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Plenary presentation Wed-Mo-PL4-05 given at MT26, 22 – 27 September 2019; Vancouver, Canada.

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DEPARTMENT OF ENGINEERING

Electrical Engineering
CAMBRIDGE

Flux Pumps

Superconducting Wireless Power

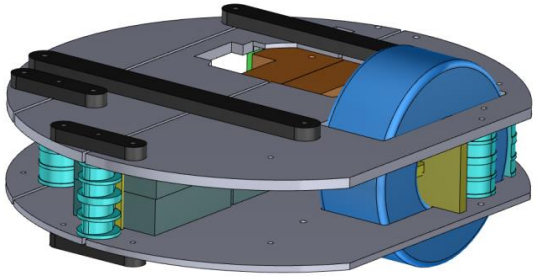
Superconducting Power Switches

James Gawith
University of Cambridge
Electrical Power and Energy Conversion Group

Flux Pumps

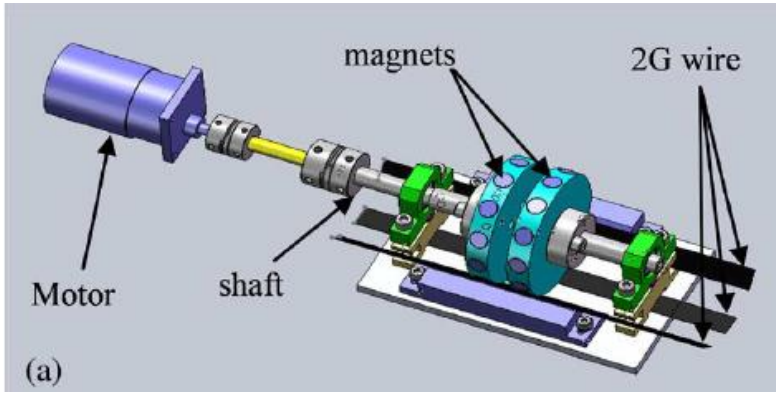
- **Wireless power supplies** for superconducting magnets
- Provide **thermal, mechanical, electrical isolation** of magnet
- **No** high-current **DC supply** or **current leads** required

University of Cambridge/NHMFL
Application: High Field Magnets



University of Cambridge
Application: Compact MRI

Victoria University Wellington
Application: Rotating Machines



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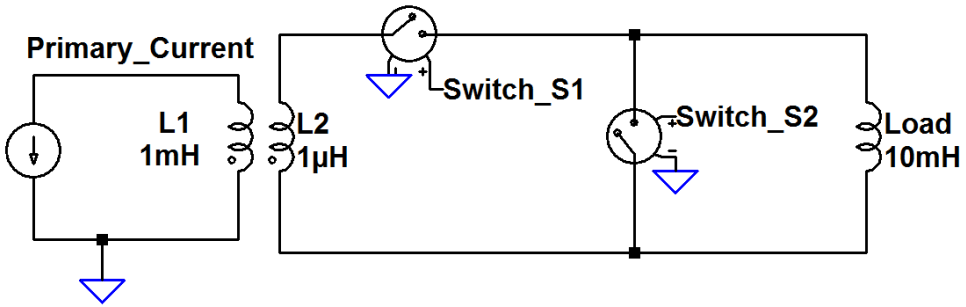
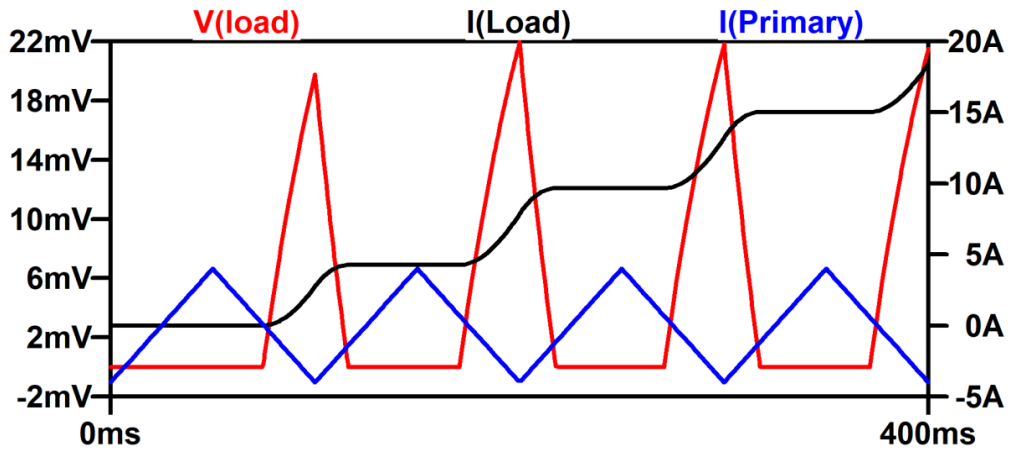
‘Transformer-Rectifier’ Flux Pump

- Normal to HTS transformer -> HTS rectifier -> Load magnet
- SPICE simulation developed for optimisation
- Key components are **<u>superconducting switches</u>**





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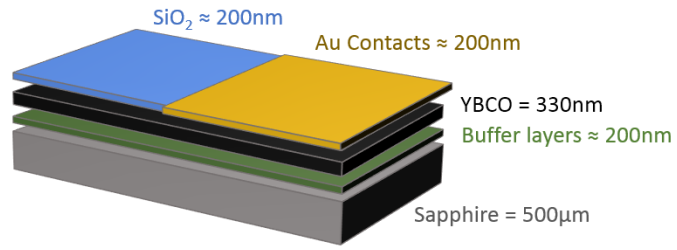
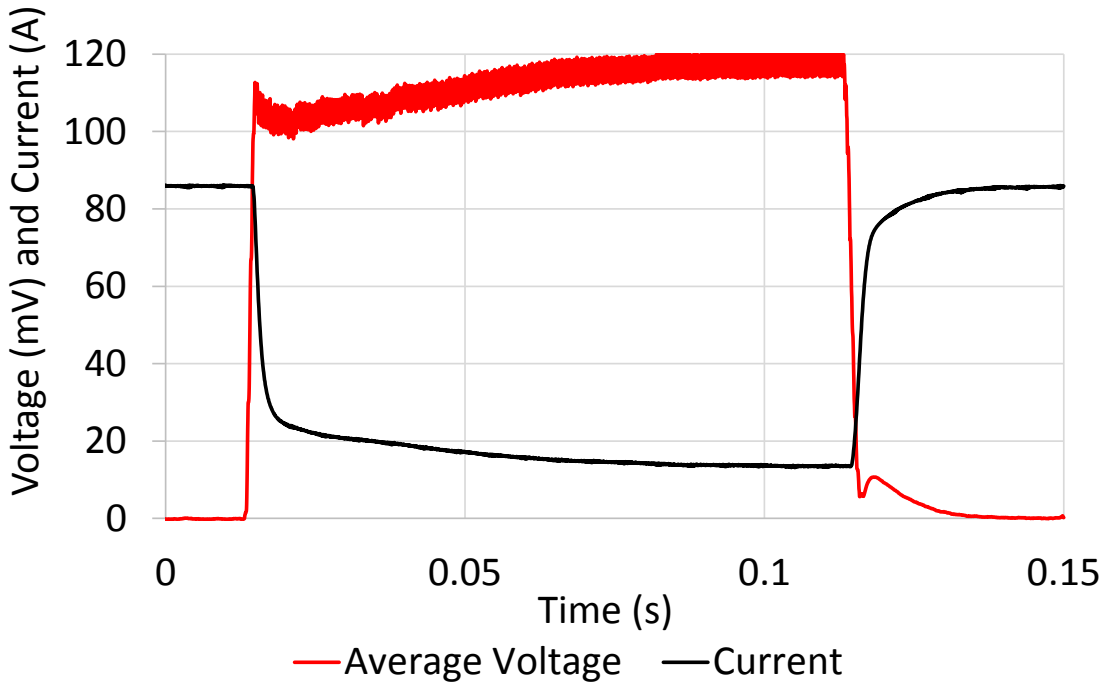
HTS AC Field Switch

- Off-state by **dynamic resistance**
- Does not exceed J_C, T_C, or B_C
- **100A** I_C to **9mΩ** off-state with **2cm²** active material
- **<10ms** transition times



Switch Characteristic at 8.8kHz, 50mT



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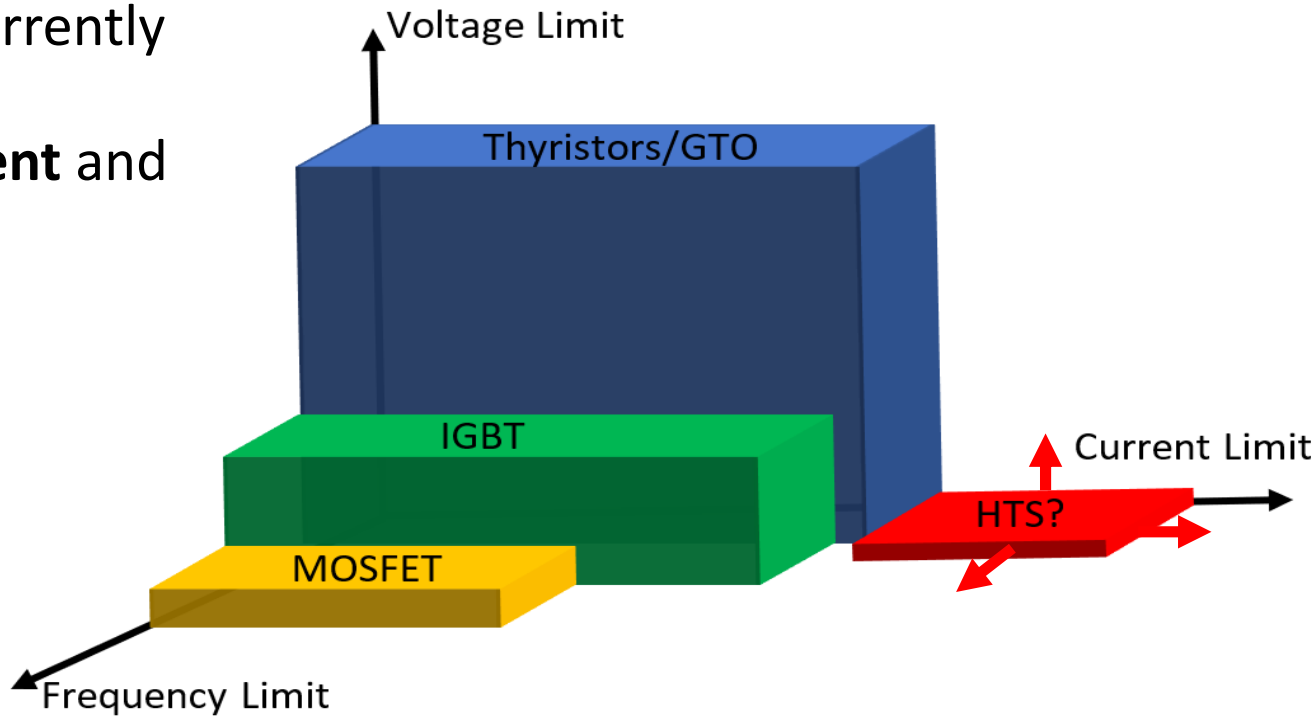
HTS Power Electronics?

- **Semiconductors** dominate currently
- HTS competitive at **high current** and **low voltage/frequency**
- Widen applicability
  - Improve **materials**
  - Improve **design**
  - Explore **actuation** methods



Thanks for Listening!

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Woolf Fisher Trust
Fitzwilliam College

Talk later this morning:
Wed-Mo-Or12 - Flux Pump and Cryostats

Cambridge EPEC Superconductivity Group

Supervised by Dr Tim Coombs

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