



Free-range Resonant Electrical Energy Delivery System (FREE-D) for a Ventricular Assist Device

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Disclosure

- **I have no actual or potential conflict of interest.**



Problems with LVADs and Drivelines

- **LVADs proven efficacious**
 - REMATCH, Rose et al
 - NEJM 2001
 - INTERMACS
- **Transcutaneous Drivelines**
 - Infection
 - Repeated hospitalizations
 - Surgical interventions
 - Reduced quality of life



Wireless Power

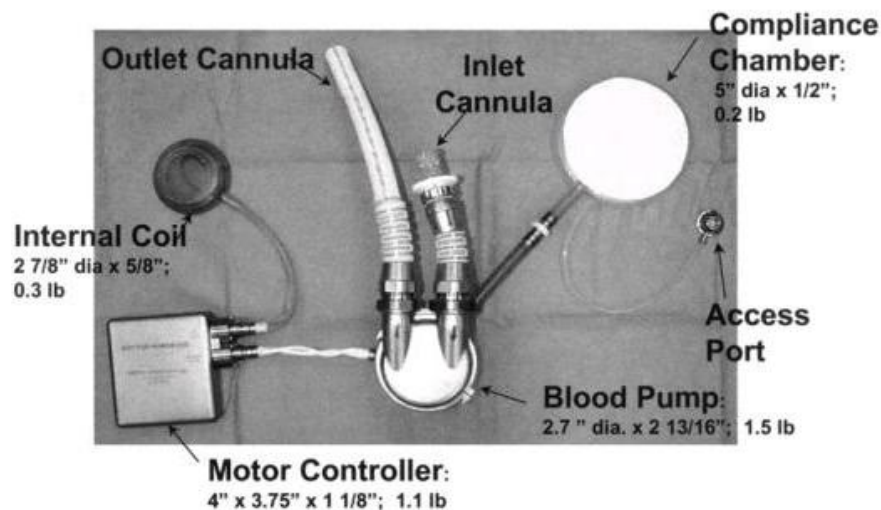


Previous Inductive Coupling Systems

- **Technology**
 - Inductive coupling
 - “Point” charging
- **Limitations**
 - Distance
 - Misalignment
- **Previous LVAD Applications**
 - TETS
 - LionHeart
 - Abiocor



PowerMat Charging Pad

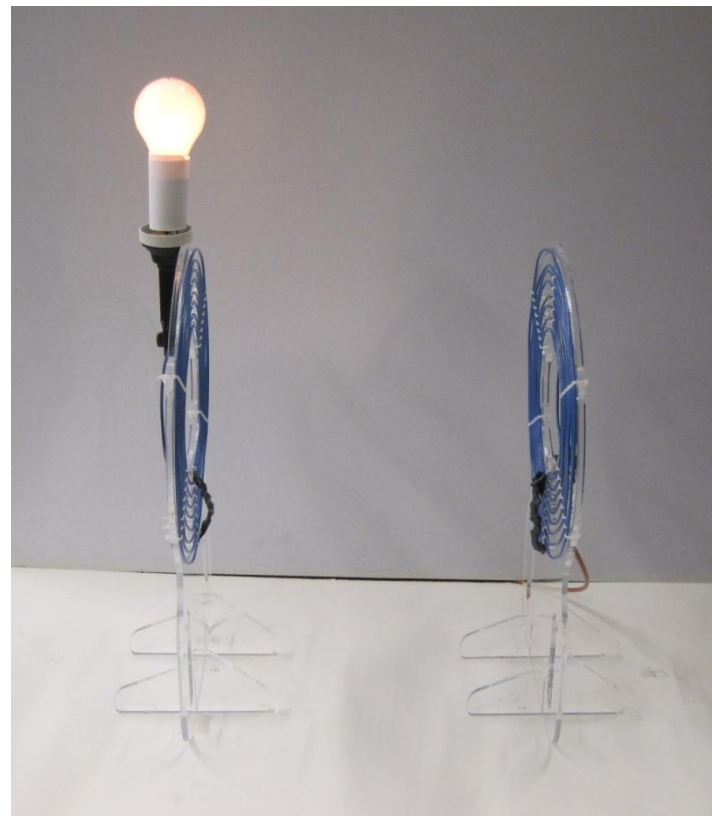


LionHeart, El-Banayosy et al



FREE-D System

- **Technology**
 - Resonant coupling
 - High Q resonators
 - “Volume” charging
- **Benefits**
 - Efficiency
 - Adaptation
 - Distance
 - Orientation
 - Safety



FREE-D System Demonstration



Safety and Regulations

- **EM Exposure**
 - Specific absorption rate (SAR)
- **Thermal Energy**
 - RF energy radiation
 - Electronics temperature
- **Electrical Regulations**
 - Frequency bandwidth
 - Field strength of emissions
- **Efficiency is important!**
 - Transmitted power



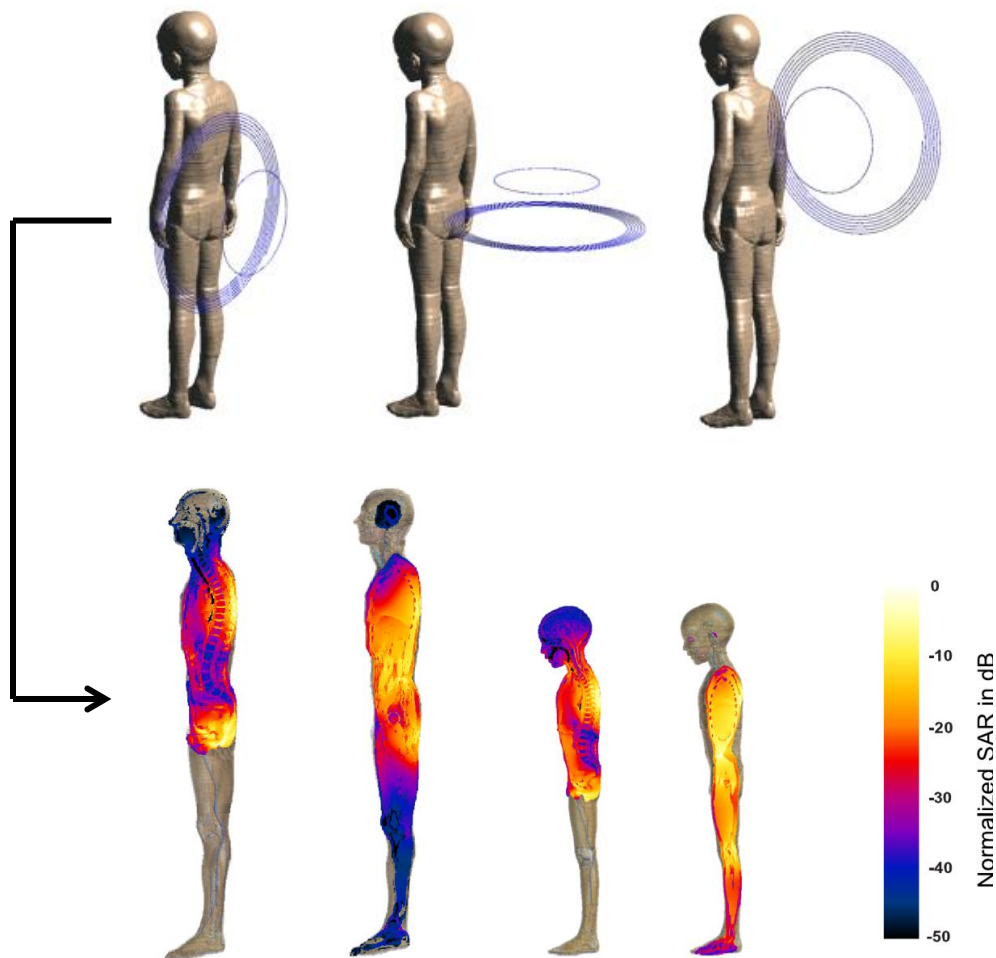
IT'IS SAR Simulations

- **Coil Alignments**

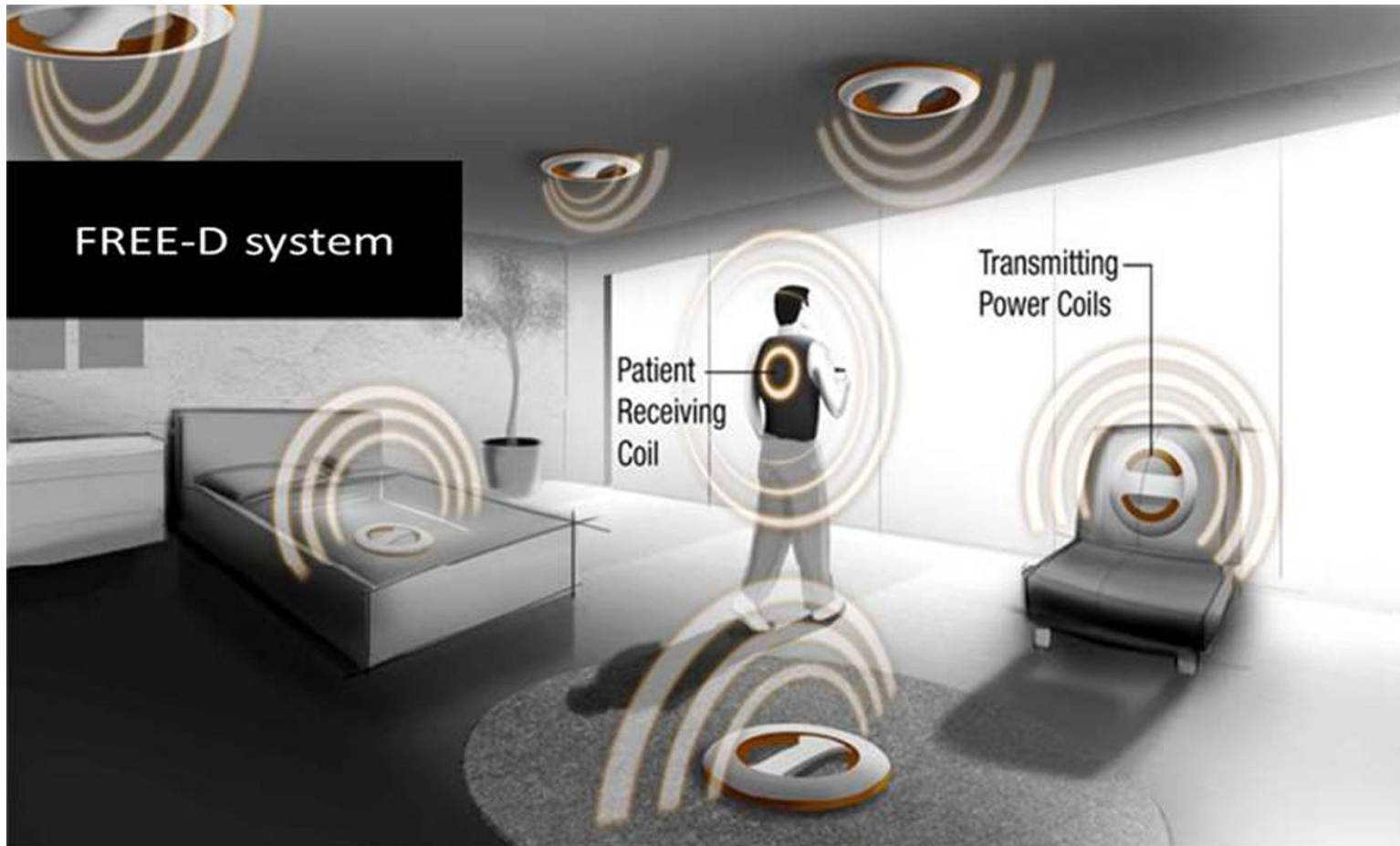
- Coronal
- Axial
- Sagittal

- **SAR Levels**

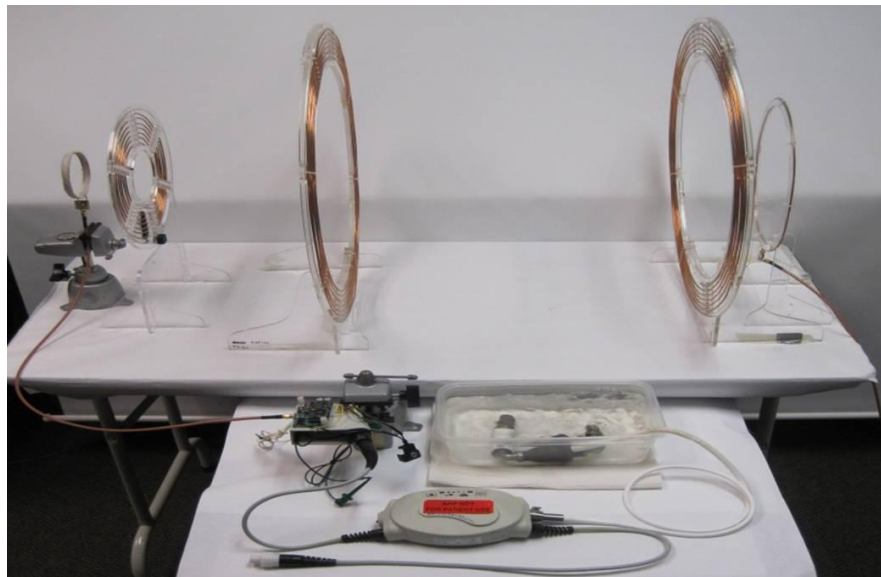
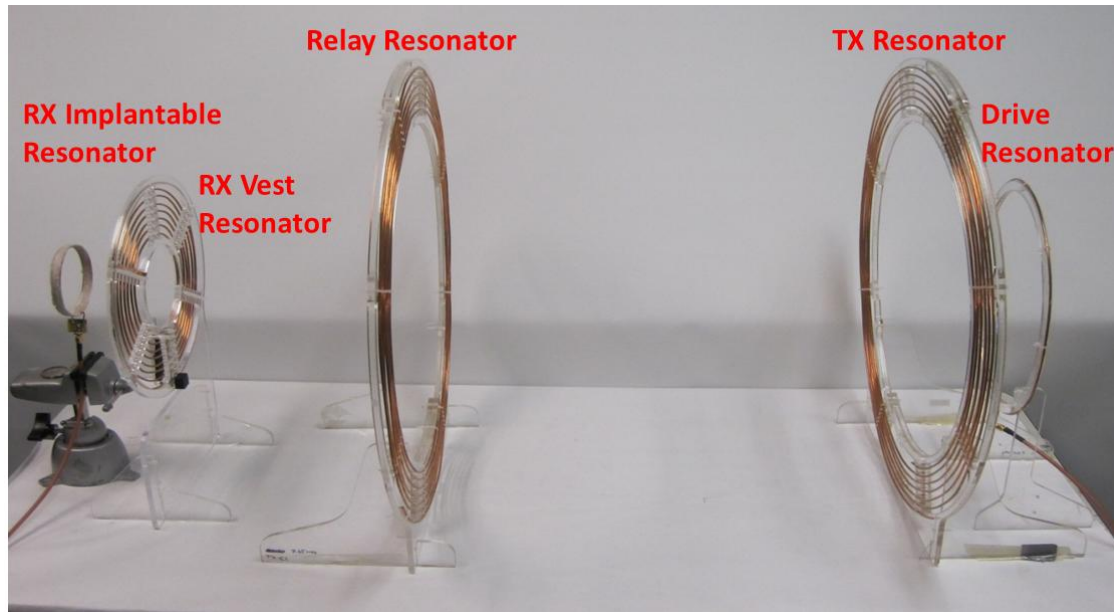
- Measurements for coil aligned at 10mm and 75mm from body.
- Worst case SAR for coronal alignment
- Peak SAR limitations reached at 45-280W



Implementation

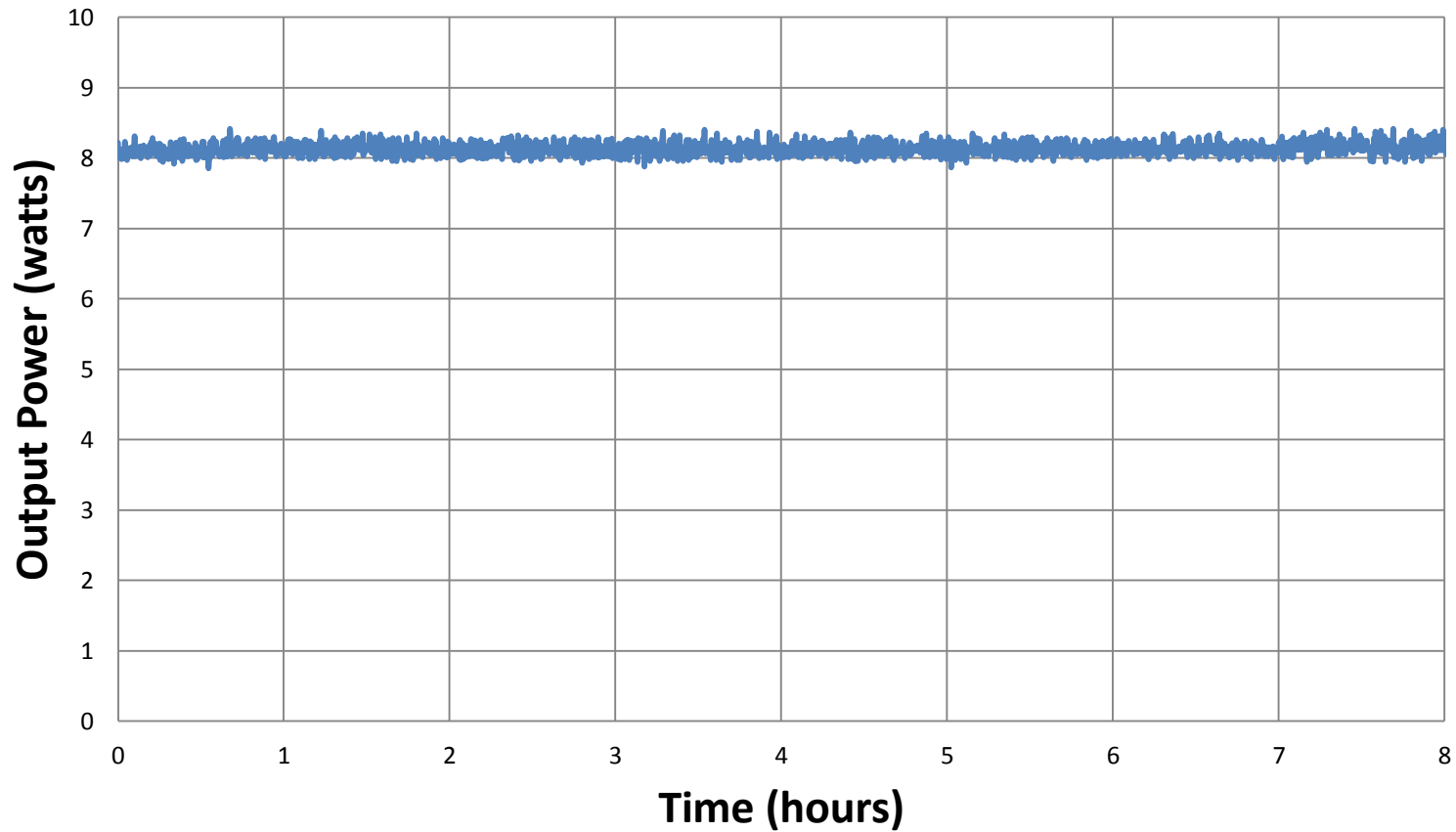


Methods



Power Delivery to LVAD

Continuous Power Delivered



Conclusion

Conclusion from Abstract