

SHARP Memo

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Re: SHARP image file metadata stamping and encoding

We will begin stamping human-readable and machine-readable information onto the dark parts of the SHARP images. This memo describes the data and its format. Note that only the 2048 x 2048 pixel, high-resolution images will be stamped in this manner, at this time.

1. Human readable data

The human-readable data will be stamped as text in an otherwise unused portion of the images (See Fig. 1). The information includes the filename and plan-file comments, plus various illumination and imaging parameters, including a graphical representation of the pupil fill. Also included are a SHARP logo, and a 5- μm -long scale bar divided into 200-nm and 1- μm regions. The scale bar values will be approximate ($< 2\%$ uncertainty) until accurate measurements are made and included in the software. These measurements may vary from chip to chip, zoneplate to zoneplate, etc.

In order to avoid scaling the image to a different range than the data itself when viewed in an image viewer, the metadata is automatically scaled to match the (filtered) maximum value of the image.

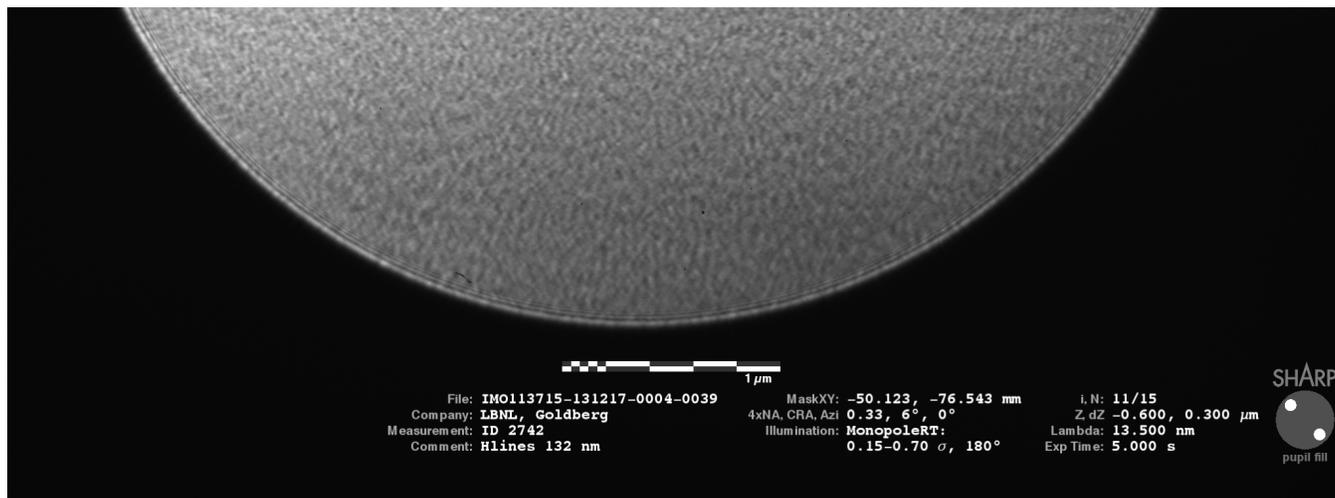


Fig. 1. Human readable data is included at the bottom portion of the images, in the shadow of the M_C mirror.

2. Machine-readable data

The machine-readable array contains much more information than the human-readable data, including every field written to the database and to the output CSV file. Data is written in ASCII (string) format, encoded as bytes, in the following format,

$$key_1=value_1, key_2=value_2, key_3=value_3, \dots key_N=value_N$$

with no blank spaces, commas separating the fields, and equal-signs separating keys from values, and no trailing comma. Since the information is in byte format, scaled on 0–255, it will appear black against the normal background of the image, which is not subtracted from the raw data.

To signify the presence of the metadata in the image, the array is padded with five 1s, and it ends with five 9s.
Testing for five 1s in the first five elements of the image shows that there is metadata.

One additional piece of information is included: the length of the metadata string array is encoded as a two-byte signed integer, following the five 1s, and before the first *key=value* pair.

The final format looks like this example

```
1 1 1 1 1 43 8 105 109 97 103 101 95 112 111 105 61 40 49 48 50 56 59 49 53 48
56 41 44 118 109 97 115 107 95 100 121 61 45 55 48 46 54 54 53 53 44 112 108 97 110 95
. . . 46 54 49 9 9 9 9 9
```

- Elements 1 to 5: Five 1s for the header.
- Elements 6 and 7: 43 and 8 are a two byte representation of the integer 2091
- Elements 8 to 2098: key=value,key=value,etc.
- Elements 2099 to 2103: Five 9s for the tail.

Since the data is encoded as strings, the length will be different every time. Also, users should note that the order of the keys can change arbitrarily, and new keys will be added over time, as required.