

# **Progress with Cavity Testing at Fermilab**

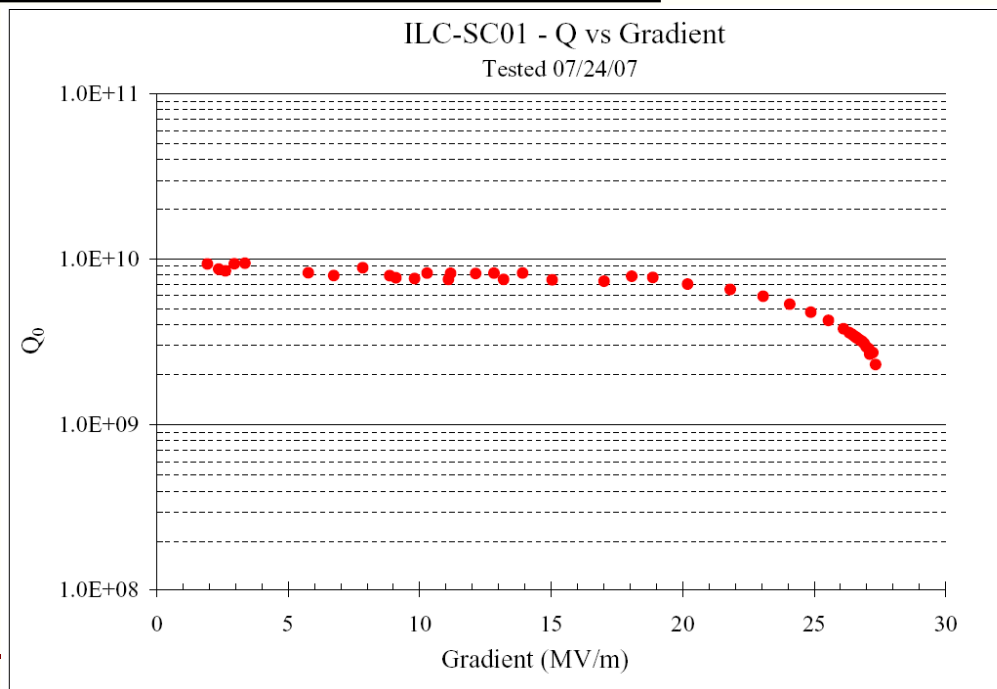
**Mark Champion**

**9 August 2007**

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# First Cavity Test Result on July 24, 2007







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# TD-IB1 ILC Cavity Vertical Test Stand; Construction Completion, Test, and Full Operational Readiness Clearance (ORC) July 23, 2007





## Vertical Test System Recent Results



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- Received operational approval July 23
- Performed first cavity test July 24 with strong support from Jefferson Lab: Tom Powers and Christiana Grenoble
- Testing performed at 2.0 K
- No Q vs Temperature data, but capability exists
- Achieved ~27.5 MV/m at  $Q \sim 2e9$  with field emission; limited by quench (see plots on following slides)
- Multipacting and field emission processed at 6-7 MV/m and 10-15 MV/m, respectively.

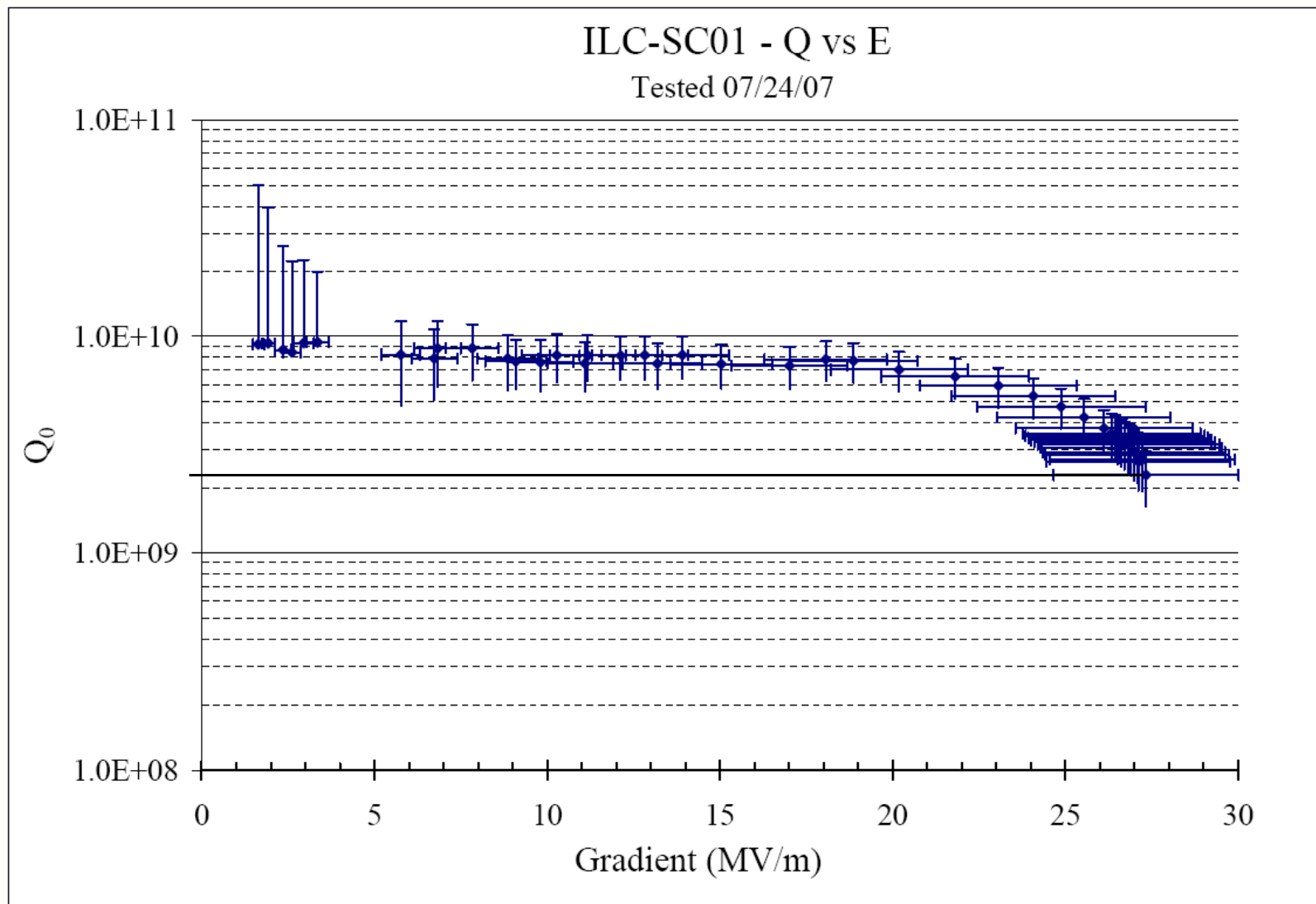


# Final Performance: Q vs Eacc

All testing performed at 2.0 K



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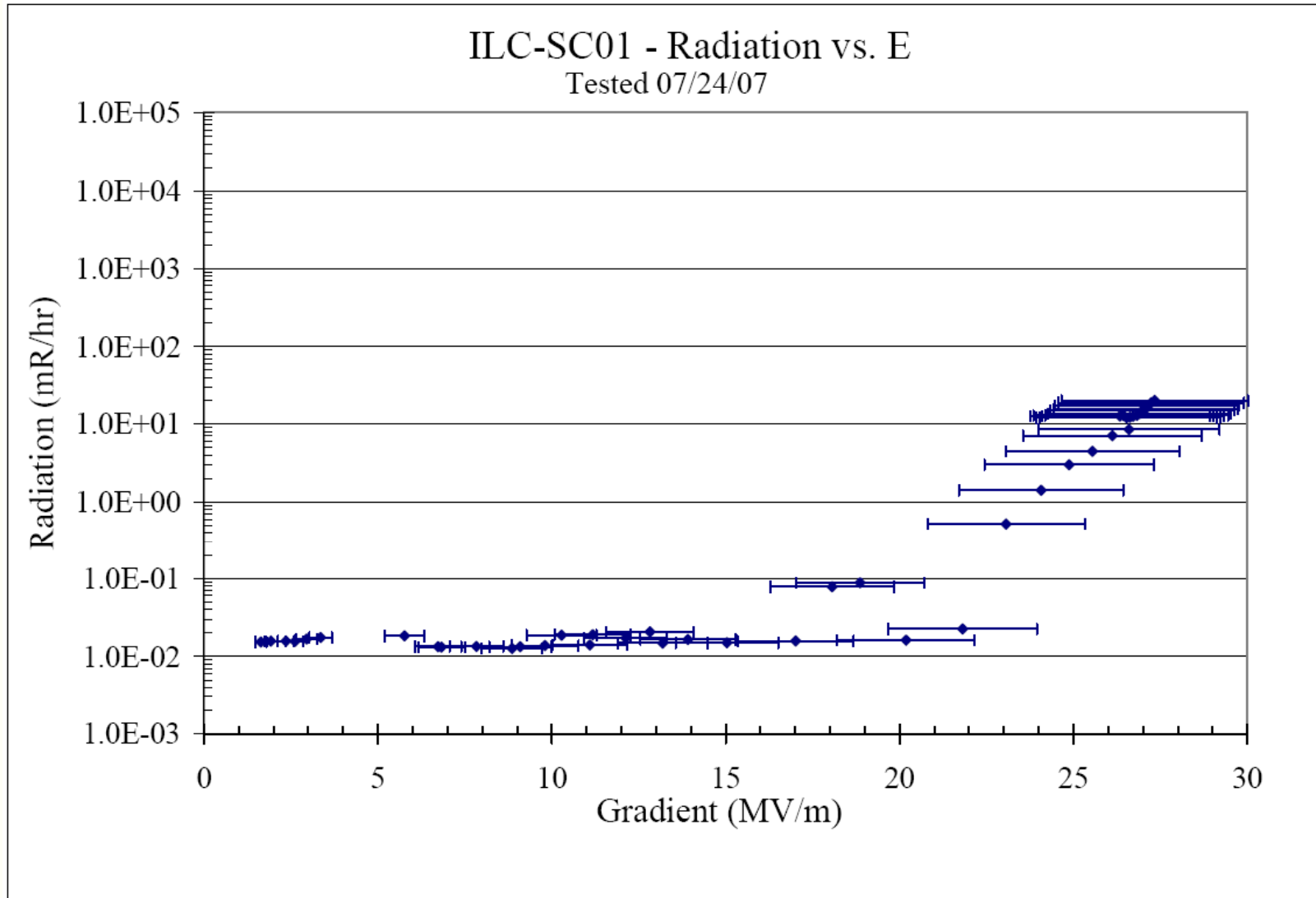


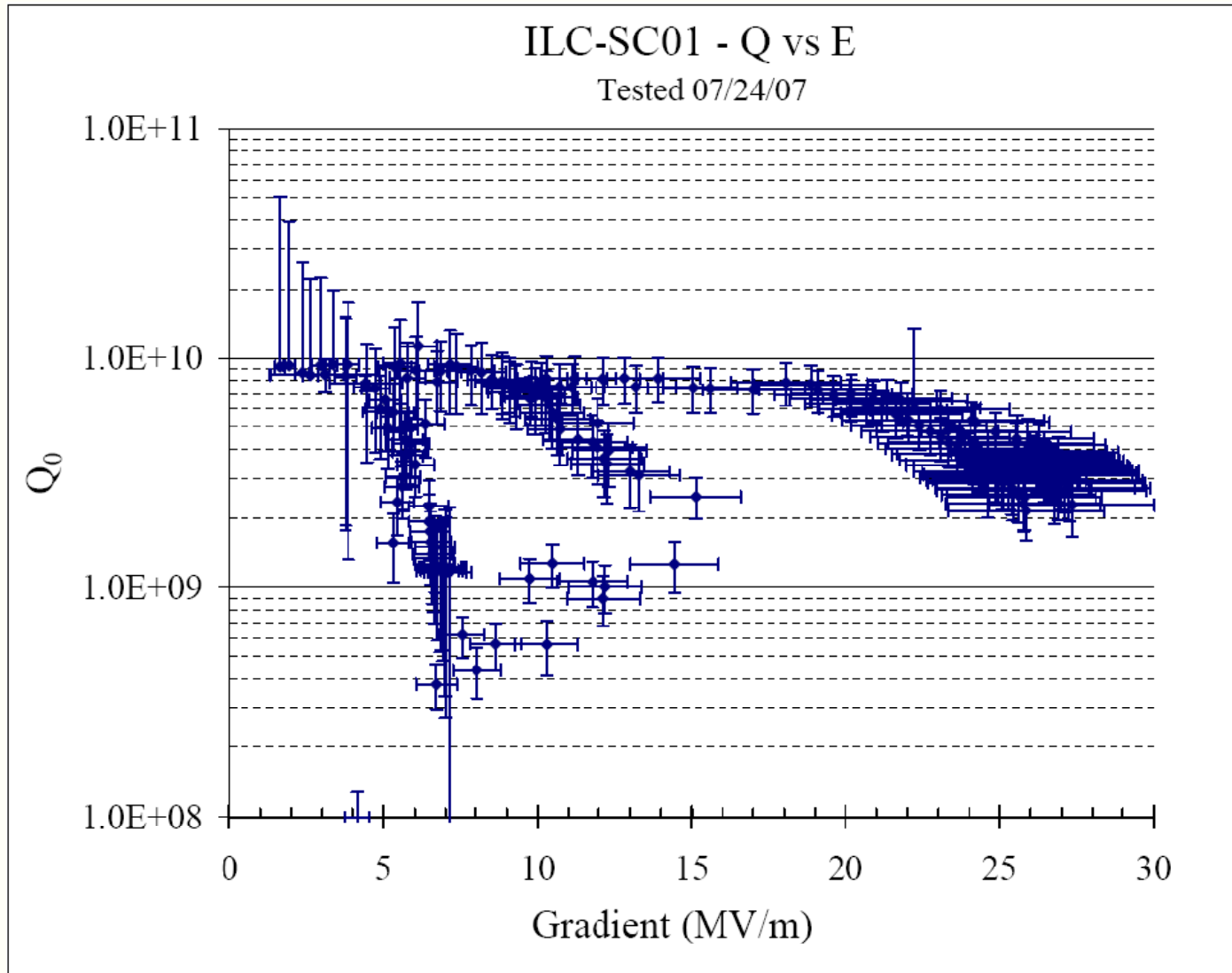


# Final Performance: Radiation vs Eacc



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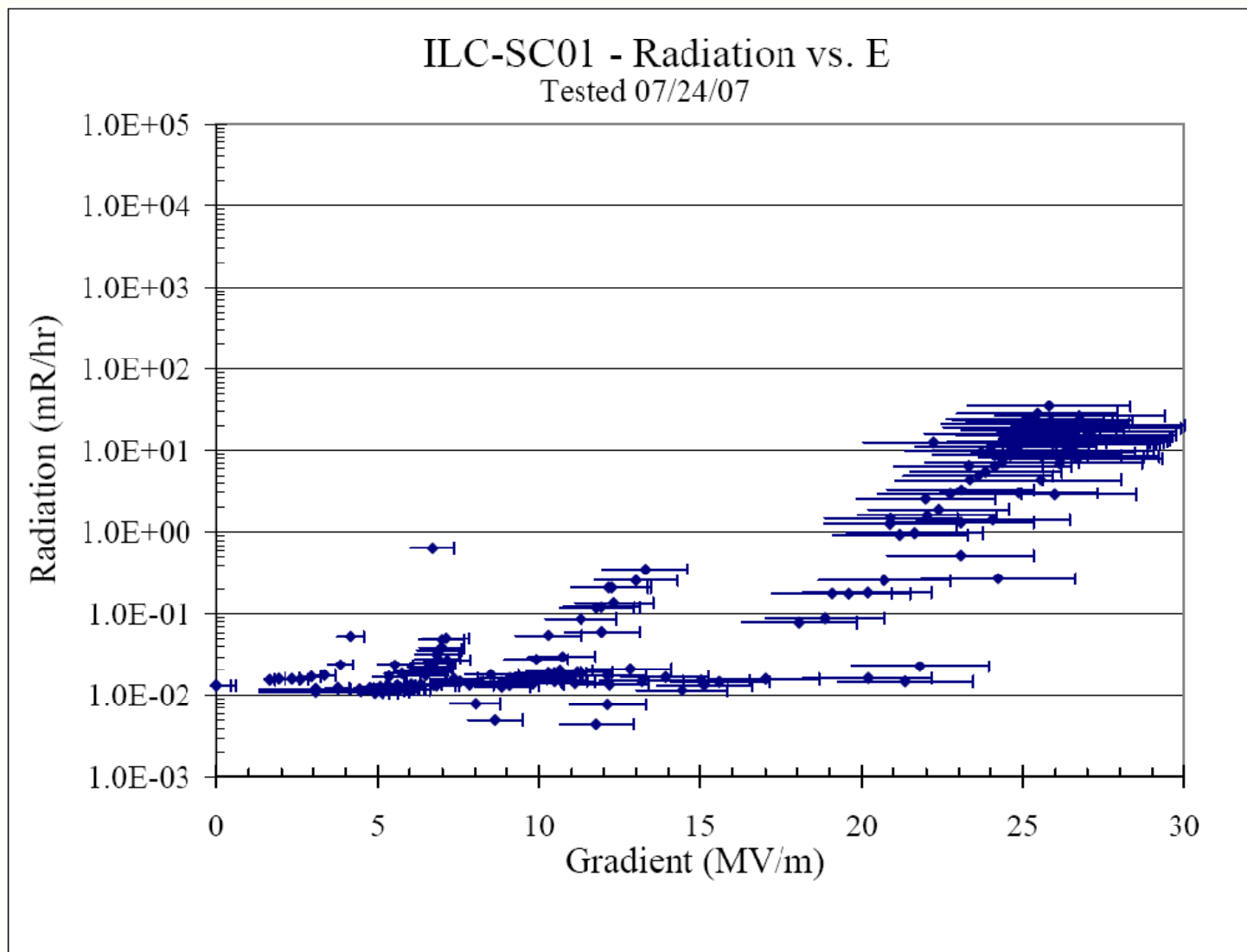




# All Data: Radiation vs Eacc



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### E-mail from Joe Ozelis:

“I am pleased to report on behalf of the VTS team, that Fermilab’s superconducting cavity Vertical Test Stand in IB1 successfully tested its first superconducting cavity today. We tested a 1.3GHz ILC single call cavity (built, and kindly loaned to us, by Peter Kneisel of JLab) that reached 27 MV/m at 2.00K. The cavity exhibited fairly strong multipacting around, with some accompanying radiation. The MP barrier was eventually breached and the 6-7 MV/m cavity went out to about 26 MV/m with some field emission. The field emission eventually processed somewhat, allowing the cavity to reach 27.4 MV/m, where it was limited by thermal breakdown. Maximum radiation produced was 35mR/hr (quite modest), with no observable radiation outside of the shielding lid (consistent with expectations). The cavity Q was rather low, owing to the fact that it was tested without the inner magnetic shielding of the Dewar in place – this means that the background magnetic field was on order of 50mG (as opposed to the ~10mG that is expected with the inner shielding in place). As a result, one would expect the cavity Q to drop from ~ 2E10 to 1E10 due to the additional surface resistance (about 10n-Ohm). Our observed result of 9E9 is consistent with this. Attached are PDF plots of the complete Q vs E and radiation curves, and of the final Q vs E and radiation curves (after MP and FE processing).

Of course, we still intend to optimize the RF and data acquisition systems, and study our calibration sensitivities with a view towards minimizing measurement errors. However these first results are encouraging, and no significant issues with either the hardware systems, interlocks, or software were found.”



- **IB1 cryogenic plant is down due to contamination – recovery completion expected end of next week**
- **Single-cell cavity still in dewar – along with Helium – and cannot easily be extracted until recovery is complete**
- **AES1 prepared at JLab (HPR and assembly) and shipped to FNAL to support VTS commissioning**
  - **Issue: no active pumping yet, and no burst disk installed on cavity**
  - **JLab providing additional valve and burst disk; these will be installed on the cavity in the MP9 cleanroom**
- **AES1 test likely to begin week of August 20**
- **Plan to perform mode measurements, and based on results, apply thermometry to suspect cells**
- **AES1 has undergone four processing cycles at JLab**
  - **Quench limited at ~18 MV/m**

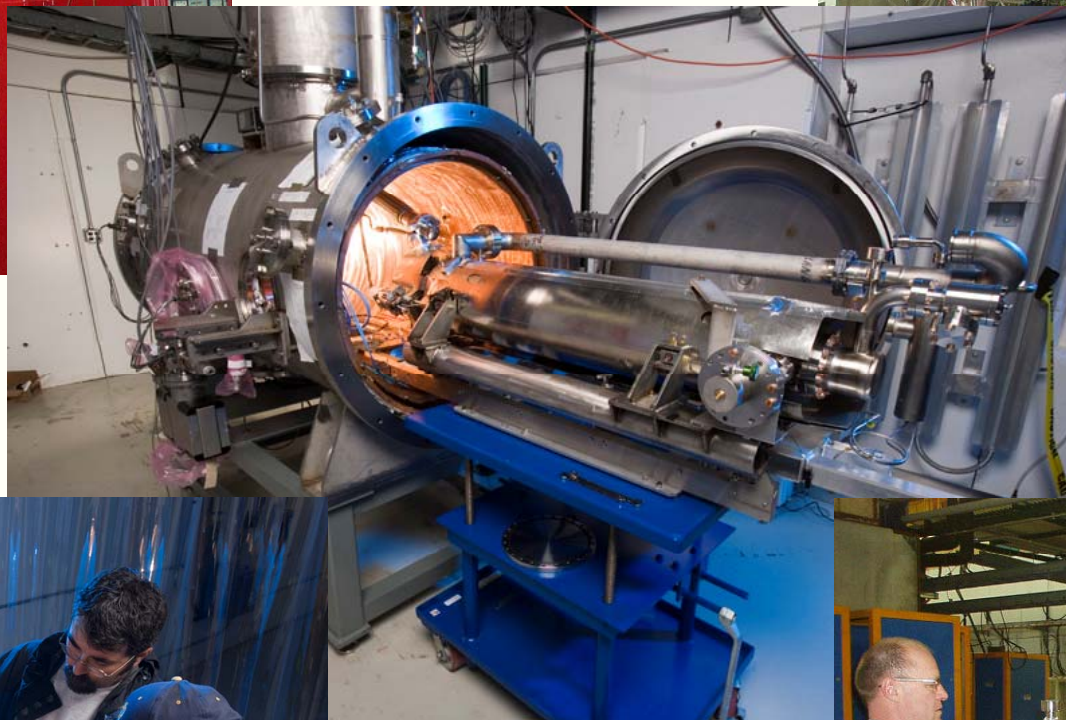


## ILC Cavities Horizontal Test Stand

*Ready for operations  
in August 2007*



**300 kW RF  
klystron system**





- **Cavity C22 installed and ready for test**
- **Received operational approval week of July 23**
- **RF system was operated briefly week of July 30**
  - **Several minor problems noted and corrected**
  - **Outstanding issues with digitizers and data archiving**
- **Expect to resume RF operations next week**
  - **Perform RF conditioning of fundamental power coupler prior to cool down**
- **Cool down week of August 20 if all goes well**