



# ITM03; LHO ITMx Post O2 inspection

LIGO-T1800013-v1

A feature was found at the location predicted by TCS. This feature is highly absorbing. This feature was present in the scans of the optic as received from the coater.

No other absorbers over 20 ppm were found in the center 60 mm of the optic.

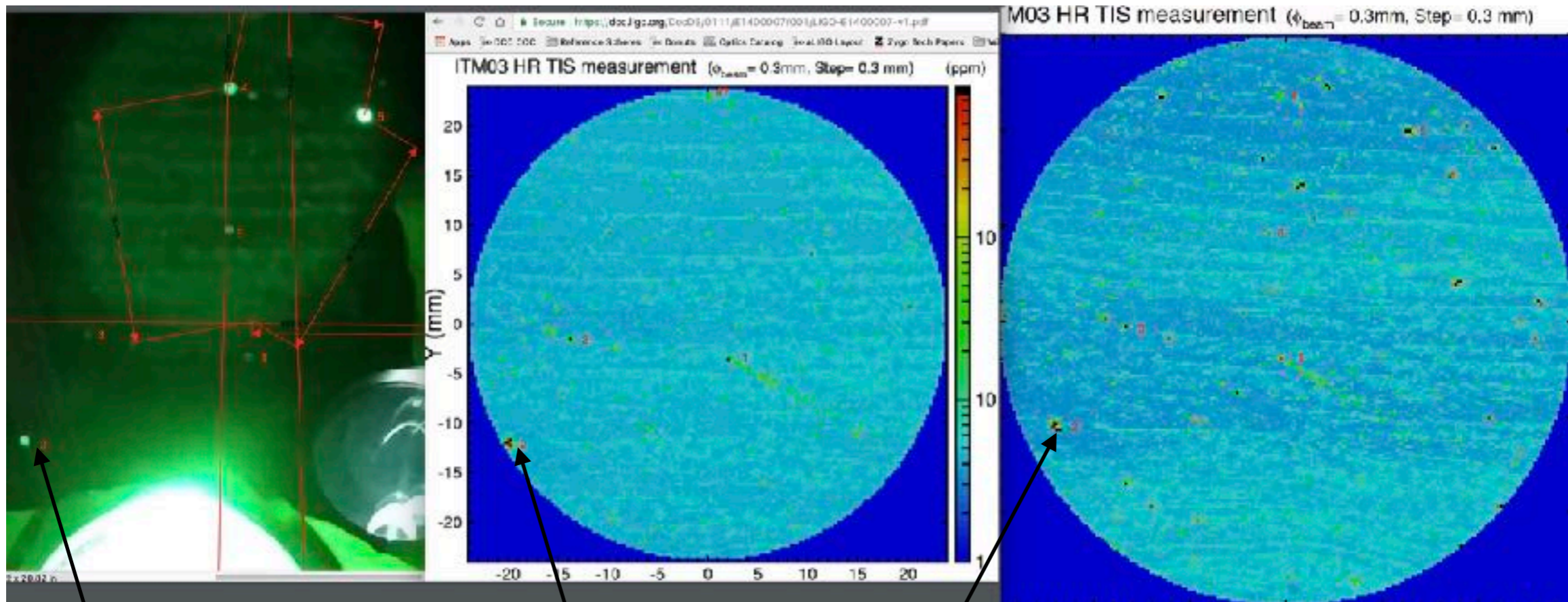
Authors: G. Billingsley, L. Zhang January 2018

# Experimental process

- Scatter measurement -  
The map before installation: measured after First Contact cleaning with ion gun.  
The map after O2: measured as-returned from LHO, no cleaning
- Cleaning with ion gun because there was some dust visible when checking with a flash light.
- Gentle absorption: the measurement was carried out with a beam of 0.3mm in diameter and 0.9W, i.e.  $12.7\text{W}/\text{mm}^2$ . The lower limit of sensitivity for this scan was about 20ppm.
- High resolution probe of the high absorption spot.  
The measurement was done with a beam of 60  $\mu\text{m}$  in diameter at 25 mW, i.e.  $8.8\text{W}/\text{mm}^2$ .
- All scatter and absorption data are referenced from LIGO-E1000766

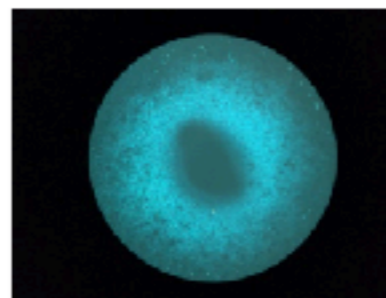
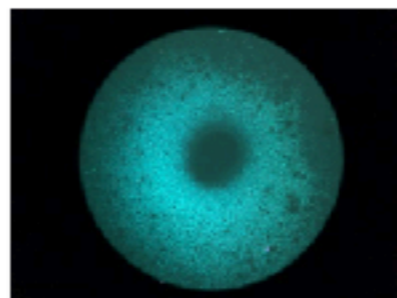
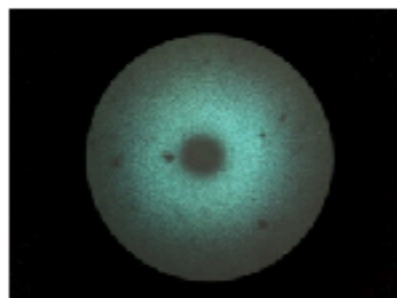
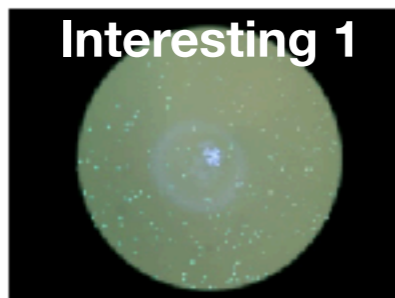
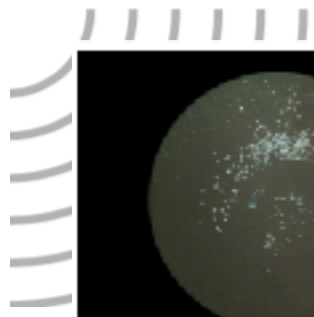
# ITM03 scatter

In chamber view, before install, after removal

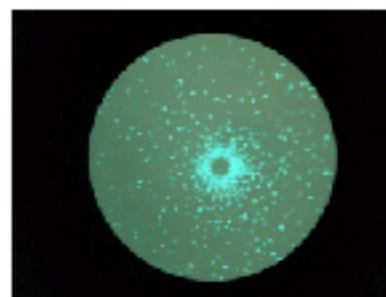
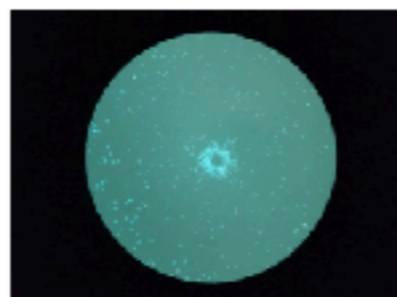
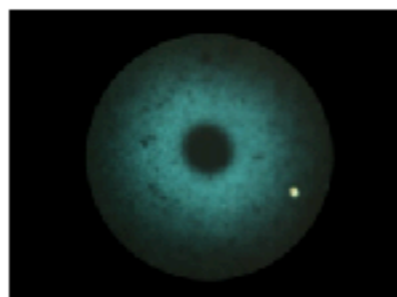
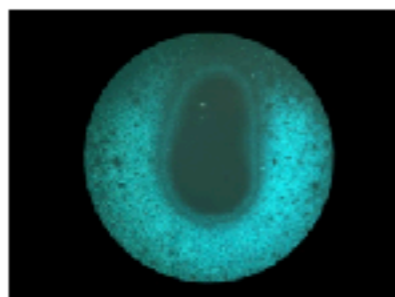
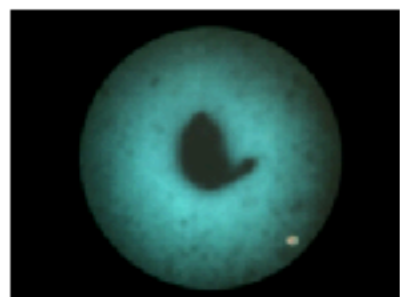


**Spot # 2 found to be the high absorber,  
Present in "before" and "after" scatter scans**

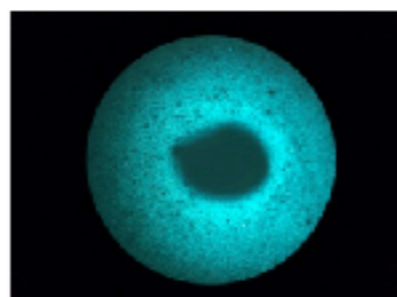
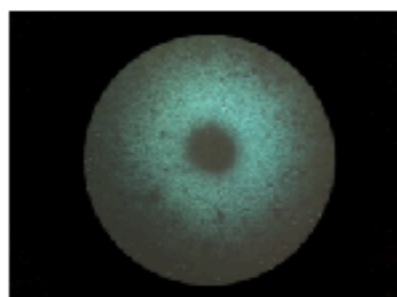
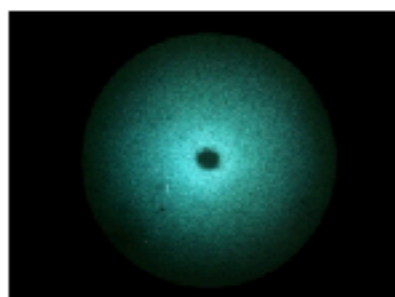
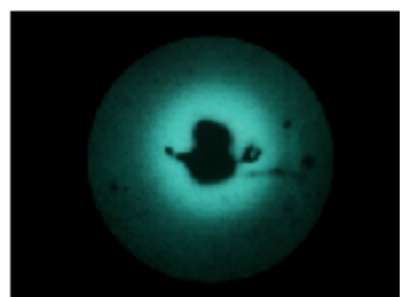
Scatter before installation: 5.6 ppm. Scatter after installation 6.3 ppm



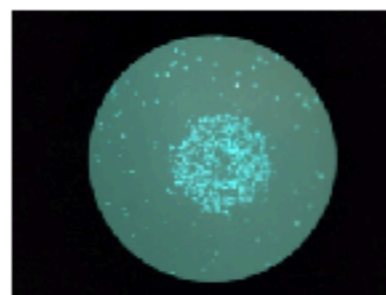
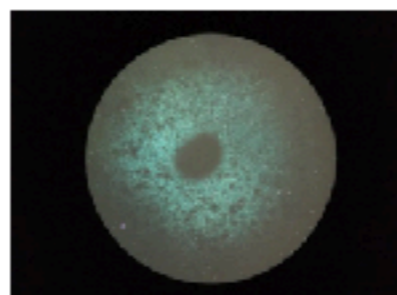
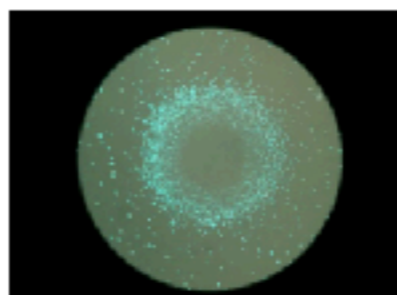
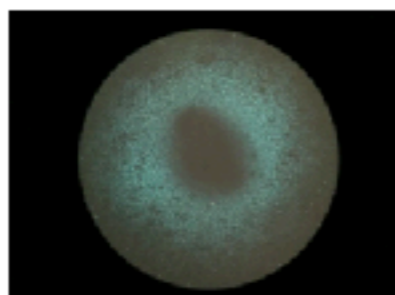
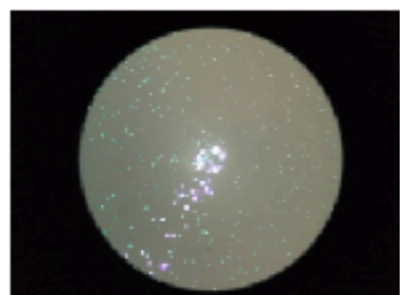
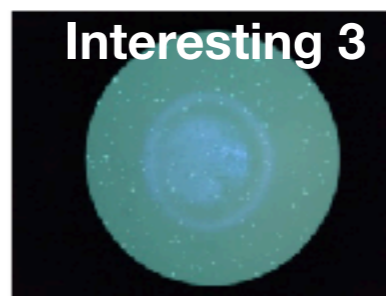
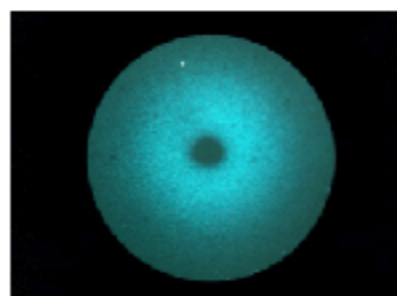
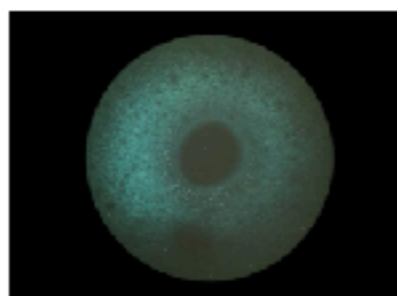
Features found within a radius of ~60 mm of center.



1 mm  $\varnothing$  field

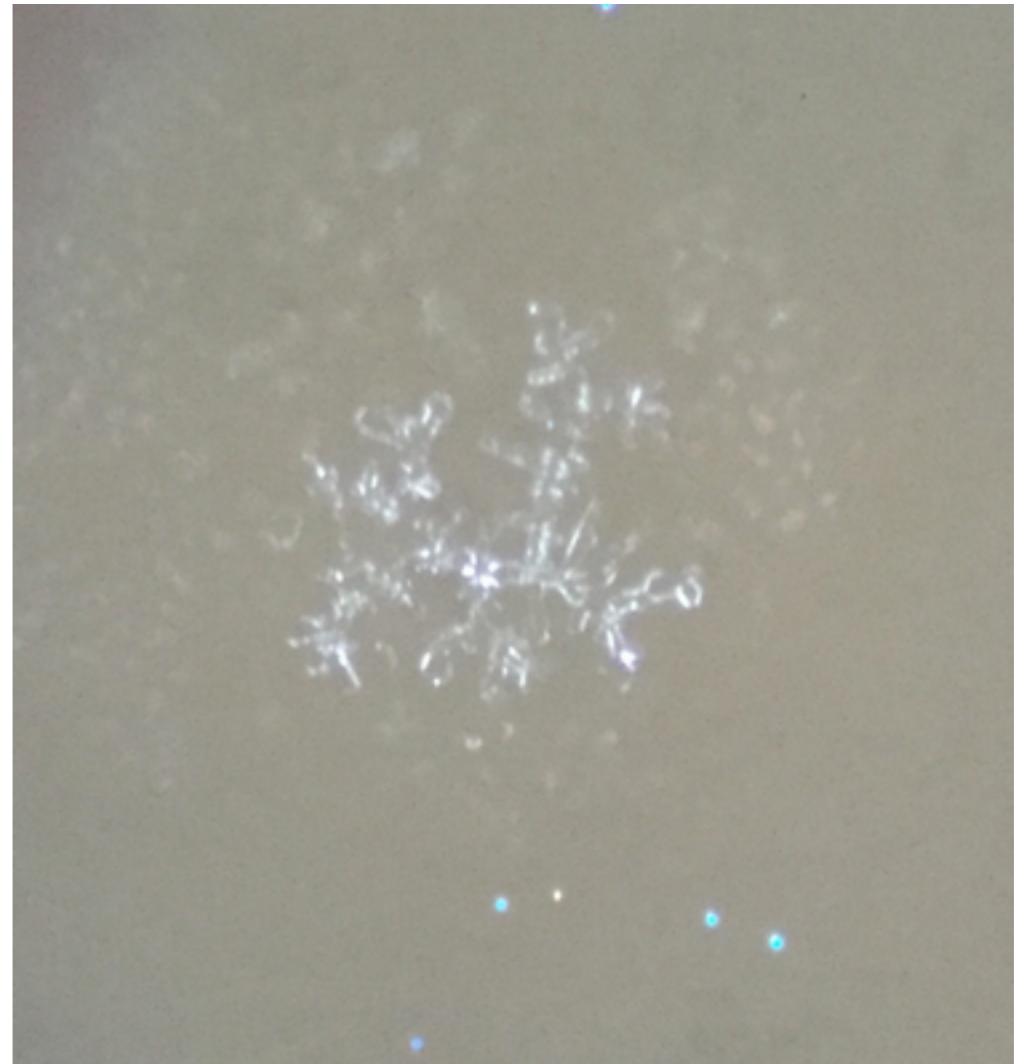
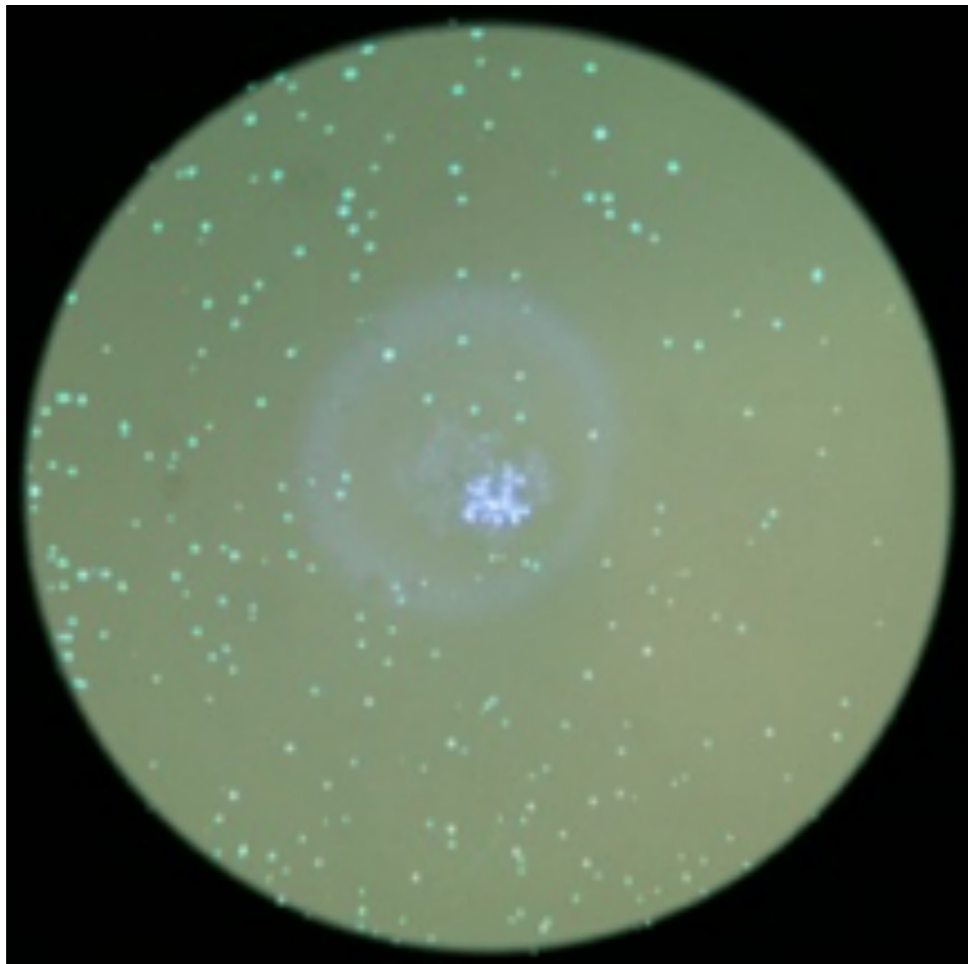


Center scale squares are 50  $\mu$ m



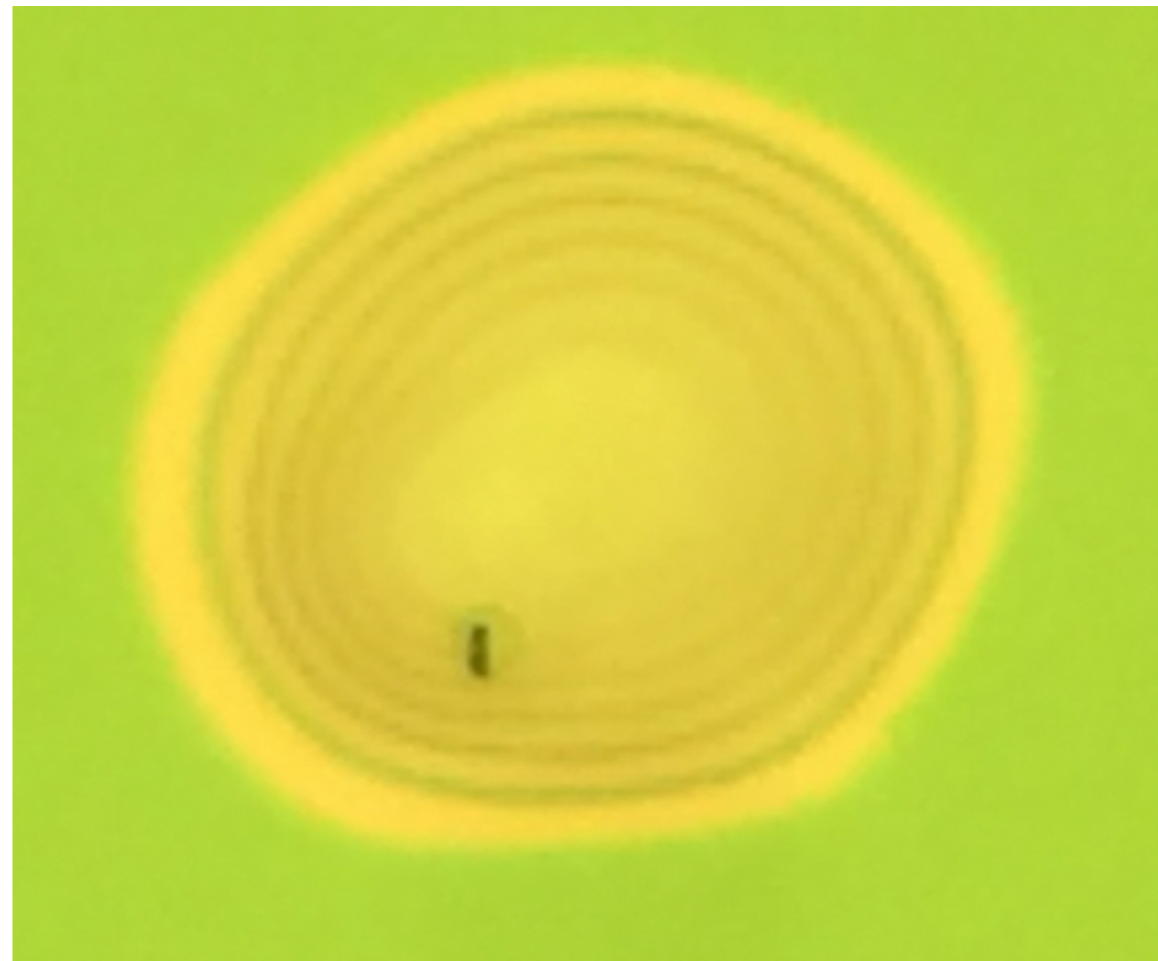
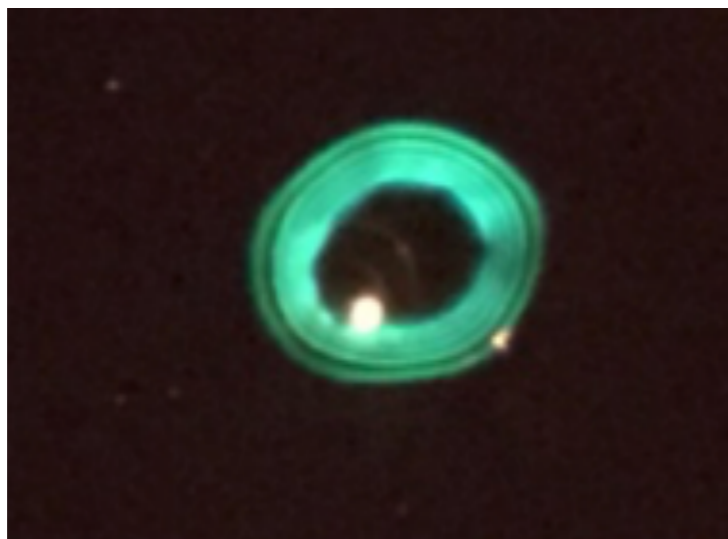
# Interesting 1 (5, -27)

- Branch-like center structure



# Interesting 2 (-8, -39)

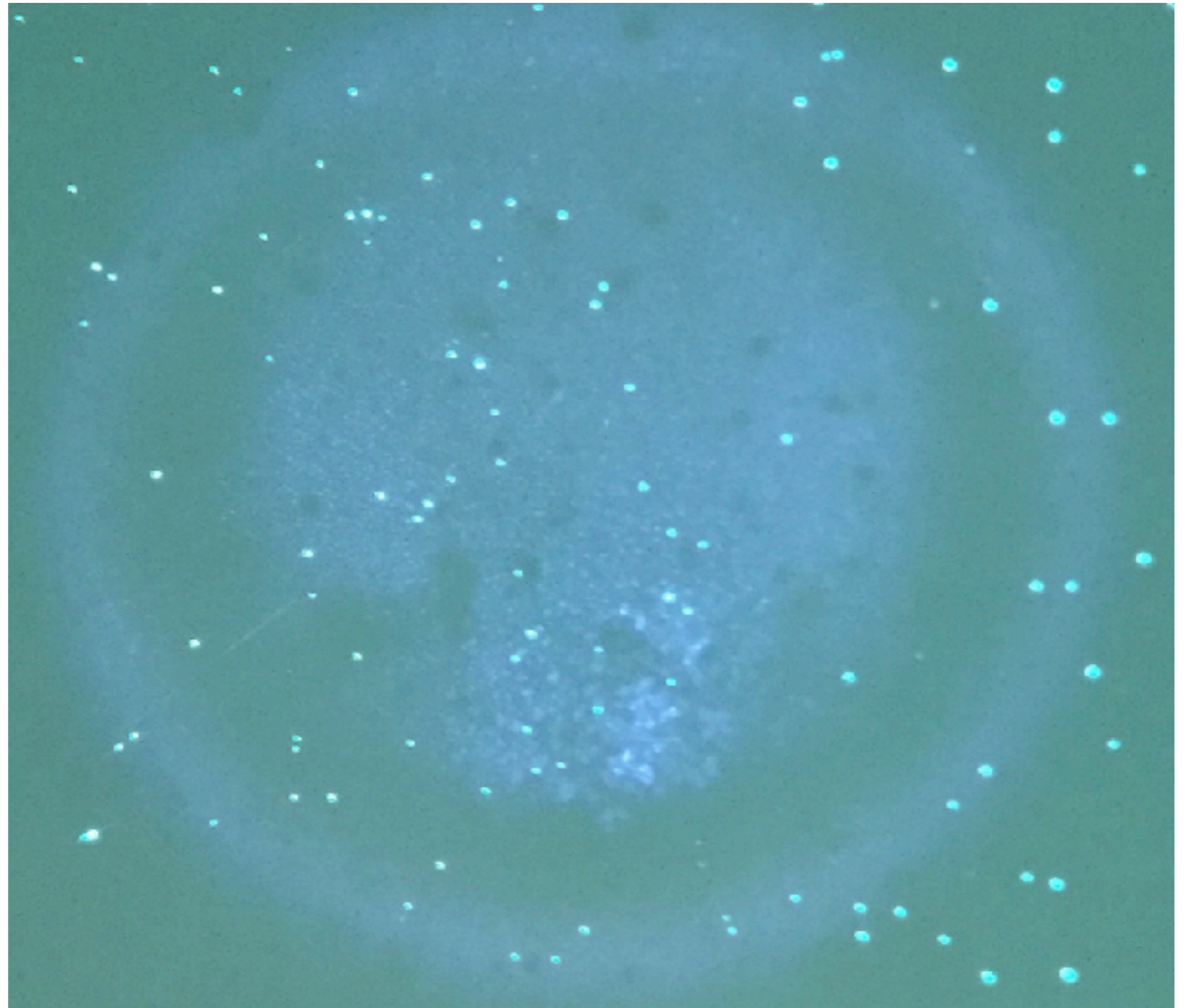
- Shown in bright field
- $\sim 80 \mu\text{m}$  in diameter



LIGO

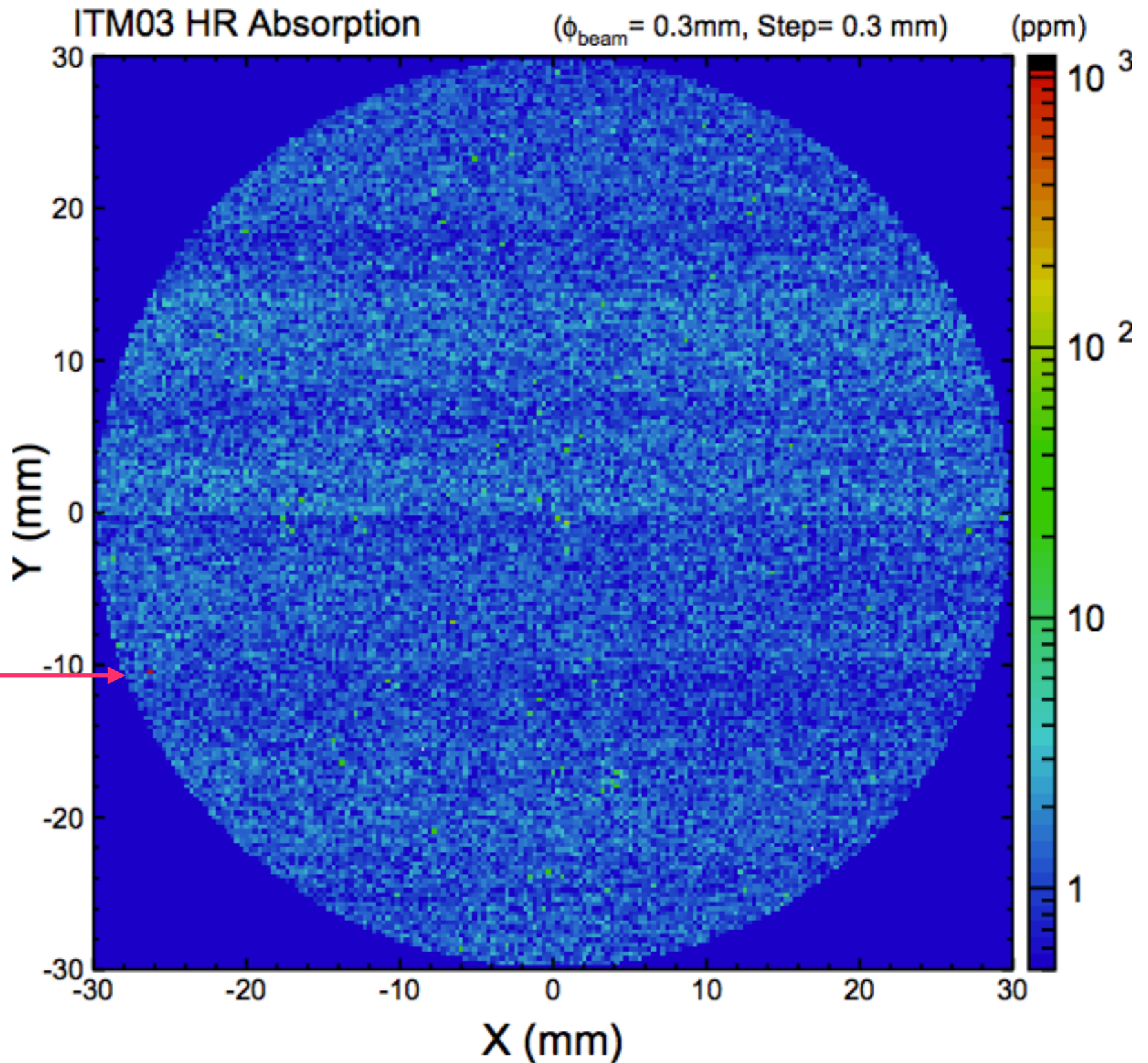
# Interesting 3 (-60, -43)

- Center is filled



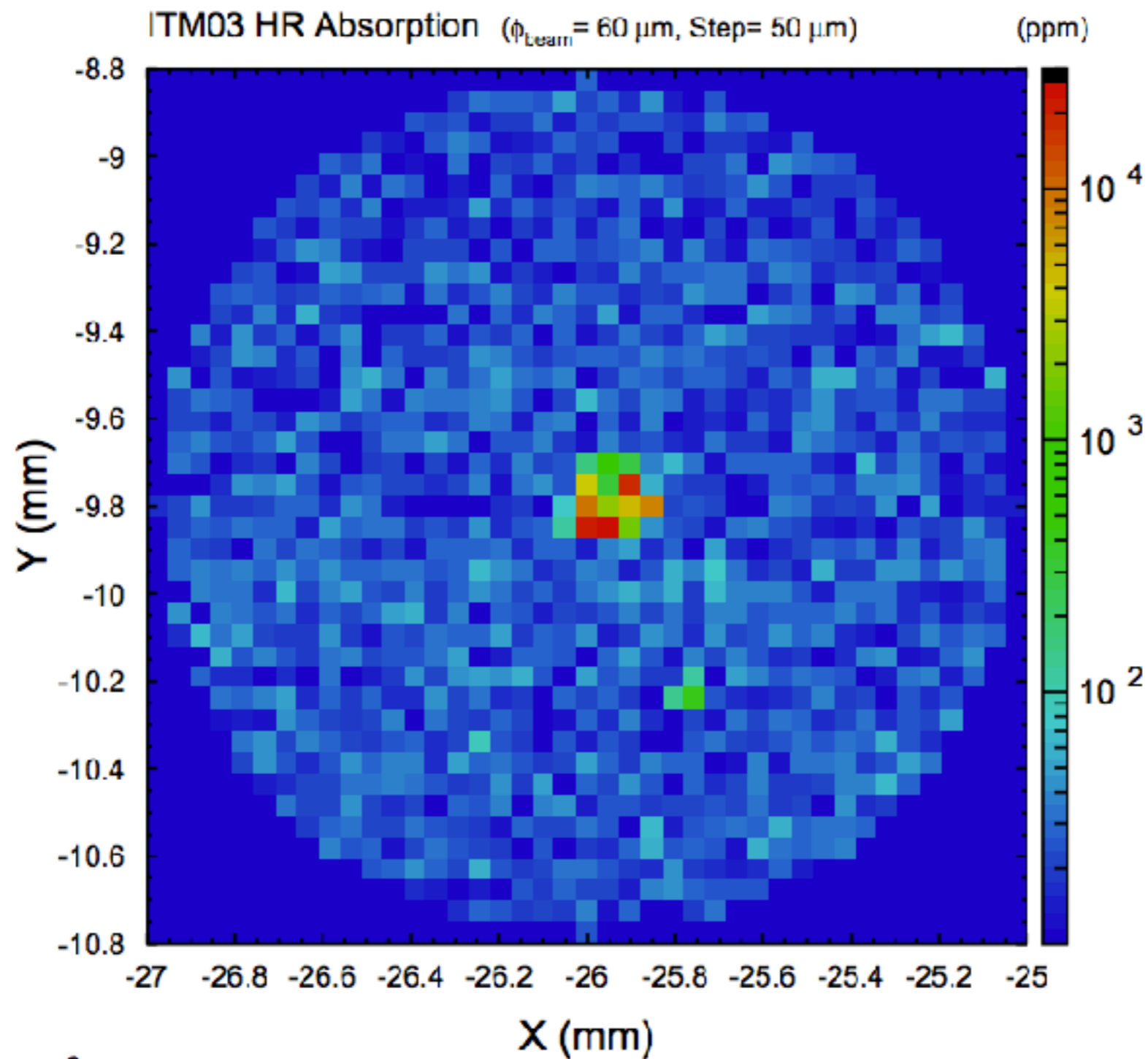
# Absorption spot

- noise floor ~20 ppm

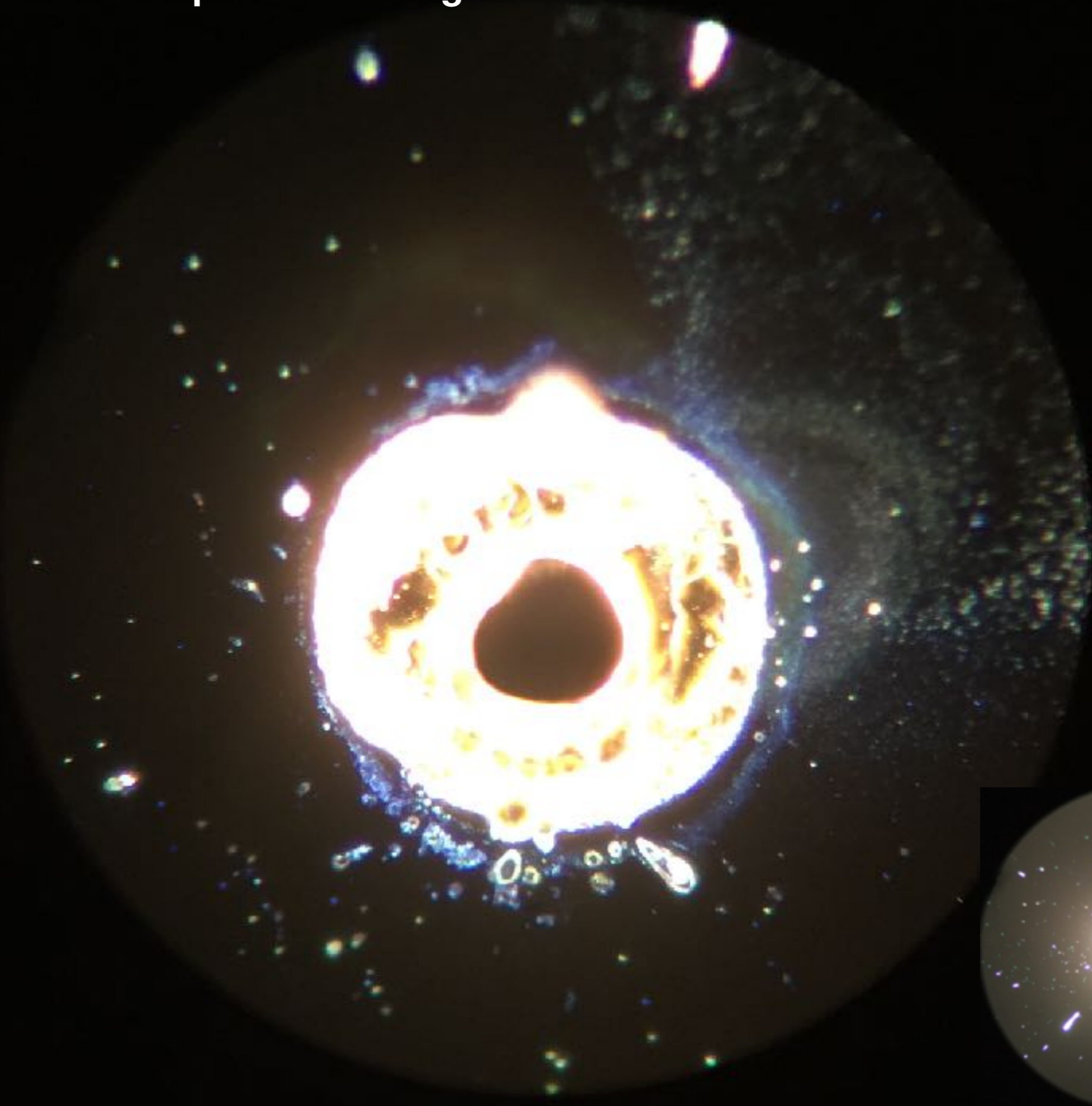




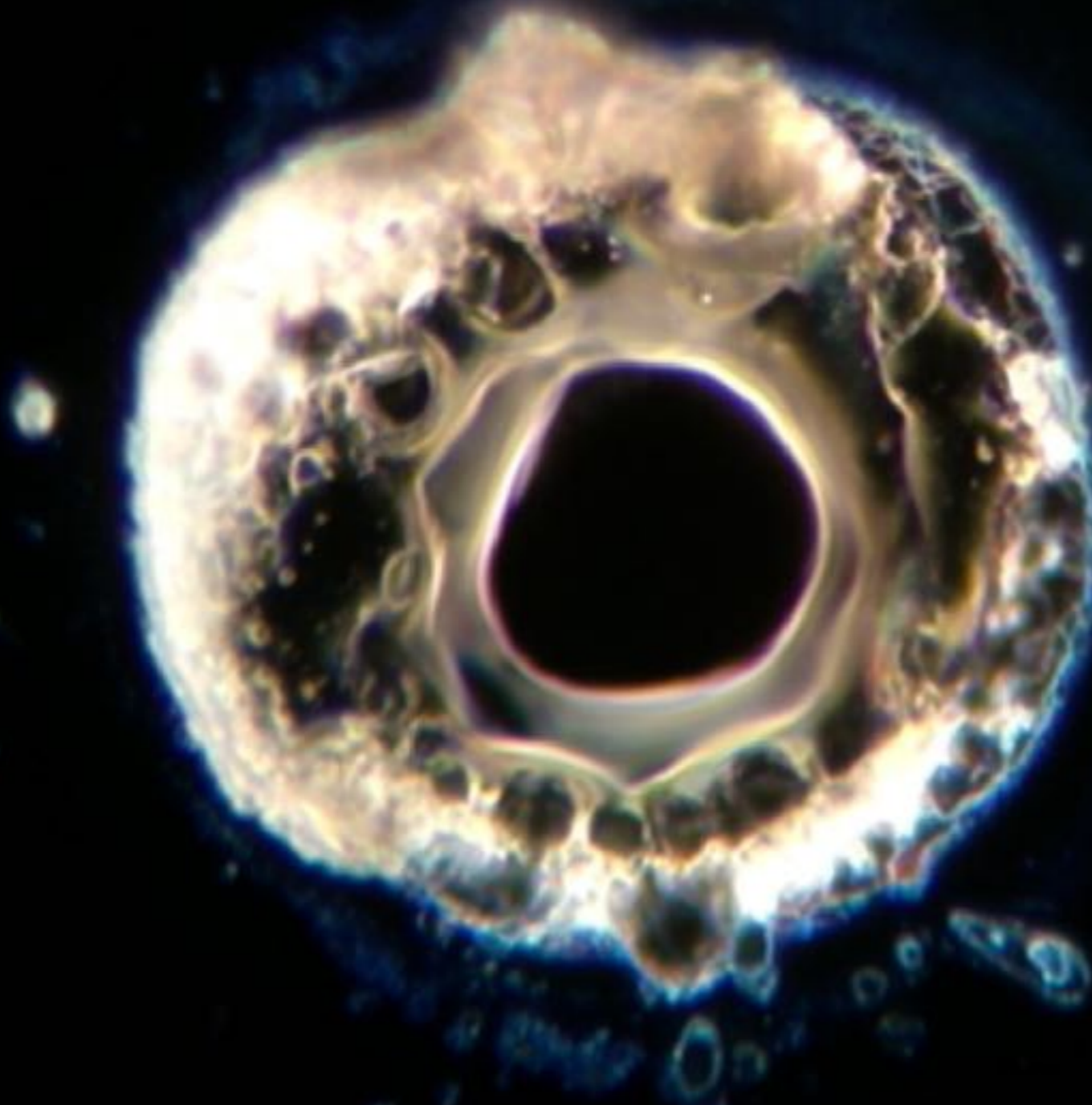
# Probe absorption with smaller beam



absorber: 155  $\mu\text{m}$  across bright center



absorber: 155  $\mu\text{m}$  across bright center



# Absorption spot seen in figure data?

- Polished and coated data 60 mm mask (orange circle)  
0.06 nm rms polished, PV 0.49 nm  
0.08 nm rms coated, PV 1.06 nm - 1 pixel = 400  $\mu\text{m}$
- Interesting point #1 is in a similar, though not exact location to the point seen low right.

