

BeamMap2/BeamR2 Pulsed Laser Procedure

Introduction

This note outlines the steps of measuring low duty cycle pulsed laser beams with a BeamMap2 or a BeamR2. Be sure that your software is up to date before beginning. You can check for updates by visiting the DataRay website and checking the **Downloads** page.

The example used in this document is a 33 kHz PRR, with a 1 μ s pulsewidth and a 15 μ m waist. This is close to the limits at the 2 RPS rotation rate. Note that the minimum allowable frequency is:

$$f_{min} = \frac{500}{Beam \ diameter \ in \ \mu m} kHz. \tag{1}$$

First Time Setup

Use the following steps to set up a measurement for the first time:

- 1. Start the DataRay scanning slit software and press **Go** with the laser off.
- 2. Go to Setup -> Device EEPROM programming and set the Nominal motor start speed to 2 RPS. Click OK.
- 3. Go to **Setup -> Enter wavelength** and enter the wavelength of your beam in nm. Click **Yes**.
- 4. After 40 seconds, with laser off, press the green padlock 🔓 in the toolbar to lock the baseline.
- 5. Click the Filter drop-down menu and select No Filter.
- 6. Turn on the laser. As soon as all profiles are visible, center the beam to within 100 μm of the image coordinates (0, 0). See Fig. 1 for reference.



Figure 1: The software display after initial setup and centering of the beam



- 7. Right-click on one of the profiles and deselect **Auto Gain**.
- 8. Click **X** in the toolbar to show only the u profiles. Adjust all four individual profile gains to 8-12 dB lower than their current values, until the troughs of the profile data are no longer above zero (see Fig. 2).



Figure 2: The profile gains should be lowered so that the troughs of the profile data all touch zero

- 9. Click **Y** in the toolbar to show only the v profiles. Adjust v profile set to the same gain values. Click **X** in the toolbar once more.
- 10. Take note of the laser and attenuator settings so that you can acheive the same power later to be sure that future setup is identical next time.
- 11. Click the Filter drop-down menu and select Filter = 1.0% Full Scale.
- 12. Click the Average drop-down menu and select Average 5. The result should look something like Fig. 3.



Clip[a]	13.5%	R=500 um				View = 0 : Tilt = -45	
BeamMap2.3 ready							<u> </u>
M^2_u 1.11	1.17		0				
NA 0.051 0.046							<u> </u>
X2c 9.9 um							
Y2c 52.1 um							
Zo_u 3.4 um -75.4 um			•			Job file = C:\Users\Andrew Mac	Gregor\Documents\DataRay\130502 Ab
Ellipticity 0.86		Centroid: [absol	ute] Delta: (52 um)	Relative Power: 0.00 Full Ran	ige = 2		
2Wu1a 22.2 um		2Wu2a	14.8 um	2Wu3a	25.8 um	2Wu4a	110.9 um
2Wu1b 13.6 um		2Wu2b	8.8 um	2Wu3b	15.0 um	2Wu4b	53.4 um
	Average of S		Average of 5		Average of 5		Average of 5
			$\mathbb{A} \vdash \vdash \vdash$				
M							
				/ \			
Scale = 10.0 um/div zplane = - Peak = 4.0	165 um % base = 2.8 % C 0.0:SCRN 11.3 = 19.3 d	Scale = 9.0 um/div	zplanc = 0 um Peak = 5.3 % base = 2.8 % SLIT 0:ADC 0.0:SCRN 11.3 = 19.3 d	Scale = 11.0 um/div zz	planc = 215 um cak = 4.3 % base = 2.8 % LIT 8:ADC 0.0:SCRN 11.3 = 19.3 d	Scale = 50.0 um/div	zplane = 1.1 mm Peak = 3.8 % base = 2.7 % SLIT 12:ADC 0.0:SCRN 11.3 = 23.3

Figure 3: The sofware after changing the filtering and averaging settings for the pulsed beam

- 13. If any of the profiles are touching the top of their range, reduce the gain a further 4 dB.
- 14. Press **Stop**, then **File -> Save job file** and save these settings.
- 15. Click on **M2** in the toolbar to show the screen in Fig. 4a. A CW laser dialog (Fig. 4b) is also given for comparison. For an example of the final result of proper first setup, see Fig. 5.





(a) M2 measurement of the pulsed laser after setup

(b) M2 measurement of a CW laser for comparison

Figure 4: M2 measurements of the final pulsed laser setup and a CW laser for comparison



Clip[a]		13.5%	R=500 um							View = 0 : Tilt = -45	
BeamMap2.3 ready							_				
M^2_u	1.16	1.33			0						
NA	0.051	0.049						$\mathbf{\overline{v}}$			
X2c		10.2 um									_
Y2c		52.4 um									
Zo_u	-0.2 um	-71.2 um				<u> </u>					
Ellipticity 0.83		Centro	id: [absol	ute] De	lta: (53 um)	Relative Power: 0.00	Full Range - Z				
2Wu1a 22.9 um		2Wu2	а		15.4 um	2Wu3a		26.9 um	2Wu4a	111.8 um	
2Wu1b		13.3 um	2Wu2	b		9.1 um	2Wu3b		15.7 um	2Wu4b	57.2 um
	Λ	Average of 5				Average of	5		Average of 5		Average of 5

Figure 5: The final result of the pulsed laser setup in the DataRay software

Procedure

Use the following steps to run measurements after having completed First Time Setup instructions at least once:

- 1. Open the DataRay scanning slit software. Go to File -> Load defaults.
- 2. With the laser off, press **Go**.
- 3. After 40 seconds, lock the baseline by pressing the green padlock 🚨 in the toolbar.
- 4. Press Stop, then File -> Load job file, and load your settings (saved on first run, see First Time Setup).
- Note that the laser and attenuator settings must give the same power onto the BeamMap as you used during First Time Setup. If not, repeat the instructions in the First Time Setup section of this document.
- 6. Press Go and turn on the laser to begin measurement.