Question
Section 2.0.1
What formulae did you use to come up with 300 nm resolution with a 600 nm laser? One of the basic formulas that most people use

Spatial resolution = 0.61 λ / NA

Where λ is the wavelength of the laser, and NA is the numerical aperture of the microscope objective being used.

If we use your 600 nm (it really should be 633 which would make the spot size a little larger) with a NA of 0.9 we get

0.61 x 600 divided by 0.9 = 407 nm
0.61 x 633 divided by 0.9 = 429 nm

Both of these values are larger than you 300 nm spec.

Answer:
Section 2.0.1 states "The confocal resolution must be equal to or better than 300 nm (lateral) and 500 nm (vertical) at an imaging wavelength of 600 nm using the objective described in section 2.3.5." The objective described in section 2.3.5 is an oil objective having an NA = 1.3. Therefore, assuming a laser wavelength of 633 nm, the attainable resolution would be:

0.61 x 633 / 1.3 = 297 nm

The question above assumed an NA = 0.9 instead of 1.3 causing the confusion.

Question
Section 2.1.1
Please explain what you mean by aperture stops in great details.

Answer:
Field and aperture stops are a common microscope feature used to control the incident white light illumination for standard white light imaging. They are used to optimize contrast and resolution. The field stop (also called field diaphragm) governs the diameter of the white light beam hitting the sample. It typically consists of an adjustable leaved-diaphragm-iris located in the illumination train such that it is imaged onto the object plane. The aperture stop (also called aperture diaphragm or condenser aperture diaphragm) controls the illumination brightness and the angle of the light cone hitting the sample. Closing the aperture stop can be used to reduce the effective numerical aperture (NA) of the microscope illumination. Opening the aperture stop increases the NA of the illumination reaching a maximum determined by the objective. Adjustments in the aperture stop effect image contrast and resolution.

Question
Section 2.4.5
Please explain why you want to have the objective fixed with the sample movement. This always introduces more noise into the system.

It is a large mass to move using piezos. You will have to slow down the scanner speed which will cause more thermal drift into the system.

Answer:
Our experimental requirements dictate that the NSOM system be capable of this mode of operation. One could imagine using a bottom far-field objective to illuminate a specific portion of a sample (i.e. the end of a nanowire) while measuring the near-field response away from this excitation (i.e. evanescent waveguiding along the nanowire). This experiment can be accomplished two ways. (1) The bottom objective may be fixed in position relative to the scanning stage or (2) the stage and bottom objective may both remain stationary while the tip carries out the scanning motion. Either solution is acceptable for the requirement of Section 2.4.5.

Question
Section 2.5.4
Which objectives for NSOM in air and liquid do you want to use?

Answer:
Section 2.5.4 does not refer to air or liquid scanning. Section 2.5.4 refers to compatibility with apertureless type tips. Section 2.4.3, on the other hand, does refer to scanning in air and liquid environments. Assuming the hollow cantilever type of NSOM tip is used, Figure 2, the top objective used in air must be at least 20x magnification with NA $\geq$ 0.4. For NSOM operation in water, the top objective may be either an air or water-dipping objective. A water-dipping objective is preferred and is designed to be operated with the objective tip penetrating water. A water-dipping objective would be used if the vendor suggests liquid-NSOM be carried out with water covering both the NSOM tip and the tip of the objective. If only the NSOM tip is in water and the objective does not touch the water, then an air objective would be sufficient.

Question
Section 2.7.2
Can the Raman spectrometer be installed separately from the microscope (optical coupling)?

Answer:
The spectrometer can be physically separated from the NSOM microscope but must be optically coupled either through fiber coupling or free-space coupling.

Question
Section 2.9.6
Please explain in more details why you want to move the bottom objective? This will create more noise in the system.

Answer:
One could imagine using the bottom far-field objective to illuminate a specific portion of a sample (i.e. the end of a nanowire) while measuring the near-field response away from this excitation (i.e. evanescent waveguiding along the nanowire). In a more general sense, one might want to excite a small area of the sample with a tightly focused beam while measuring the near field response everywhere else. This experiment can be accomplished two ways. (1) The bottom objective may be fixed in position relative to the scanning stage or (2) the stage and bottom objective may both remain stationary while the tip carries out the scanning motion.