

# Jefferson Lab

## ILC – America Meeting

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# JLab Perspective on ILC R&D

- A project of this magnitude requires the best national and international resources, including SRF, where JLab has a recognized core competency.
- JLab expects a role in ILC R&D consistent with fulfilling our primary mission in Nuclear Physics (NP).
  - *ILC-specific new and allocated resources in High Energy Physics (HEP) need to be identified*
- SRF-based Nuclear Physics and ERL/FEL program at JLab provides a foundation for timely and cost-effective start of ILC R&D.
  - *JLab technical infrastructure and expertise, partnerships with national labs, and university and industry relationships*
- Partnership at the international level will be essential for the success of ILC.
  - *JLab has demonstrated technical and managerial acumen in a national context as a partner in the SNS*



# Existing JLab SRF capabilities for ILC R&D

- **Demonstrated construction capability – historical contribution**
  - CEBAF construction
  - SNS construction
  - 12 GeV Upgrade Prototypes
  - SRF- and energy-recovery-based world's highest power tunable IR FEL
- **Existing infrastructure**
  - Production facilities
  - R&D facilities
  - Test facilities
  - Beam test capabilities using FEL
- **Existing expertise from concept to operation**
  - Cavity engineering, design, production, processing, testing and operating
  - Cryomodule engineering, design, production/procurement, product integration
  - RF and LLRF system definition, design and construction
  - Complex SRF system operation



# International capabilities required to support ILC R&D

- **World-class resource for SRF technology in support of the broad SC mission, capable of addressing all stages of development from concept through prototyping and testing in an operational environment**
  - **State-of-the-art understanding:**
    - Staffed for sustained excellence in science, accelerator physics, design/engineering, technology, manufacturing and quality control
    - Operational experience tightly folded back into design improvements
  - **State-of-the-art tools**
    - Design codes: rf structure, cavity-beam interactions, mechanical
    - Prototyping facilities: EBW, CNC machining, furnaces, etc.
  - **State-of-the-art processing and assembly facilities**
    - Ultra-clean cavity fabrication and processing infrastructure
    - Manufacturing engineering development for rapid, reliable, clean cryomodule assembly
  - **State-of-the-art testing and analysis facilities**
    - Versatile, well-instrumented, cold cavity and materials testing infrastructure (based on the VTA)
    - Versatile, well-instrumented cryomodule testing infrastructure (based on the CMTF)
    - Surface and material science capability for QA, new understanding and new process development
  - **Industrial linkages to support technology transfer**
    - Codified engineering basis ready for transmission, derived from and updated by all the above
- **Short cycle time for new designs**
  - **Deep scientific understanding**
  - **Developed in-house or in collaboration with others in the SRF community, as determined by project needs.**
- **Performance levels significantly surpassing today's achievement**
  - **minimum loss (high  $Q_0$ )**
  - **efficient control (complex low level RF control)**
  - **accelerated current (reduced HOM impedance via dampers)**
- **Reliable, predictable and cost-effective production**
  - **Project quantities for smaller projects**
  - **Technology**



# Possible roles for JLab in the context of an international ILC R&D effort

- Host of a collaborative SRF activity center providing identified capabilities and addressing:
  - Refining SRF aspects of the accelerator design for manufacturability, cost and performance
  - Involving industrial partners to transfer the design and manufacturing processes
- Develop at least one Engineering Test Facility identified in the TESLA and USLCSG documents as an industrial prototype
- Contribute to the ILC Global Design Organization, including hosting it
- Integrate with the national SRF consortium, providing synergistic collaboration
  - *e.g. Provide high-performance cryomodule design and development for pulsed (high gradient, low loss) and cw applications (low loss, damped Higher Order Modes) supporting SMTF*

**We are discussing these roles with DOE-SC**

