum gain and ow signal for the same detector channel	Low signal from the detector	Check optical coupling of the affected detector to the skin, if needed part hair, apply coupling gel, apply gentle pressure through outer cap or bandage Check connection of affected fiber optic cable to the instrument
Data overly noisy	Ambient light interference	Make sure head is well shielded and/or not directly illuminated by ambient light, in particular fluorescent tubes.

Phantom test



Subject test



THE END

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