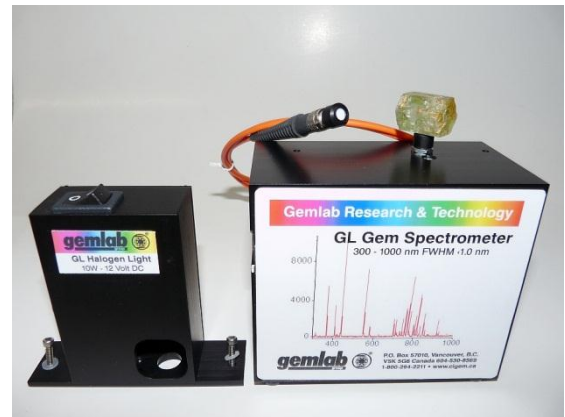
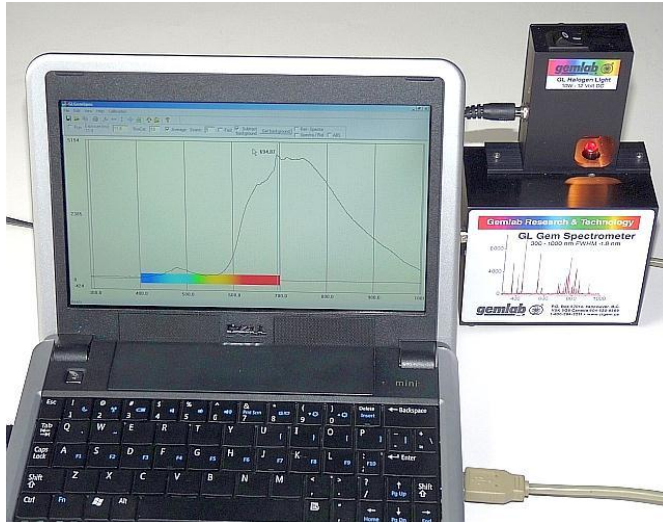


## HOW TO GET STARTED Version 2.5

GLGemSpec

The GL Gem Spectrometer should be used with the mounted GL Halogen 10W gem holder (optimized for the VIS-NIR 400 – 950 nm range) or without the holder (sample is placed directly onto the cosine diffuser of the spectrometer entrance port, external light source required) or with the flexible GL Fiber Probe (optional, for experienced users). The fiber probe with diffuser allows testing of larger gem materials and mounted gems and/or while observing them with an external light source.

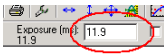


Your GLGemSpec system is a “digital spectroscope” with much higher sensitivity and range than the diffraction grating hand spectroscope used by many gemmologists. It measures transmittance (NOT absorbance or absorption) though the spectra can be converted in real-time with the GLGemSpec program or edited in various formats with the free Spekwin32 spectroscopy software. It will require some practice and re-thinking to set the proper parameters and to analyse the obtained spectra.

With proper reference spectra bulk-testing can be done quickly and efficiently.

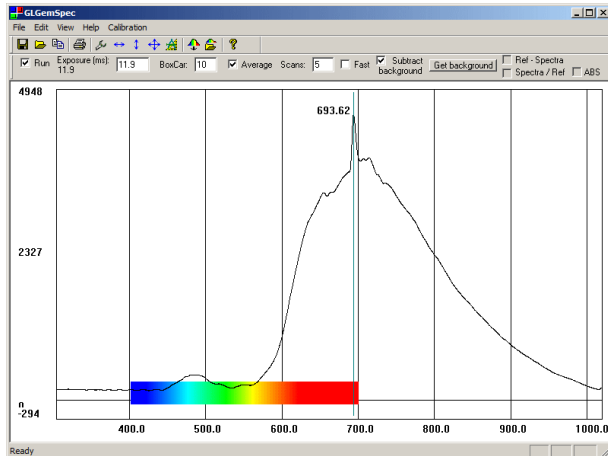
### FIRST STEPS

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 program to your computer or run it directly from the CD.

2. After starting GLGemSpec you can set initial parameters such as Exposure  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. Click on “Get background” and then on “Subtract background”. Your 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 a gemstone (or included sample) with TABLE DOWN onto the pedestal inside the gem holder.



The gemstone has to cover the opening above the visible white Teflon cosine corrector (do not scratch it):


You now see the “raw transmission spectrum” of your gemstone which can be used to help in its identification.


For testing opaque materials or gemstones with little or no light transmission such as diamonds an external light source (fiber optics halogen light or Xenon flash-light) has to be used; aim the light at the side of the sample and make necessary adjustments (exposure if necessary) while observing the spectrum.

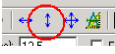
If you assemble a data-base of your own reference spectra you can bulk-test and identify quickly many stones based on their spectral pattern. For “corrected” transmission and absorbance spectra please read below.

Note: The colour bar is for reference only. It can be removed under “settings” by unselecting the box “Add colour bar”.

4. Before you save a spectrum for further processing a “lamp correction” must be done: Remove the gem and take

a “reference spectrum” by clicking on  Now put your gemstone back on and click Spectra/Ref

 giving you a transmission spectrum corrected for the low intensity levels of the halogen bulb towards the red and blue. For an absorption spectrum click “ABS” (absorbance).

5. For the normalization feature (version 2.5) to work properly the “y autoscale”  should not be used after taking the “reference spectrum”. Instead place your stone on the sample platform and click “Spectra/Ref” or “ABS” and then “norm”. Now your spectral graph should appear between 0 and 1 and it can be saved at this point. You cannot zoom in this mode. Before you change parameters do the reverse: unclick “norm” then “ABS” or “Spectra/Ref” and then click “y autoscale” or “x and y autoscale”. Now you can change parameters and use the zoom mode.

6. Further adjustments can be made by clicking on the various functions on the toolbar. For very dark stones the exposure time can be increased to 100+ ms as long as no over-saturation of the sensor occurs (visible by oscillations present on the spectral curve). A strong external light source (Halogen or Xenon) can be used for cabochons and larger stones. The number of scans can be increased to improve and stabilize the spectrum. It is recommended to leave “Average” ON and “Fast” OFF. 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. This is also recommended when the spectrum does not appear to be right. All “settings” are saved when quitting the program.

7. By clicking on the right mouse button anywhere on the graph you can move the marker to a specific point for wavelength (in nm).

8. GLGemSpec (Version 2.2+) has a zoom feature: a fixed 400 – 700 nm range can be selected under the “View” option; for other zoom ranges click on your left mouse button and draw a rectangle from left to right all the way to

the bottom of the area you want to cover. If the spectrum disappears click "y auto-scale" or "x and y auto-scales" and the original view returns.

9. You can load or save a spectrum: Name it **[nameS]** for Scope Mode, **[nameT]** for Transmittance, **[nameA]** for Absorbance and **[nameNS/T/A]** for normalized spectrum. The program adds the .fak extension: **AlexBrazilINT.fak**

## EDITING AND PUBLISHING

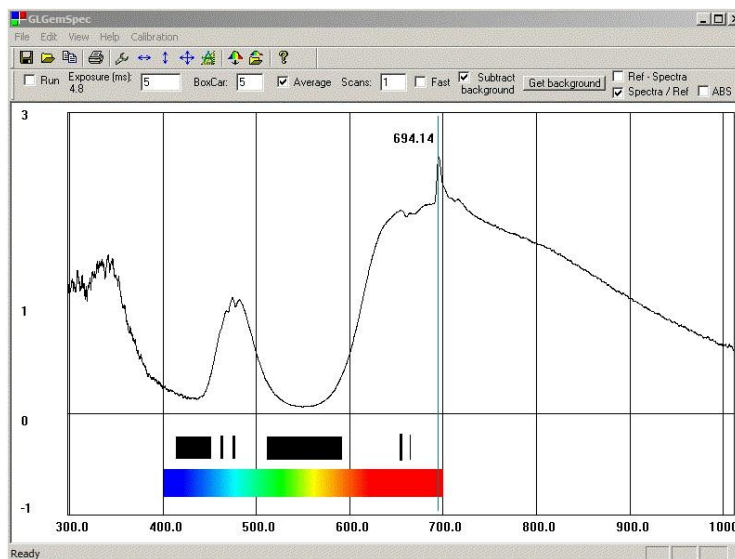
The GLGemSpec program is an efficient and fast interface to obtain spectral measurements and manipulate the spectra including normalization (Version 2.5); however, printing and editing features are limited. For further processing SpekwIn32 is used as a powerful editor for saved .fak files.

Download the program from [http://www.ffmpeg2.de/spekwin/index\\_en.html](http://www.ffmpeg2.de/spekwin/index_en.html) and install it on your computer.

Open a saved .fak file and choose "Transmittance" or "Absorbance" depending on [nameT.fak] or [nameA.fak] when importing the spectrum; the program allows numerous adjustments such as smoothing, normalization, baseline correction, colouring, etc.

It is beyond this short introduction to explain all the possibilities. A database of spectra and downloadable reference spectra are available at the GLGemSpec Support Area (you must log-in to access the user area).

**TRANSMISSION/ABSORPTION/EMISSION:** Spectra obtained with the GL Gem Spectrometer look different from



spectra seen through a traditional hand-held spectroscope when observed in a graph; in publications terms such as "relative absorption", "reflectance", "transmission", etc. are often being used.

The spectra obtained after clicking "Spectra/Ref" show transmittance; for example if transmission for certain wavelengths (in nm) is LOW absorbance for those wavelengths will be HIGH (in a conventional spectroscope one would see dark lines or bands at these positions; see diagram).

## PLEASE NOTE

Both the GL Halogen 10W Gem Holder (for the VIS-NIR 400 – 950 nm range) and the GL Fiber Probe (orange) have been matched and 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; previous experience in interpreting spectra is recommended. Critical operational data (firmware) is stored in your spectrometer's flash memory.

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 of second-order effects from diffraction grating. Mercury -vapor lamps may damage the GL Fiber Probe with extensive use.

\* 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 LabVIEW VIs are provided for developers; included is a runtime version of LabVIEW 7.1 which can be installed on your computer for use with the GL Gem Spectrometer.

\*\*\* The name and logo GEMLAB GROUP is a registered trade mark (Registration # TMA407372 with the Canadian Intellectual Property Office).

Warranty: According to consumer laws in 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 Research and Technology at (604) 530-8569 or by e-mail at [gemlab@cigem.ca](mailto:gemlab@cigem.ca)

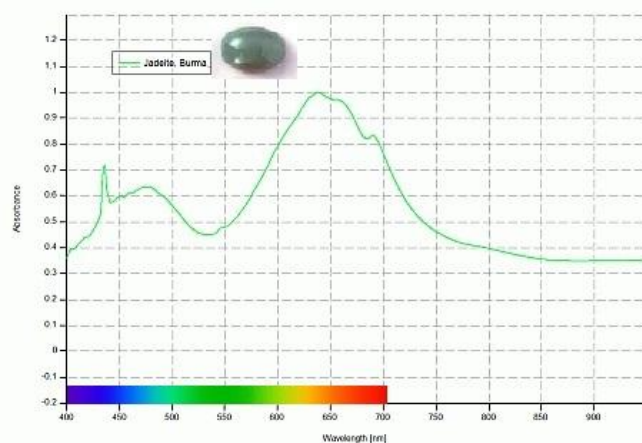
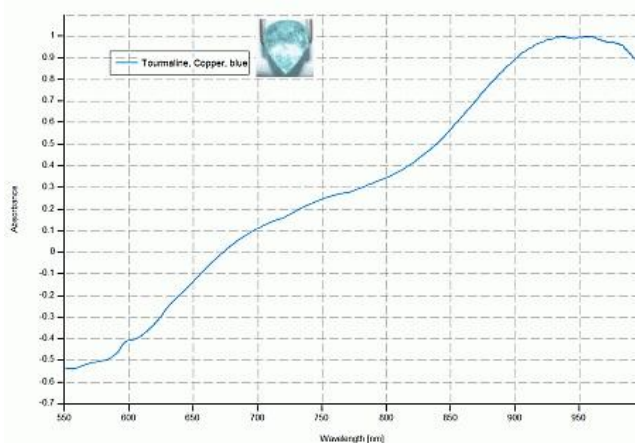
Mailing address: P.O. Box 57010, Vancouver, B.C. V5K 5G6 CANADA

Vancouver, April 26, 2012

Author: Wolf Kuehn, B.A., M.A., Dipl. oec., F.G.G., F.G.A.

Copyright ©2012 Gemlab Research & Technology

This article was prepared for licensed users of the GL Gem Spectrometer system and may not be copied, reproduced, transmitted, displayed, performed, distributed, rented, sublicensed, altered, stored for subsequent use or otherwise used in whole or in part in any manner without Gemlab Research & Technology's prior express written consent.



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)