Image on the beam diagnostics camera during focusing

People can be surprised by the pattern of fringes one gets when tries to image the backreflection of a well aligned polarised laser beam from the interface between the immersion medium (let us assume we have a water objective) and an ampty coverslip.

This is indeed normal, it is the result of using polarised light. Perfect alignment is reached when the lobes are more or less symmetric, that means they have roughly the same intensity. To reach this, you have to precisely position the beam to enter at the center of the objective entrance pupil, and the beam must be of course aligned with the optical axis of the objective. (Note that parallel beam displacement, not tilting, is necessary.)

The classic paper by E. Wolf “Electromagnetic Diffraction in Optical Systems. II.” shows some 4 lobed patterns for polarized light. http://rspa.royalsocietypublishing.org/content/253/1274/358 These figures are also reproduced in his text book if you have access to that instead.
https://books.google.nl/books/about/Principles_of_Optics.html?id=aoX0gYLuENoC&hl=nl

Adding a drop of water on top of the cover slip reduces the back-scattering intensity by an order of magnitude or so, but the basic shape remains the same. Even if one removes everything extra from the beam path, these fringes remain there, they are universal. There are a lot of surfaces, coatings, etc., perfectly aligned in order to obtain such an image. Interferences are unavoidable, note that all those images reported above are slightly defocused.

Such images are used for the daily and fundamental alignment of the MicroTime 200. The detailed procedure is described in the user manual of MicroTIme 200. Although the MicroTime is extremely robust we suggest its sers to spend 5-10 minutes every day for verifying the quality of the alignment by inspecting the backreflection pattern. Have a look how this is used also by watching the tutorial How to exchange the main dichroic of the MicroTIme 200.

This article is based on a dialogue open in Researchgate “How can I properly align laser beam into the confocal microscope? ”
https://www.researchgate.net/post/How_can_I_properly_align_laser_beam_into_the_confocal_microscope

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