HBUP

Heat Brain-Ultra Precision



ufficiobrevetti@policlinico.mi.it

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Ca' Granda
Ospedale Maggiore
Policlinico

A NEW INTEGRATED METHOD TO:

- Estimate the heat (energy) transfer in the human brain
- Tailor precision thermotherapy

ufficiobrevetti@policlinico.mi.it

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Why moving towards heat measurement instead of just temperature: fundamental premises

- Currently, no methods to calculate exactly a priori how much heat (energy) should be subtracted or delivered to the pathological area.
- Temperature has a loose link with heat in the human brain/body: brain activation is characterized by heat production, but temperature is reduced during activation.
- Actual methods for thermotherapy rely only on temperature measurements, but **heat, not temperature, is the important quantity**

ufficiobrevetti@policlinico.mi.it

Heat measurement: premises

No methods to calculate exactly

- How much heat should be subtracted or delivered

Temperature has a loose link with heat

- Brain activation characterized by heat production

but

- Temperature is reduced during brain activation

Actual thermotherapy

- Relies only on temperature measurements

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Therapeutic hypothermia/hyperthermia



Cancer diseases



Neonatal hypoxia



Parkinson’s and neurodegenerative diseases



Stroke/cardiovascular diseases

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Our innovative solution

Non-invasive **Brain Heat Flux Measure Technology** to **evaluate brain heat flow with magnetic resonance** for monitoring and diagnostic purposes.

Installed on a ad hoc informatic/electronic support and eventually installed on every **MRI/MRS** machine for *in-vivo* heat-flow monitoring.

Key benefits

- Complete **non-invasive procedure** for estimating heat flow.
- **Applicability** in vulnerable tissues
- **Simultaneous evaluation** of temperature and heat flow.

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Brain Heat Flux Measure Technology

This innovative technique will allow to calculate:

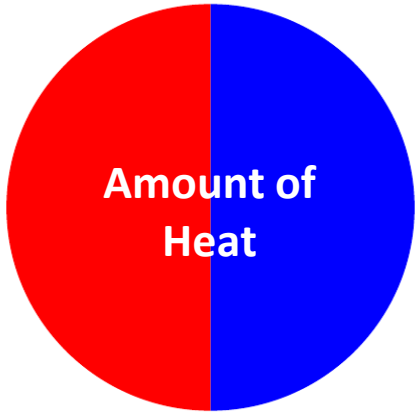
- The **exact amount of heat to be delivered** in the desired area in an accurate way, instead of heating empirically the brain based on local temperature variations, being more selective and less destructive on brain tissue.

- **How much heat must be removed** from the desired area (e.g. in therapeutic hypothermia during stroke and perinatal asphyxia) with accuracy and precision.



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HBUP calculates



To be delivered

More selective and less destructive on brain healthy tissue.



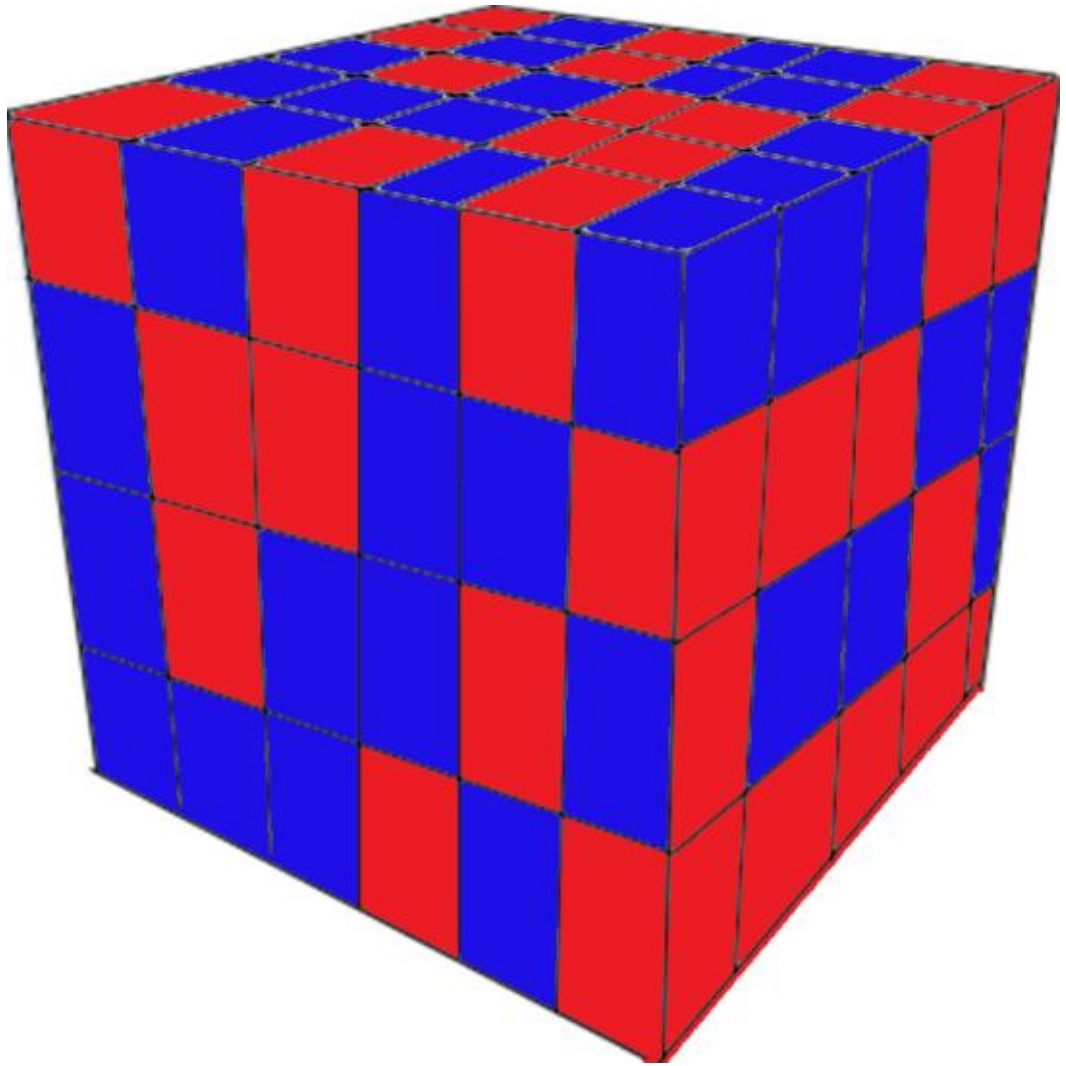
To be removed

From the desired area with accuracy and precision.

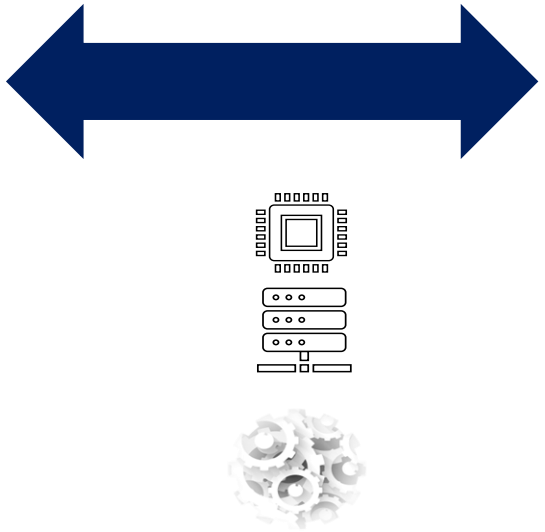
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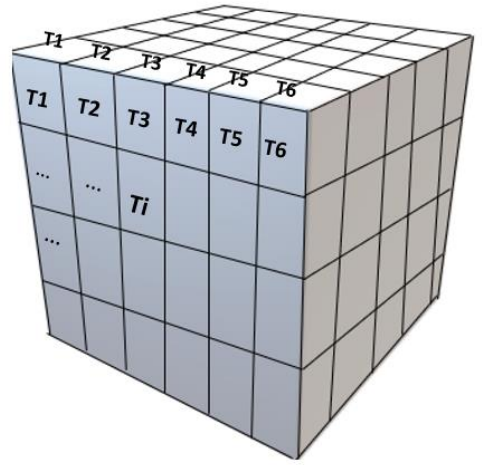
A NEW INTEGRATED METHOD



Heat Power Density [W/m³]



HBUP Device

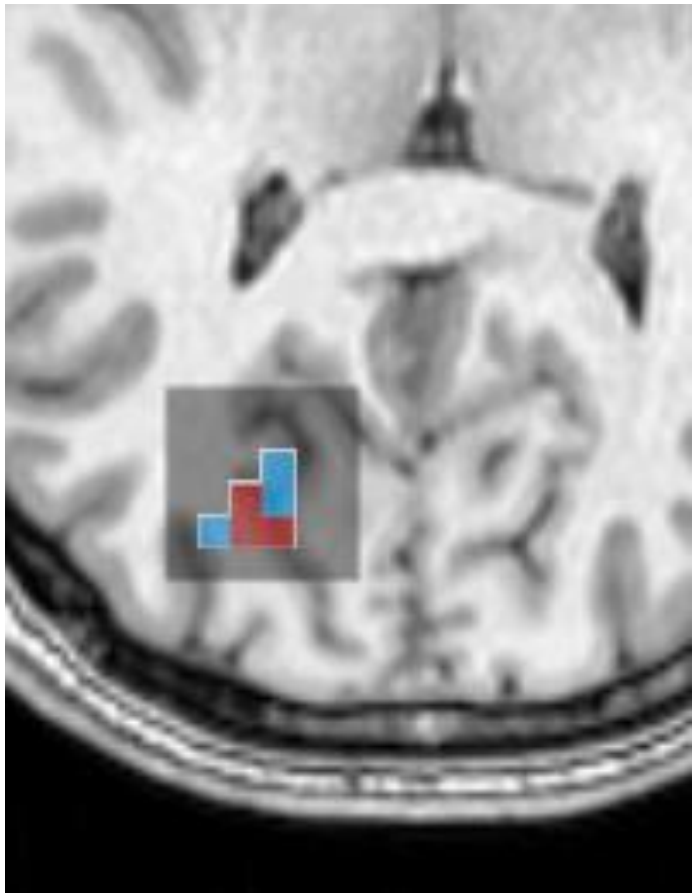


Temperature [°C]

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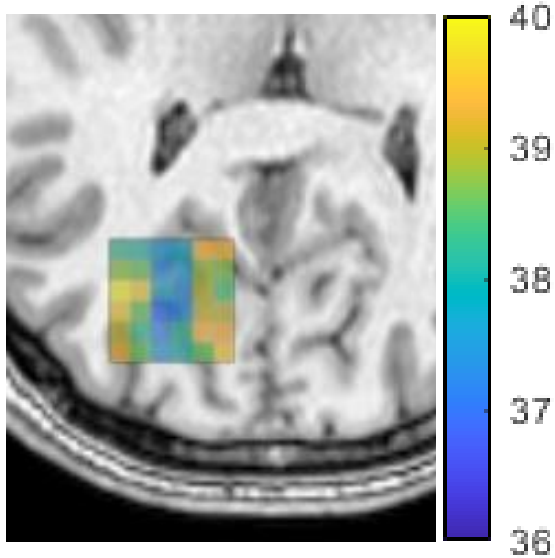
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Heat Power Density [W/m³]



Source Well

Temperature [°C]



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A new integrated method to study brain function

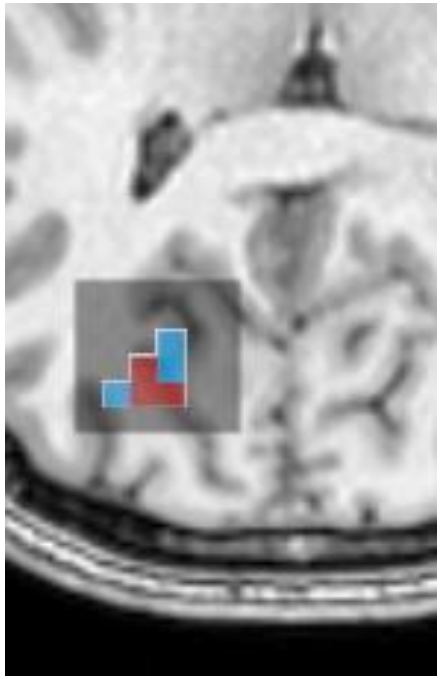
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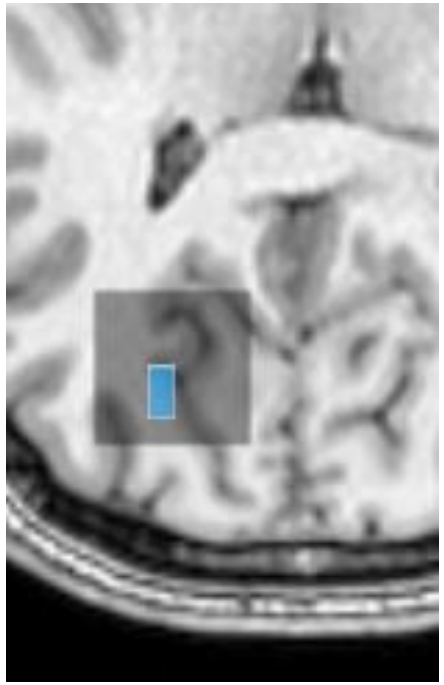
Heat Power Density [W/m³]

Source

Well

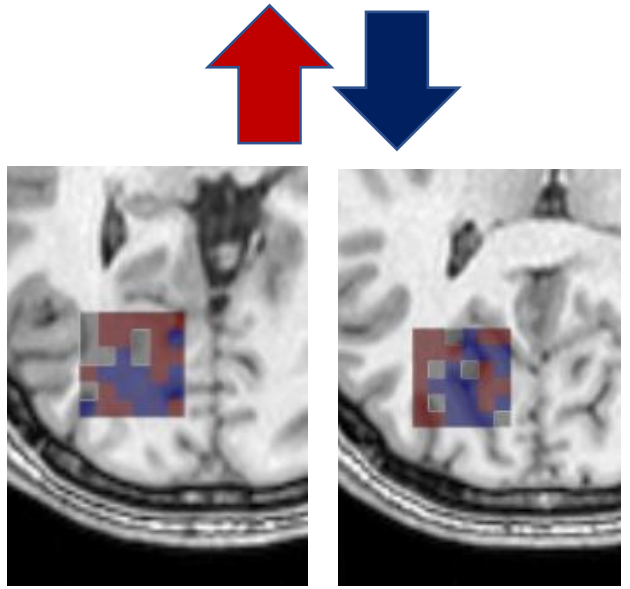


Before activation



During activation

Temperature Difference [°C]



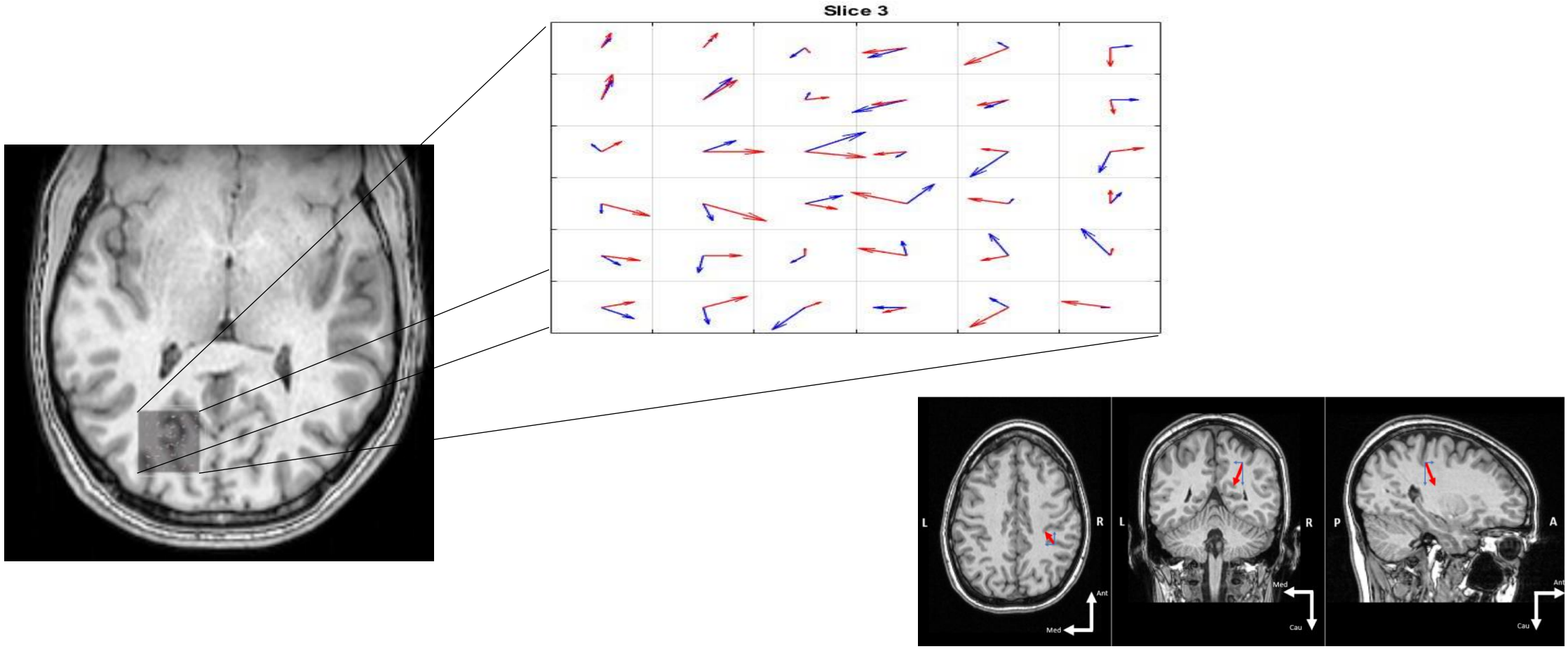
Slide 2

Slide 3

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Heat flow vectors



During activation

Before activation

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Brain activation allows to differentiate healthy brain from tumor and allows to thermoablate tumor saving healthy tissue.

References

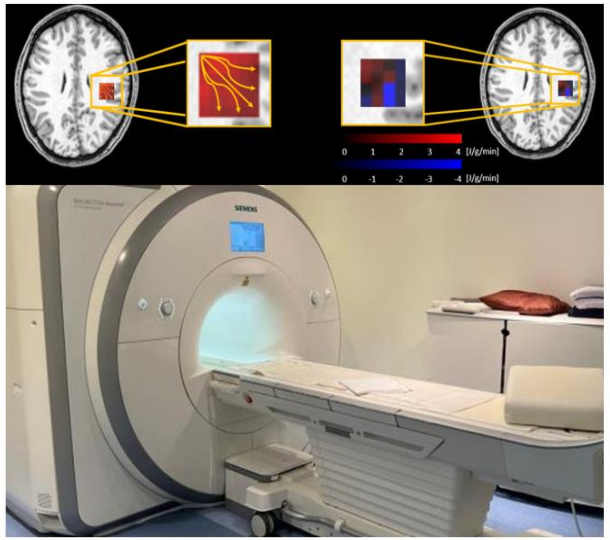
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PATENT PROTECTION

- **Heat numerical and vectorial analysis**
- **Heat numerical and pictorial data representation**



- **Patent Number:** IT102019000022419

- **Granted**
- **Under examination**

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Tested HBUP

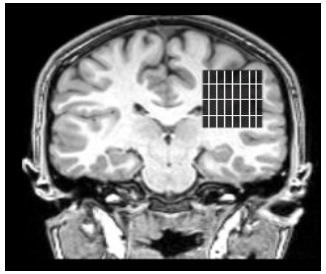
- **Healthy volunteer subjects**



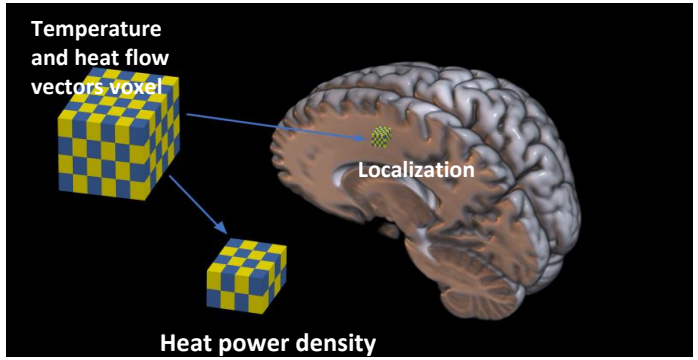
Results → • **Writing scientific article**

Methodology

Versatility



- **Selectivity area of interest.**



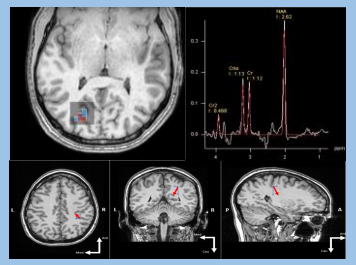
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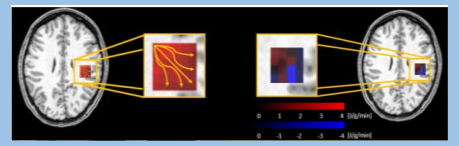
Input (Measurements)



Spectroscopic Imaging

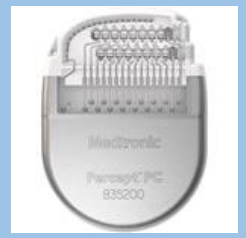


Heat calculations

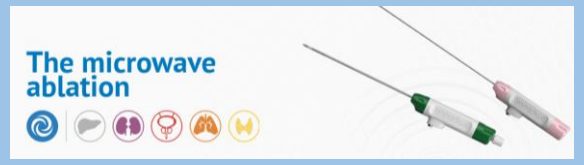


HBUP Device

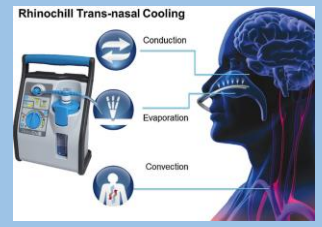
DBS



Thermal ablation



Cooling devices



Magnetic Resonance



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Road Map



- **Advanced state of development of the algorithm.**



- **The methodology has been already applied in the human brain of healthy volunteers.**



- **The time expected for full development & implementation is about 2/4 years.**
  - **Optimize the model**
  - **Interface – friendly user**

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Deep Brain Stimulation

(DBS)

Thermal Transfer Solutions

(TTS)

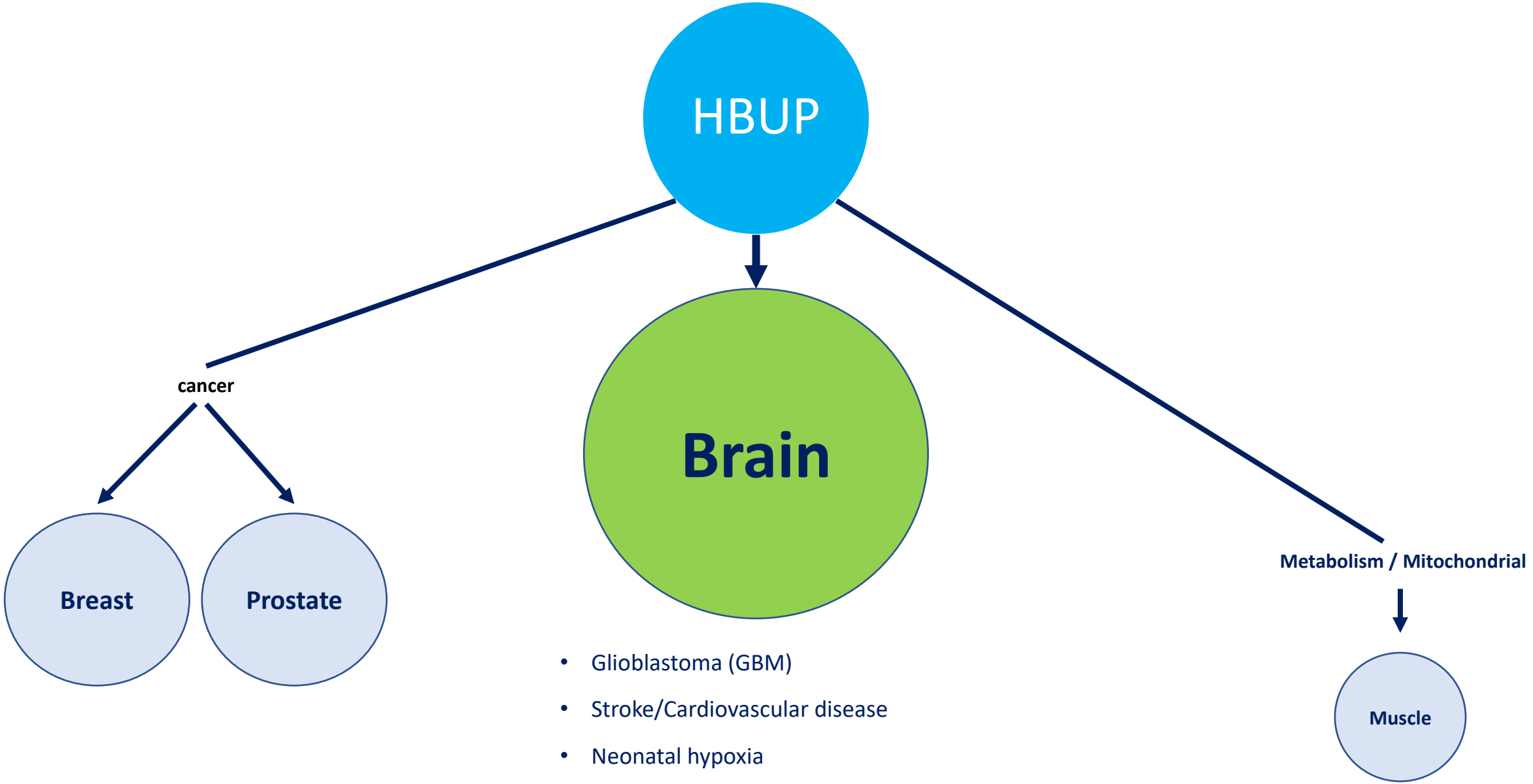


Thermal Ablation

Cooling devices

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- Glioblastoma (GBM)
- Stroke/Cardiovascular disease
- Neonatal hypoxia
- Parkinson disease / Neurodegenerative diseases

- Sport medicine and muscular diseases

ufficiobrevetti@policlinico.mi.it

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Thank you for your attention!

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