HOW TO GET STARTED

The GL Gem Spectrometer should be used with the mounted GL Halogen 10W gem holder (optimized for the VIS-NIR 360 – 950 nm range) or without the holder; in this case the sample is placed directly onto the cosine diffuser of the spectrometer entrance port (an external light source such as Xenon or halogen flashlight is required) or with the flexible GL Fiber Probe (optional, for experienced users).

Your GLGemSpec system is a “digital spectroscope” with much higher sensitivity and range than the diffraction grating hand spectroscope used by many gemmologists.

It measures transmittance (NOT absorbance/absorption) though the spectra can be converted and observed in real-time with the GLGemSpec software.

Some practice and re-thinking will be required to set the proper parameters and to analyse the obtained spectra. Please contact us at (604) 530-8459 or e-mail: gemlab@cigem.ca if you have any questions or need assistance.

FIRST STEPS

1. Connect the GL Gem Spectrometer with the supplied USB cable to a free USB port on your computer; it will be recognized by Windows as a USB device. Copy the GLGemSpec.exe, spectrlib_shared.dll and the databases to a dedicated folder on your computer. Start the program.

2. At start several parameters are already pre-set (default 350 – 950 nm range). You can change Exposure (usually 20 – 50, adjust to achieve maximum signal intensity between 5 – 10,000 counts for the built-in halogen light). BoxCar recommended value 5 - 10.

Now click on RUN after the box has turned white. You should see a slightly vibrating line near 0 across the spectral range. NOTE: If selected exposure is set to 500 ms or higher click on “Get background” and then on “Subtract background”. Your base line should now be smoother.
3. Make sure the light holder is connected with the power adaptor and switched ON: you should see the bell-like curve of the halogen light's emission spectrum.

**SCOPE MODE:** Place the included sample with TABLE DOWN onto the pedestal inside the light holder.

![Graph showing emission spectrum]

Smaller gems (.05ct+) can be placed on top of the white Teflon cosine corrector but do not scratch.

You now see the “raw transmission spectrum” of your gemstone.

For testing dark materials or gemstones with poor transmission such as diamonds an external light source should be used; aim the light at the side of the sample and adjust exposure while observing the spectrum (tripod holder recommended).

*Note: The colour bar is for reference only and does not represent the exact location in the visible colour spectrum (400 – 700 nm).*

**TRANSMISSION AND ABSORPTION SPECTRA**

4. Before you save a spectrum and for further processing a “lamp correction” must be done: While the light is ON remove the sample and take a “reference/lamp spectrum” by clicking . Now select **Spectra/Ref** and replace your sample gemstone. You see the transmission spectrum corrected for the lower intensity of the halogen bulb towards the red and blue; “autoY” (default) keeps the full spectrum always visible.

For an absorption spectrum click “ABS” (absorbance). Both views show normalized (Y from 0 – 1) spectra and can be saved for reference purposes. Call it [nameS] for Scope Mode, [nameT] for Transmittance, [nameA] for Absorption spectrum. The program adds the .fak extension: AlexBrazilT.fak

5. Unclick **Spectra/Ref** or **ABS** and you are back in **Scope Mode**. Clicking “X autoscale” sets the horizontal wavelength scale to its full range (300 – 1,000 nm). “Y autoscale” sets the vertical intensity scale (if “autoY” is not selected) to the minimum and maximum. “X and Y autoscale” is a combination of the previous two all of which can be set manually with ...

6. If only a portion of the spectrum is visible and “autoY” is not selected double click with the left mouse button anywhere in the window and the spectral graph will fit (“Y autoscale”); after clicking the right mouse button you can move the marker to a specific point for wavelength (in nm) measurement.
By default “autoY” is selected but can be turned OFF after taking a “reference/lamp spectrum”. This is recommended when zoomed in or for weak spectra needing exposure adjustment. For very dark stones the exposure time can be increased to 500+ ms; be aware of oscillations or squarish parts present in the spectral curve indicating over-saturation of the sensor.

Hint: Save your lamp spectrum. Start GLGemSpec, load Source/Lamp spectrum, click Spectra/Ref for normalized transmission and ABS for absorption spectrum, turn halogen light ON and replace sample.

A strong external light source (Halogen or Xenon) can be used for cabochons and larger stones. The number of scans can be increased (recommended 5 and higher) to improve and stabilize the spectrum.

Before taking a new spectrum it is best to restart the GLGemSpec program to flash out all data and computations stored in the memory of the spectrometer (recommended when the spectrum does not appear to be right).

EDITING AND PUBLISHING

Reference spectra can be saved and loaded with ; the saved file (with the extension .txt) will cover the full range (300 – 1,000 nm). The program window can be printed and/or saved as an image.

For zooming click your left mouse button and while holding down draw a rectangle from left to right all the way to the bottom of the area you wish to cover.

The current view can be saved as a spectral file (with the extension .fak). Both .txt reference files and multiple .fak files saved by other users can be opened in GLGemSpec and/or in Spekwin32 for editing. During import choose “Transmittance” or “Absorbance” depending on [nameT.fak] or [nameA.fak]; the program has various features such as smoothing, normalization, base-line correction, colouring, etc.

If you assemble your own data-base of normalized reference spectra you can bulk-test and identify many stones quickly based on their spectral pattern.

TRANSMISSION/ABSORPTION/EMISSION:

Spectra obtained with the GL Gem Spectrometer look different from spectra seen through a traditional hand-held spectroscope. The spectrum obtained after clicking “Spectra/Ref” shows transmittance; i.e. if transmission for certain wavelengths (in nm) is LOW absorbance for those wavelengths will be HIGH (in the conventional hand gem spectroscope one would see dark lines or bands at these positions; see image left).
PLEASE NOTE

Both the GL Halogen 10W Gem Holder (for the VIS-NIR 400 – 950 nm range) have been optimized for your GL Gem Spectrometer using the GLGemSpec software. The use of accessories (in particular fibers and light sources in a customized setup and/or made by other manufacturers) may lead to different results. Any changes made to the hard and soft-ware may cause problems in the proper operation of your instrument.

For experiments LW and SW UV LEDs can be used to illuminate samples in the light holder; however, be aware that mercury-vapor lamps may damage the GL Fiber Probe with extensive use. We also recommend the GL Analyser PL405 kit for photo-luminescence studies using a blue laser (405nm).

* The GL Halogen 10W gem holder is an exclusive design of Gemlab Research & Technology and is protected by copyright laws.

** For each GL Gem Spectrometer unit a software package with a single user license has been provided. The GLGemSpec program works with the GL Gem Spectrometer only. The included LabVIEW subroutines (Vis) are provided for developers; a runtime version of LabVIEW 2009 should be installed on your computer for use with the GL Gem Spectrometer.

Warranty: According to consumer laws in the country of use (usually 6 months). This is an electronic device; do not drop, expose to heat, high humidity levels, sudden temperature change, radiation, etc. We have a local repair facility for re-alignment and reprogramming of firmware in case of accidents.

For further information contact Gemlab R & T at (604) 530-8569 or by e-mail at gemlab@cigem.ca

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Typical absorption in the 920 - 940 nm range of Cu bearing tourmaline - Jadeite, Burma - naturally coloured with typical absorption lines at 437 nm, 630 nm, 655 nm and 690 nm (edited in Spekwin32)