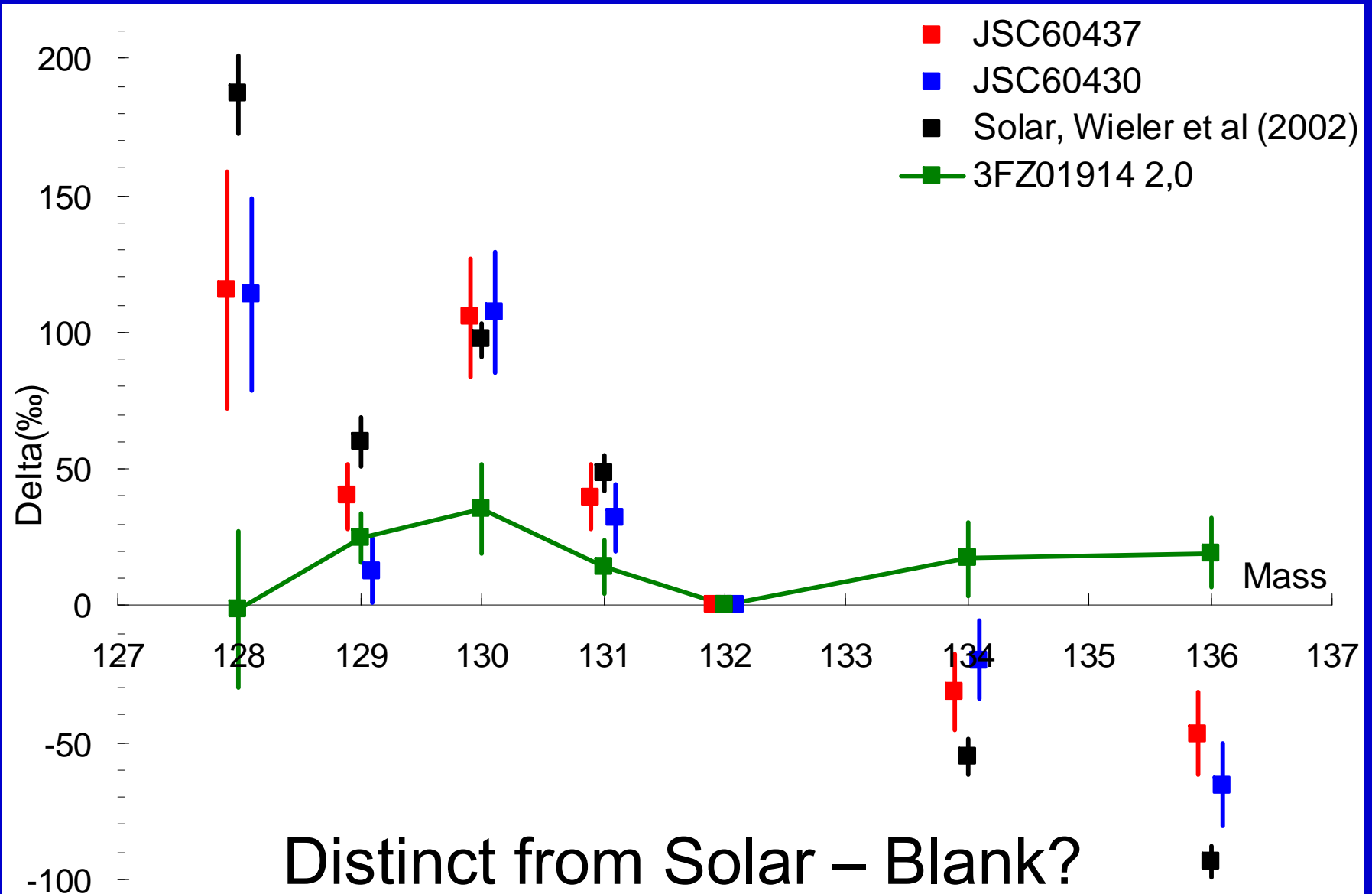


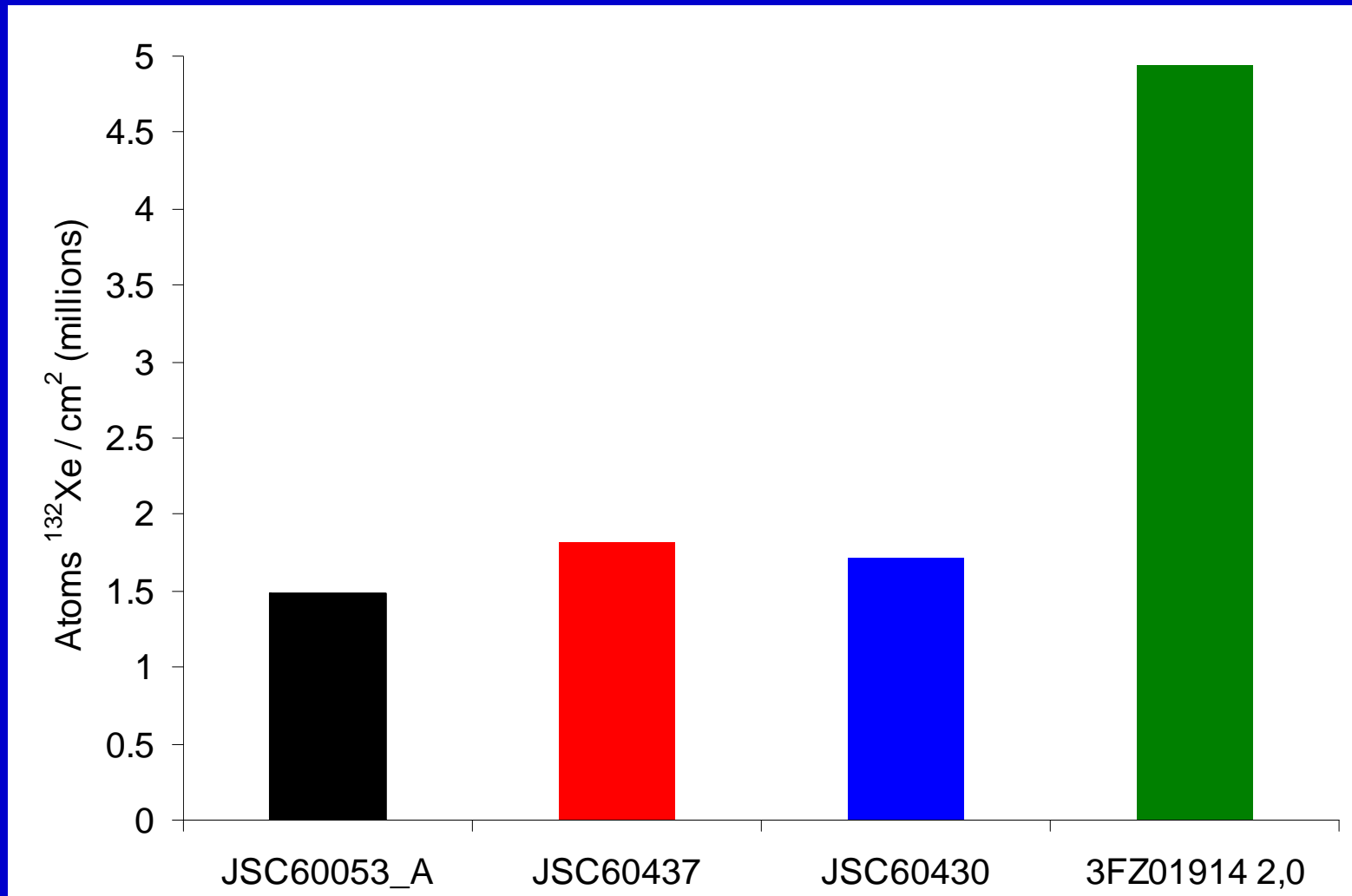
SOLAR XENON IN GENESIS SILICON SAMPLES

Sarah Crowther & Jamie Gilmour
School of Earth, Atmospheric and
Environmental Sciences
The University of Manchester

Last Year...



Gas Concentrations



JSC60053_A possibly affected by cutting procedure

Conc based on mass, 700 μm thickness, $\rho = 2.33 \text{ g cm}^{-3}$

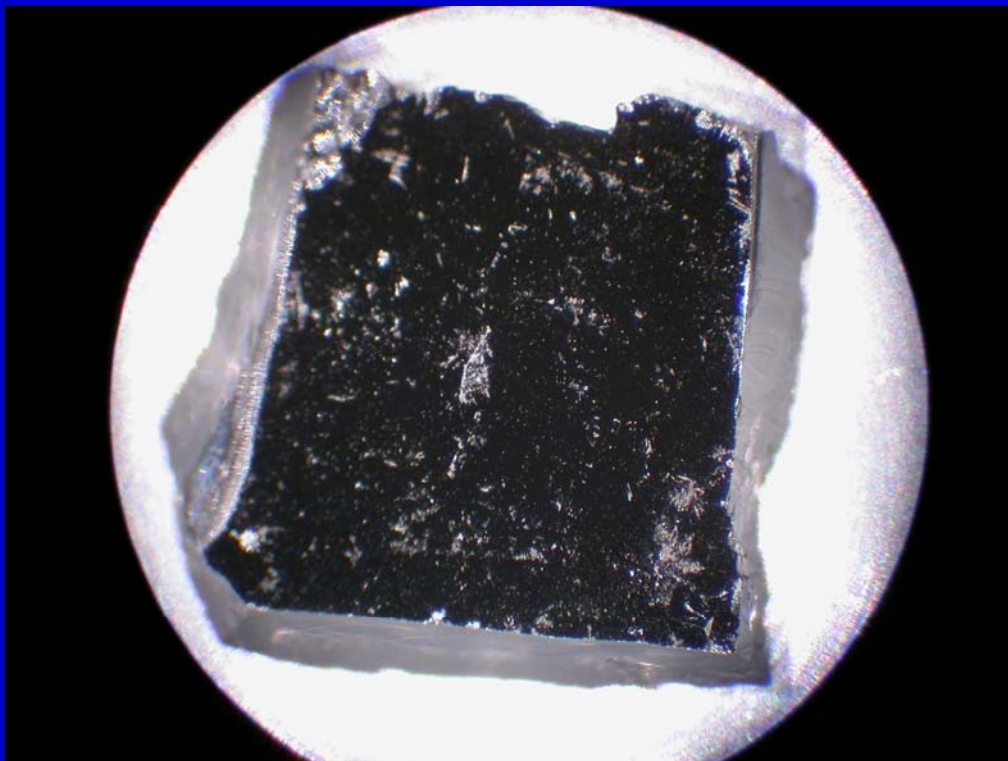
UV Laser Ablation

- Ablate just the top layers of sample where solar wind is implanted
- Tripled Nd:YAG 355 nm
 - High power – up to 400 mJ
 - Large beam – ~ 9 mm diameter at laser
- Can extract gas by heating with 4 W
 - 400 mJ per pulse @ 10 Hz = 4 W
 - Try ablation @ 1 Hz

Plan Of Attack

1. Spot ablation
 - Test technique
 - Depth profile

60457

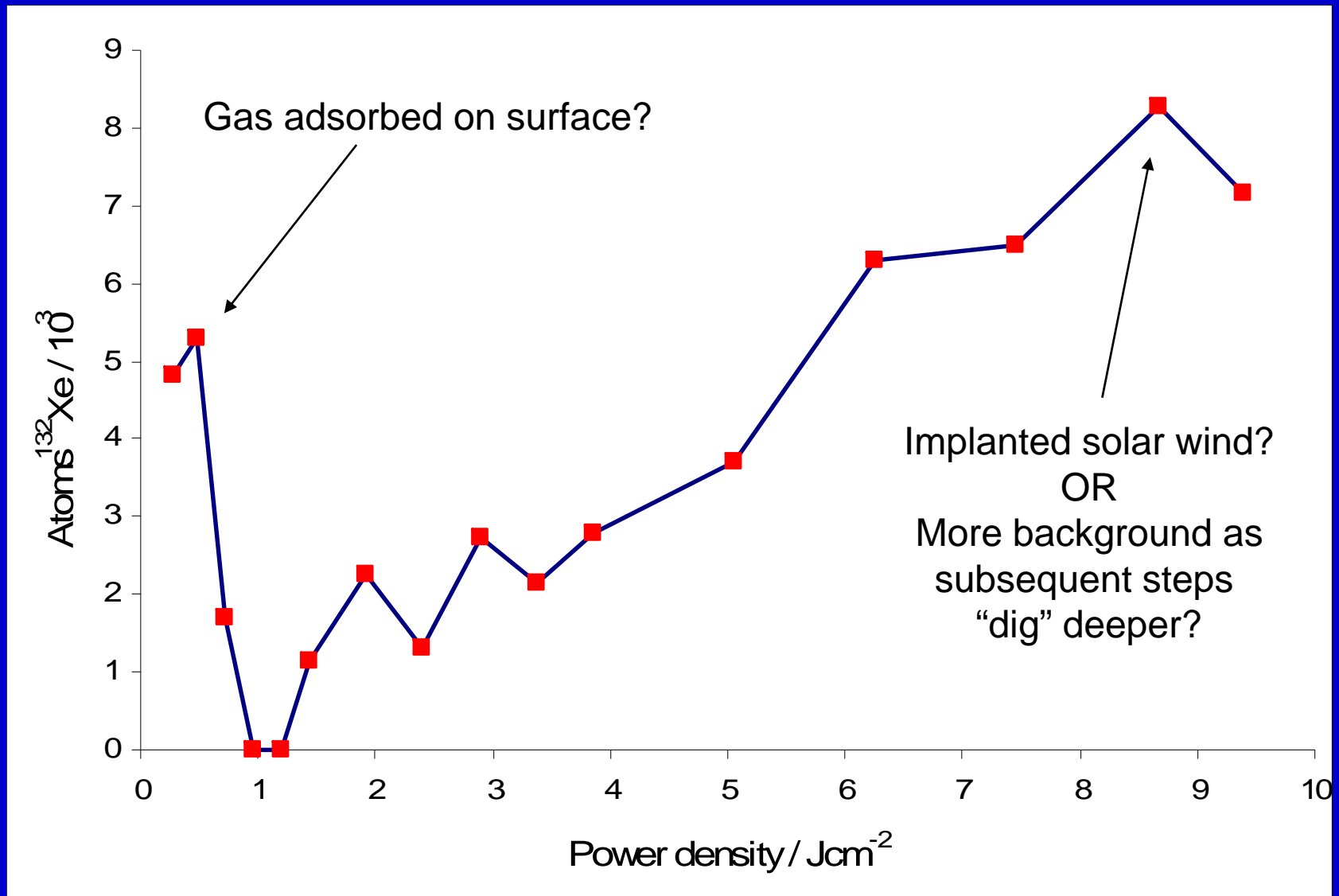


CZ-Si

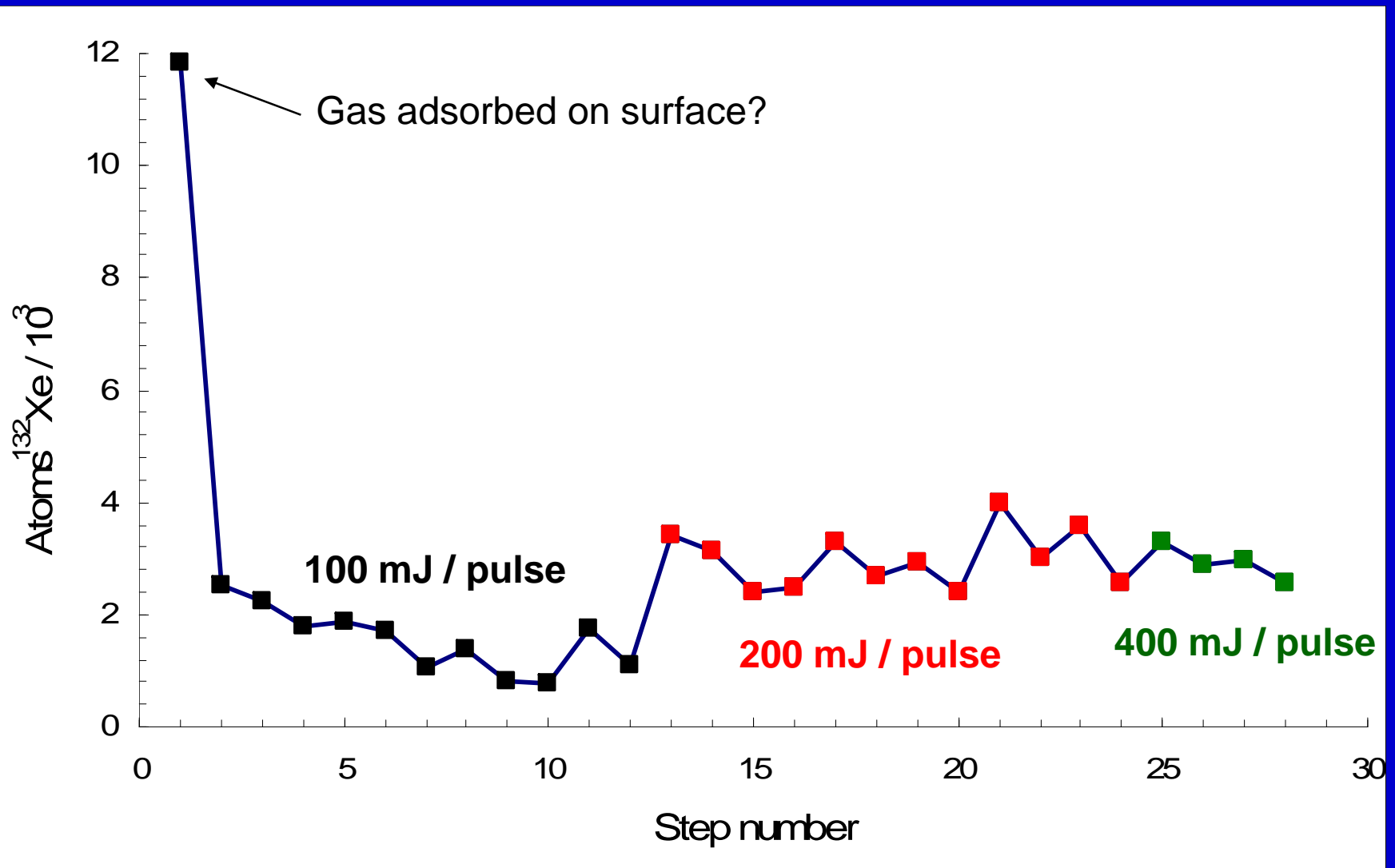
4.279 x 4.267 mm

0.02830 g

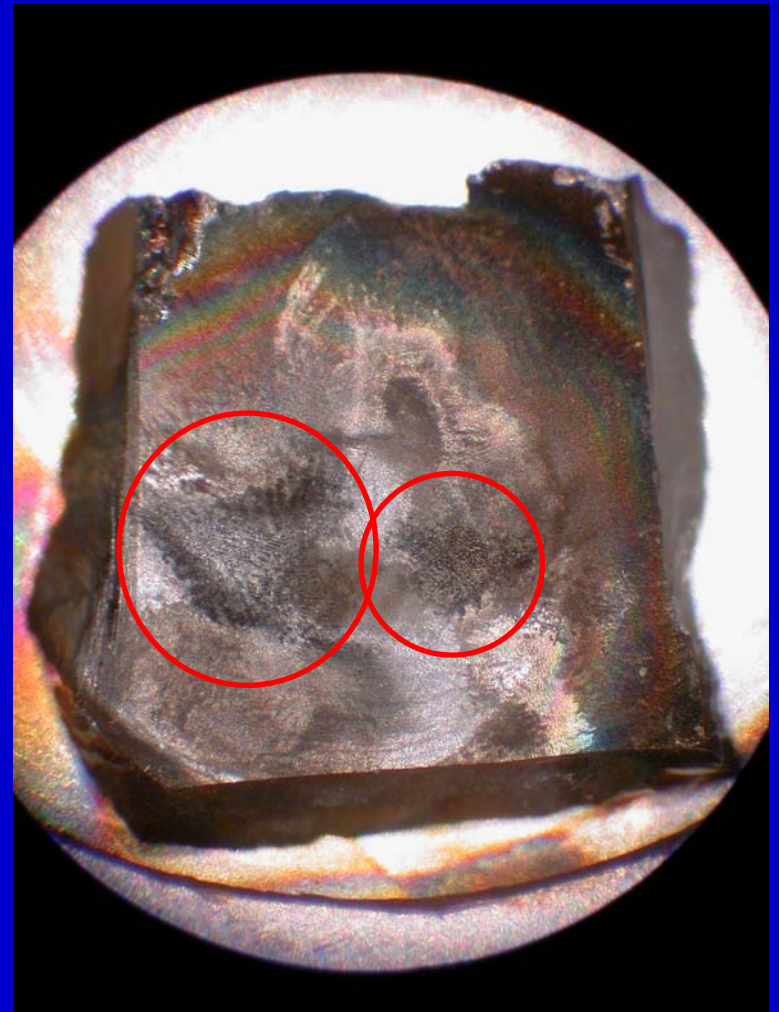
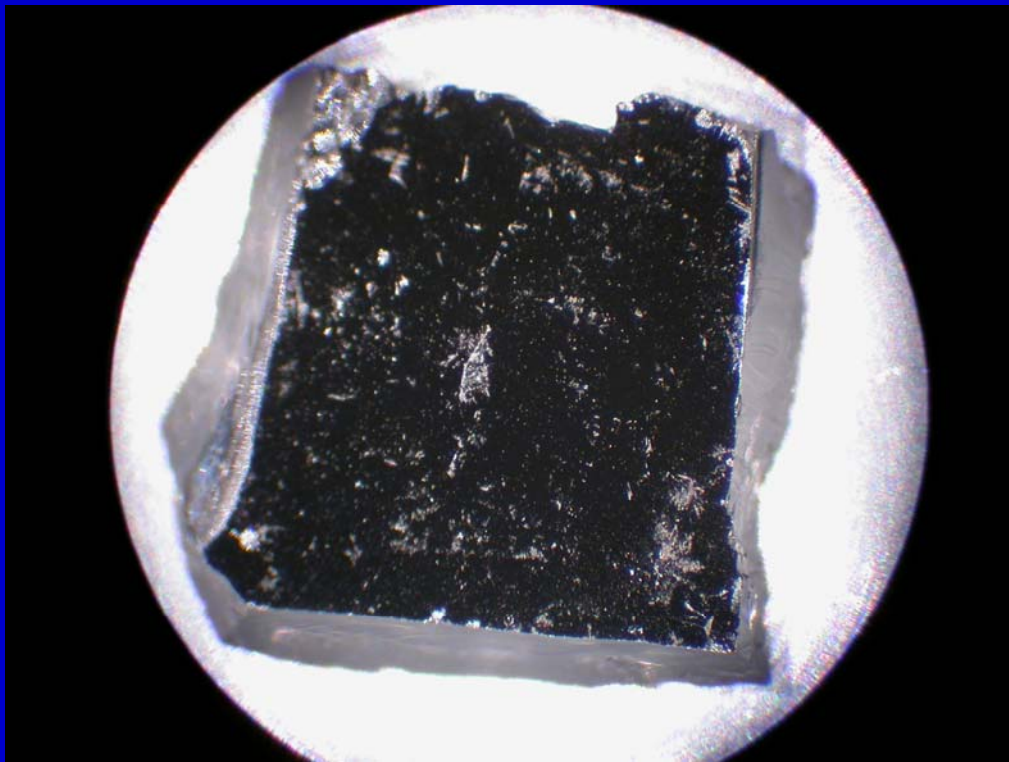
60457 – 1st spot



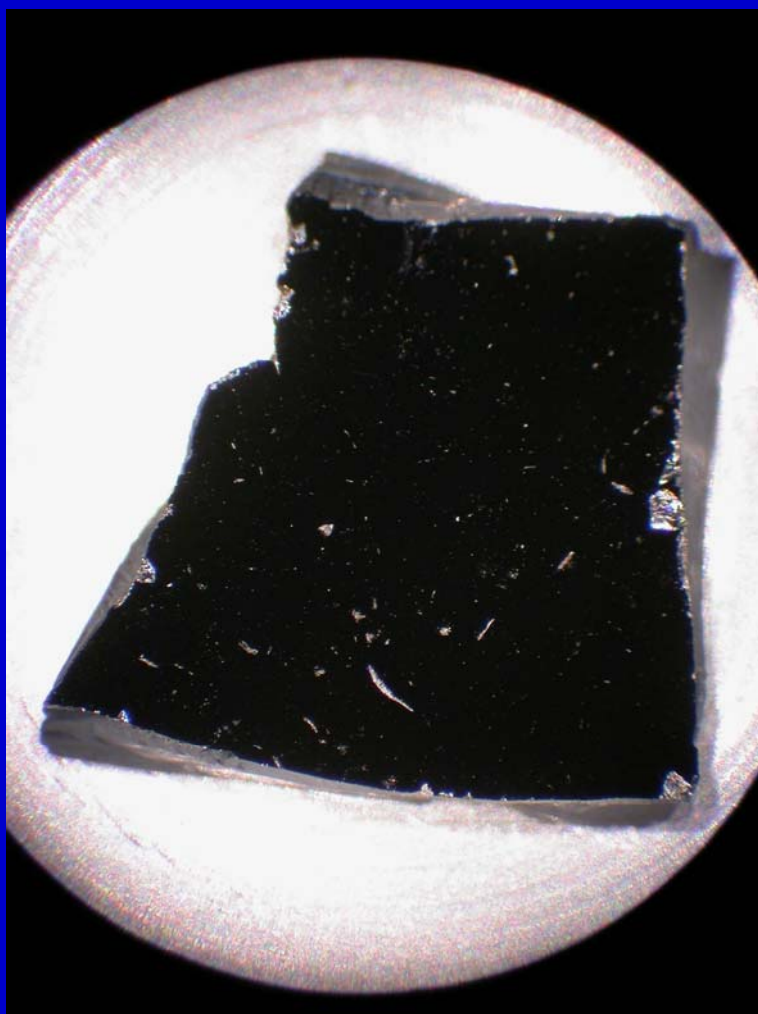
60457 – 2nd spot



60457



60462



CZ-Si

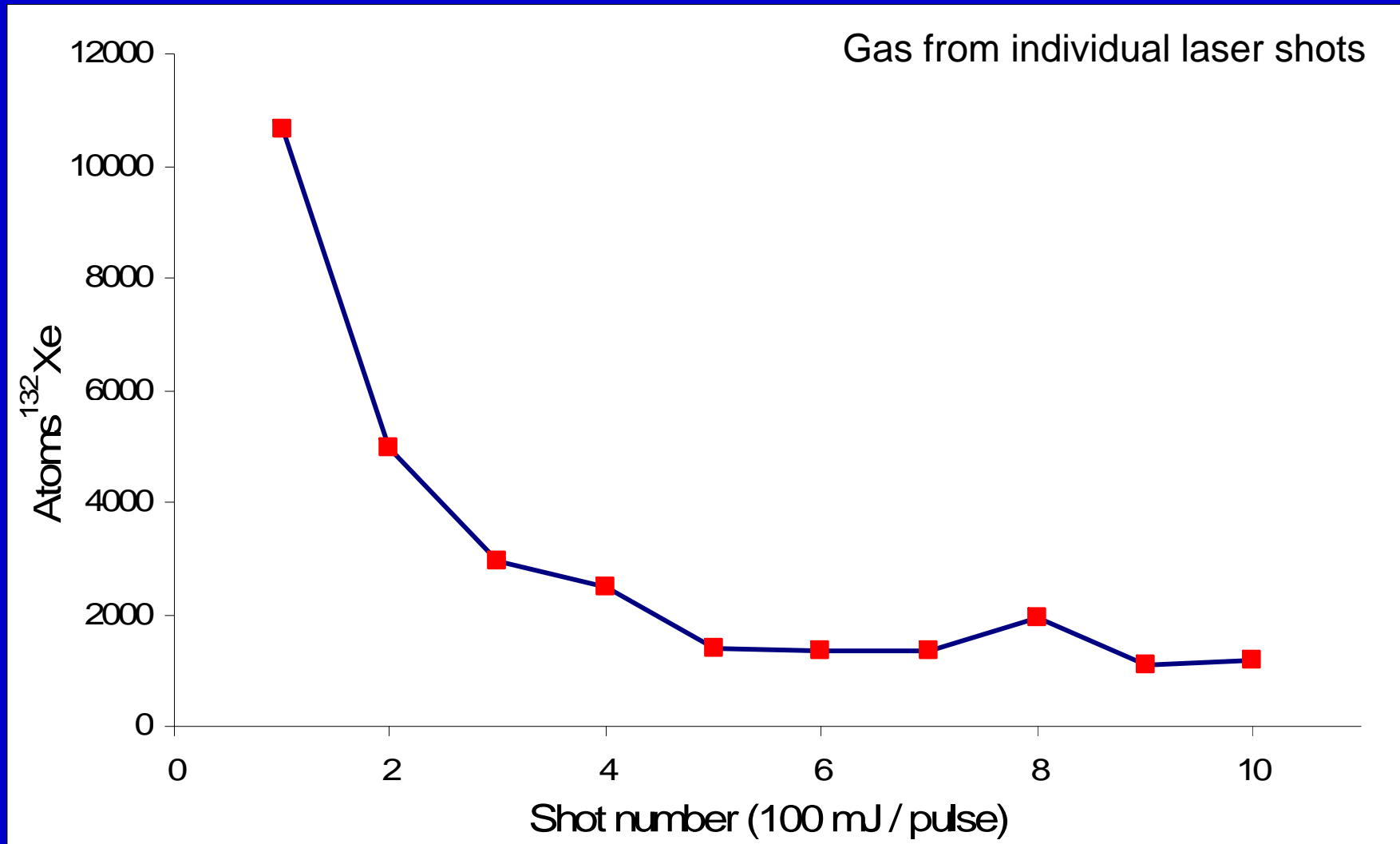
5.932 x 5.303 mm

0.03890 g

60462 – 1st spot

- 100mJ / pulse, 10 shots, 1 Hz
- Very first laser shot – see mark on sample
 - Mark ~ 1 mm diameter
- Gas from 1st 10 shots ~ 10^4 atoms
 - Approx what expected in 1 mm circle
- Very little gas in subsequent attempts
- Is the “surface contamination” really the solar wind?
- Too small to confirm ratios

60462 – 2nd spot



Plan Of Attack

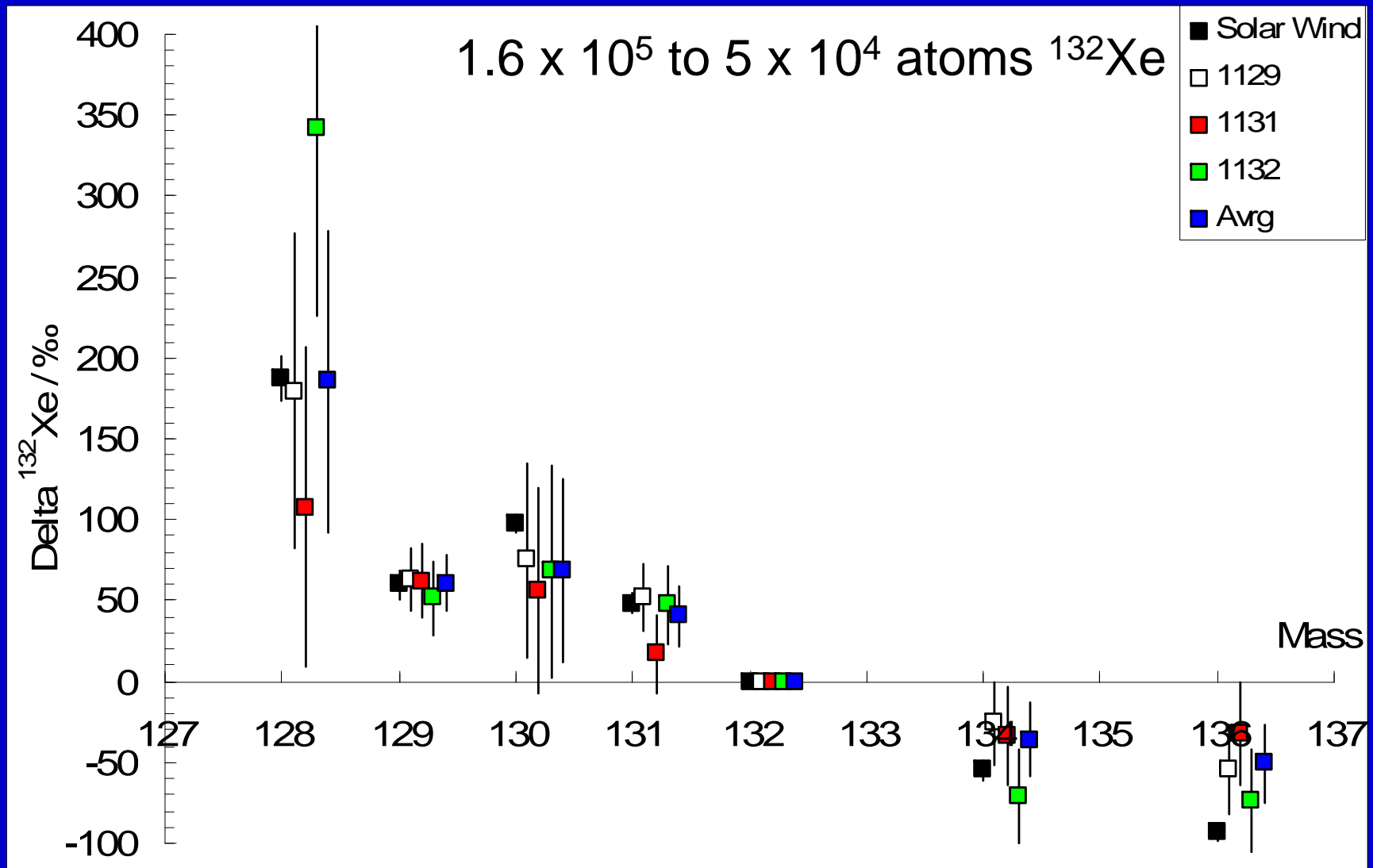
1. Spot ablation

- Test technique
- Depth profile

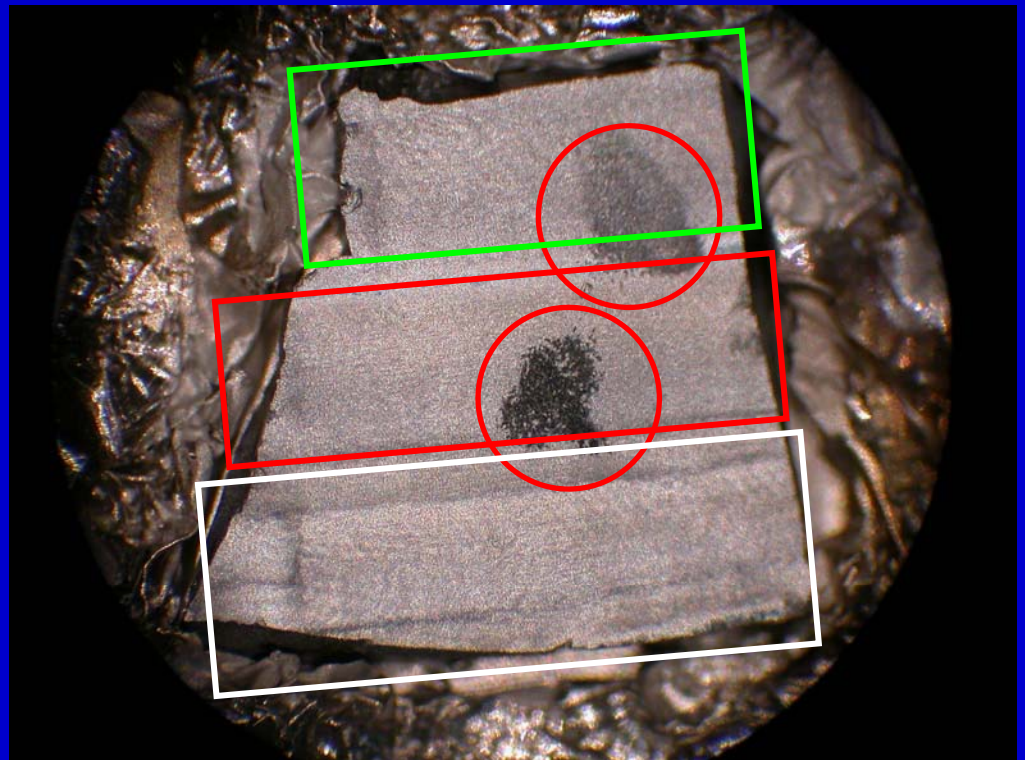
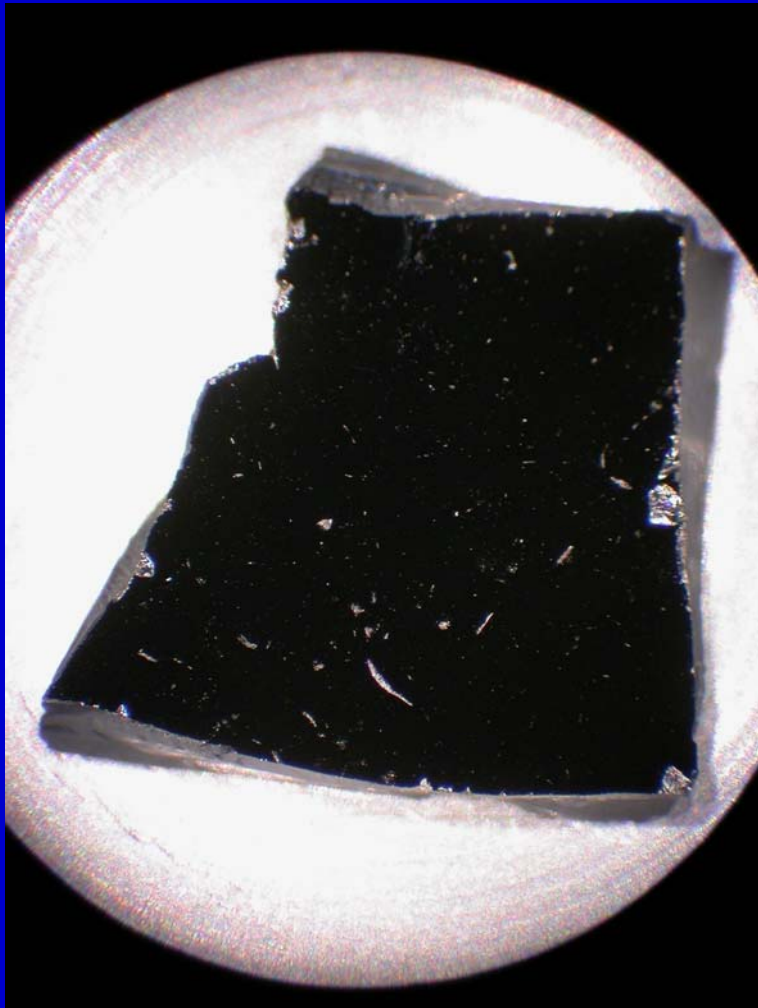
2. Raster small area

- Confirm whether solar wind

60462 – Raster 3 small areas



60462



Plan Of Attack

1. Spot ablation

- Test technique
- Depth profile

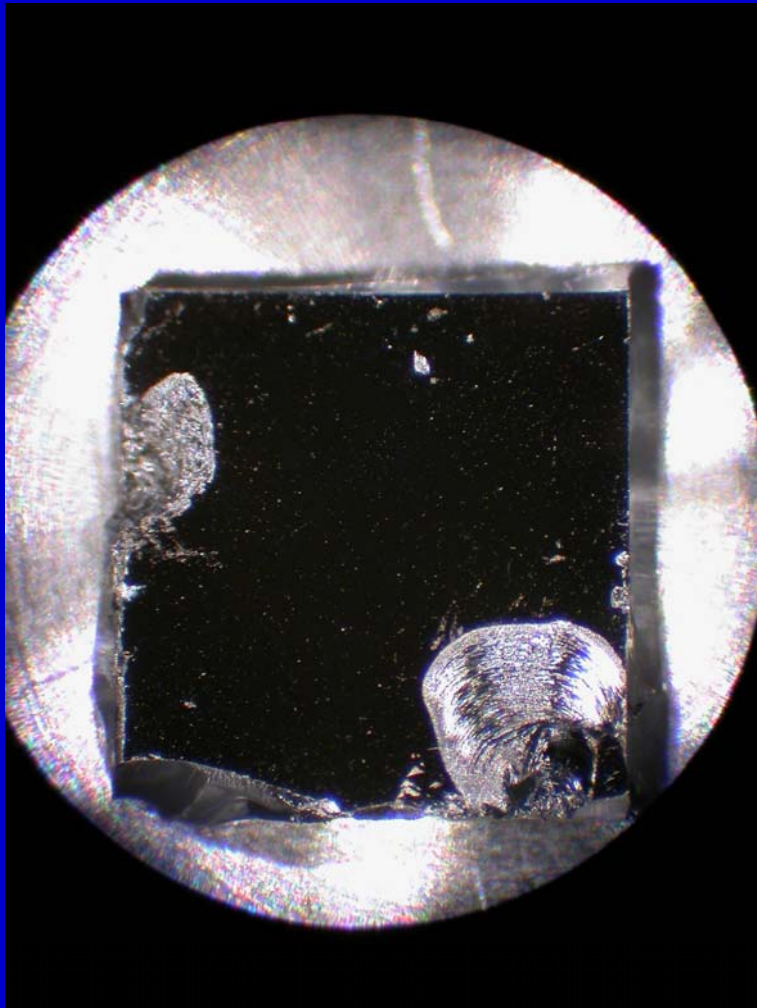
2. Raster small area

- Confirm whether solar wind

3. Raster whole sample

- Determine ratios more precisely

60473

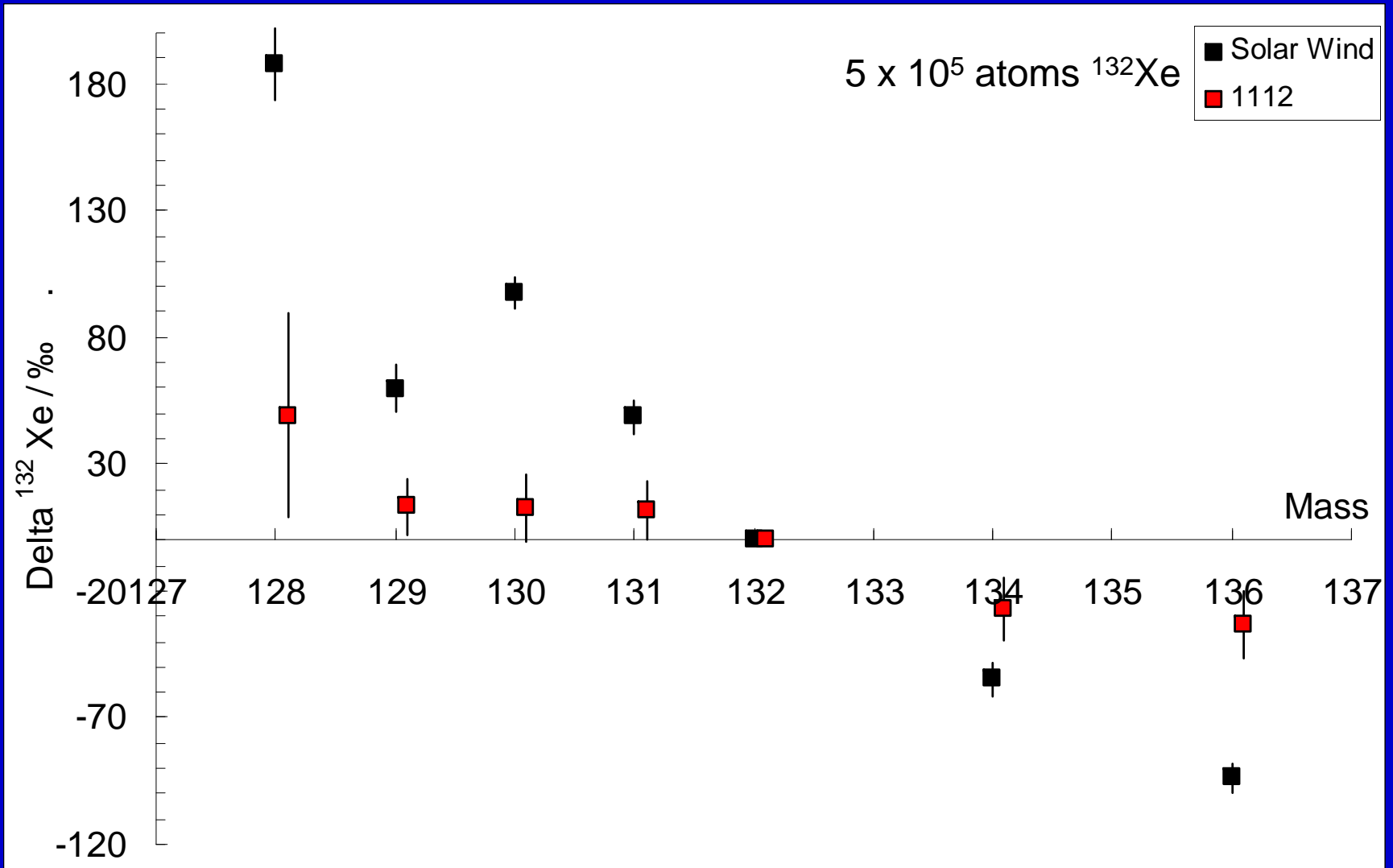


CZ-Si

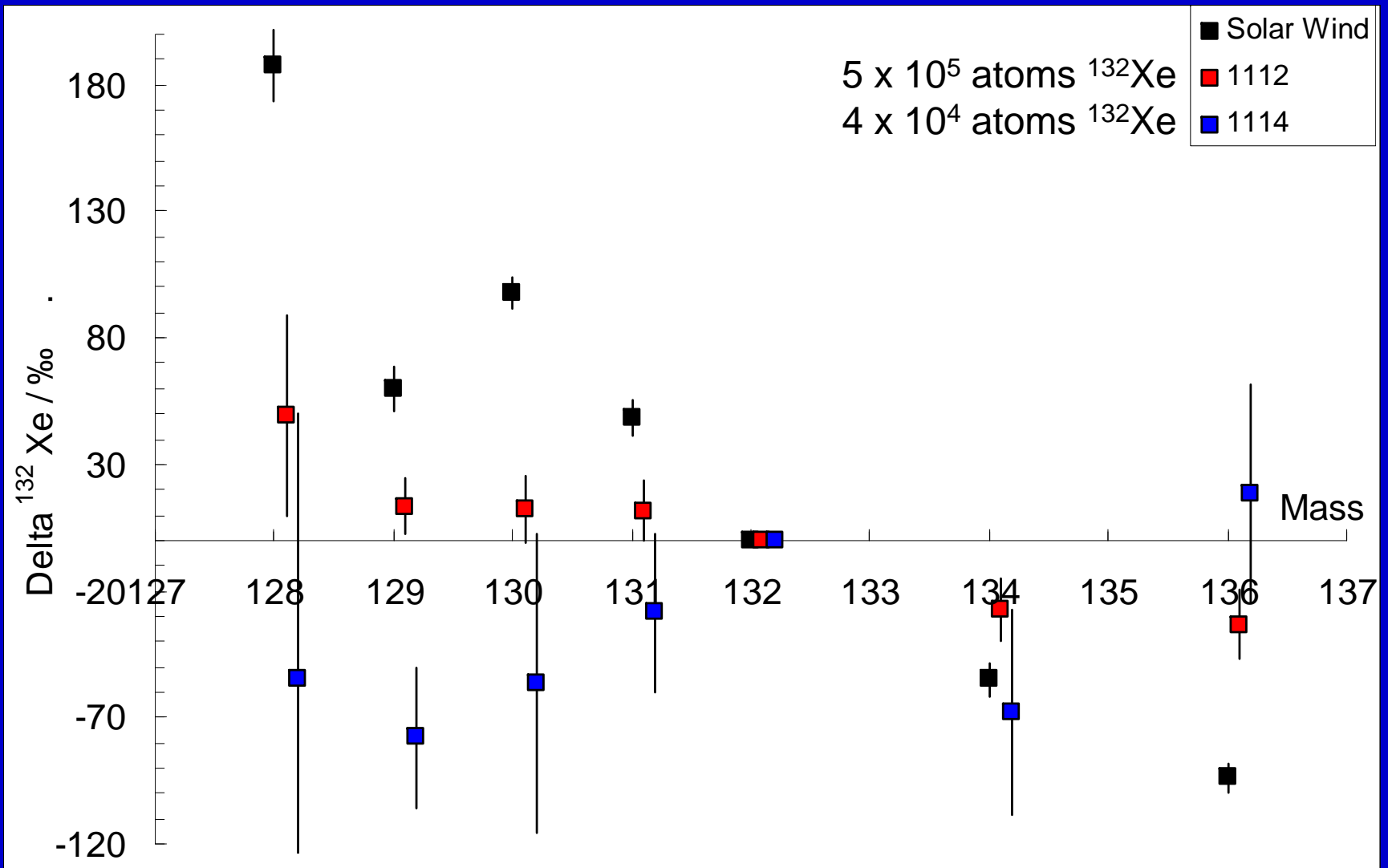
4.045 x 3.893 mm

0.02620 g

60473

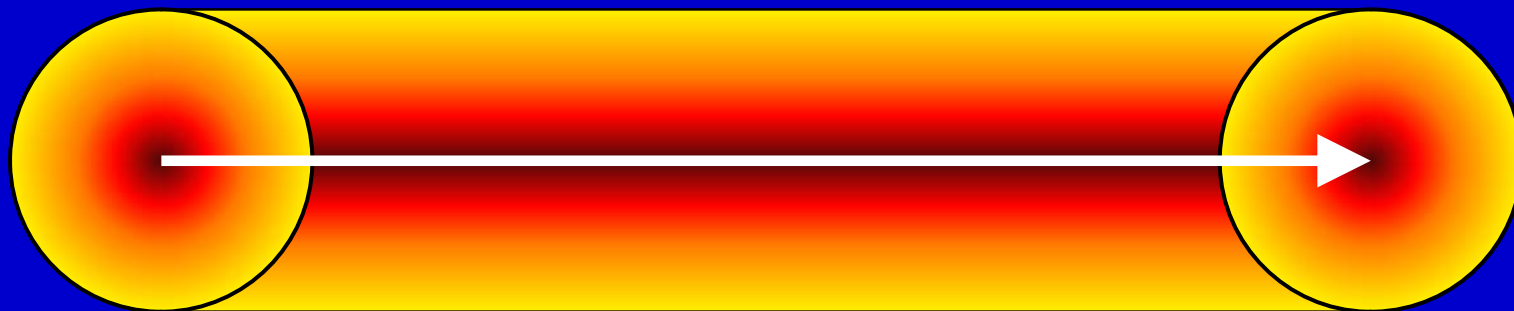


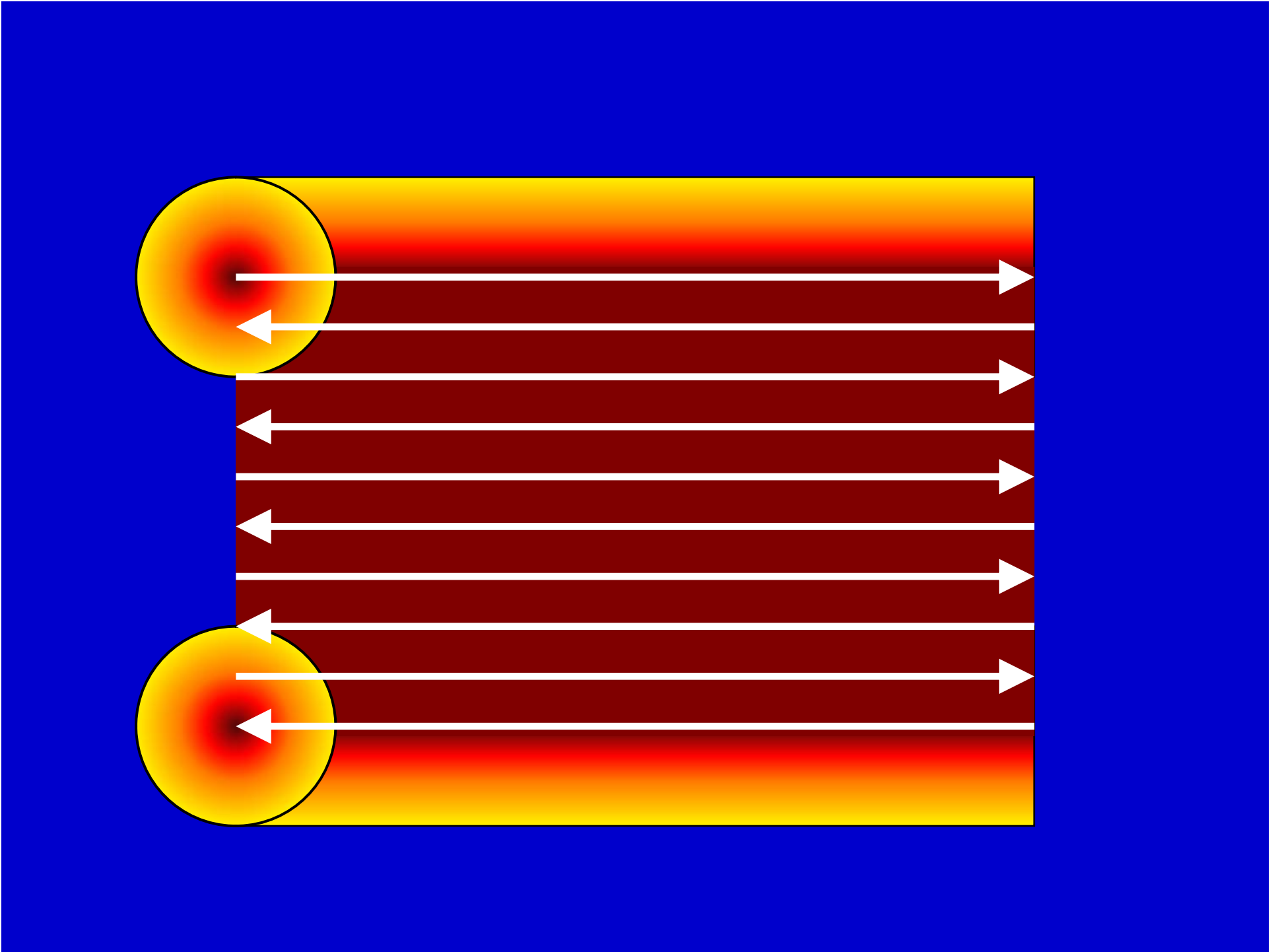
60473



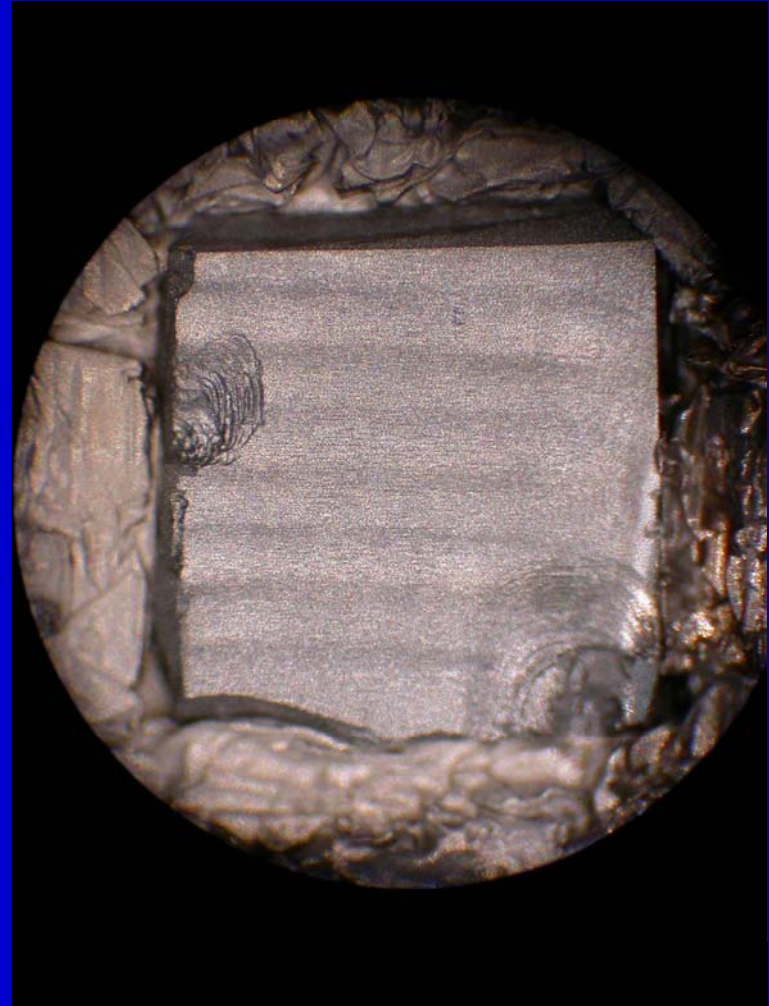
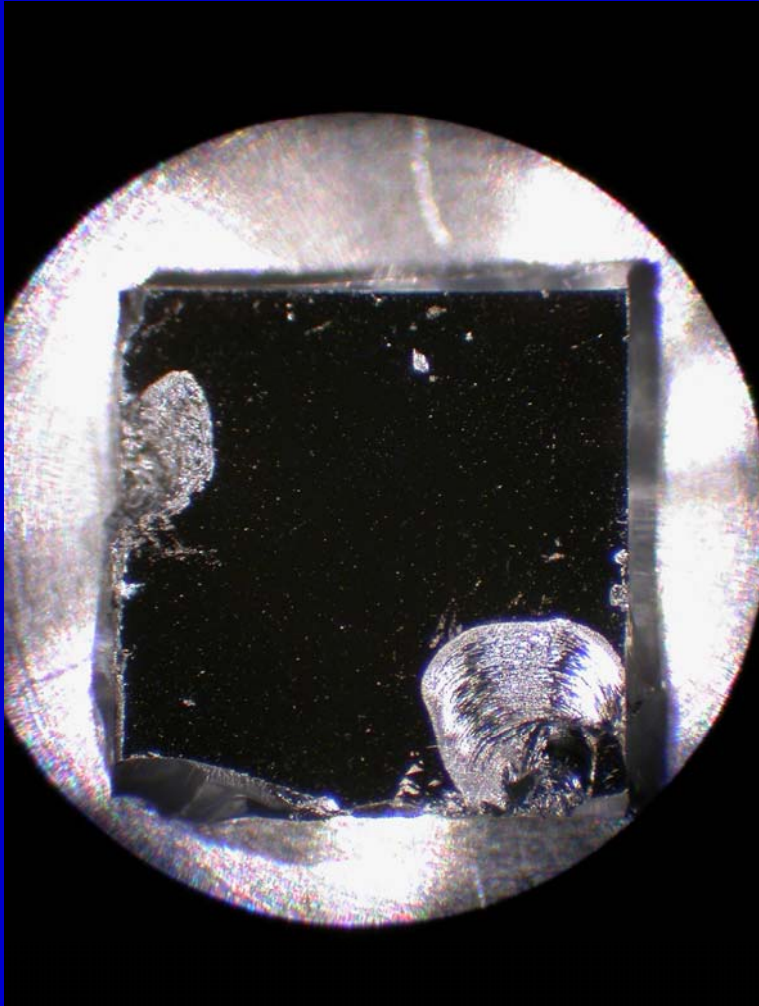
60473 - Raster

- 1st raster $\sim 5 \times 10^5$ atoms ^{132}Xe
 - ~ 4 times that expected from this area
- 2nd raster $\sim 4 \times 10^4$ atoms ^{132}Xe
- Why not solar, like small raster?
- Mixture of solar wind and background Xe
 - Extracted all solar wind
 - But also extracted too much background Xe
 - Ablated too deep





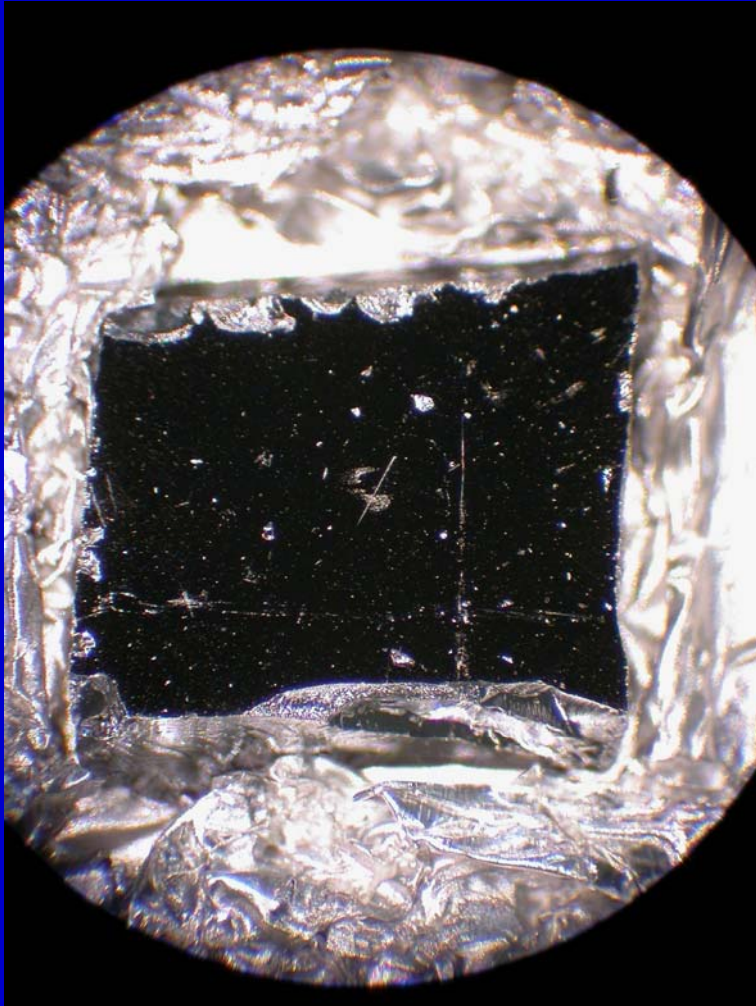
60473



Plan Of Attack 2

4. Raster at lower laser power
 - Separate solar wind from air

60489



CZ-Si

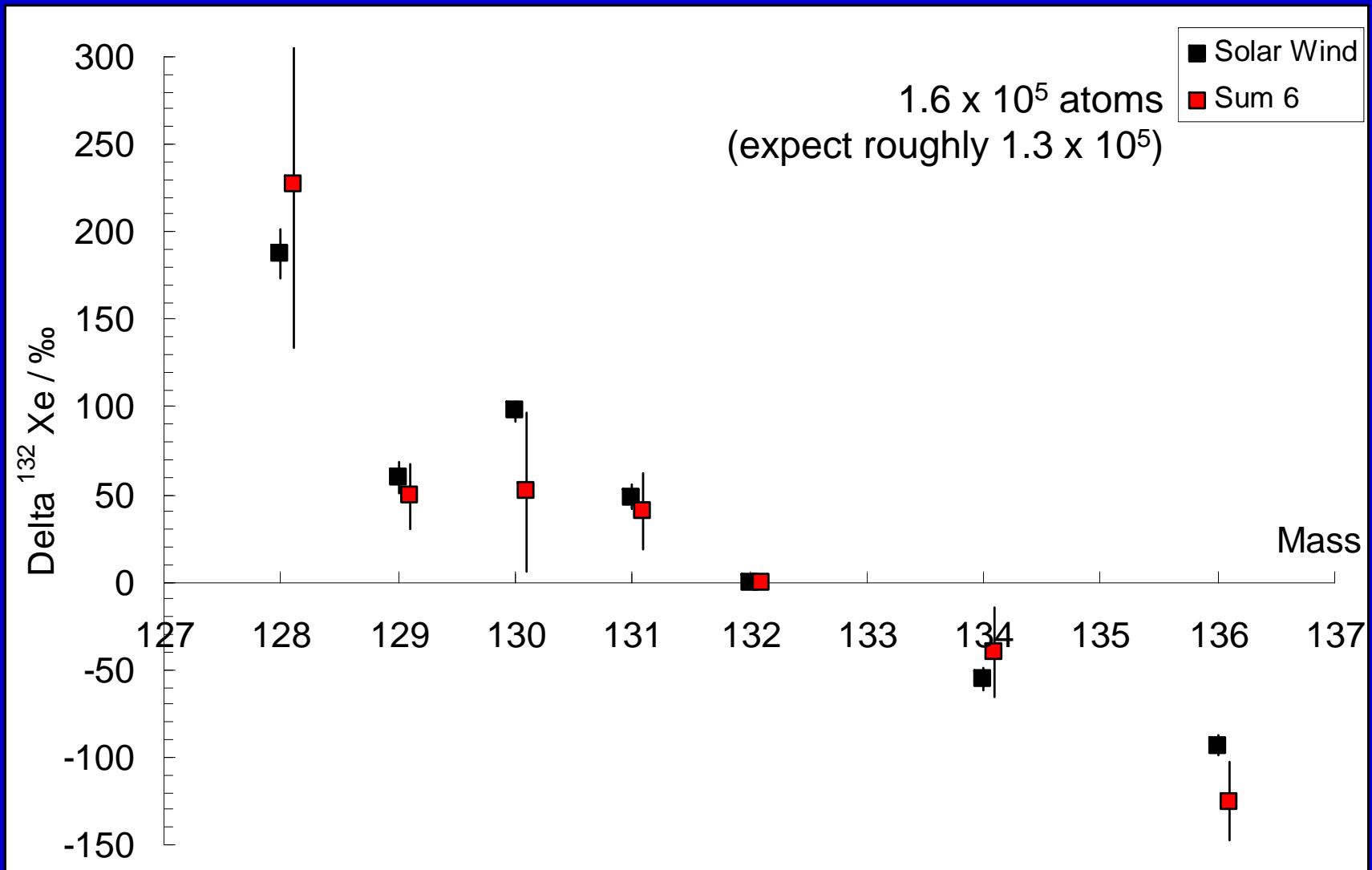
4.285 x 3.741 mm

0.2633 g

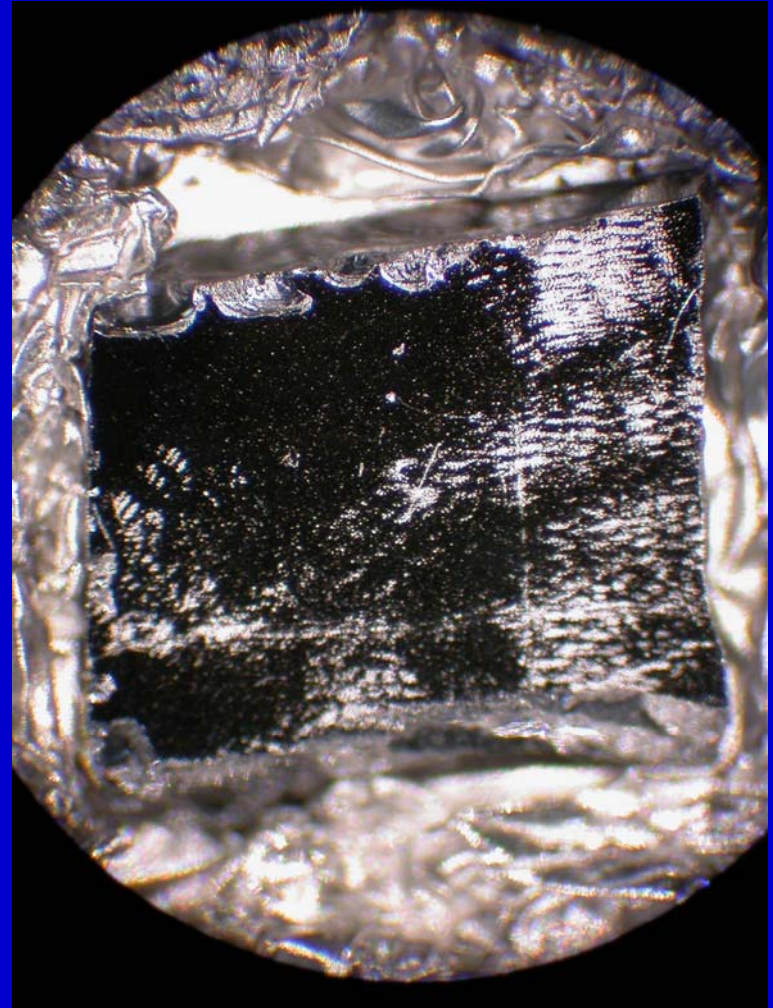
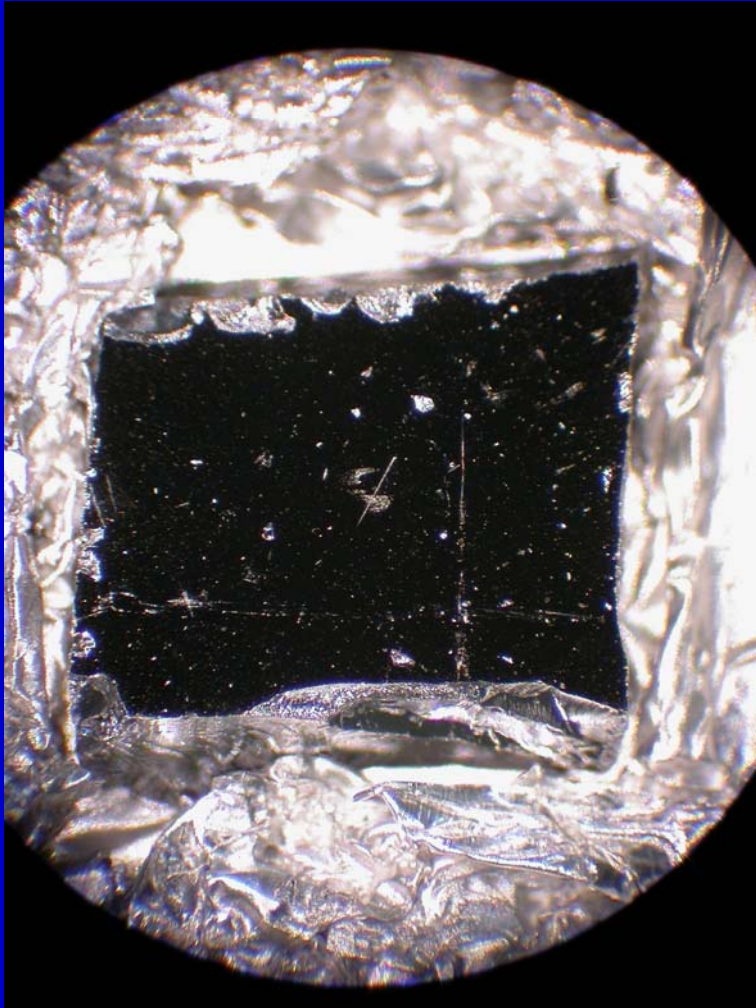
60489

- Reduced laser power by factor of 10
 - Was 100 mJ/pulse
 - Now ~ 10 mJ/pulse
- Repeated rasters over whole sample
 - 1st = air
 - 2nd to 7th ~ solar
- No trend
 - 2nd to 7th rasters identical within error

60489



60489



Plan Of Attack 2

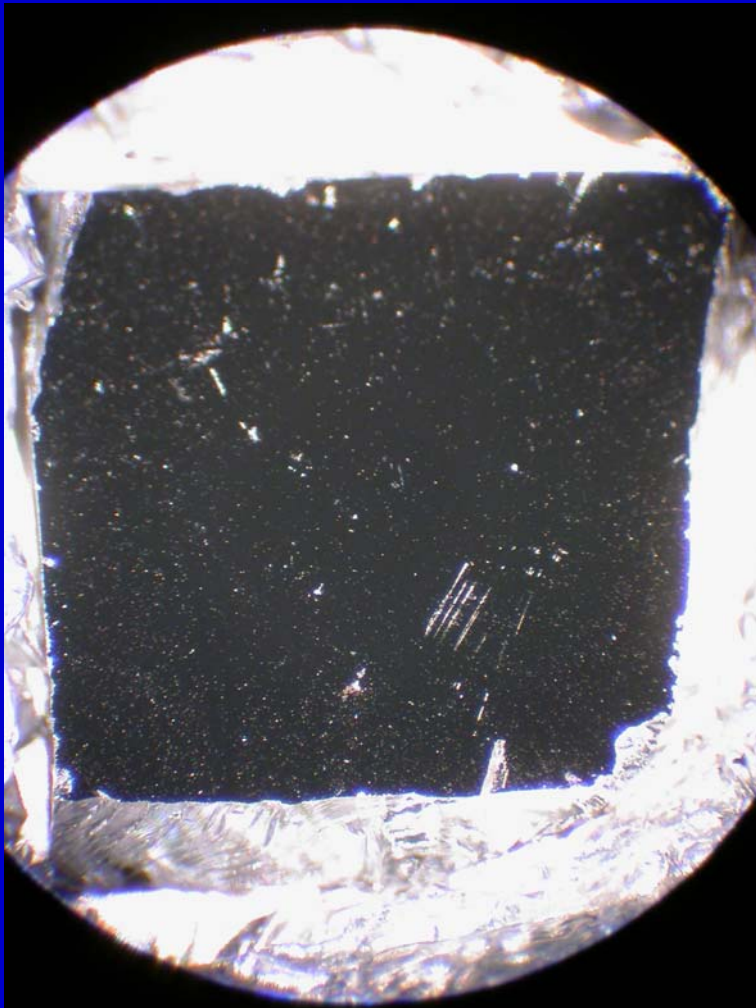
4. Raster at lower laser power

- Separate solar wind from air

5. Get all solar wind in 1 analysis

- 1st raster to remove air
- Same raster, but pulse ablation laser at 5 Hz
- Could have also tried slower raster with laser still at 1 Hz

60480

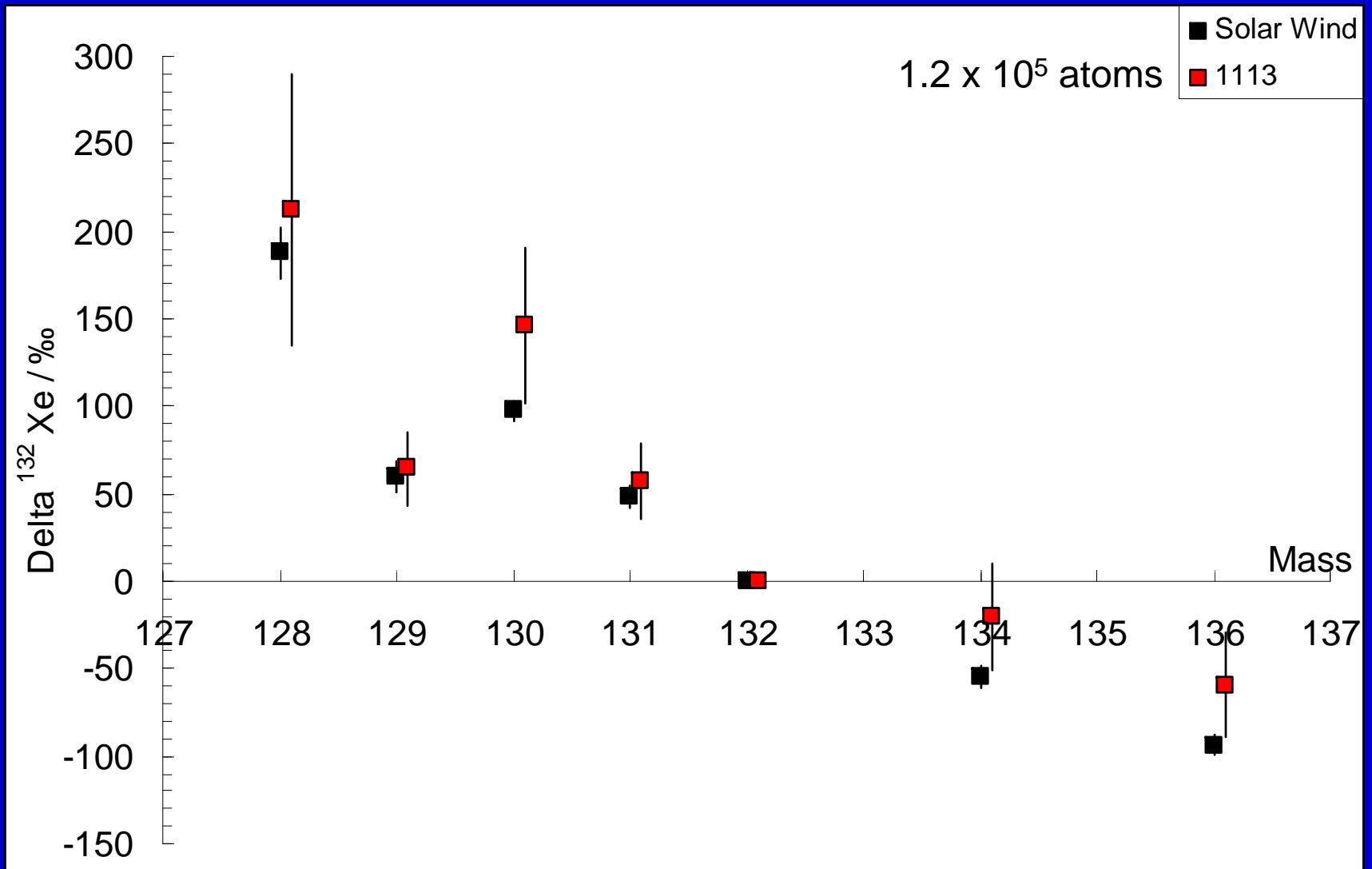


CZ-Si

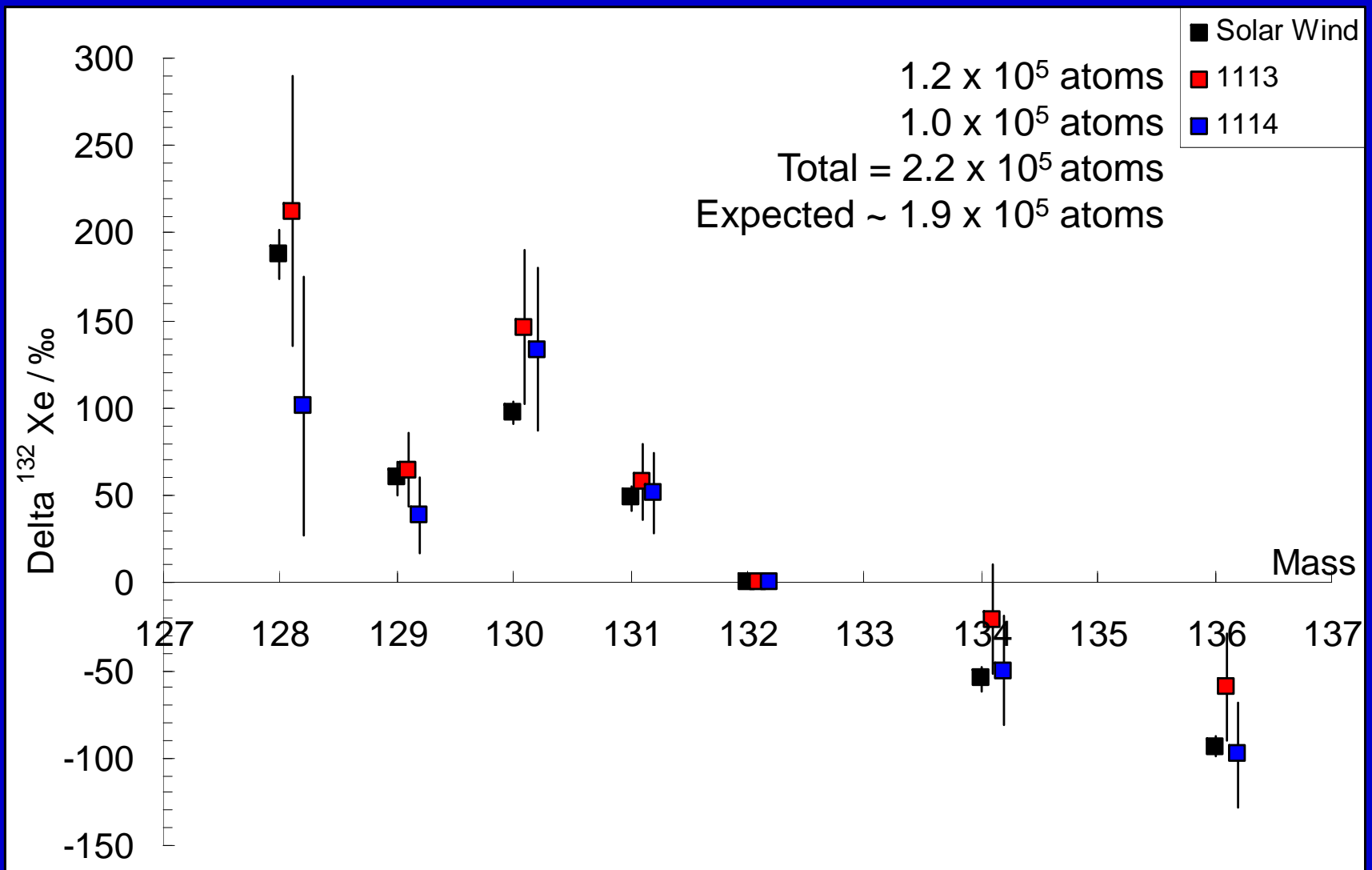
5.039 x 4.825 mm

0.03815 g

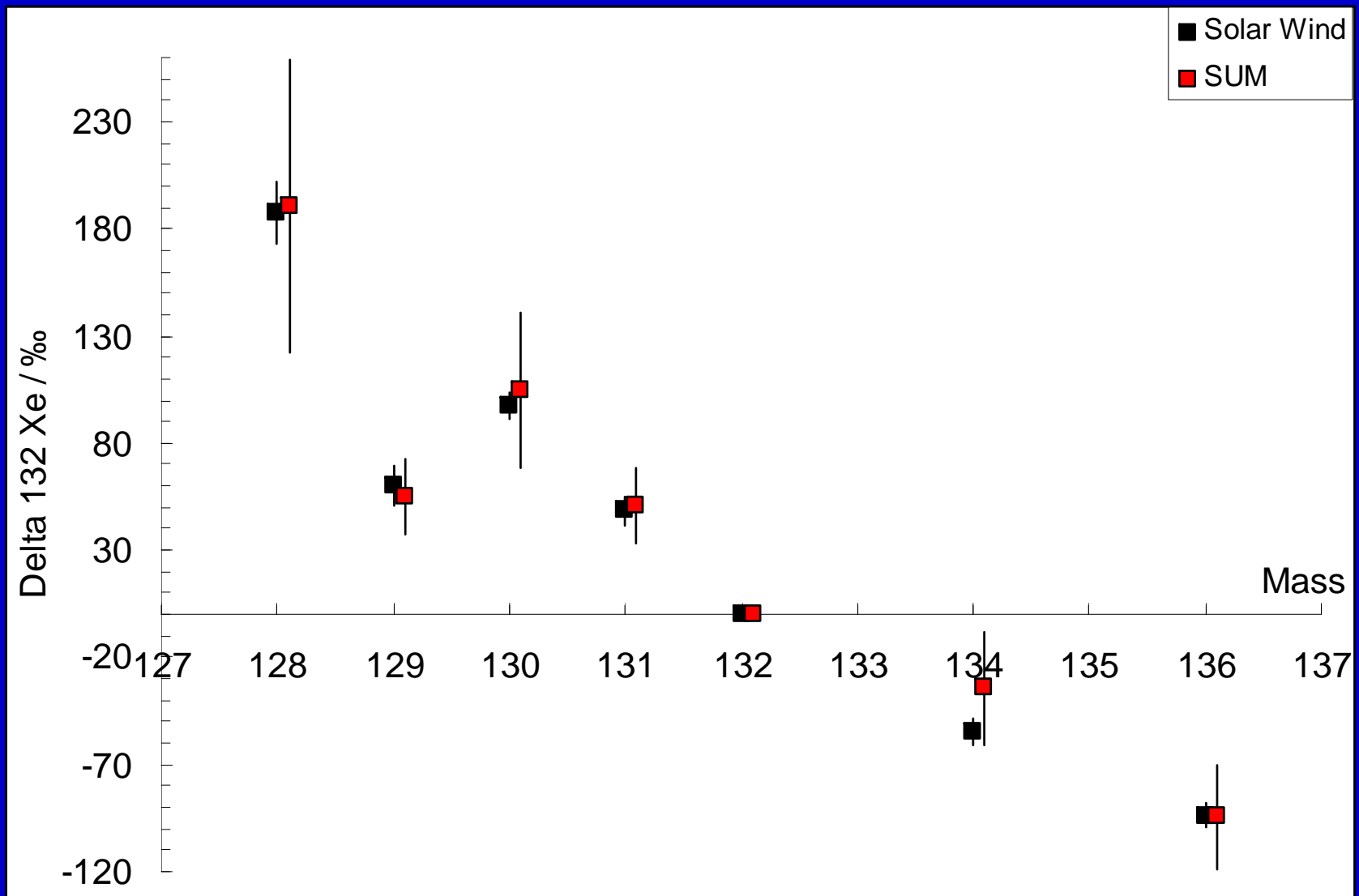
60480



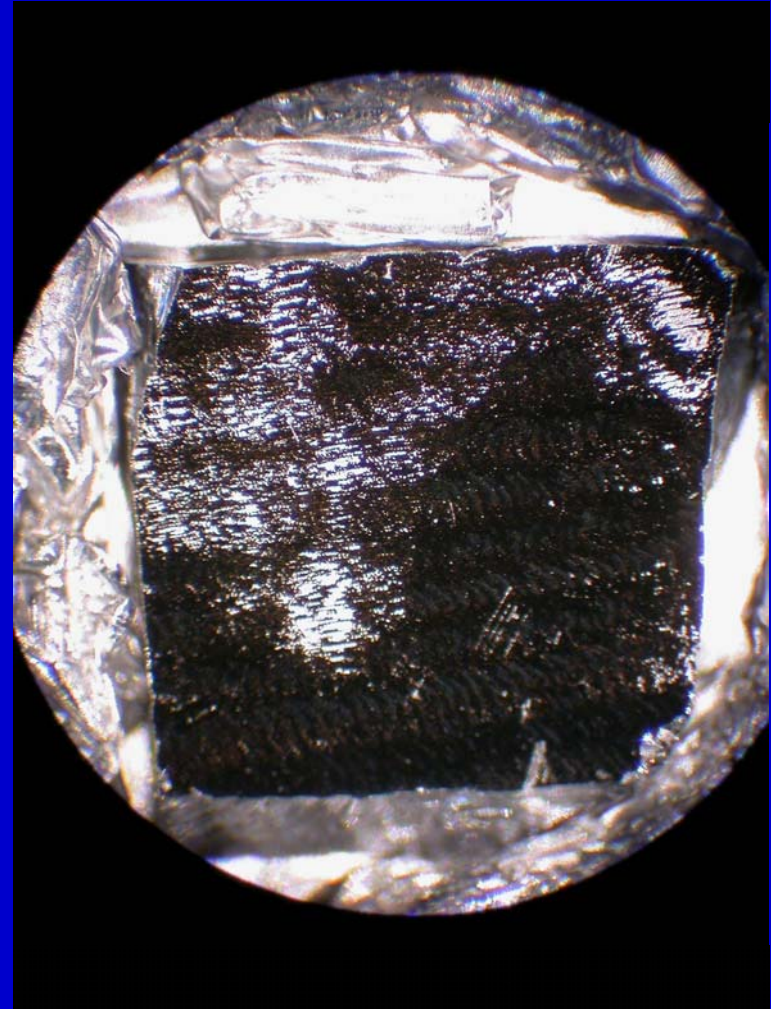
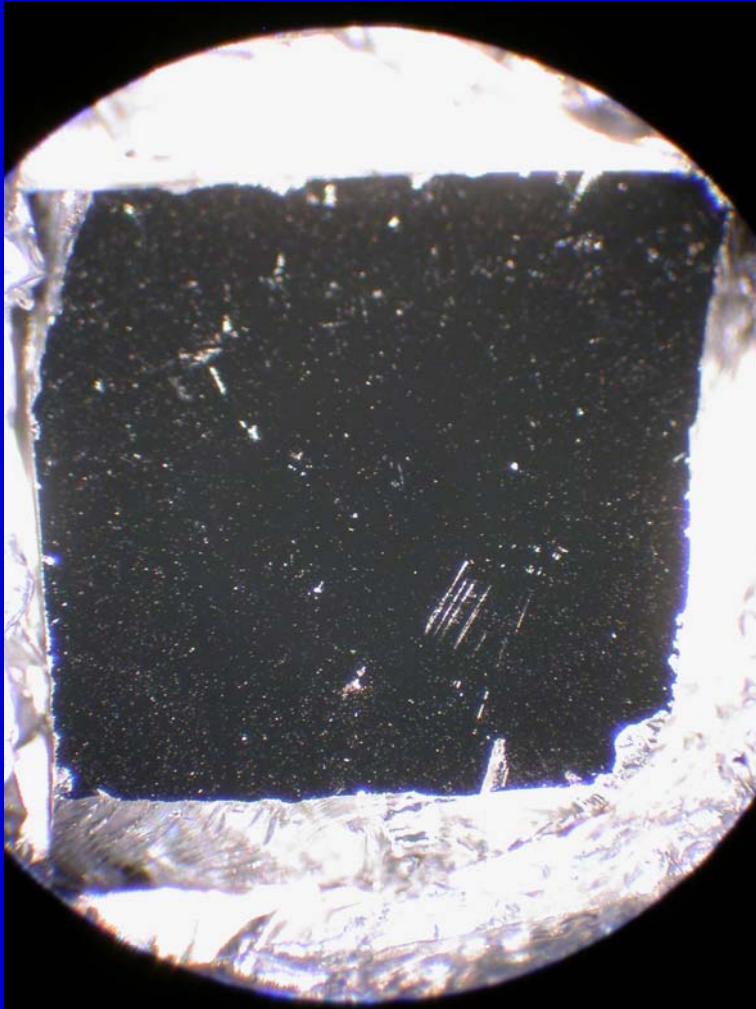
60480



Sum



60480



Summary

- Solar Xe identified in Si targets
- Low power UV ablation successfully extracts implanted solar wind
 - Power density $< 700 \text{ mJ cm}^{-2}$
- High powers
 - “Dig” too deep
 - Also extract Xe intrinsic to Si