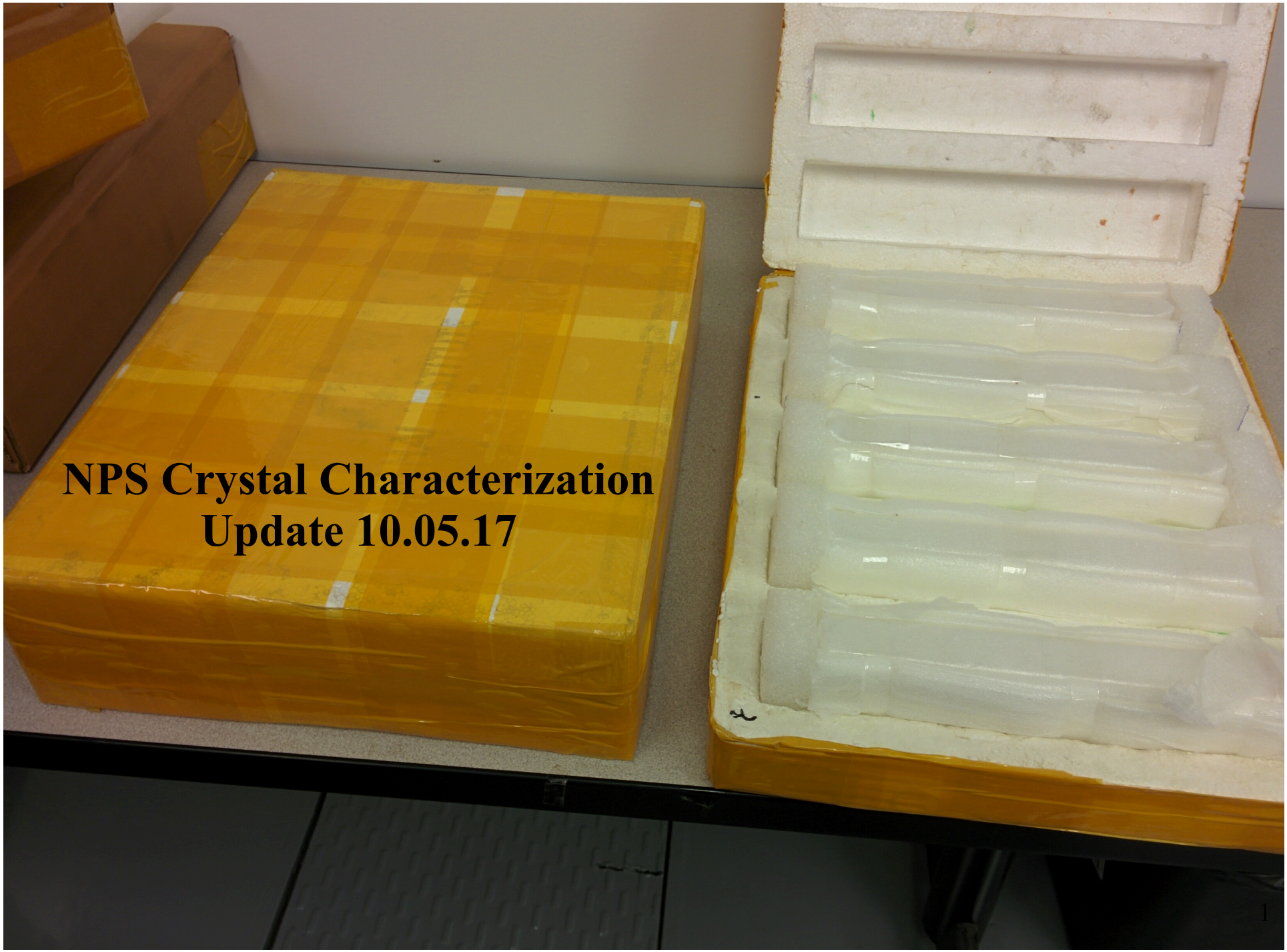
NPS Crystal Characterization Update 10.05.17



The crystals pack:

1) Crystals arrived in 16 boxes
2) Ten crystals per box
3)Two crystals packed together

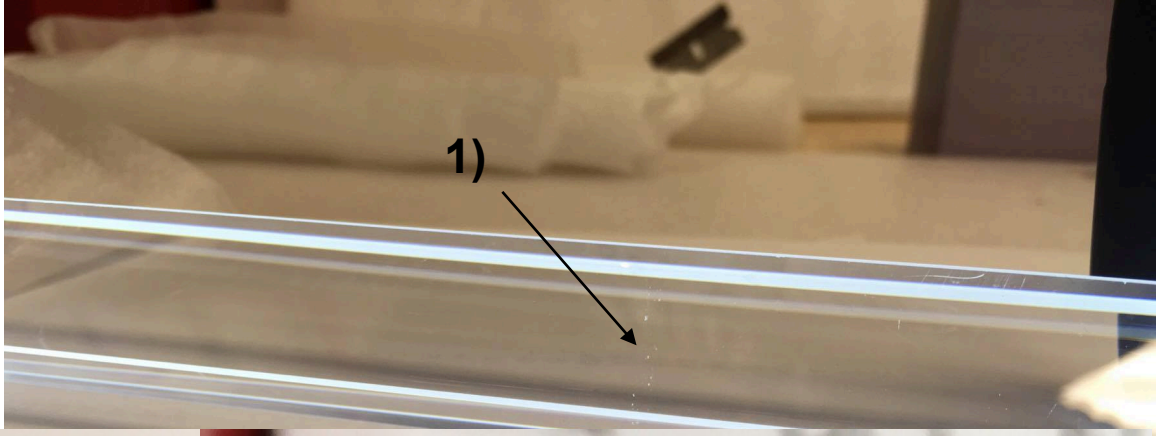
Expected dimensions :

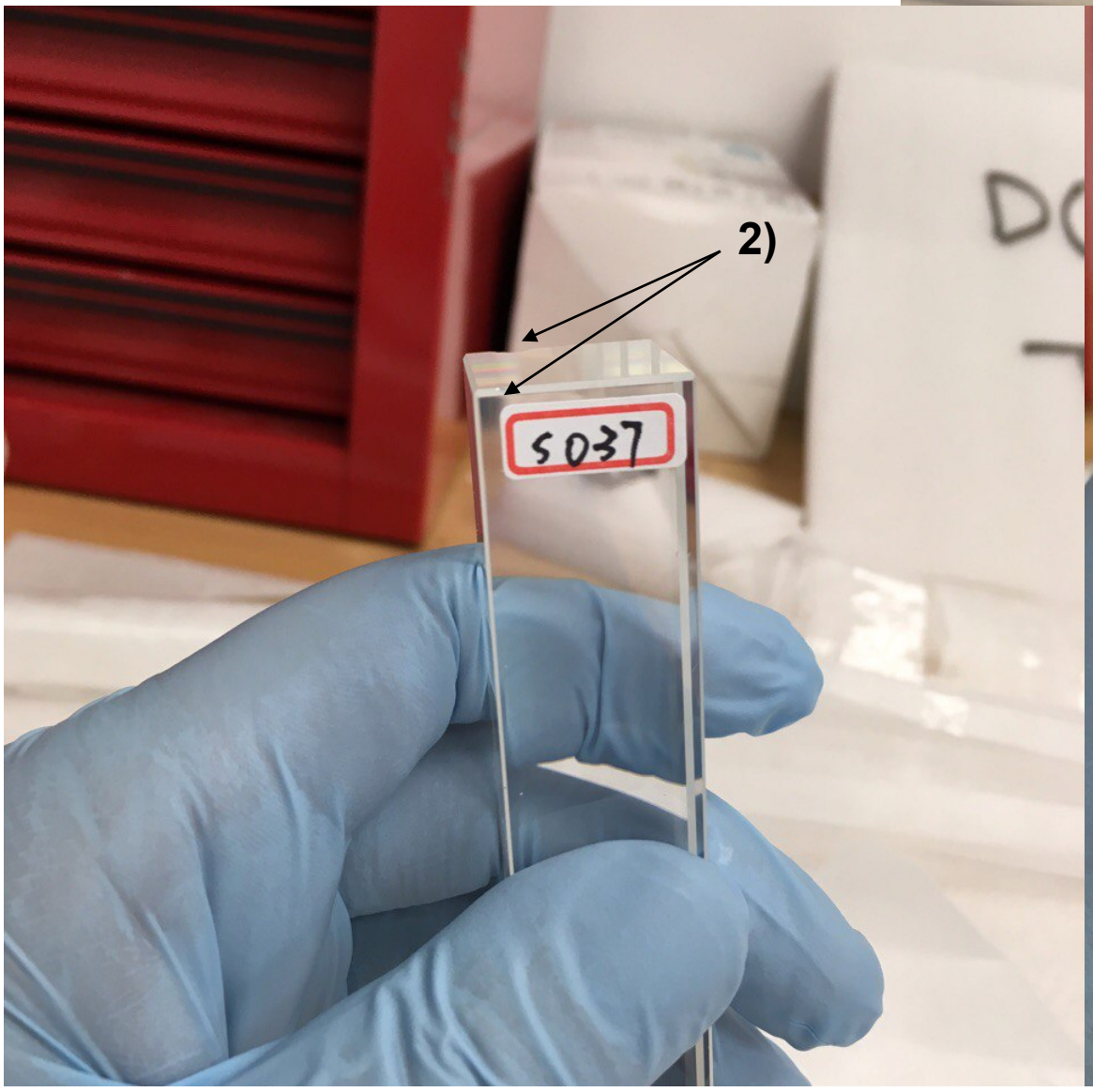
Height	20.5	±	0.05 mm
Width	20.5	±	0.05 mm
Length	200.5	±	0.05 mm

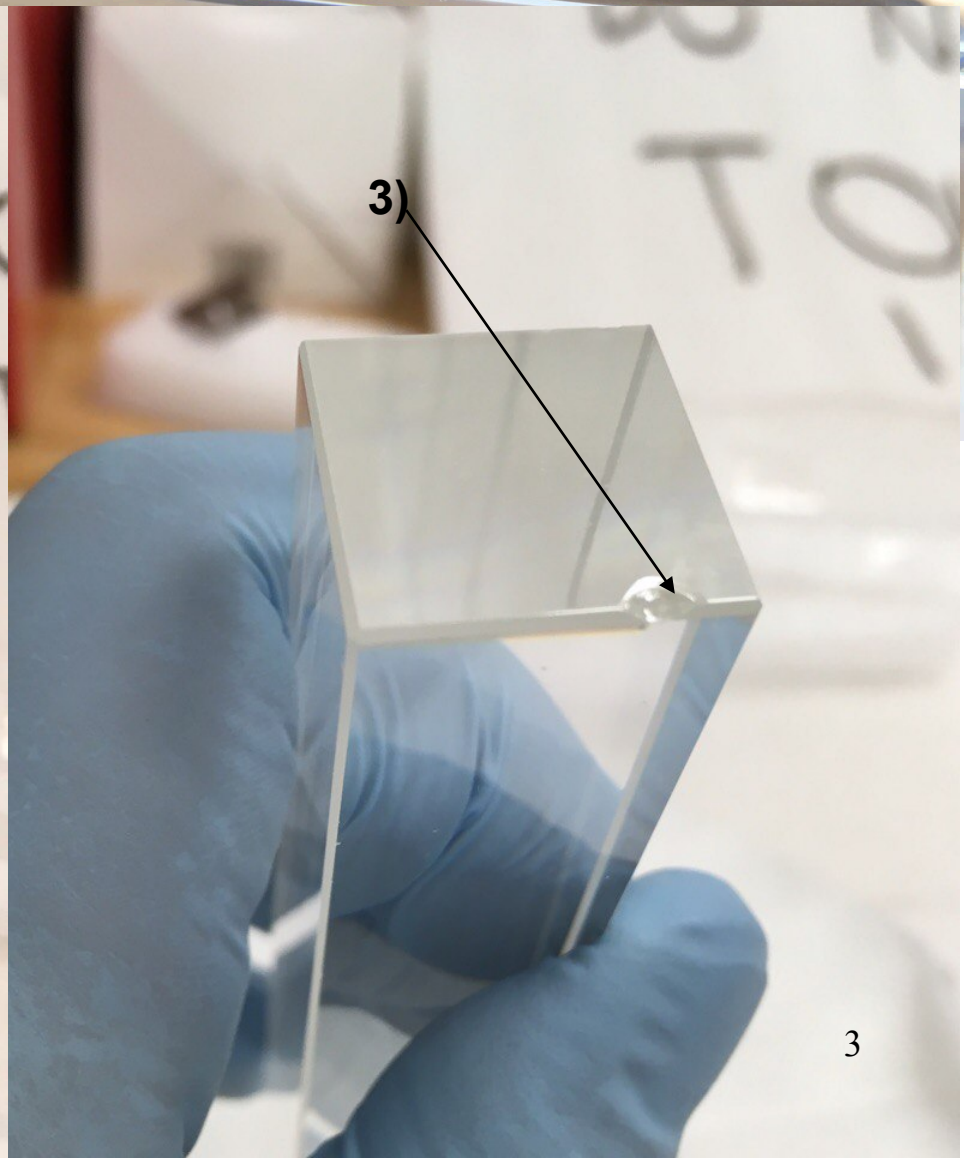
Visible defects:

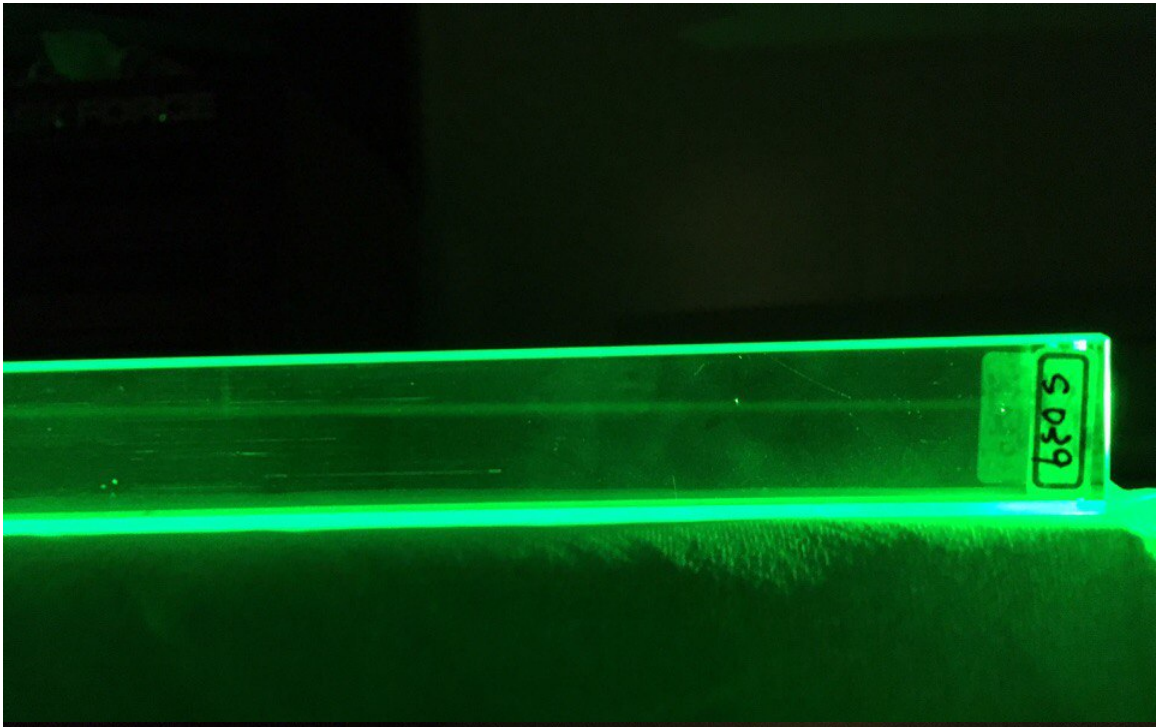
1) Small spots in the volume
2) Small cracks at the edge
3) Big crack at the edge (one crystal)
4) Minor scratches

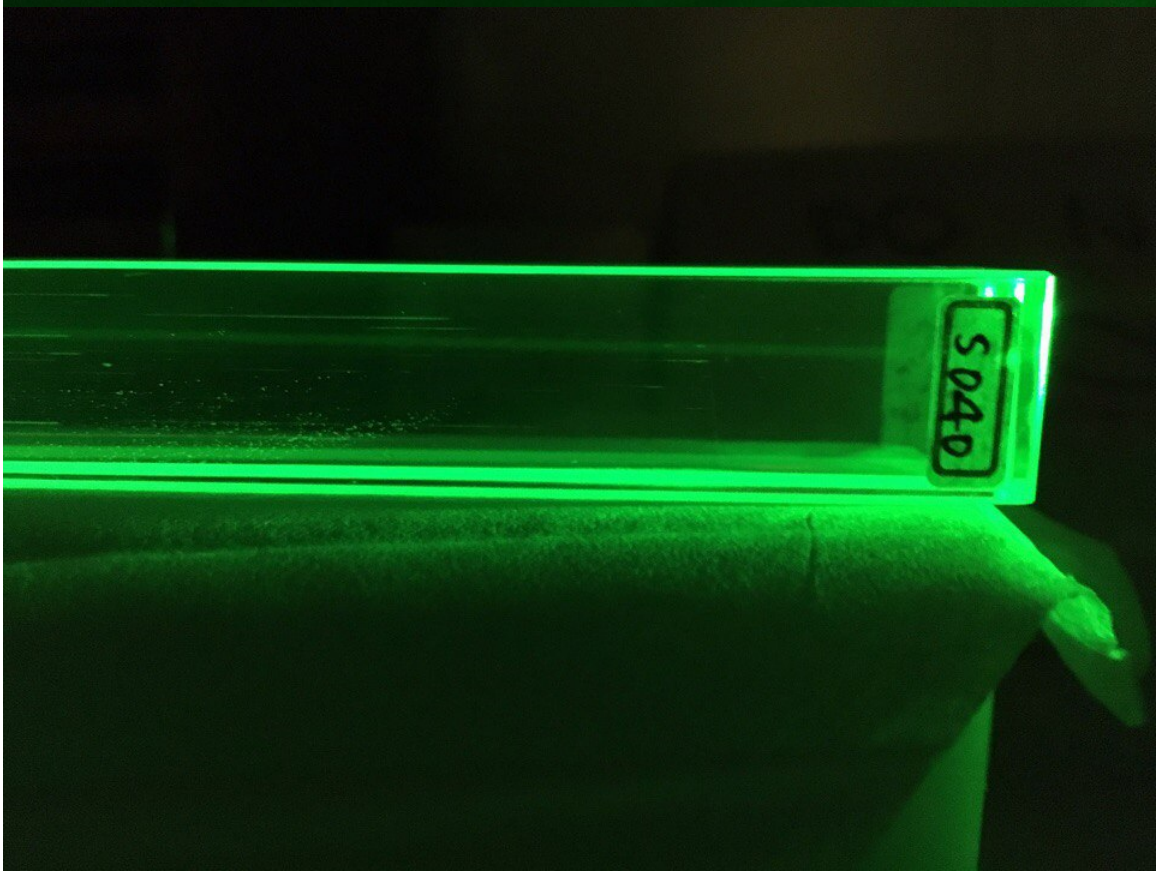
**pics made for different crystals*











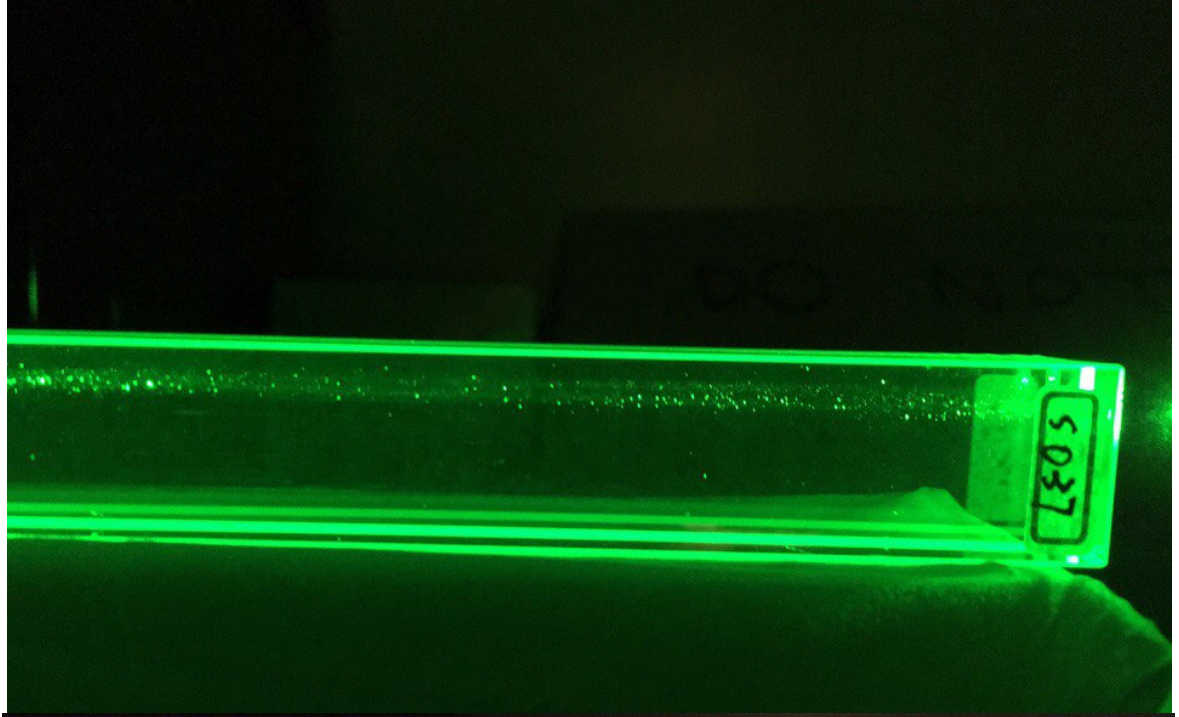
Visible defects with laser pointer

5039 No visual defects

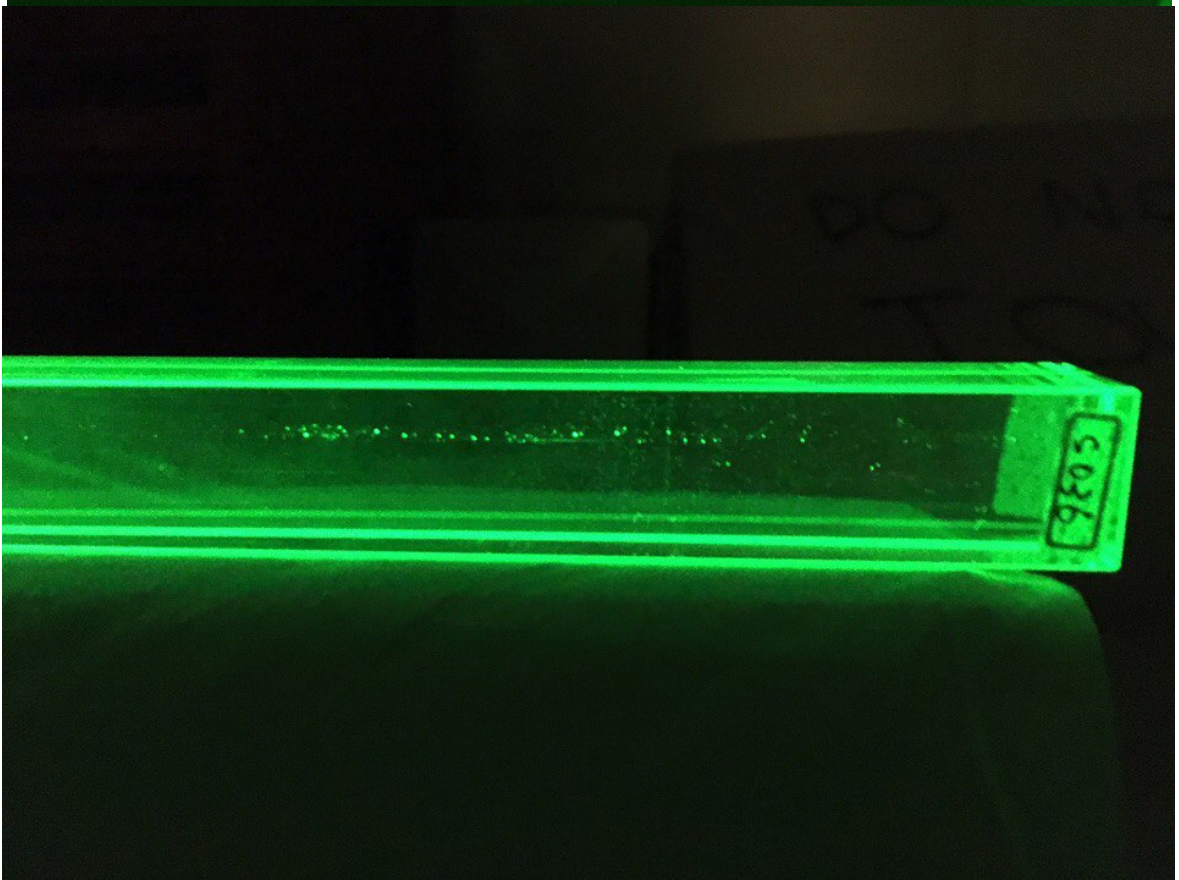
Best crystal

5040 No visual defects

Visible defects with laser pointer



5037 Dust in the volume



5036 Dust in the volume

Mechanical measurements

Characteristics:

Tools Error

A ruler (Length): 0.5mm

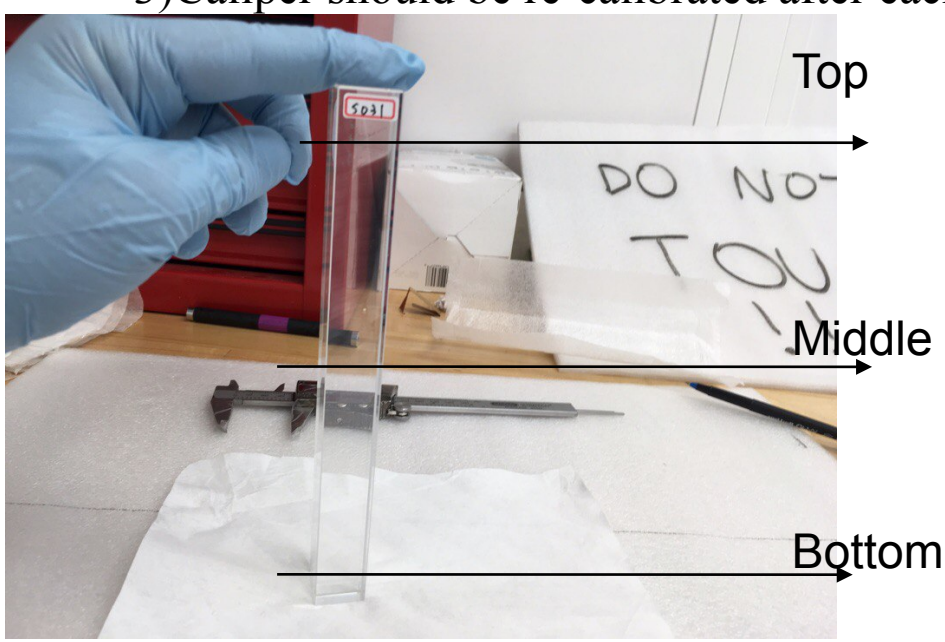
Caliper (Width and Height): 0.05mm

Measuring algorithm

1)Thin tape stuck to the caliper edges introduce additional 0.02 mm error (excluding minor damages of the crystal)

2)Two measurements per row for each dimension with the caliper

3)Caliper should be re-calibrated after each row



Notes :

- low cost

-dangerous (high probability to damage the crystal during measurements)

-takes one full business day to measure one box (8 hours for 10 crystals)

N	Label	Length	Top-1-1	Top-1-2	Top-2-1	Top-2-2	Middle-1-1	Middle-1-2	Middle-2-1	Middle-2-2	Bottom-1-1	Bottom-1-2	Bottom-2-1	Bottom-2-2
1	**5032**	200.5	20.43	20.46	20.59	20.69	20.49	20.56	20.54	20.56	20.55	20.42	20.46	20.45
2	**5031**	200.5	20.47	20.4	20.46	20.49	20.46	20.44	20.52	20.56	20.39	20.37	20.46	20.5
3	**5033**	200.5	20.53	20.52	20.57	20.51	20.57	20.57	20.56	20.55	20.52	20.53	20.51	20.53
4	**5036**	200.5	20.55	20.55	20.51	20.5	20.6	20.62	20.59	20.54	20.52	20.55	20.47	20.5
5	**5034**	200.5	20.53	20.52	20.5	20.51	20.67	20.66	20.54	20.53	20.52	20.51	20.47	20.54
6	**5035**	200.5	20.59	20.55	20.53	20.49	20.59	20.56	20.52	20.54	20.51	20.52	20.55	20.54
7	**5039**	200.5	20.67	20.65	20.66	20.61	20.59	20.53	20.56	20.53	20.52	20.55	20.52	20.51
8	**5037**	200.5	20.58	20.6	20.53	20.57	20.52	20.51	20.52	20.53	20.52	20.56	20.52	20.52
9	**5040**	200.5	20.51	20.53	20.5	20.53	20.63	20.6	20.51	20.51	20.52	20.52	20.45	20.45
10	**5038**	200.5	20.53	20.5	20.57	20.53	20.52	20.51	20.6	20.57	20.49	20.58	20.5	20.51

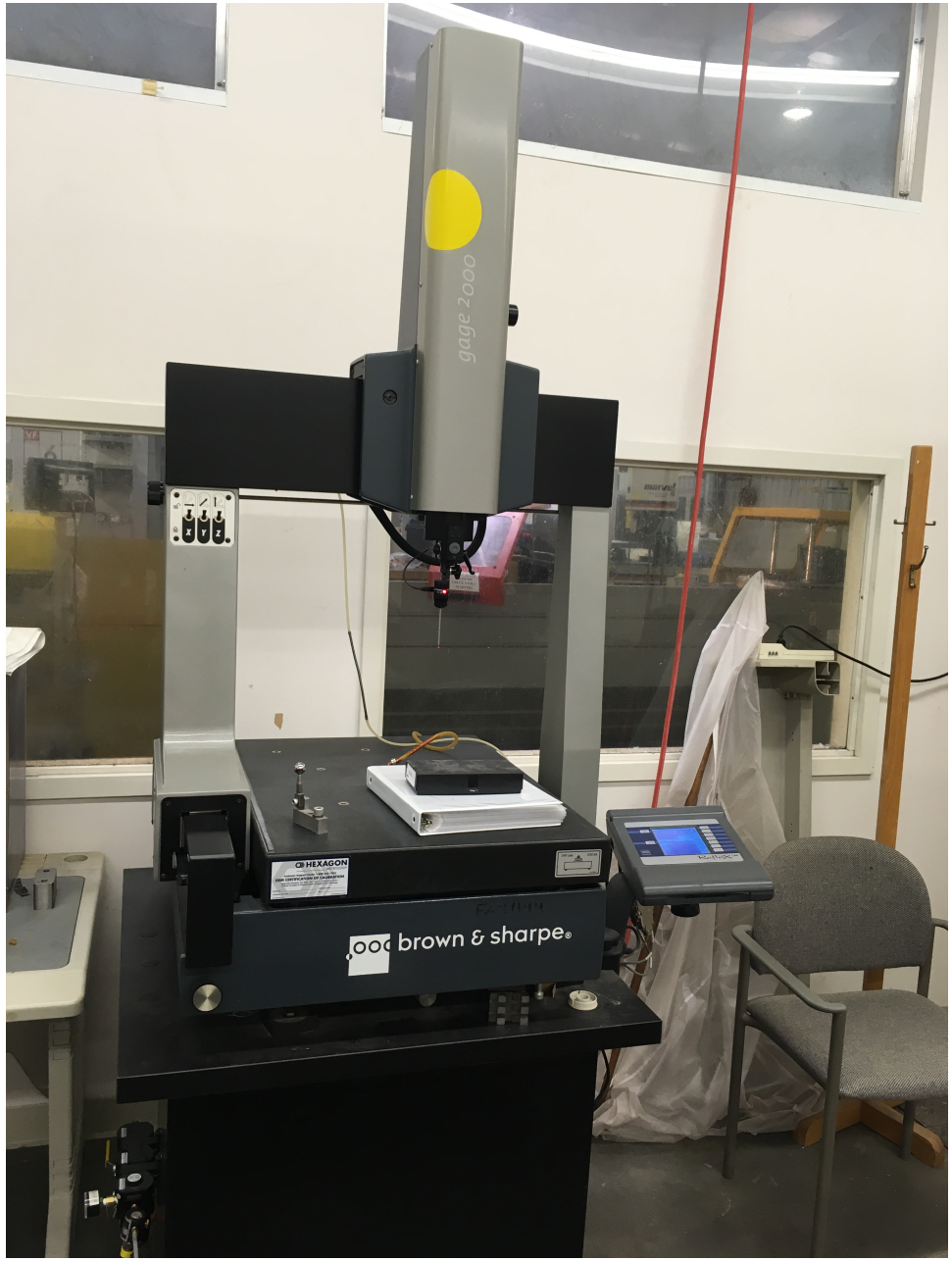
Programmable shape measuring machine

Characteristics:

-programmable
-high accuracy (few mkm)
-safe

Notes:

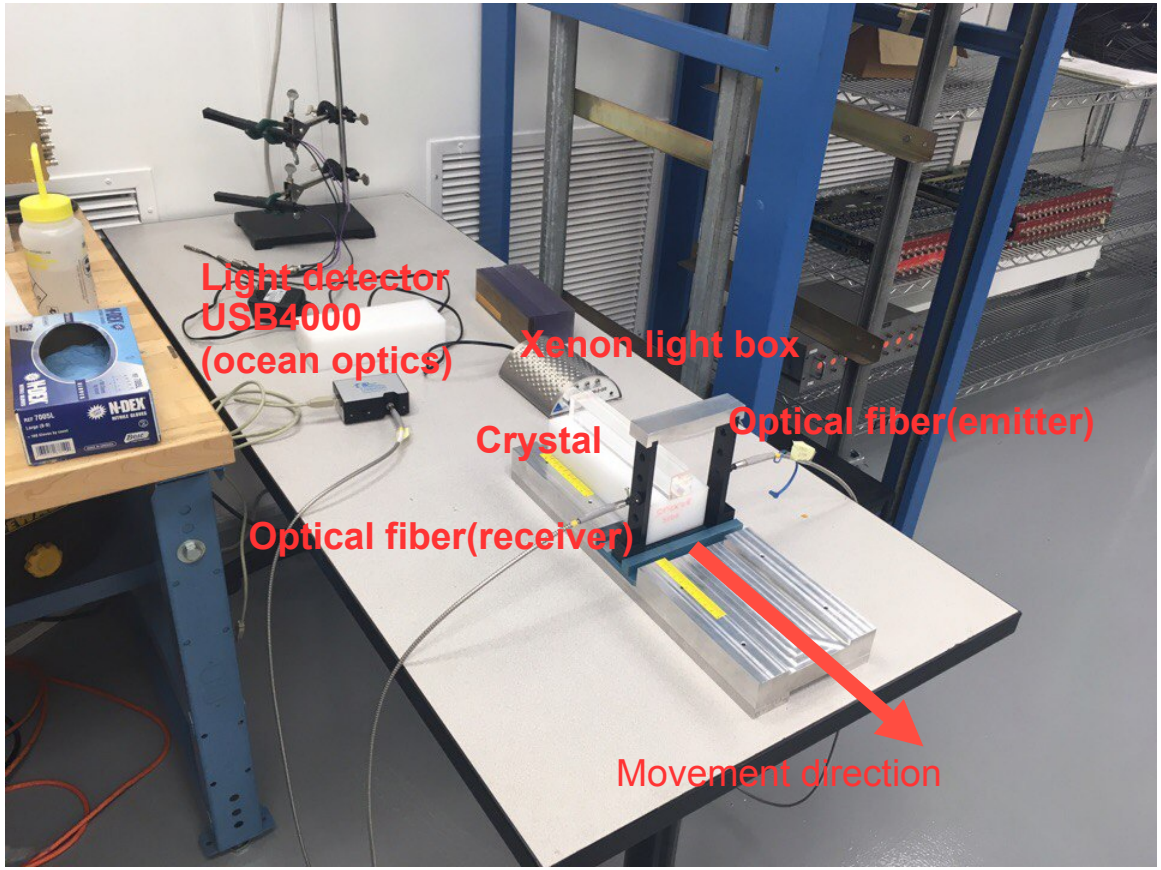
-need to schedule measurements with other JLab department (time, cost)
-can not perform measurements by ourselves



The optical system (Ocean optics) crystal dimensions measuring setup

Characteristics:

-automatic (moving platform) or
 manual (slide by hand)
-safe (less crystal movement)
-preliminary transmittance measurements
  in the same time
-easier to perform
-less time per one crystal box



Notes:

- Precision of the method depends on light detector sensitivity and light beam size.
- For the current setup with available converged and diverged lenses the beam size is 3mm and detector sensitivity is 10%.
- Estimated measuring error is **300 mkm** in best case scenario.

Laser micrometers

Characteristics:

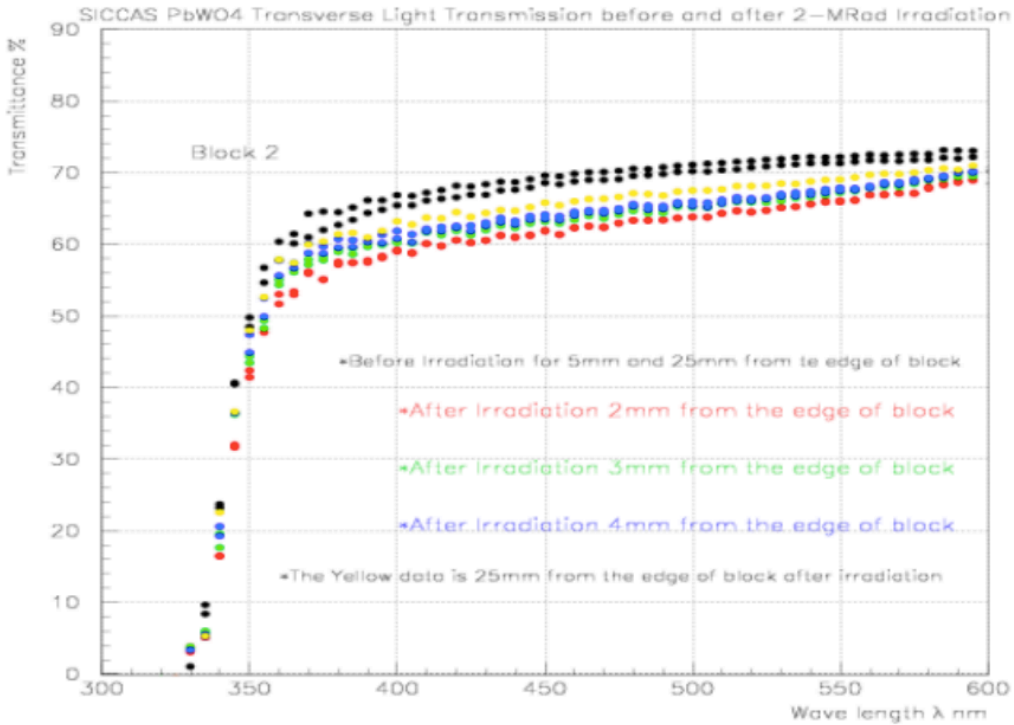
-laser tool
-safe for crystals
-very accurate (~ mkm or less error)
-measuring one or two dimensions

Notes:

-NPS crystals is 70% transparent for wave length above ~300 nm
-Possible solution is spray or glue material to surface of the crystal
-How to remove spray without crystal damage ?
-Additional time for spraying, gluing

STANDARD MODEL	
Model	LS-9030D
Measurable target	ø0.3 mm to ø30 mm ø0.01" to ø1.18"
Smallest detectable object	0.3 mm 0.01"
Measurement accuracy	±2 µm ±0.08 Mil
Repeatability	±0.1 µm ±0.04 Mil
Sampling cycle	16000 samples/sec.

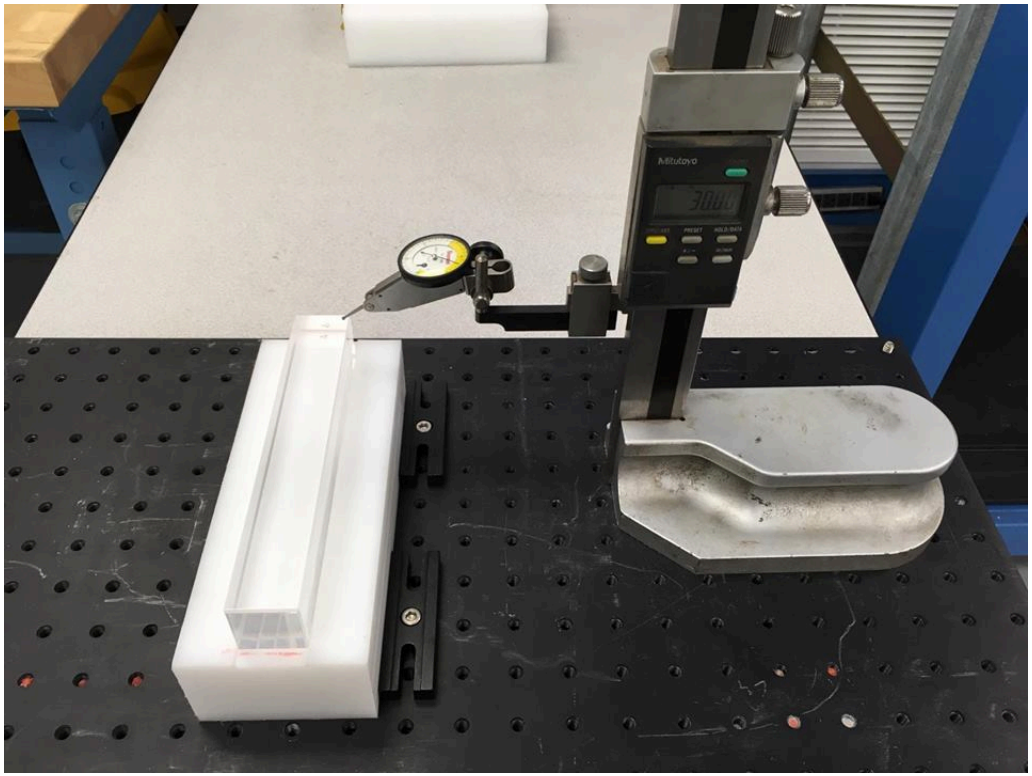
SMALL DIAMETER MODEL	
Model	LS-9006D
Measurable target	ø0.04 mm to ø6 mm ø0.001" to ø0.24"
Smallest detectable object	0.04 mm 0.001"
Measurement accuracy	±0.5 µm ±0.02 Mil
Repeatability	±0.03 µm ±0.012 Mil
Sampling cycle	16000 samples/sec.



192-671-10 Mitutoyo Digital Height Gage 18”

Characteristics:

-can measure all crystal dimensions
(450 mm measuring rage)
-safe
-0.01mm or 0.005mm Switchable Resolution
-rigid construction ensures repeatable measurement
-coarse / fine feed switching.
-SPC Output



Notes:

-Works with Optional Touch Probe (Bi-directional touch-signal prove is an optional accessory. It can quickly and accurately measure steps, inside width, and outside width)
-Exactly what we need