Transforming Cerebral Monitoring for Brain Health

Company Presentation

June 2022

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Luciole Provides a Comprehensive Solution for Brain Monitoring

1 Luciole Medical has **first-mover position in brain monitoring** with a platform measuring brain function parameters in a broad range of hospital settings, from neurocritical care to surgeries

2 **Only company to have obtained market approval** (CE-mark) **for both** its adhesive patch and intracranial probe

3 **Transformative analytics platform** can integrate additional sensors to provide unparalleled real-time data capture from multiple sources

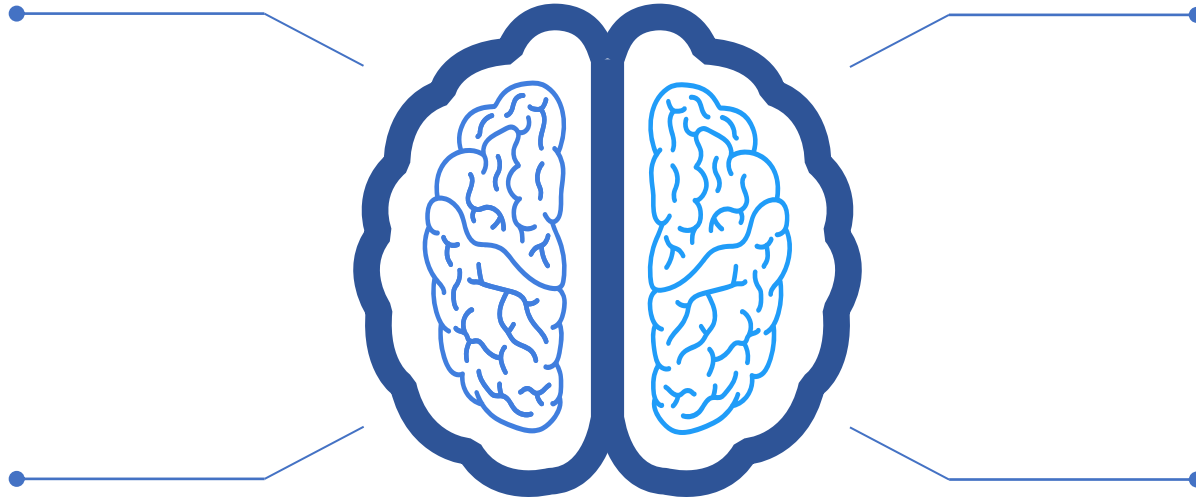**4** **Experienced leadership team** and a Board with seasoned MedTech executives and entrepreneurs

5 **Company moving toward next stage of corporate development:** initiation of FDA and Chinese market registration and progress in commercialization and product development strategy

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Currently No Effective Solution for Comprehensive Brain Monitoring

For an organ that consumes over 15% of the body's oxygen, there is **no effective and reliable mode of measurement**

Brain oxygen desaturation during anesthesia/surgery can have **serious and long-term medical impact**

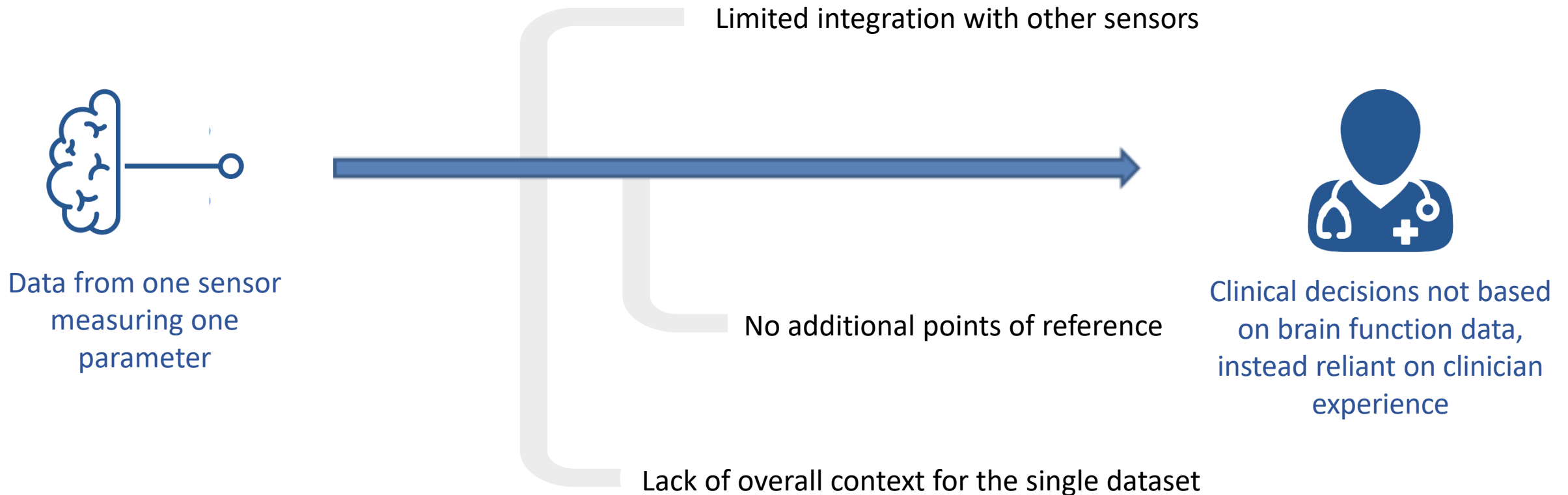Monitoring oxygenation in real time is an **important predictor of brain function,** backed by scientific evidence*
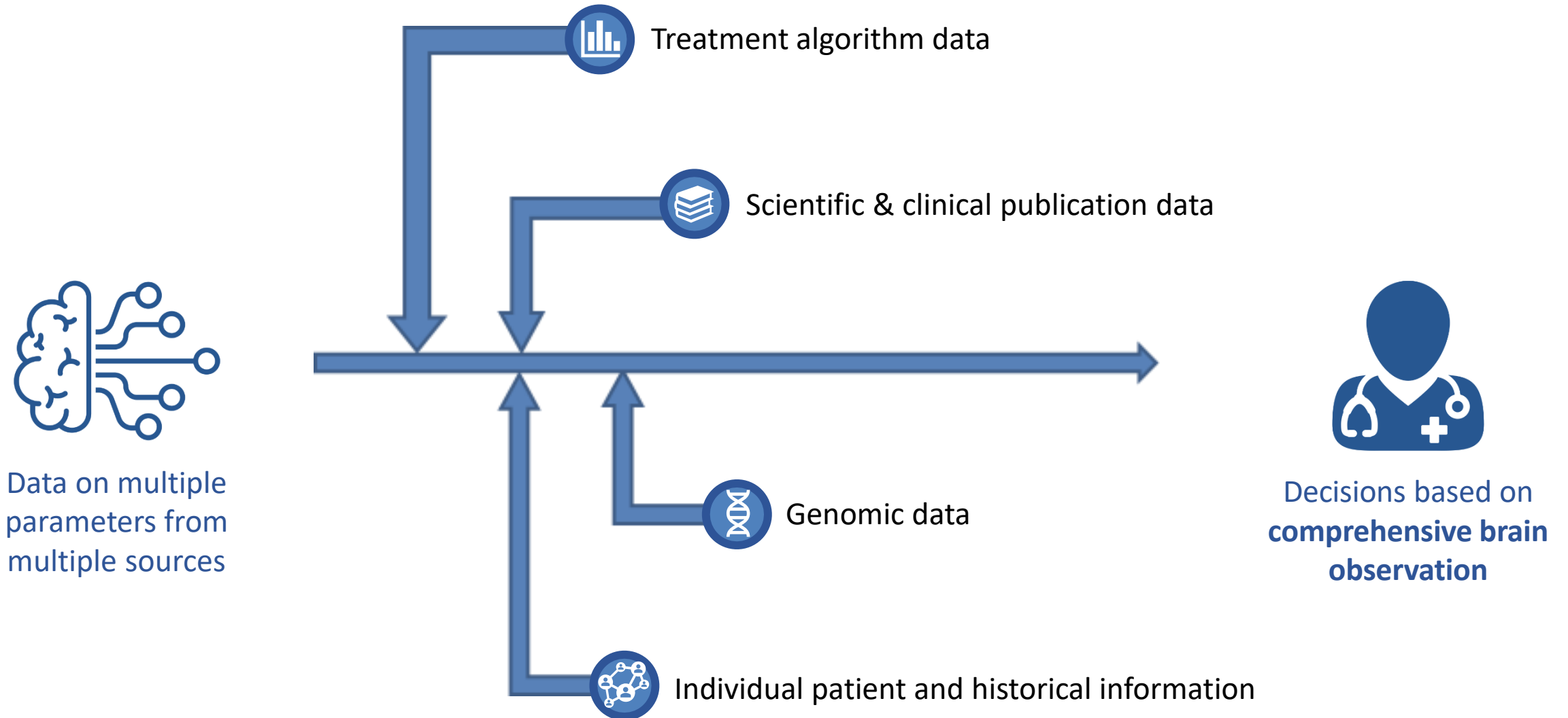
Global brain monitoring market is estimated to grow **to USD 8 billion by 2025**; rapid increase in wearables leading to changes in clinical practice

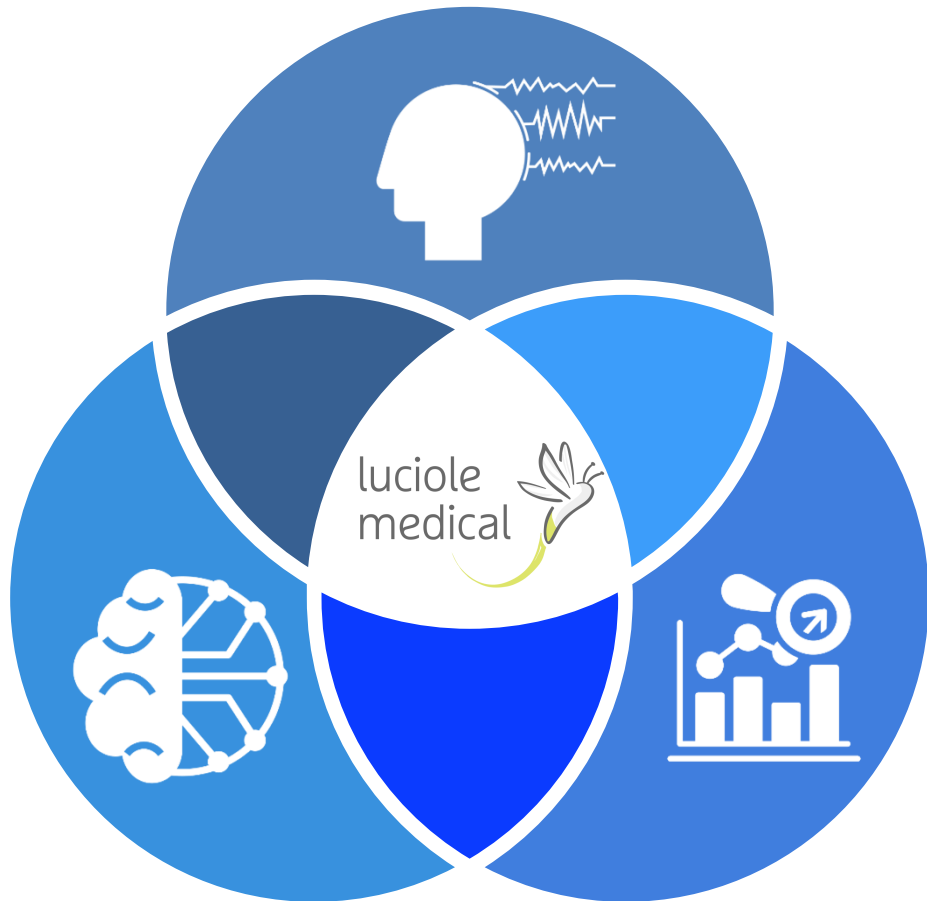* (1) Slater JP., et al., (2009) Ann. Thorac. Surg. (2) Subramanian B., et al., (2016) Anesth. Analg.

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The Current State of Brain Oxygen Monitoring

Limited integration with other sensors

Data from one sensor measuring one parameter

No additional points of reference

Lack of overall context for the single dataset

Clinical decisions not based on brain function data, instead reliant on clinician experience

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The Revolution of Individualized Brain Health

Treatment algorithm data

Scientific & clinical publication data

Data on multiple parameters from multiple sources

Genomic data

Decisions based on **comprehensive brain observation**

Individual patient and historical information

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Luciole's Solution: Integrated Real-time Data Capture Sensors and Analytics

Proprietary new sensors

- Adhesive patch for non-invasive applications
- Intracranial probe for ICU
- Wearable brain monitoring patch (in development)

Integration of data from external sources

- Microdialysis
- ECG / EEG
- Other sensors

Advanced data analytics software platform

- Provides key information in real-time
- Provides context to measured data

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Market Segments Where Brain Monitoring Represents High Medical Need

Neurocritical care
- Subarachnoid haemorrhage
- Traumatic Brain Injury
- Cerebrovascular reactivity
- Stroke
- Cardiac arrest

Anesthesia
- Cardiac surgery
- Orthopedic and spine surgery
- Extra Corporeal Membrane Oxygenation

Pediatric
- Surgery
- Metabolic disease
- Extra Corporeal Membrane Oxygenation

Sleep apnea
- Diagnostic
- Treatment monitoring
- Post surgery apnea

Medical Wearable
- Brain health monitoring

Established

Upcoming

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Market Potential: Underserved Large Markets, Increasing Awareness

01 Originally fragmented markets for invasive vs non-invasive sensors

02 Poor product conception and performance leading to low adoption by clinicians

03 Limited clinical impact demonstrated by monitoring activities

04 Medical awareness and evidence of impact of cerebral oxygen desaturation and flow issues in brain health

05 Strong and fast evolution toward precision and data-based medicine

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Luciole Product Suite: Brain Monitoring Sensors
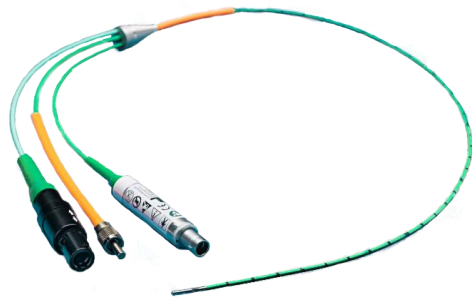

Patch

Measures:
- Oxygen metabolism
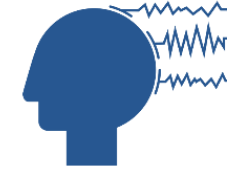- Cerebral blood flow of the subjacent tissue
- Cerebral water concentration

Probe

Measures:
- Intracranial pressure
- Brain temperature
- Oxygen metabolism
- Cerebral blood flow
- Cerebral water concentration

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Luciole Product Suite: Real-time Data Capture and Analysis Software

Visualize combined data from all devices

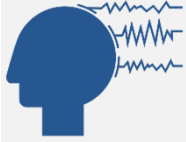**Analysis** of trends and patterns in data captured

Clinical **decision** support

Innovating Brain Observation Technology

Luciole's patented Technology Surpasses Current Methodologies

- **Patch** developed **based on extensive knowledge and hemodynamics data captured** from inside the brain using Luciole probe
- Data can be **monitored remotely**

- Measurements using light lasers increases **data readout accuracy**
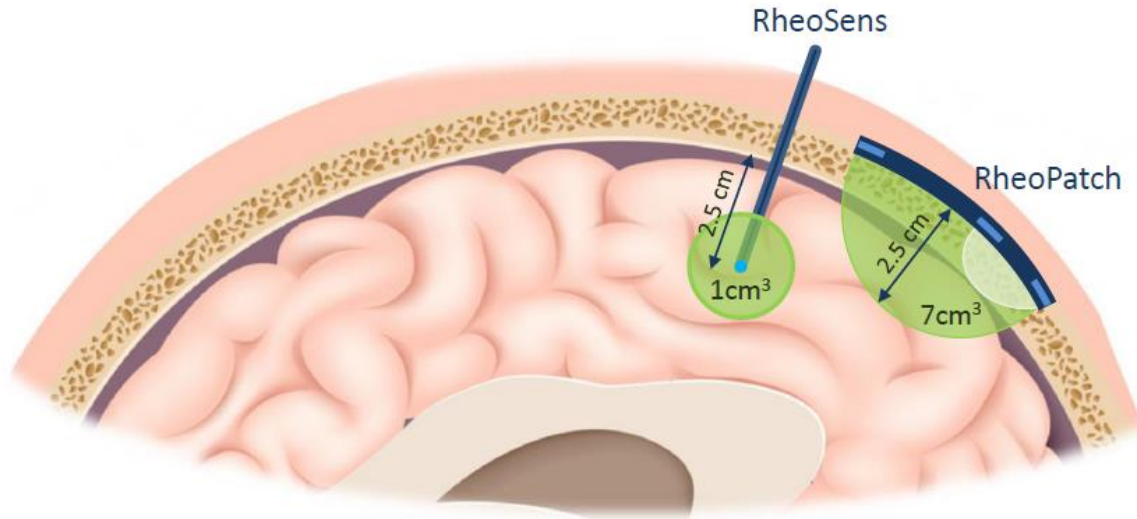- **Absolute oxygen saturation values** determined with advanced algorithm

- **4 wavelengths** used to detect oxygenated and deoxygenated hemoglobin
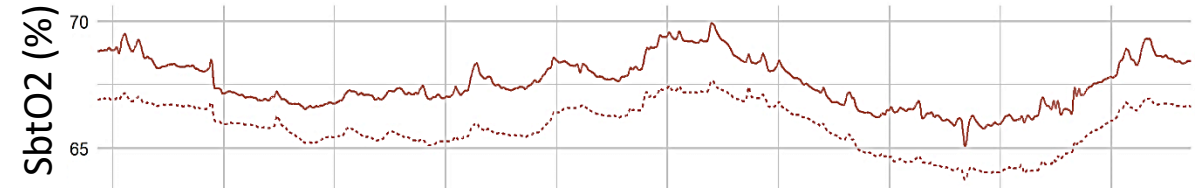- Tissue and water compartment signals **enhance specificity** to isolate brain oxygen saturation data

Cerebral Blood Flow (CBF) – critical for supplying brain with oxygen

- **Only company** with patch that measures CBF
- Luciole's patch detects blood flow in the brain based on well-established and validated method used for heart analysis
- **Patch determines CBF** using wavelength specific for Indocyanine Green (ICG) dye as it transits through brain's circulatory system

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Complex Algorithm in Patch Can Accurately Capture Brain Oxygenation Data

Oxygen saturation determined with Luciole's proprietary algorithm using signals received from 2 different depths

Data obtained from inside the brain (with probe) validates measurements taken in parallel from outside the skull (with patch)
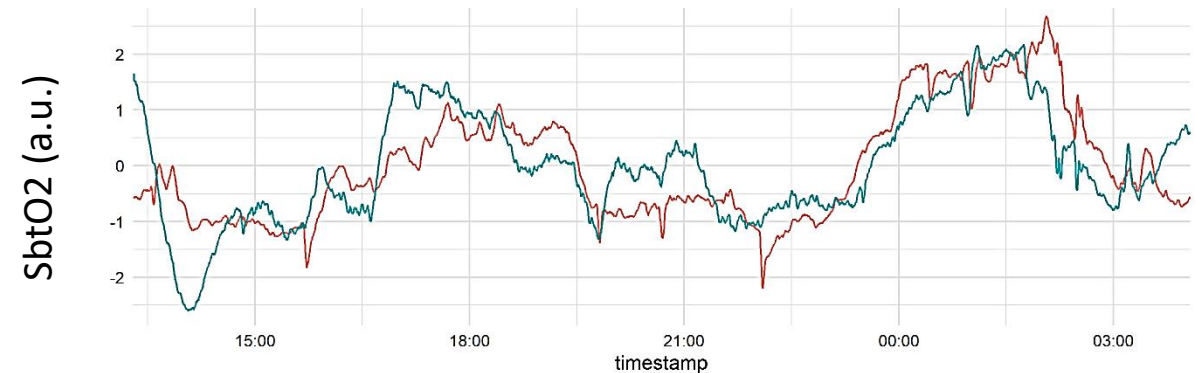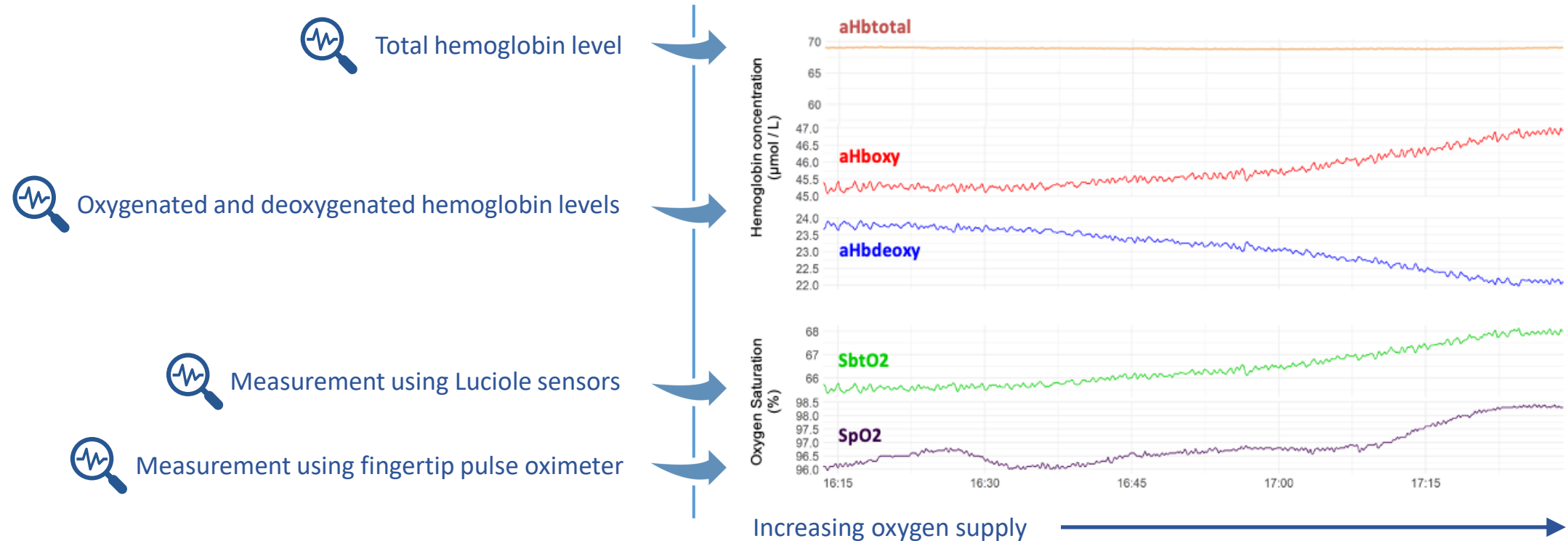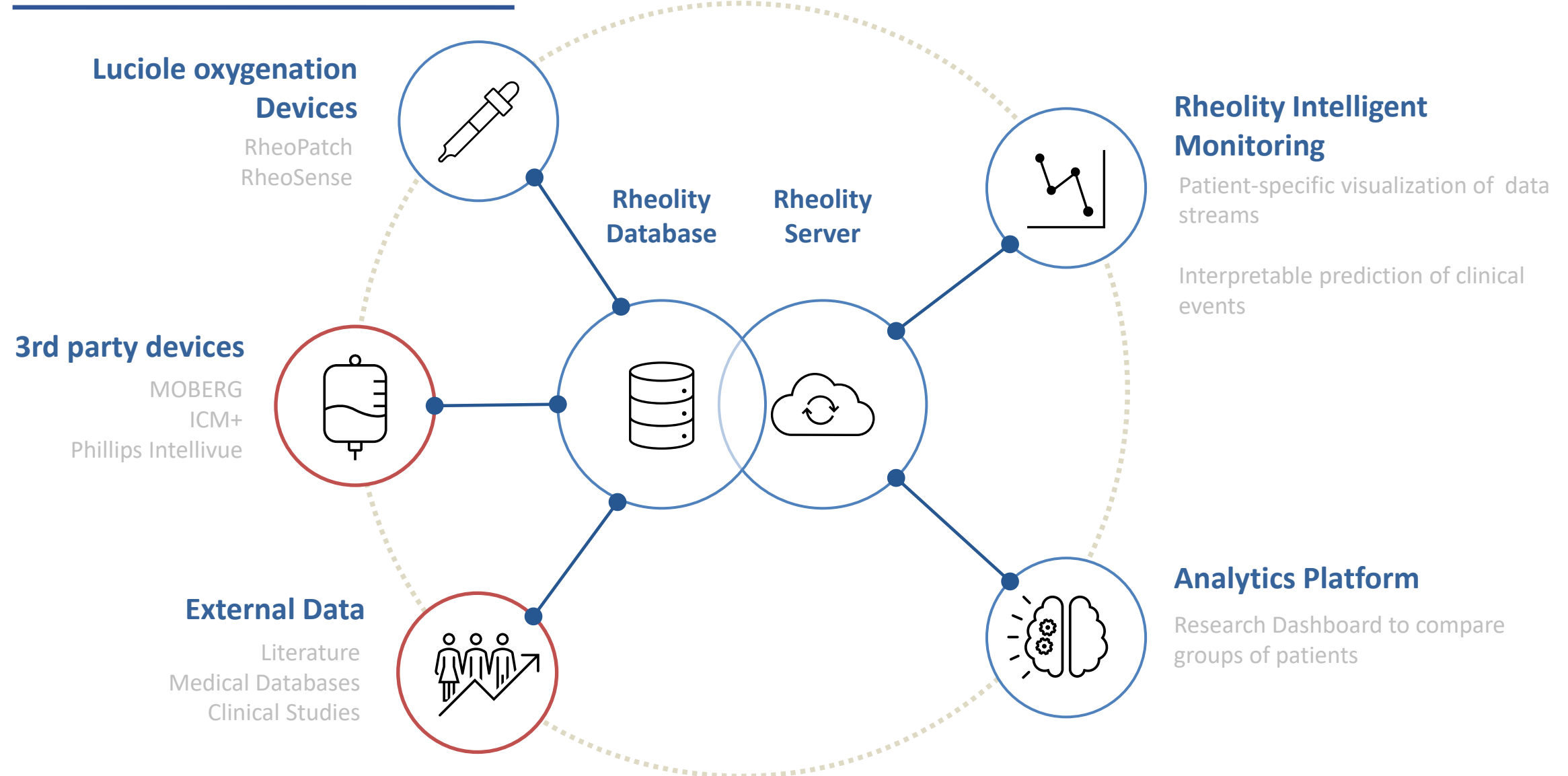
Patch signal readings from 2 different depths

Luciole's proprietary algorithm isolates oxygen saturation data

Validation with parallel measurements by patch and probe

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Luciole's Sensors Effectively Detect Oxygenation Status in Brain

Total hemoglobin level

Oxygenated and deoxygenated hemoglobin levels

Measurement using Luciole sensors

Measurement using fingertip pulse oximeter

aHbtotal

aHboxy

aHbdeoxy

SbtO2

SpO2

Hemoglobin concentration (µmol / L)

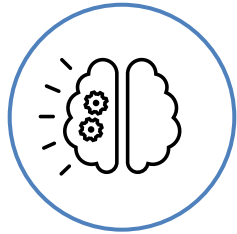Oxygen Saturation (%)

Increasing oxygen supply

- Luciole's sensors can **accurately detect increased oxygen saturation in the brain** corresponding to increased oxygen uptake in arterial blood validated with fingertip pulse oximeter
- Data **correlates well** with measured hemoglobin concentrations

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Global Architecture

Luciole oxygenation Devices

RheoPatch
RheoSense

3rd party devices

MOBERG
ICM+
Phillips Intellivue

External Data

Literature
Medical Databases
Clinical Studies

Rheolity Database

Rheolity Server

Rheolity Intelligent Monitoring

Patient-specific visualization of data streams

Interpretable prediction of clinical events

Analytics Platform

Research Dashboard to compare groups of patients

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Luciole's Echo System Evolution

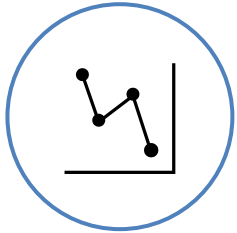|			
Comparison between patients within the same hospital	Patter recognition based on similarity algorithms	Fully anonymized integration of data, smart algorithmics using AI* and NLP*	**Predictive Analytics** Ongoing dev.
Visualization of the current available data with predefined ref groups	Smart contextualization of reference groups	Smart alarms and predictions based on AI* technology	**Descriptive Analytics** ✓ Functional — Ongoing dev.
Full connectivity with the Luciole oxygenation devices	Connectivity with all 3rd party monitors		**Explanatory Analytics** ✓ Functional
Database Optimized for time series data, ready to be deployed			**Data Engineering** ✓ Functional

Time, Data →

*AI: Artificial Intelligence, NLP: Natural Language Processing

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Validating Clinical Data

A total of 818 days of measurements, **305** patients
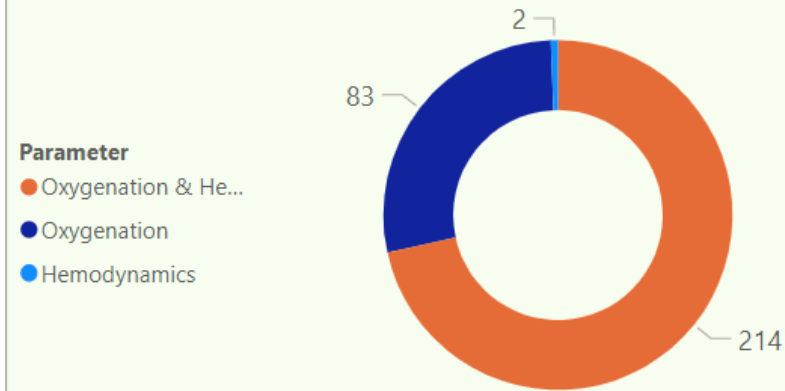
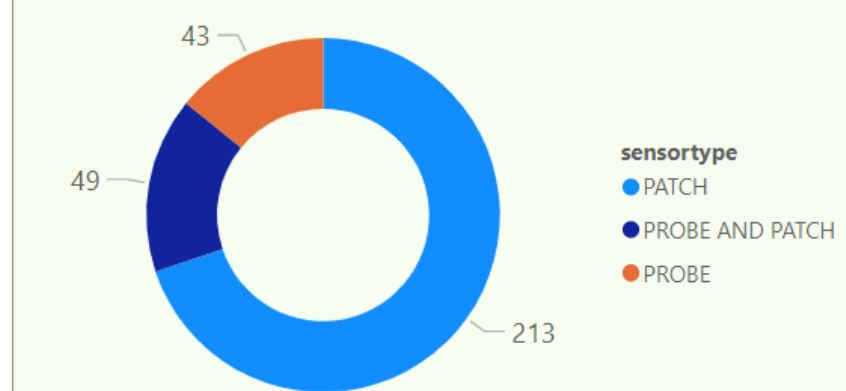**305** Patients

818 Days of Measurements

32 Centers

Centers
- Charité
- CHUV Lausanne
- Erasme
- Hirslanden
- HUG
- Innsbruck
- Inselspital
- Kantonsspital Baden
- Luciole
- MUG
- Pitie-Salpetriere
- Rothschild
- SNRI
- Stuttgart
- Tierspital
- Timone
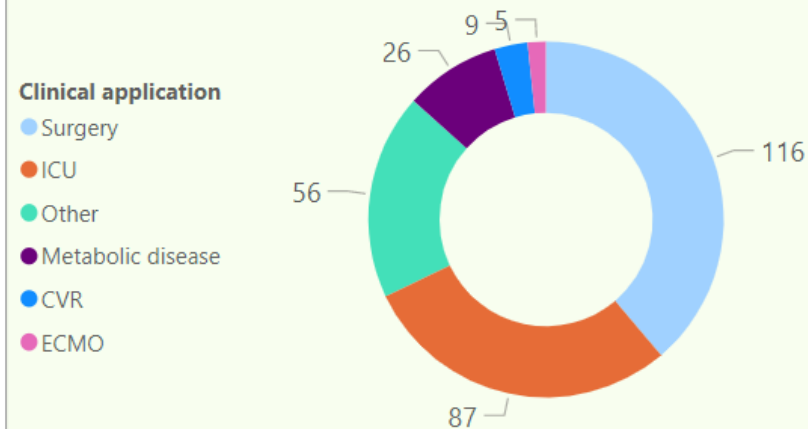- Triemili
- Tuebingen
- TUM
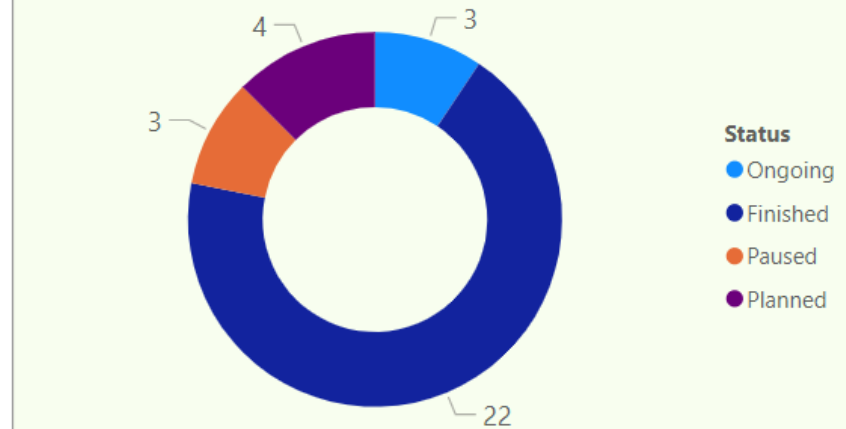- UKBonn
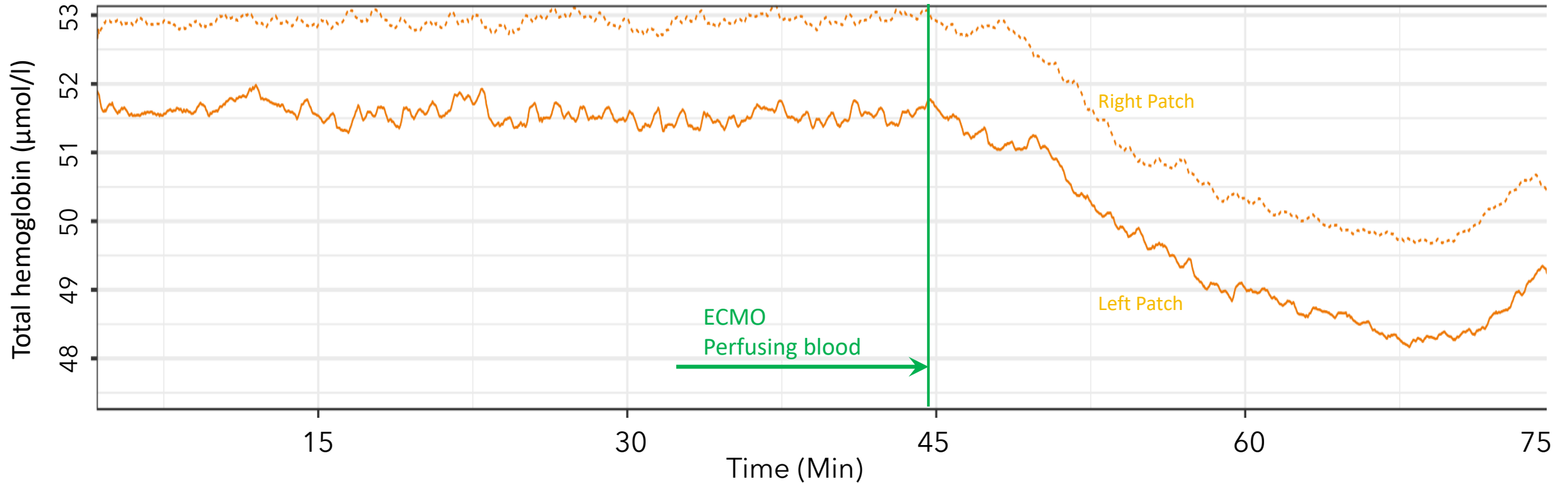- UKH
- USZ

N° Patients / Parameter measured

Parameter
- Oxygenation & He...
- Oxygenation
- Hemodynamics

2
83
214

N° Patients / Type of Sensor

sensortype
- PATCH
- PROBE AND PATCH
- PROBE

43
49
213

N° Patients / Clinical application

Clinical application
- Surgery
- ICU
- Other
- Metabolic disease
- CVR
- ECMO

9 5
26
56
116
87

Status of the studies

Status
- Ongoing
- Finished
- Paused
- Planned

4 3
3
22

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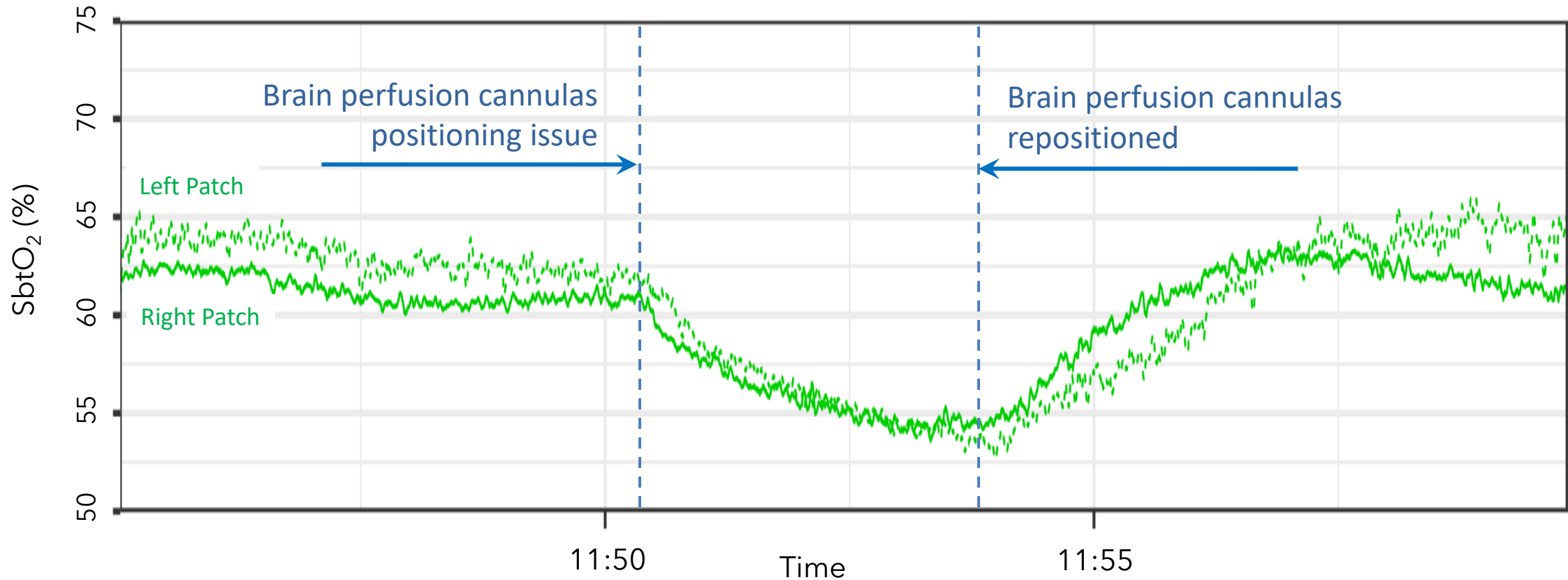# Case study: ECMO Intervention vs Brain Oxygen Reactivity Monitoring (Patch)
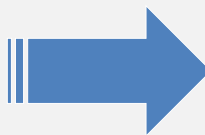

ECMO, blood dilution with heparin ➞ Significant decrease of total hemoglobin

Case study: Cardiac surgery, Cerebral Perfusion Event Monitoring (Patch)

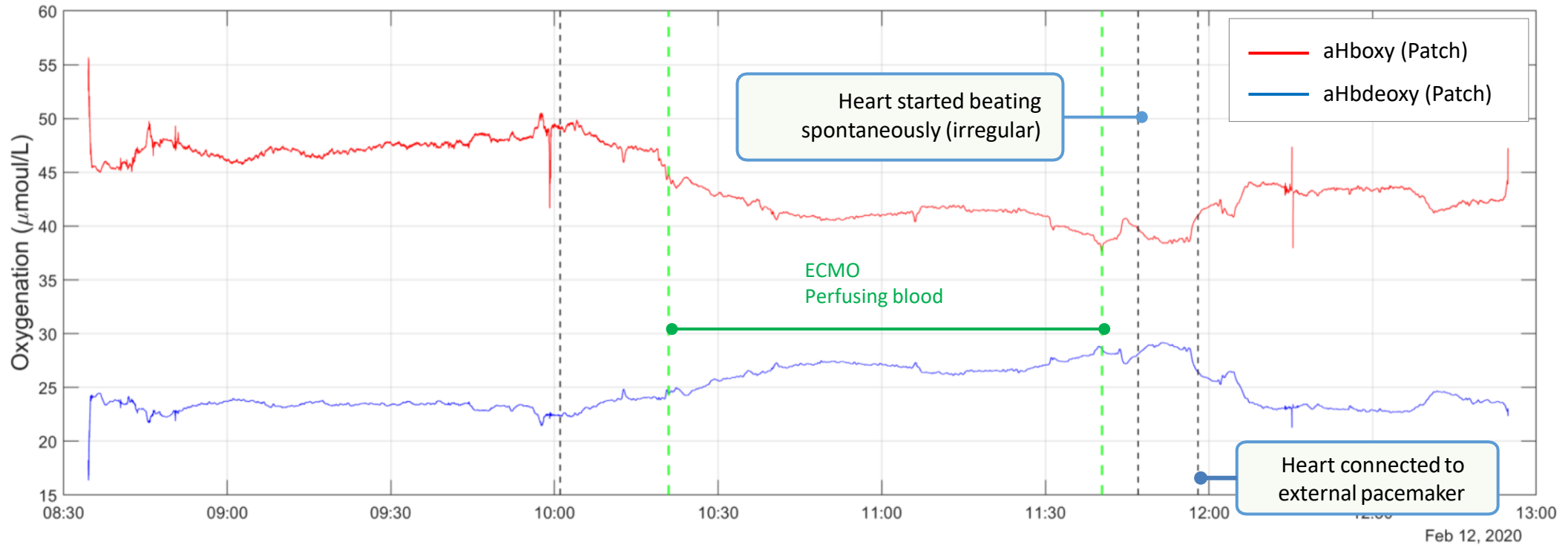Rapid SbtO$_2$ level decrease

→ **Cause determination**

Cause correction
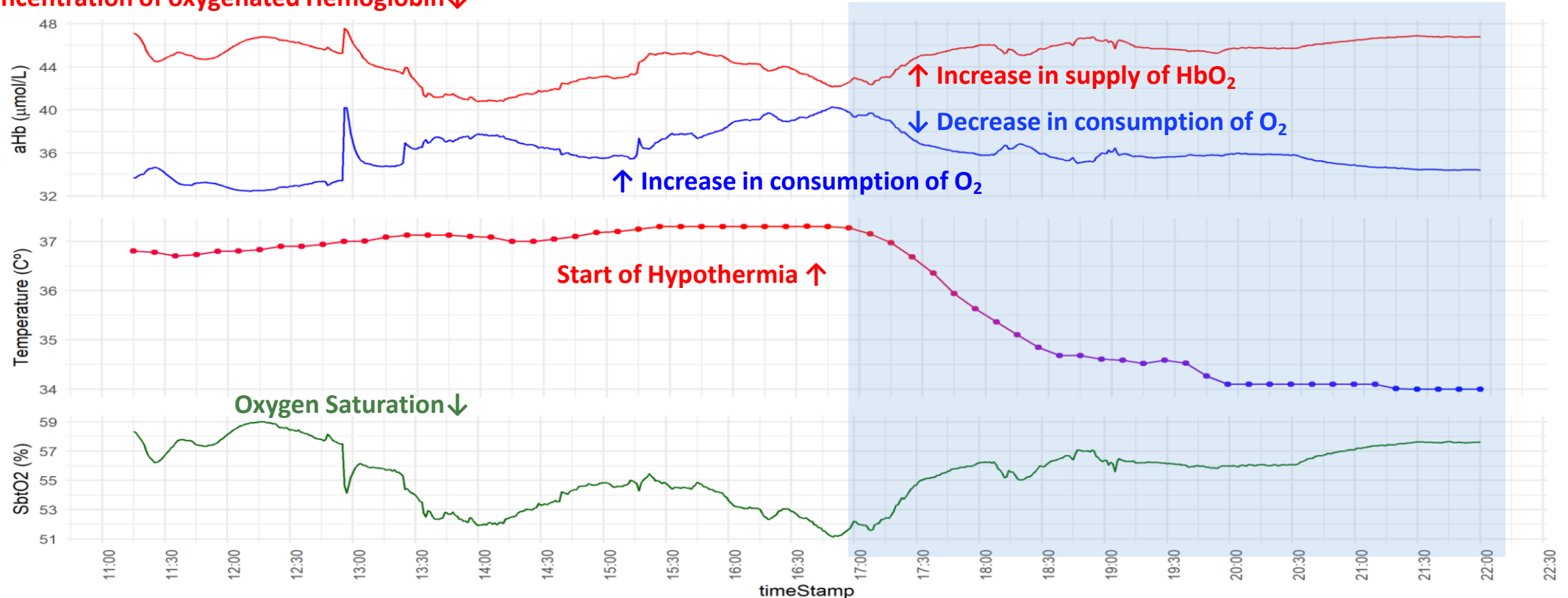
→ **SbtO$_2$ level restoration**

Case study: Brain Oxygenation During Bypass Surgery (Patch)

Identification of dilution of blood by heparin "flush" and ECMO during surgery

Case study: Brain Oxygenation During Induced Therapeutic Hypothermia (Probe)

Concentration of oxygenated Hemoglobin↓

↑ **Increase in supply of HbO₂**

↓ **Decrease in consumption of O₂**

↑ **Increase in consumption of O₂**

Start of Hypothermia ↑

Oxygen Saturation↓

- Female, 49 years
- Suffering of SAH, admitted to USZ neurointensive care unit after a vasospasm.
- A **probe** is inserted in the left-anterior part of the brain.
- After a significant decrease of oxygen supply, hypothermia is started.

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Case study: Brain Oxygenation During Hypotension Event (Probe)
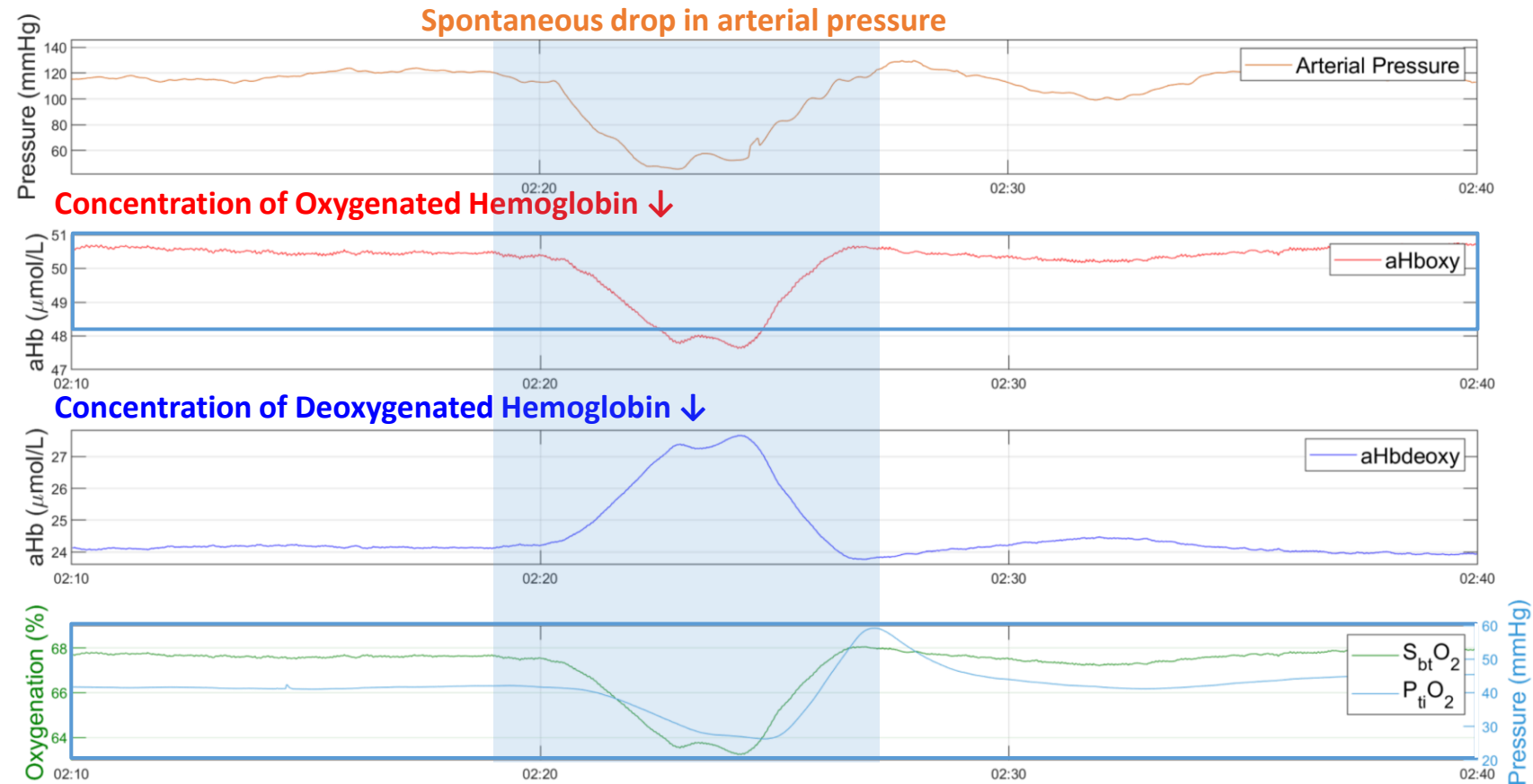
- Female, 54 years
- Suffering of SAH, admitted to USZ neurointensive care unit after a vasospasm.
- A **probe** is inserted in the left-anterior part of the brain. After two days, a **patch** is also attached.

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Experienced Leadership Team and Board with Value Creation Track Record

Board

Philippe Dro, PhD, MBA
CEO & Chairman of the Board
- Former CEO of GlycoVaxyn
- Former CEO of EndoArt
- Co-Founder of Axovan

Bruno Reihl, PhD
- Former CTO and deputy CEO at Disetronic
- Former CEO of Raumedic
- Founder of several companies

Markus H. Muser, PhD
- Over 25 years experience in engineering and medicine
- Inventor of several patents
- Co-founder and co-owner of AGU Zürich

C.A. (Oscar) Izeboud, PhD
- CEO, Scenic Biotech
- Former Head of Healthcare at NIBC Bank and Kempen & Co
- Former Business Development at Crucell

Berthold Hackl, MsC, MBA
- Founder & MD of Sorrento Investment GmbH
- Former General Manager Eurofins Europe
- Former CEO of Invendo Medical

Management

Nicolas Bouche, BSc, Thermal engineering and Energy systems
COO
- Former Head of Engineering at Nestlé Institute of Health Sciences
- Former Scientific Services and Quality Department Head at Nestlé Research
- Former CTO of Anecova SA

Rotem Kopel, PhD, Electrical engineering & Neurosciences
CTO
- Former COO & CTO at MoodKnight
- Former CEO & co-founder at MindMatters foundation
- Former Head of European Outreach at Israel Brain Technologies

Jérôme Vercoutere, MSc, Industrial engineering and Management
Senior product software manager
- Former CTO at Limmex AG, Zurich
- Former co-founder & CTO at TheAssets.co, Paris
- Former Hybrid Cloud Computing Engineer at IBM, Montpellier

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Luciole Medical in a Nutshell

Only company applying deep understanding of brain hemodynamics to transform individualized brain health

Very high medical need indications and underserved large markets

Integrated powerful analytics platform for knowledge-based clinician decisions

Wearable brain monitoring device in development

Fund-raising underway to execute commercialization & strategic development

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Thank You

Contact:

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