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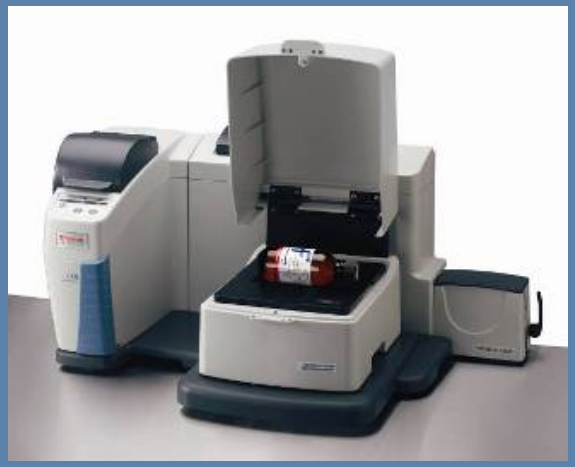
DXR Instrument Basic Maintenance



DXR User Training

Introduction

- Maintenance information for DXR Raman Microscope and SmartRaman instruments

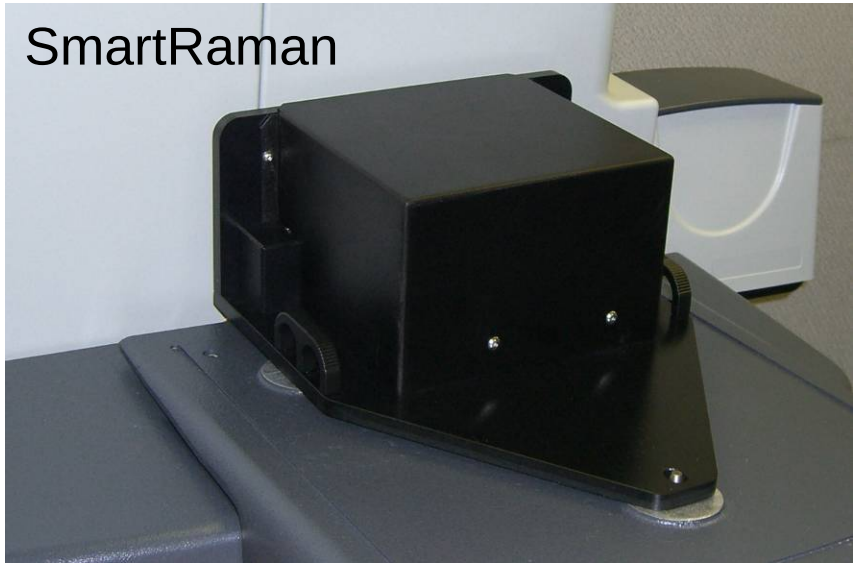
DXR Raman Microscope

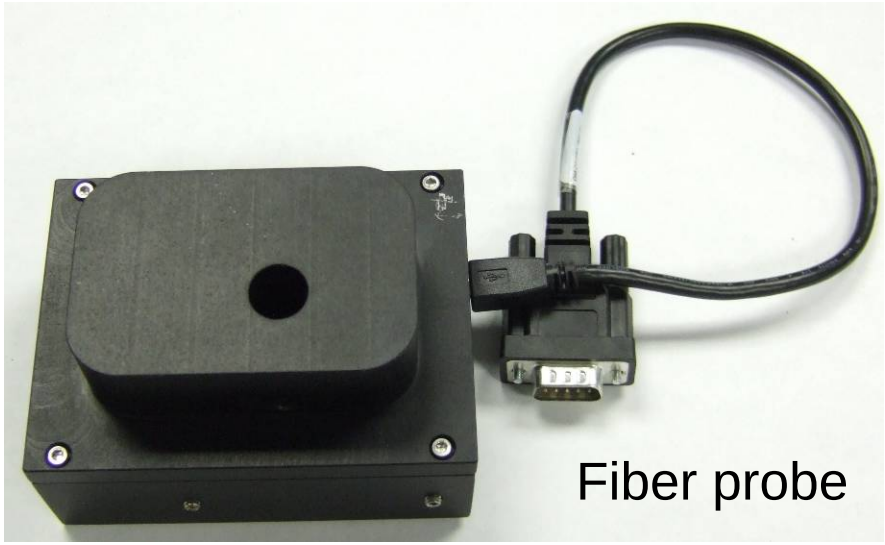
DXR SmartRaman

Alignment and Calibration Tools

- Microscope
- SmartRaman
- Fiber probe

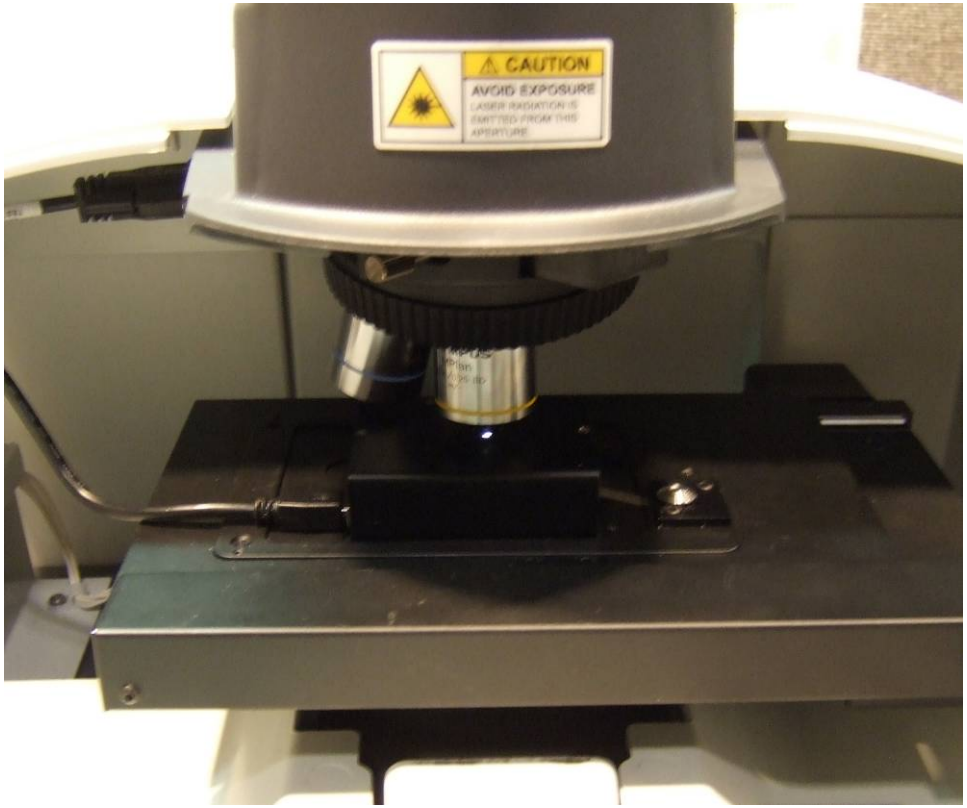
Microscope



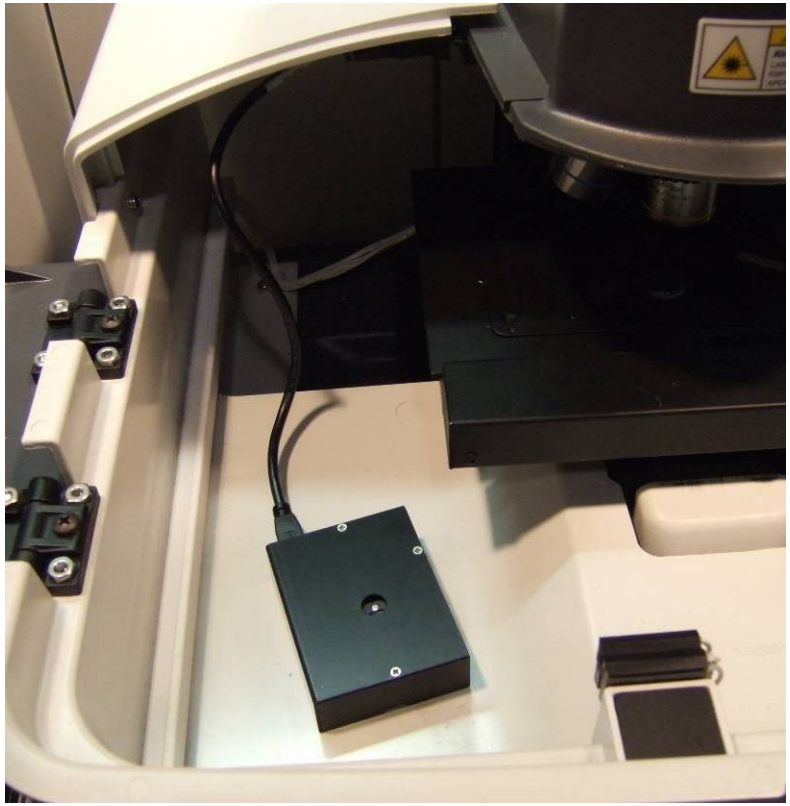


DXR Microscope Alignment tool

- Microscope alignment tool placement and storage



Align tool on stage



Storing align tool

Alignment and Calibration

- Two important but different processes for optimal performance

- Alignment is the process of bringing the laser beam and spectrograph sampling point into agreement
  - For the DXR Raman microscope, a third constraint is the visual crosshair which designates the sampling point
  - Alignment needed for best spatial resolution of microscope

- Calibration assures the accuracy of the spectrum wavelength (x-) axis and intensity (y-) axis
  - Software operations using known reference materials
  - Neon and polystyrene for the x-axis
  - White light for the y-axis

Alignment

- What is the process?
  - Align visual path – using oculars to center the visual path, so that what is in the center of the crosshairs is what is sampled
  - Align spectrograph path – so that the signal from the center of the crosshairs is what is sent through the spectrograph to the detector
  - Align laser path – aligns the laser to sample what is in the middle of the crosshairs

- How often?
  - Any time the instrument is moved
  - If there are a lot of users some people prefer to re-align on a regular basis
  - Software default is 30 days
  - A good starting point would be once a week

Calibration after Alignment

- If you think about it, calibration is dependent on optical alignment of the system

- Therefore, for best practices, you should run Calibrate Instrument after you run a new alignment

- How often should you re-align or re-calibrate?

  It depends on…
  - Your environment
  - Your lab practices
  - Your personality; how anal (as in *analytical*) are you?

- Keep records of a standard sample and let that be your indicator
  - ValPro Qualification – separate software and procedure

Calibration

- What is the process?
  - System calibrates several important aspects
  - Wavelength – x-axis
  - Apertures
  - Automatic intensity correction – y-axis
  - Laser power

- How often?
  - Recommended you re-calibrate after you re-align
    - Software can be configured to remind after the alignment procedure is completed
  - If you are doing QC or quantitative work possibly every day or once a week – preference, environment, and lab practice
  - Software default is 30 days, again, try once a week as a default

Calibrate Instrument

- The system is aligned. Next step: Calibration

- Calibration assures the accuracy of the spectrum wavelength (x-) axis and intensity (y-) axis
  - Software operations using known reference materials
  - Neon and polystyrene for the x-axis
  - White light for the y-axis

- Choose Collect > Calibrate Instrument from the OMNIC menu
- Place the alignment tool on the microscope stage and focus on the pinhole -or-
- Place the calibration accessory onto the SmartRaman

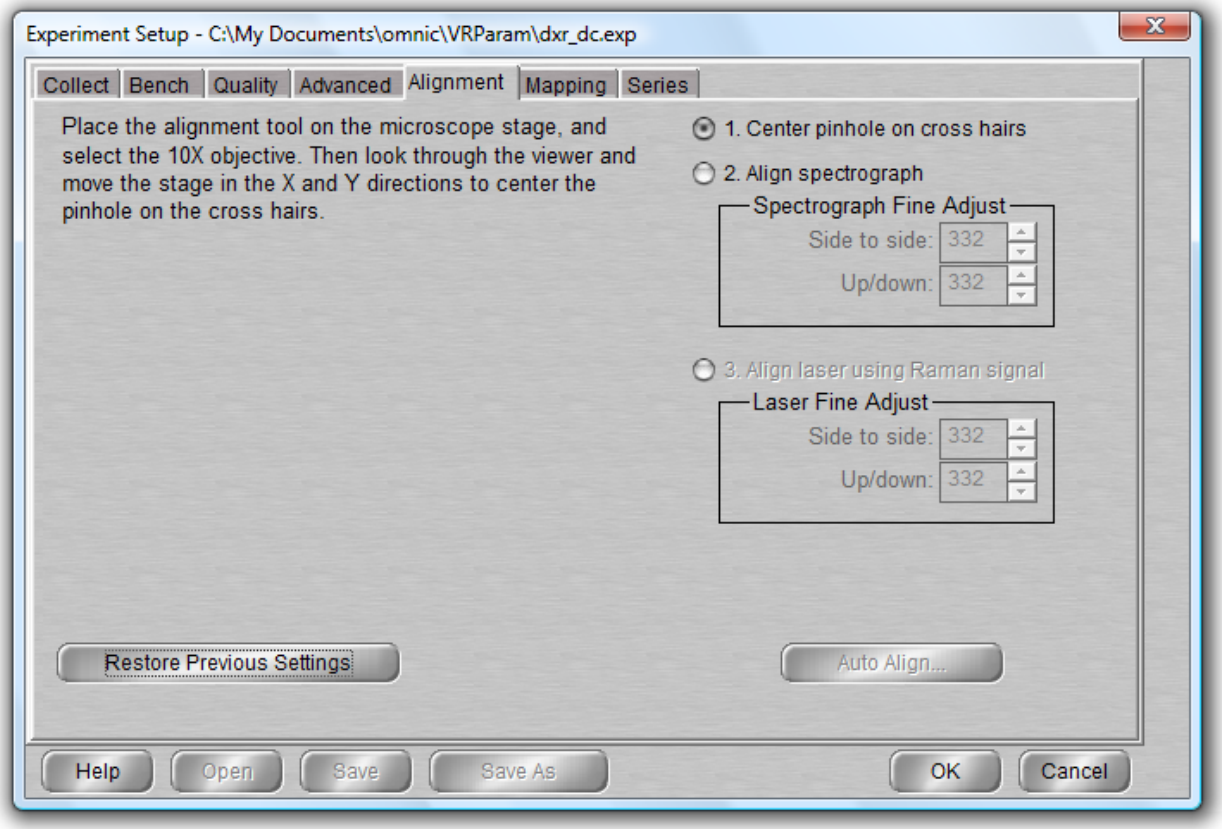
Alignment and Calibration

- How can I tell if my instrument needs alignment?
  - By following a regular alignment schedule this will not be a concern.
  - Alignment is a quick process, and the instrument is very stable.
  - Trying to analyze small features, such as a 1 micron feature, can be easily done with the DXR Raman Microscope, just be sure to align on a regular basis to maintain maximum spatial resolution.

- How can I tell if my instrument needs calibration?
  - Again, following a regular calibration schedule will remove this concern.
  - A known sample, such as the polystyrene card that comes with the instrument, can be analyzed, and the resulting peaks checked against known values. Spectra can be found in the sample libraries.

DXR Raman Microscope Alignment

- The pinhole is a point source to register the alignment of the visual crosshair (camera & oculars) and the spectrograph focus



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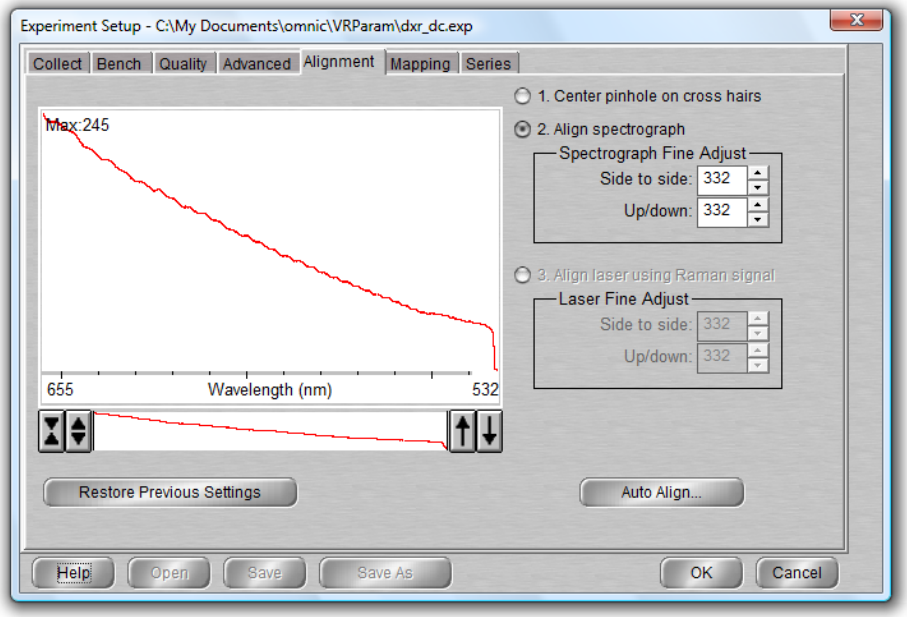
DXR Microscope spectrograph alignment

- The spectrograph input optics are brought to a focus by the microscope objective
- Spectrograph alignment adjusts the instrument beam path so the signal from the pinhole is maximized
- This guarantees the spectrograph focus coincides exactly with the visual reference (crosshair)



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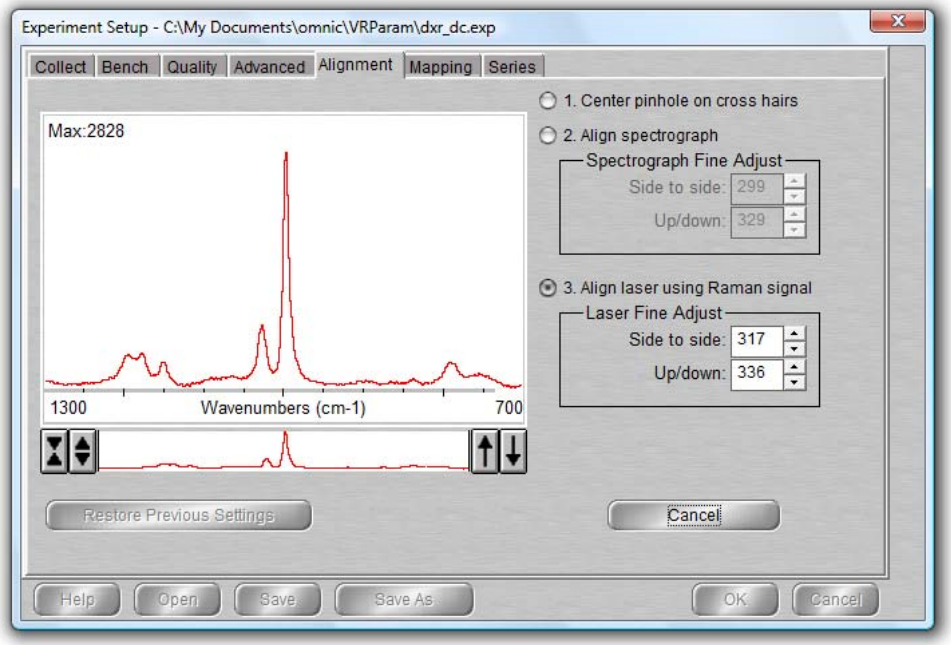
DXR Microscope Laser Alignment

- At this point, the spectrograph and visual reference are aligned. The final step is to bring the laser into alignment.
- Laser alignment adjusts the laser beam path so a Raman signal is maximized
- This guarantees the laser focus coincides exactly with the spectrograph focus



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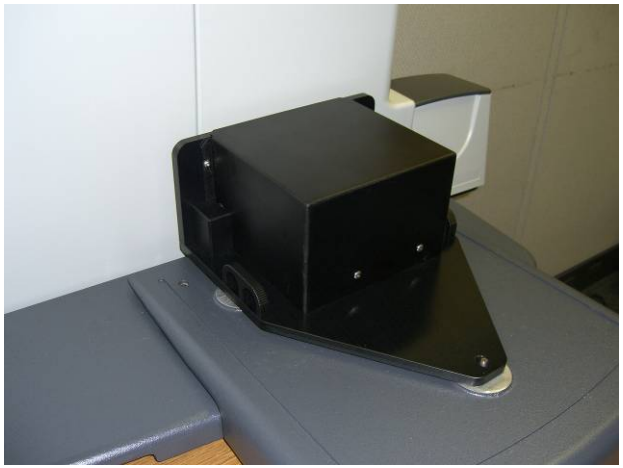
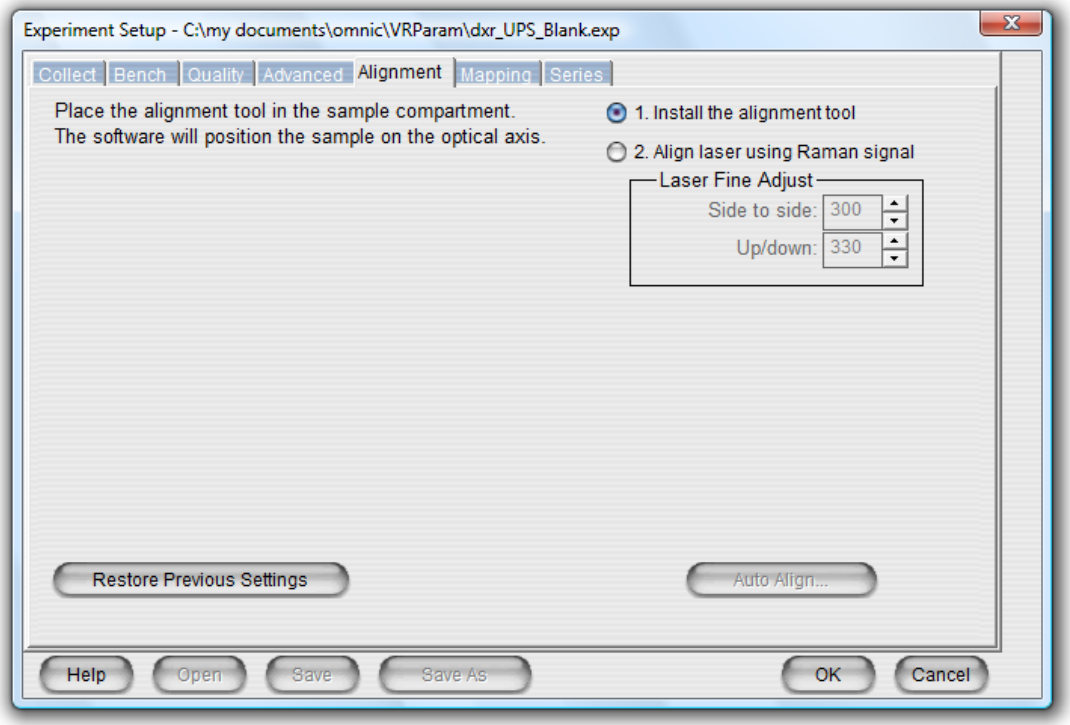
DXR SmartRaman Alignment

- Sampling point is fixed so we only need to align laser to the sampling point





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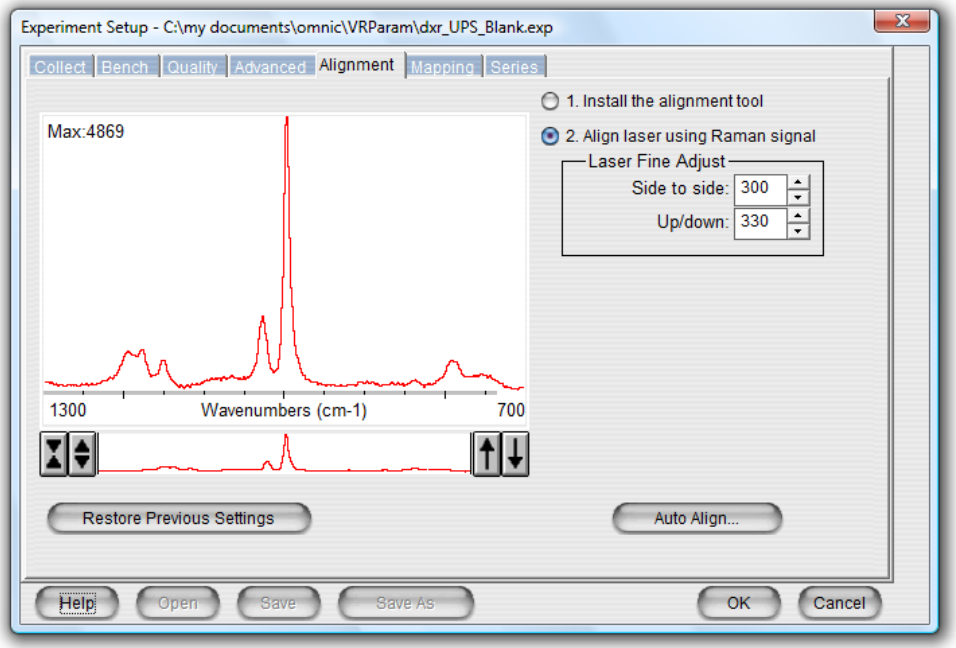
DXR SmartRaman Alignment

- Laser alignment adjusts the laser beam path so a Raman signal is maximized
- As with the microscope, this guarantees the laser focus coincides exactly with the spectrograph focus



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Fiber probe

- Using the alignment and calibration tool for the fiber probe.

Calibrate Instrument

- The system is aligned. Next step: Calibration

- Calibration assures the accuracy of the spectrum wavelength (x-) axis and intensity (y-) axis
  - Software operations using known reference materials
  - Neon and polystyrene for the x-axis
  - White light for the y-axis

- Choose Collect > Calibrate Instrument from the OMNIC menu
- Place the alignment tool on the microscope stage and focus on the pinhole -or-
- Place the calibration accessory into the Smart Raman

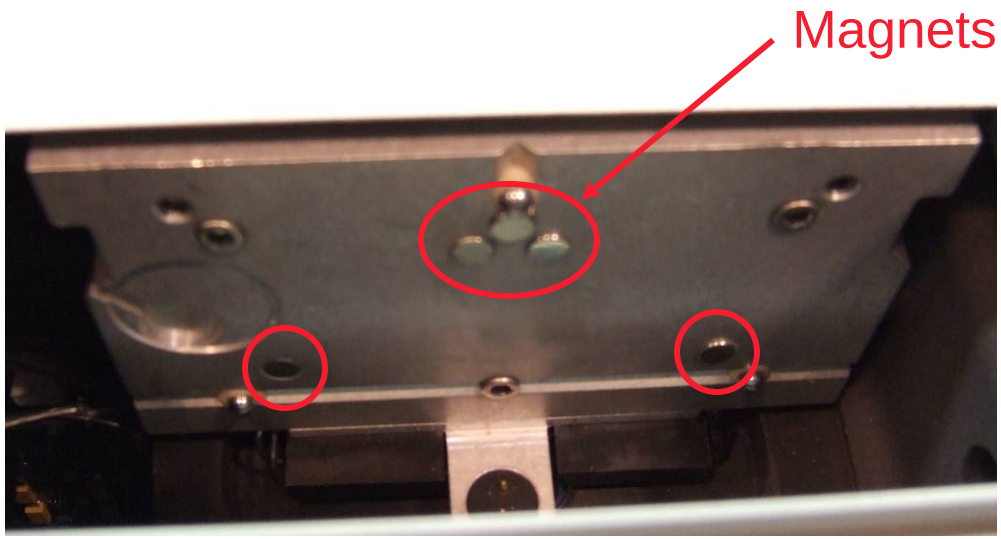
Smart Backgrounds

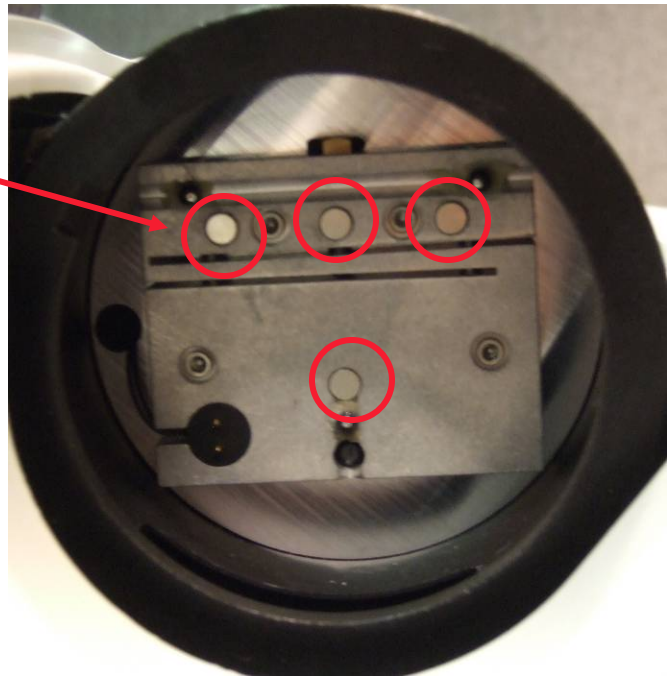
- How often should I collect new Smart Backgrounds?
  - Things to consider:
    - How is the instrument being used?
      - A QC environment may mean more frequent background re-collection
    - How stable is the environment the instrument is in?
      - A room with constant temperature means a stable instrument.
      - If the instrument is being moved around to different environments, then more frequent backgrounds may be suitable
  - Software default is 180 days
    - Some may prefer once a week or once a month
  - It takes about 13 hours to collect a complete set of backgrounds, so it can be done overnight or over a weekend.

Checking Magnets

- Grating Door – make sure it is closed when storing the grating

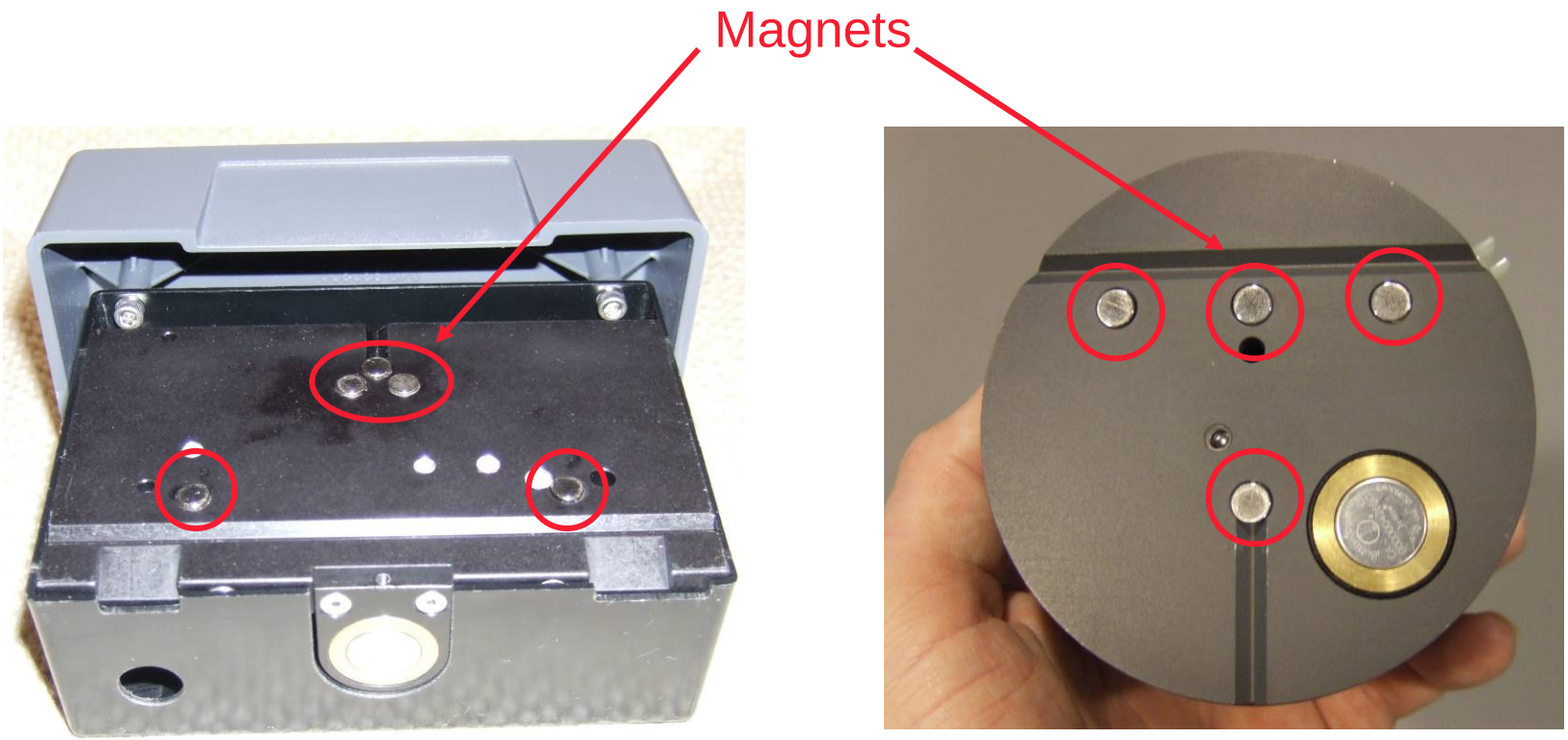
- Checking magnets
  - Inside instrument and components
  - Types of debris and problems





Checking Magnets

- Checking magnets on components



Cleaning Magnets

- Cleaning the magnets
  - Grating
    - Can simply remove magnetic debris, and use a Kim-wipe to clean the base
  - Filter
    - Can remove magnetic debris, and use a Kim-wipe if needed to clean the base
  - Inside instrument
    - Need to be careful so that nothing falls into the instrument
      - Debris that falls from the grating base would go into the spectrograph
    - Can cover the grating base opening with a piece of paper or a business card to stop debris from falling in.
    - Can use fingers or tweezers (plastic would be easier) to remove debris from the inner magnets

Lasers and the laser sled

- How to change/replace a laser
  - Lasers are consumables and will need to be replaced.

1. System with no laser installed

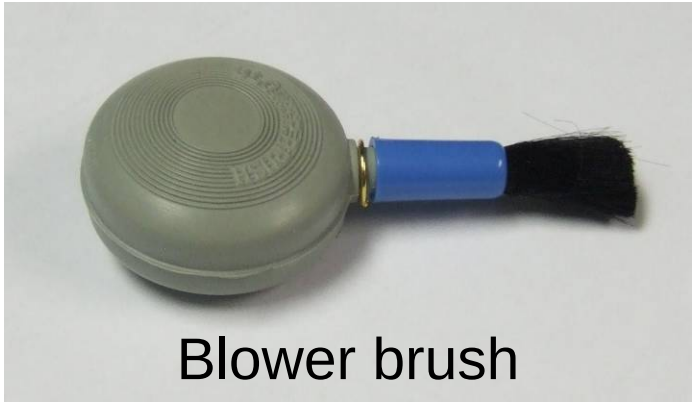
2. System with laser being slid into place

3. System with laser slid firmly into place

4. System with laser in place and locked.

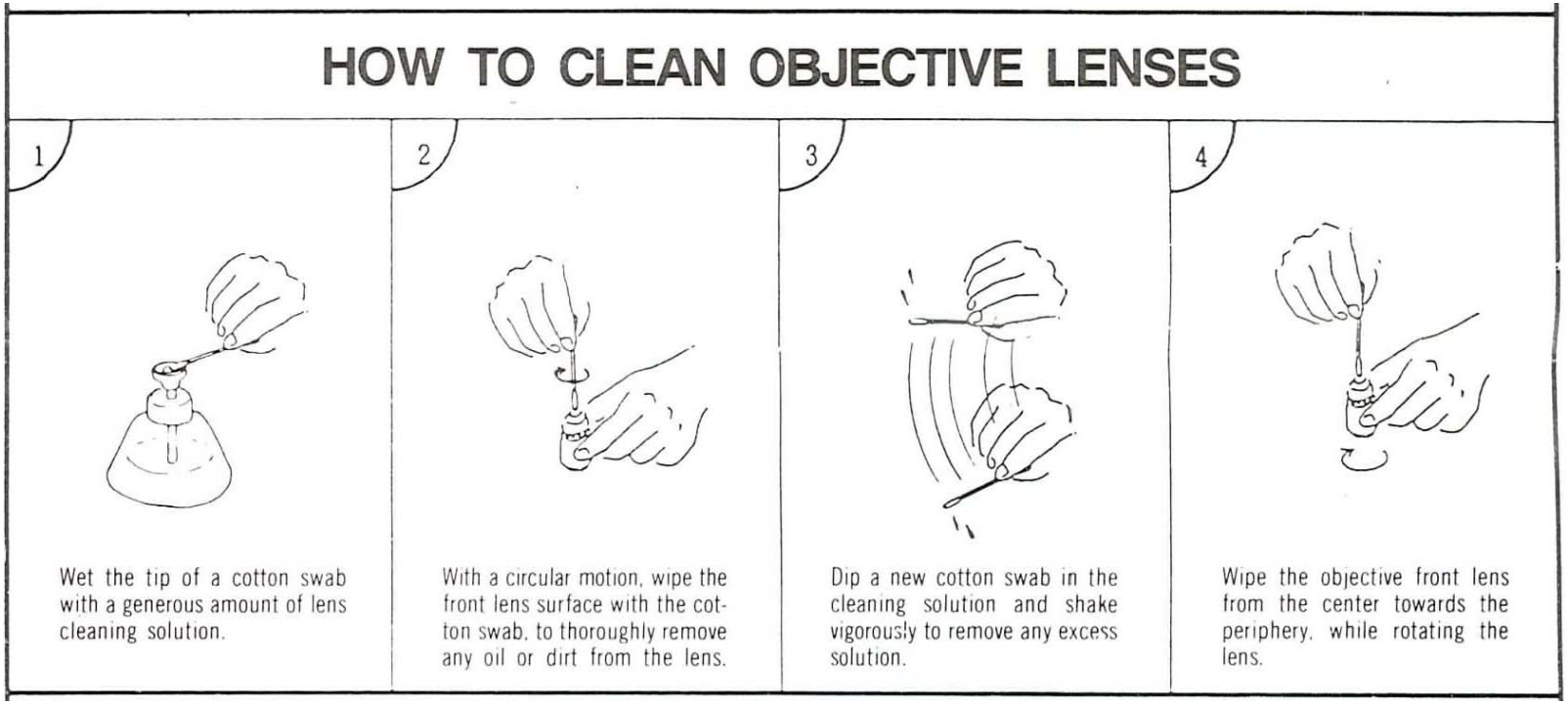
Microscope specific maintenance

- Microscope Stage
  - Initializing – Atlμs menu, System Configuration, X-Y Stage
- Illuminator bulbs
  - Replacing a bulb - Instructions in Spectrometer Help Topics in OMNIC
- Oculars/eyepieces – careful cleaning required
  - Coatings, particulates, etc
  - See next slide
- Objectives – careful cleaning
  - More details on upcoming slide


Blower brush

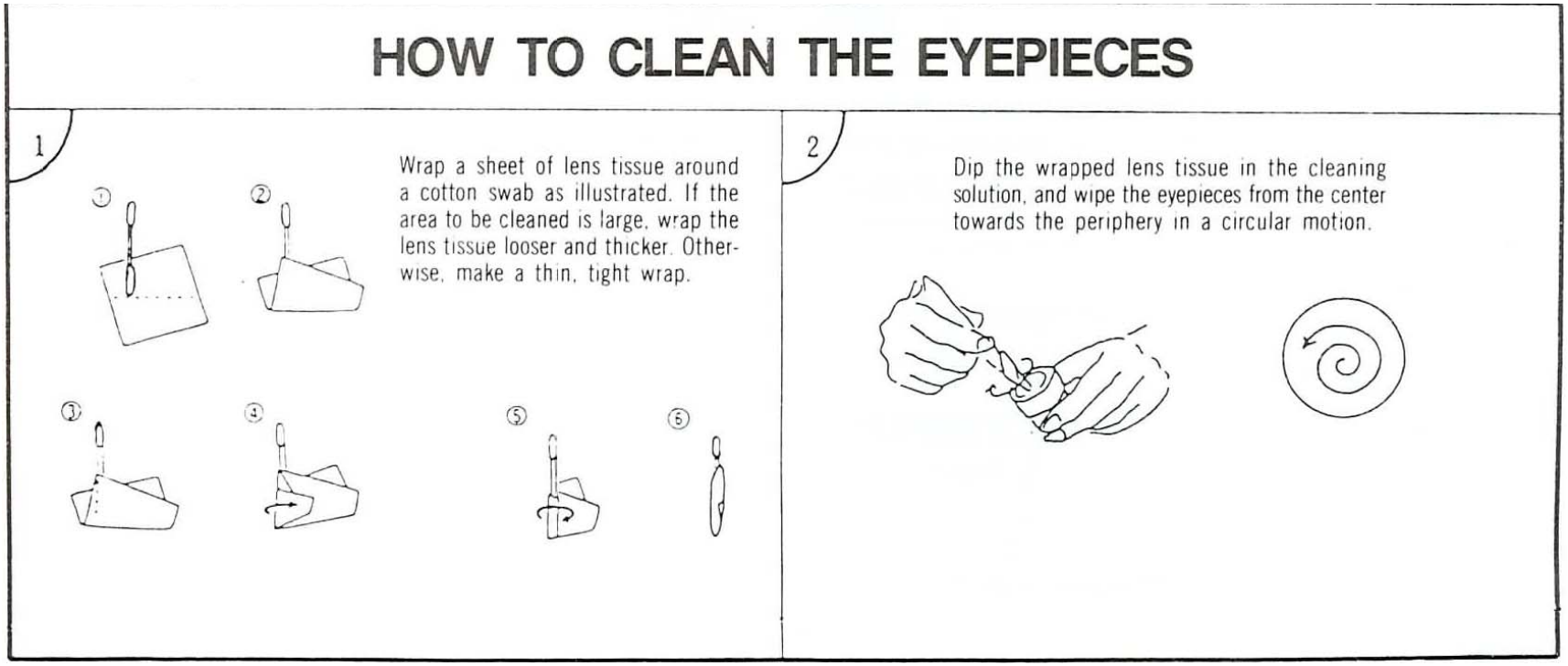
Cleaning the Objectives

- Objectives
  - Cleaning – wipe thoroughly and carefully with a cotton swab, using cleaning solution (ethyl alcohol or other)
- From Olympus:



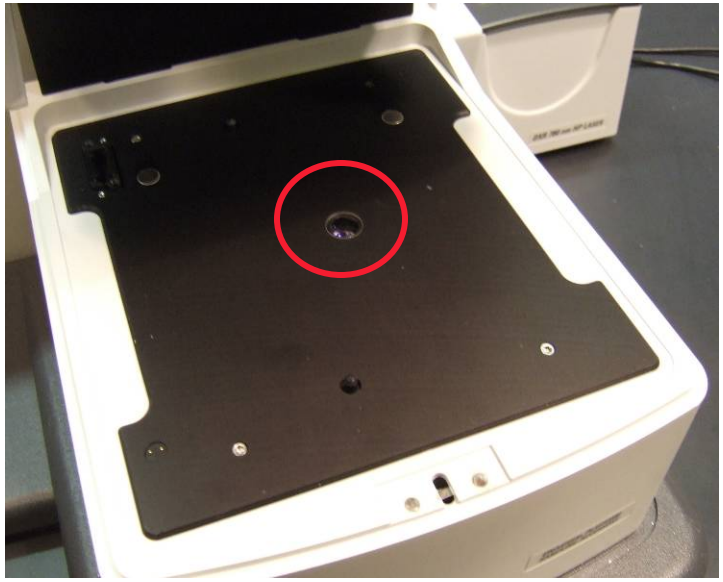
Cleaning the Eyepieces

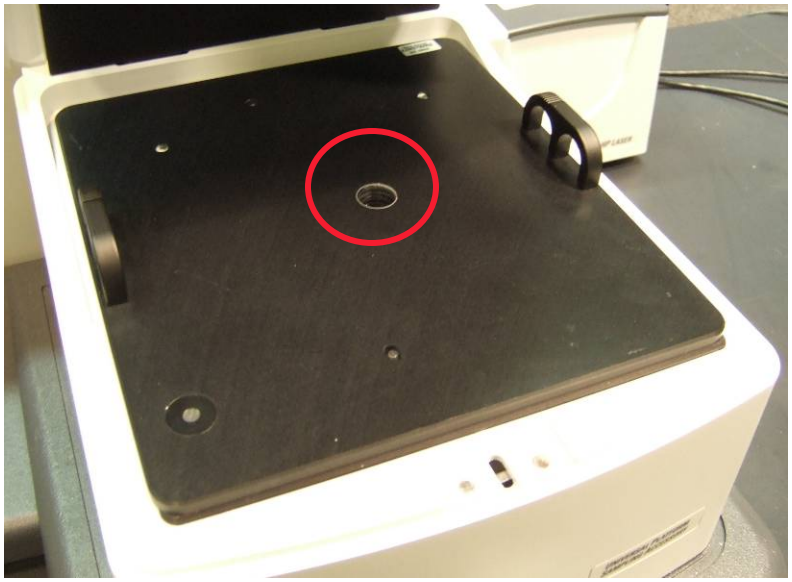
- Cleaning the oculars/eyepieces
  - Wipe gently and carefully with lens tissue
    - Lightly brush or blow to remove particles before using lens tissue
    - From Olympus:



SmartRaman specific

- Optical windows on the Universal Plate Sampling Accessory
  - Blow off any dust or particulates, isopropyl alcohol and a lens tissue
- Optical window on the Blank Toolhead
  - Blow off any dust or particulates, isopropyl alcohol and a lens tissue
  - Both sides of the plate





Fiber probes

- Caps
  - Keep caps on the probe tip and <u>especially</u> the fibers when the probe is not in use.
- Probe tip
  - Cap for storage, and when not in use to minimize laser exposure danger
  - Clean probe tip with lens tissue and isopropyl alcohol or lens cleaning solution.
- Fiber connectors
  - Caps for storage, don't touch the fibers especially with fingers.
- Be careful about bending
  - Too tight a bend radius can lead to fiber breakage