



Micat Calibration Report

Microscope name: **microscope**

1. USAF Resolution Target Analysis Output

Effective size of pixel = $0.0804 \pm 0.0004 \mu\text{m}$

Field of view = $(264 \pm 1 \times 198 \pm 1) \mu\text{m}^2$

These uncertainties are from the regression only and may be an under estimation.

This is based on an image size of 2464×3280 pixels, and will need scaling for other images.

Greyscale input image has hashlib md5 hash
396e821e583869f0e2fd2c91d867b724

Report produced on 03 June 2026

Micat analysis software version: 0.1.0

NOTE: These results are only valid if all elements in the following image are correctly labelled.

2. USAF Resolution Labelled Image

Ensure that the elements have the correct group and element number before using these results.

Smallest labelled element is group 7, element 6.

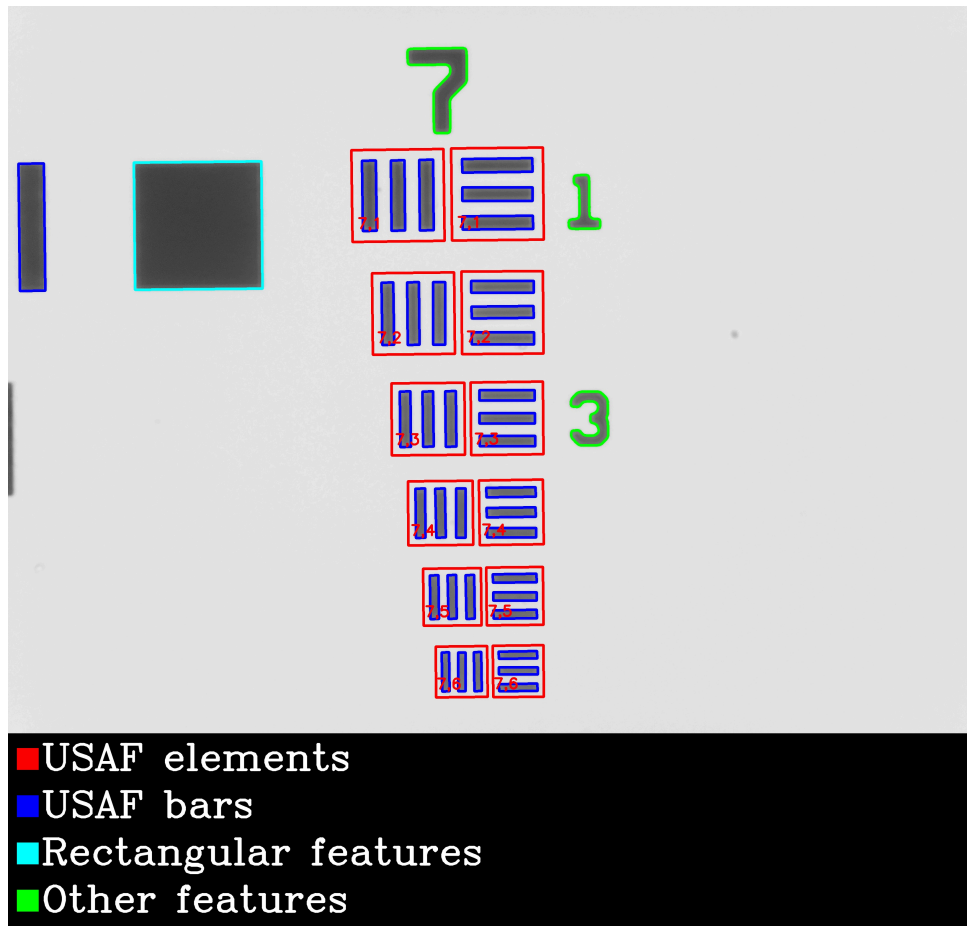
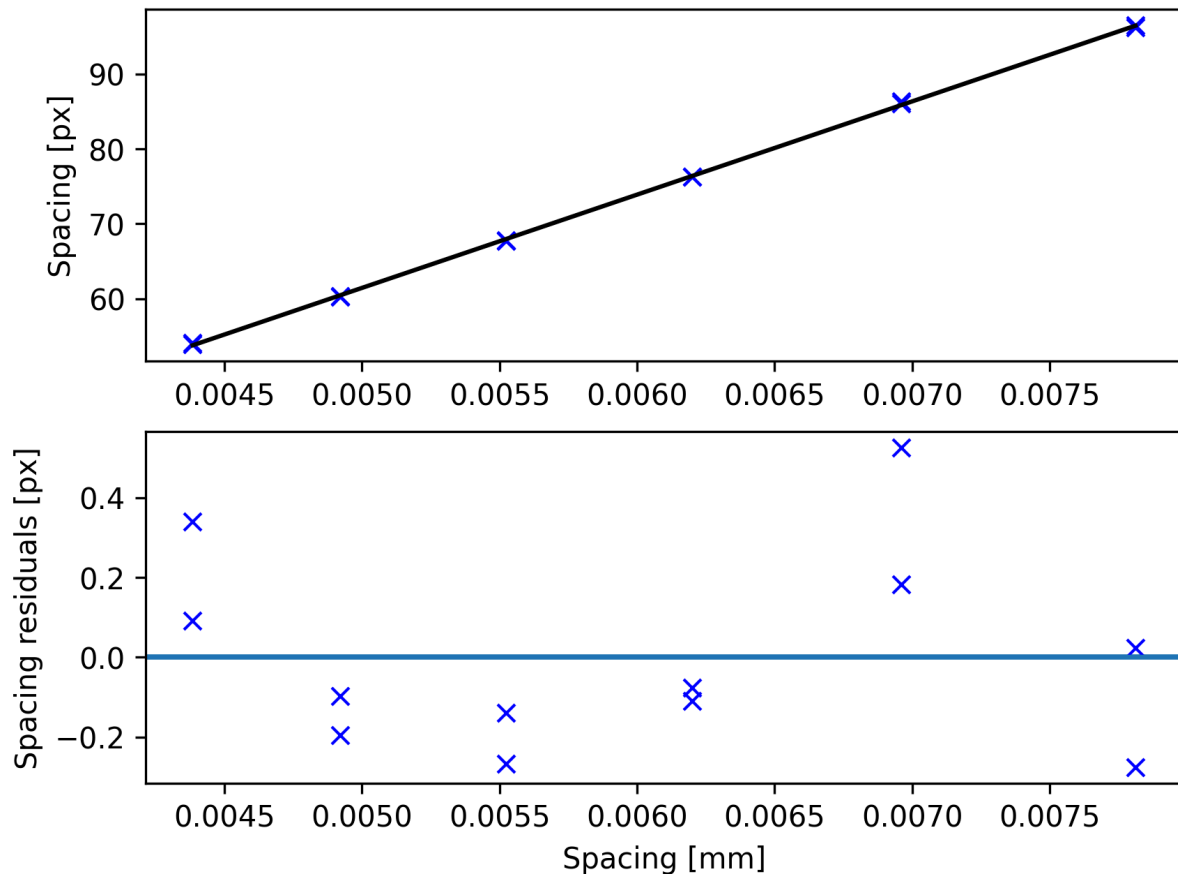


Figure 1: Labelled USAF resolution target used for calibration. Red boxes mark a set of 3 lines, each of which will be surrounded by a dark blue box. Light blue highlights the squares, and green highlights other features including numbers.

3. USAF Resolution Plots

The spacing plot should be an increasing, linear fit. The residuals should be distributed around $y = 0$ with no overall trends.



4. System Information

Metadata	
Camera	
camera_board	picamera_v2
Microscope	
hostname	microscope
microscope-uuid	57cd7978-541f-49d3-906e-38ac4325b713
version	v3.0.0-alpha4
version_source	07ad48550b58cb0bd54ce74cbb1078b49f56f414
Capture Time	
capture_time	02 March 2026, 10:01
capture_time_unix	1772445690

5. Methodology

Calibration was performed using an automated analysis of a USAF 1951 resolution target image.

The input image is first converted to greyscale and thresholded to identify contours. Detected features are classified based on shape: rectangular features with an aspect ratio consistent with USAF bars (approximately 5:1) are retained, while other features are discarded or labelled separately.

Bars are grouped into sets of three based on their relative spacing and alignment, forming individual USAF elements. The spacing between bars is measured in pixels, and each element is assigned a group and element number based on the known geometric progression of the USAF target.

The physical spacing corresponding to each element is calculated using the standard relationship for line pairs per millimetre:

$$2^{\left\{ \left(g + \frac{e-1}{6} \right) \right\}}$$

where g is the group number and e is the element number.

A linear fit is performed between the measured pixel spacing and the known physical spacing. The gradient of this fit is used to determine the calibration factor (micrometres per pixel), and the associated uncertainty is estimated from the covariance of the fit.

The field of view is then calculated from the image dimensions and the calibrated pixel size.

Further implementation details and source code are available at: <https://gitlab.com/openflexure/micat>