

Industrial Participation & SRF Infrastructure at Fermilab

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Outline



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- **Goals for SRF infrastructure**
- **Why industrial participation?**
- **Industry interest**
- **Examples of current participation (not including construction related industries)**
- **On-going industrial cost study**
- **Review charge question #5: “Does the SCRF plan for FY08 and beyond make use of and develop U.S. industry at an appropriate level?”**
- **Next steps**

Goals for SRF Infrastructure

- **To perfect U.S. fabrication & processing of SRF cavities and modules and to demonstrate performance with a full range of testing (including beam)**
 - Deploy ILC design / processing / assembly techniques
 - Establish process controls to reliably achieve high gradient cavity operation and module performance
 - Test cavities and modules at the component level and in a systems test to demonstrate yield, reproducibility and beam performance
- **To facilitate commercial production of SRF components and modules**
 - Train and transfer SRF technology to the US industry
 - Allow industrial participation and input to the process
 - Similar to SC cable and magnet technology transfer
- **To participate in SRF Research and Development**
 - Develop expertise in SRF technology and provide training base for construction and operation of future accelerators
 - Our attempt to fit into the world's SRF community

All of this work will be carried out with US/international collaboration

Why Industrial Participation?

- It is expected that U.S. industry must play a large role in the production of mass produced cavities and cryomodules.
- Limited experience currently exists in U.S. industry, particularly for cavity fabrication and processing.
- U.S. industry has expertise in reducing mass production costs, particularly if engaged early in the development cycle.
- Fermilab initiated the formation of a network of industrial companies to stimulate interest and participation in the ILC.

Linear Collider Forum of America



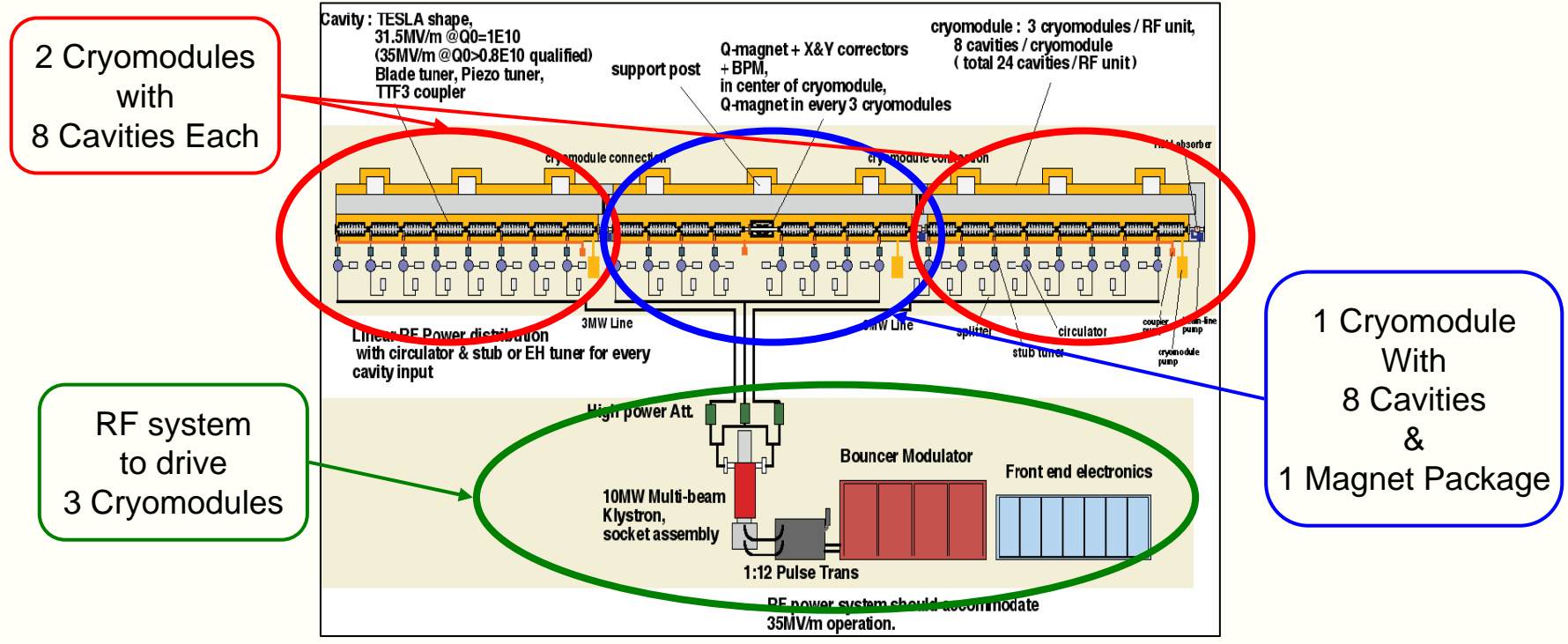
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- (from LCFOA mission statement) “LCFOA provides a formal network for its U.S. industry members with a common business interest to interact with U.S. government funded R&D efforts during the design and siting of the ILC.”
- The LCFOA was formed in September 2005 and has met three times (~twice per year). The fourth meeting is planned for February 28, 2007 in Washington, D.C.
- The LCFOA lists 26 members, six of whom contributed to the RF Unit cost study.

Current Contracts & Discussions

- **CPI:** Producing six 3.9 GHz couplers. Ordered twelve 1.3 GHz couplers based on DESY drawings and specifications. Fabrication scheduled to immediately follow the DESY TTF order.
- **AES:** Contract to fabricate four 9-cell 1.3 GHz TESLA design cavities. Order placed for six 9-cell GHz cavities with equal end group lengths. (Order for eight cavities of this type placed with ACCEL.) Plan to order 24 additional cavities in FY07.
- **Niowave:** Contract to design HPR system, including fabrication specifications and drawings.
- **Roark & Niowave:** Three phase contract to produce 1-cell 3.9 GHz, 1-cell 1.3 GHz and 9-cell 1.3 GHz cavities. Has subcontract with Niowave to do pre-weld chemistry.
- **ABLE Electropolish:** Chicago area company. Met with Fermilab a couple of times and visited JLab. Proposing to send a person to JLab for six months.

RF Unit Cost Study



- Three cryomodules, eight cavities in each, with a magnet package in one cryomodule.
- Also includes: Klystron, Modulator, RF distribution, RF power couplers and Low Level RF.

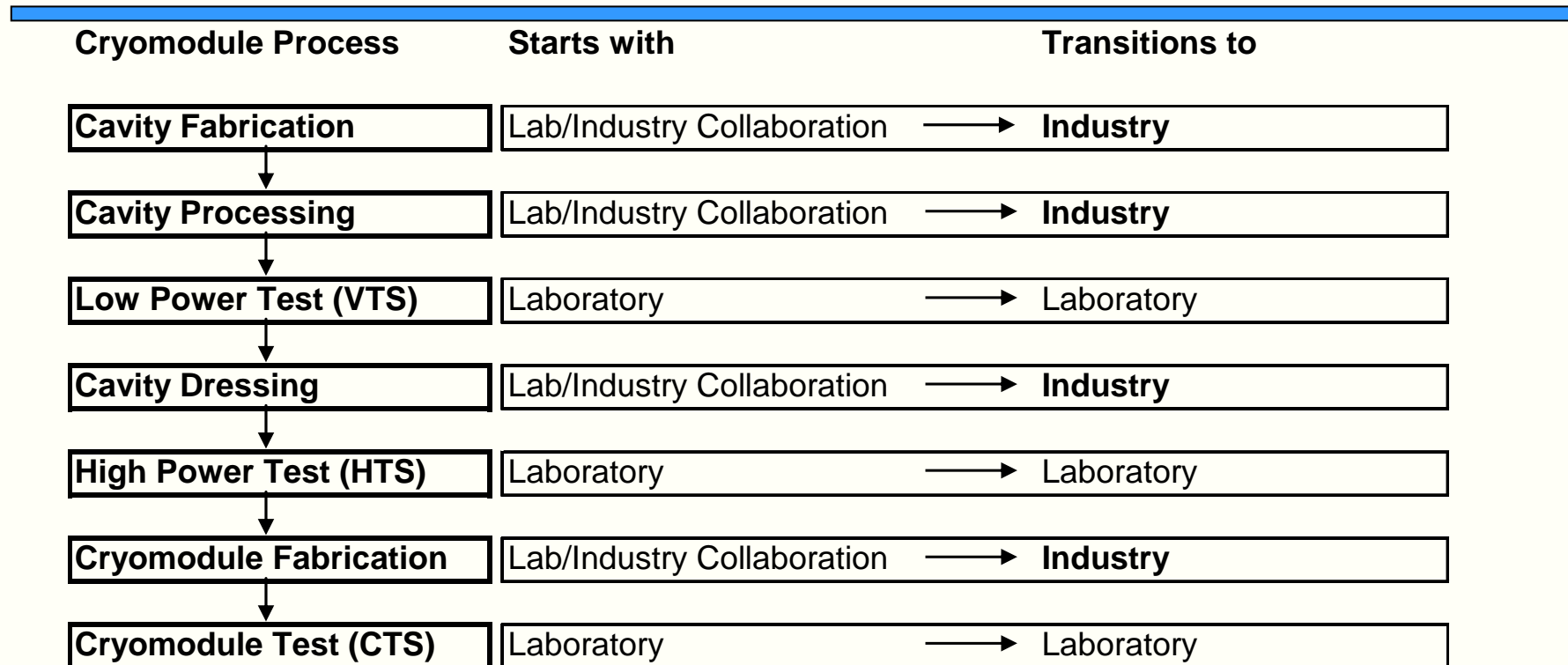
RF Unit Cost Study

- **Contracted with AES (and team members Meyer and CPI) for an industrial cost study of an RF Unit.**
- **Kick-off on July 26, 2006. Work was completed final report (for comment) issued on January 26, 2007.**
- **Identified potential for cost reductions of up to 25% in cavity fabrication and 35% in power coupler fabrication.**
- **Identified other areas to pursue for cost reductions.**

Review Charge Q5

- **Does the SCRF plan for FY08 and beyond make use of and develop U.S. industry at an appropriate level?**

Development of Industry



- The technology for cavity fabrication, cavity processing, cavity dressing and cryomodule fabrication will be transferred to industry.
- Cryogenic testing of cavities and cryomodules along with beam tests will remain the responsibility of US laboratories.

Required Funding

Infrastructure	M&S	SWF	Total with Indirect
Cavity Fabrication Infrastructure	\$ 3,000	\$ 675	\$ 4,380
Cavity Processing Facilities	\$ 11,100	\$ 4,590	\$ 18,945
Vertical Test Stand (VTS 2 & 3)	\$ 2,625	\$ 1,845	\$ 5,475
Horizontal Test Stand (HTS 2)	\$ 1,220	\$ 1,057	\$ 2,805
Cavity/Cryomodule Assembly Facilities (CAF_MP9 & ICB)	\$ 690	\$ 270	\$ 1,158
NML Facility (ILCTA_NML)	\$ 18,270	\$ 23,220	\$ 51,700
Cryogenics for Test Facilities	\$ 10,690	\$ 950	\$ 13,692
Cryomodule Test Stand	\$ 5,400	\$ 2,970	\$ 10,180
Material R&D	\$ 870	\$ 722	\$ 1,960
Illinois Accelerator Research Center	\$ 20,000	\$ 4,050	\$ 28,605
Grand Total (\$k)	\$ 73,865	\$ 40,349	\$ 138,900

- **\$5.5M is budgeted for industrialization both in the FY08 and FY09 ILC program requests. It is not included in the infrastructure request above.**

Next Steps



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- **Close out AES RF Unit cost study contract and analyze the information.**
- **Use cost study information to target drivers for cost reductions (i.e. DFM / value engineering, etc.)**
- **Early emerging targets: cavities and end group parts, power couplers, helium vessels, vacuum vessels, magnet package, cryomodule assembly....**
- **Plannning for \$5.5M in FY08 and in FY09 for industrialization as part of the ILC program.**
- **Establish contracts with various companies to: assist in DFM, reduce fabrication costs, transfer technology, develop experience, qualify as vendors,**
- **We have not yet determined explicit work scopes.**

Candidate Industrial Participation



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- Design improvements in cavity end parts. Fewer, simpler parts.
- Develop high volume machining vendors for niobium parts.
- Stainless steel helium vessel.
- Design improvements in power couplers.
- Magnet package design.
- Vacuum vessel. Tooling and/or design changes/tolerance reductions to eliminate or minimize post weld machining of flanges.
- Cryomodule assembly.
- HOM housing. Cost reduction improvements in fabrication.
- Cavity and cryomodule factory layouts.
- Develop commercial electropolishing expertise.

Conclusions

- **There is no debate – U.S. industry needs to be involved in our pursuit of the ILC.**
- **Industry needs to be involved early to have the greatest impact on our designs.**
- **We need to develop industrial sources of competition for the components and systems we will purchase – now to support development, and in the future to support construction of the ILC.**