WinCamD-LCM series SNR

The intrinsic **SNR** (**S**ignal to RMS **N**oise **R**atio) of **WinCamD-LCM** series cameras is **2500:1**. This value is derived as follows:

1. Select **File**, **Load defaults** to reset the camera to factory defaults.

2. Capture an image of a beam by clicking **Go**, allow auto-exposure to adjust, then click **Stop**.

   (a) The beam should have a diameter less than 1 mm and greater than 200 μm, so that there is a wide zero level.

3. Right-click on the profiles. Select **Linear raw mode (ADC mode).**

4. Right-click on the profiles. Select **Enter Intensity Multiplier** and enter **20**.

5. Right-click on the 2D area and select **Setup Software Aperture**; select **Turn off** and click **OK**.

6. Click **Go**. Once the beam has stablilized, click **Stop**.

- The orange profile shows a new profile scaled up by a factor of 20. It has a peak-to-peak noise of ~4% about a mean level of ~50% (Fig. 1). Dividing by the **Intensity Multiplier** entered above, the peak-to-peak noise is calculated at 0.2% of the signal ($\frac{4\%}{20}$). The offset level, around 2.5% of the ADC range ($\frac{50\%}{20}$), is set to ensure that negative electrical noise is correctly sampled.

- **SNR** conventionally refers to **Signal** to **RMS Noise Ratio**. Statistically, peak-to-peak Gaussian random noise is 5 to 6 times the RMS noise. The RMS noise is therefore ~0.04% of the signal peak, a ratio of **2,500:1**.
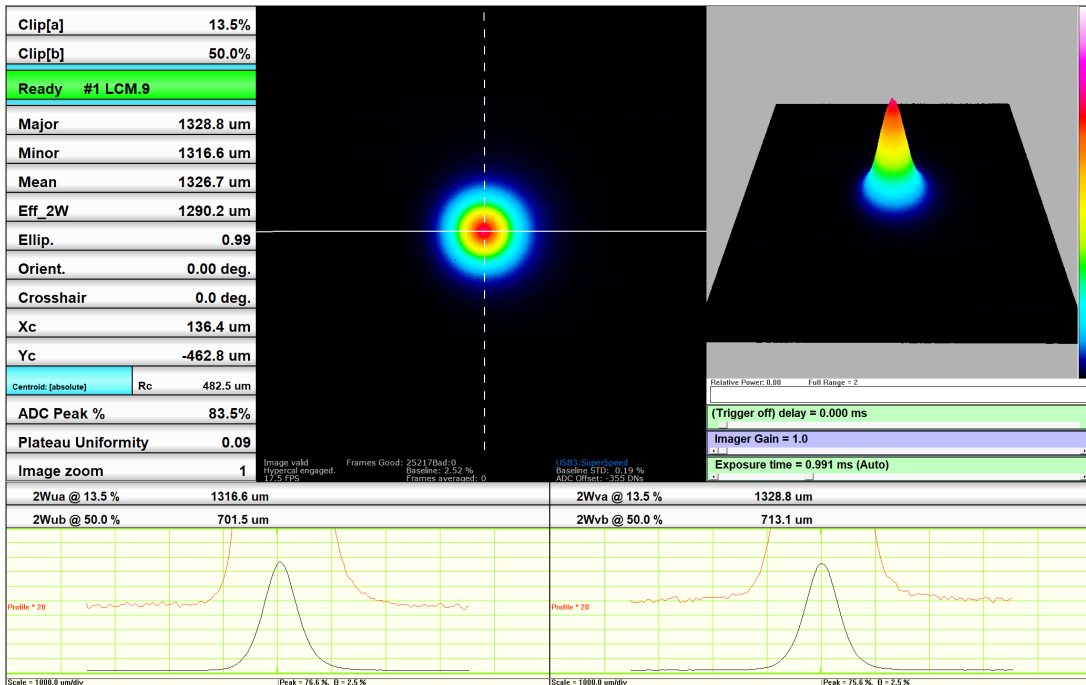

Figure 1: Above the zero level tails of the black profile curves, the orange lines represents the noise. **Linear raw mode (ADC mode)** is enabled. An **Intensity Multiplier** of 20 is enabled to make the noise on the plot more visible.

The profiles from Figure 1 use the default profile smoothing of 0.2% of full range - some level of smoothing is standard industry practice. With **No Filtering**, the noise is 2 to 3 times higher (Fig. 2).
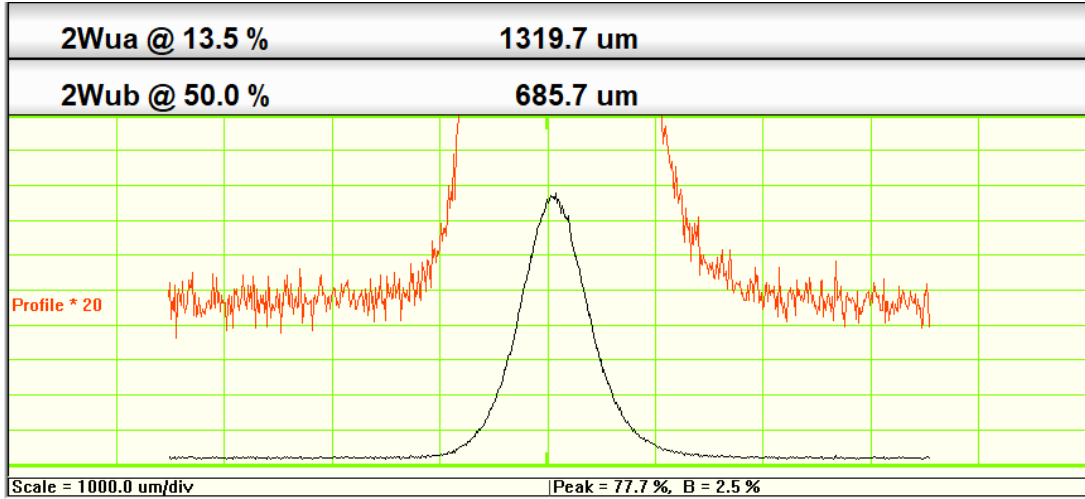

Figure 2: The profile without any smoothing. Note the absence of any structured noise. Noise is very low and close to the sampling limits of the 4096 levels of the LCM's 12-bit ADC.