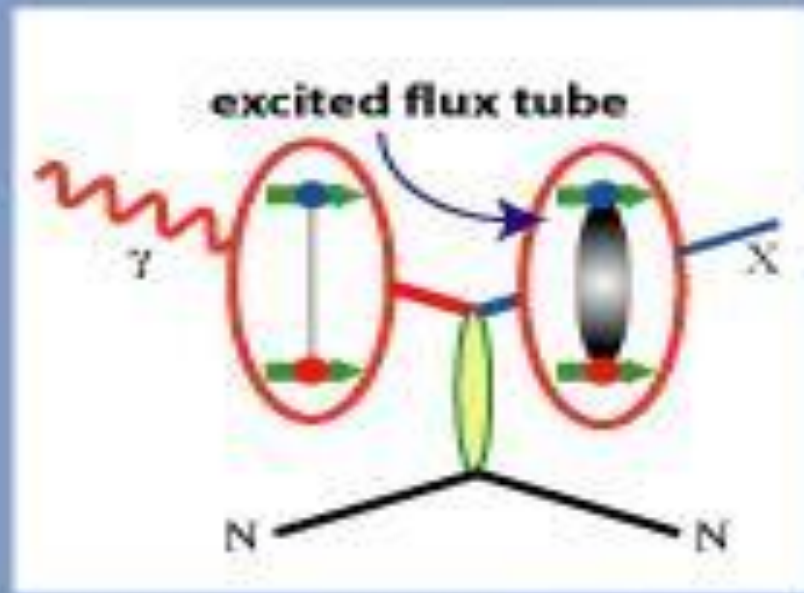


DIAMOND RADIATOR DEVELOPMENT FOR THE GLUOX EXPERIMENT

Brendan Pratt
University of Connecticut
HUGS 2015

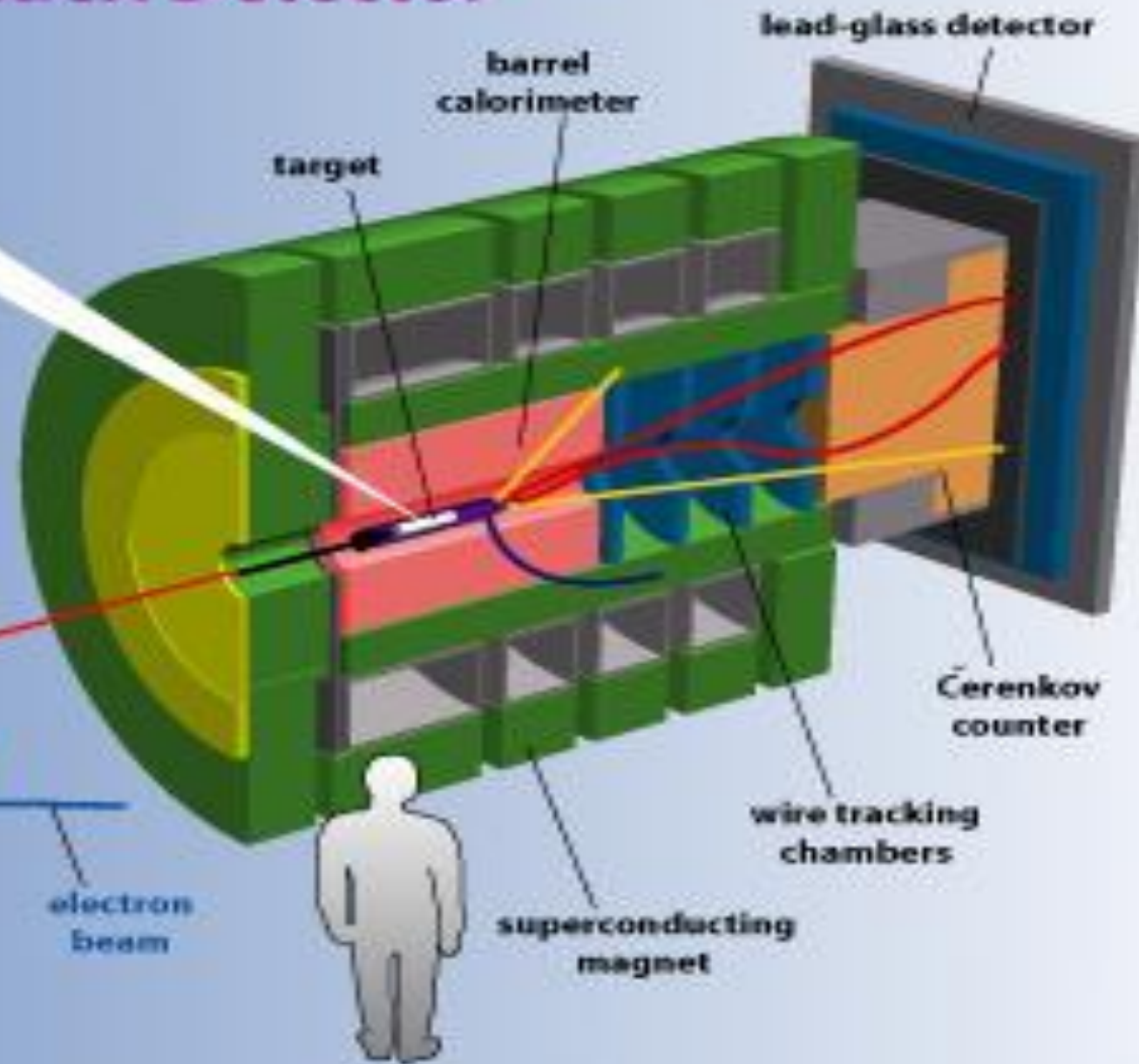
GlueX Detector



electron-diversion magnet

photon beam

electron beam



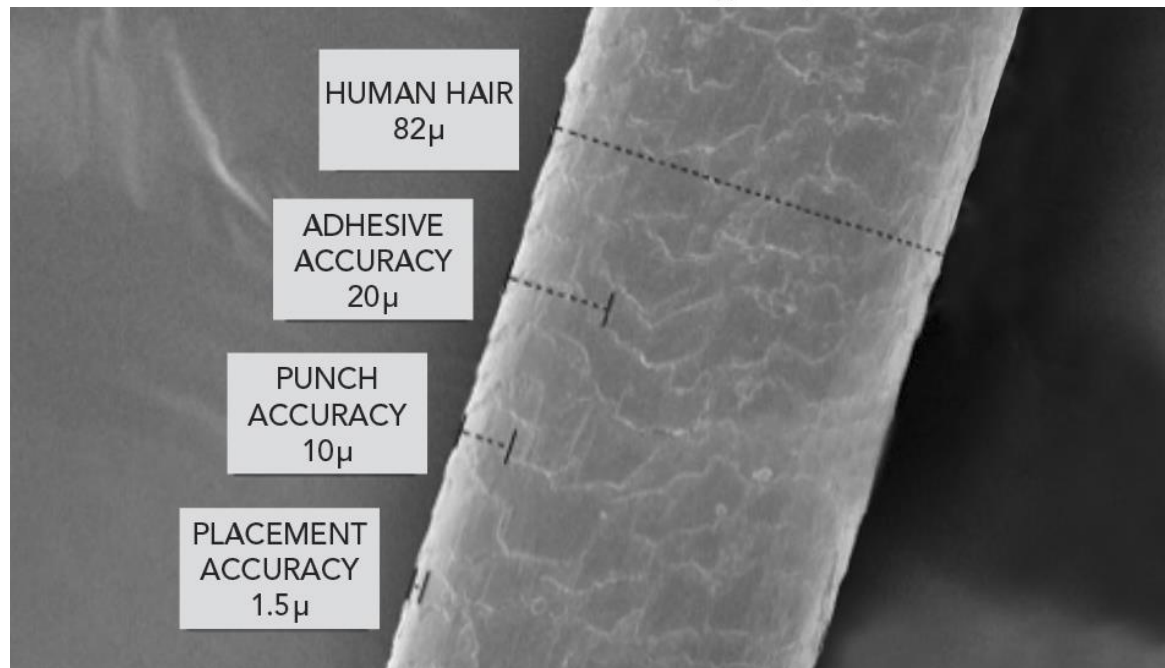
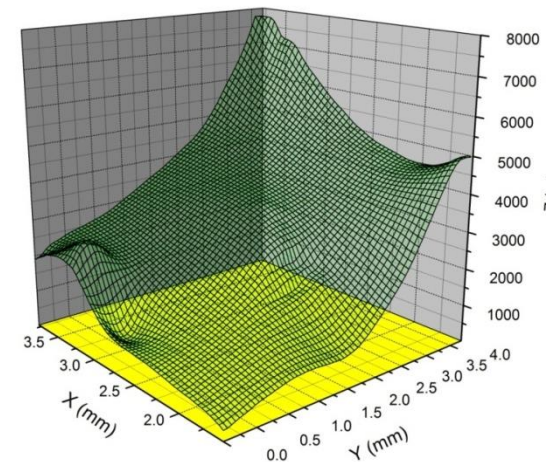
THIN AND FLAT DIAMONDS

Radiators restricted to 20 μ m thickness due to multiple scattering

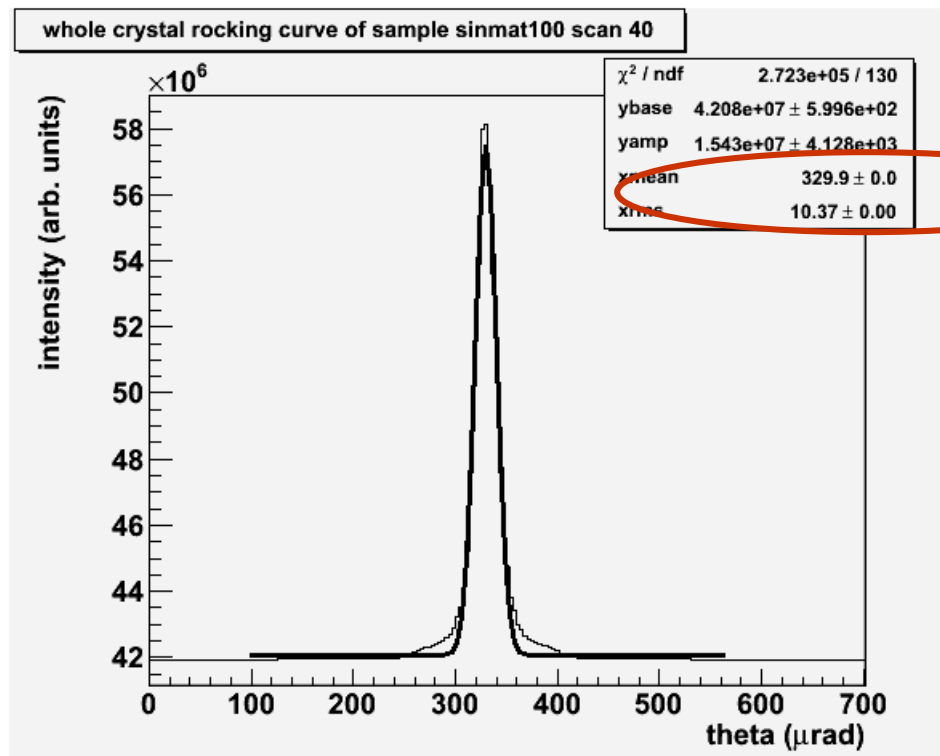
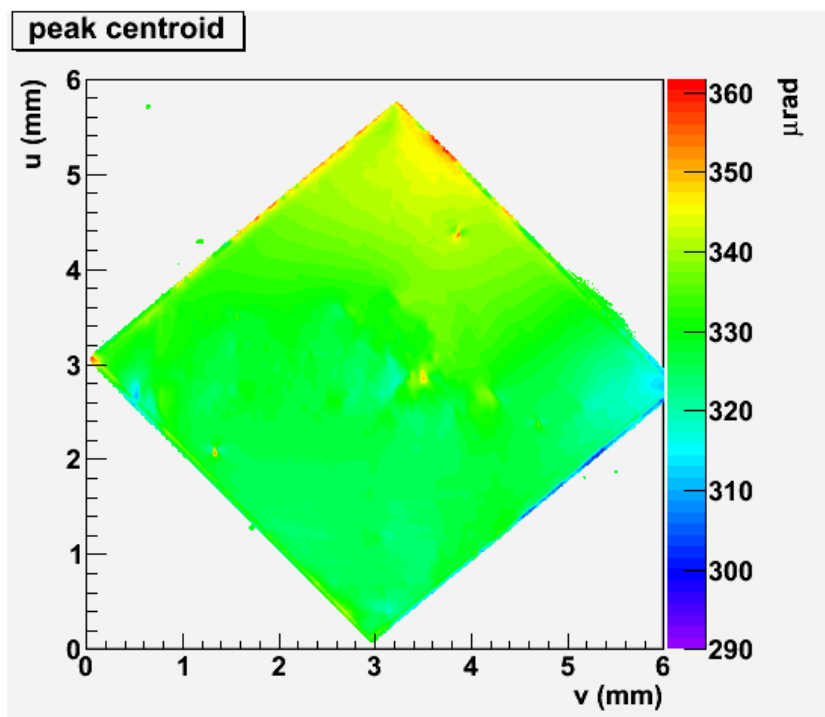
Must also have well defined crystal structure with whole crystal rocking curves less than 30 μ r

Techniques for thinning diamond exist, but they leave samples stressed and “potato chipped”

Laser ablation as a viable method for machining while keeping internal crystal structure unchanged

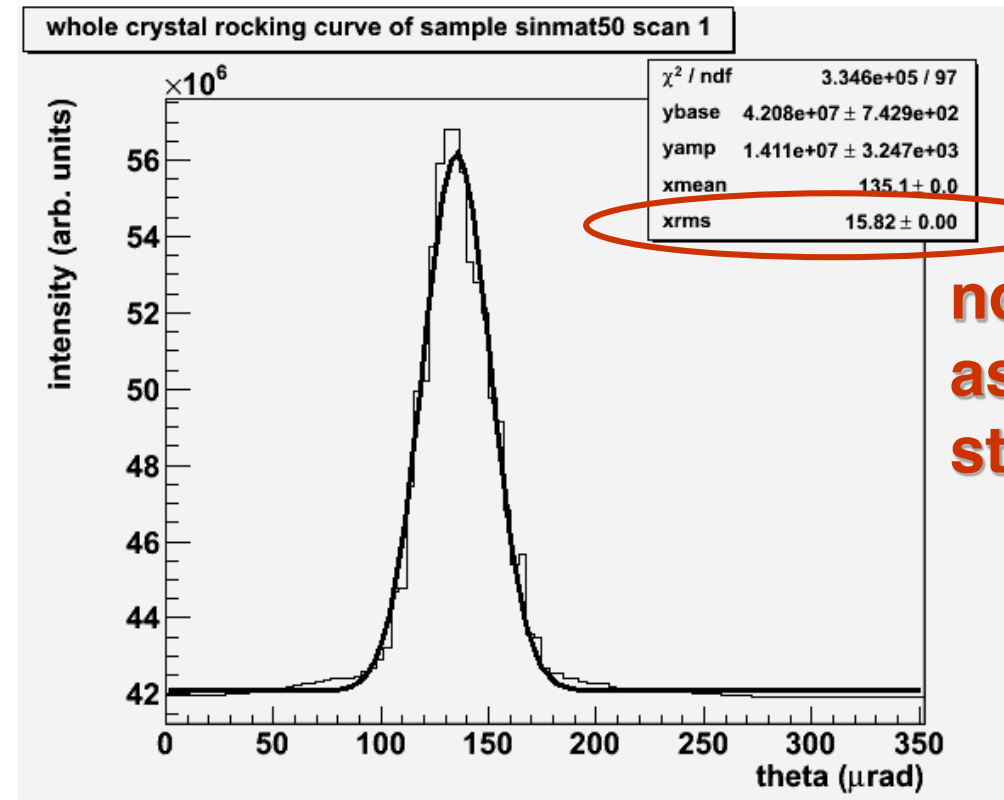
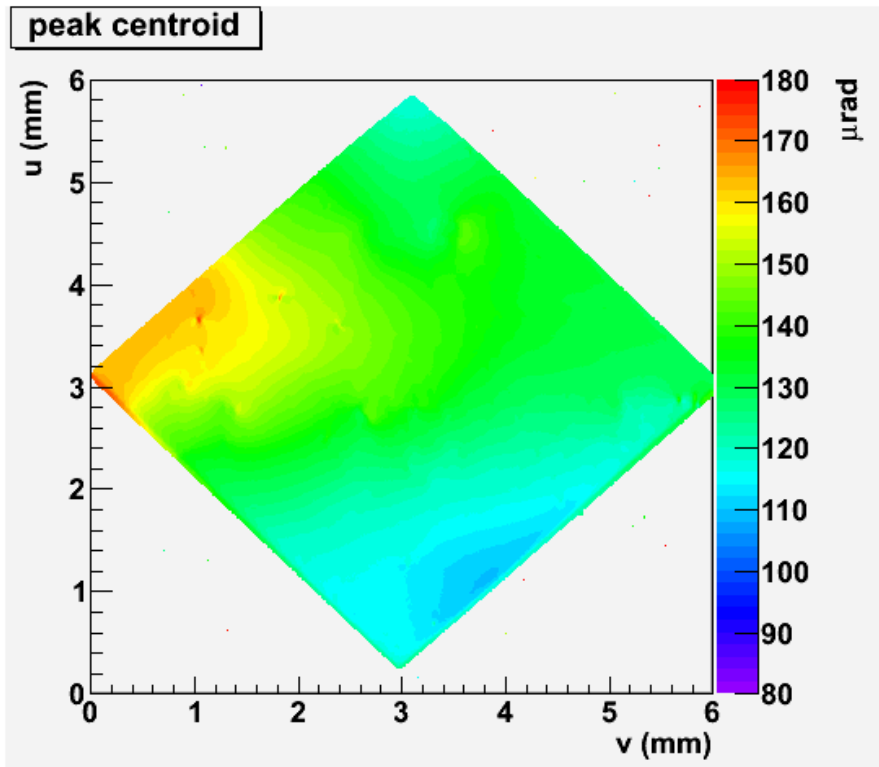


X-RAY ASSESSMENT: S150



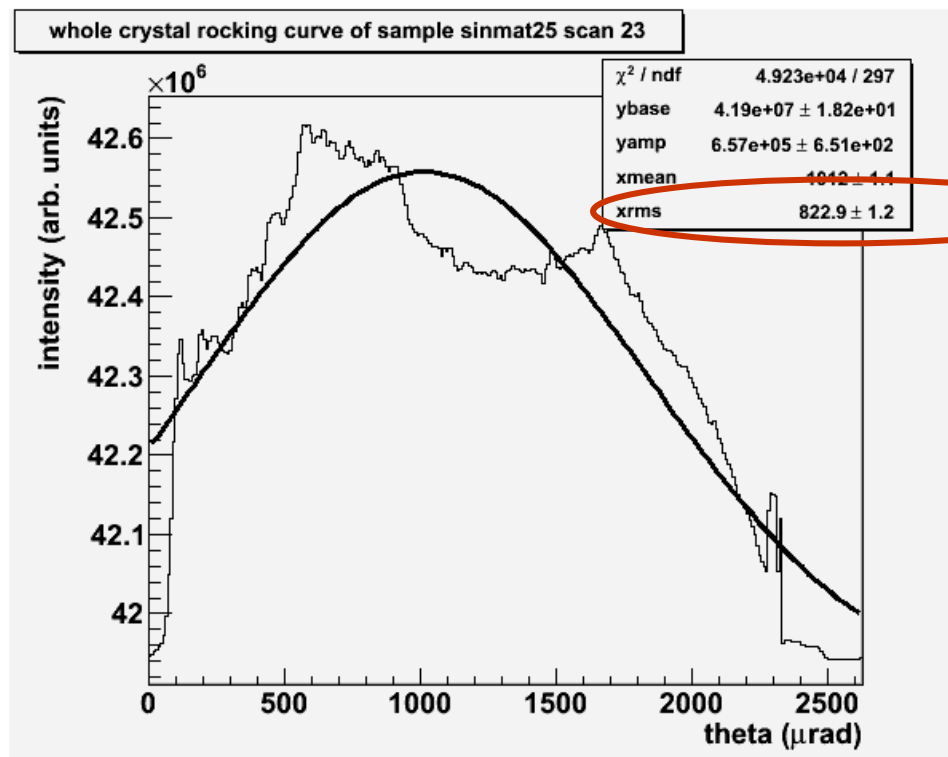
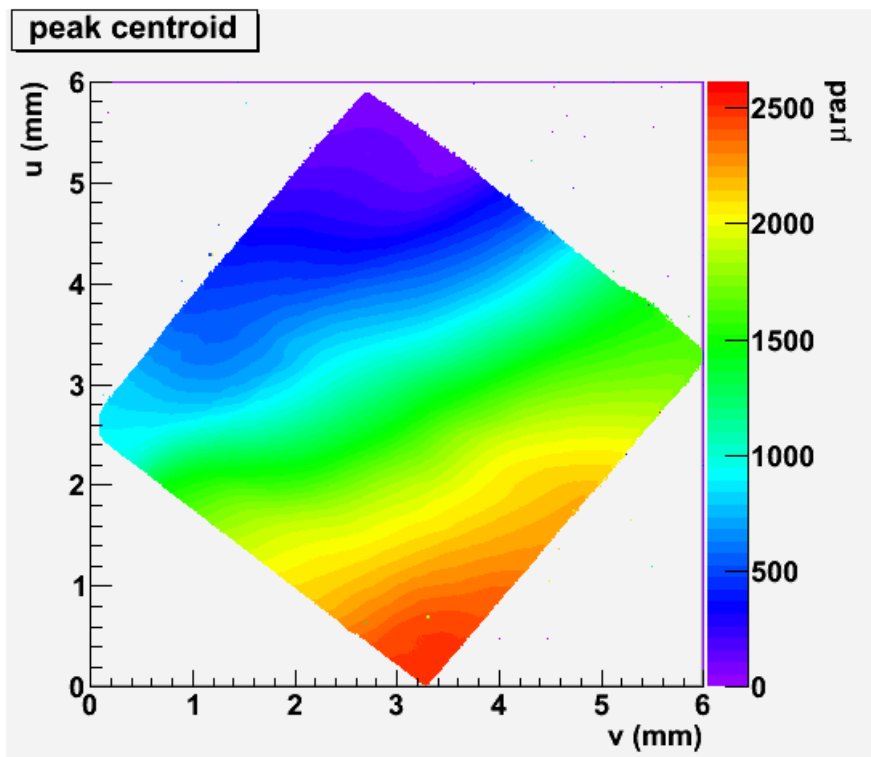
limited by
instrumental
resolution !

X-RAY ASSESSMENT: S90



**not as flat
as S150, but
still in spec.**

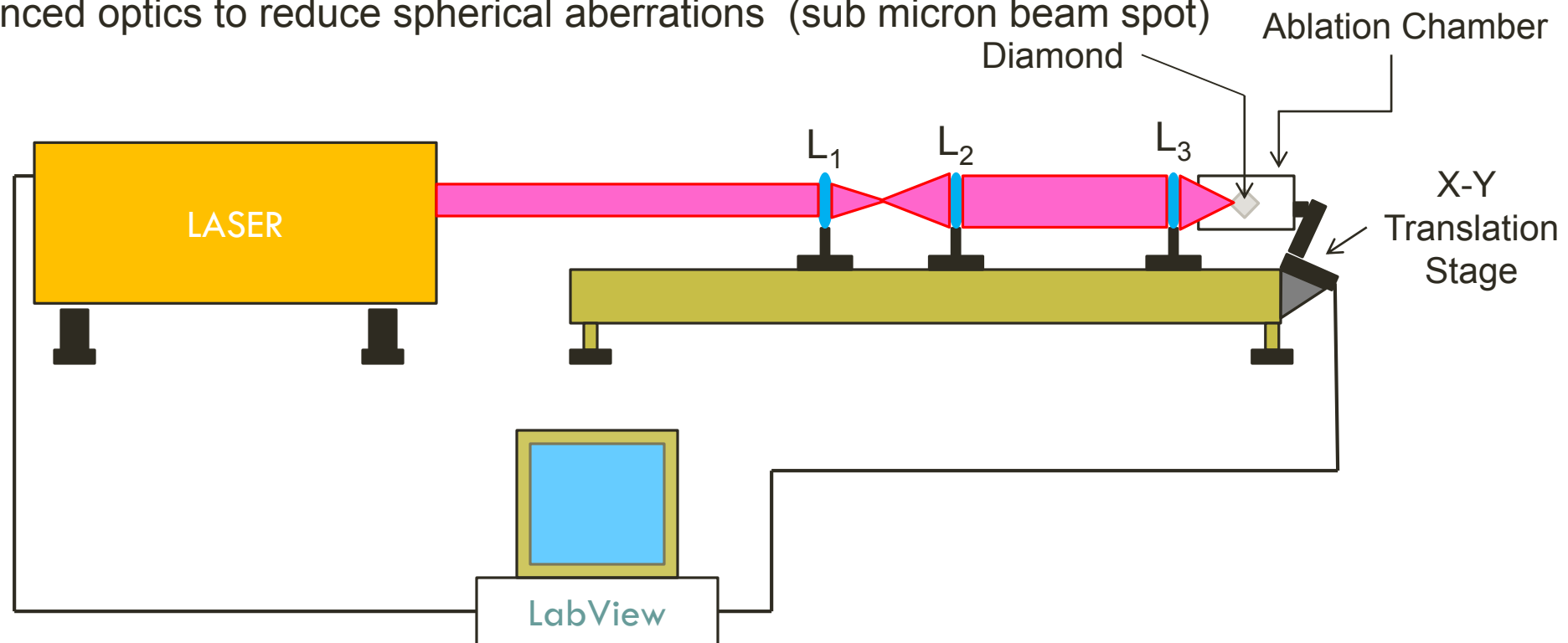
X-RAY ASSESSMENT: S30 – THE *REAL* TARGET



**challenge
lies here!**

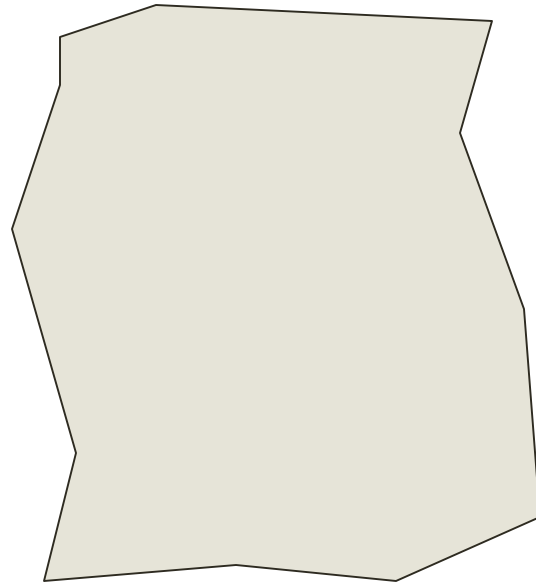
UCONN LASER ABLATION FACILITY

- CNC style XYZ translation and laser pulsing via LabView
- Ablation Chamber optimized to reduce amorphous carbon deposition on windows
- Enhanced optics to reduce spherical aberrations (sub micron beam spot)



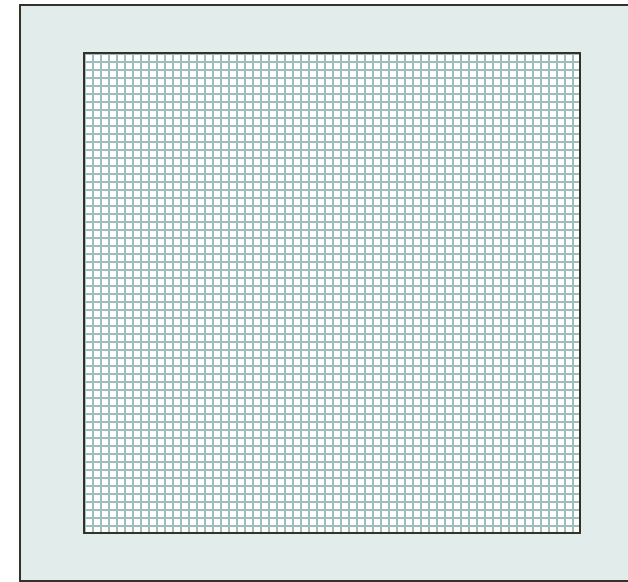
NEW IDEA TESTED IN 2012: *ADD A FRAME*

diamonds appear to warp severely when thinned to 20 microns



warping is from combination of mounting and internal stresses

try to stiffen the diamond by leaving a thick outer frame around the 20 micron region



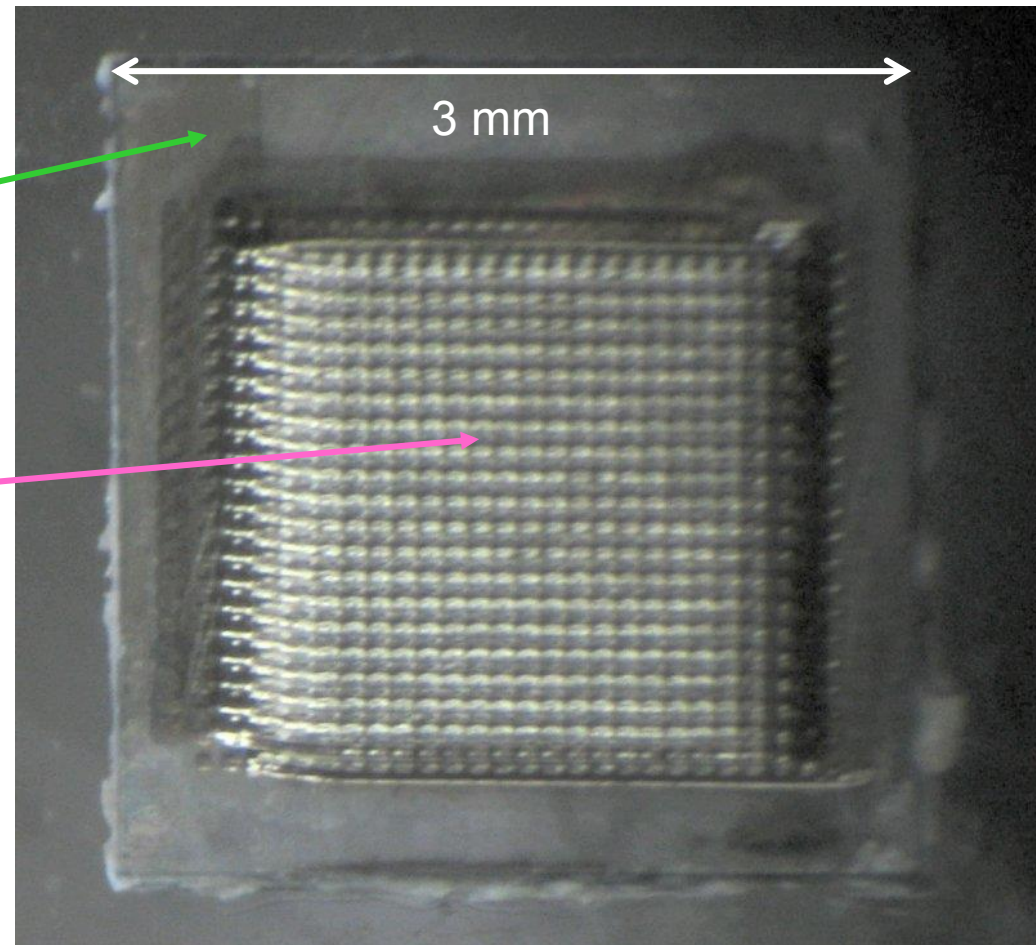
frame around 20 micron is still part of the single crystal, maintains planarity

FIRST "PICTURE FRAME" SAMPLE: U40

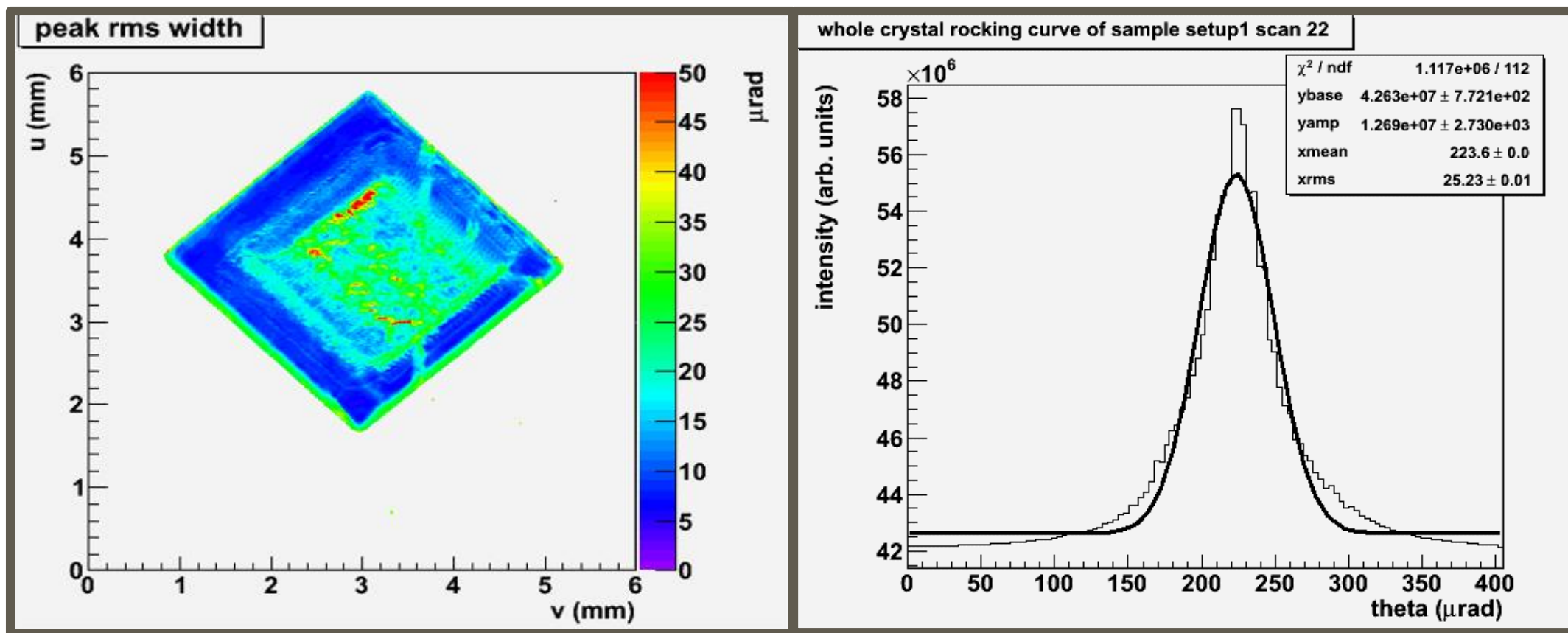
315 micron
frame around
outside edge

thinned inner
rectangular
window

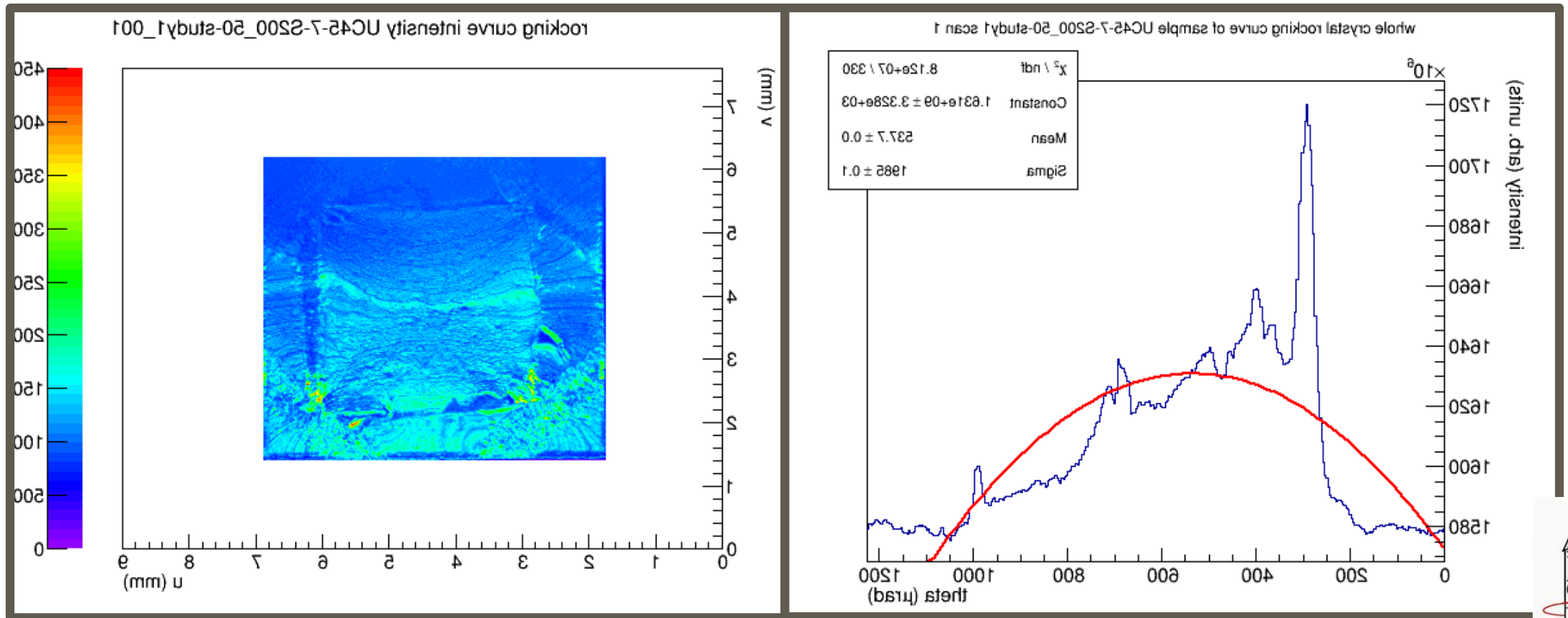
residual raster
pattern is from
a coarse laser
step size



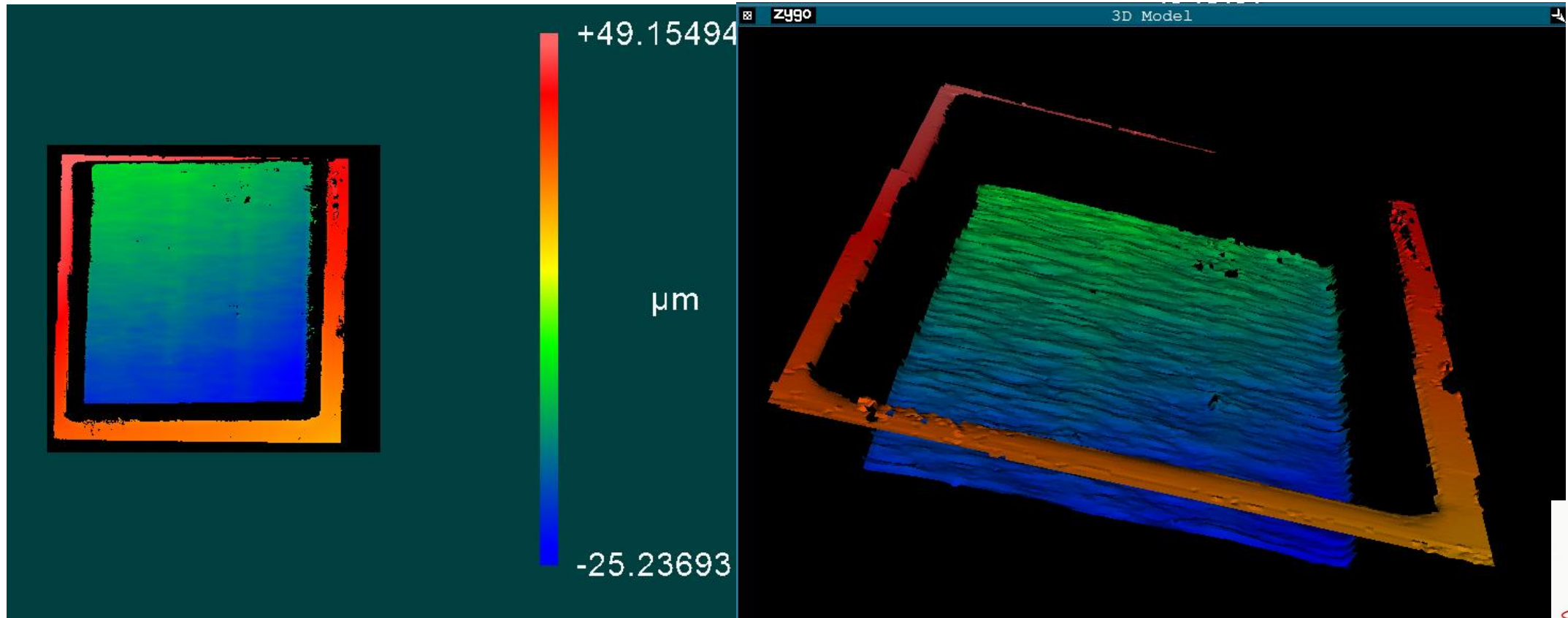
LASER ABLATION



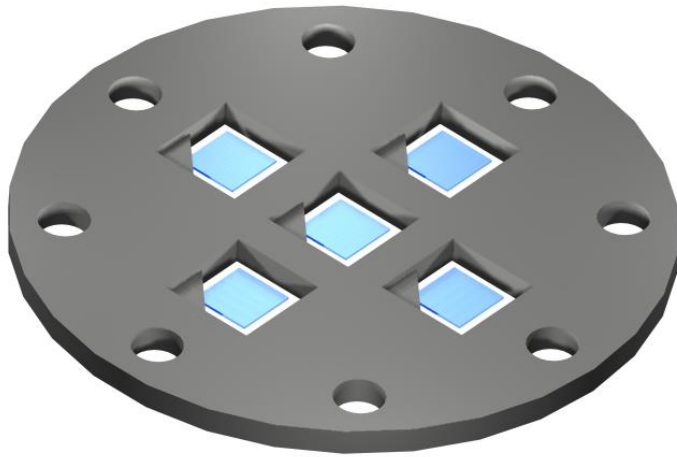
VAPOR PHASE ION ETCHING



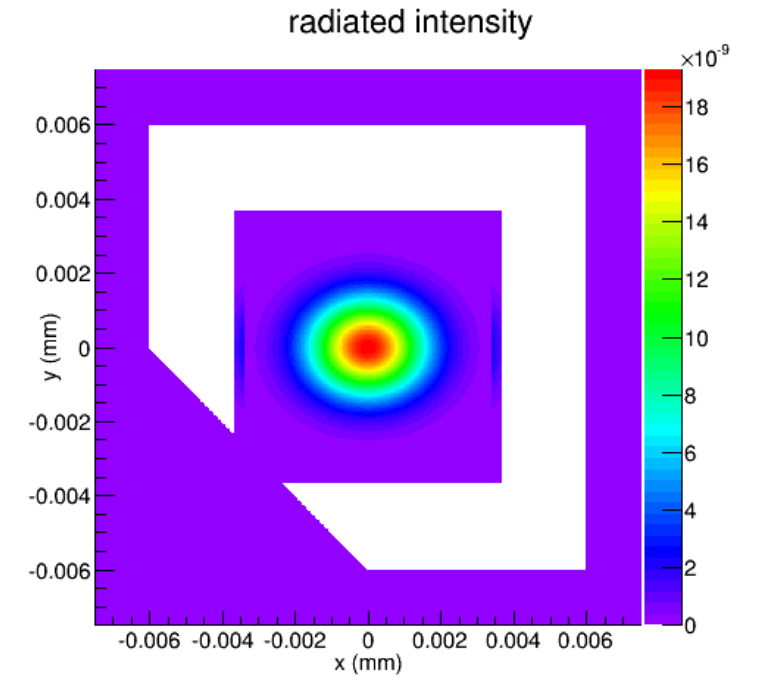
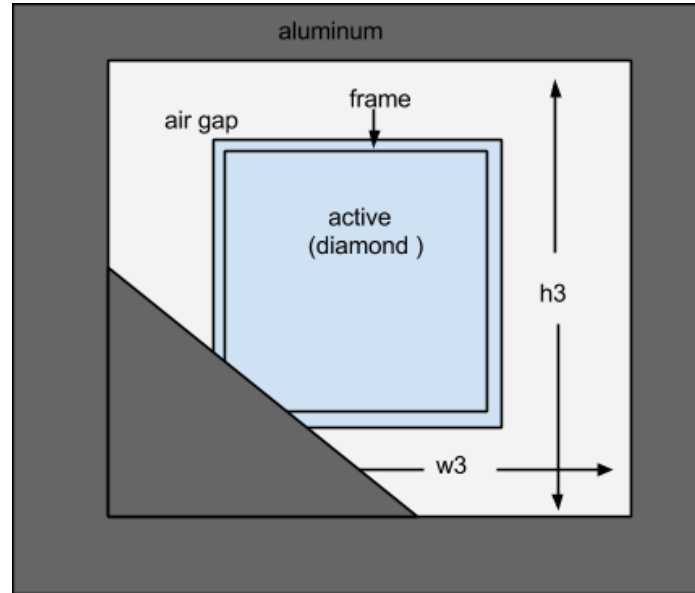
IMPROVEMENTS

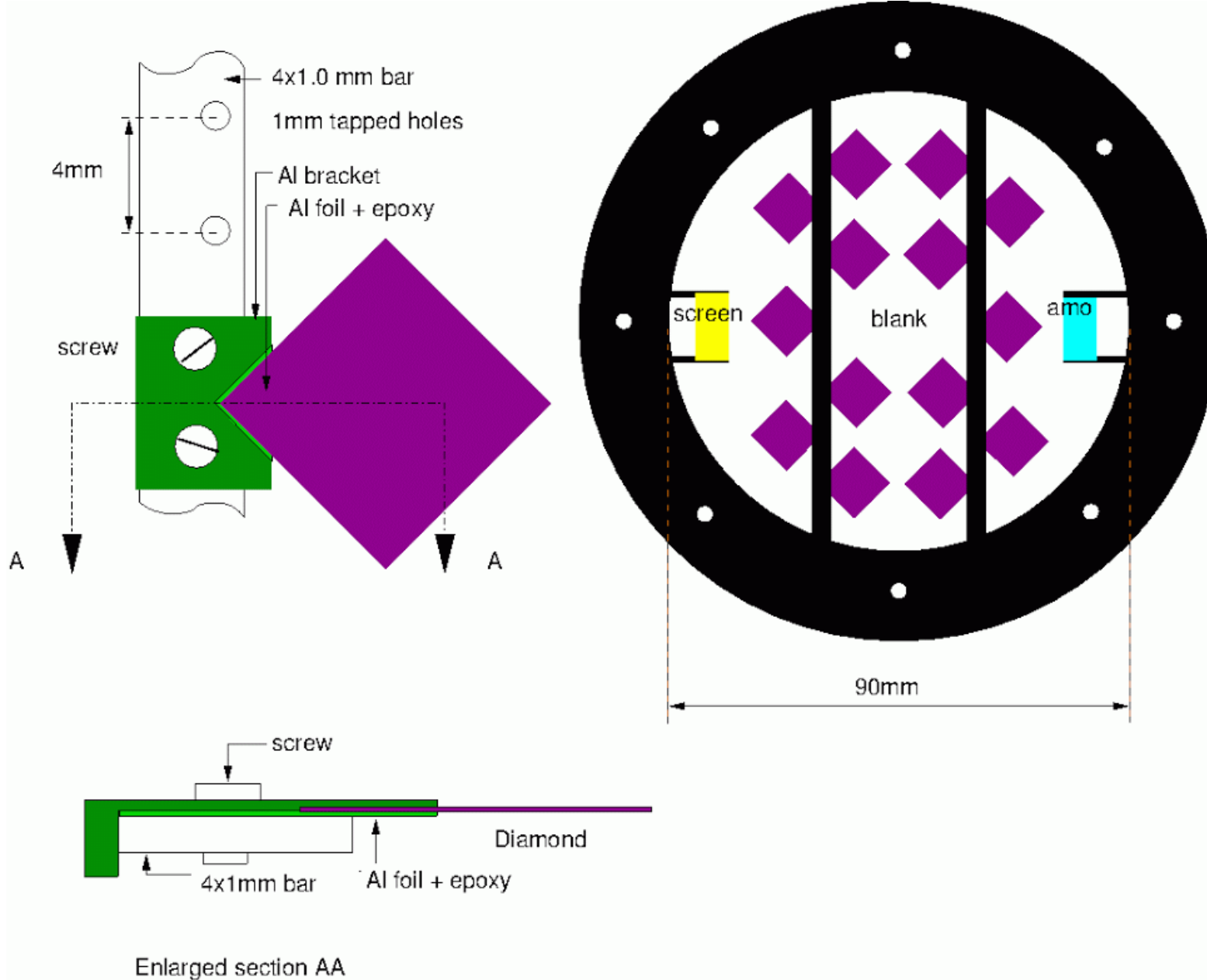


SIMULATION OF BACKGROUND GENERATION



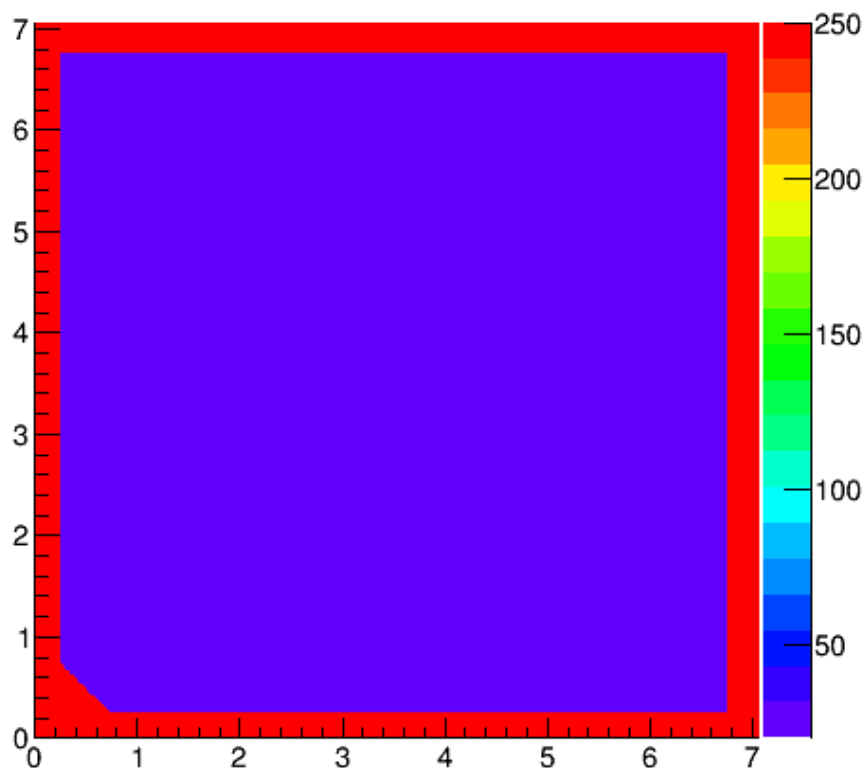
initial design concept



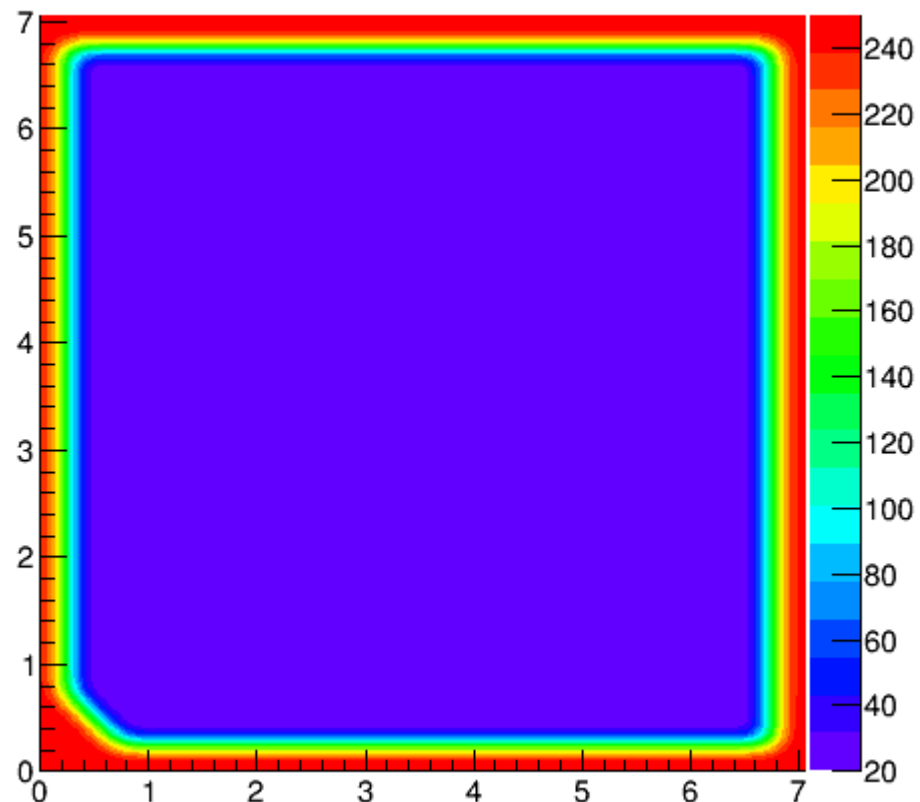


ADDITIONAL CAPABILITIES

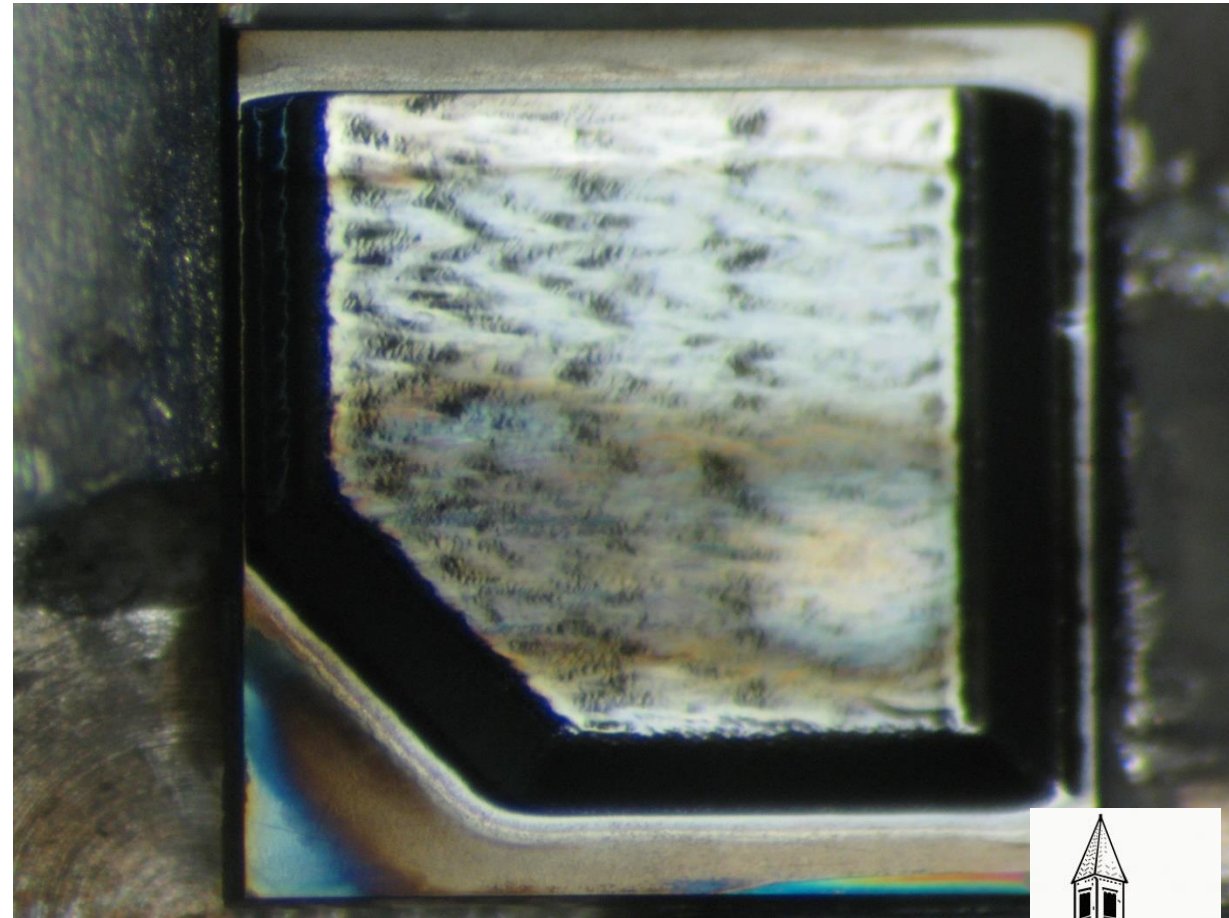
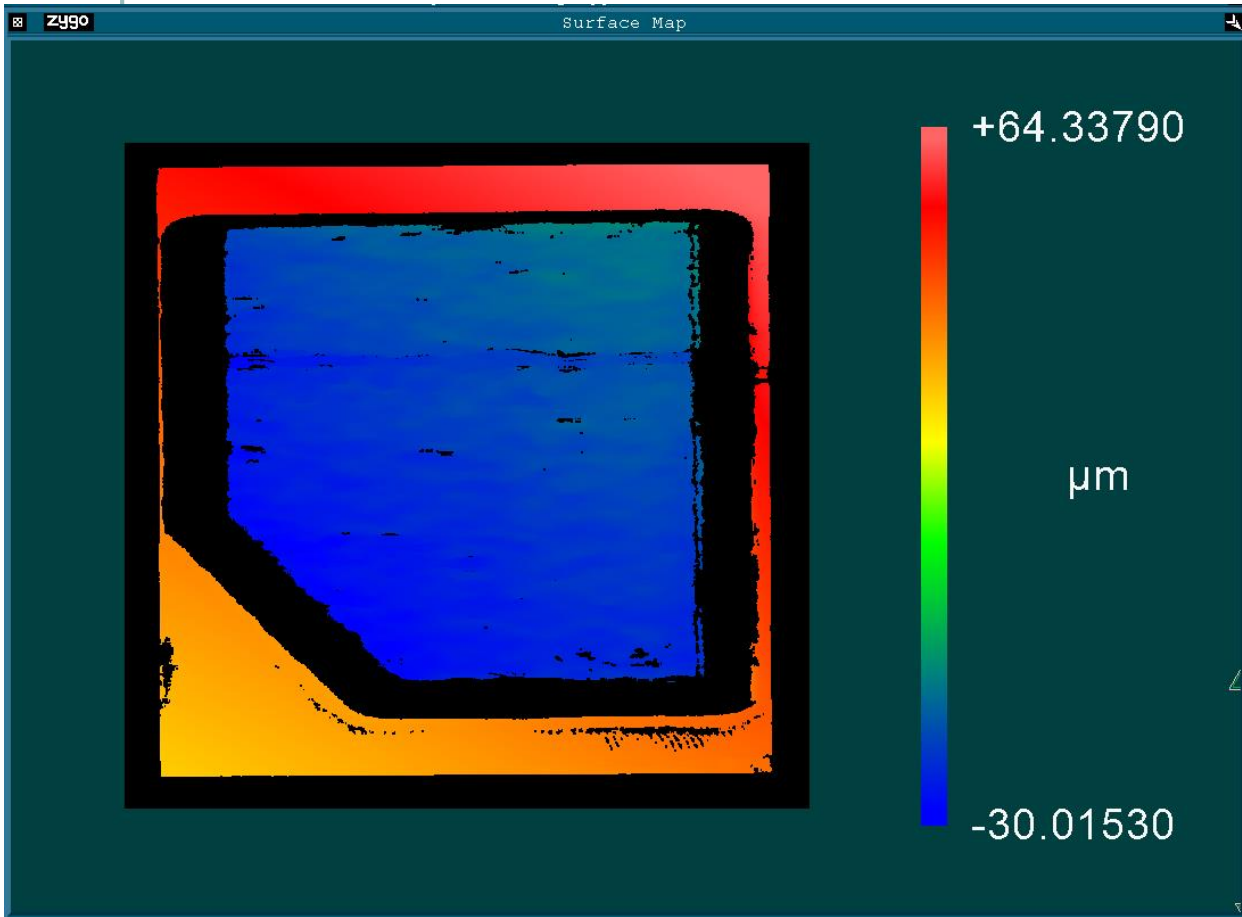
target surface



target surface



UC30-14-C225



ACKNOWLEDGEMENTS

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