B-CRATOS

Brain Interface: Wireless Powering and Communication

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Connecting a brain and a bionic arm with wireless technology

B-CRATOS teams are working on a system to transmit effectively signals from the brain to a prosthesis, and, in return, stimulate the brain with data sent from the prosthesis. In other words, a two-way communication.

How to? By developing a **wirelessly powered, battery-less implantable brain interface** capable of detecting and wirelessly transmitting multi-channel, high-speed neural signals and precisely stimulating cortical targets!

To achieve this, researchers from NTNU and BRME engineers are collaborating to develop and integrate NTNU's **novel wireless communications and powering technologies** with Blackrock's **neural interface platforms**, in the form of an Implant unit and an external unit made as a wearable device.

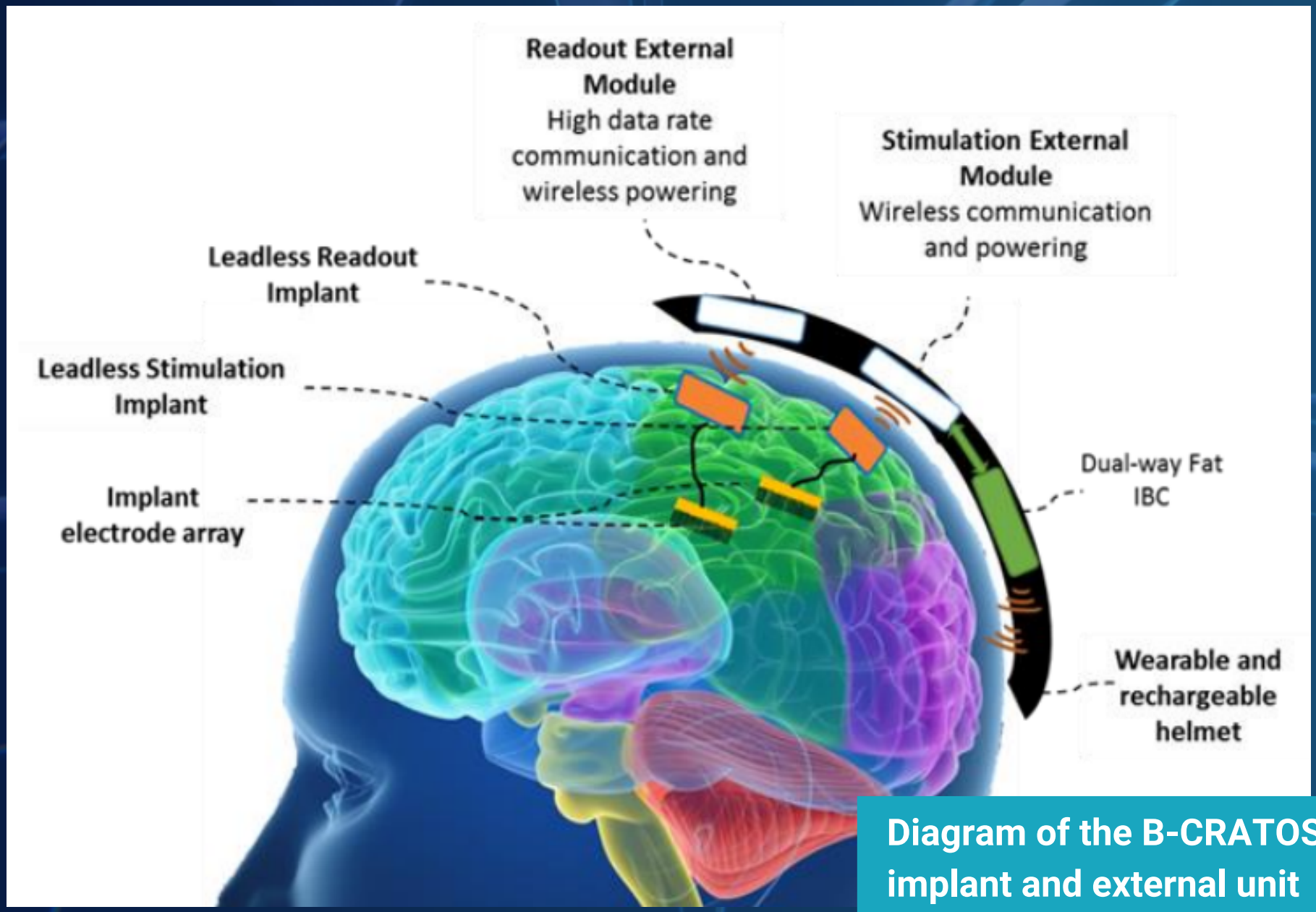
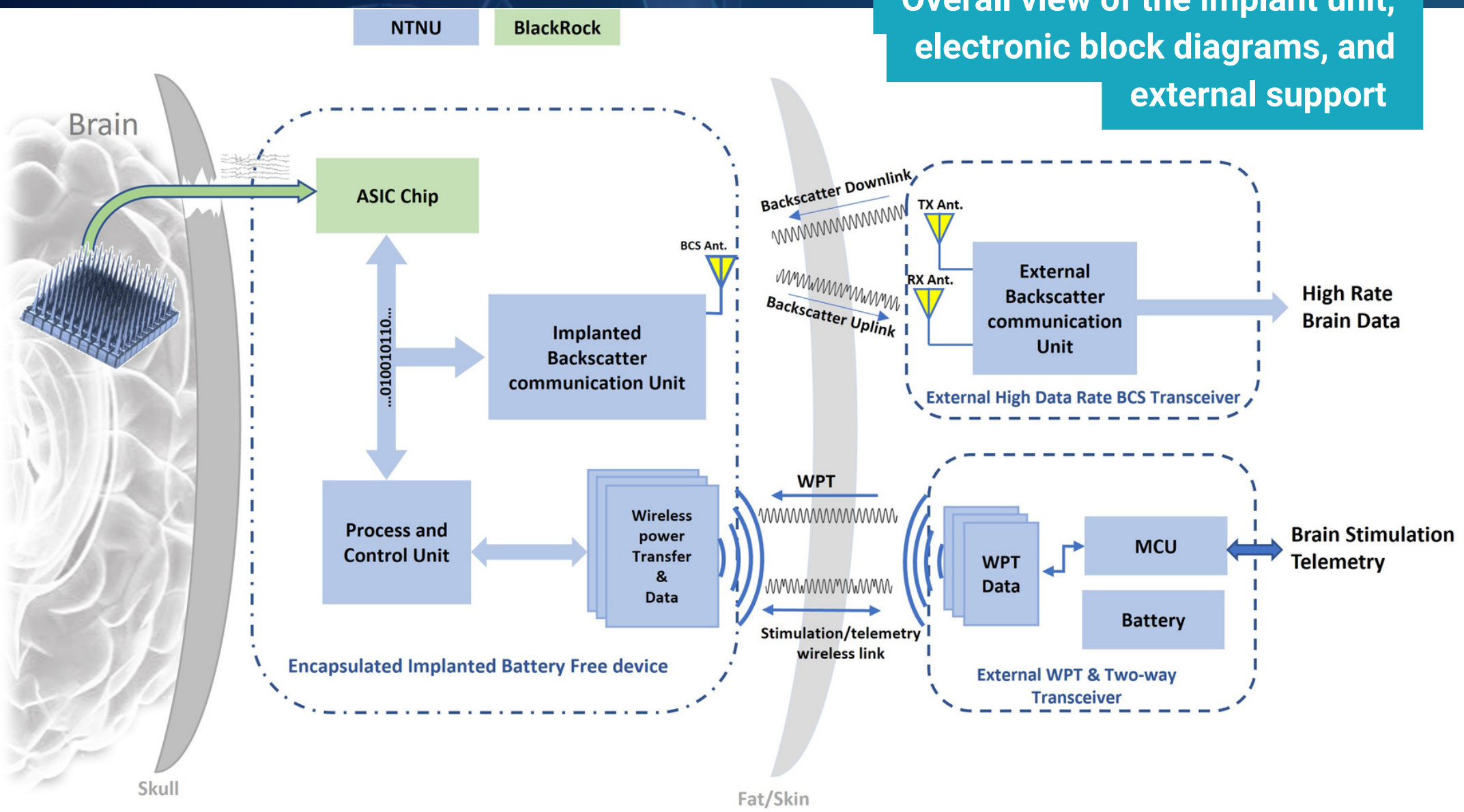


Diagram of the B-CRATOS implant and external unit

The implant electronics will use a **custom-designed ASIC chip** to perform the brain signal acquisition, in which the neural signals are efficiently sampled and converted to the digital data for transmission.
The data will be constructed in a custom digitized format and delivered to the backscatter com unit.

Overall view of the implant unit, electronic block diagrams, and external support



The **external unit** reads implant data using the RF backscattering technique. It includes a **wideband antenna** to support the required bandwidth of the data, a **local RF generator, receiver and transmitter chains**.

- The reader extracts the same data fed to the implant's backscatter switch.
- The data is exchanged with the FAT-IBC sub-system (In-body wireless microwave communication platform through fat tissue channel) to be transmitted to the AI Module developped by a team led by LINKS foundation.

The external unit can run on battery charge or an external electric power supply.

Design challenge for optimal safety and transmission

When it comes to wireless devices, there are a certain number of standards to observe, to respect a level of health safety and data security. For instance the **SAR (Specific Absorption Rate)**, **RF emissions, data security using NFC standards** must all be taken into account for the design of the system.
Of course, this requires exhaustive testing and poses constraints to the development of the system. But that's a challenge we gladly embrace to make a safe technology!

To know more and follow our progresses, you can check our public reports!

- Implant Module – preliminary report (month 12)

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