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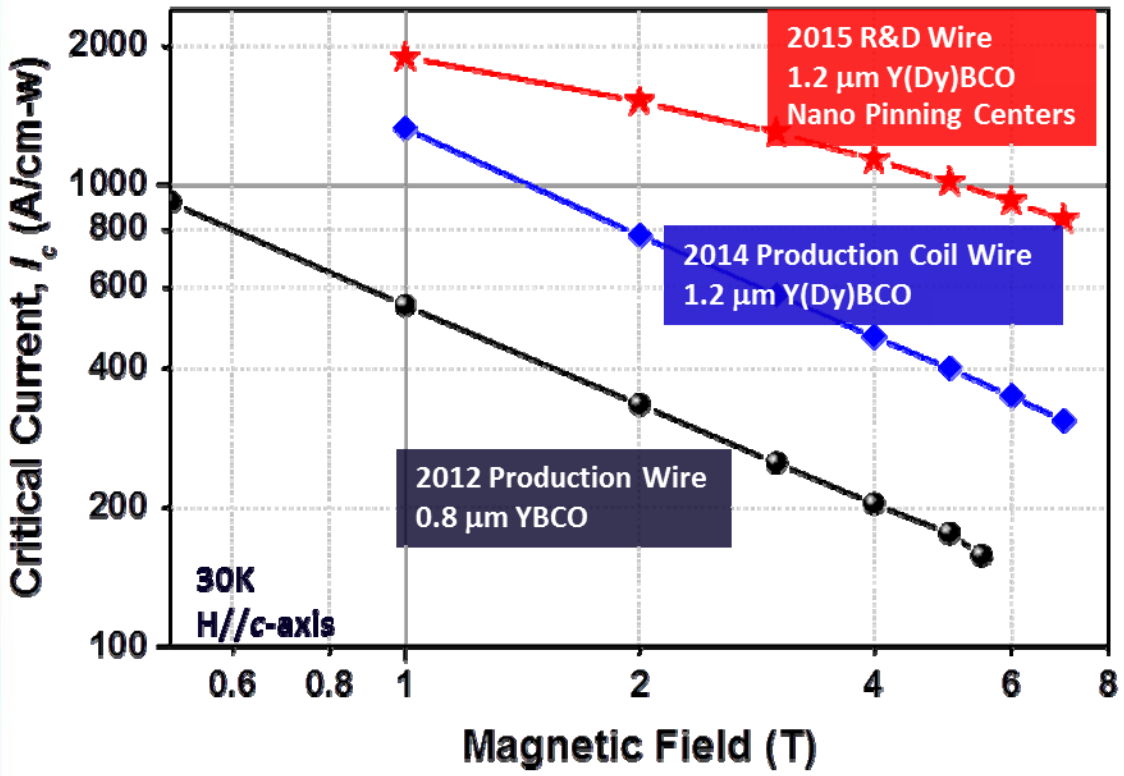
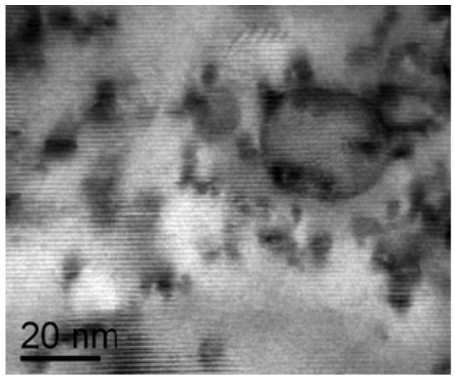
Progress in Superconductor Wire Development in USA

Venkat Selvamanickam

Wire R&D Focused on Low-Cost, Scalable Processes for Enhanced Performance

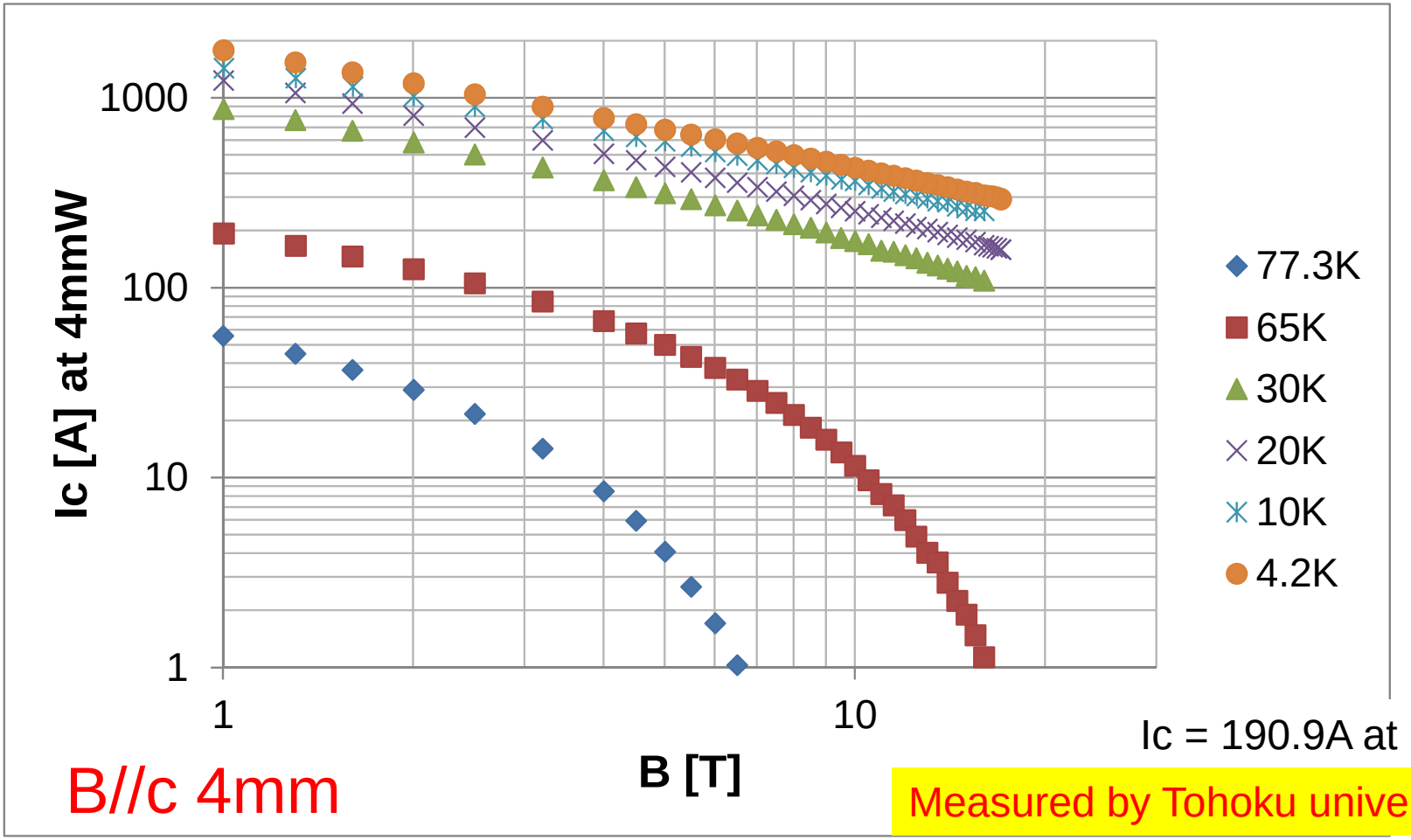
Reel-to-reel ion irradiation for enhanced pinning





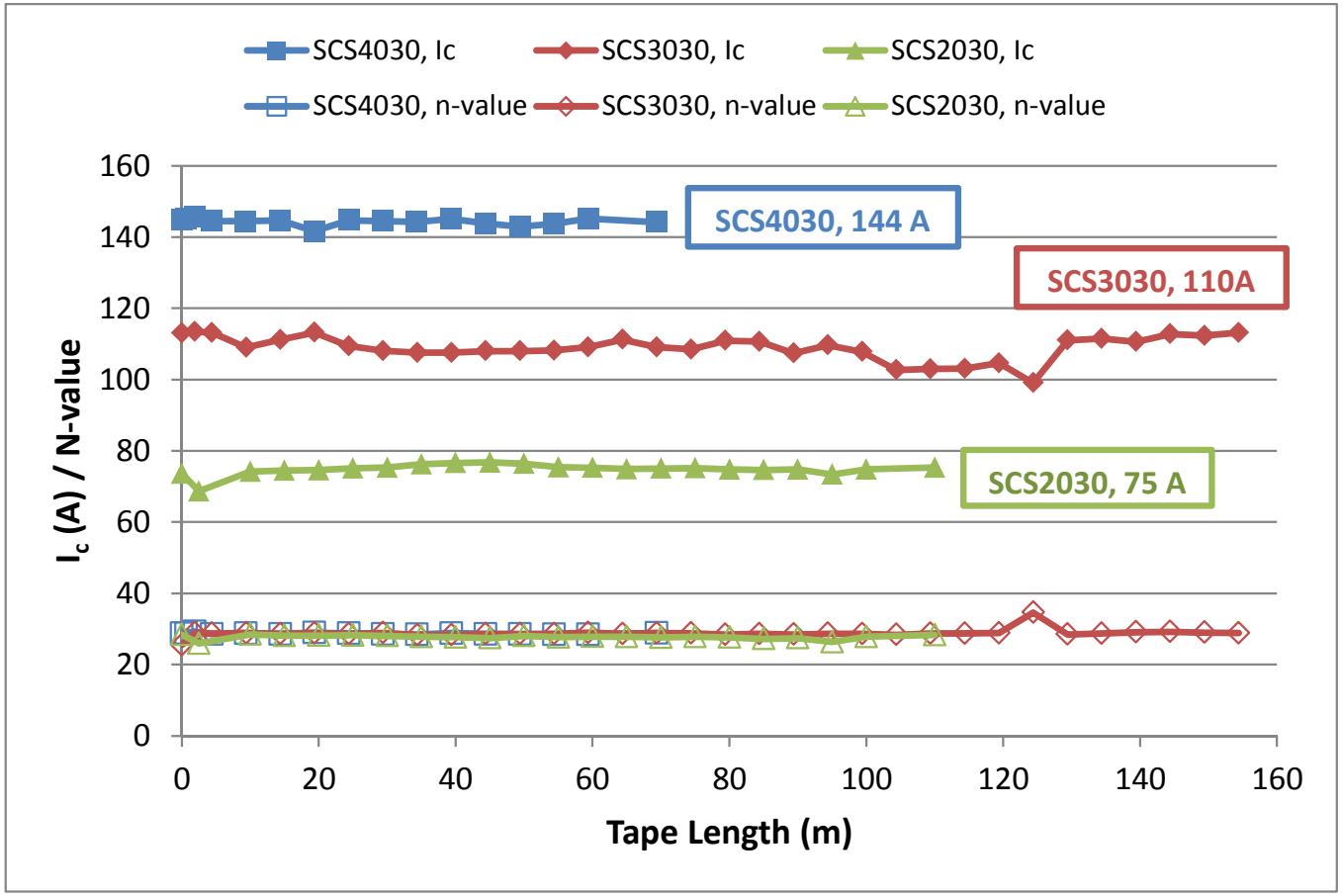
Ion irradiation induced pinning centers
Welp, Kwok, Miller- ANL

The Performance of Enhanced A.P wire



- Enhanced A.P wire shows high in-field performance

Development progress of 30µm substrate



- Base performance of 30µm substrates are comparable to 50µm.

STEP 3 - 2G HTS Tape Completed // Measure

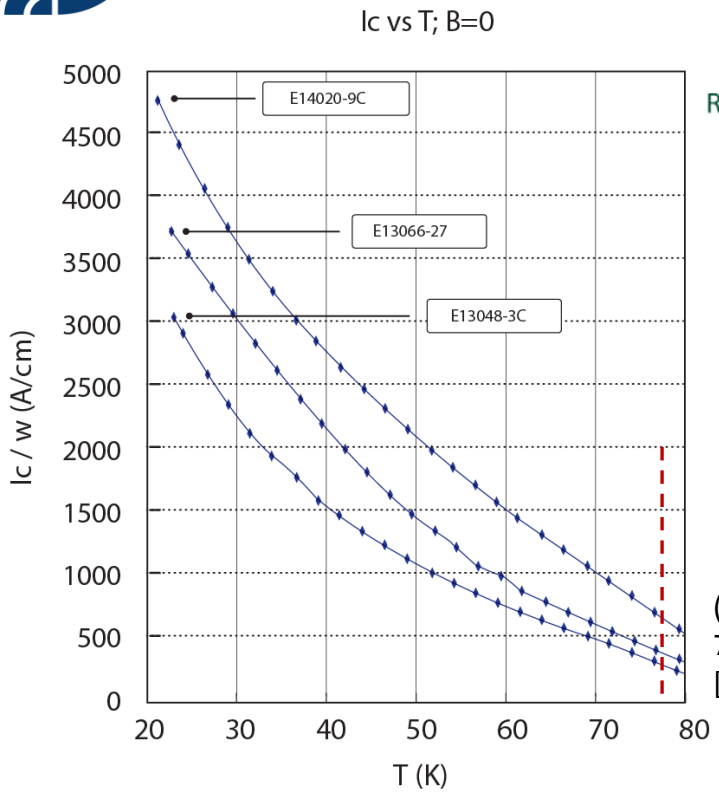
UNLOADING:
12mm x 400 meter length (RE)BCO HTS with Silver cap layer

METROLOGY: TapeStar XL Atmospheric, Reel-to-Reel

Tape Product Width:	3mm	4mm	10mm	12mm	100mm (tbd)
Batch Size: (meters)	3000	2150	1000	850	100
Capacity: Kilometers/Year/Machine	950	750	300	250	25

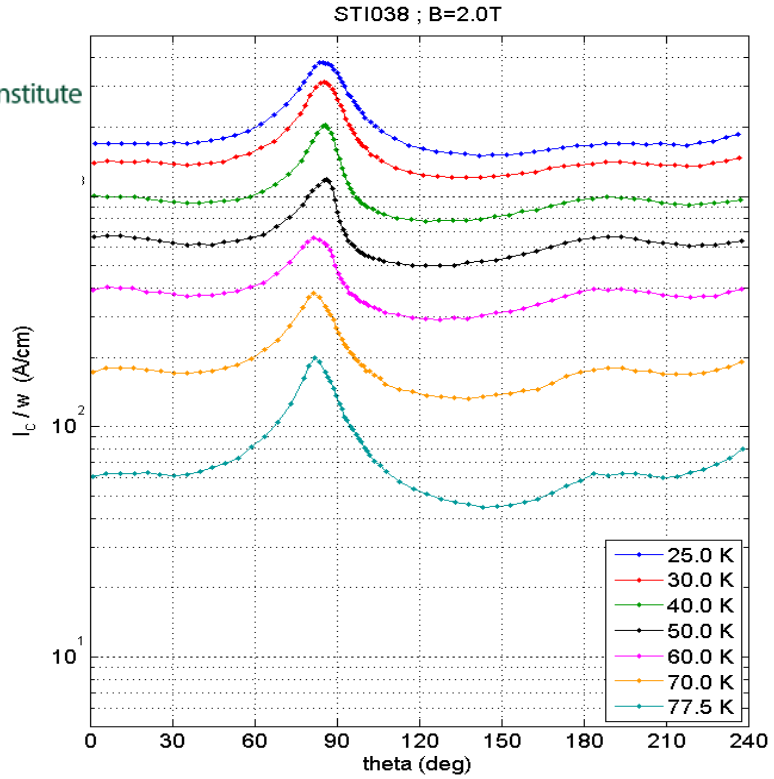
STI SUPERCONDUCTOR TECHNOLOGIES INC.

Conductus® Low Temperature Performance



Robinson Research Institute
VICTORIA UNIVERSITY OF WELLINGTON
TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

(3) Samples
77K I_c
[300-600] A/cm



Low temperature measurements show high performance potential of STI 2G Tape

- I_c Correlation between 77K →30K values *using STI Process for 2G Film Growth*
- 600A @77K SF improves by a factor of 8 = 4800A @20K
- Angular Scan In-Field performance, 2 Tesla 77K→25K
- No artificial pinning center

STI SUPERCONDUCTOR TECHNOLOGIES INC.

Advanced Superconductor Manufacturing Institute

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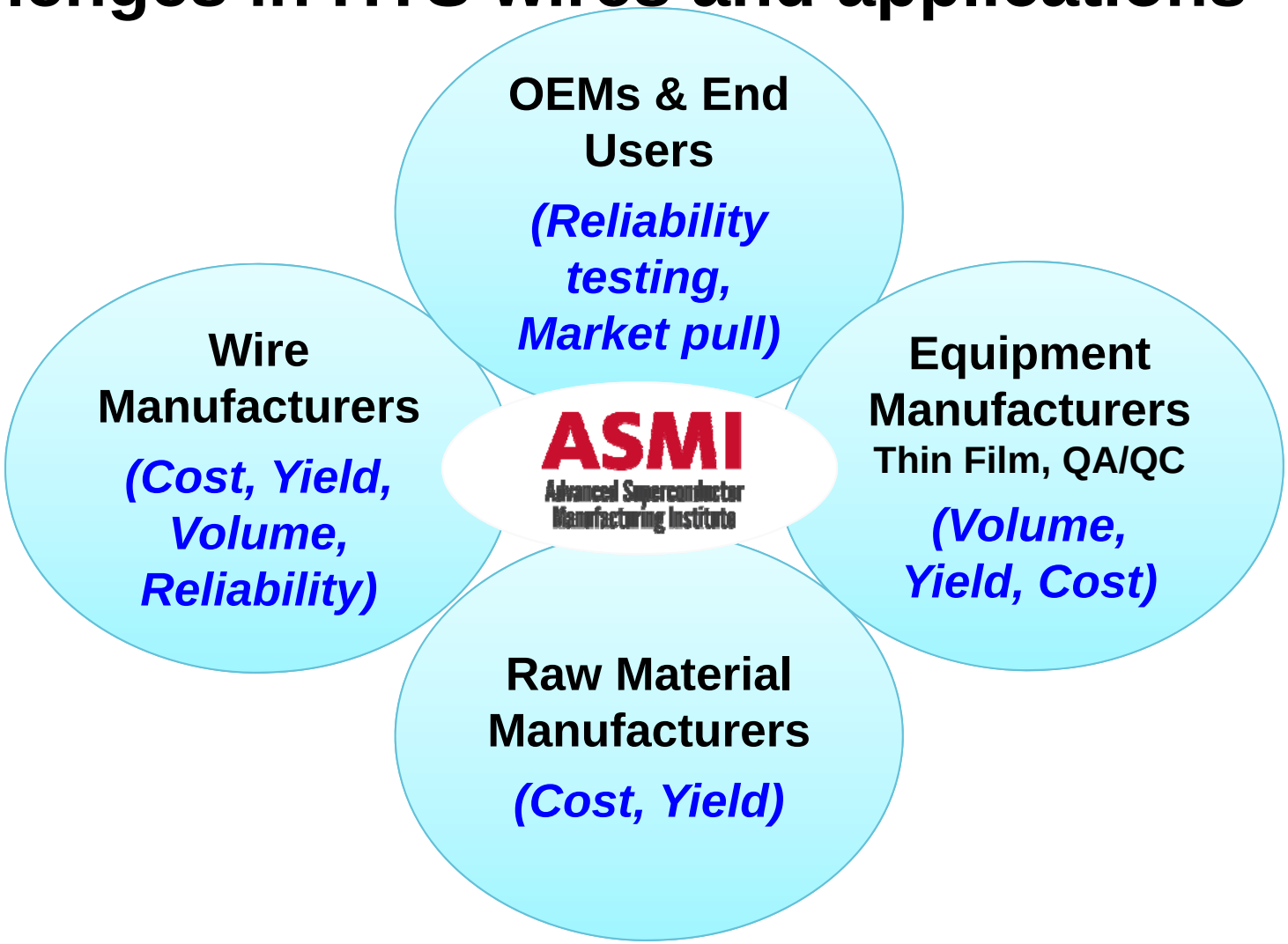
ASMI Advanced Superconductor Manufacturing Institute

Institute needed to bring industry together to comprehensively address manufacturing challenges in HTS wires and applications



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ASMI
Advanced Superconductor Manufacturing Institute

Established ASMI as a 501c(3) entity; Received AMTech Funding from NIST

- ASMI created as a not-for-profit entity in Texas in Oct. 2014
- Responded to NIST's AMTech Program planning awards FFO to fund this entity for building a consortium

Advanced Manufacturing Technology Consortia (AMTech) Program

- UH's AMTech proposal awarded a $ 500 K grant for an 18-month roadmapping effort; – one of 16 recipients among 118 applicants
- First significant step towards an eventual National Manufacturing Institute.
- Hired Dr. Syed Ahmed as Executive Director of ASMI
  - 30+ years experience at Southern California Edison

- Web site: http://superasmi.com/

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ASMI
Advanced Superconductor Manufacturing Institute

Objectives of ASMI

- Address the "**missing middle**" in advanced superconductor manufacturing innovation to bridge the gap between manufacturing of superconductor prototypes to commercialization.
- Establish an '**industry commons**' to test concepts close to maturity and to be a test-bed for comprehensive testing of homogeneity and reliability of superconductor wires and power devices.
- **Workforce development and training** in superconductor manufacturing at all education levels.
- Engage and assist **small and medium enterprises** to address manufacturing impediments to commercialization and reduce the associated manufacturability risk during adoption of this technology.

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ASMI
Advanced Superconductor Manufacturing Institute

ASMI Industry-driven Projects

First workshop of ASMI in November 2015. Several industry-driven projects identified

- High throughput HTS wire manufacturing :
  - **10-fold increase in manufacturing throughput** with negligible increase in capital costs by overcoming rate limiting steps in deposition processes.
- High-yield, low-cost HTS wire manufacturing:
  - Develop in-line quality control and process control tools for real-time detection of yield-limiting problems during wire manufacturing. Improve **manufacturing yield** to produce *kilometer lengths* **to over 90%**
- Long low-AC loss wire manufacturing:
  - Develop innovative manufacturing equipment and process technologies for production of **fine multifilamentary superconductor wires in lengths of 1000 meters to achieve 10 to 50-fold reduction in AC losses.**
- Reliability testing, especially accelerated lifetime testing, and Standards development
- Improved cryocooler and interface technologies:
  - Develop **cryocooler technologies** for **long life/low maintenance** (25-year lifespan and minimum 50,000 hours between maintenance).

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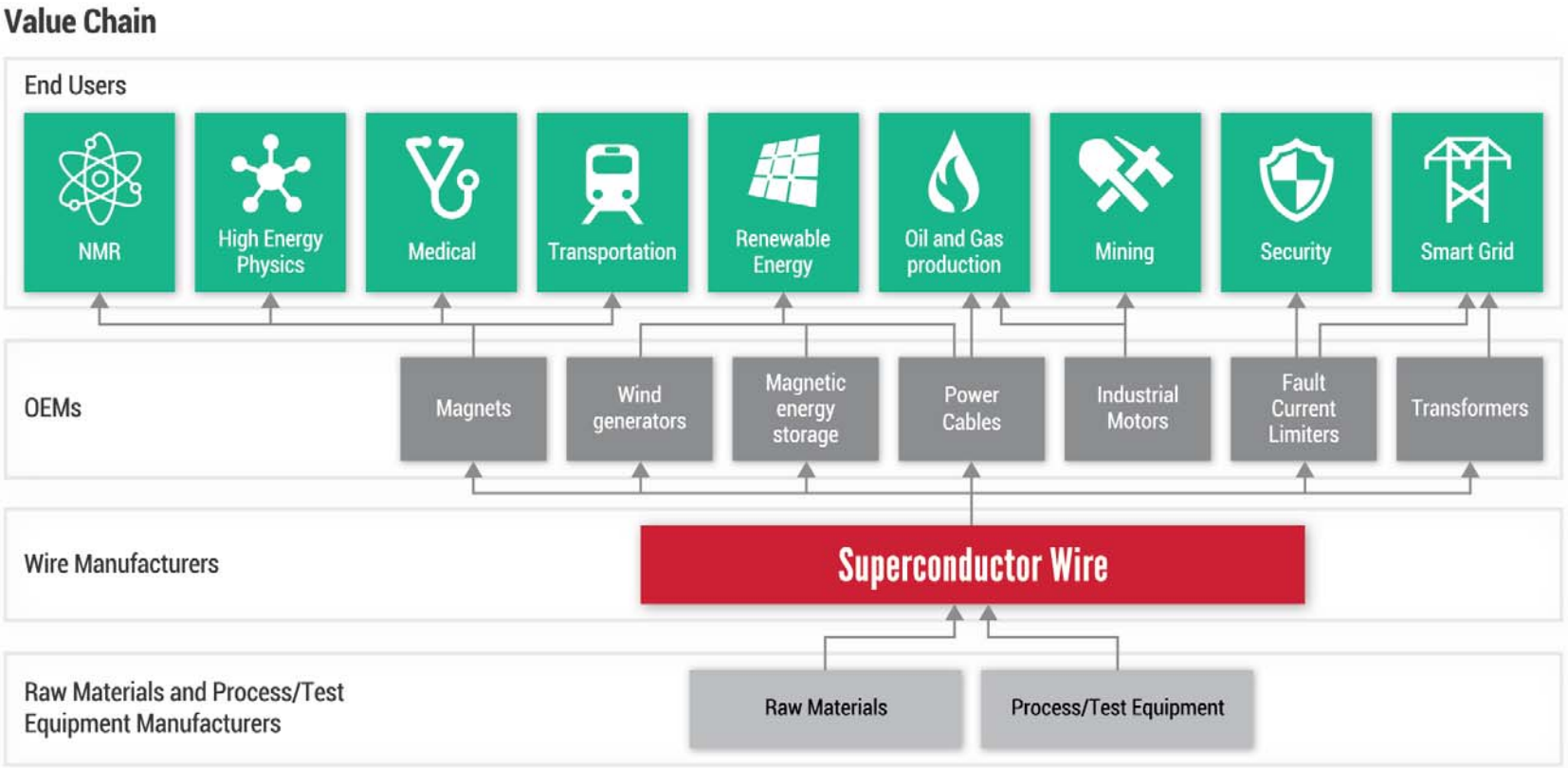
ASMI will address the entire value chain & broad range of superconductor applications



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ASMI
Advanced Superconductor Manufacturing Institute

50 Institutions provided support for ASMI NIST proposal; > 30 committed to memberships

$157M cost share funding from industry & other partners; $70M federal funding requested