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2G HTS Applications Developments

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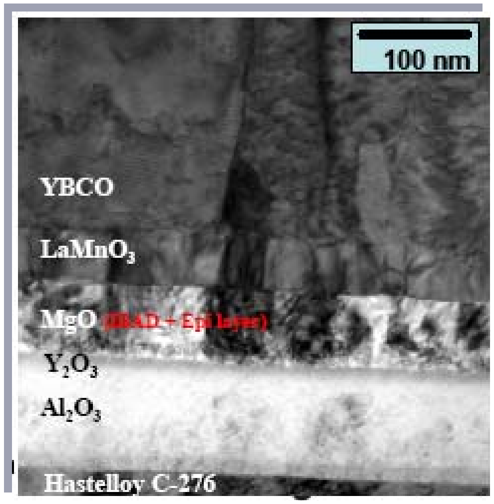
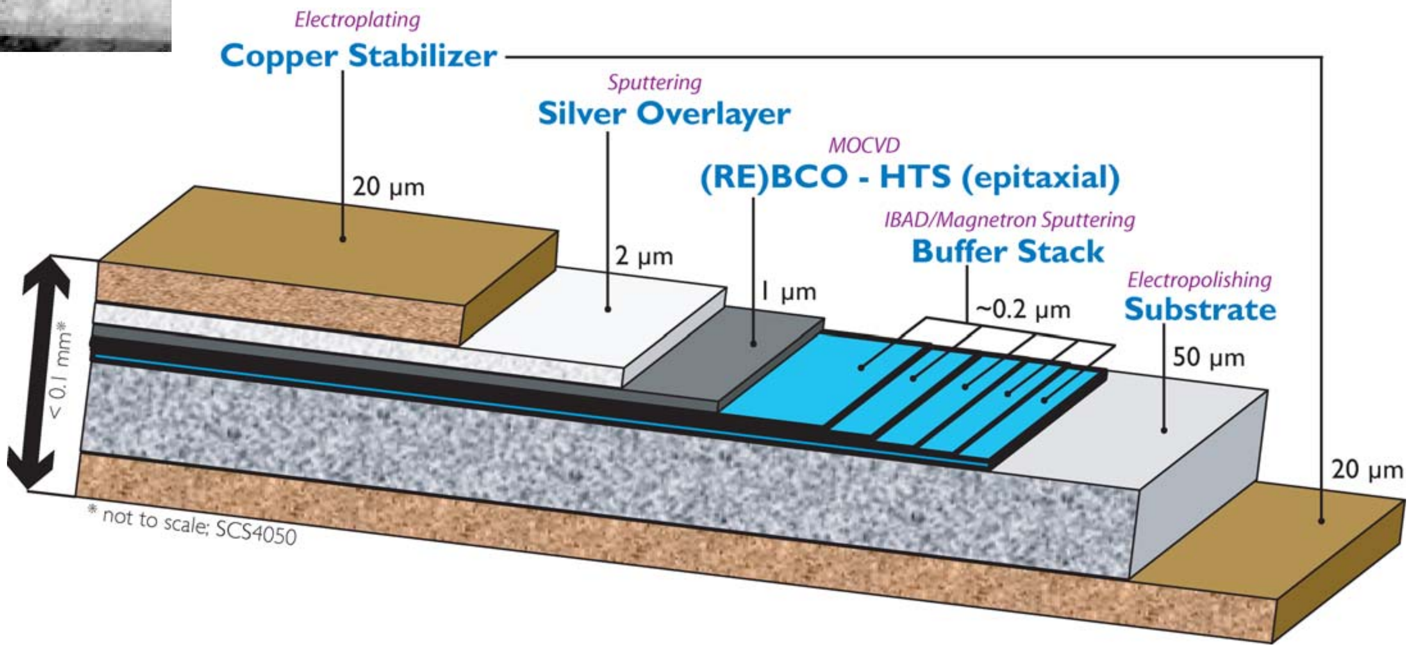
Barcelona, Spain – 25 February 2011

Outline

- 2G HTS for SC Applications
- Projects
  - 2G HTS SMES
  - FCL Transformer
  - FCL Module Development
  - HTS Cable
  - HTS Generator / Motor
- Summary

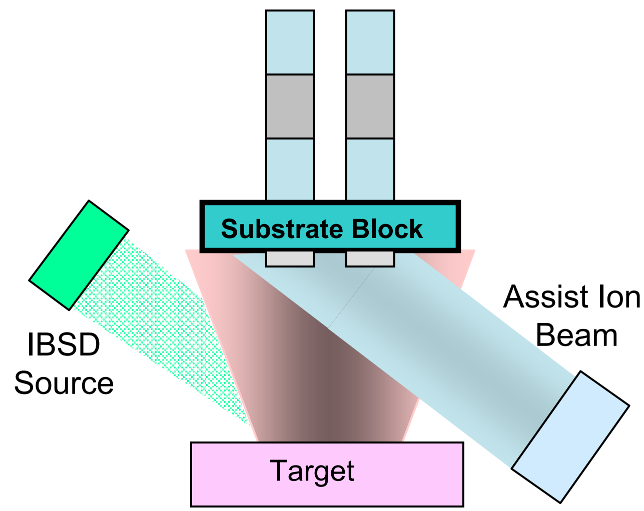
SuperPower® 2G HTS wire architecture



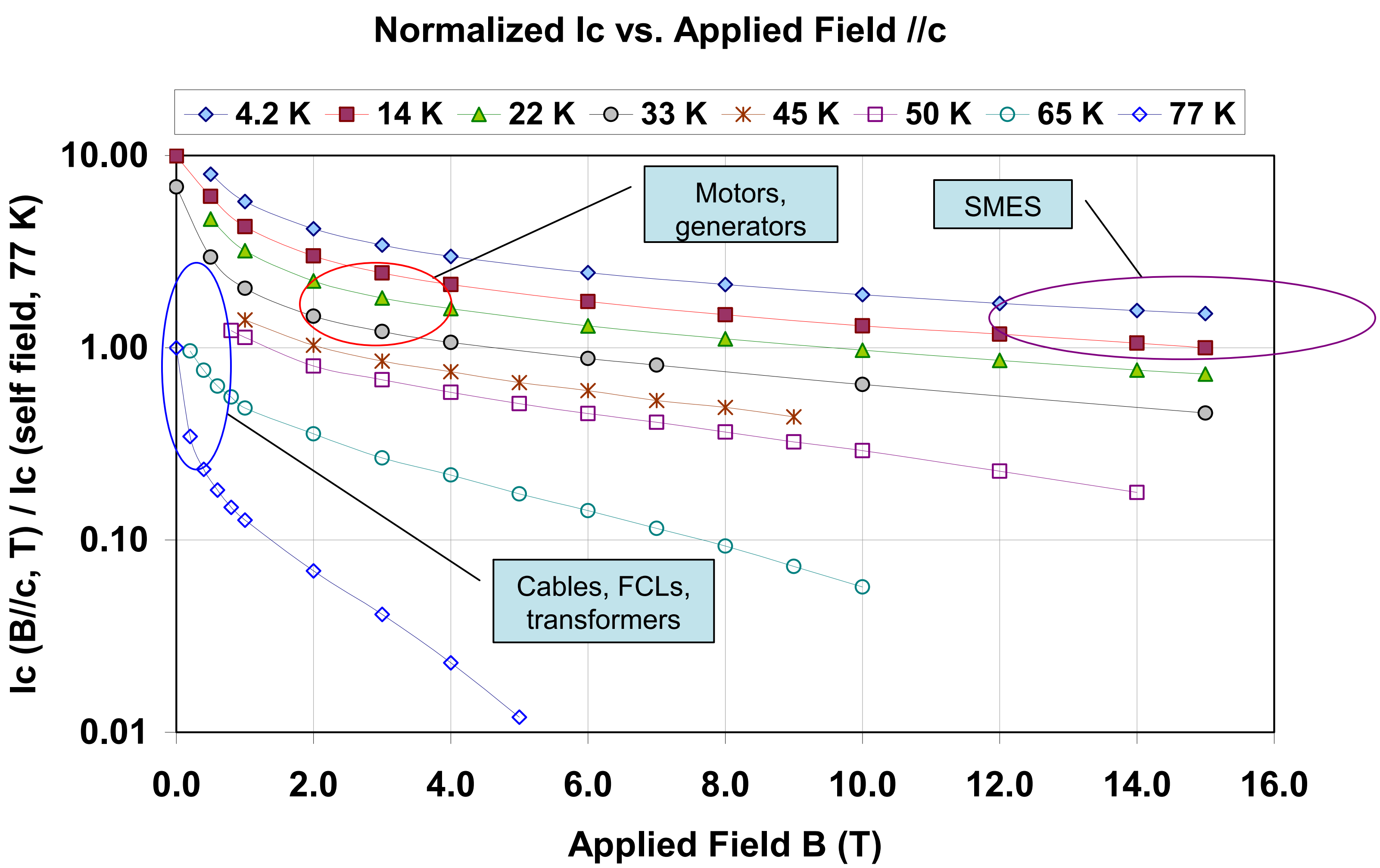


Advantages of SuperPower 2G HTS technology

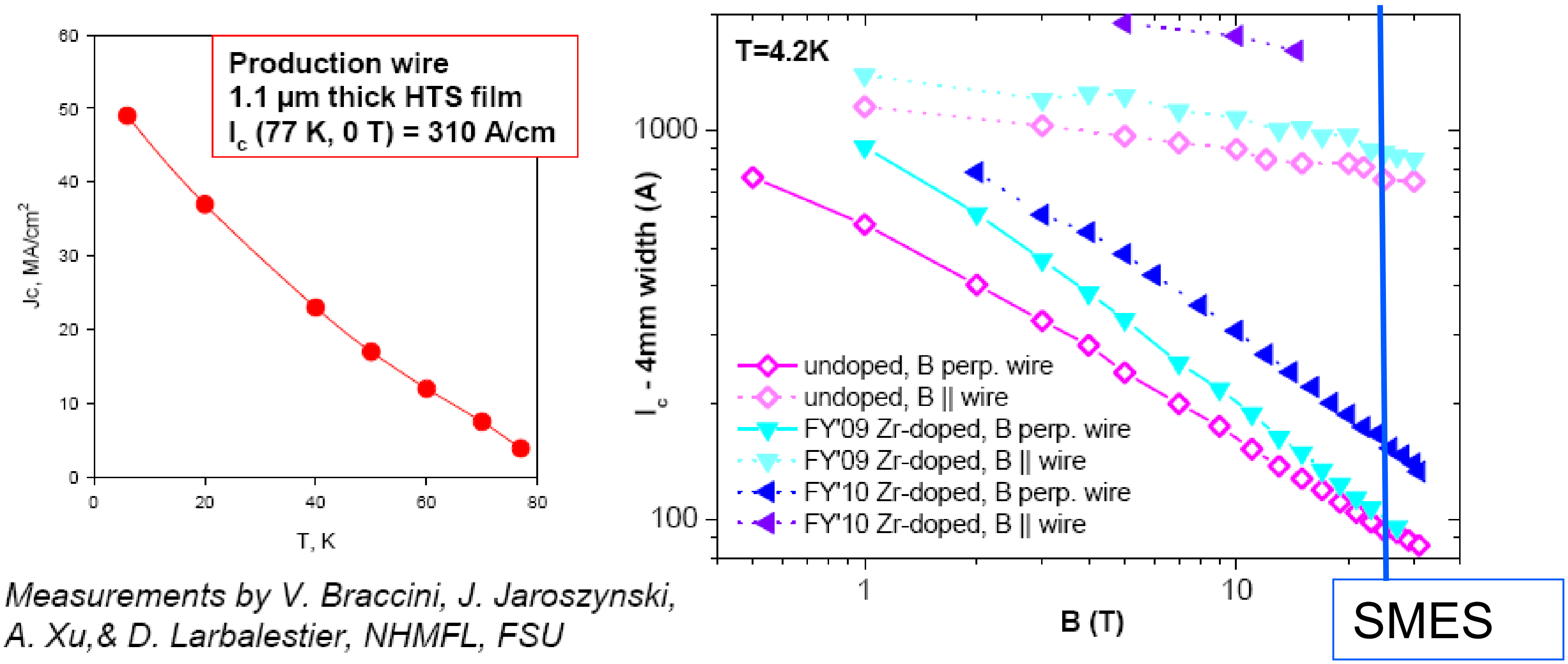
- **Virtually any substrate can be used due to IBAD texture layer**
  - ***High-strength*** substrates
  - ***Non-magnetic*** substrates
  - ***Low cost, off-the shelf*** substrates (Inconel, Hastelloy, Stainless Steel)
  - ***Very thin*** substrates (50 μm)
  - ***Resistive*** substrates – for low ac losses
  - ***Easy to handle*** – less possibility of defects
- **Small grain size – sub-micron range**
  - ***No issues with percolation*** in any length
  - Can pattern wire to ***very narrow filaments for low ac loss wire***
- **IBAD MgO develops excellent texture within 10 nm thickness**
  - ***High throughput***



2G HTS offers excellent performance for all electrical device operating ranges



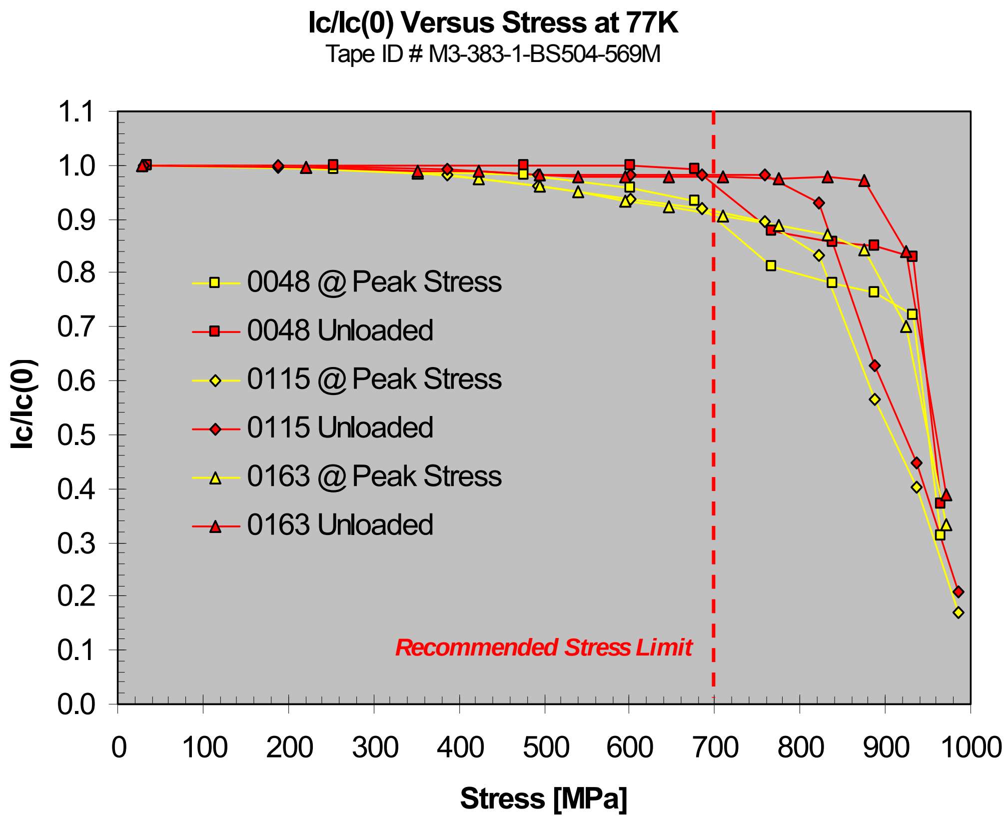
Excellent performance extends to higher fields, enhanced with Zr-doping



Measurements by V. Braccini, J. Jaroszynski, A. Xu,& D. Larbalestier, NHMFL, FSU

Advances with Zr-doping being locked into production

2G HTS Wire – Ic vs. Axial Stress



Data from Ron Holtz, NRL

- Ic drops by up to 10% reversibly under peak stress up to 700 MPa (about 0.6% strain)
- Above 700 MPa (0.6% strain) Ic degrades irreversibly
- N-value does not change with peak stress up to 700 MPa
- N-value degrades irreversibly coincident with irreversible Ic degradation
- Define σ_{IcRL} (ε_{IcRL}) = "Ic Reversiblity Limit" = Peak monotonic stress (strain) for >98% reversibility of Ic
- σ_{IcRL} (ε_{IcRL}) = 700 MPa (0.6%)

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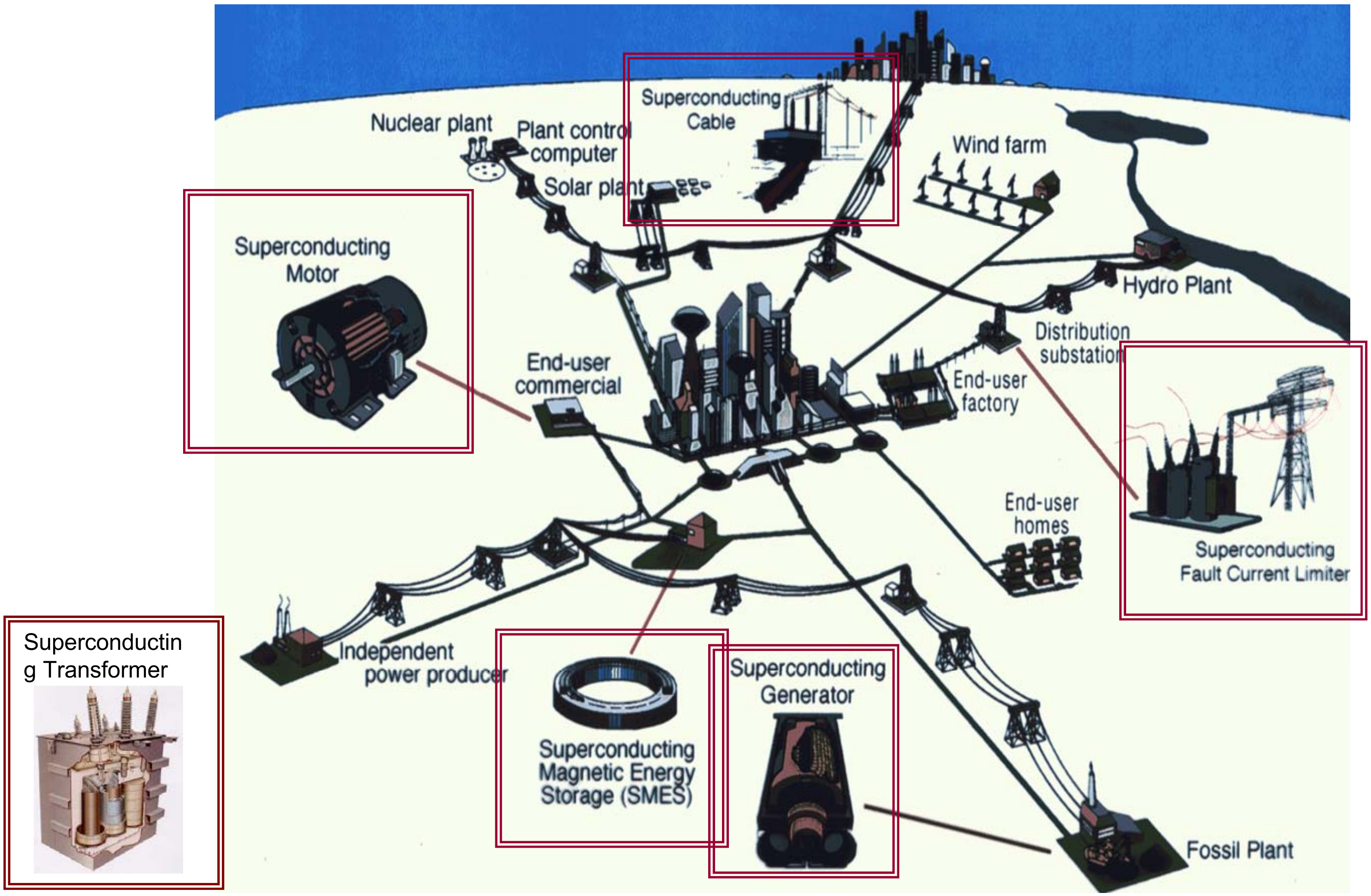
Superconductors: improving the generation and delivery of power



New superconducting magnetic energy storage (SMES) project initiated

- Energy stored in DC magnetic field ($E \sim B^2$)
- ARPA-E funded proof of concept project recently awarded ($5.2M/3yr)
- Project Participants
  - ABB (lead – power electronics / system integration)
  - Brookhaven National Laboratory (high field coil design / fabrication)
  - SuperPower (2G HTS / coil design support)
  - UHouston (enhanced 2G HTS fabrication)
- Storage capability (~2.5 MJ / 20 kwh)
  - 25 Tesla coil
  - Enhanced power electronics
  - >80% round trip efficiency

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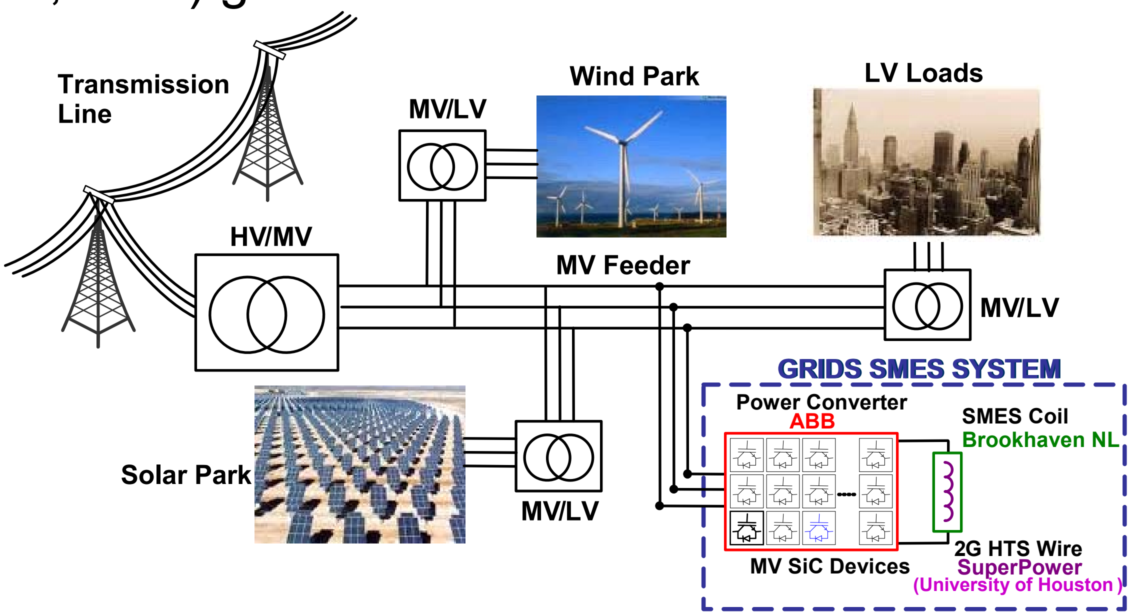
SMES Usage

- SMES is currently used for short duration (secs) energy storage for improving power quality
- In a utility situation, SMES could be used for either:
  - diurnal storage (hours), charged from baseload power at night and meeting peak loads during the day
  - medium term storage (minutes) to level out variations in renewable (solar, wind) generation



Components and operation of a SMES unit

- A typical SMES system includes three parts:
  - superconducting coil,
  - power conditioning system
  - cryogenics
- Once the superconducting coil is charged
  - With a persistent current switch: the current will not decay and the magnetic energy can be stored indefinitely
  - With non-persistence: the current will decay based on the residual resistance in the system
- To charge the coil, the power conditioning system uses an inverter/rectifier to transform AC power from the grid to direct current to power the magnet
- The stored energy can be released back to the network by discharging the coil using the power conditioning system to convert DC back to AC power
- The inverter/rectifier accounts for about 2-3% energy loss in each direction. SMES loses the least amount of electricity in the energy storage process compared to other methods of storing energy

Why SMES?

- There are several reasons for using superconducting magnetic energy storage instead of other energy storage methods
  - the time delay during charge and discharge is quite short
  - power is available almost instantaneously
  - very high power output can be provided for a brief period of time
  - high energy density
- Other energy storage methods, such as pumped hydro or compressed air have a substantial time delay associated with the energy conversion of stored mechanical energy back into electricity
- With SMES the loss of power is less than other storage methods
- In SMES, the main parts are motionless, which results in high reliability

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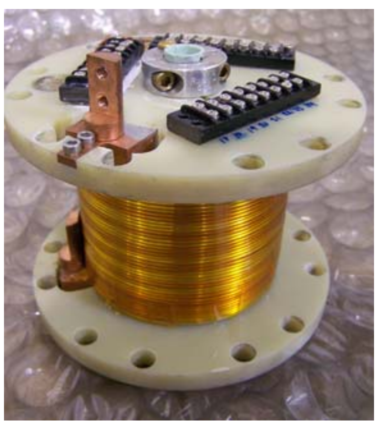
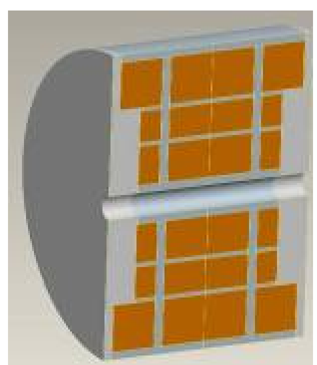
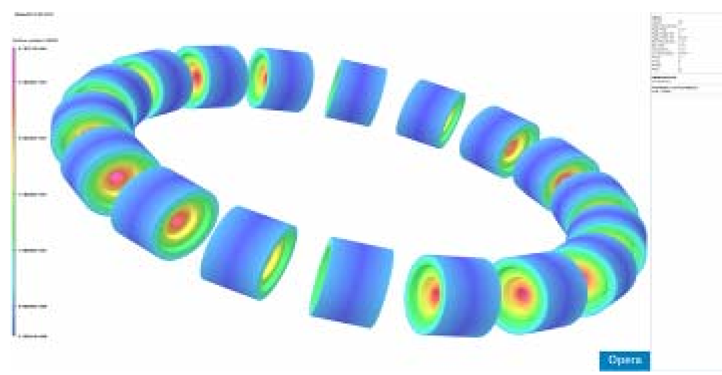
Why high field HTS SMES?

- Energy stored scales as $B^2 * r^{3,}$ while losses scale as r^2
- 2G HTS enables high field operation for a compact, high energy density system
- Toroidal geometry lessens the external magnetic forces, reducing the size of mechanical support needed
- Fields in a toroidal SMES are mainly axial (//a,b), maximizing the use of 2G HTS
- Due to the low external magnetic field, toroidal SMES can be located near a utility or customer load







Challenges

- High fields equate to high stresses
  - mainly hoop stress << SP 2G HTS can handle up to 700 MPA hoop stress
- High performance conductor required for economics to be competitive with advanced batteries (need to be in the $50/kAm range)
- Persistent current joints / switches highly desirable to reach loss targets
- Long lengths will be required to minimize / eliminate splices / joints (each splice is a loss source)

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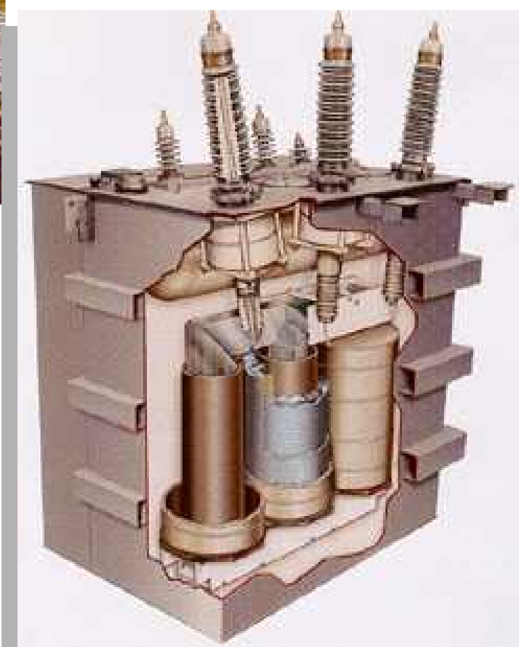
HTS Transformers for the power grid – half the size and weight

Benefits:

- Greater efficiency
- Smaller, lighter and quieter
- Can run indefinitely above rated power without affecting transformer life
- Do not require cooling oil like conventional transformers, thus eliminating the possibility of oil fires and related environmental hazards / costs



Program history

Phase 1: 1994 – 2000 (Waukesha, IGC, ORNL and RG&E)

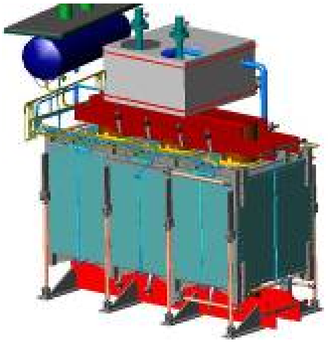
- 1 MVA 1-ϕ prototype tested 1998–
  13.8kV HV/6.9kV LV; Bi-2212; 25 K
- HV, vacuum, ac loss testing, cold mass assembly at ORNL
- HV breakdown caused by MLI;
  later reached 13.8 kV in air

Phase 2: 2000 – 2005 (WES, SuperPower, ORNL and Energy East)

- 5/10 MVA 3-ϕ prototype tested 2003/04–
  24.9kV HV/4.16kV LV; Bi-2223; 25 K
- HV, ac loss testing, cooling system design/fab at ORNL
- Transformer failed HV dielectric tests; cracked epoxy
  insulation; root cause & lessons learned analysis done

Phase 3: 2005 – 2010 (WES, ORNL)

- Waukesha Electric is using internal funds; DOE
  base program funding to ORNL
- Conceptual design rework; 115 kV rating; YBCO; 70 K
- HV cryogenic dielectric & ac loss testing,
  composite dewar development at ORNL
- Simplify manufacturing process



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Program history

Phase 4: 2010 - 2015   New Project

- FCL transformer being designed and constructed in a

  $ 21.2 M Smart Grid program
- Partners:
  - Waukesha Electric Systems,
  - SuperPower,
  - University of Houston,
  - Oak Ridge National Laboratory
- To be installed Southern California Edison grid by early 2014 (MacArthur Substation)
- 28 MVA (69 kV : 13 kV, 40 MVA overload capability)
- Fault current limiting capability ~ 40 to 50%

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Why HTS Transformers?

- HTS transformer development is underway worldwide
  - Projects in Japan, Korea, China, India, Australia
- The grid contains a great many transformers
  - On average there are 6-8 transformers between a generator and its load
- Many transformers in the grid are aging, creating a ready HTS market
  - 110,000 US transformers >10MVA are more than 35 years old
- HTS transformers can save energy and reduce CO_2 emissions*
  - Even at 99.4% efficiency, transformer losses are 40% of total grid loss because they are so numerous
  - If HTS transformer is 0.2% more efficient, losses are reduced by 1/3
  - SAVINGS– ~25 TW-hr, with associated 1.5 x 10^7 ton annual CO_2 reduction
- Transformer size, weight, fire hazard, and environmental impact reduced.
- Overload operation is possible with no loss of lifetime
- Fault current limiting capability is possible– supports Smart Grid

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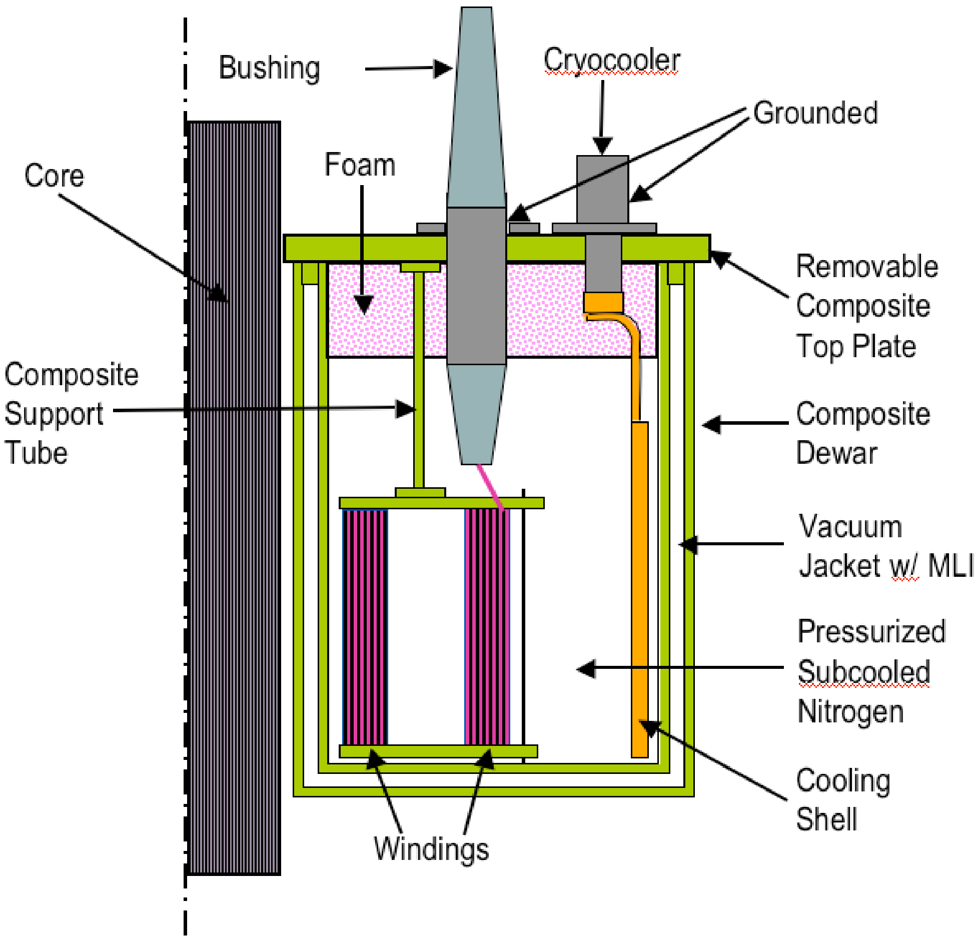
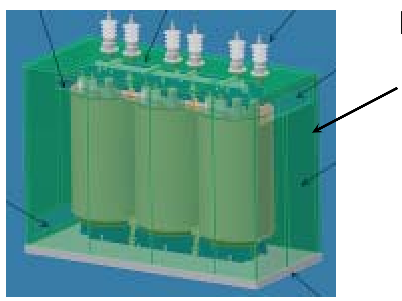
Conceptual Design

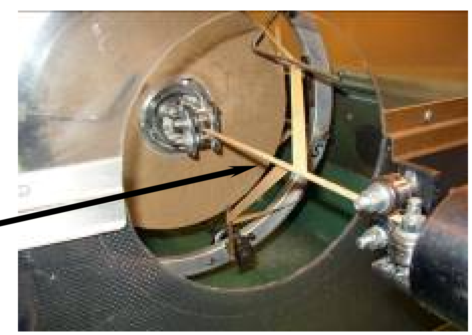


- Conventional WES manufacturing techniques are adapted to HTS winding design
- Supported by many tours of WES shop and discussions with experienced WES coil winders
- 70-K subcooled nitrogen is a good substitute for oil
- Co-wound conductor for stability and fault handling
- Composite coil dewars
- Air-cooled core

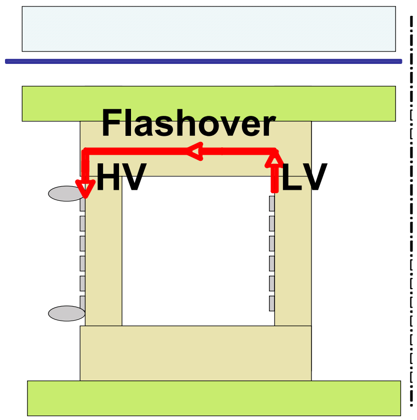


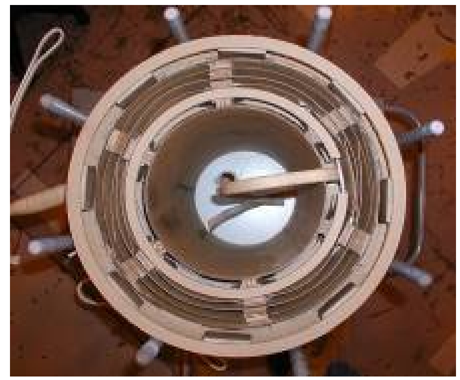
The windings will be similar to Waukesha's conventional design

- HV – Continuous disc winding; 8-12 turns/disc
- LV – Screw winding; 8-15 conductors in parallel
  - Roebel cable is another option
- Exact number of disc turns or parallel conductors is determined by unit power ratings and tape I_c
- Windings will contain several individually-tested modules to limit amount of conductor at risk in a test failure
- Conductor transpositions will be at module junctions
- Need laminated or thick plated HTS tape to handle:
  - High speed insulating process
  - High stresses during fault
  - FCL function



Insulation studies for up to 650 kV BIL successful





Waukesha Test Coil

- Similar 350-kV BIL coil passed all tests in FY 2008
- Standard WES design pressboard structure
- Copper conductor with WES polymer insulation
- Disc windings
- HV Tests in LN passed in Fall 2009

ECI Bushing Test

- Electro-Composites 650 kV BIL bushing
- Solid epoxy core
- Copper drawlead tube
- ECI found no damage after LN immersion
- Production version on order

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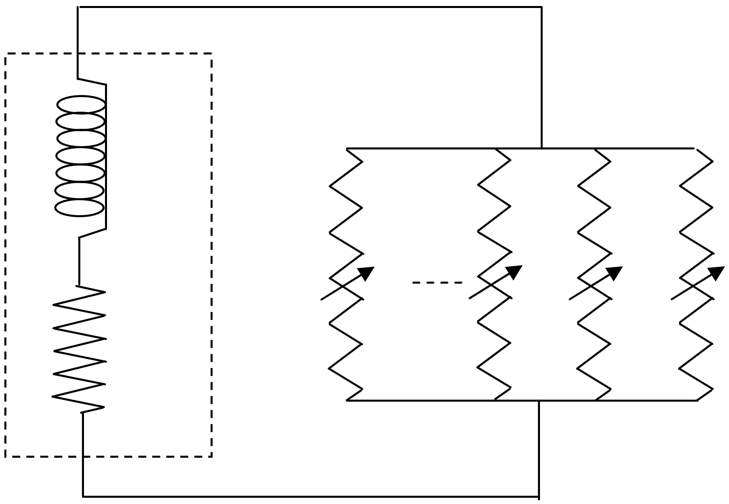
HTS Fault Current Limiters: New technology for a growing problem

- As new sources of generation are added, utilities are faced with the threat of higher levels of fault current
  - HTS Fault Current Limiters (FCLs) address the market pull to cost-effectively correct fault current over-duty problems at the transmission voltage level of 138kV and higher
  - The HTS FCLs will reduce the available fault current to a lower, safer level (20%-50% reduction), so that existing switchgear can still protect the grid
- Utility market needs at the transmission level:
  - Accommodate increasing fault currents due to added generation
  - Prevent breaker failures & associated problems (e.g., welded contacts, bus bracing, etc.)
  - Maintain flexibility to accommodate load growth and “open access”
  - Avoid adverse side effects imposed by existing solutions
  - Reduce “through fault” stresses on aging infrastructure
  - Avoid need for expensive 80kA breaker upgrades
- HTS FCLs are a natural complement to AC HTS cable systems
- Discussions with 20+ utilities have consistently validated the need

General operation of the SFCL



Parallel Superconducting / Shunt Coil Elements

For a meter long element,

Shunt impedance is 1.5 to 10 mΩ / m

Minimum X/R ratio at 77K is 30

X/R ratio at RT is ~ 3.75

Tape resistance at RT is ~ 336 mΩ / m

Stabilizer Layer

- Silver is extremely conductive, making recovery under load difficult
- Modify the stabilizer layer to a material with higher resistance, to assist RUL

Substrate Layer

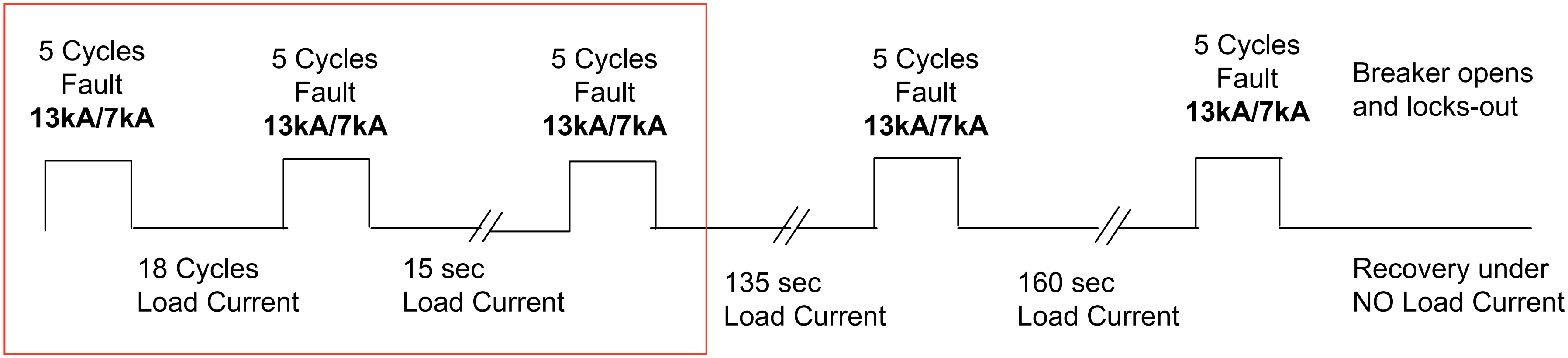
- Hastelloy is a good choice of material for the substrate (high resistance)
- A thicker substrate limits the temperature at the end of the fault current so as not to burn the tapes
- A thicker substrate lowers the resistance of the tape making RUL more difficult

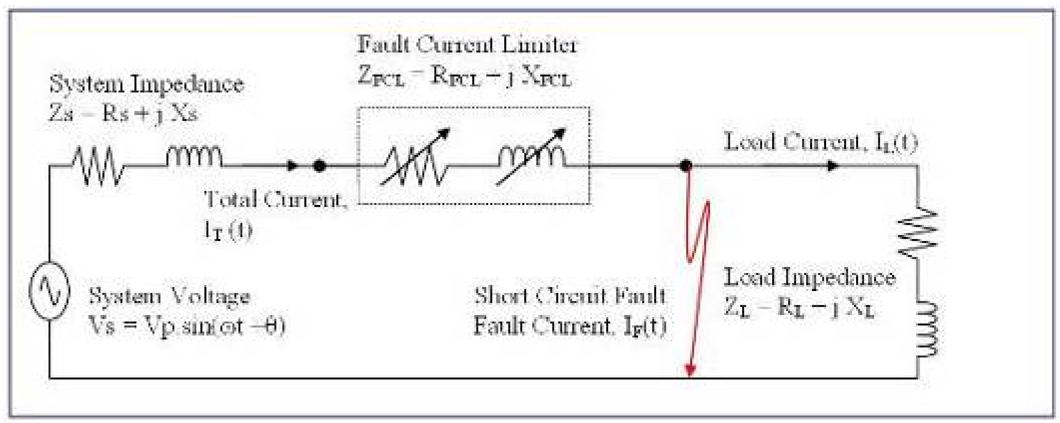
Proof-of-concepts and developments through 2009

- Fault Current Testing with MCP 2212 (2004)
- Fault Current Testing with 2G YBCO (2006)
- Completed **design and testing of HV bushings** (ORNL, SEI, 2006)
- **Weibull 2G failure study** of ‘standard’ HTS superconductor architectures (2006)
- Investigated several engineered 2G architectures for improved RUL (2008)
- Improve **connector design** (2008)
- Modify 2G conductor to improve performance for FCL application (2008)
- Designed / tested **compact 55kA shunt coils** to withstand high fault transient loads (2008)
- Thermal simulation of RUL process (2008)
- Demonstrated **Recovery Under Load** (RUL) proof of concept and requirements (2008)
- Investigated **LN_2 dielectric** properties (with ORNL, 2005-2008)
- Beta device testing specifications established (2008)
- Study of the Impact of bubbles on **breakdown mechanism** and LN2 dielectric strength (with ORNL 2008)
- Improved understanding of the impacts of recovery under load **(RUL) for module design** (2009)
- Optimized performance of the 2G HTS wire (2009)
- Investigated the performance of **more compact ‘module’** concepts (2009)
- Tested FCL module components at rated voltage in a cryogenic environment (2009)

Reclosure sequence drives recovery requirements

- Rounds of KEMA testing focused on critical AEP reclosure sequence on an HTS element





- Straight and meander path elements were used
- Improved connector designs were used

2G SFCL module development

- Matrix concept carried forward to allow for customization
- No magnetic trigger coils with 2G – Ic trigger (possible due to tape uniformity)
- Non-inductive Design Concepts:
  - Straight element design – concept with 40-50cm long elements of multiple parallel tapes, discrete joints to shunt coils – early design and testing, half length module (12 elements) tested at KEMA.
  - Meander path design – similar to straight element design but without discrete joints, shunt coils tap into meander without 2G break
- All designs look for robust construction with minimal number of joints

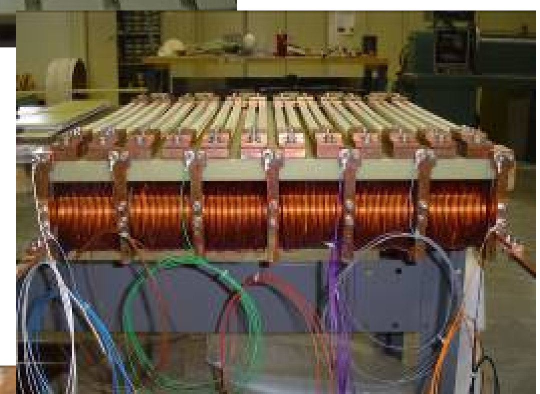
Straight element design

Used in test module for KEMA test

- 12 elements (40 cm free) of 4 parallel tapes
- Discrete terminals at ends of elements
- One shunt coil (~10 mΩ) per pair of elements
- Mechanical terminations (no soldering) for 2G elements

• KEMA tests confirmed earlier single element (4 parallel tapes, 20 cm long) results.

Top view showing tape layout



End view showing shunt coils

Terminal detail

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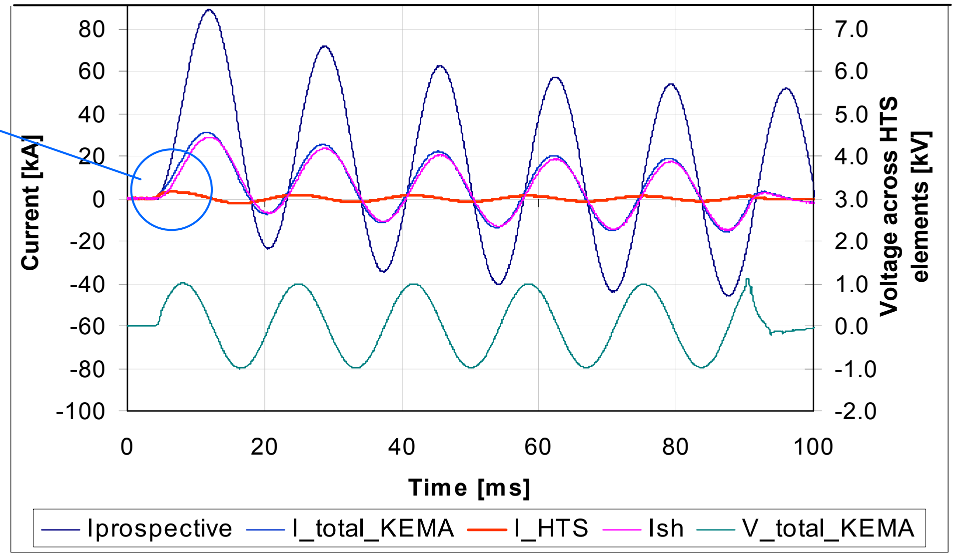
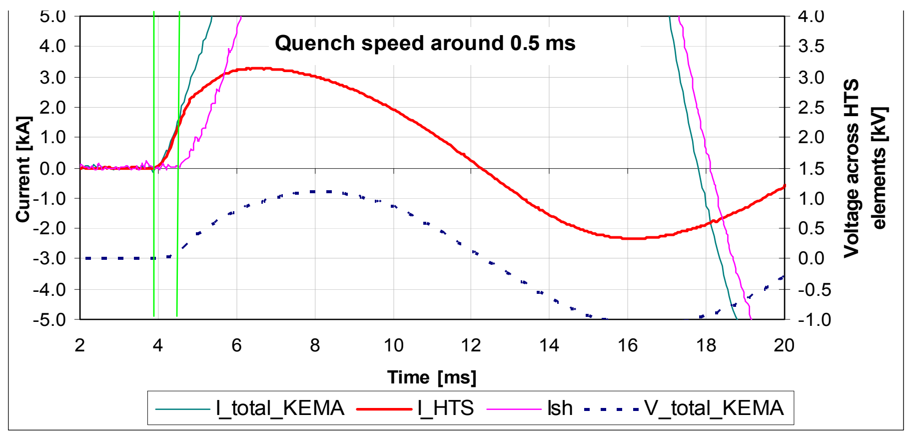
2G Conductor for SFCL shows consistent, excellent performance

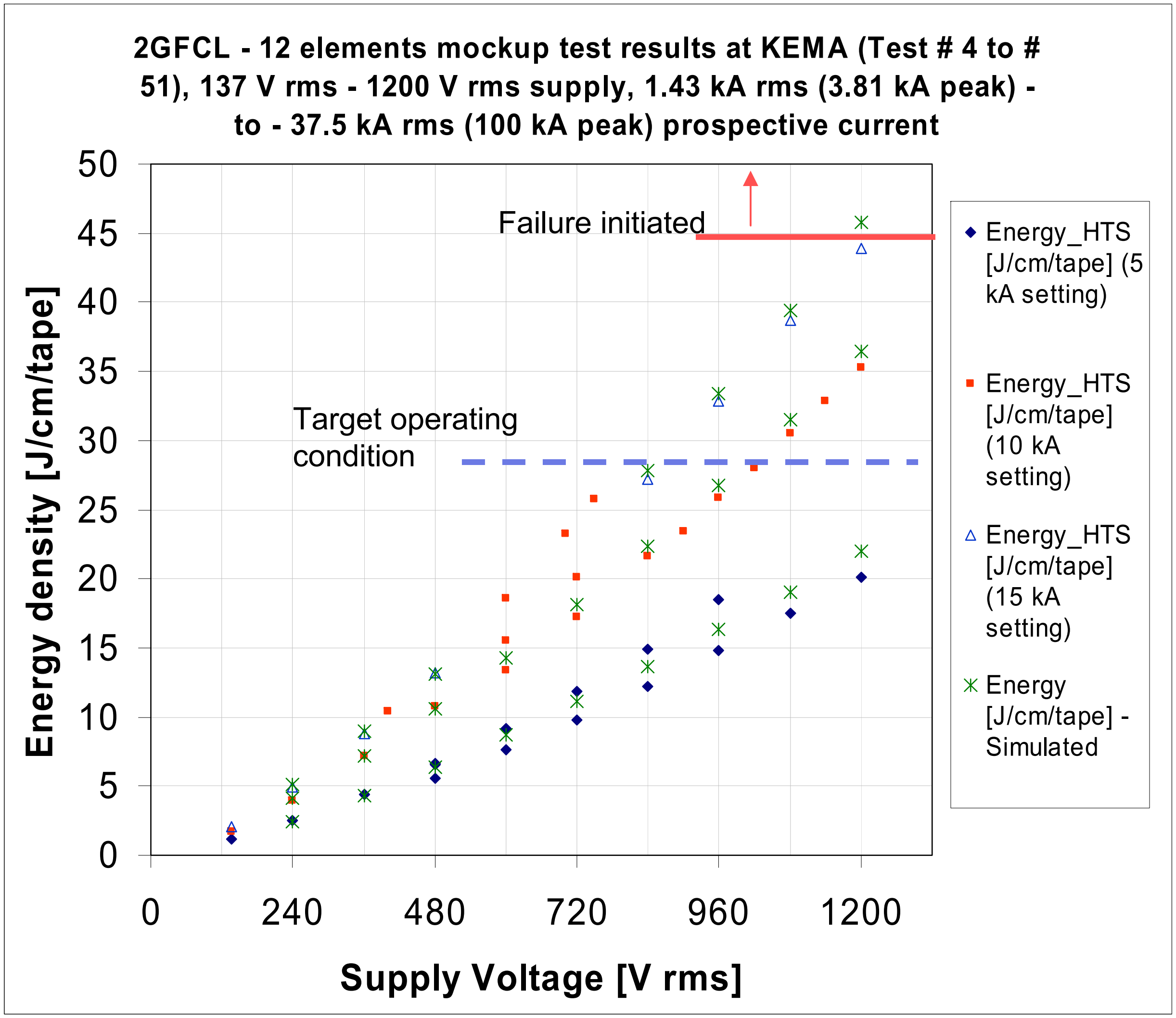
Fast response time



High-power SFCL test	2G
Prospective current	90 kA*
Limited current	32 kA
Peak current through element	3 kA
Response time	< 1 ms
Element quality range	Narrow



KEMA test results – Energy in 2G FCL elements



Test Results –

Energy dissipation

- 2GFCL elements tested to 37.5 kA rms (100 kA peak) prospective fault current at 1200 V rms supply
- 2G tapes performed well up to 38 J/cm/tape and start failure at 43.91 J/cm/tape
- Design limit around 25 J/cm/tape – around 65% of failure value => need to establish probability of failure at variable energy level (Weibull distribution)
- Excellent current limiting performance
- Excellent agreement between simulation and test results – performance predictability is critical to success

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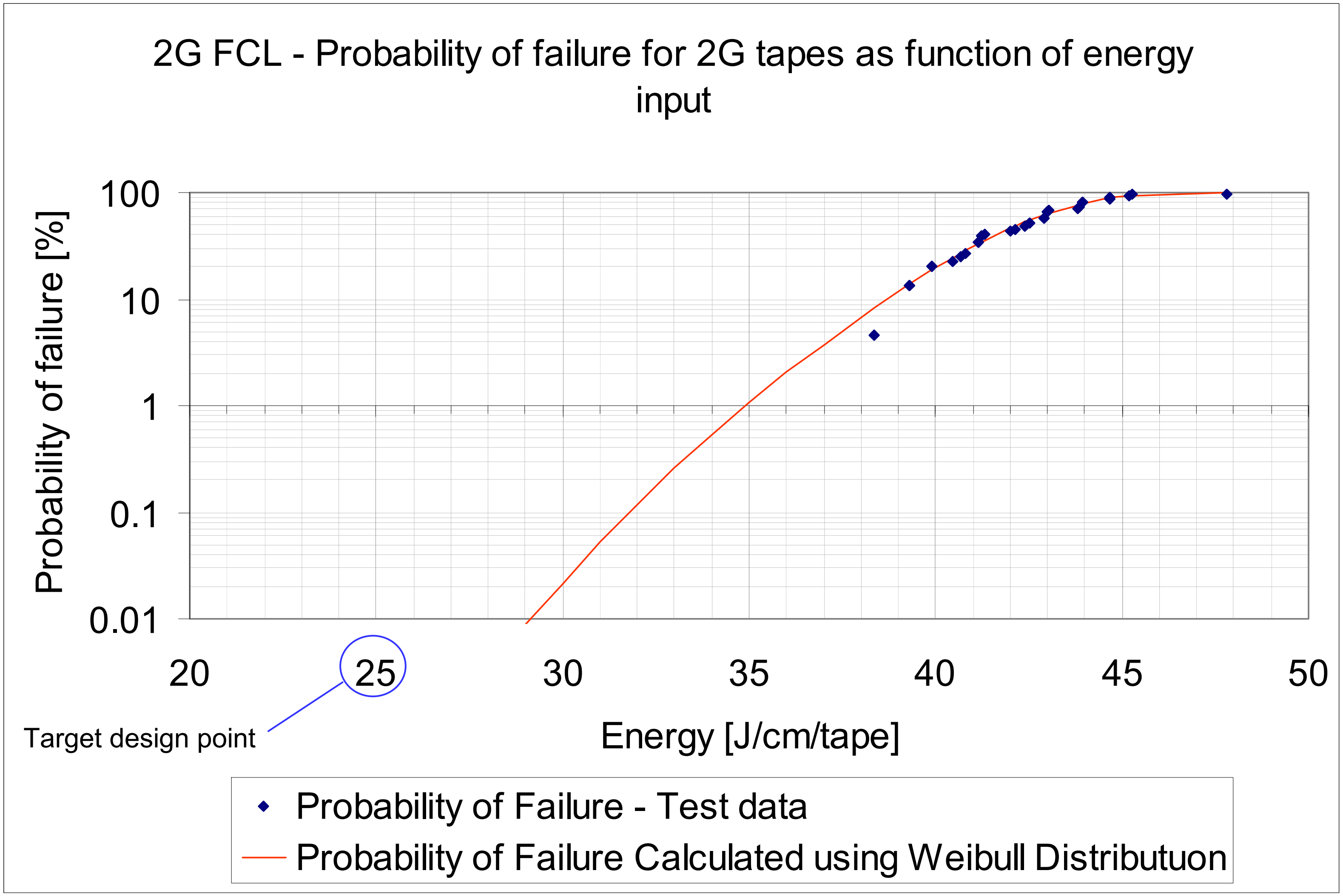
Weibull Plot of 2G failures (100 micron Hastelloy, “Standard” SFCL tape)



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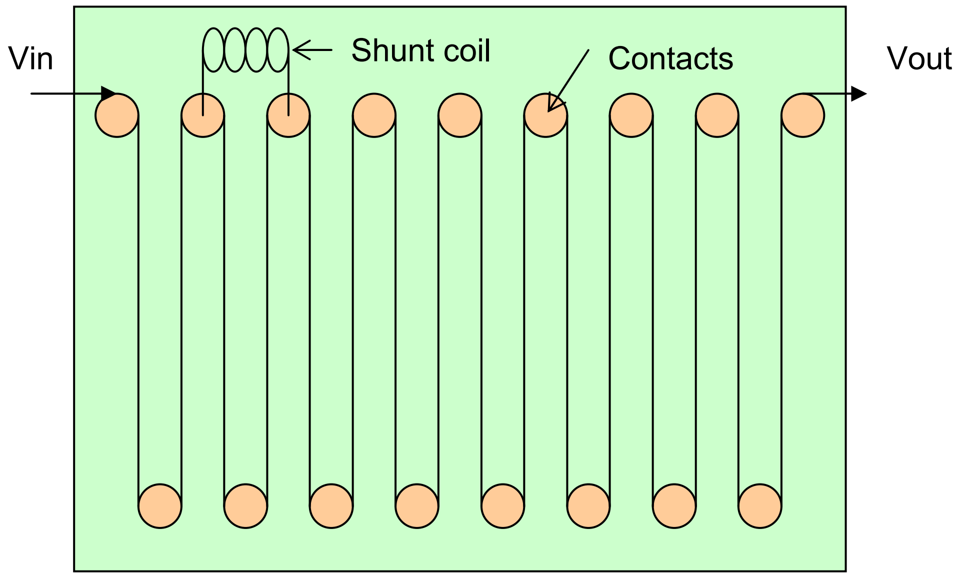
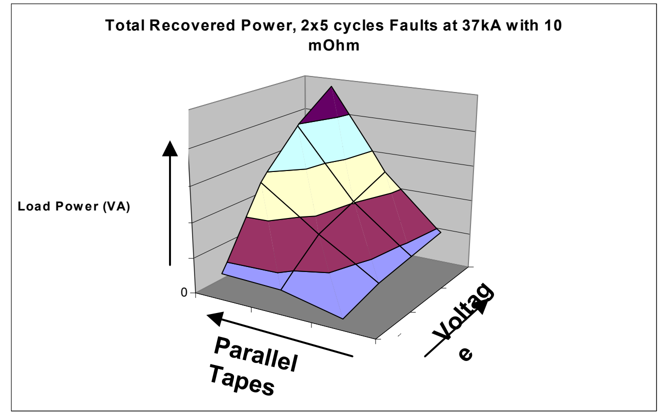
Meander path design

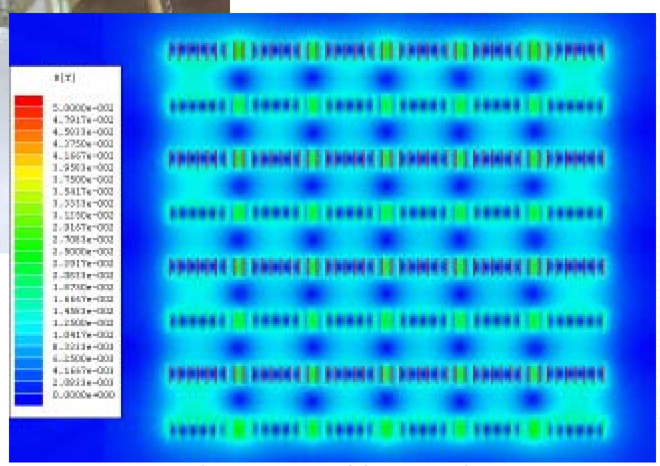


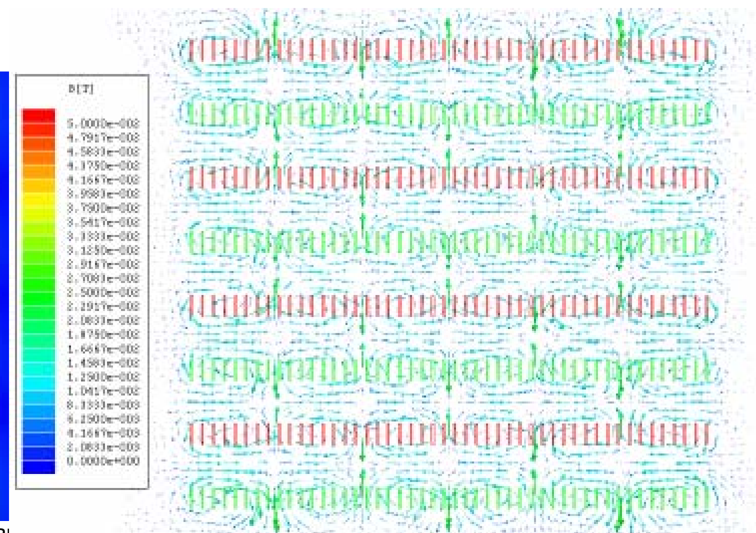
- “Standard” meander path configuration. Note that YBCO orientation alternates between contacts
- Top contacts can be either electrical or mechanical
  - Electrical contacts connect tapes to shunt coil system
  - Mechanical contacts for support only
- Bottom contacts are for mechanical support

2G RUL capabilities tested at KEMA (2008)

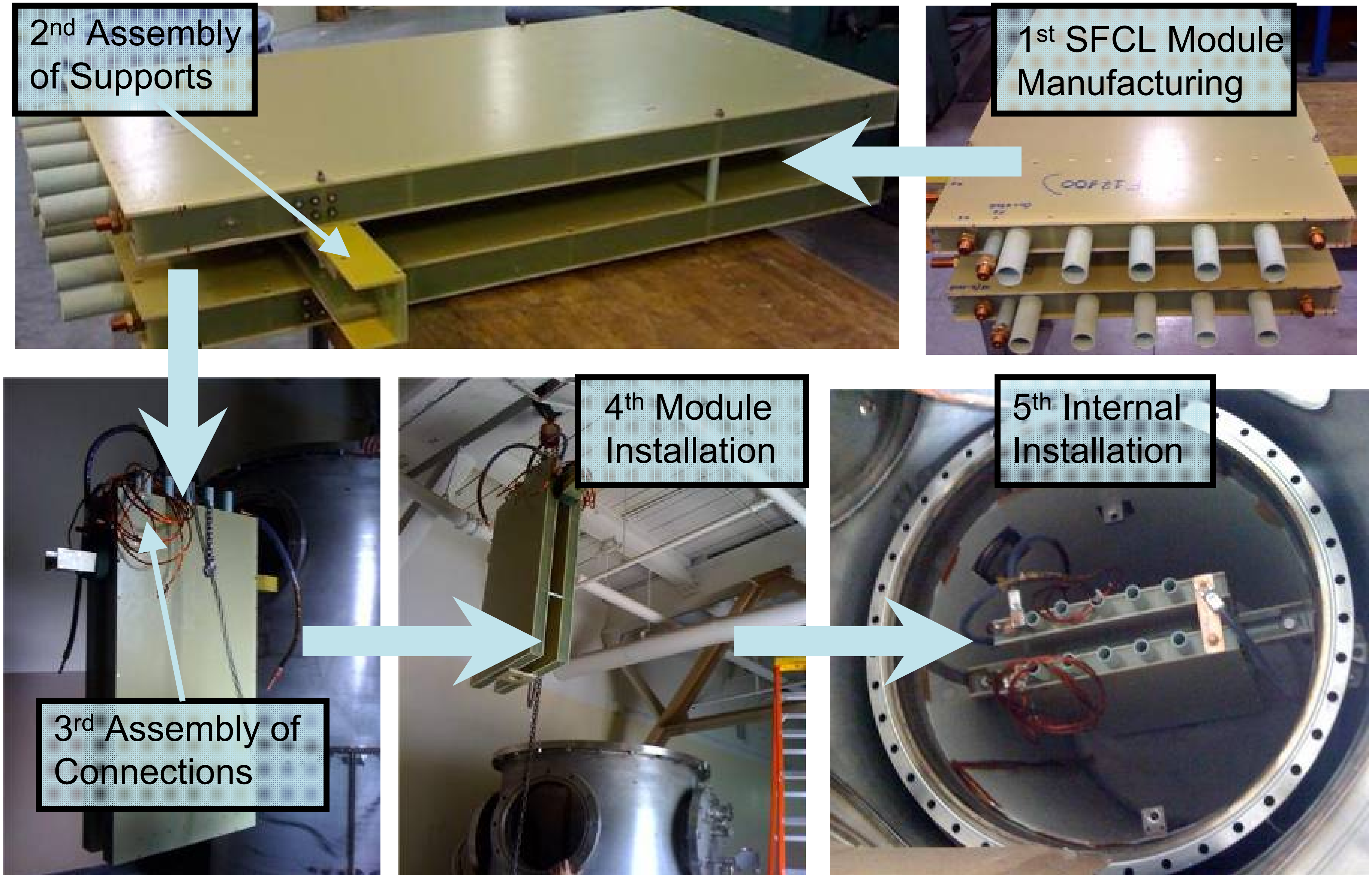
- "Standard" SC12100 2G tapes used
- Test conditions
  - 37 kA fault
  - follows AEP sequence
- Test variables
  - Shunt impedance
  - Number of parallel tapes
  - System voltage (v/cm/tape)
  - Load Current





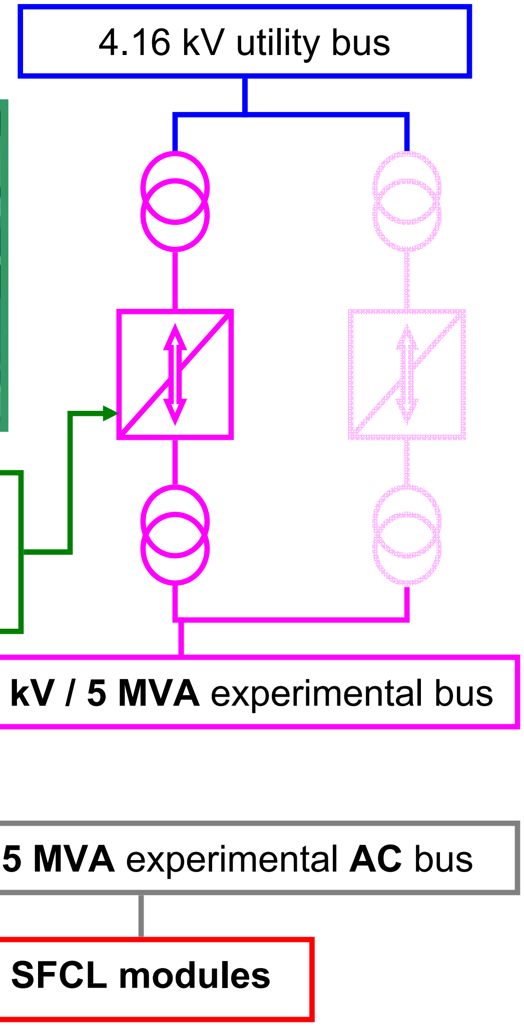


Current SFCL module manufacturing and assembly



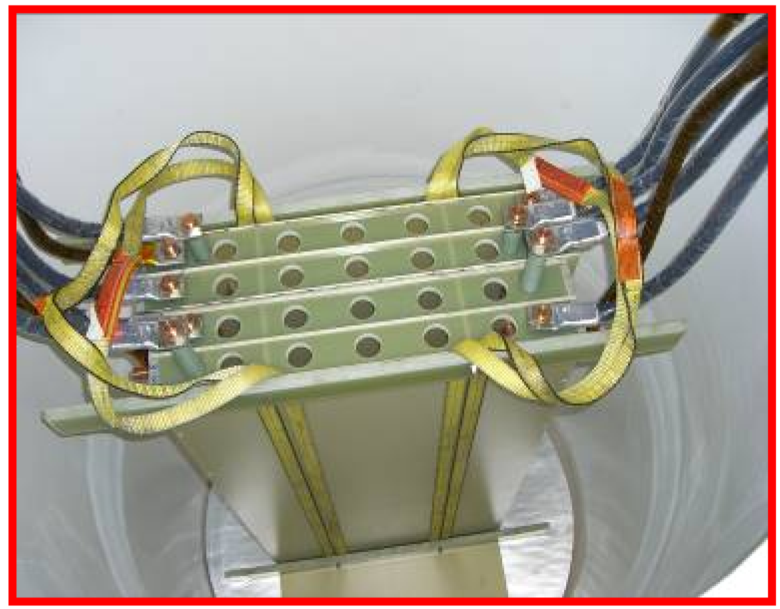
FSU-CAPS testing power in **2009**

Real Time Simulator RTDS



5 MVA power available in **2009**

5 MW Converter "Amplifier"



SFCL modules

FSU-CAPS testing power in 2010

Real Time Simulator RTDS

4.16 kV utility bus

AC Voltage feedback to RTDS

AC current reference from RTDS

0…4.16 kV / 10 MVA experimental bus

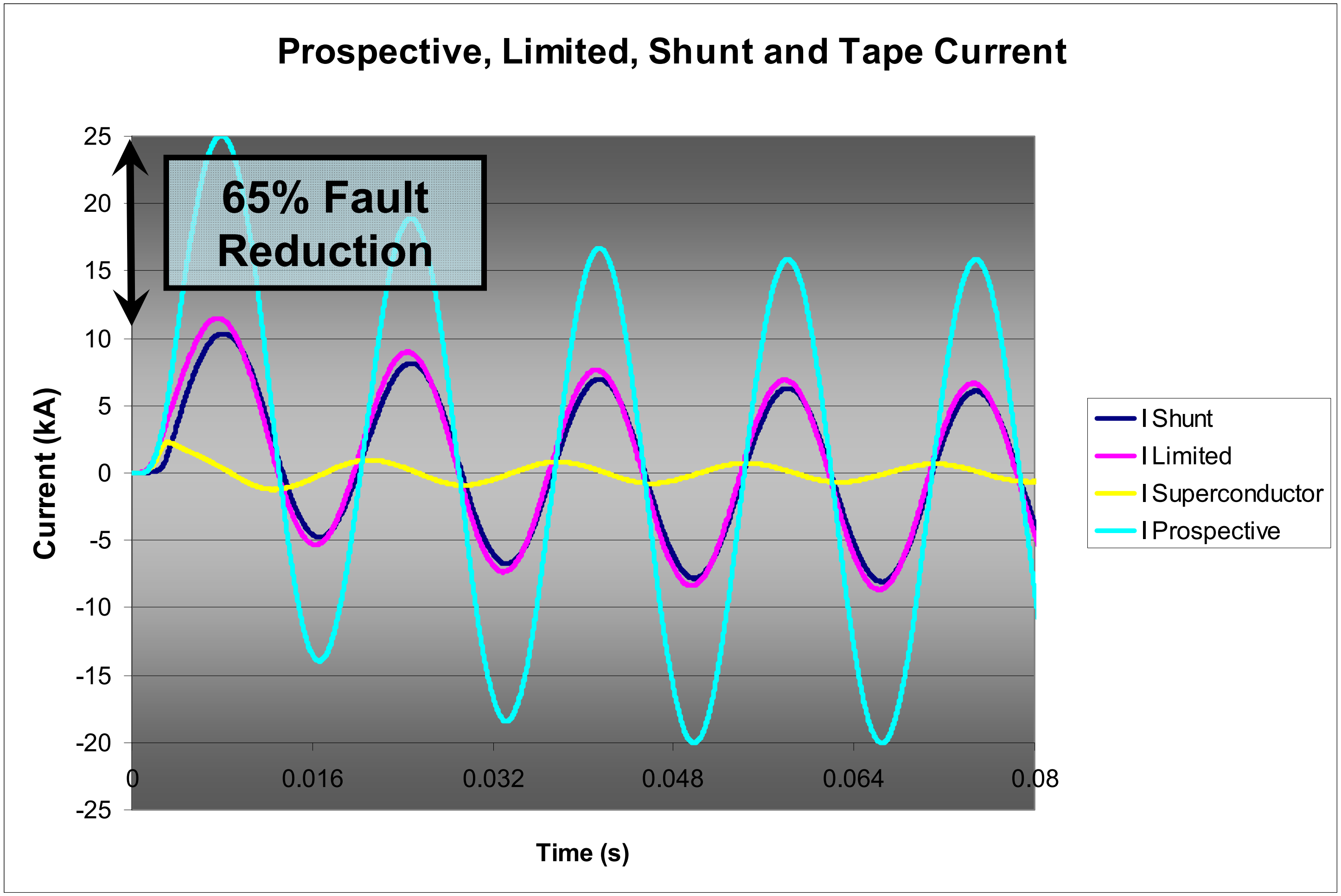
SFCL Device

10 MW Converter "Amplifier"

SFCL Device under test

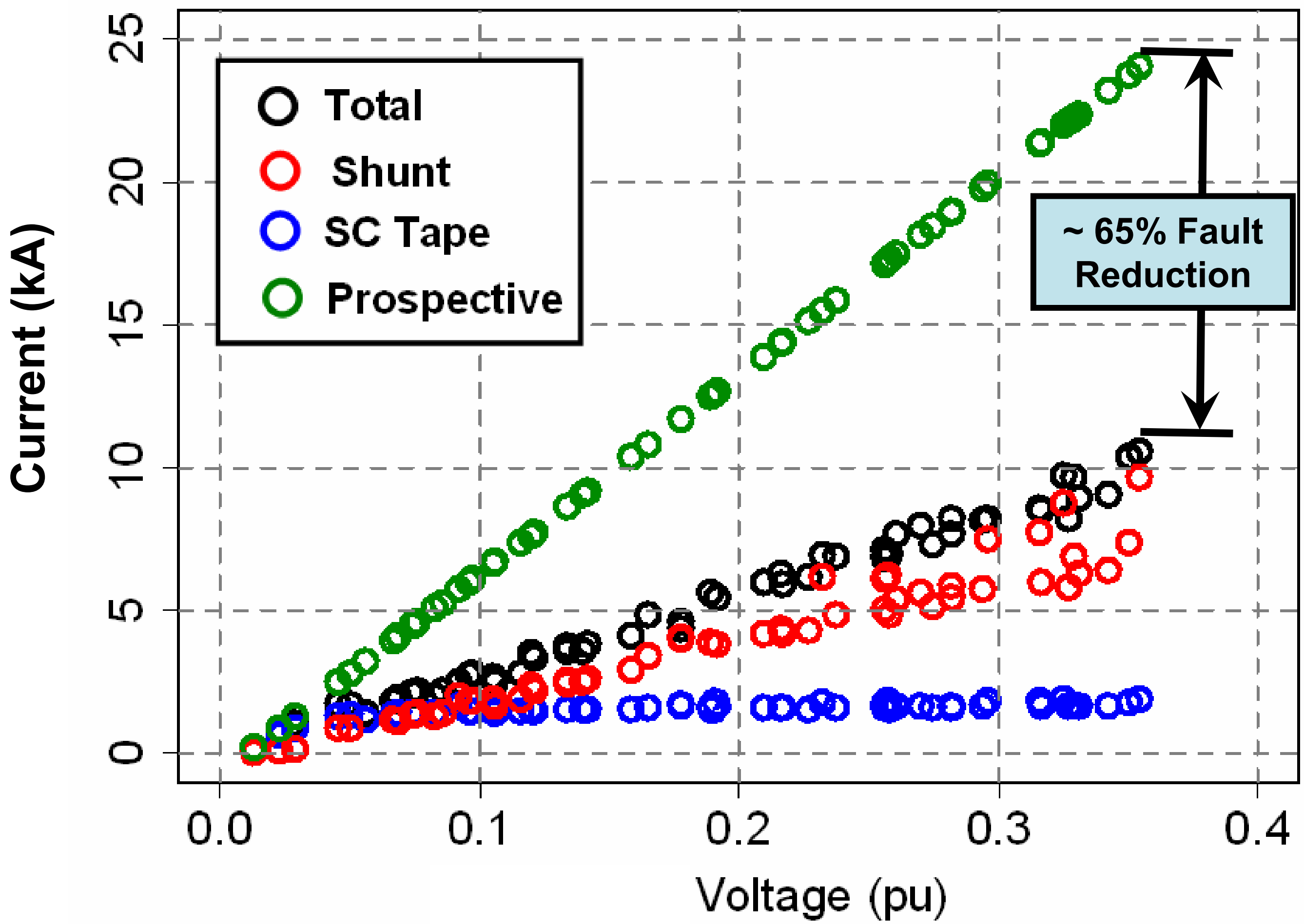
10 MVA power available in **2010**

Limited current with a single 2 tape circuit in a module



65% Fault reduction at 1st peak with 2 tape circuit for a prospective of 26kA

Limited current for a 2 tape circuit vs. voltage



A single circuit of 2 tapes in a SFCL module will limit 65% of 1st peak fault in the entire voltage range (up to 25kA prospective tested at CAPS)

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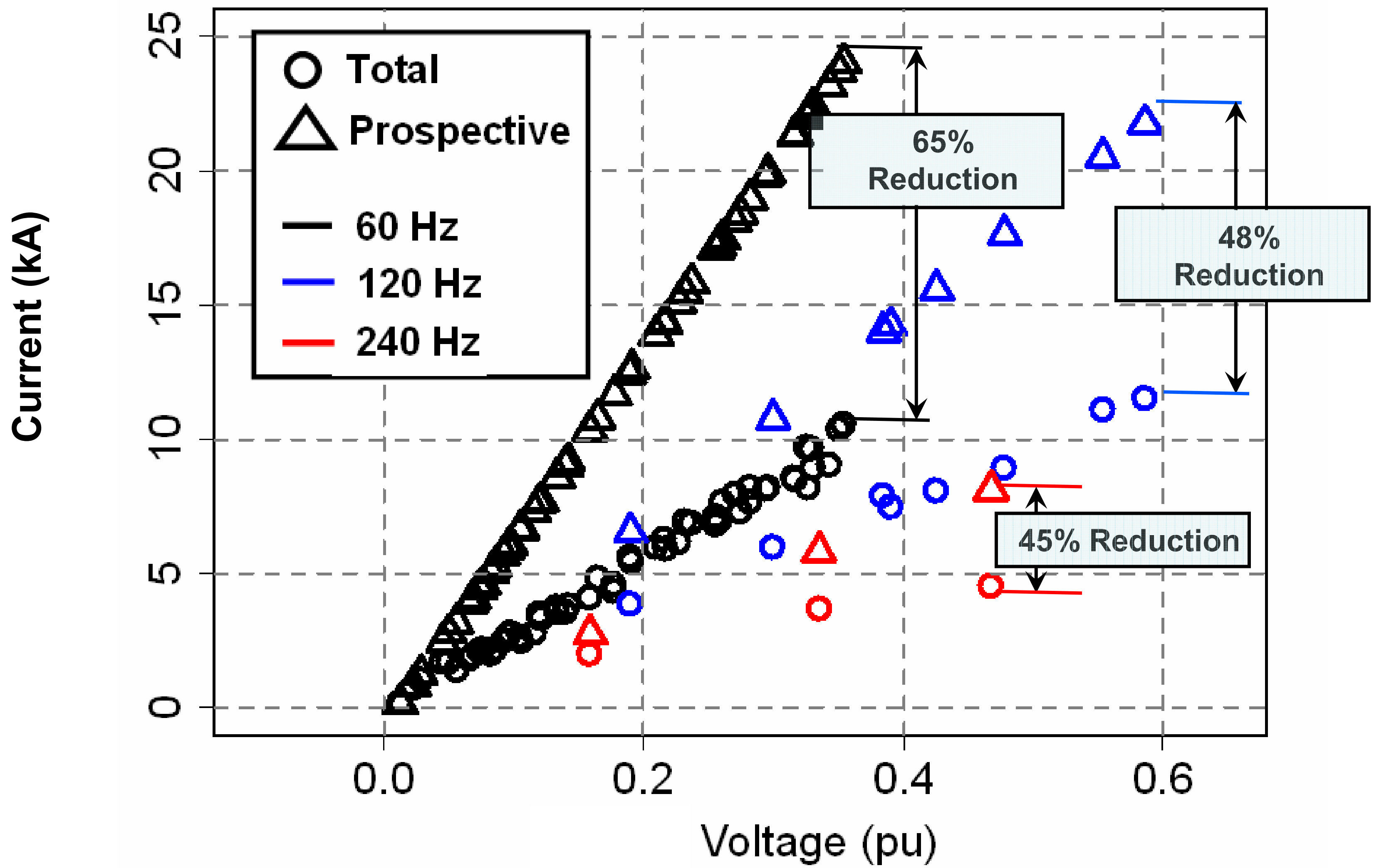
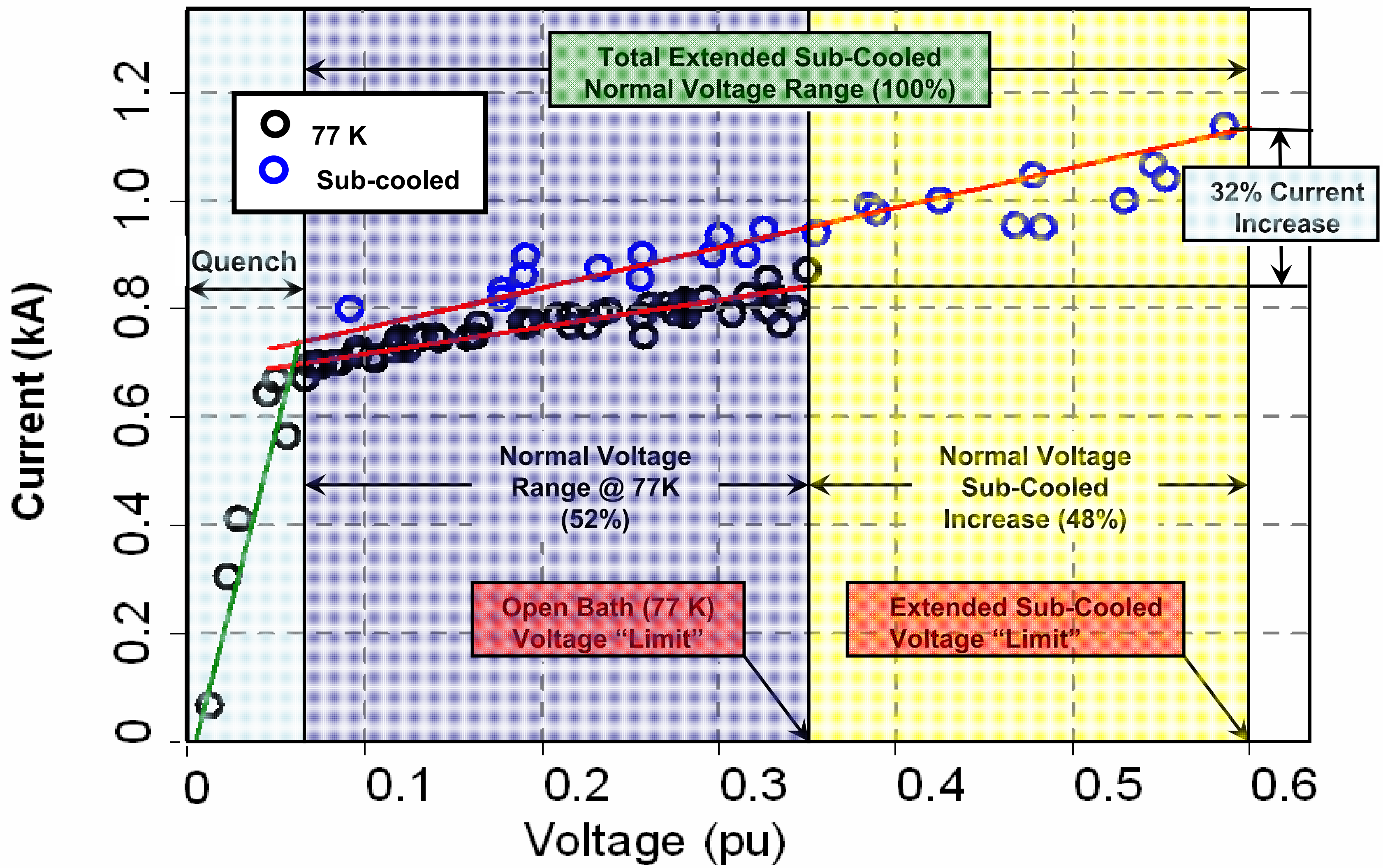
Peak current for 2 tapes vs. voltage and frequency



Current at different frequencies play a critical role in tape performance due to eddy current, skin depth on tape and non-homogeneous inductance at quenching.

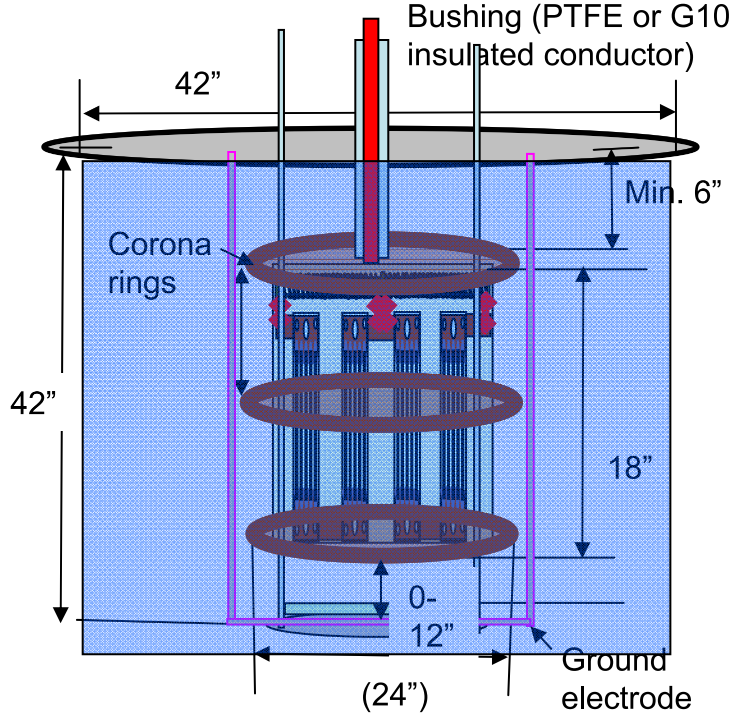
SuperPower Inc.

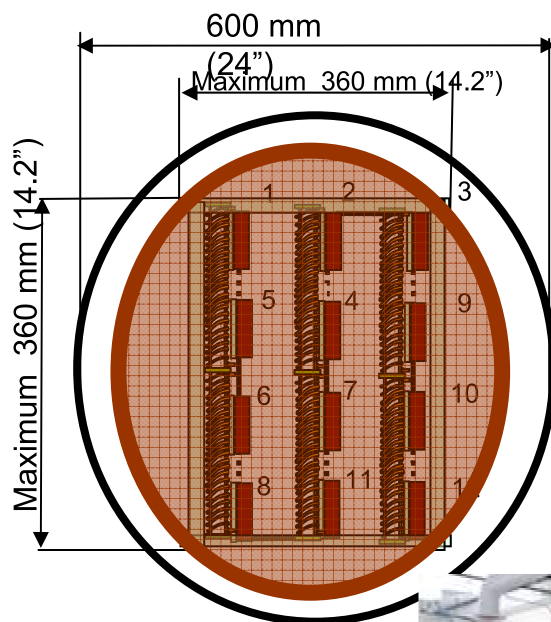
Peak current per tape and voltage for sub-cool and 77K



Sub-cooled conditions improved 48% voltage (192% increase) and 32% current (132%), a total of **~253% increase in power**.

HV test module assembly– 12 element mockup

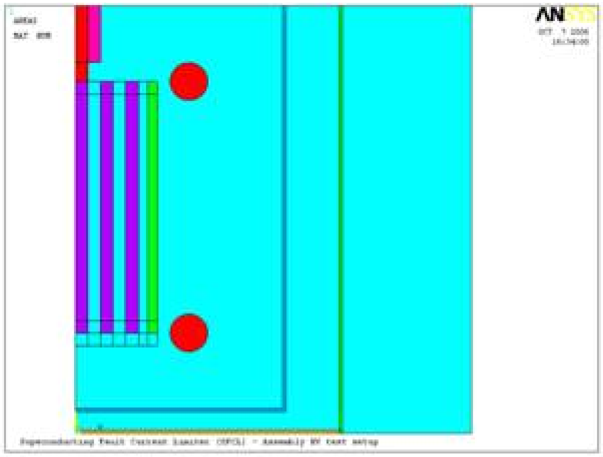


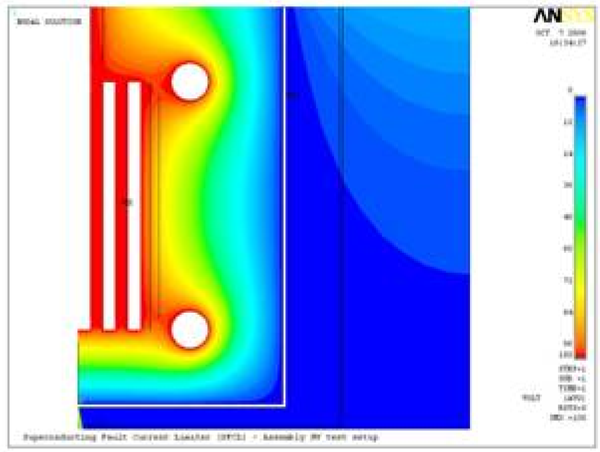


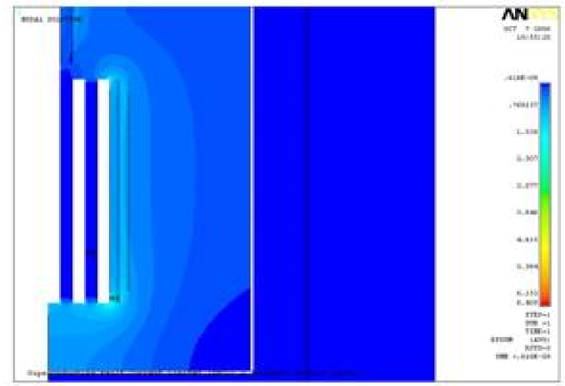
- 12 element mockup assembly to fit into an open bath fiberglass test cryostat
- Assembly at SP
- Tested at ORNL

2G FCL – high voltage test rig

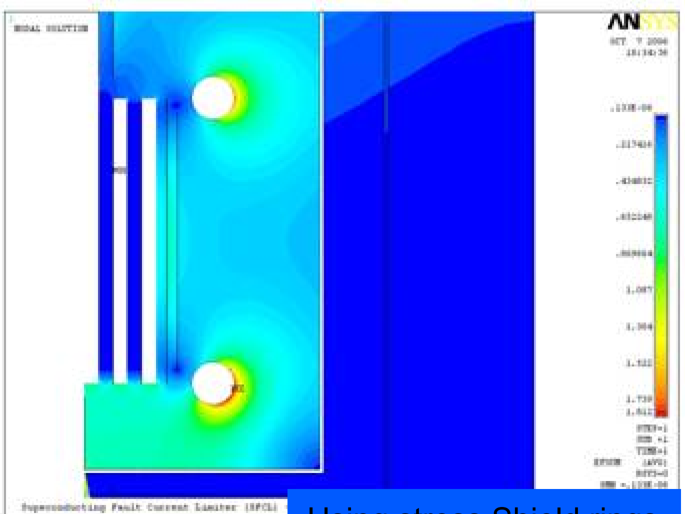
FEA results shows how the stress shield ring can be used to reduce stresses in sharp edge geometries







Sharp 2G element and connector edges



Using stress Shield rings

Radial gap [in]	Axial gap [in]	Shield [Yes/No]	Em @100 kV [kV/mm]	Ex @100 kV [kV/mm	Ey @100 kV [kV/mm
0.5	6	Yes	8.93	8.93	3.44
1	6	Yes	5.00	5.00	2.58
2	6	Yes	3.03	3.03	2.03
4	6	Yes	2.07	2.05	1.74
6	6	Yes	1.81	1.75	1.66
8	6	Yes	1.73	1.62	1.65
10	6	Yes	1.70	1.55	1.61
6	6	No	> 6.5	> 4.6	> 4.5

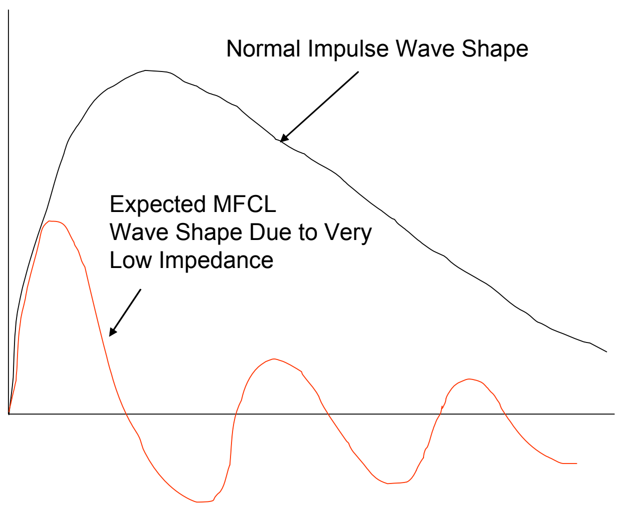
High voltage test requirements for Alpha

It is not possible to achieve standard BIL test waveforms across the terminals - See figure below

Tests based on typical 138kV requirements for Breakers, Transformers & Current Limiting Reactors

Based on input from AEP and NEETRAC Members

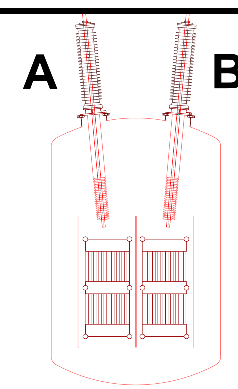
Test sequence will follow transformer standard



Tests to be Conducted	Proposed SFCL Requirement
60Hz Withstand	Based on ANSI Breaker C37.06 Table 4
Partial Discharge	Based on ANSI Transformer C57.12.00 Table 6
BIL Lightning Impulse	Based on ANSI Reactor C57.16 Table 5
Chopped Wave	Based on ANSI Transformer C57.12.00 Table 6
Switching Impulse	Based on ANSI Transformer C57.12.00 Table 6
Partial Discharge	Acceptance criteria established

Configurations for impulse testing:

- Impulse terminal A wrt to ground, with B open
- Impulse terminal B wrt to ground with A open
- Tie A & B together and impulse wrt to ground



Outline

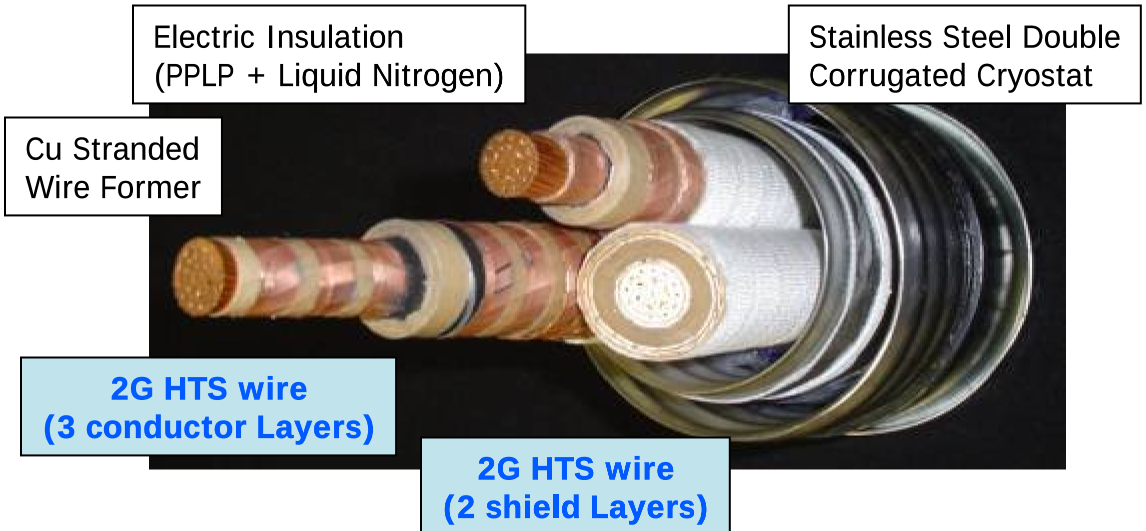
- 2G HTS for SC Applications
- Projects
  - 2G HTS SMES
  - FCL Transformer
  - FCL Module Development
  - HTS Cable
  - HTS Generator
  - Other
- Summary

Albany Cable Project - Program Overview

- 350m long - 34.5kV - $800A_{rms}$ - 48MVA
- Cold dielectric, 3 phases-in-1 cryostat, stranded copper core design
- Two Phases – Phase I - 320m + 30m BSCCO
  - Phase II - 30m BSCCO replaced by 30m YBCO cable

SuperPower Inc.	Project Manager; Site infrastructure, Manufacture of 2G HTS wire
nationalgrid	Host utility, conventional cable & system protection, system impact studies
SUMITOMO ELECTRIC	Design, build, install, and test the HTS cable, terminations, & joint
Linde	Design, construct and operate the Cryogenic Refrigeration System, and provide overall cable remote monitoring and utility interface
NYSERDA; Department of Energy, United States of America	Supported by Federal (DOE) and NY State (NYSERDA) Funds

Demonstration of the world's first device made with 2G HTS conductor in a live power grid



350 m cable made with 30 m segment of 2G HTS thin film tape was energized in the grid in January 2008 & supplied power to 25,000 households in Albany, NY


Installation at Albany Cable site (Aug. 5, 2007)

SuperPower Inc.

Power transmission cable manufactured by SEI with SuperPower 2G HTS conductor

Benefits

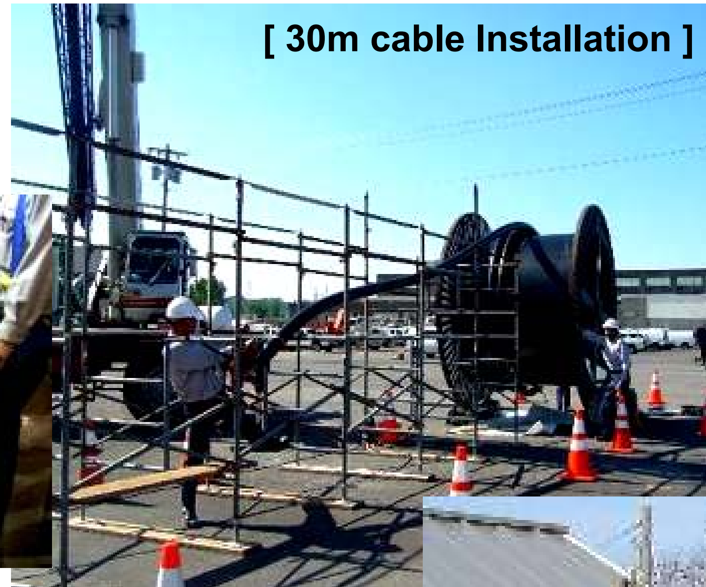
- 5 (AC) to 10 (DC) times more capacity than comparable conventional cables
- Can be used in existing underground conduits → saves trenching costs
- Liquid nitrogen coolant is also dielectric medium (no oil)
- Greatly reduced right-of-way (25 ft for 5 GW, 200 kV compared to 400 feet for 5 GW, 765 kV for conventional overhead lines)
- Operating at high currents, can obviate the need for step-up / step down transformers
- Can be used on conventional equipment with minor modifications

SUMITOMO ELECTRIC

Ingenious Dynamics

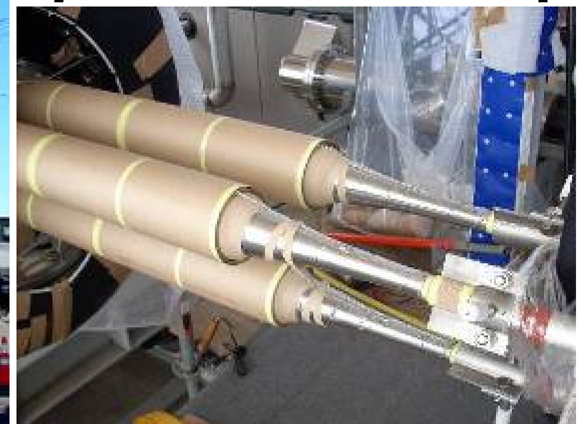
Replacement of 30 meter Section with YBCO Cable (Phase II)

[Joint Re-assemble
BSCCO-YBCO]



[30m cable Installation]

[Termination Re-assemble]

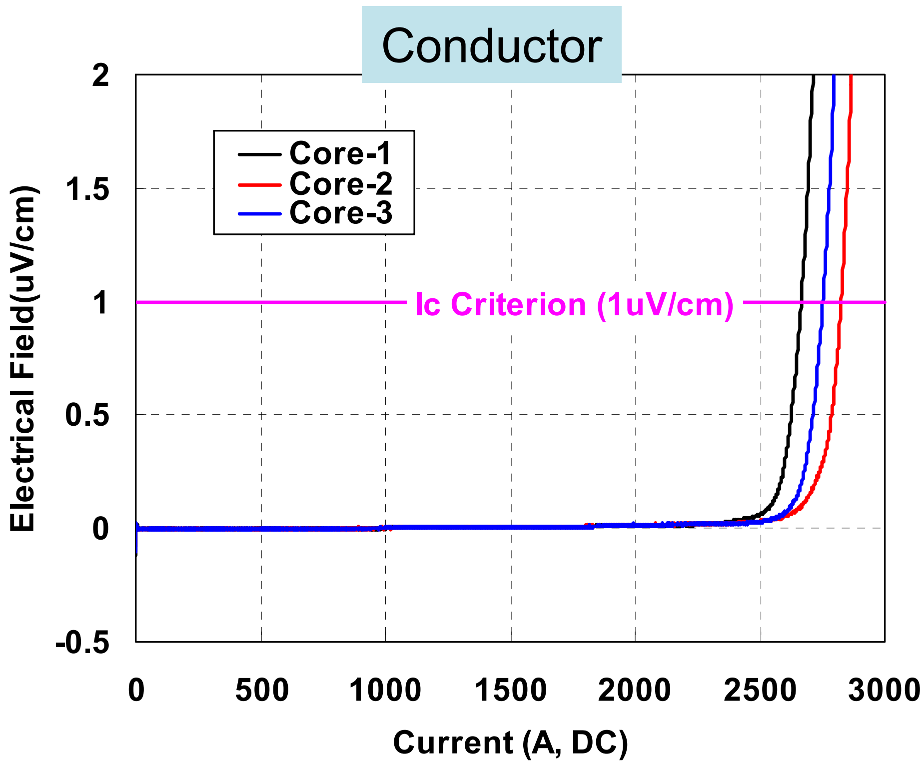


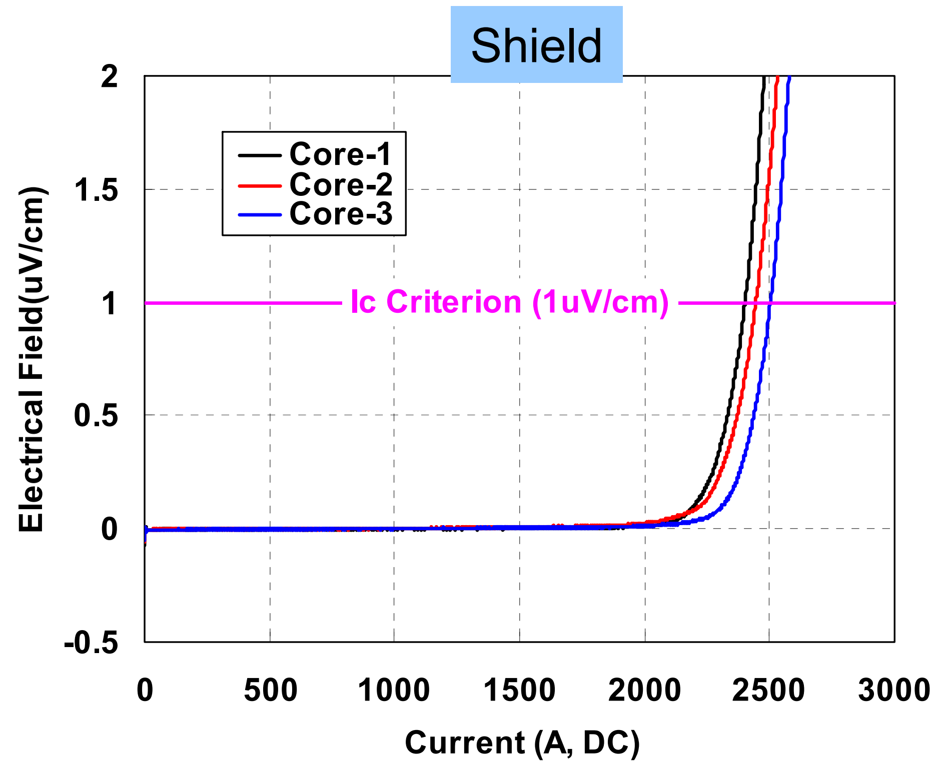
SuperPower Inc.

YBCO Cable - Critical Current Measurement

Sample: 3 meter 3-Core

- **Ic (Conductor) = Approx. 2660 – 2820A (DC, 77K, 1uV/cm)**
- **Ic (Shield) = Approx. 2400 – 2500A (DC, 77K, 1uV/cm)**

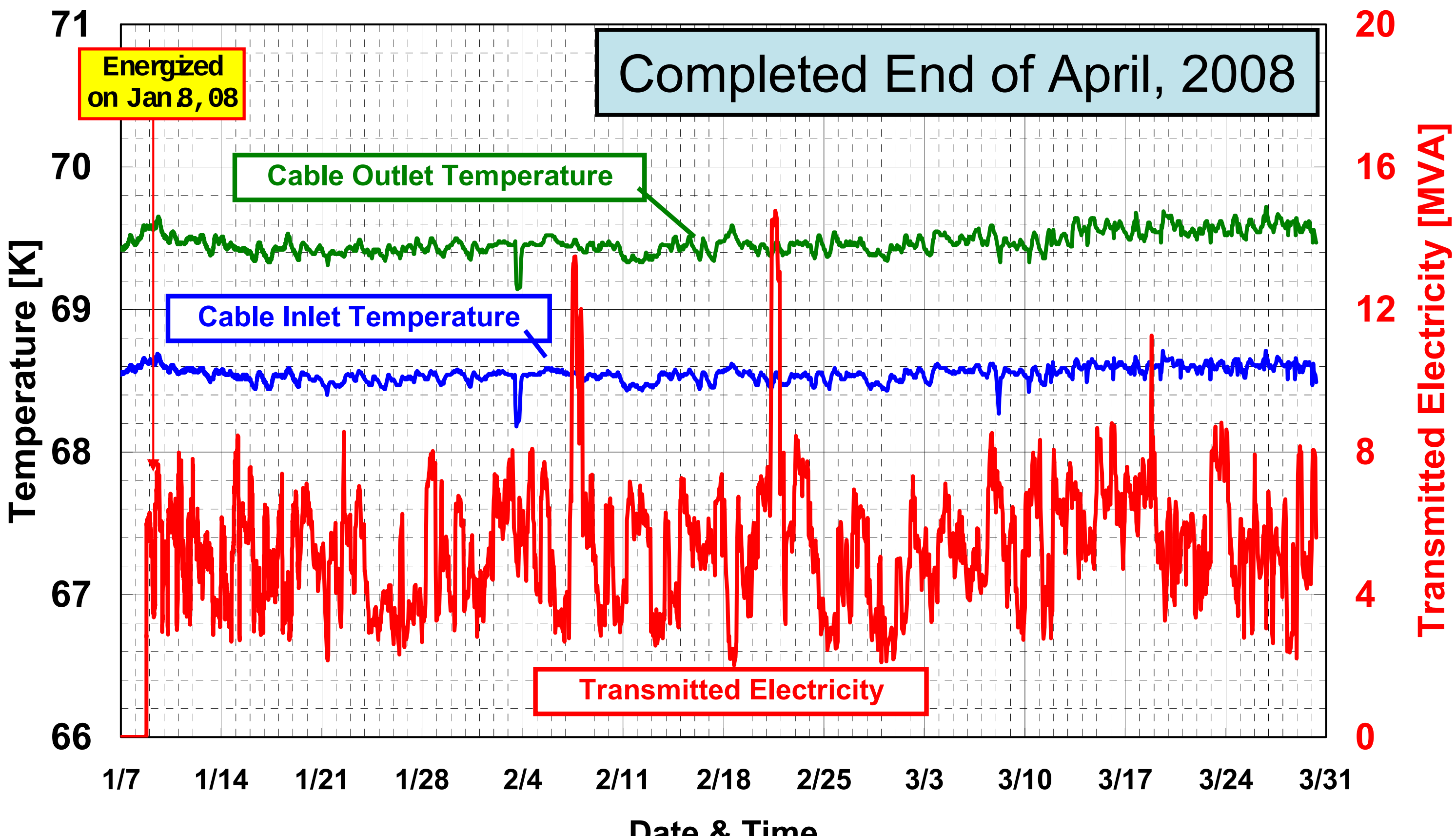




Very good match between test results and design values

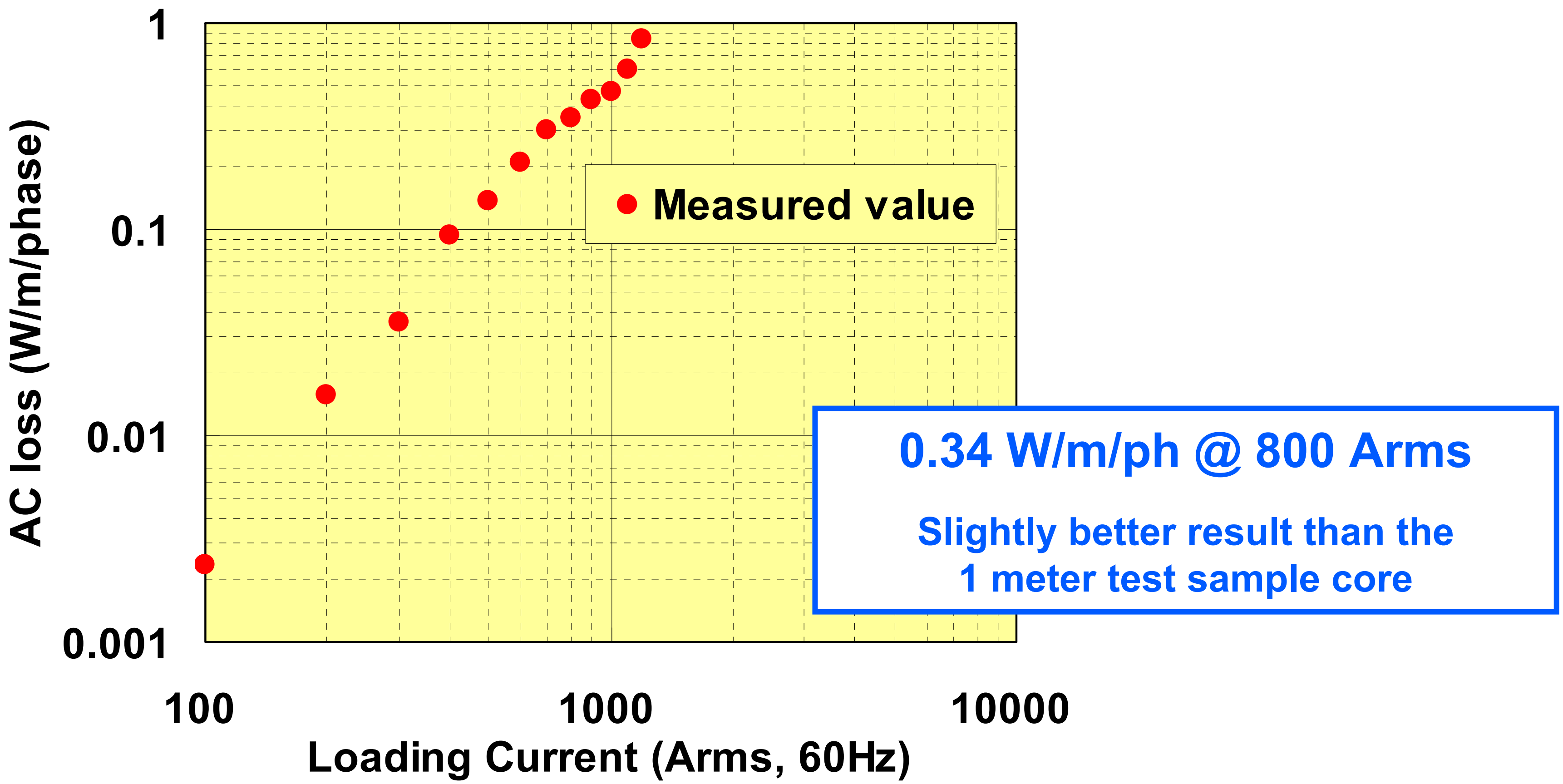
Re-connected with live network and back in service (Phase-II)

- HTS Cable System re-connected with live network; back in service Jan. 8, 2008
- HTS Cable System was operated successfully in unattended condition
- Long-term Operation completed successfully end of April 2008



AC Loss Measurement

Sample:	**2.5 meter single core**
Current loading:	**go & return through conductor and shield**
Measuring:	**Lock-in amplifier with electrical 4 terminals**



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SuperPower Inc.

HTS Coils for Motors and Generators

- Distinct Advantages:
  - Improved efficiency, including CRS for cooling the devices
  - 50% reduction in full load losses
  - Improved power quality enabling faster switching speeds
  - 30% - 50% smaller and lighter, heat disposal of less concern
  - Inherently quiet, no iron teeth
  - Higher magnetic fields – greater power density
- Industrial Applications
  - Wind and hydro-electric generators, petroleum refining, machine tool operation
- Military Applications
  - **Navy:** all electric ship
  - **Air Force:** electrically-driven power aboard military aircraft, airborne active denial systems, self-protect systems, directed energy weapons

Superconducting generators offer benefits for wind energy production

- High power generators under development for wind turbines and off-shore power production.
  - More economical
  - Less # of generators to maintain for same power generation
  - Superconducting generators can mitigate voltage fluctuation → enhance power system stability, larger reactive power output capacity[1]
- Cooling of superconductors consumes 1% of produced power
- Superconductors can be used in auxiliary systems such as Superconducting Magnetic Energy Storage (SMES) for smoothing wind generator output[2]
- Superconducting generators can be beneficial in high power wind turbines
  - Reduce generator weight & volume by 50% or more (above 5 MW, conventional generators are too heavy)
  - More efficient
  - Direct drive without gearbox possible.
  - No Rare Earth magnet limitations

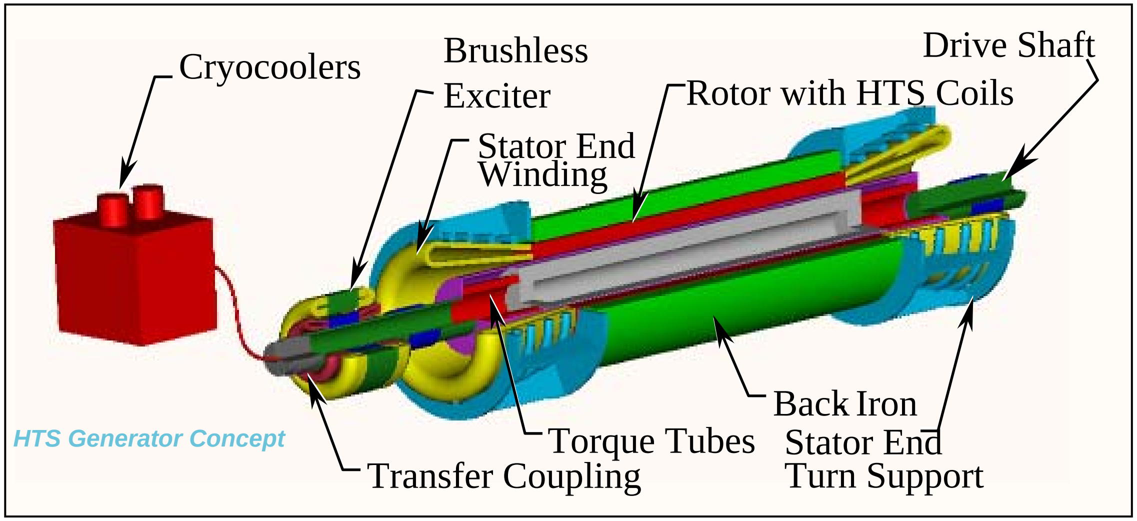
[1] Sakamoto et al. 15th PSCC, Liege, 22-26 August 2005
[2] Takahashi et al. DOI 10.1109/ICEMS.2007.4412245

HTS generator project with the Navy

Benefits:

- Improved efficiency, including the cryogenic refrigeration system required for cooling the devices, resulting in a 50% reduction in full load losses
- Improved power quality that enables faster switching speeds
- Improved ship configuration flexibility because devices are about 30% lighter and 50% smaller and heat disposal is less of a concern
- Inherently quiet since they do not need iron teeth, a major source of structure-borne noise
- Higher magnetic fields allow for greater power density

- *SuperPower*
- *Baldor Electric*
- *General Dynamics-Electric Boat*
- *Naval Surface Warfare Center (Philadelphia)*
- *Naval Research Lab*
- *ORNL*



HTS Generator Concept

Coil Applications: World record performance achieved in high field coil constructed with 2G HTS wire

2009:	27.4 Tesla at 4.2K in 19.89 Tesla background field
2008:	33.8 Tesla at 4.2K in 31 Tesla background field
2007:	26.8 Tesla at 4.2K in 19 Tesla background field
2006:	2.4 Tesla at 64K in self field

2009 Insert Coil

>>>

Nuclear magnetic resonance (NMR) spectroscopy

Other applications for HTS

Military:
Navy's Electric Ship, Air Force

Medical Devices:
MRI, NMR,
Proton Therapy

Transportation:
Maglev Trains

Space:
Propulsion systems,
radiation shielding

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Launch of superconducting devices in energy applications has fueled growth of 2G HTS demands

- After 20+ years since its discovery, HTS is now inserted in devices in electric power devices and in other industrial devices
- Rapid growth of HTS market projected as wire cost is reduced and price: performance continues to improve
- The 2G HTS community is rapidly scaling capacity to meet the increasing demands for conductor

Questions?

Thank you for your interest!

For further information about SuperPower,
please visit us at: www.superpower-inc.com

or e-mail: info@superpower-inc.com