



New Optical Inspection Results at JLab

An in-depth update since Chicago meeting ILC08

(Highlights reported in US Regional Talk by Mark Champion)

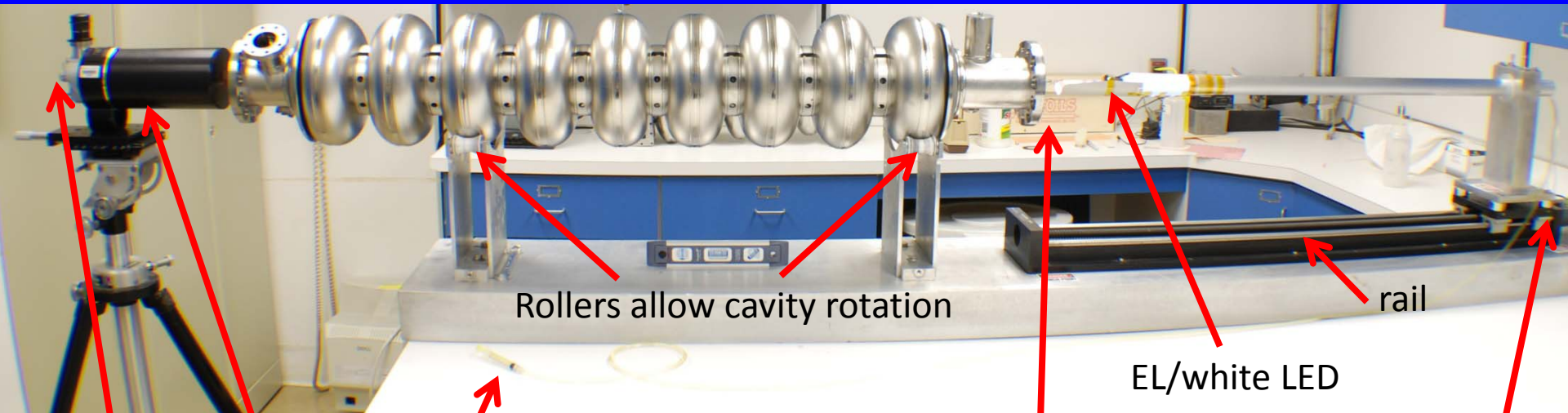
Rong-Li Geng

Jefferson Lab

TILC09, April 17-21, 2009, Tsukuba, Japan



JLab High Resolution Cavity Inspection Apparatus



Rollers allow cavity rotation

EL/white LED

rail

Mirror tilter

Mirror

Questar QM1

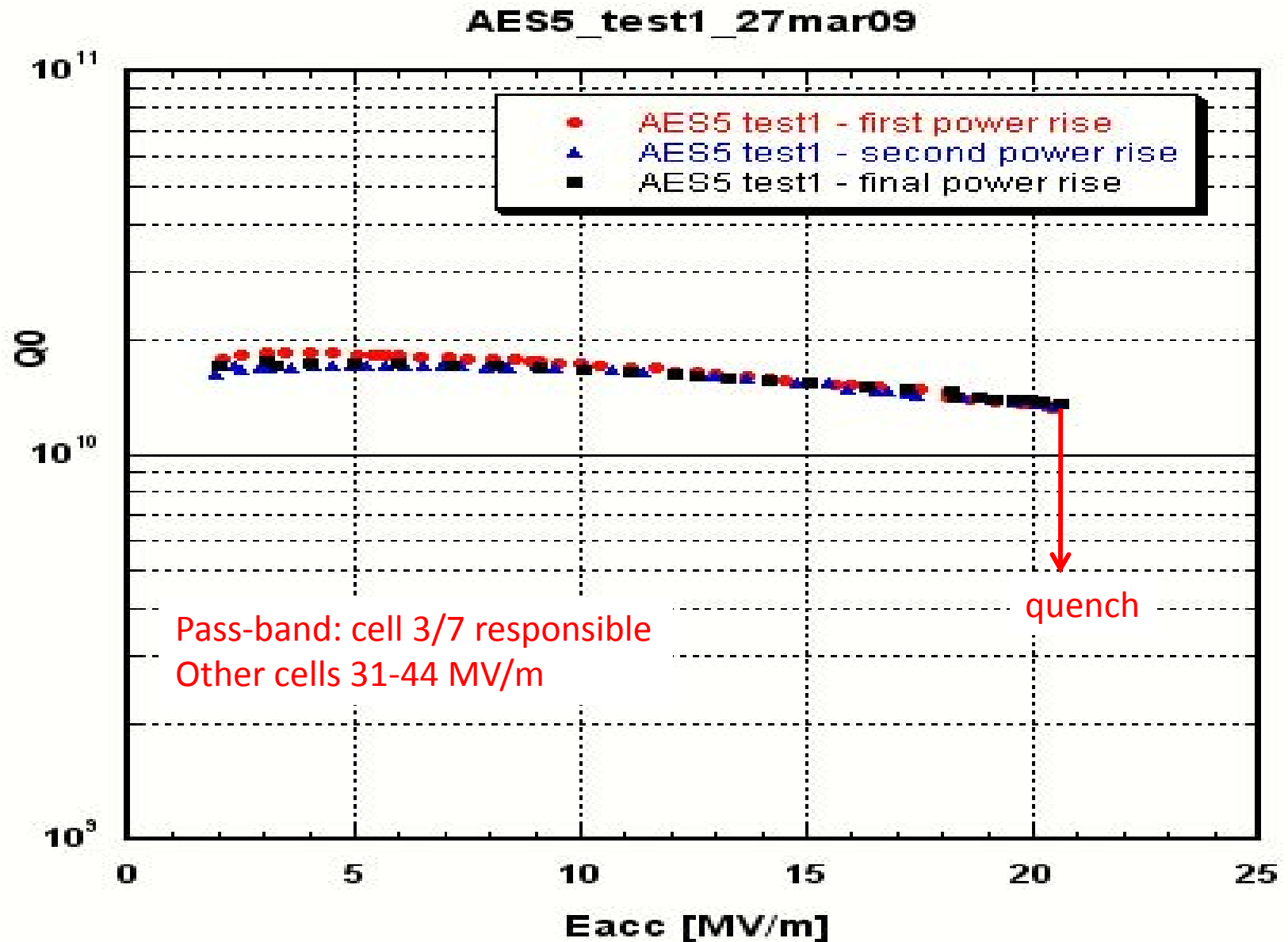
- Working Range: 22 – 66 inches
- Resolution: better than 3 microns at 22 inches

Step motor

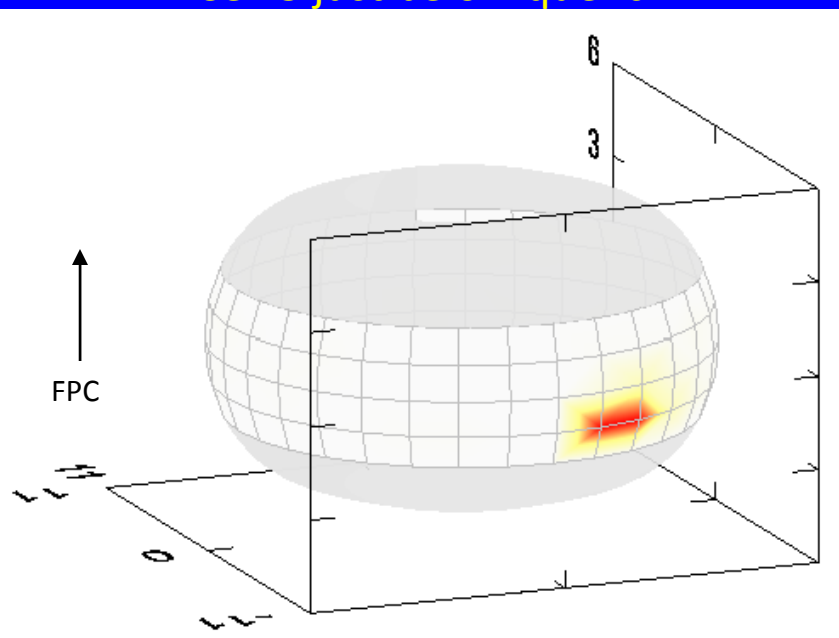
Nikon digital camera
Pixelink CCD camera

New step motor controller added for mirror insertion/retrieval
New cavity rotation actuator is under preparation

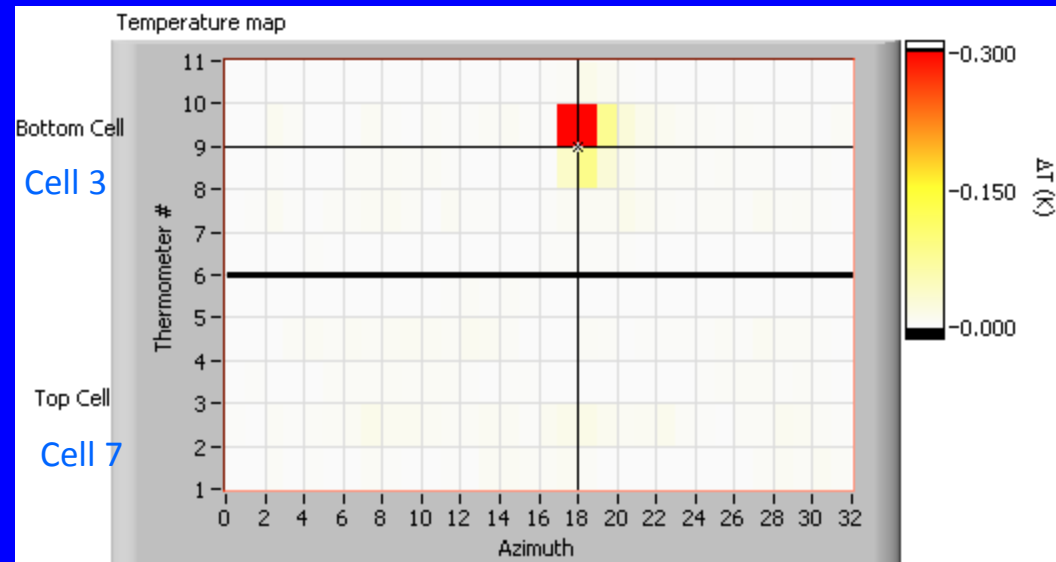
New 9-cell AES5 1st RF Test after 1st Light EP



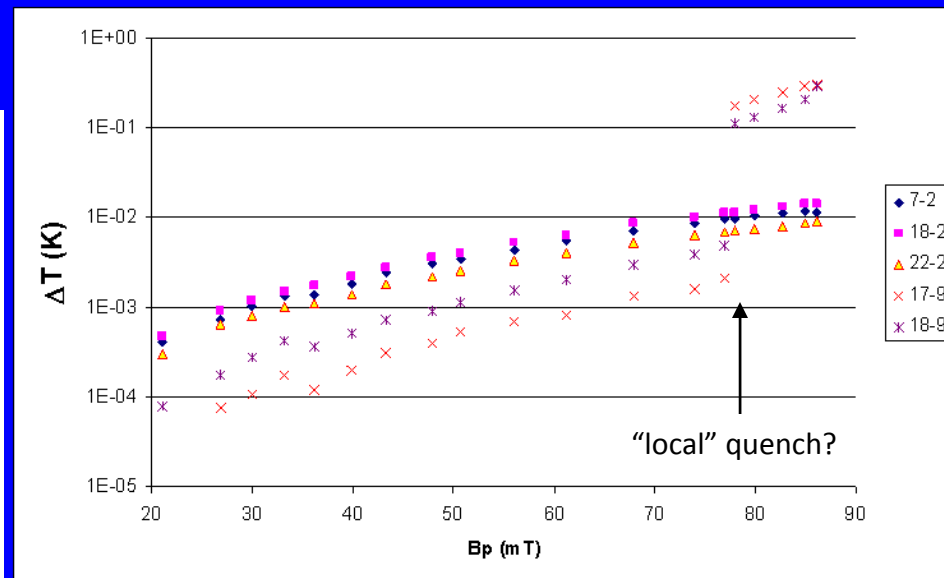
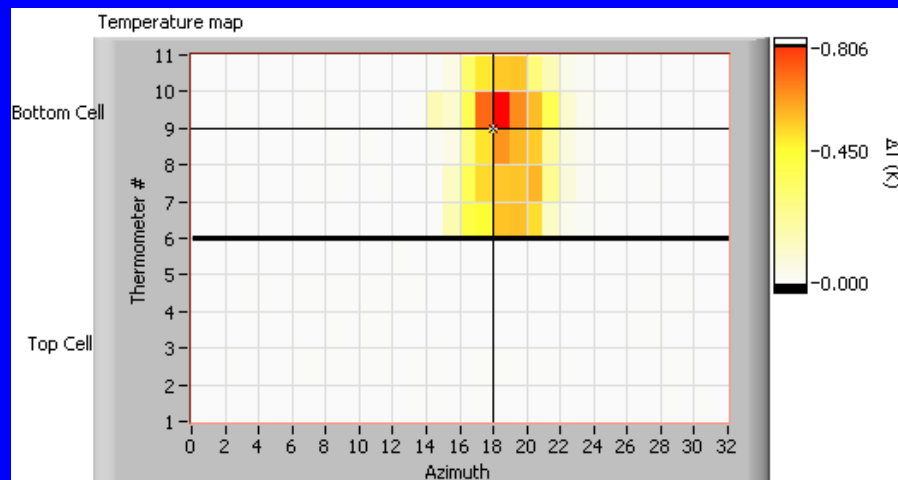
Cell 3 just below quench



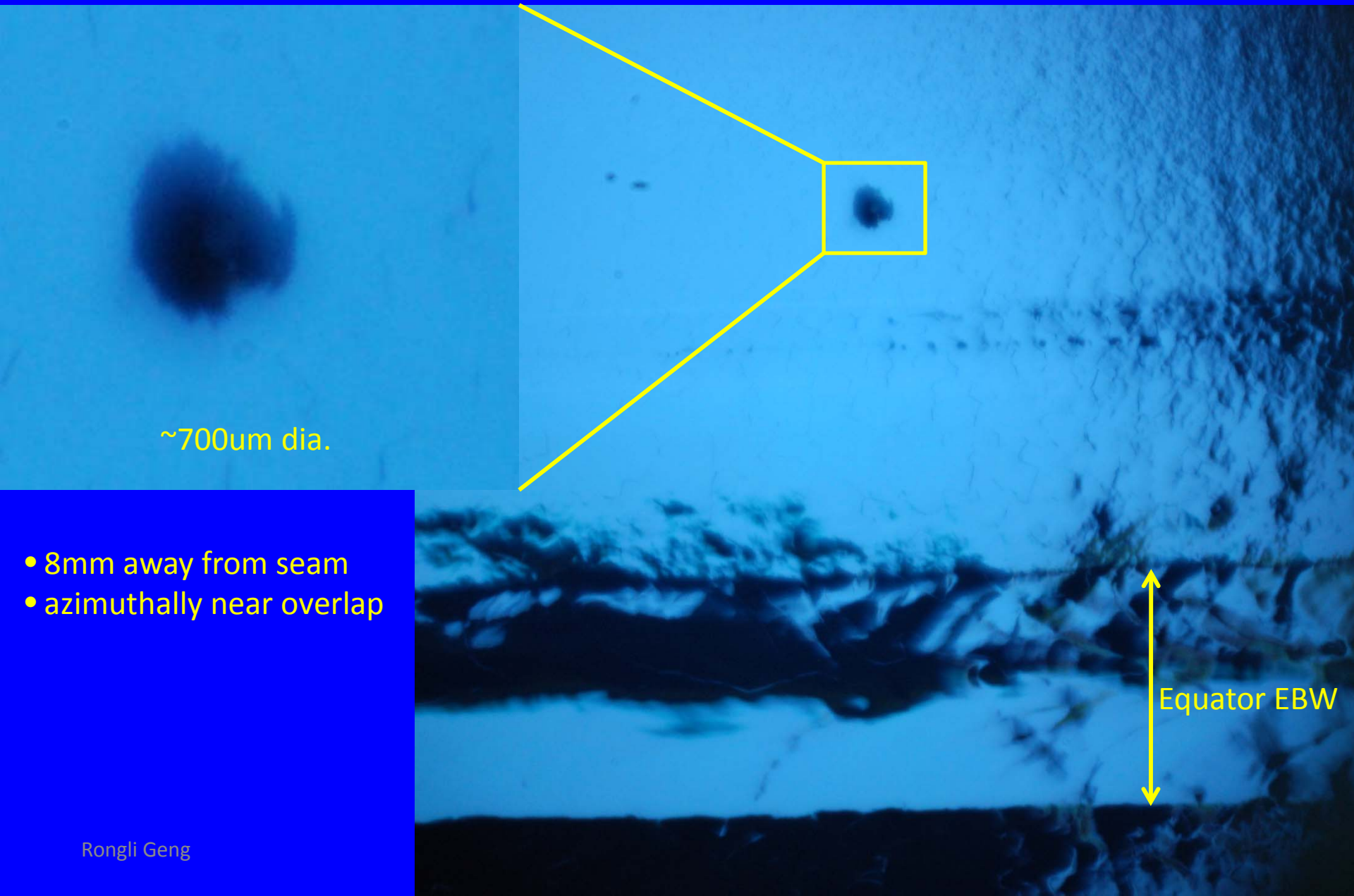
T-map just below quench



T-map during quench



A 700 μm defect observed near T-map hot spots

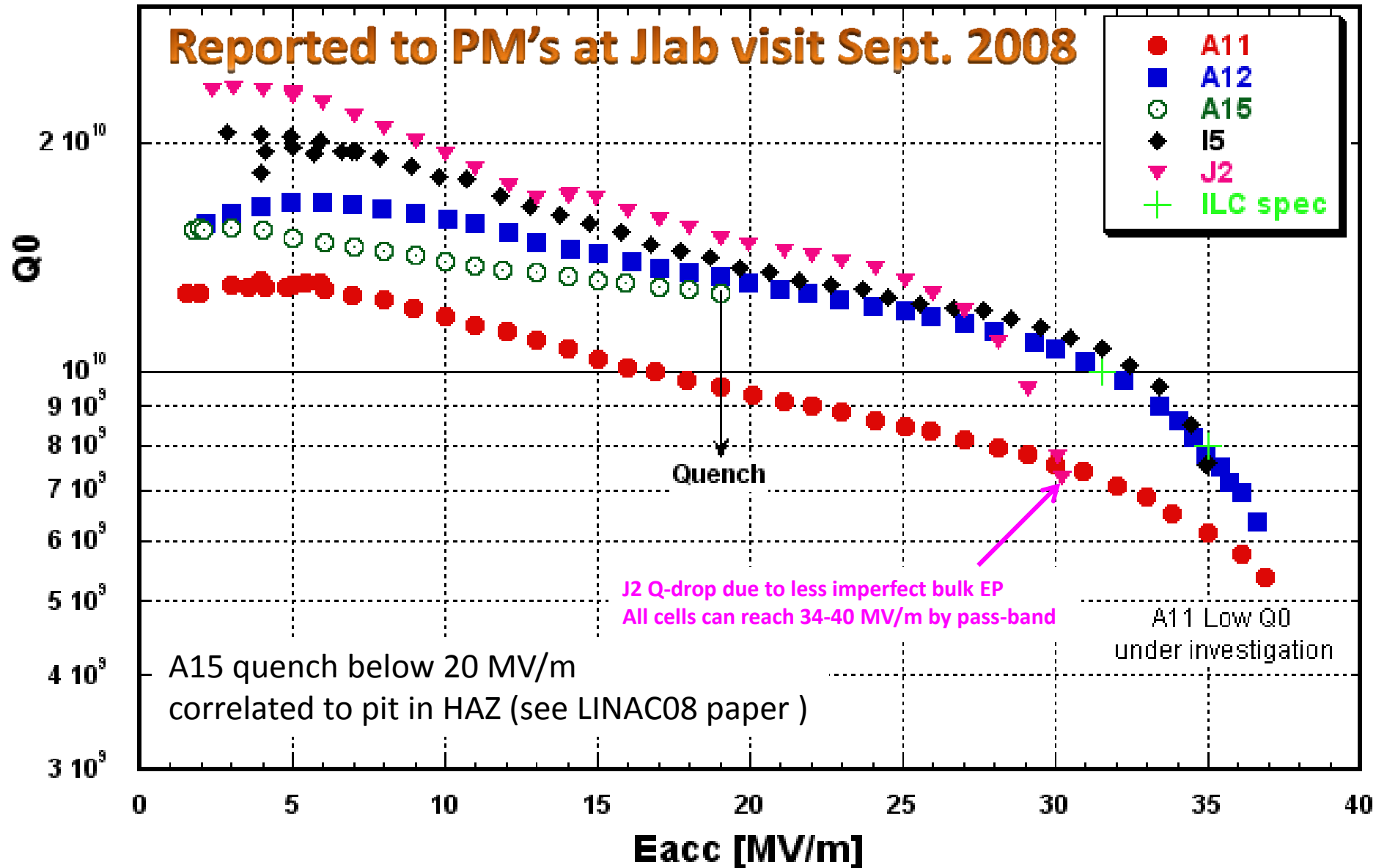


~700 μm dia.

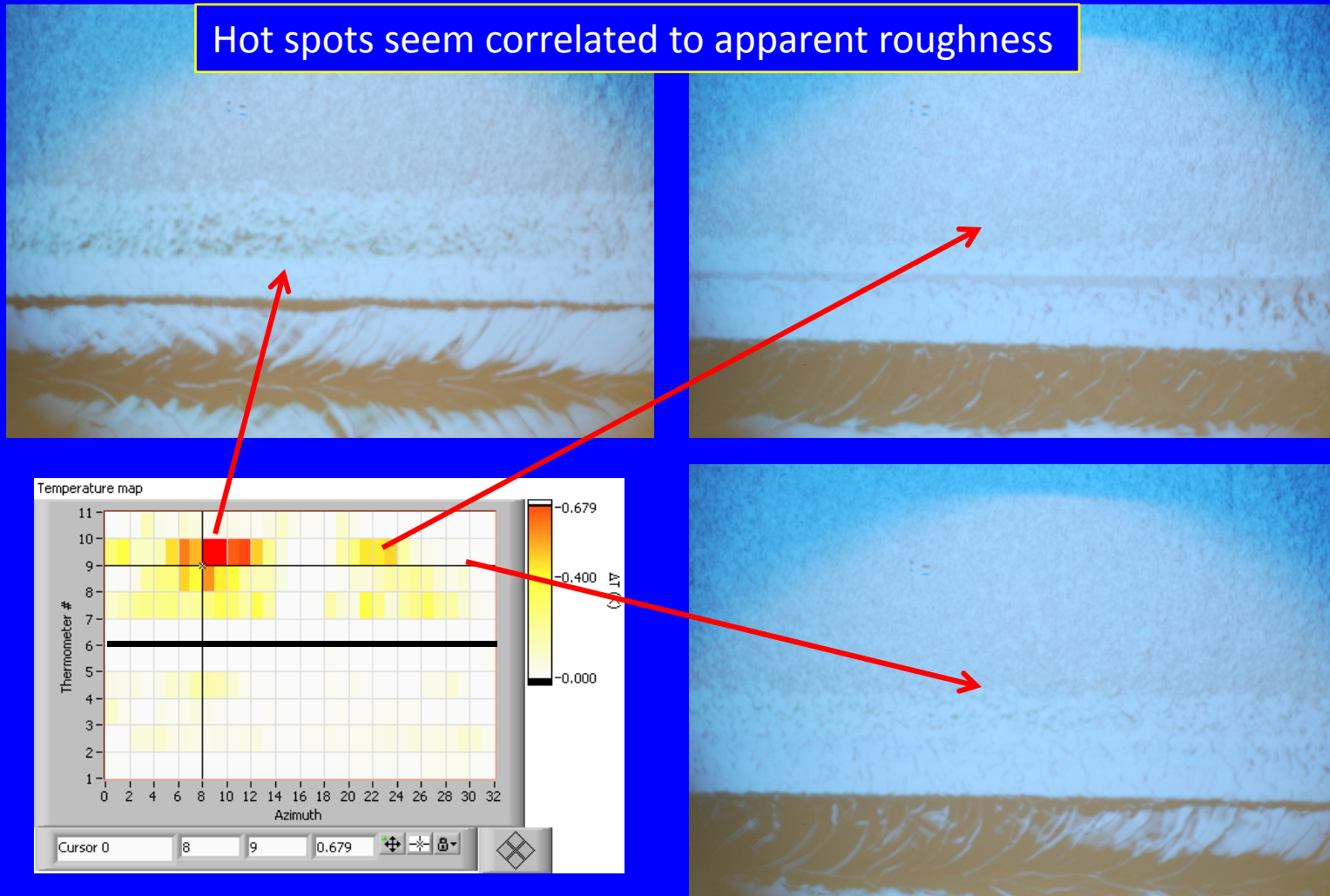
- 8mm away from seam
- azimuthally near overlap

Equator EBW

Reported to PM's at Jlab visit Sept. 2008

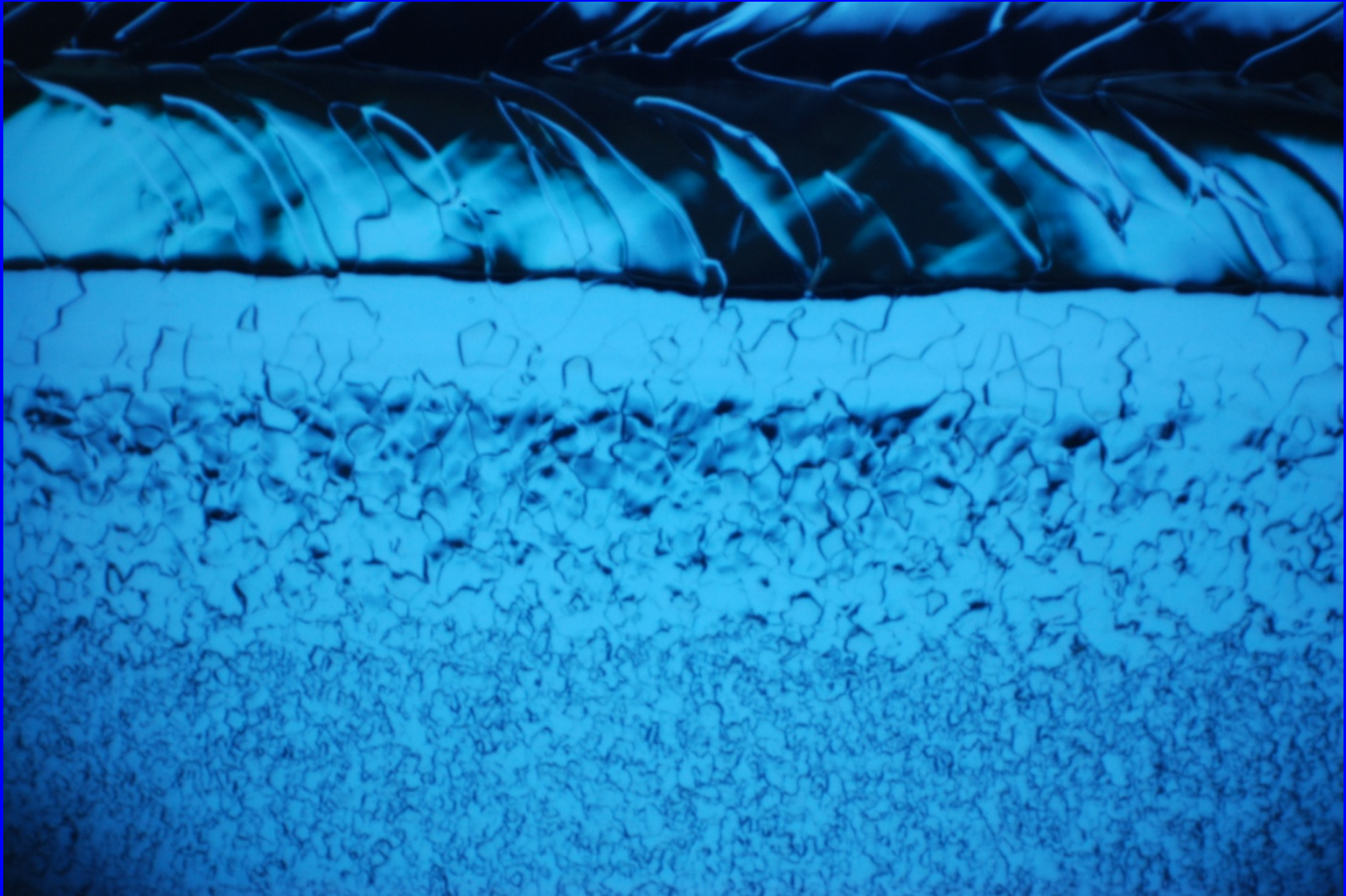


J2 (30 MV/m strong Q-drop) T-mapping and Inspection cell#1 from input coupler port, Equator weld & “hot” HAZ

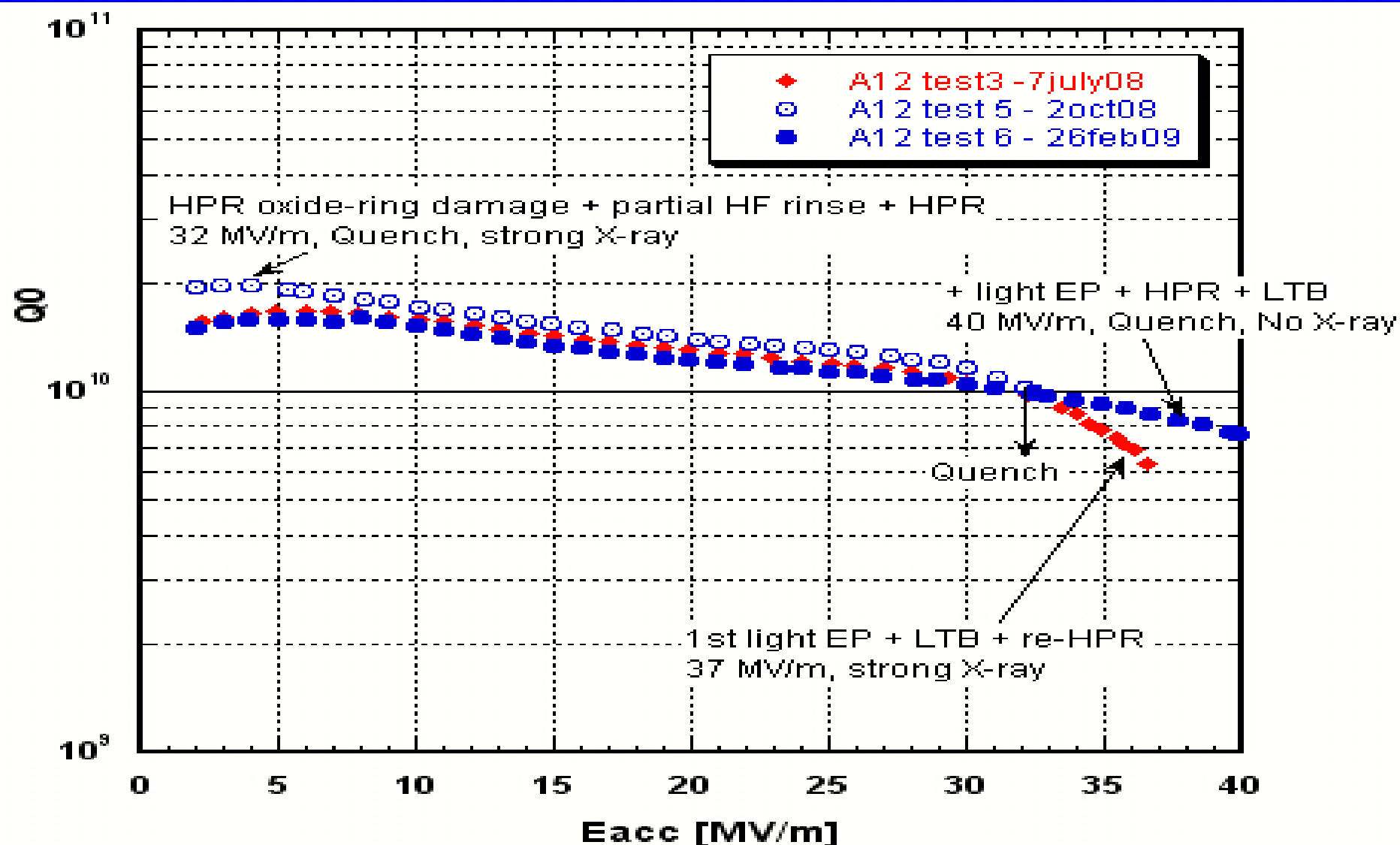


General appearance of HAZ of equator EBW in J2

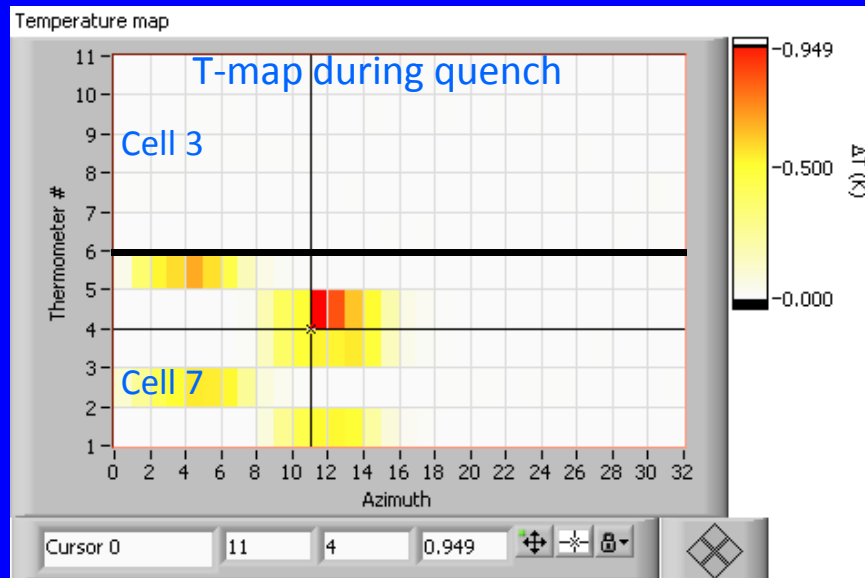
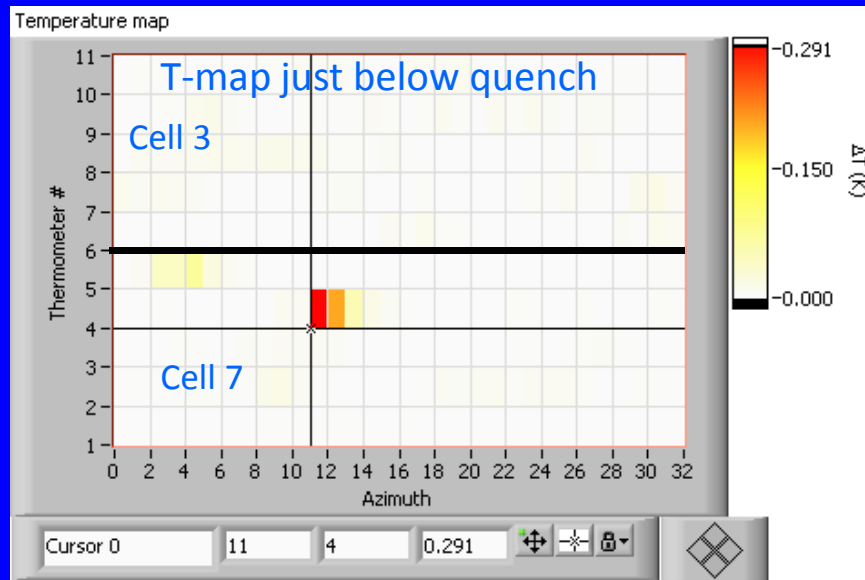
apparent roughness likely caused by “bad” bulk EP which was done @ 3rd use of electrolyte
(and we now know it was due to water addition after first use of electrolyte – this problem is now fixed)



A12 Degradation due to Tool Failure and Recover by Re-EP



A12 (30 MV/m quench) T-mapping hot spots in Cell#7



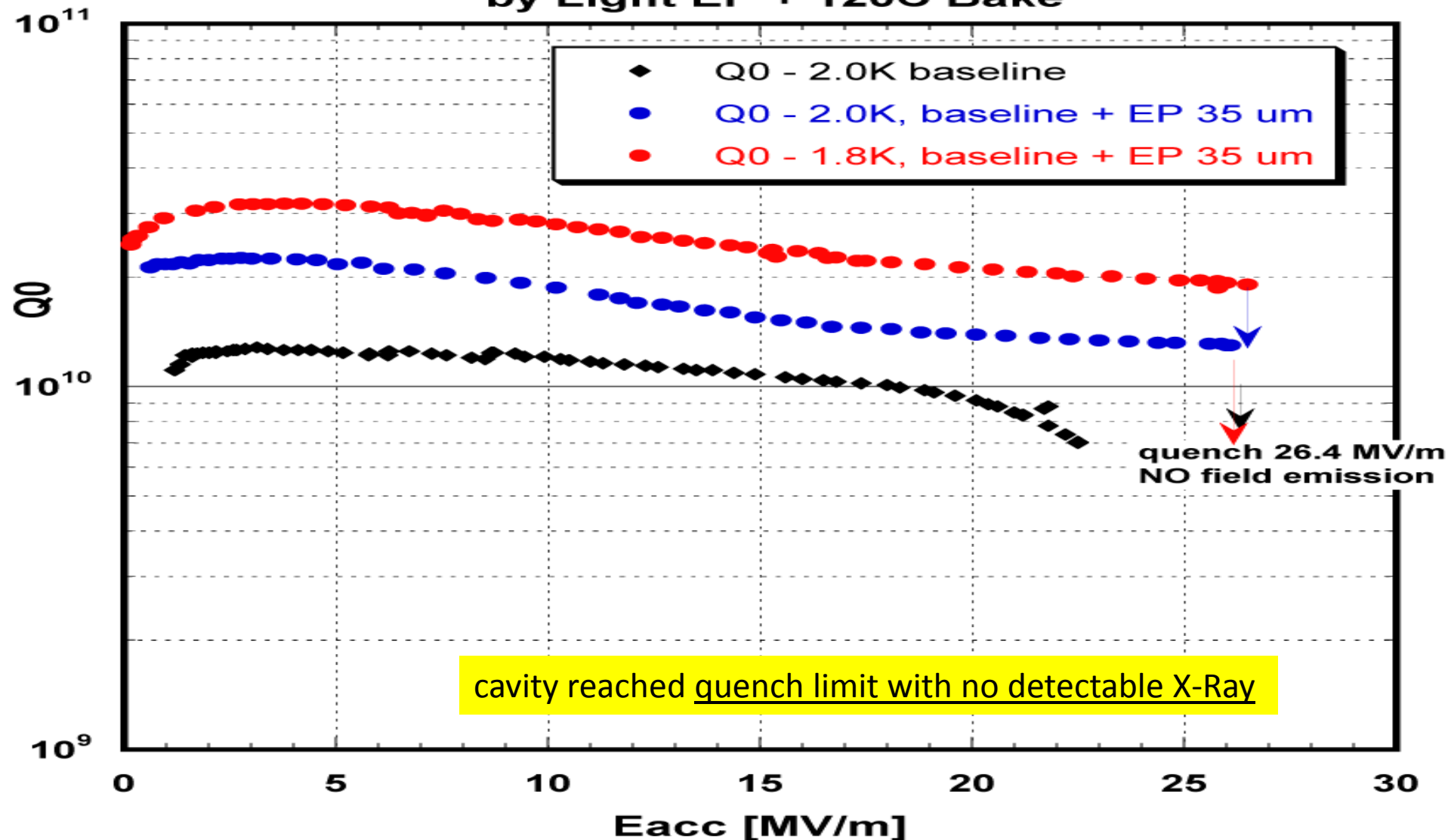
No gross defect observed

Cell 7 equator EBW seam

Line inside box is weld prep machining line

BCP + EP Improves Q of JLab 7-cell Cavities

JLab 7-cell cavity HG007 Performance Improvement by Light EP + 120C Bake



HG7 BCP+ EP, 26.5 MV/m quench no X-ray

- One example of documented natural EBW defect
- Cell #7 EBW overlap
- Pass-band indicates quench source in Cell 1/7
- Next step T-mapping suspected region
- Candidate cavity for countermeasure development

Weld Number:

 [2322](#)

Nb, High Gradient Cavity Equatorial, 7.25" dia., 0.0625" thick, step weld, full penetration

 [2326](#)

Nb, Low Loss Cavity Equatorial, 6.984" dia., 0.0625" thick, step joint, full penetration

Note any irregularities with the weld.

Data Input

Welder

Date

(ex date format 10-Jan-2003)

Upload Photo File 1

(HG007.jpg)

Comment on assembly and welding

During weld of dumbbell 94-93 to the end group, the gun filament blew during the final weld. The weld dimpled but not hole. It was completed after the filament was replaced. The weld thins down some in the area of the dimple but is intact. Picture is attac

As built

As found following last RF test

Summary

- Defect near equator correlated w/ quench
 - Quench limit 15-20 MV/m by SINGLE defect, other cells > 30 MV/m
 - Near, but outside, equator EBW
 - New 9-cell cavity AES5
 - Also 9-cell cavity A15 (reported previously)
 - Similar (but smaller) defects also observable in 31-44 MV/m cells
- Roughness near equator correlated w/ Q drop
 - Caused by water addition into acid
- Examples of quench limit > 30 MV/m
 - Two 9-cell cavities (A12 and J2) quench limited > 30 MV/m
 - Both were T-mapped to show 1-point failure
 - No observable feature at quench location
- Inspection of JLab 7-cell and other cavities
 - Opportunity for understanding of common problem