

ImaGemTM Newsletter

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COLOR GRADING - A NEW APPROACH

Accurate and consistent grading of color are key benchmarks by which gemologists and gem labs are rated. Color grade has a significant impact on the value of a diamond. According to Rapaport the price of a round 1-carat stone with clarity of VVS2 varies \$1000 between a color grade of G and H. In response to the need for accuracy and consistency the industry requires gemologists to be certified only after extensive training on examining stones and using master stones, then passing practical tests that demonstrate their proficiency in color grading. Labs point out that more than one gemologist is involved in deciding a color grade. Still, there is a continuing uneasiness in the trade about both the accuracy and consistency of color grading. A [study of the same 17 stones that were graded by the major gem labs](#) revealed the actual differences in grading including color. At the heart of color grading diamonds is the ability of trained graders to perceive and distinguish color, to have standard master stones of different sizes and shapes, and to have standard lighting conditions and procedures.

Enter ImaGem with the same goal of improving the accuracy and consistency of color grading but with a new approach. We used scientific knowledge about perception, developed new techniques for calibrating lights and spectrometers, and used new methods for collecting and processing color data. Finally we made appropriate quantitative adjustments for size and fluorescence. We also discovered the secret that to achieve a high level of accuracy and consistency in color grading an average of the readings of body color only should be used. Colorimeters using an integrating sphere to collect data are unable to separate body color from diffraction and fluorescence. Achieving both increased accuracy and consistency is essential to increasing industry confidence in color grading. ImaGem did all of this and secured protection of the intellectual property incorporated in these many advances with three patents and many trade secrets. ImaGem has also achieved high levels of accuracy and consistency in measuring and grading fluorescence in a diamond. Using the new method fluorescence zoning can be mapped both in finished and rough diamonds. Magnitude and color of fluorescence affect the value of a diamond.

These advances were first reported to the trade in [an article in the October 2003 issue of Modern Jeweler magazine \(download a PDF copy of the article\)](#). The author, Ivan Solotaroff, when he visited our laboratory noticed on the monitor of the GL 3000 grading module that a stone's color grade was shown to 1/3 of a grade on the GIA scale. ImaGem will also report color measurements on CIE scales which represent a scientific and established standard world wide. In the next newsletter more information about ImaGem's highly accurate and consistent approach to color grading as well as service offering with a guarantee will be presented.

QUESTIONS TO ASK WHEN SELECTING GEM GAUGING EQUIPMENT (Part I, Definitions)

Over the last two decades many technological advances have been made in the gem and jewelry business and successfully adopted by the industry. This article examines in particular advances in gauging technology and compares the performance and special features of various systems for the purpose of future purchases of equipment.

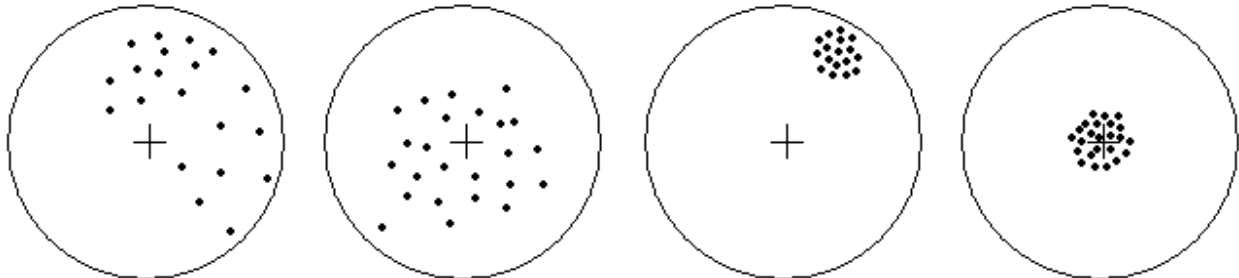
ImaGem, OctoNus, OGI, and Sarin manufacture equipment for gauging diamonds and other precious stones. Each system provides data with respect to accuracy, or repeatability or both. These terms need to be defined and understood to make informed assessment of equipment. Statistics provides a scientific definition of these important concepts (Farnum, Nicholas R. 1994. Modern Statistical Quality Control and Improvement, Duxbury).

- Accuracy is defined in terms of the difference between a measurement of a standard and an average of measurements obtained by a system. If the average of measurements equals the true value, statisticians say a system is unbiased or accurate.

- Repeatability represents variation between repeated measurements.

A system must be calibrated using a standard to achieve accuracy. Calibration is usually done manually; frequency and procedure for calibration are provided by the manufacturers of these systems. A new and preferred approach is to incorporate a means of automatically checking calibration of a system for each stone.

Repeatability, also called precision or consistency is measured by the standard deviation of the measurements. Repeatability may be stated, for example, as within plus or minus 10 microns with say 95% probability. The smaller the range of repeatability for a given level of probability, the higher is the reliability of a system. There are four possible scenarios: **a system may be accurate and repeatable, or accurate but not repeatable, or not accurate but repeatable or not accurate and not repeatable.** The following figure illustrates these cases:



Inaccurate and not repeatable (a) Accurate, but not repeatable (b) Inaccurate but repeatable (c) Accurate and repeatable (d)

(Farnum, Nicholas R. 1994. *Modern Statistical Quality Control and Improvement*, Duxbury).

Accuracy and repeatability therefore should not be confused with each other; buyers of these systems must also take in to consideration how easily accuracy and repeatability on these systems can be achieved and maintained in the field. Industry will benefit by adopting a terminology that is precise and used and understood by everyone. Check if the manufacturer provides a calibrating standard. Also, some systems have different linear repeatability for different size stones. A system with lower reliability on repeatability for larger, more valuable, stones is not as desirable as one with the same reliability for all stones or one with higher reliability for larger stones.

In the July issue, sources of inaccuracy and lack of precision and a comparison of reliability on different systems is discussed. This technical material addresses in great detail the latest technical advances in gauging technology.



ATTENTION WHOLESALERS AND DEALERS: WHAT ARE YOUR TOTAL COSTS TO OBTAIN FULL GRADING REPORTS?

The Cost Analysis Tool mentioned in the [April issue of ImaGem newsletter](#) is now easier to use. The [improved version](#) allows you to calculate the carrying and shipment costs and ImaGem's charge for grading. This tool compares the total cost to obtain full grading reports from other labs versus those from an On-site Independent Lab operated by ImaGem, or its affiliates. See how an on-site lab can increase your profits and improve quality of service to customers. Send questions and comments to newsletter@imageminc.com.

ImaGem plans to provide grading services in Delhi, Bangalore, Chennai, Antwerp, Dubai and Australia. Interested parties, please contact Suresh Jain at ImaGem Inc. at 1-215-477-9920 (9am – 6pm EST) or srjain@imageminc.com.

Readers ask... Is fire included in ImaGem's measurements of a diamond's light behavior?
Rick Lewis, GG, Philadelphia, PA

Under the lighting conditions that ImaGem utilizes, fire, which is the breakup of light into colors, is already incorporated into the measurements of brilliance and sparkle. (For a definition of terms and

