

"Updates on RRCAT cavities Processing & testing"

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IIFC 650 MHz Meeting
August 23, 2011

- RRCAT made two more single cell 1.3 GHz (2nd prototype) during 2011.
- Both the cavities have been tested for Pre-dispatch qualification at RRCAT before shipment to FNAL. (Mechanical, RF, Vacuum leak check)

TE1CAT003
arrived FNAL
(May-11).



TE1CAT004
arrived FNAL
(August-11).

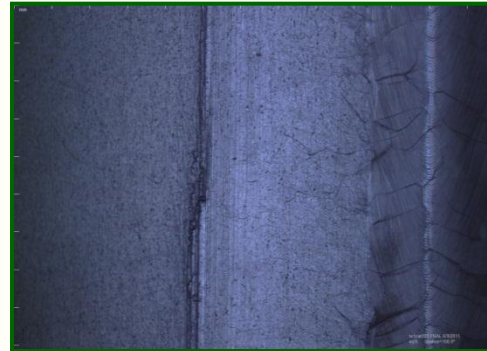
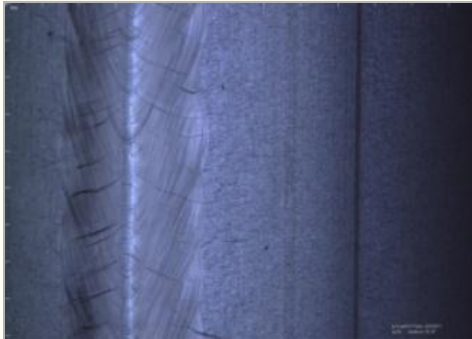
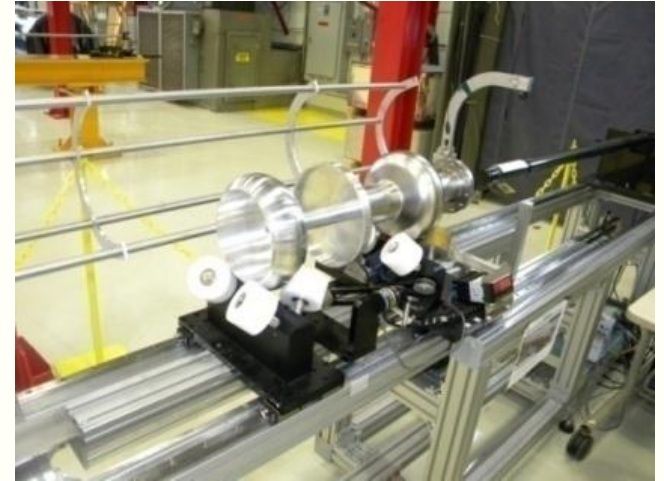


- **TE1CAT003**

- **Optical Inspection**

- Inner weld bead better
- Some concern on special spots and machining marks

Optical inspection at FNAL



- **TE1CAT003**

- **RF Testing**

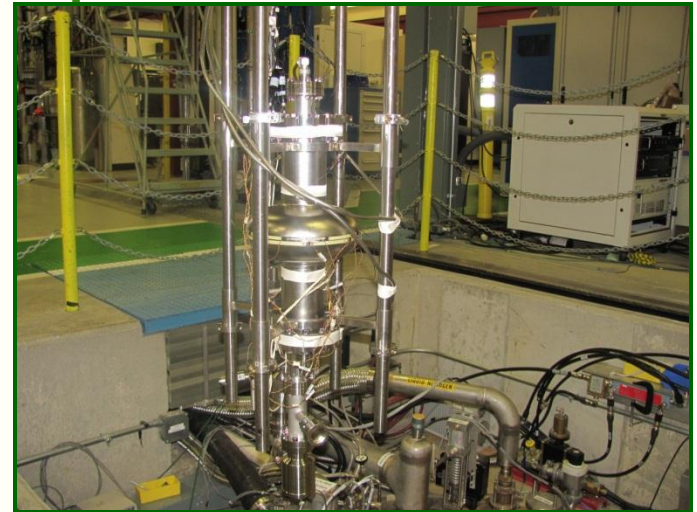
Frequency	TE1CAT003
RRCAT	1299.87123
FNAL	1299.91538
'Q' factor	
RRCAT	9463.7265
FNAL	10014.8086

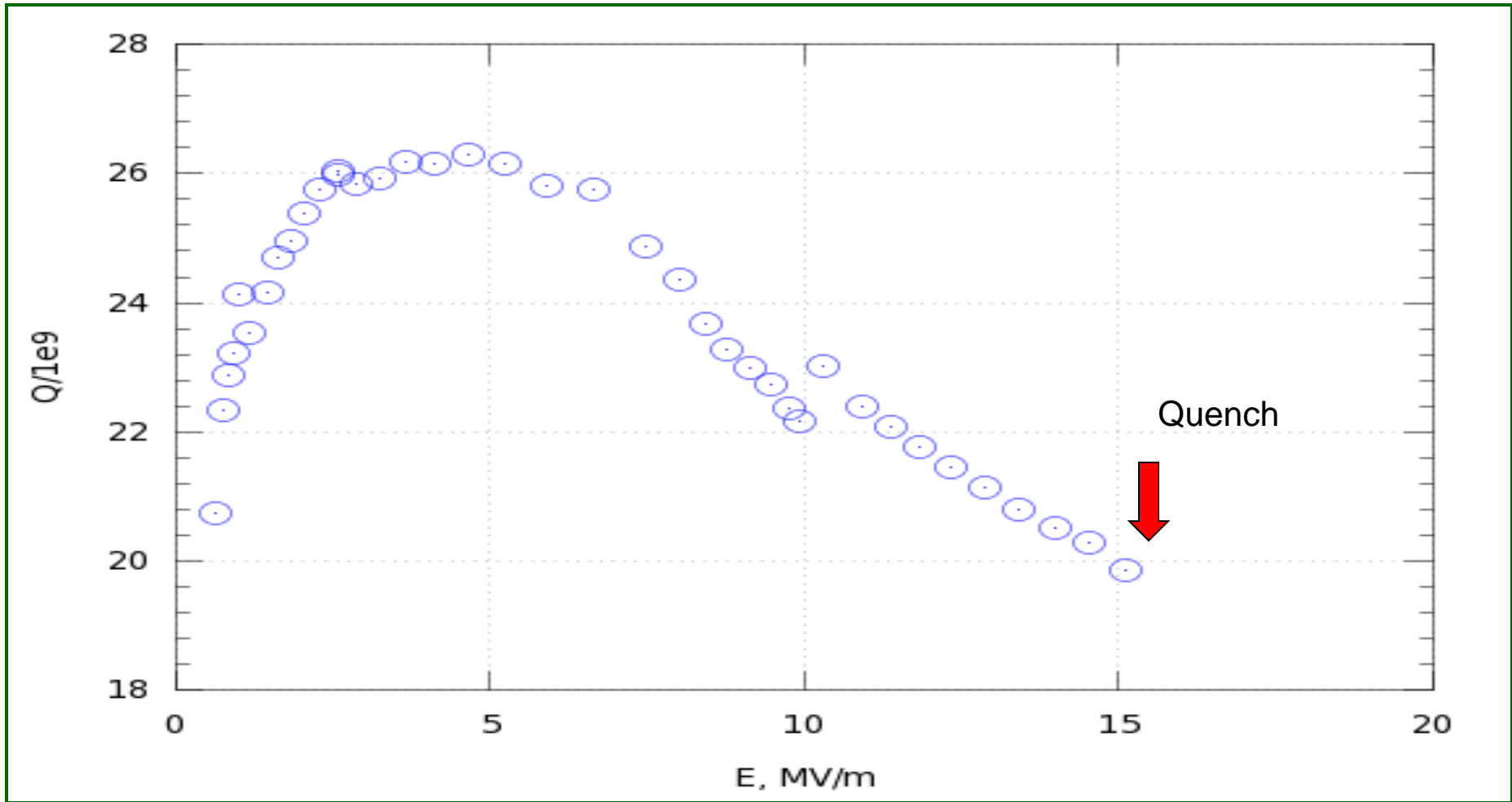
- **TE1CAT003**
 - **Standard processing**
 - 120 μm Bulk EP (ANL),
 - 800 C 2 Hrs (FNAL),
 - 20 μm Light EP (ANL),
 - HPR , clean room assly (ANL)

- **TE1CAT003**

- **VTS @2 K test**

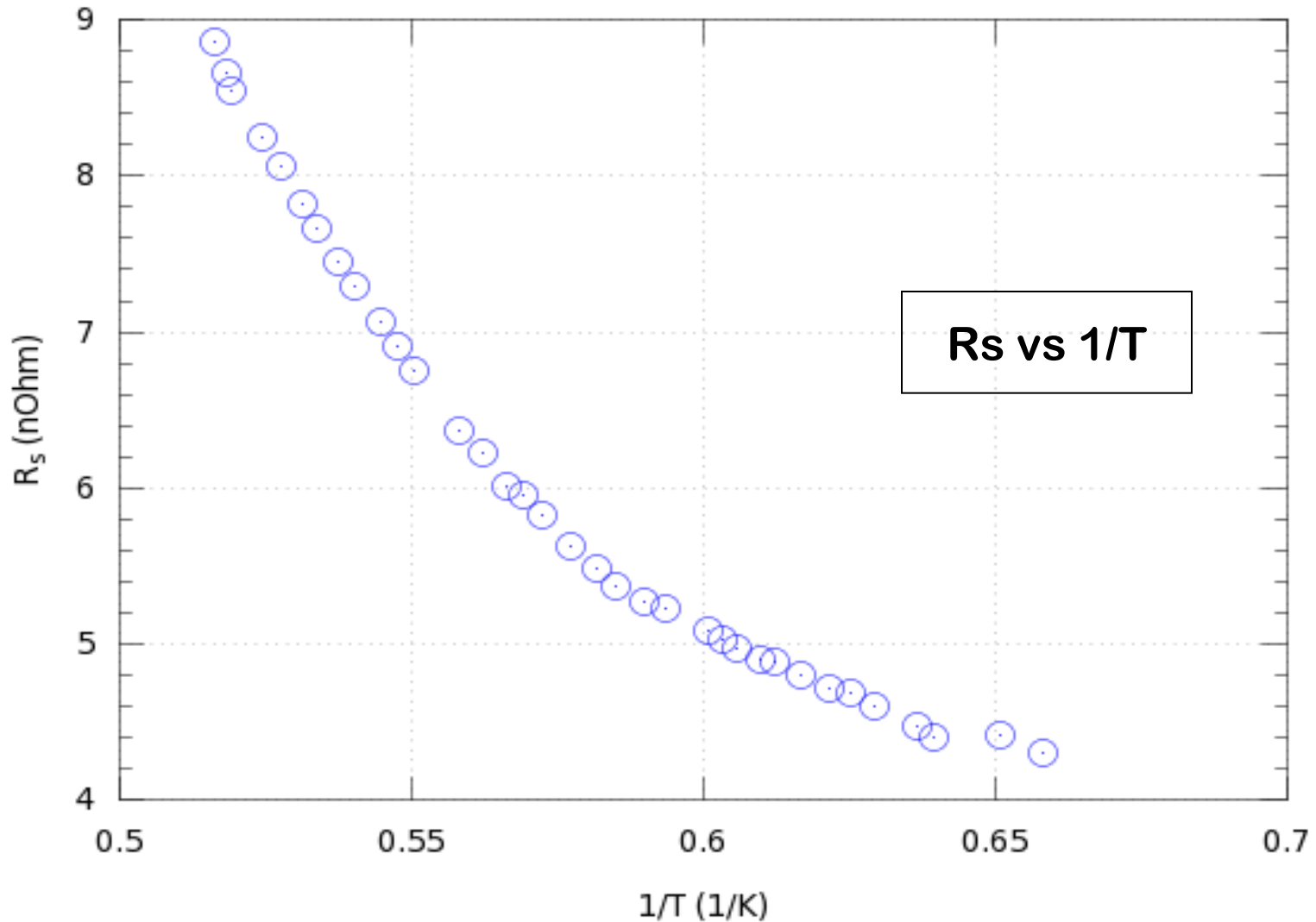
- 120 C x 48 Hrs low temp bake
- 15 MV/m (**Quench**)
- Fast thermometry indicated **hot spot**

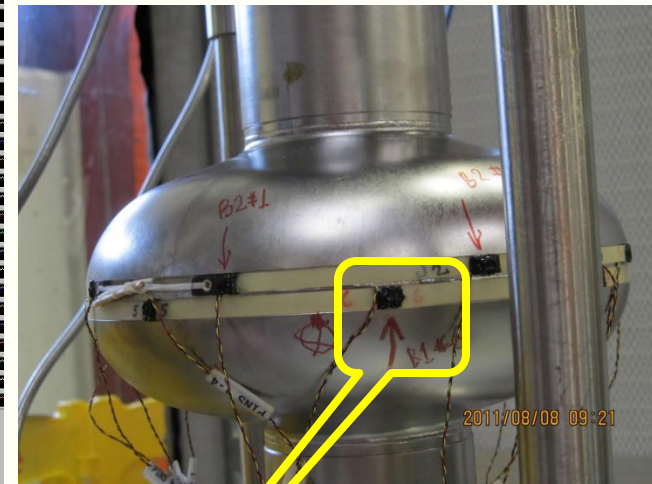
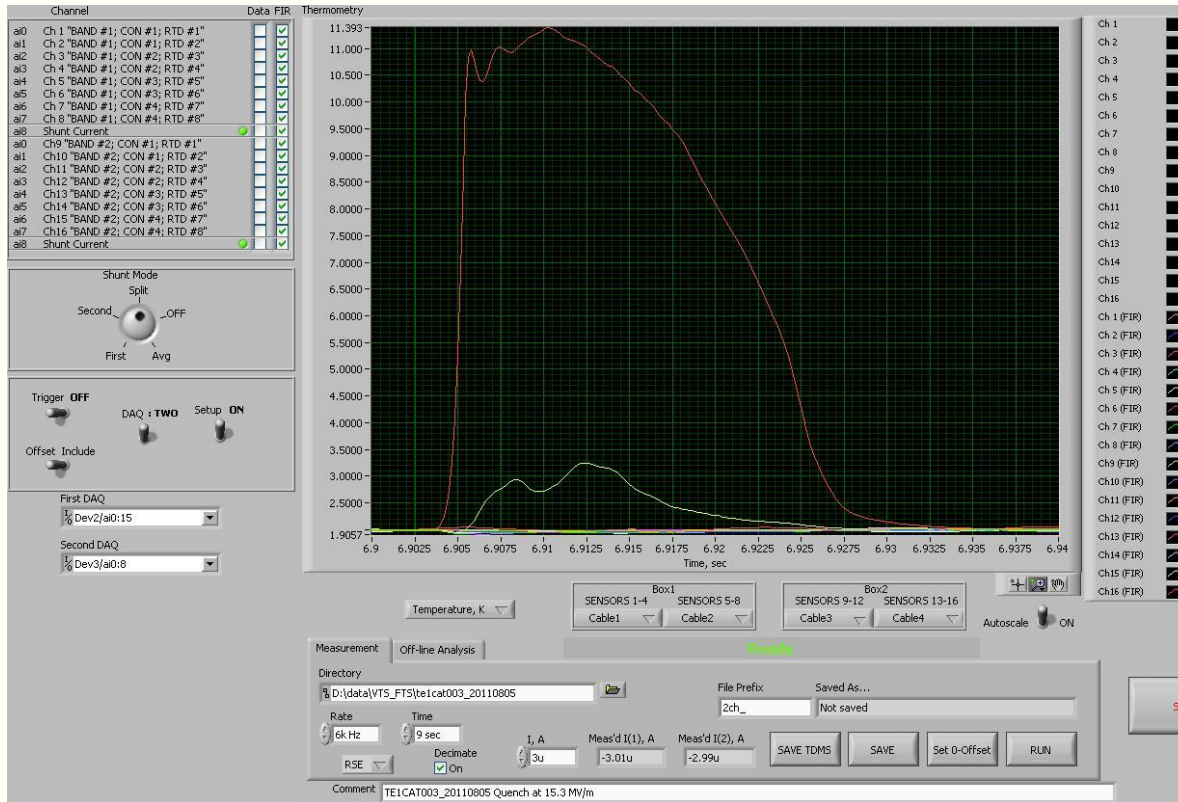




$Q/1e9$ vs E 2 K

TE1CAT003 - 2 K test results

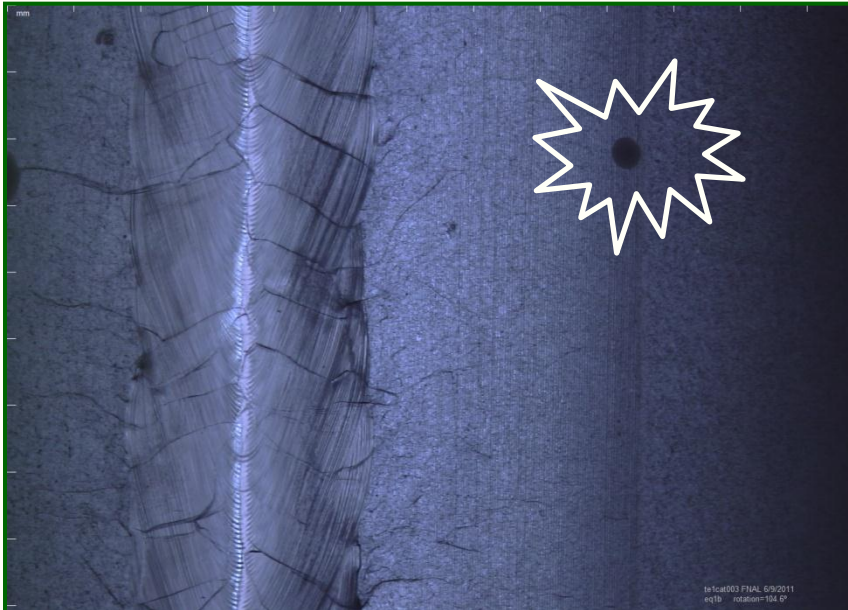




FTS un-filtered response to a quench. Red trace -- RTD#6 on the Band 1 (aka B1RTD6), white trace -- RTD#1 on the Band 2 (aka B2RTD1). Notice that the entire X-axis is 40 msec.
-by Dimitri

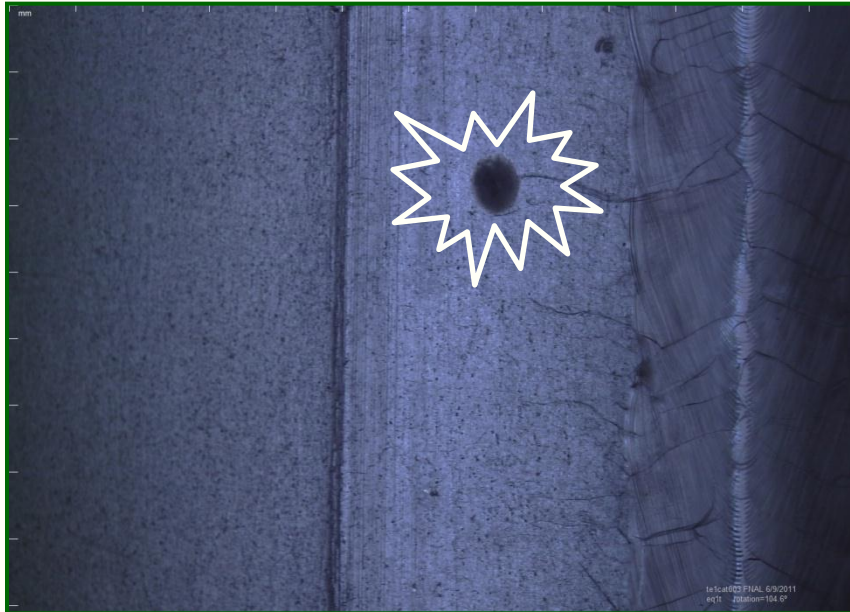
Before EP_
te1cat003_eq1b_104.6

After EP_
te1cat003_eq1b_104.6



Before EP

te1cat003_eq1t_104.6



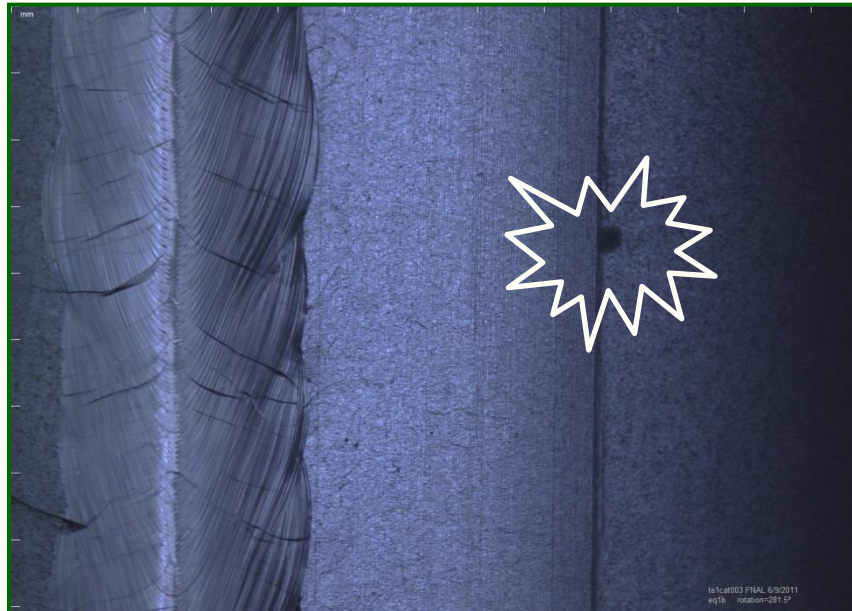
After EP

te1cat003_eq1t_104.6



Before EP

te1cat003_eq1b_281.5



After EP

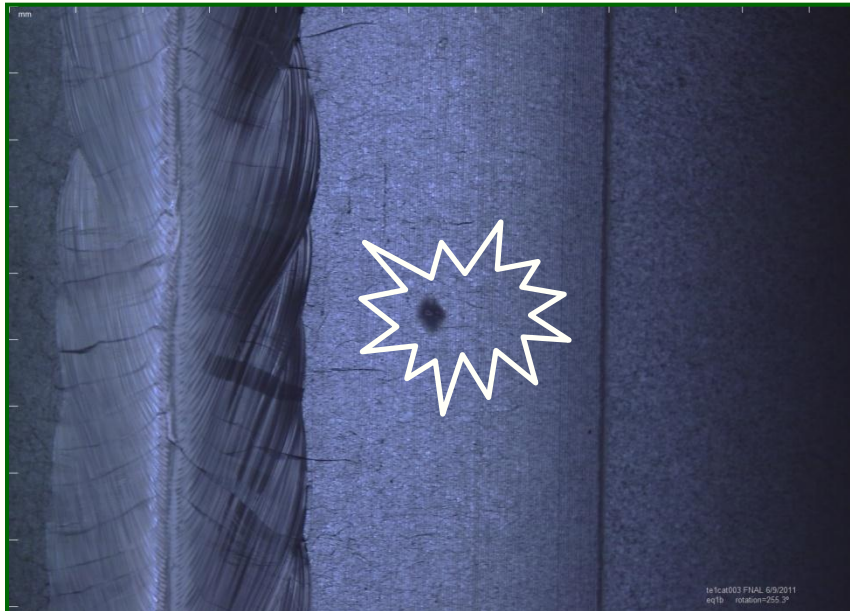
te1cat003_eq1b_281.4



Possibility of doing internal optical inspection after EP before HPR & clean room assembly ?

Before EP

te1cat003_eq1b_255.3



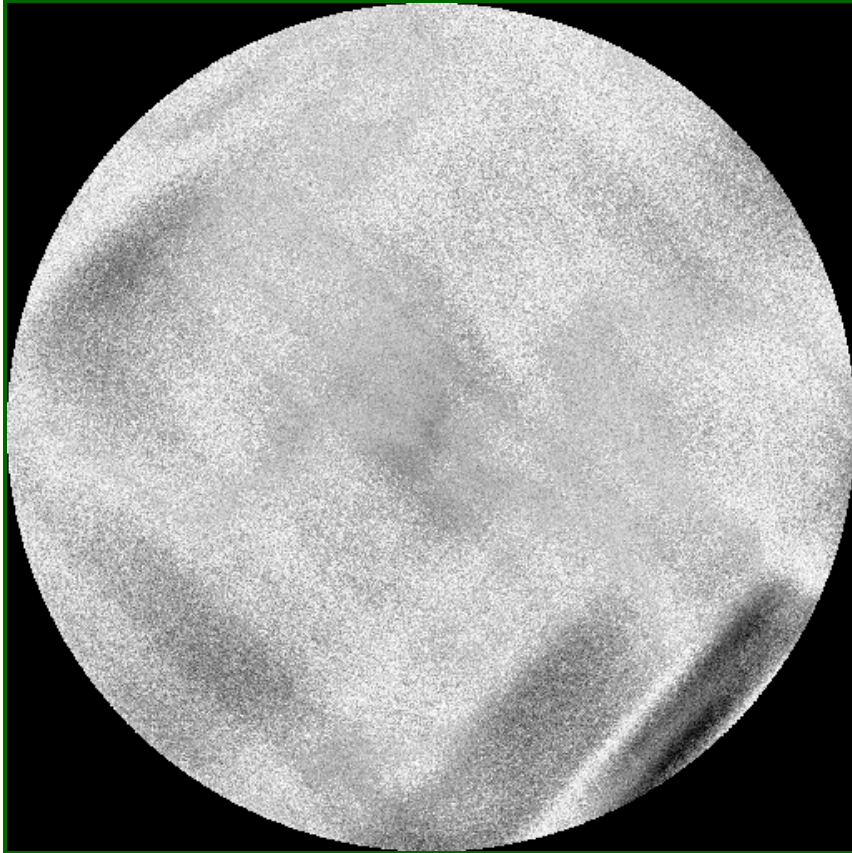
After EP

te1cat003_eq1b_255.2

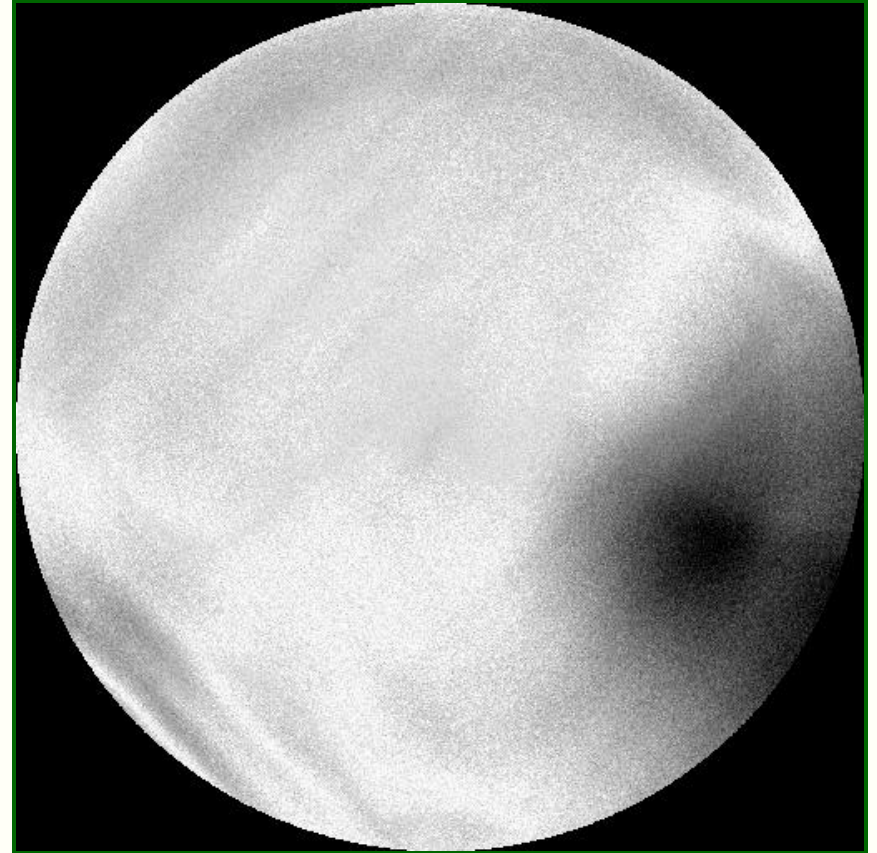


Not all black spot shows up like Pit/bump after EP

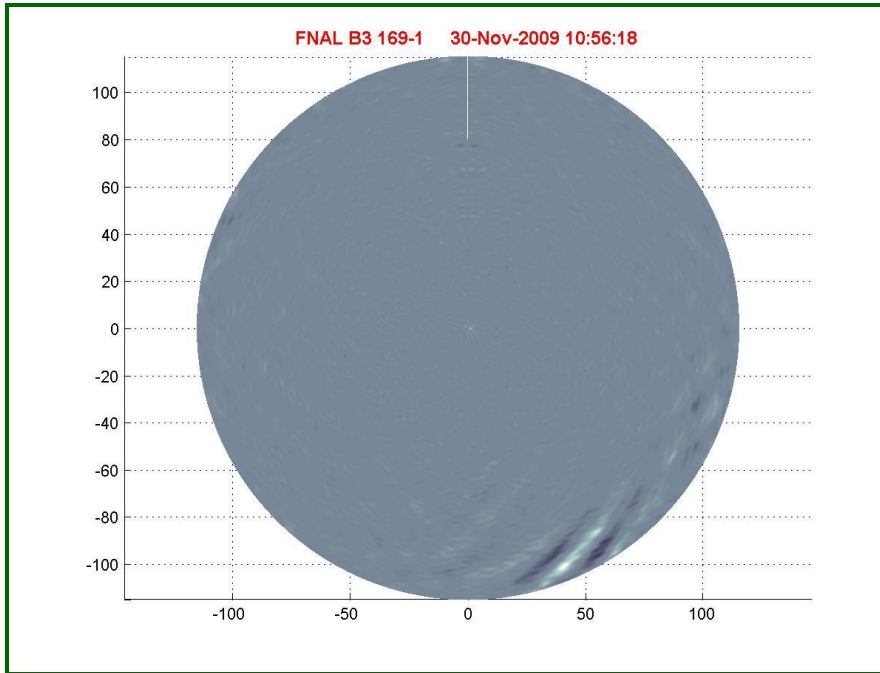
FNAL B3 169-1



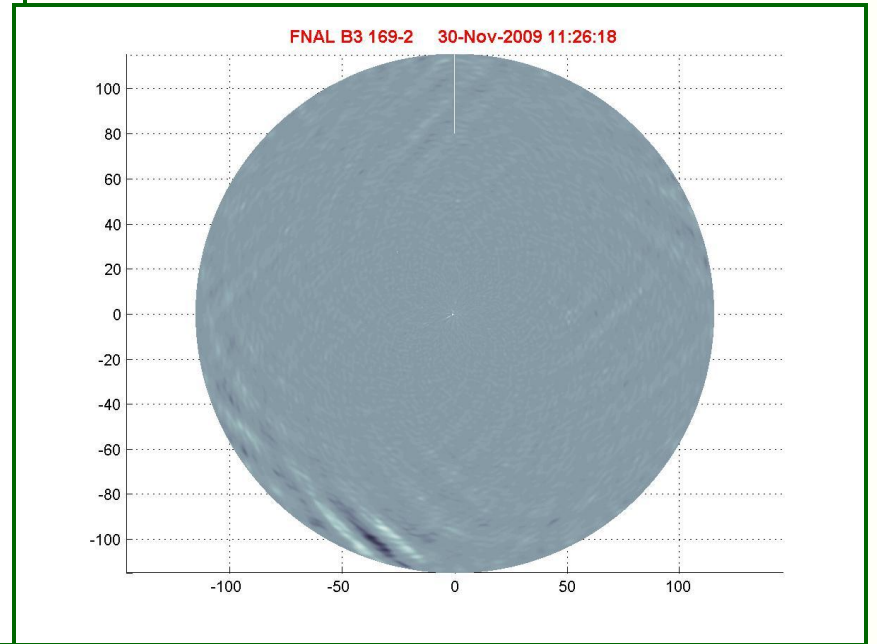
FNAL B3 169-2



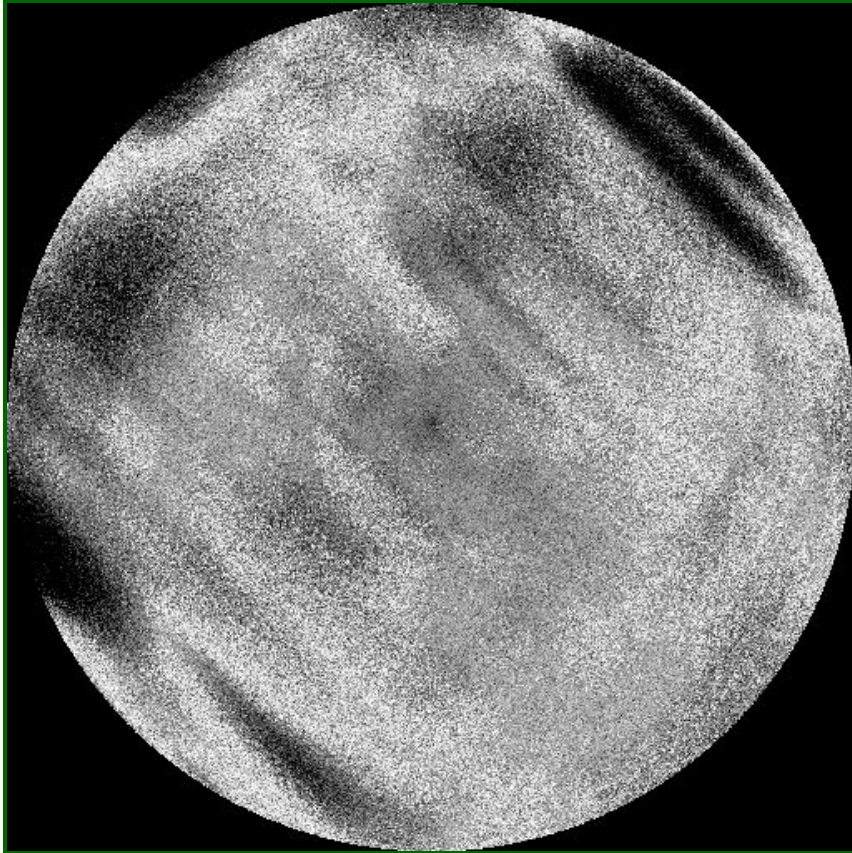
FNAL B3 169-1



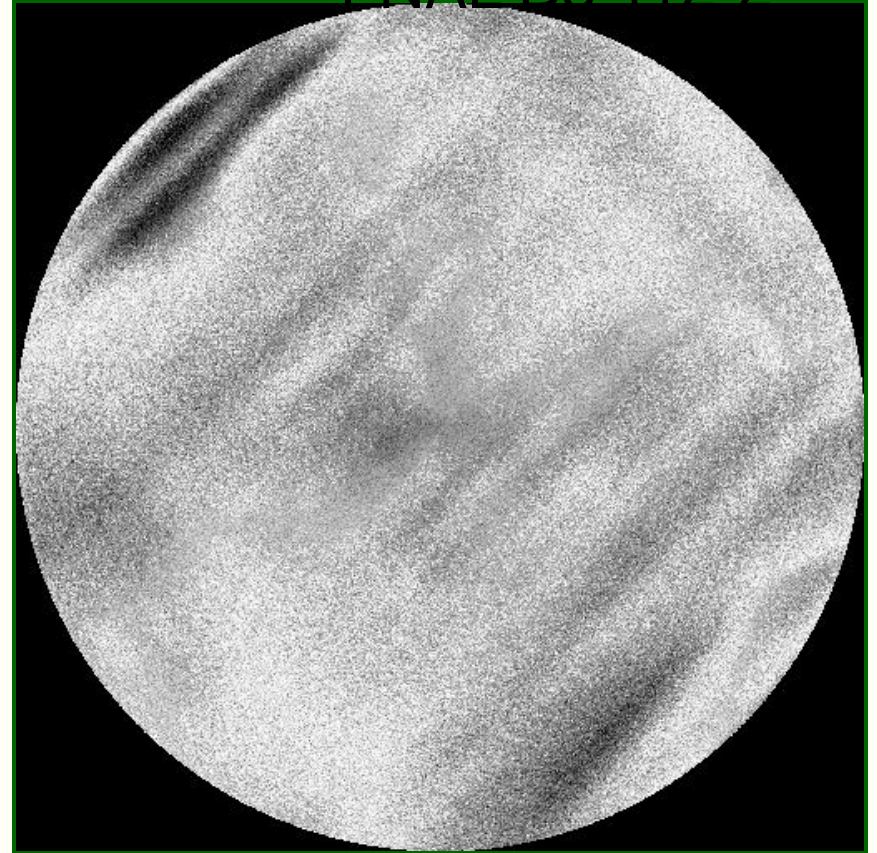
FNAL B3 169-2



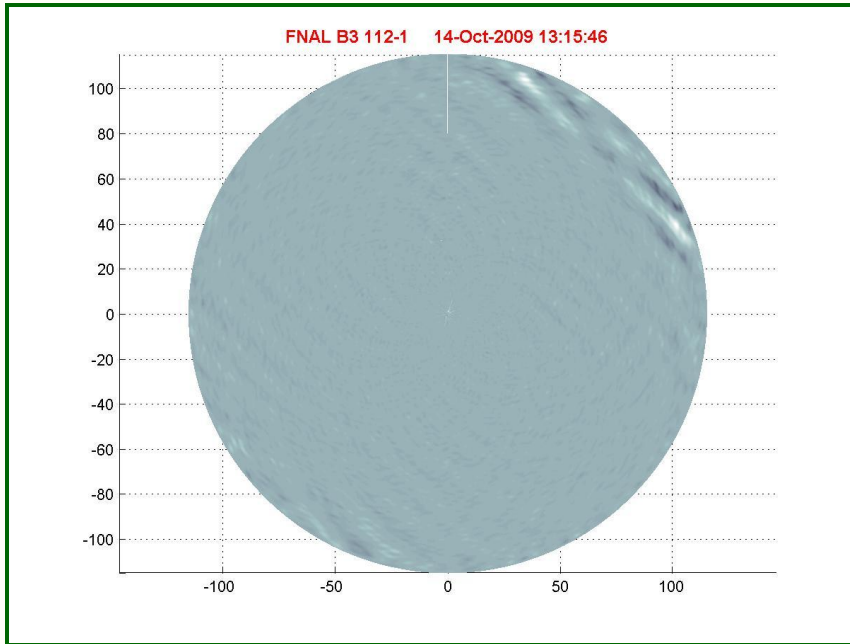
FNAL B3 112-1



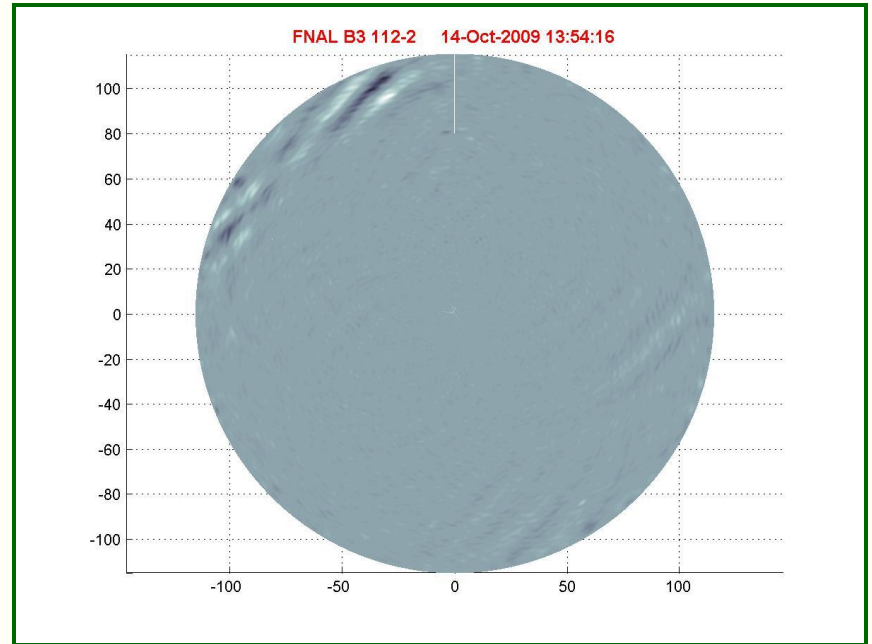
FNAL B3 112-2



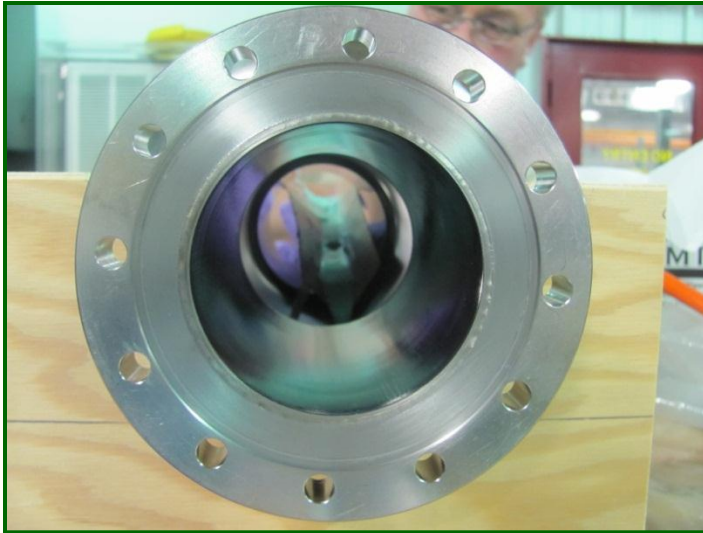
FNAL B3 112-1



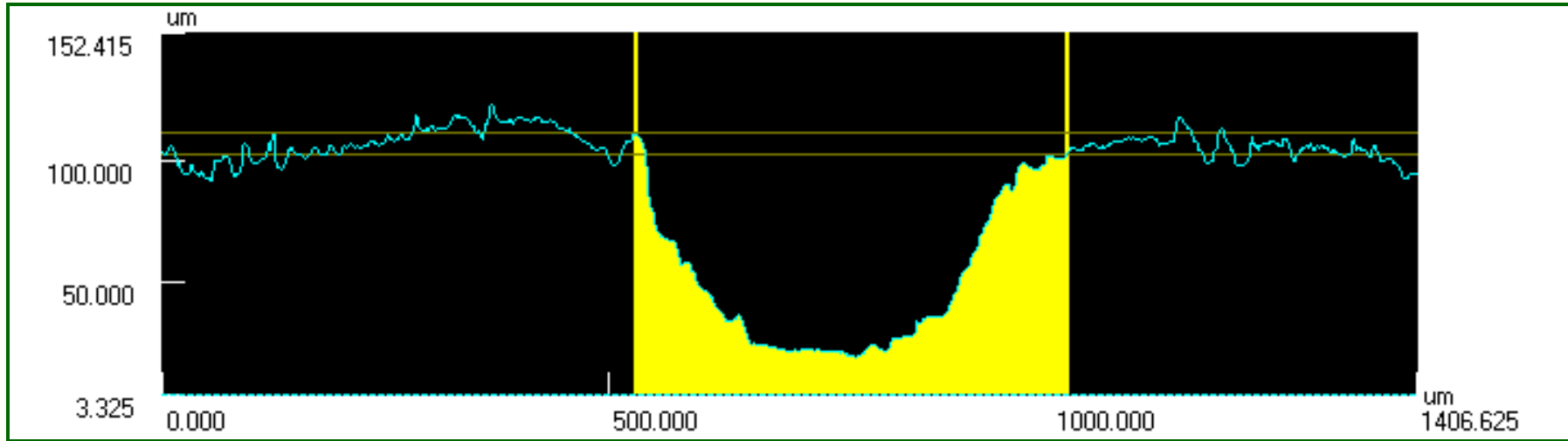
FNAL B3 112-2



Mold star-15
Silicone-Rubber for Molding
Shelf life ~ 50 min
Moderate curing cycle ~ 4 Hrs
Self Degassing compound



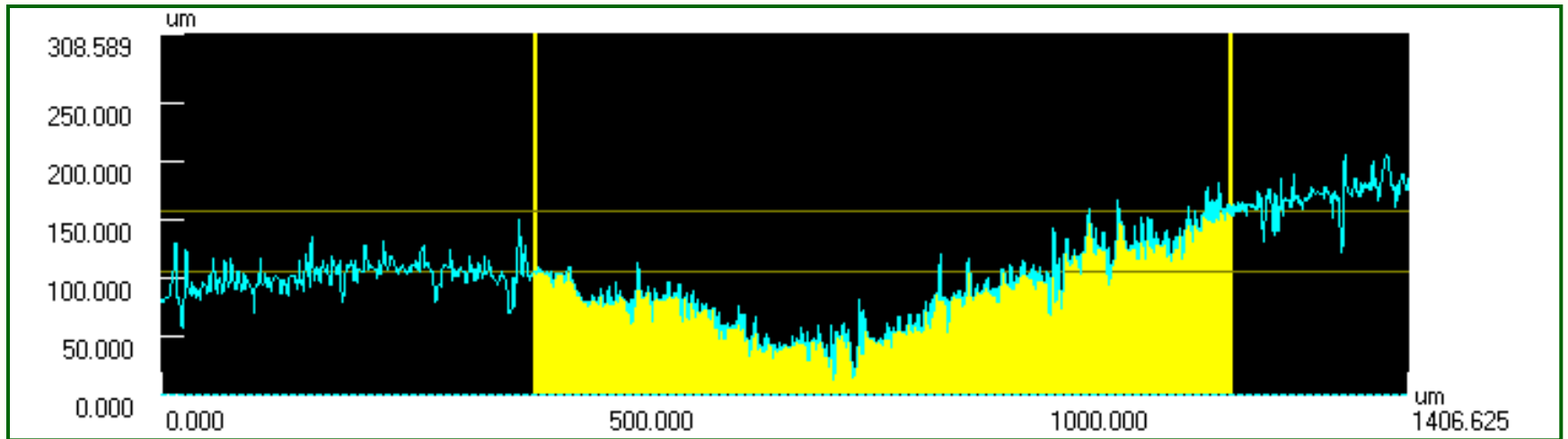
Laser Scanning Microscope



-by Donna

Profile1	Horz. dist.	Hght. diff.	Hght. ave.	Angle	C.S. length	C.S. area	R	Comment
All	1406.625um	9.559um	86.512um	0.389°	1717.152um	117127.567...		
Seg.1	481.564um	9.121um	48.829um	1.085°	577.971um	21961.255u...		
Seg.2								
Seg.3								
Sen.4								

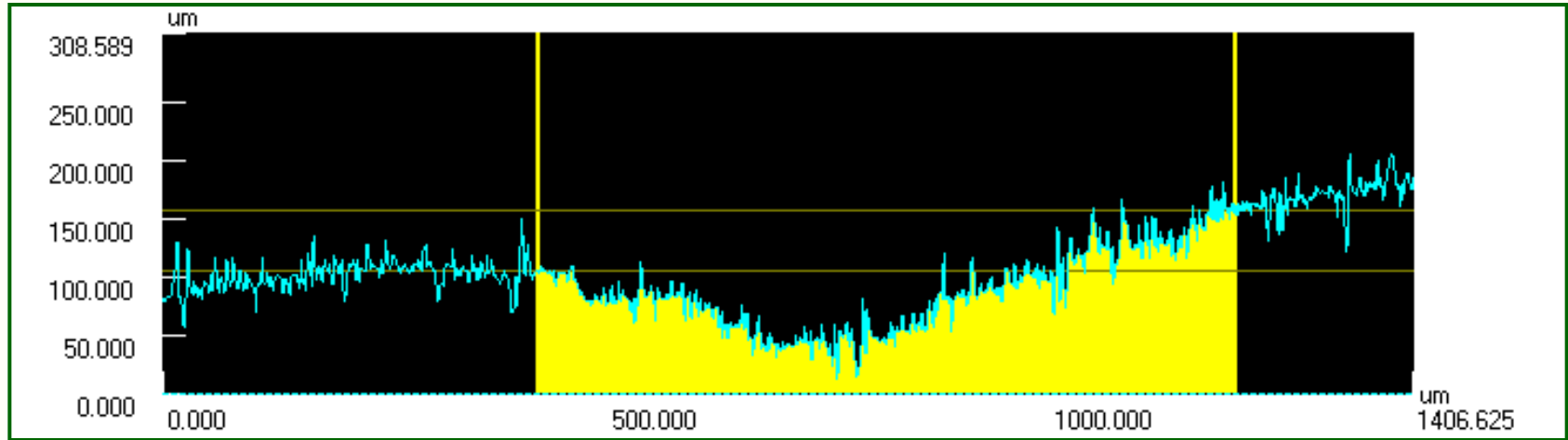
A pit seen on this plot is a bump on the actual cavity.



-by Donna

Profile1	Horz. dist.	Hght. diff.	Hght. ave.	Angle	C.S. length	C.S. area	R
All	1406.625um	103.241um	103.711um	4.198°	8086.792um	146025.380...	
Seg.1	784.208um	51.659um	87.708um	3.769°	4550.765um	68982.716u...	
Seg.2							
Seg.3							
Seg.4							

A pit seen on this plot is a bump on the actual cavity.



-by Donna

Profile1	Horz. dist.	Hght. diff.	Hght. ave.	Angle	C.S. length	C.S. area	F
All	1406.625um	103.241um	103.711um	4.198°	8086.792um	146025.380...	
Seg.1	784.208um	51.659um	87.708um	3.769°	4550.765um	68982.716u...	
Seg.2							
Seg.3							
Seg.4							

A pit seen on this plot is a bump on the actual cavity.

Optical inspection

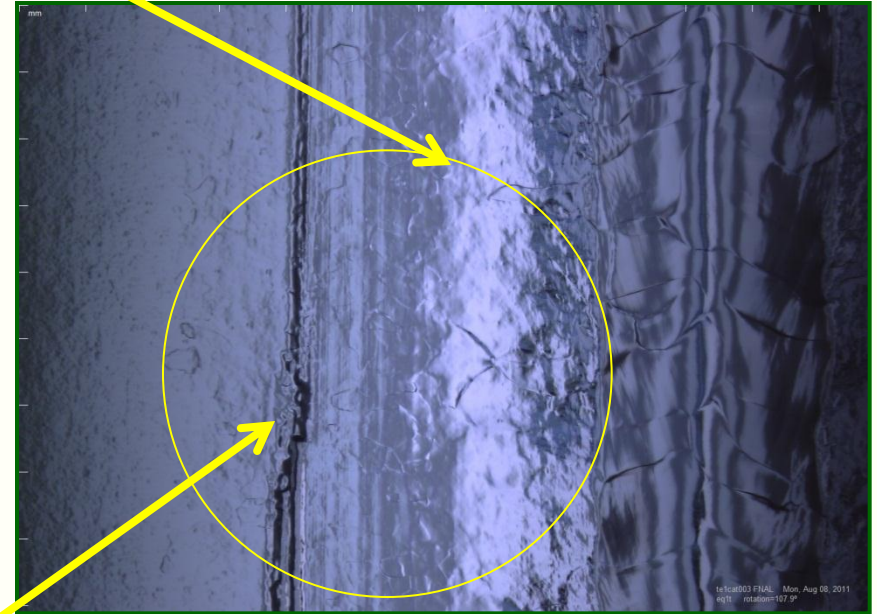
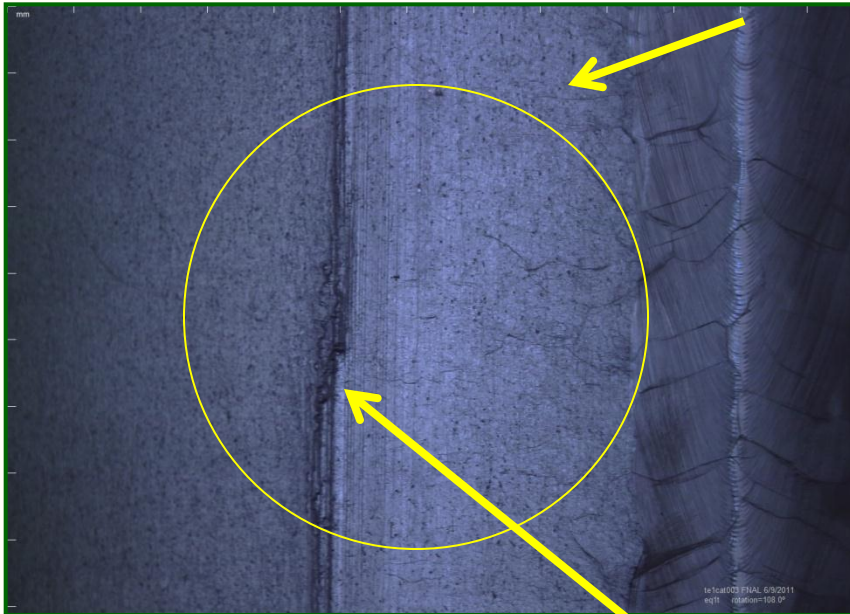
Before EP

EqT1_108 deg

After EP

eq1t_107.9

Embedded mark concern (appear to have been cleaned during EP)



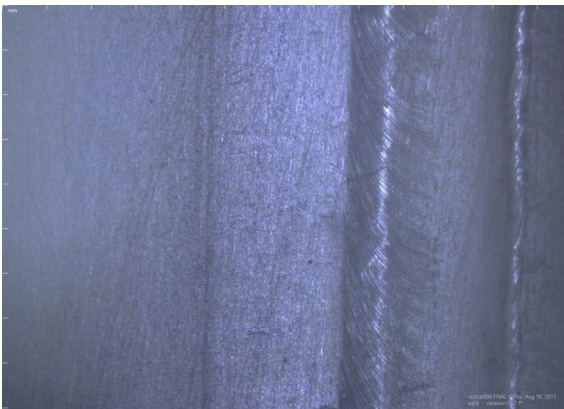
Machining marks concern

- **2 K result TE1CAT003**
 - Quench limited at low field
 - T-map identified Hot spots looked like **pits** during optical Inspection
 - Replica & profilometry done
 - (results from Donna Hicks- they are Bumps)
- **Plans to make efforts to improve the performance**
 - **Consider the defects limiting performance a Local ?**
 - **Hot spot & Optical Inspection**
 - Laser Melting
 - Mechanical grinding (KEK technique)
 - Local mechanical hand polishing
 - **Consider the defects limiting performance Global ?**
 - **Machining marks and embedded particles near equator ?**
 - Tumbling
 - **Low surface resistivity 4 nΩ during Q vs T**

- **TE1CAT004**

- **Optical Inspection**

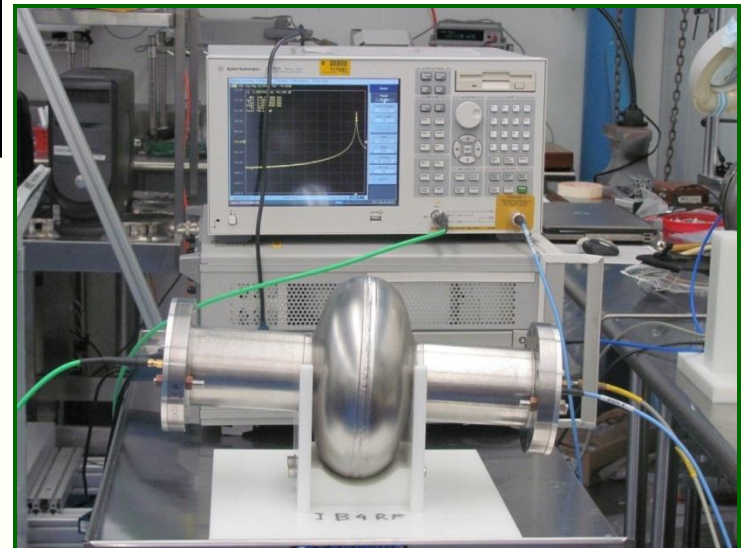
- Inner weld bead has been mechanically polished
- No stains marks seen



- **TE1CAT004**

- **RF Testing**

Frequency	TE1CAT004
RRCAT	1299.2873
FNAL	1299.7172
'Q' factor	
RRCAT	9237.3484
FNAL	9676.3592



- **TE1CAT003**
 - 2nd processing with defects repair

- **TE1CAT004**
 - Optical & RF inspection is done
 - Processing & testing
 - Standard processing steps
 - EP (120 μm) + 800 C Bake + EP (20 μm) + HPR
 - Add CBP

Thank you