

FEATURE UPDATE | AUGUST 2026

Laser Sawing of Diamond Crystals, Revisited

Forty-five years after the first laser saws entered the cutting factory, I take my own look back at the technology, the machines, the science, and the market it helped build.

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IN BRIEF

- I trace laser sawing from the lamp-pumped Nd:YAG systems I wrote about in 1981 to today's ultrafast, water-jet-guided, and multi-axis machines.
- Laser equipment now serves both natural- and laboratory-grown diamond manufacturing.
- CVD and HPHT production have created a growing need for precision coring, slicing, and seed recovery.
- Recent research points toward cleaner cutting, with less graphitization and subsurface damage.

A NOTE ON SOURCES

In 1981, I described a newly commercialized technology that was starting to reshape diamond manufacturing: the laser saw. Forty-five years later, laser processing has grown from a novelty confined to a handful of Antwerp and New York cutting houses into a core technology spanning rough planning, sawing, faceting, marking, and the recovery of seed crystals for laboratory-grown diamond synthesis. What follows pulls together what equipment manufacturers, trade organizations, market researchers, and peer-reviewed researchers have reported through mid-2026. One note before I get into it: some of the figures below — vendor specifications, market forecasts, company statements — come from the source itself rather than from independent testing. I've flagged the handful of places where that distinction really matters, rather than repeating the caveat after every sentence. [1, 2]

A Revolution Remembered

In the Fall 1981 issue of *Gems & Gemology*, I published "Revolution in Diamond Cutting: Laser Sawing of Diamond Crystals." I described a lamp-pumped Nd:YAG laser saw that could divide rough material that conventional bruting and blade sawing couldn't safely handle, and I explained how laser cutting could open up fancy shapes that simply weren't practical before. Replacing a spinning phosphor-bronze blade charged with diamond powder with a beam of light was, at the

time, a bold thing to propose. I didn't expect, forty-five years on, to still be writing about where that idea went. [1]

Laser processing today covers sawing, kerfing, drilling, marking, inscription, bruting assistance, and multi-facet cutting. It's used on both mined and laboratory-grown diamonds, though the equipment and the order of operations differ from factory to factory.

From Lamp to Ultrafast Beam: Five Generations

Industry accounts usually break the development of diamond sawing into five stages. Mechanical blade sawing came first. Then came lamp-pumped Nd:YAG laser sawing, the kind I wrote about in 1981. After that came infrared diode-pumped systems with better beam quality and throughput, followed by green-diode-pumped solid-state lasers that cut a narrower kerf. The fifth stage is water-jet-guided laser cutting, where the beam travels through a thin column of water by total internal reflection instead of moving through free space. [3]

Synova, the Swiss manufacturer that commercialized this as Laser MicroJet®, says the water column cools the workpiece, keeps the beam guided through the full cutting depth, and produces narrow, nearly parallel kerfs. The company and trade press also describe it as reducing cracking risk in stressed stones — that's a manufacturer and trade-source claim, not something I've verified myself. [4, 5]

Synova later extended the method to shaping, blocking, bruting, and drilling. In 2019 the company introduced its DaVinci Diamond Factory, billed as an automated, single-setup system that turns rough diamond into a fully faceted, 57-facet round brilliant. [5]

Ultrafast lasers, with pulse durations measured in picoseconds or femtoseconds, have also moved into commercial diamond work. In ultrashort-pulse machining, energy arrives so fast that little heat has time to spread into the surrounding material, so researchers describe much of the removal as non-thermal, or “cold,” ablation. Compared with longer-pulse methods, this can shrink the graphitized heat-affected zone, though results still depend on wavelength, pulse energy, atmosphere, and the material itself. [6, 7]

OPMT Laser reports positioning tolerances near ± 0.003 mm on some of its femtosecond platforms, and heat-affected zones under 5 microns for certain diamond applications. [7]

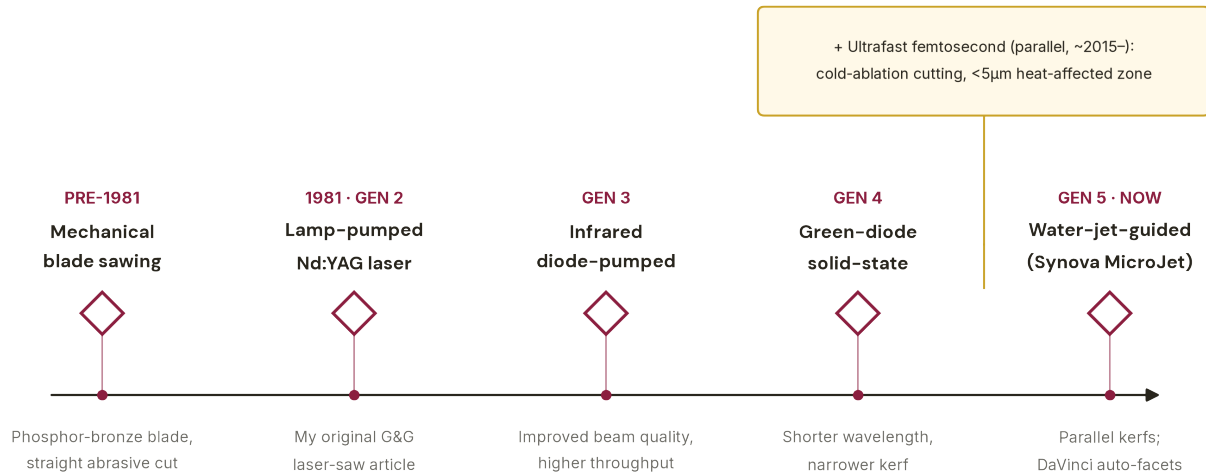


Fig. 1 — Five generations of diamond laser sawing, 1981–2026, with the parallel rise of ultrafast femtosecond systems. The same water-jet-guided and ultrafast platforms now also recover CVD seed crystals for lab-grown growers, discussed later in this update. Diagram by the author.

The Equipment Landscape Today

The equipment side of this business is a fairly small circle of specialist manufacturers. Sarine Technologies combines rough-diamond planning and inclusion scanning with saw-plane software, laser cutting, marking, and inscription — its Advisor®, Galaxy®, Strategist, Rhino, and DiaMark® systems are built to work together. [8, 9]

In India, Sahajanand Technologies (STPL) and Dharmaj Technologies supply Surat's cutting sector. Dharmaj's RatnKanti laser-assisted faceting machine offers 8- or 16-facet programs in green- or infrared-laser configurations and can take cutting parameters straight from Sarine's planning software. [10, 11]

Bettonville, in Belgium, markets laser systems for two-dimensional sawing and three-dimensional shaping, coning, and drilling of natural, HPHT, and CVD diamond, with published cutting depths beyond 20 mm. The same laser-ablation and laser-assisted machining principles show up at companies like EWAG and Micro-LAM, though they use them to make polycrystalline-diamond cutting tools rather than gemstones. [12–14]

A New Application: Slicing Laboratory-Grown Crystals

The rise of laboratory-grown diamond production has opened up a substantial new use for laser equipment. CVD producers periodically need to separate a grown crystal from its seed substrate and prepare that seed for reuse. A 2025 Fraunhofer study describes a process where laser cutting separates the substrate, mechanical polishing preps the cut face, and laser trimming removes the polycrystalline rim. Under the conditions those researchers reported, one HPHT seed

went through as many as 20 CVD growth runs. [15]

Manufacturers have built products specifically for this. Synova markets Laser MicroJet systems for graphite-removal coring and for slicing seed wafers to controlled thicknesses — its case study talks about slices around 250 microns. OGI Systems markets its Manifest green-laser platform for CVD and HPHT tasks including polycrystal removal, thin-slice cutting, and seed extraction. [16, 17]

Inno Laser said in 2025 that it had achieved large-format “hidden cutting” of 25 mm single-crystal and mosaic-spliced diamond material over the prior year, and named Diamond Foundry, SF Diamond, and Zhongnan Diamond among the customers tied to its diamond-processing business — based on the company's own statement, as reported by FuTu News. [18]

An India Today report from June 2026 put India's CVD reactor count above 14,000 — roughly double the estimate from three years earlier. Drawing on Indian export data, the same report said laboratory-grown stones made up about 51 percent of loose-diamond export volume in March 2026, and slightly more than half in April. Those numbers describe export volume, not export value, so I wouldn't read them as a stand-in for how the two sectors actually compare on revenue. [19]

Trade reporting also suggests plenty of Surat businesses that used to focus on natural rough have added laboratory-grown capacity. Laser slicing looks like a growing equipment segment because of it, though I haven't found solid public data on exactly how many laser-sawing shops exist or what they're buying. [19, 20]

What the Laboratory Is Teaching the Cutting Floor

A 2026 peer-reviewed study by Luo and colleagues compared nanosecond and green femtosecond laser cutting of CVD diamond. Under their test conditions, nanosecond cutting left visible microcracking and substantial carbonization. Near the femtosecond ablation threshold, they got crack-free kerfs and a surface roughness of 5.278 microns, and measured the carbonization layer shrink from 2.211 to 1.206 microns. Cutting in nitrogen brought roughness down to 2.705 microns with no remaining graphite layer at all. X-ray diffraction pointed the authors toward sublimation, not melting, as the dominant removal mechanism. Those numbers are specific to that study's materials and setup — I wouldn't generalize them to every production line. [6]

A second peer-reviewed paper, in the International Journal of Extreme Manufacturing, looked at in-situ laser-magnetic dual-field-assisted diamond cutting (LMDFDC). Xing and colleagues paired laser assistance with a magnetic field while machining a high-entropy alloy — not gem diamond — and reported better surface integrity, less subsurface damage, steadier material removal, and longer diamond-tool life than their comparison conditions. [21]

That experiment was about diamond-tool cutting of an advanced alloy, so it doesn't hand us a new gem-diamond saw. But it does point at where ultra-precision machining is heading: combining energy fields to manage heat, material behavior, and tool wear. Whether any of that

reaches gem-diamond sawing is still an open question. [21]

Market Forces: Growth, Competition, and Consolidation

DataHorizon Research put the global diamond-cutting-machine market at roughly \$1.5 billion in 2024, and projected it could reach about \$2.5 billion by 2033, a 6.5 percent compound annual growth rate. The firm credits jewelry demand, laboratory-grown production, and the ongoing swap of manual work for CNC and laser equipment. It also estimated laser sawing can lift carat yield by as much as 3 percent in some rough-division work — a market-research estimate, not an audited figure. [3]

None of that surprises me. When a piece of equipment cuts scrap and speeds up a bottleneck step, the money follows fast — I watched the same thing happen with the first Nd:YAG systems back in the early eighties, and it hasn't slowed down since.

Sarine Technologies reported that revenue for the first nine months of 2025 fell 27 percent from the same stretch in 2024. Trade and financial coverage points mostly to weaker natural-diamond manufacturing demand, plus growing competition from laboratory-grown stones. Sarine has responded by building out services for laboratory-grown planning, traceability, and automated grading. [22, 23]

You'll see some industry write-ups credit Sarine's technology with a very large share of rough-diamond manufacturing worldwide. The sources behind that claim don't agree on what they're actually counting — stones scanned, factories served, or slices of the production workflow — so I'm not going to put a single market-share number on it here.

The core observation from my 1981 article still holds up: a controlled beam of light can do things a mechanical blade never could. Since then, laser sawing has gone from lamp-pumped rods to water-guided beams and femtosecond pulses, and expanded from simple rough division into planning, marking, faceting, and seed-crystal recovery.

As natural and laboratory-grown production increasingly share the same equipment platforms, I expect the next round of progress to come from both materials-science research and commercial machine design in roughly equal measure. What's out there right now points to real, continued technical progress — but it's worth keeping manufacturer specs, market forecasts, trade reporting, and peer-reviewed findings in their own separate lanes.

About the Author

David Mark Baker, GG, is a Graduate Gemologist and appraiser whose 1981 *Gems & Gemology* feature, "Revolution in Diamond Cutting: Laser Sawing of Diamond Crystals," is an early account of laser technology's entry into diamond manufacturing. He has written on gemological and trade topics for publications including *Colored Stone* and *Prism* magazines and has participated in jewelry-industry organizations including the Texas Jewelers Association.

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