

Progress Report

ILC 9-cell Cavity EP and Vertical Test at JLAB

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A Thank You Note to
Ralph Afanador



Your dedication has been vital to this project, good luck at SNS.

AES#1 Shipped to FNAL

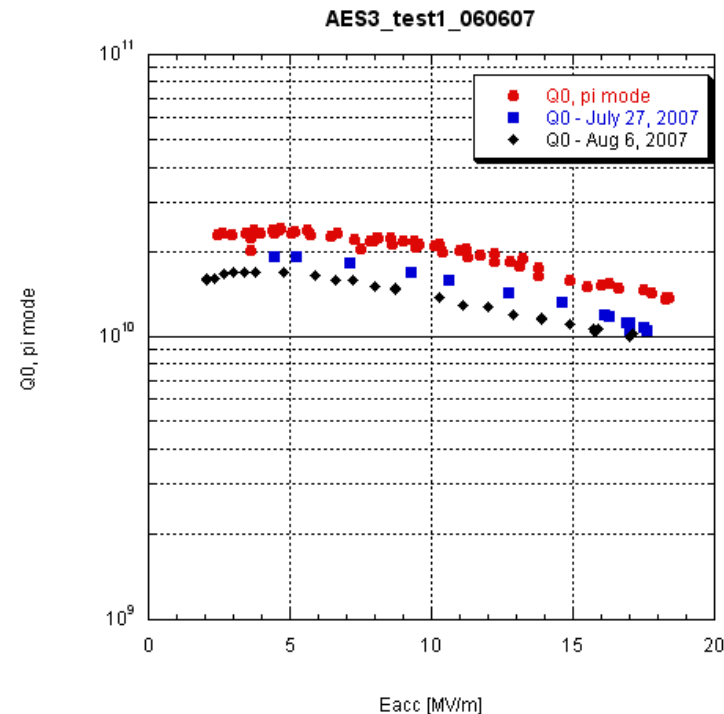
- 4 EP and vertical test cycles completed, repeatedly reaching quench limit between 16-18 MV/m, no field emission.
- Cell 3 and/or 7 responsible (pass-band).
- Shipped to FNAL under vacuum after high-pressure water rinsing and clean room assembly at JLAB.
- To be used for vertical test stand commissioning at FNAL.

AES#2 First Test Result

- Highest gradient 19.6 MV/m, quench limit.
- Early onset of field emission during initial power rise.
- RF processing reduces field emission and improves Q.
- Additional 20 um EP done, RF test in week of August 20.

AES#3 Second RF Test Result

- Additional 20 μm EP.
- Highest gradient 17.6 MV/m, quench limited.
- Cell 4 and/or 6 responsible for quench.
- Consistent with the first test result.



AES#3 Pass-Band Result

Pi mode	Cell:1,2,3,4, 5,6,7,8,9	17.6 MV/m	Quench	X-ray 37 mR/h
8/9-Pi	Cell 1,9	21.2 MV/m	No-quench	40 mR/h
4/9-Pi	Cell 4,6	18.5 MV/m	Quench	No x-ray
3/9-Pi	Cell 2,5,8	23.5 MV/m	No-quench	4 mR/h
2/9-Pi	Cell 3,7	22.9 MV/m	Occasional quench	0.3 mR/h

No X-ray when quench occurs in preferentially filled cell 4/6, first data to rule out the possibility of multipacting.

AES#3 2.5th test with thermometry

First Step Focused on Equators



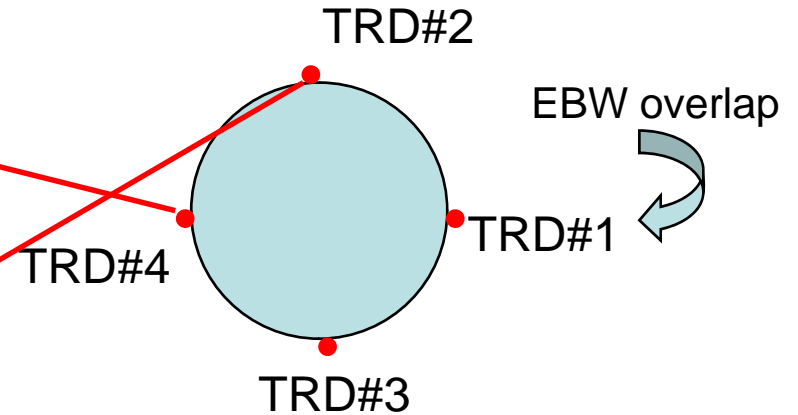
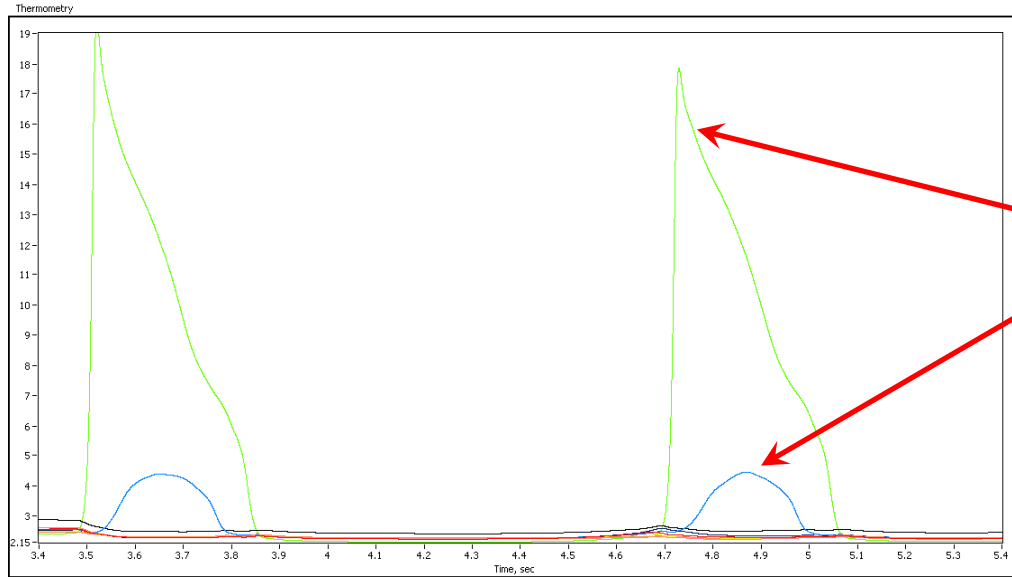
Joint test by JLAB and FNAL with help from many colleagues. Special thanks to Dmitri A. Sergatskov

4 TRD on cell #4

4 TRD on cell #6

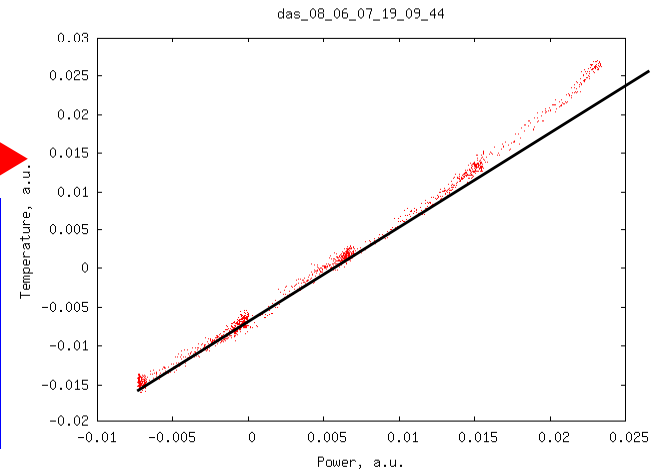


Cell #6 from field probe port reacted,
 2K bath: TRD#4 cyclic spike of 20K in synchronism with cyclic collapsing field
 Bath above lambda-point: TRD#4 spike also TRD#2
 Cell #4 silent



Power sweeping just below quench:
 TRD#4 no-linear temperature rise

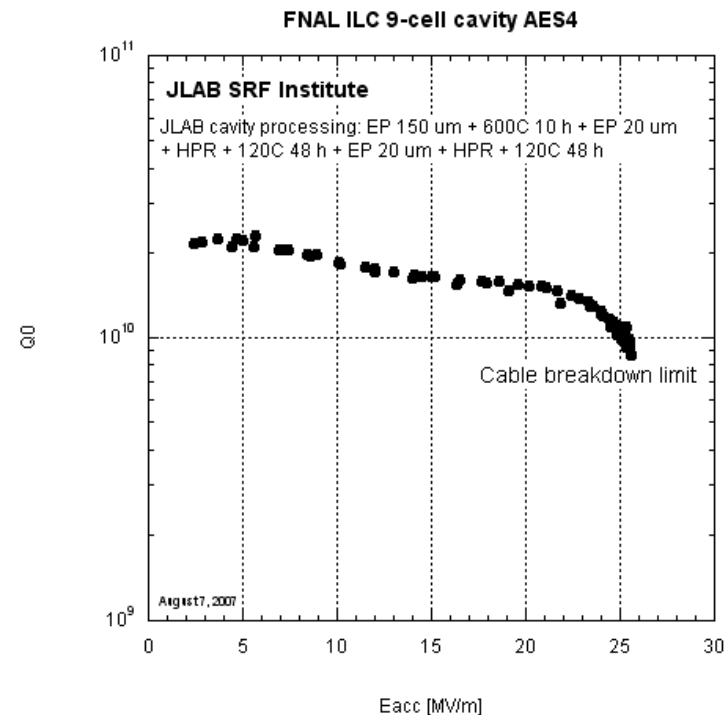
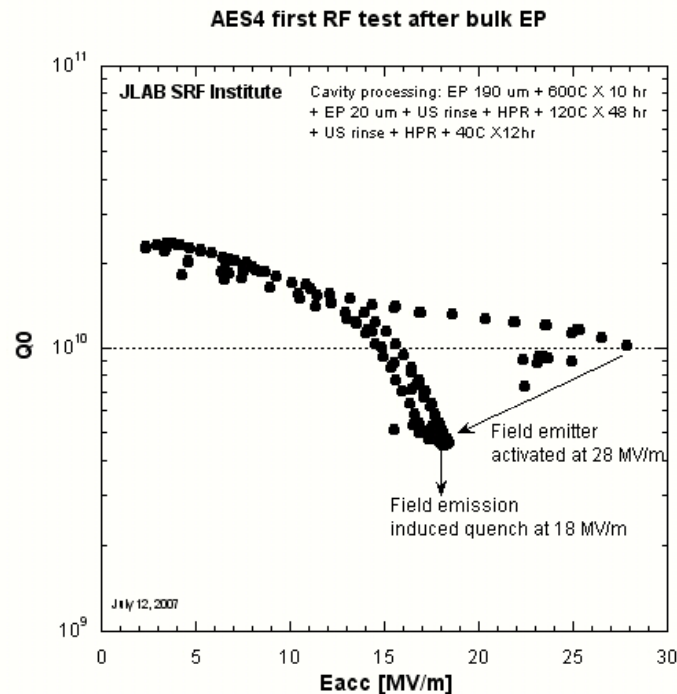
- Cell 6 found responsible for quench.
- Quench location in the 1/4 cell within TRD#2 & 4.
- EBW overlap not responsible.
- Next test 4 more thermometers around TRD#4.



AES#4 Reached 25-28 MV/m

First test reached 28 MV/m, followed by spontaneous activation of field emitters. Final limit 18 MV/m, FE induced quench.

Additional EP 20 um and HPR, reached 25.5 MV/m, limited by cable breakdown.



Additional EP 20 um done, 3rd RF test next week

New Cavity Arrivals for S0/S1

- A8 arrived at JLAB after processing and testing at Cornell.
- Field un-flatness as received 11%, tuned to $< 5\%$.
- HPR done and RF test this week.
- Would like to know the past history of A8.
- ICHIRO#5 coming to JLAB, in process of custom clearance in D.C. airport.

First Identification of Sulfur Particulates in JLAB's EP System

- Visible particulates repeatedly observed on surface of end groups and in residual water in end groups after cavity disassembled upon finish of EP cycle.
- Two sample particulates retrieved, one each from the front and back end group.
- EDX identifies 100% sulfur.

Sulfur Particulate from EP system

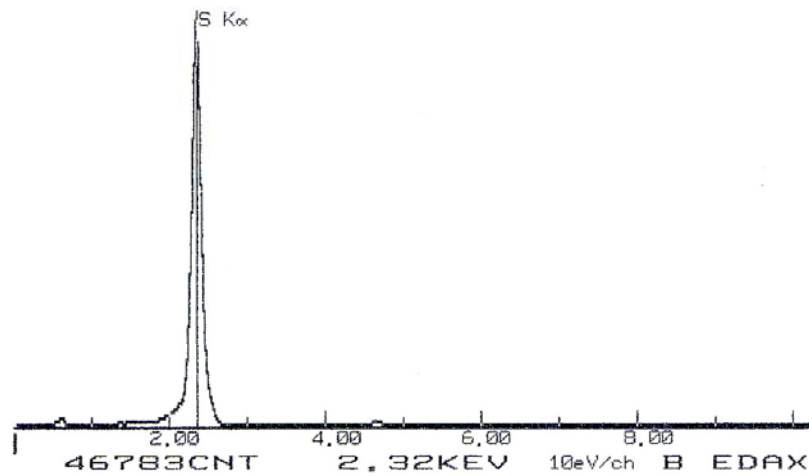
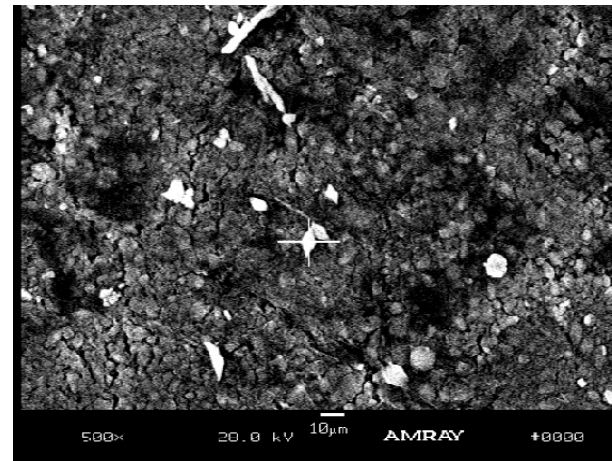
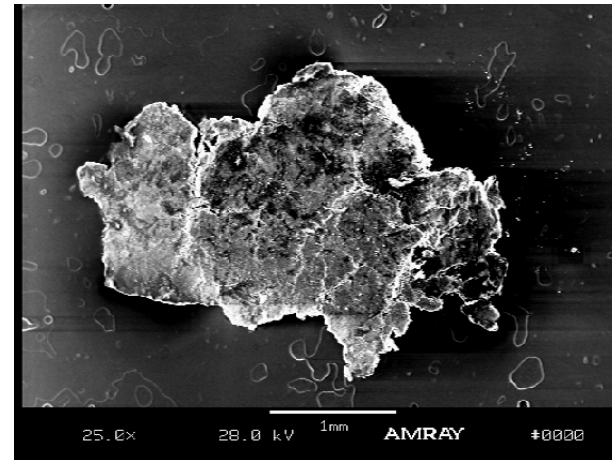


Photo credit: Andy Wu



Number of Cycles and Limitation

- 28 EP cycles accumulated since July 06.
- Total voltage-on time 62 hours.
- 27 RF test accumulated since July 06.
- Limitation is hardware (cages, flanges and field probes).
- Sometimes facility limited due to conflict with BCP etched 9-cell cavity tests.

Near Term Plan and New Proposals

- First priority to find out AES#4's ultimate limit.
- Plan to process and test A8 for at least 2 “tight-loop” cycles before the end of FY07.
- But funding for EP and test is running dangerously low.
- We are in process of FY08 AWP for ILC 9-cell EP and vertical test package.
- Propose to build a 1-cell thermometry set-up for quenching cavity diagnostics (PK).
- Propose to post-purify quenching 9-cell cavities at JLAB for understanding (and ultimately the potential benefit of increasing production yield) (RG).
- Would need additional support on top of those for EP and vertical test.