

DRAPER

Gemstone – A Networkable Implantable Wireless Neurostimulator

IMAPS NE Symposium 2018

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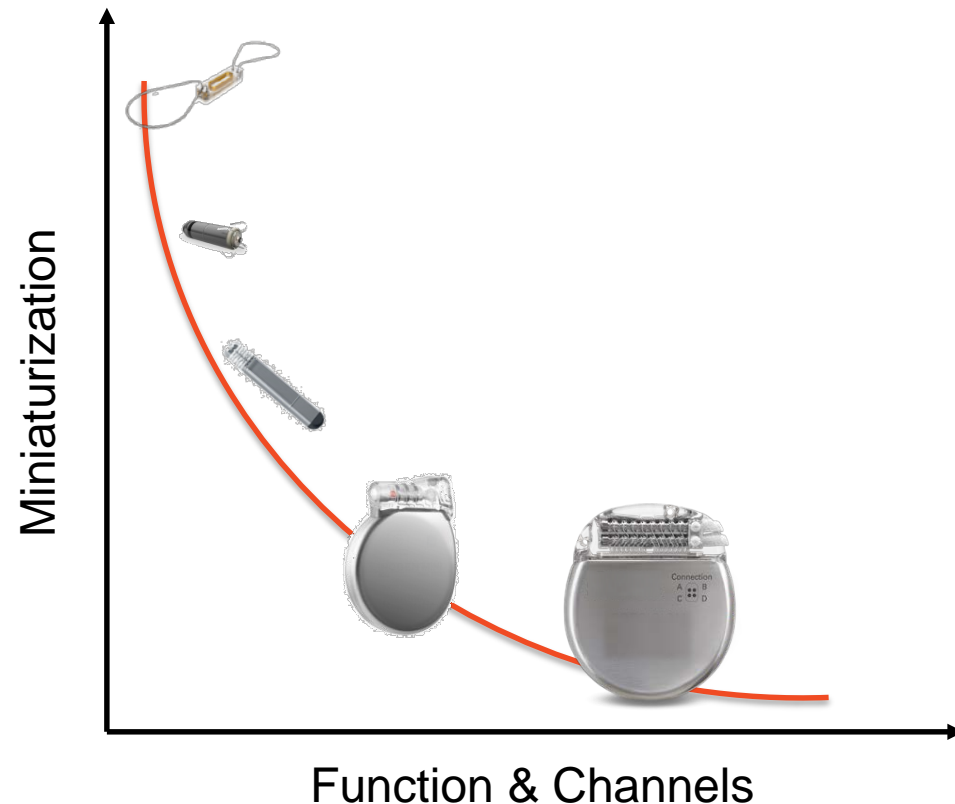
D R A P E R

Abstract

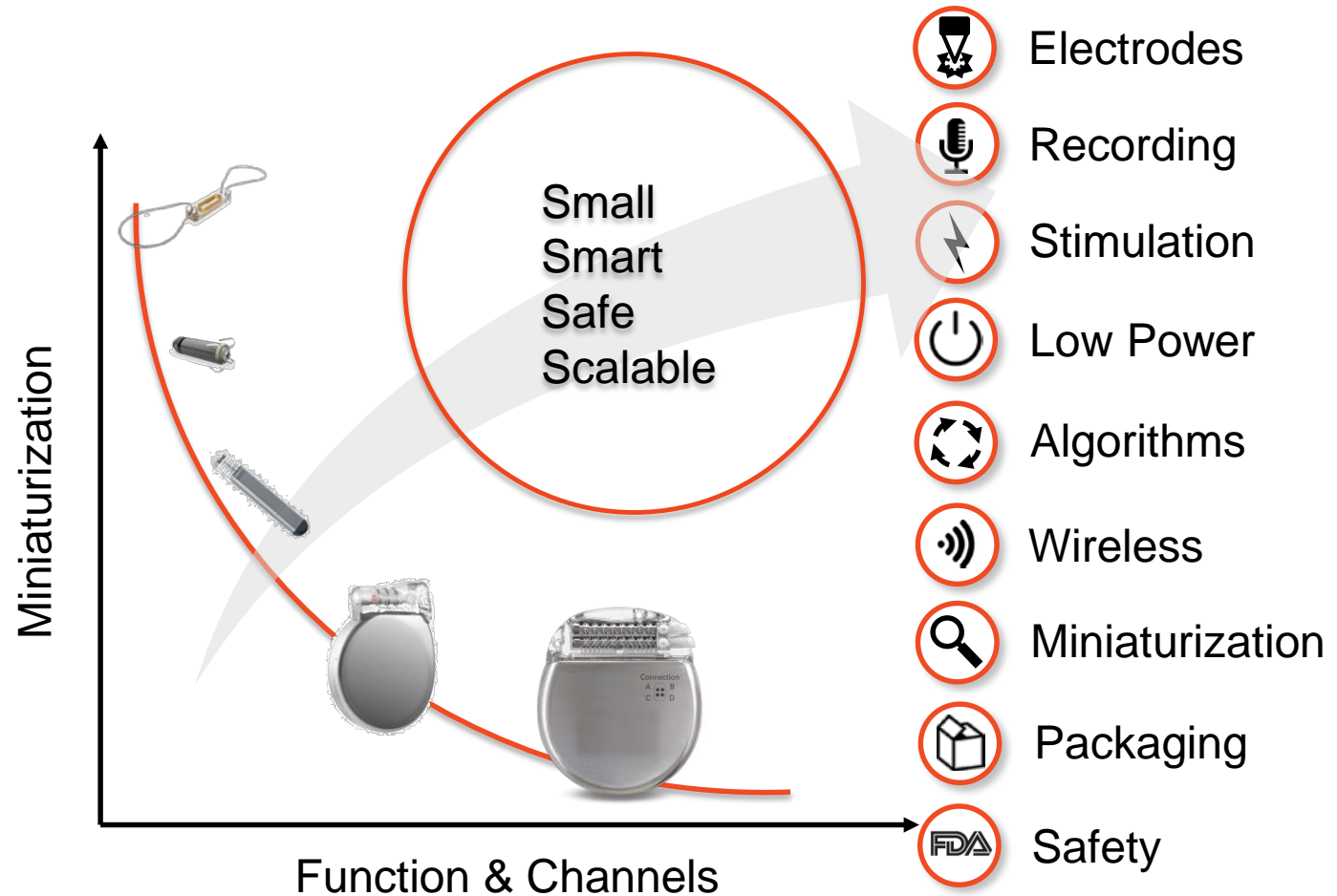
The neurostimulator arena is one that continues to grow and expand in capabilities as researchers and scientists find more uses and applications to deliver therapies for various conditions. As Draper attempts to jump ahead of the neurostimulators game, we've created the Gemstone – a wireless networkable implant that is not only capable of stimulation but also neural recording in all its 32 channels and contained in a volume less than 2.3 cm³. This talk will discuss the current state of the art of neurostimulators and compare the features of commercially available devices against Draper's Gemstones. The Gemstone will be described in detail from the microelectronics and packaging perspective along with the challenges and features that allows the Gemstone to potentially become the most advanced and flexible device of its kind to date.

Limitations of Current Technology

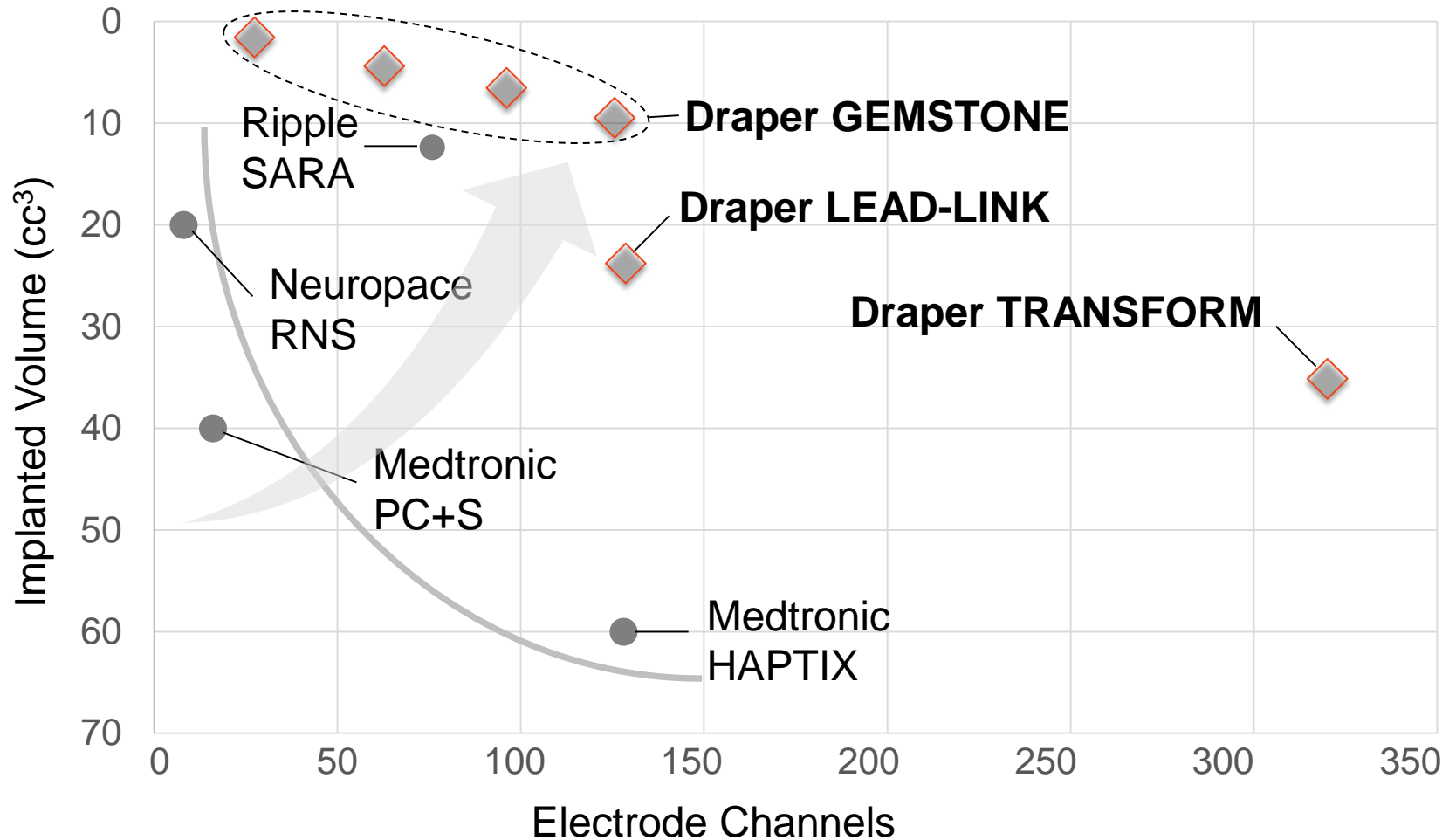
- Limited battery life
 - Finite therapy duration
 - Needs revision surgery to update/replace battery
 - Shape and size of device greatly driven by battery
- Dedicated application (low flexibility)
 - Use with limited electrode types
 - Package design tailored to specific application
- Limited/specific functionality
 - Some are purely stimulators, some are just recorders
- Low channel count to volume ratio



Miniaturization without Compromise



Comparison of State-of-the-art



Gemstone: Hardware Features

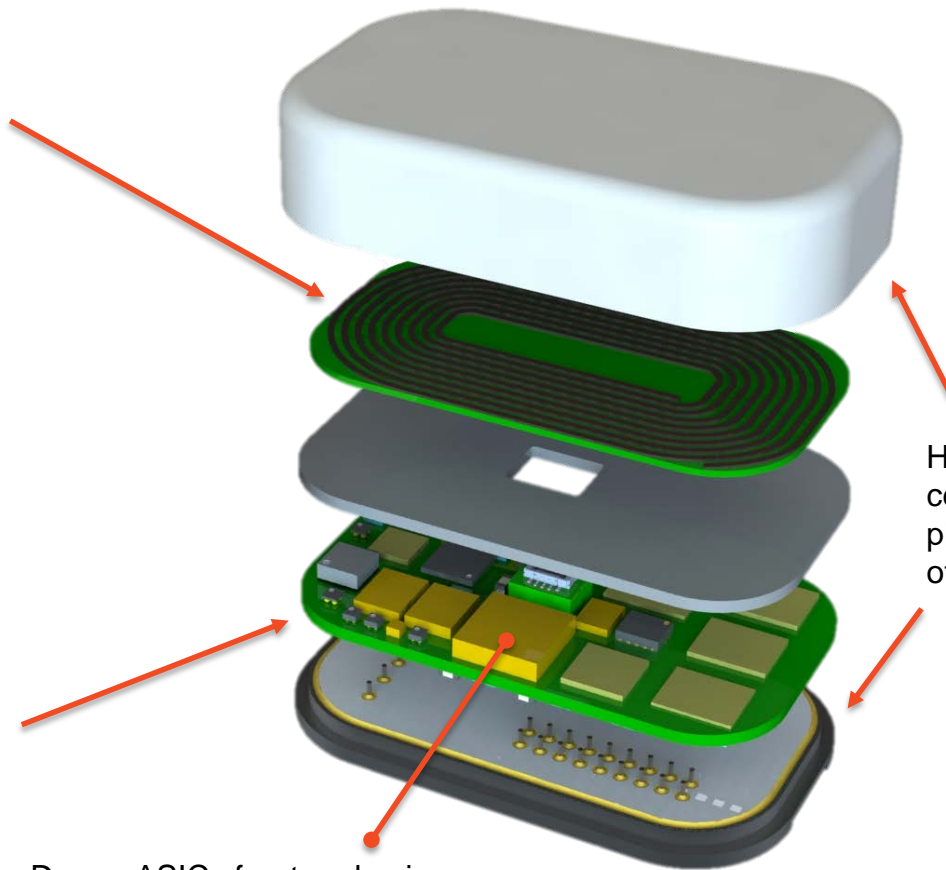
Auxiliary antenna board stacked on top of main board to host wireless data and power antennae

8-layer main board with:

- 2700+ microvias
- 2/2 lines and spaces
- 14 x 24 mm

Draper ASICs front end, microprocessor and 2 FPGAs for a total of:

- 6 bare die
- 14 packaged ICs
- 200+ passives



Hermetic package is to consist of ceramic lid and feedthrough with platinum pins to connect electrodes of choice for the system

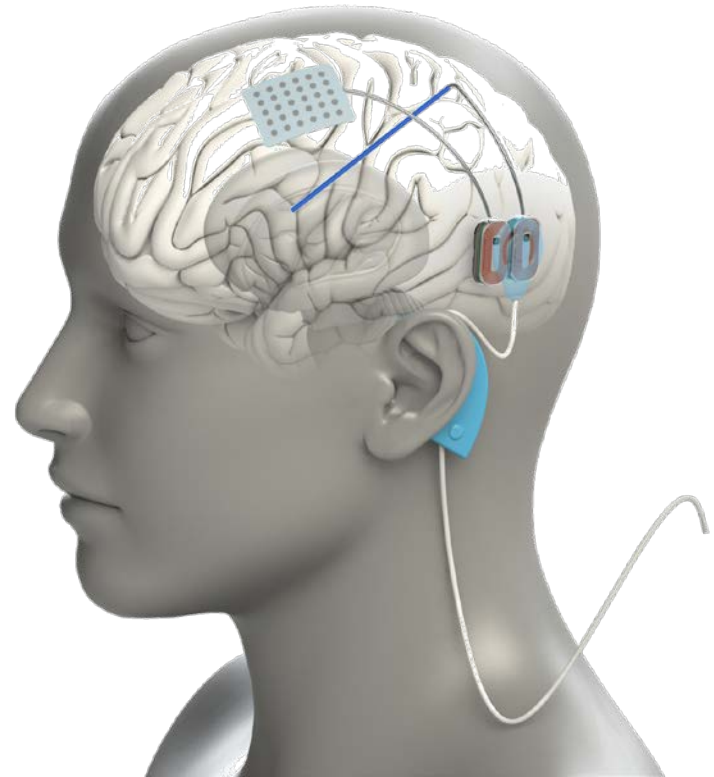
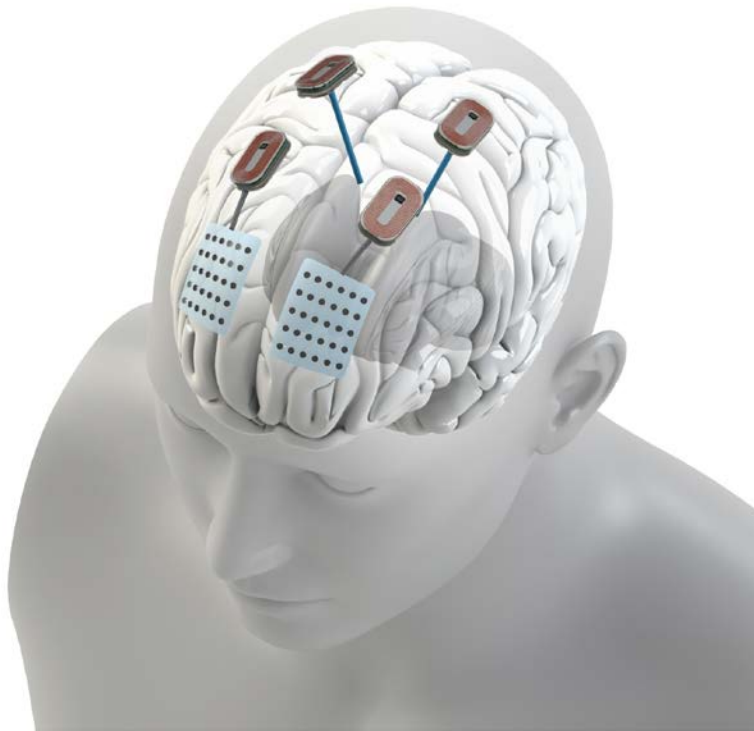
Gemstone: Wireless Networks

Leadless implants improve scalability and flexibility



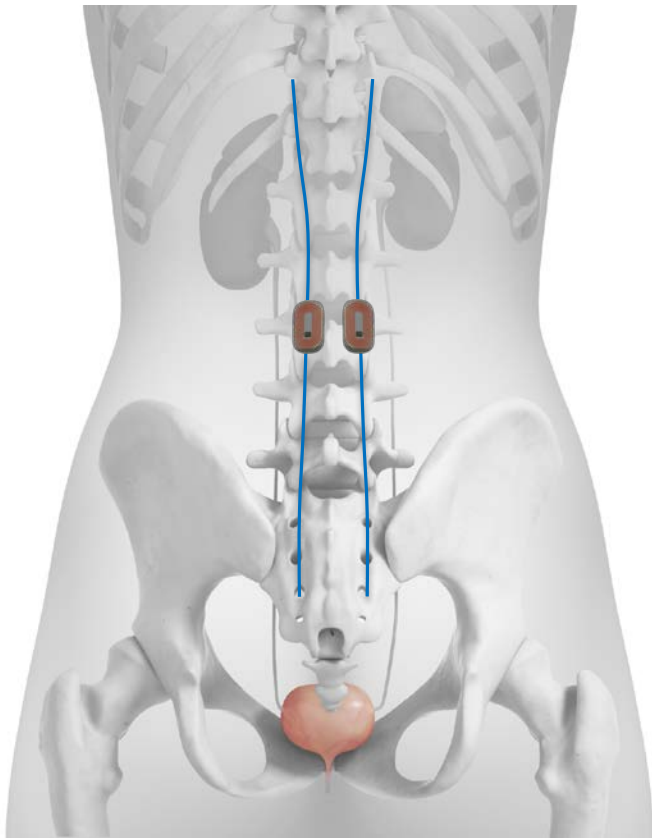
Gemstone: a flexible neurotherapy platform

Cortical applications



Gemstone: a flexible neurotherapy platform

Visceral application



Spinal application



Peripheral application



Summary



Gemstone technology poised to be the most advanced and flexible neurotherapy platform

- *32 ch single-ended / 16 ch bipolar stimulation and recording*
- *Low bandwidth communication for commands*
- *High bandwidth data for recordings*
- *Continuous wireless power (= no need for battery)*
- *Leverages demonstrated hermetic package of Ti feedthrough plate with Pt/Ir pins and ceramic lid for RF transparency*
- *Total implanted volume of less than 2.3 cm³ makes it possible to use in a wide range of applications*
- *Networkability of up to 4 Gemstones per system makes scalable platform*

A Vision for Next-generation Therapies

- **Informed decisions**
 - *Systems-level view of disease*
- **Precise & coordinated therapies**
 - *Exactly the right place*
 - *Exactly the right time*
- **Personalized care**
 - *Responsive feedback to patients and clinician*



Thank you!

Questions?