

Failure Analysis of Failed PMTs

Progress report

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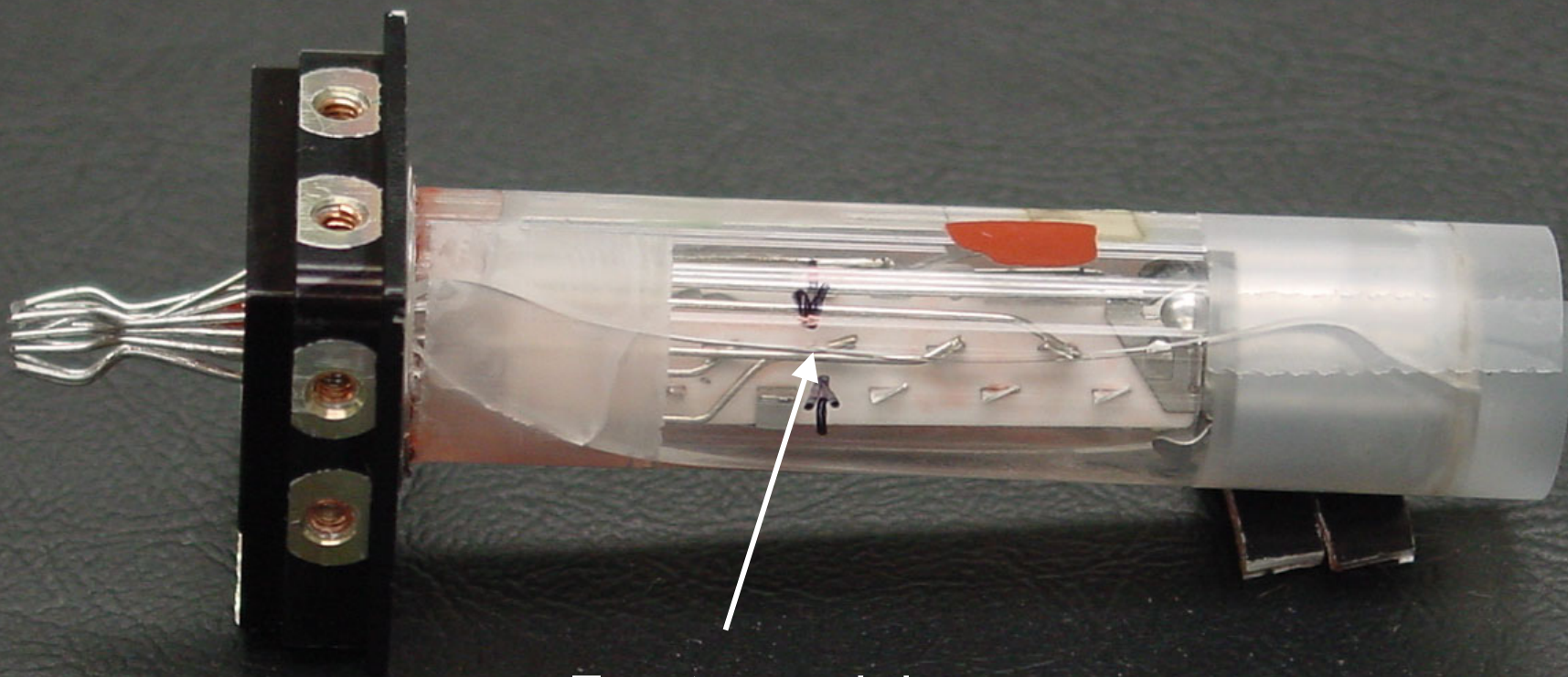
7-26-04

Disassembly of Failed PMTs

PMT	Thermal history	Fracture origin (all on outside)
AA0393	+45°C to -30°C/12 cycles	41 mm @ 9*
ZL1193	+45°C to -30°C/12 cycles	34 mm @ 3
AA0379	+40°C to -30°C/1 cycles	33 mm @ 9
AA0365	+40°C to -15°C/1 cycles	28 mm @ 8

* Distance from window + circumferential (clock) position when look down to the window with the metallization pad as 12 o'clock.

AA0379

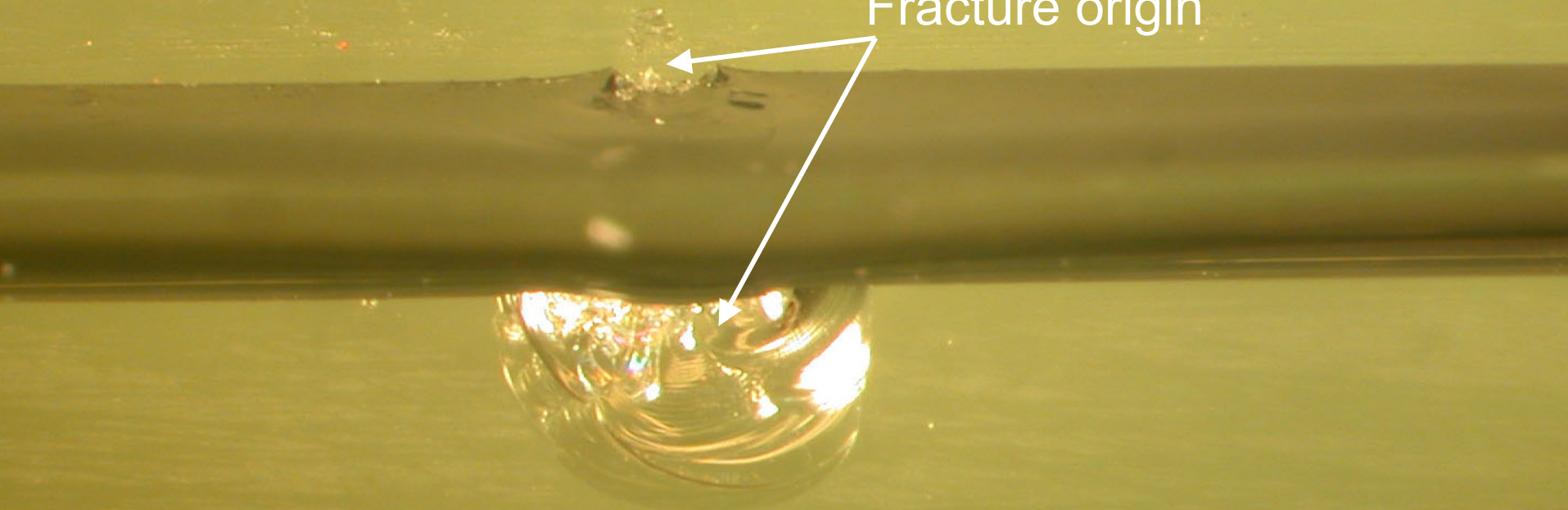


Fracture origin

23 10:42AM

Outside surface of PMT AA0379

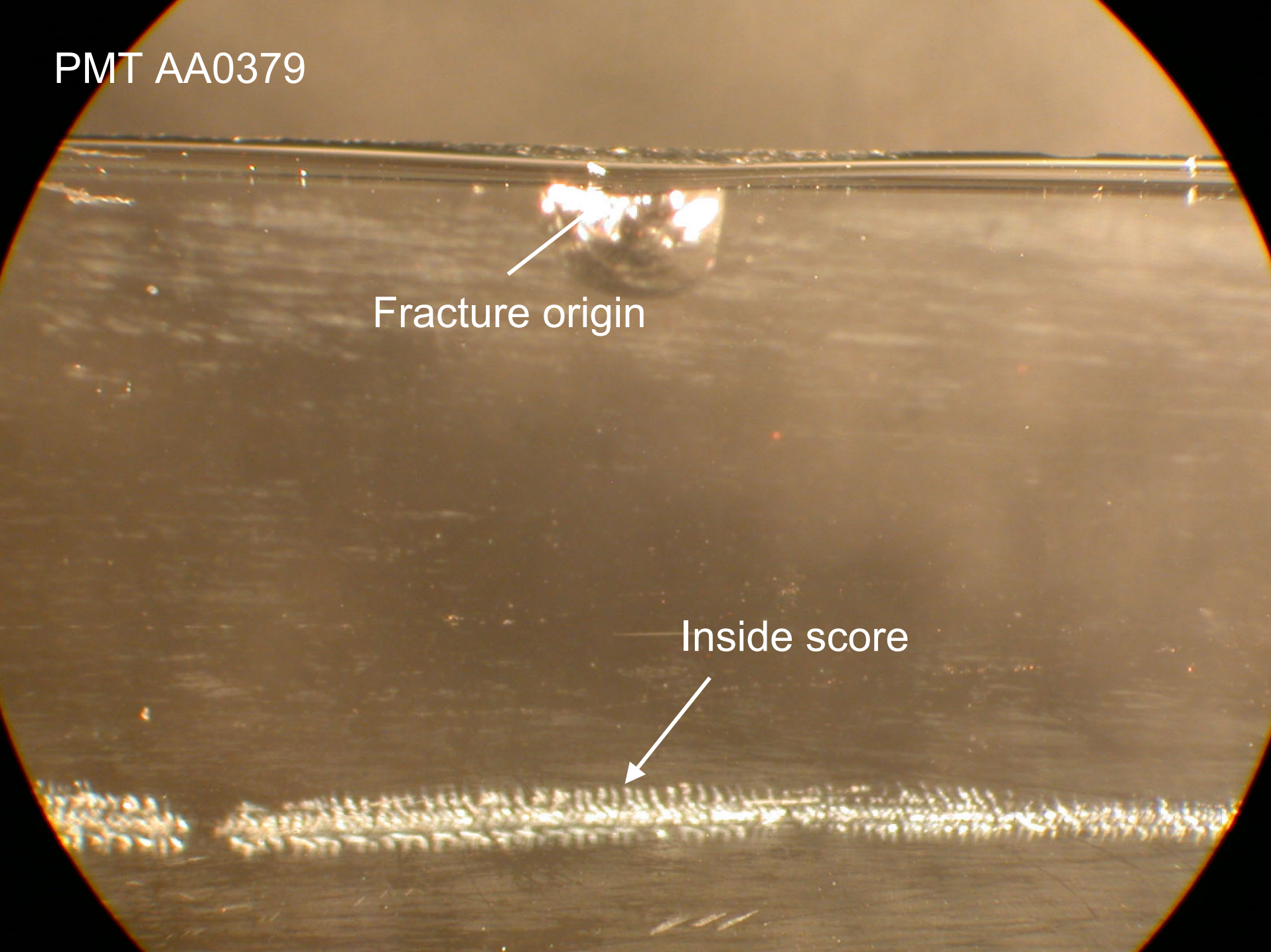
Fracture origin



PMT AA0379

Fracture origin

Inside score



PMT AA0379

Outside score



Inside score

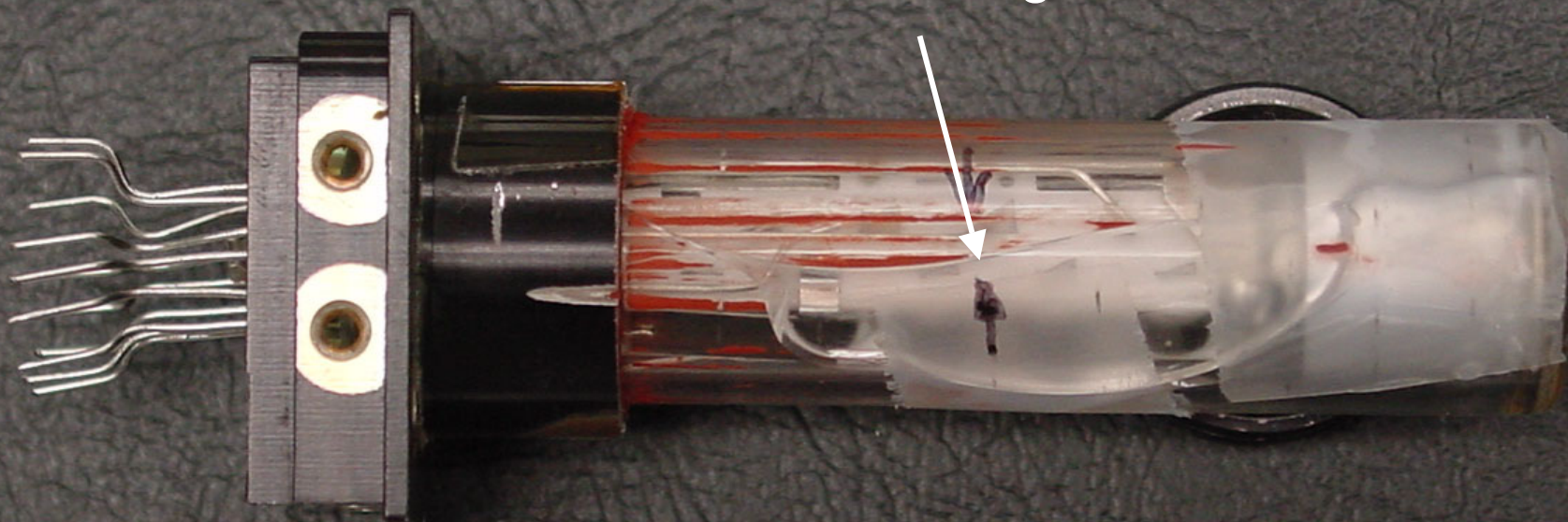


Outside score



AA0365

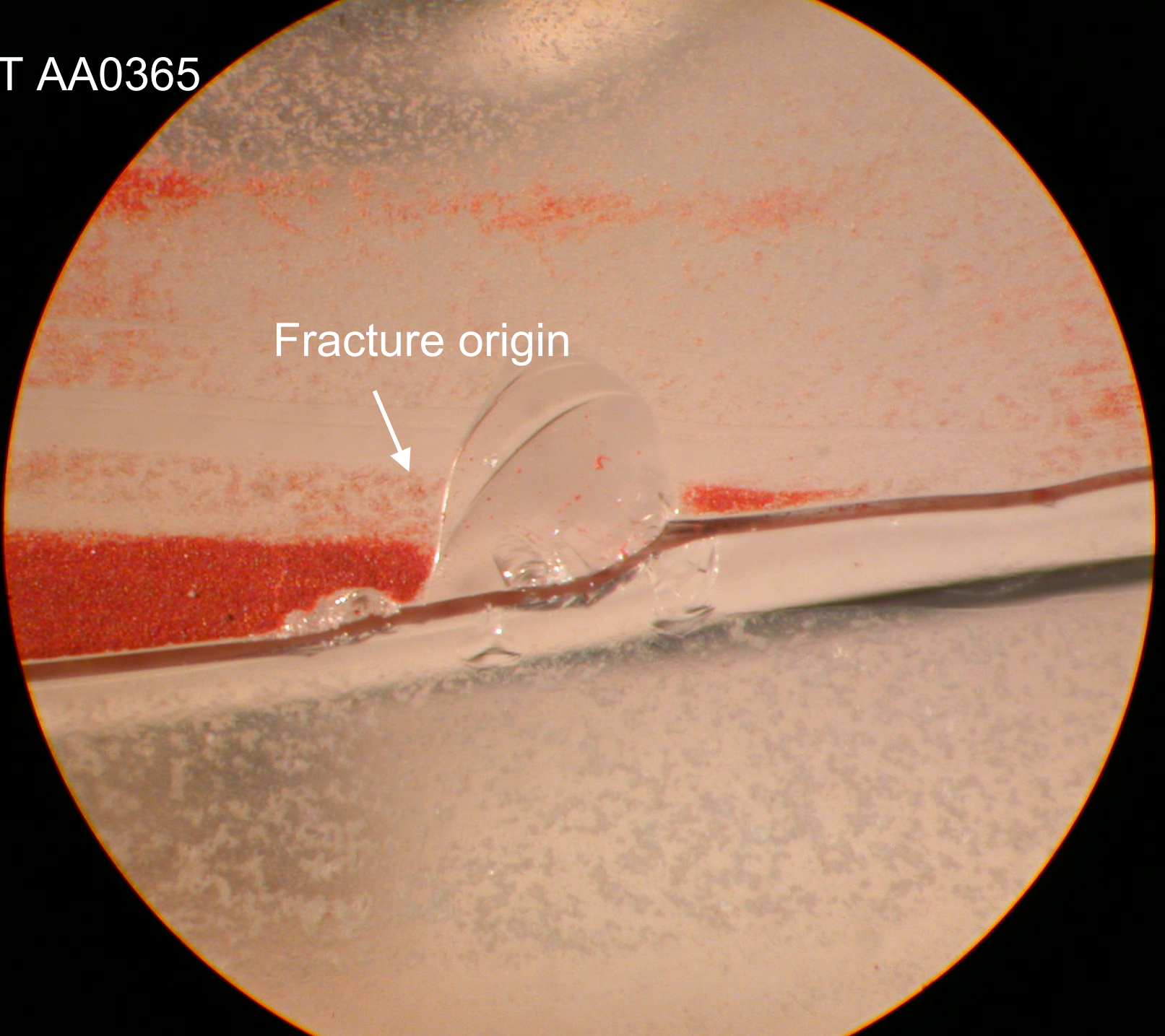
Fracture origin



26 9:14AM

PMT AA0365

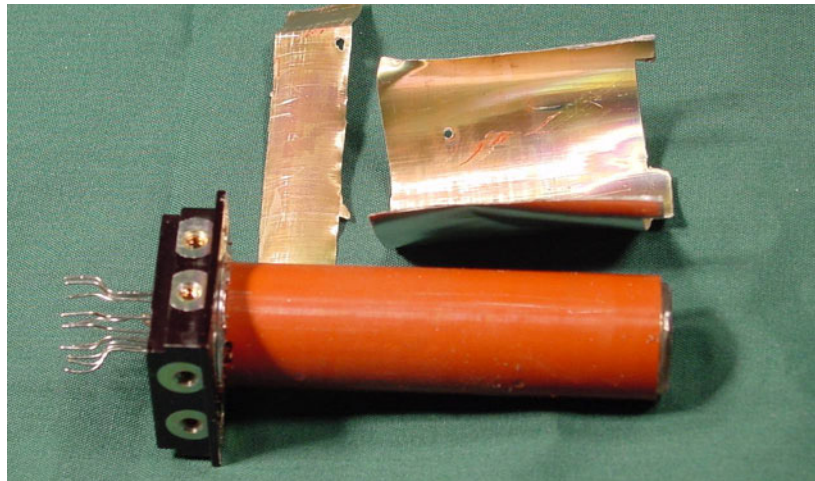
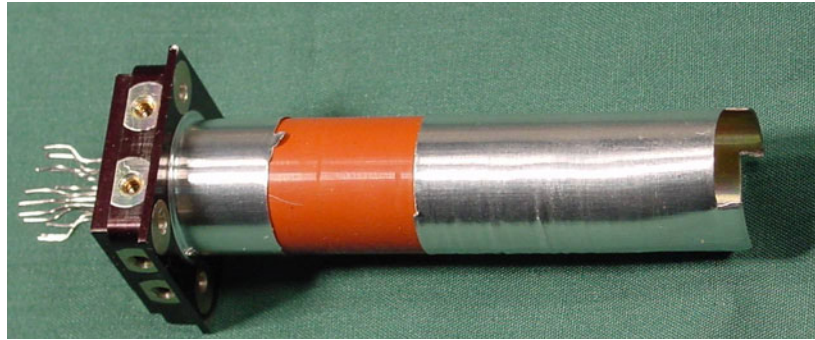
Fracture origin



Removing Housing by Machining

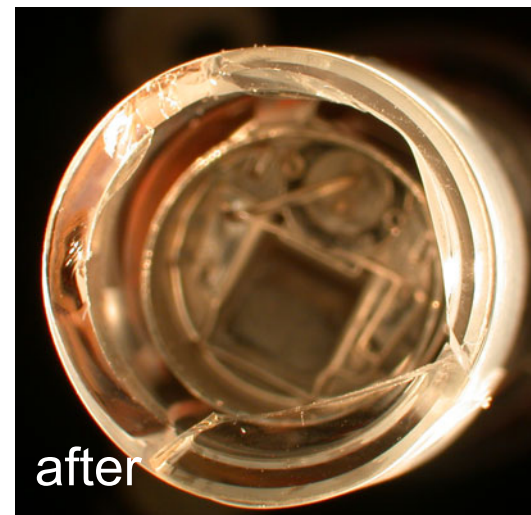
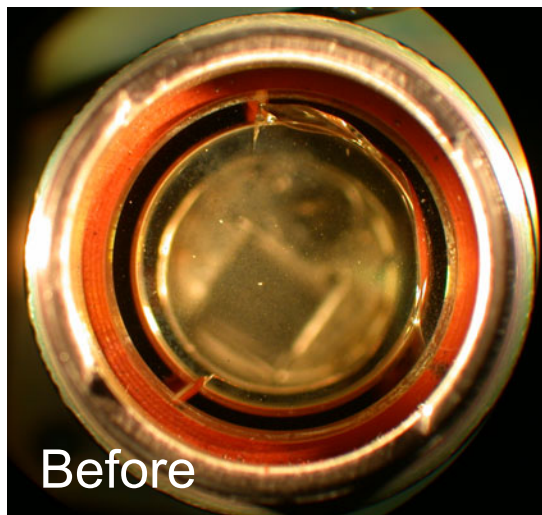
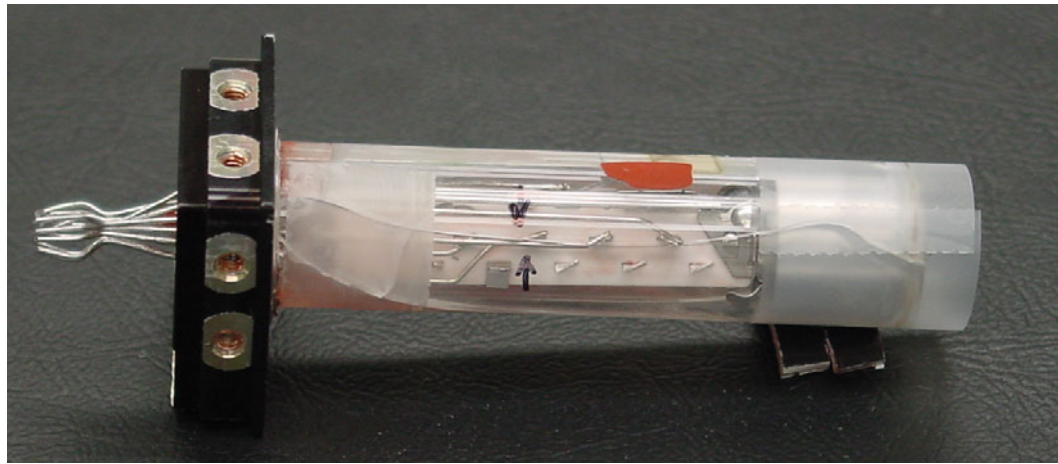
by Dewey Dove

- Successfully machined down to less than 10 mil
- Next, try to cut slots on the housing



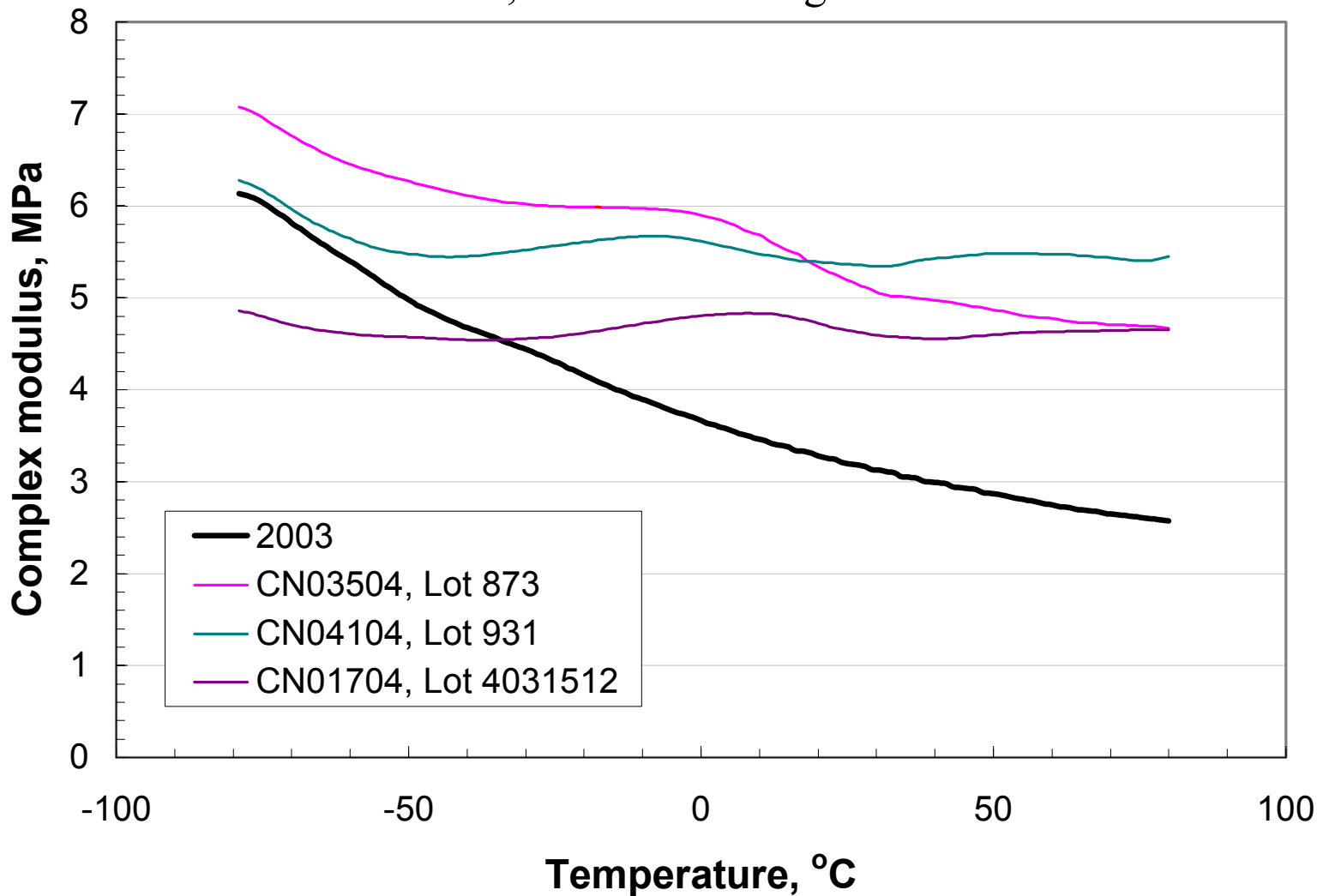
Removing RTV with Solvent

- RTV dissolved in Dynasolve 210 (Dynaloy) less than 1 hr
- Solvent got into the tube and caused cracks propagate further



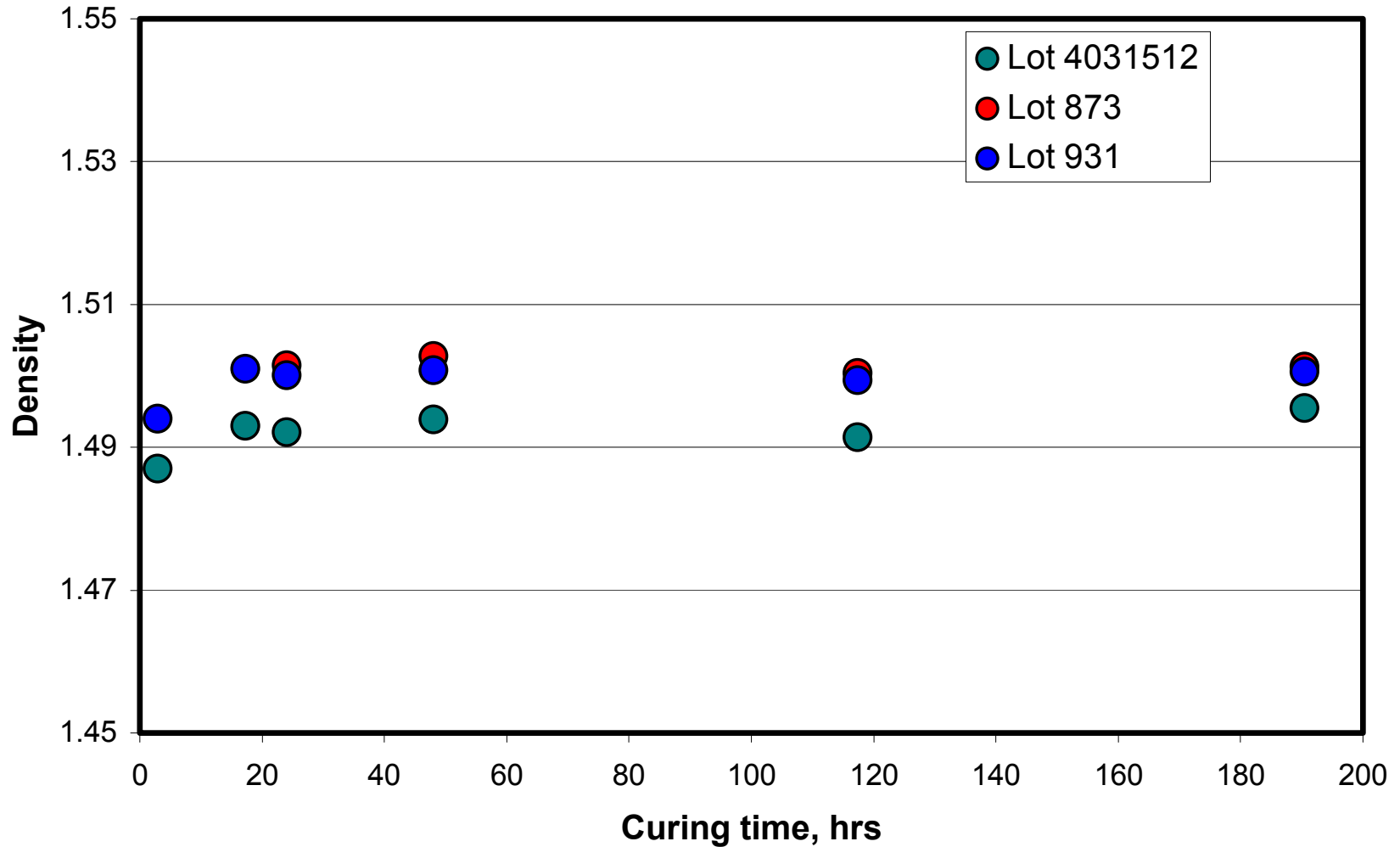
Modulus of RTV566

Measured with DMA, compression at 1 Hz, 0.05% strain, 2°C/min heating rate



Curing Shrinkage

Mark McLendon



Poisson's Ratio of RTV566 as Function of Temperatures

- Samples from all three lots showed that the Poisson's ratio does not change with temperatures from +40°C to -60°C.
- Further work underway to study repeatability

Summary

- All 4 PMTs failed from outside flaws in the middle of the tubes
- Aluminum housing successfully removed by machining
- RTV can be dissolved by solvent, but more crack propagation observed
- Modulus of RTV varies between lots, but not significantly. Strain-dependent.
- Curing shrinkage about 0.2% (volume), mostly in the first 24 hrs.
- Poisson's ratio of RTV566 doesn't change with temperature from -60°C to +40°C