1. Introduction:

Beam profiling is useful to investigate the spatial mode of the laser light. We'll look at the beam profile at the same time that we investigate its trace on an oscilloscope. This brief instruction explains how to perform beam profiling for the lasers used in Open Water's technology.

2. Required test equipments

2.1. CMOS beam profiler

2.1.1. Manufacturer: DataRay

2.1.2. Part number: WinCamD-LCM

3. Experimental set-up:

Laser beam from the tapered amplifier (TA) and the free space isolator at the operating current (5A) should be directed towards the beam profiler camera (shown below), through free space. Running the TA at lower currents is not recommended to investigate the beam profile, since higher currents result in different side modes. High power beams will saturate and damage the camera sensor, so we need to use enough ND filters to assure that the sensor is not saturated (saturated sensor results in a beam profile that is not realisti

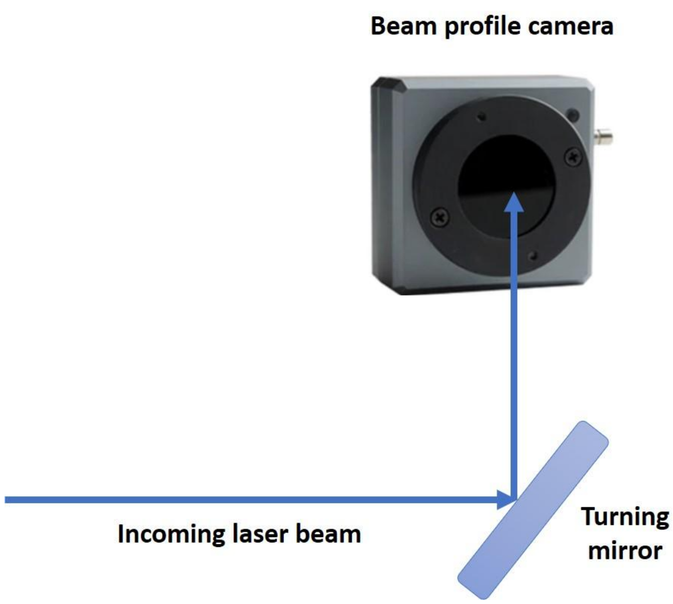

figure a

To get a stable image on the camera, it should be synchronized with the pulsing laser. To do so, connect the camera to the back of the TA power supply TTL channel, using a BNC cable. Here are the camera settings before capturing the beam profile:

- Open the DataRay software
- Trigger set up (Setup -> Setup Trigger): Choose TTL(Voltage)- positive edge
- Exposure control (right click on "Imager Gain" or "Exposure time"):
  - Enable auto gain adjustment
  - Exposure time is not relevant due to external triggering
- Make sure to zoom in to 3x for the center image

Image below shows the beam profiles for 2 different lasers operating at 5A (TA current).

First beam profile was captured using a laser with good performance. As can be seen there is one central mode with some side modes not carrying most of the laser energy. The 3D profile on the right side shows how much energy is distributed for each mode.

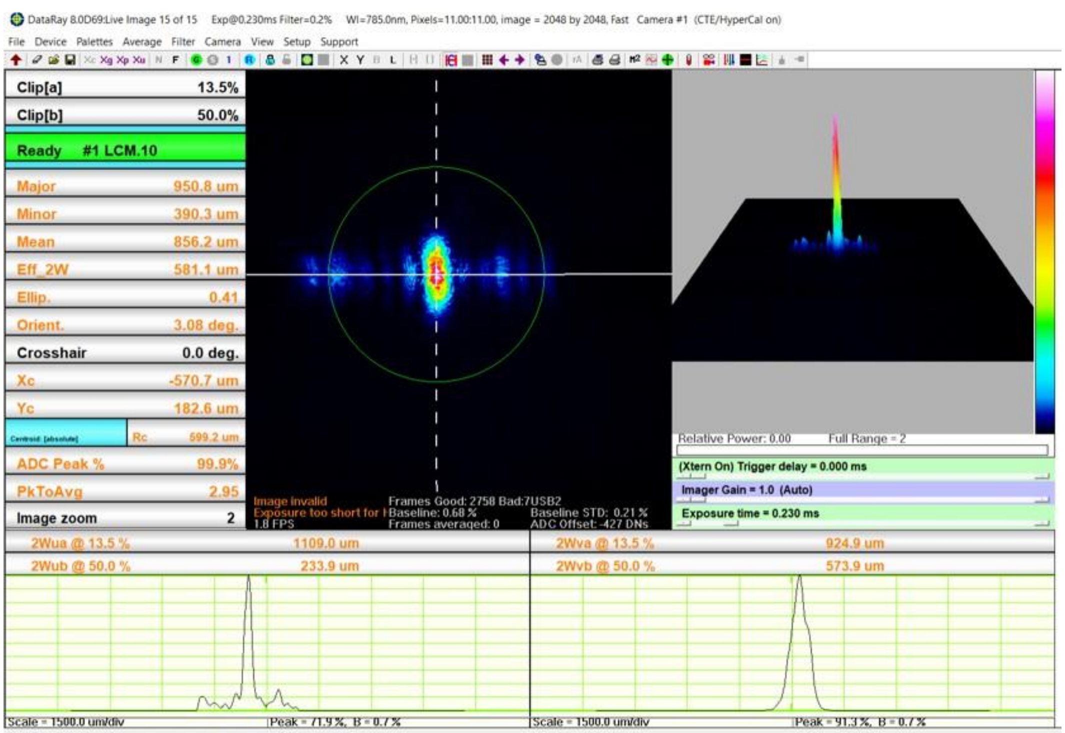

figure 2

The second beam profile was captured using a poor performing laser. Image below shows that unlike the first one, the energy is distributed over several spatial modes and more importantly there are 2 central modes (lobes) in the center of the beam. The 3D profile clearly shows the energy distribution is far from ideal. This indicates that there could be mode hopping between the 2 center lobes. Since we couple all these modes to a multi-mode fiber, it will affect the speckle contrast measurement.