



The First Truly Pattern Scanning Laser-Evolved



TOPCON CORPORATION



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* Not available in all countries, please check with your distributor for availability in your country

*Subject to change in design and/or specifications without advanced notice.

IMPORTANT In order to obtain the best results with this instrument, please be sure to review all user instructions prior to operation.

TOPCON CORPORATION
CONNECTING VISIONS 75-1 Hasunuma-cho, Itabashi-ku, Tokyo 174-8580, Japan. Phone:3-3558-2523/2522 Fax:3-3965-6898 www.topcon.co.jp

TOPCON MEDICAL SYSTEMS, INC.
111 Bauer Drive, Oakland, NJ 07436, U.S.A.
Phone:+1-201-599-5100 Fax:+1-201-599-5250 www.topconmedical.com

TOPCON MEDICAL LASER SYSTEMS, INC.
3130 Coronado Drive Santa Clara, California 95054 USA
Phone:+1-408-235-8200 Phone:(USA only)+1-888-760-8657
Fax:+1-408-235-8259 Email:tmisinfo@topcon.com

TOPCON CANADA INC.
110 Provencher Avenue, Boisbriand, QC J7G 1N1 CANADA
Phone:+1-450-430-7771 Fax:+1-450-430-6457 www.topcon.ca

TOPCON EUROPE MEDICAL B.V.
Essebaan 11; 2908 LJ Capelle a/d IJssel; P.O.Box145;
2900 AC Capelle a/d IJssel; THE NETHERLANDS
Phone:+31-(0)10-4585077 Fax:+31-(0)10-4585045
E-mail: medical@topcon.nl; www.topcon.eu

ITALY OFFICE
Viale dell'Industria 60; 20037 Paderno Dugnano; (Milano), ITALY
Phone:+39-02-9186671 Fax:+39-02-91081091 E-mail: topconitaly@tiscali.it; www.topcon.it

DANMARK OFFICE
Præstemarksvej 25; 4000 Roskilde, DANMARK
Phone:+45-46-327500 Fax:+45-46-327555
E-mail: topcon@topconandmark.dk www.topconandmark.dk

IRELAND OFFICE
Unit 276, Blanchardstown; Corporate Park 2 Ballycoolin Dublin 15, IRELAND
Phone:+353-18975900 Fax:+353-18293915 E-mail: medical@topcon.ie; www.topcon.ie

TOPCON S.A.R.L.
BAT A1 3 route de la révolte 93206 SAINT DENIS CEDEX
Tel : +33 1 49 21 23 23 Fax : +33 1 49 21 23 24 E-mail:topcon@topcon.fr; www.topcon.fr

TOPCON DEUTSCHLAND G.m.b.H.
Hanns-Martin-Schleyer Strasse 41; D-47877 Willich, GERMANY
Phone:+49-(0)2154-8850 Fax:+49-(0)2154-885177 E-mail:med@topcon.de; www.topcon.de

TOPCON SCANDINAVIA A.B.
Neogatan 2, P.O.Box 25; 43151 Mölndal, SWEDEN
Phone:+46-(0)31-7109200 Fax:+46-(0)31-7109249 E-mail:medical@topcon.se; www.topcon.se

TOPCON ESPAÑA S.A.
HEAD OFFICE
Frederic Mompou 4 Esc. A Bajos 3, 08960 Sant Just Desvern Barcelona, SPAIN
Phone:+34-93-4734057 Fax:+34-93-4733932 E-mail: medica@topcon.es; www.topcon.es

TOPCON (GREAT BRITAIN) LTD.
Topcon House, Kennet Side, Bone Lane, Newbury, Berkshire RG14 5PX United Kingdom
Phone:+44-(0)1635-551120 Fax:+44-(0)1635-551170 E-mail:medical@topcon.co.uk; www.topcon.co.uk

TOPCON POLSKA Sp. z o. o.
ul. Warszawska 23; 42-470 Siewierz, POLAND
Phone:+48-(0)32-6705045 Fax:+48-(0)32-6713405 www.topcon-polska.pl

TOPCON SINGAPORE MEDICAL PTE. LTD.
1 JALAN KILANG TIMOR #09-01 PACIFIC TECH CENTRE SINGAPORE 158303
Phone:+65-68720606 Fax:+65-67736150 E-mail:medical_sales@topcon.com.sg www.topcon.com.sg

TOPCON INSTRUMENTS (MALAYSIA) SDN.BHD.
No. D1, (Ground Floor), Jalan Excella 2, Off Jalan Ampang Putra,
Taman Ampang Hill, 55100 Kuala Lumpur, MALAYSIA
Phone:+60-(0)3-42709866 Fax:+60-(0)3-42709766

TOPCON INSTRUMENTS (THAILAND) CO.,LTD.
77162 Sinsathorn Tower, 37th Floor, Kungthoribun Rd., Klongtongnai,
Klongsam, Bangkok 10600, THAILAND
Phone:+66(0)2-440-1152-7 Fax:+66(0)2-440-1158

TOPCON CORPORATION BEIJING OFFICE
Block No.9, Kangding Street Beijing Economic-Technological Development Area,
Beijing, 100176, CHINA
Phone:+86-(0)10-6780-2799 Fax:+86-(0)10-6780-2790

TOPCON CORPORATION SHANGHAI OFFICE
14L Huamin Empire Plaza, No.726, Yan-an Xi Road,
Shanghai, 200050, CHINA
Phone:+86-(0)21-5238-7722 Fax:+86-(0)21-5237-0761

TOPCON CORPORATION BEIRUT OFFICE
P.O.Box 70-1002 Antelias, Beirut, LEBANON
Phone:+961-4-523525/523526 Fax:+961-4-521119

TOPCON CORPORATION DUBAI OFFICE
P.O.Box 293705, Dubai Airport Free Zone L.L.U. J-12, Dubai, U.A.E
Phone:+971-4-299-5900 Fax:+971-4-299-5901



Introduction

In recent years there has been an overwhelming increase in manufacturers adding pattern scanning laser technology to their product profile. However, proprietary to Topcon, PAttern SCAnning Laser (PASCAL) technology has been offered to customers since 2006 with a large number of lasers installed worldwide. Today, physicians continue to partner with Topcon by choosing PASCAL because of the advanced technology, ease of use, and superior clinical outcomes. This white paper will outline the distinct differences between PASCAL technology and other companies offering pattern-scanning lasers.

Unique Features and Benefits of PASCAL Technology

» **Less atrophic creep and increased patient comfort during treatment with exposure durations of down to 10 ms.**

» **Rapid pattern-scanning laser delivery**

- A full PRP can be completed in one or two treatment session freeing up a physicians' schedule to see more patients.
- Less patient and Doctor fatigue during any photocoagulation procedure.

» **4-Fiber beam delivery:**

- Maintains a long and constant depth of focus for all spot sizes.
- Offers a safer, easier to use platform when compared to other pattern scanning technologies.
- Guaranteed sharp edges for every spot with no hot spots within the laser lesions.

» **3-high speed galvo mirrors allows for:**

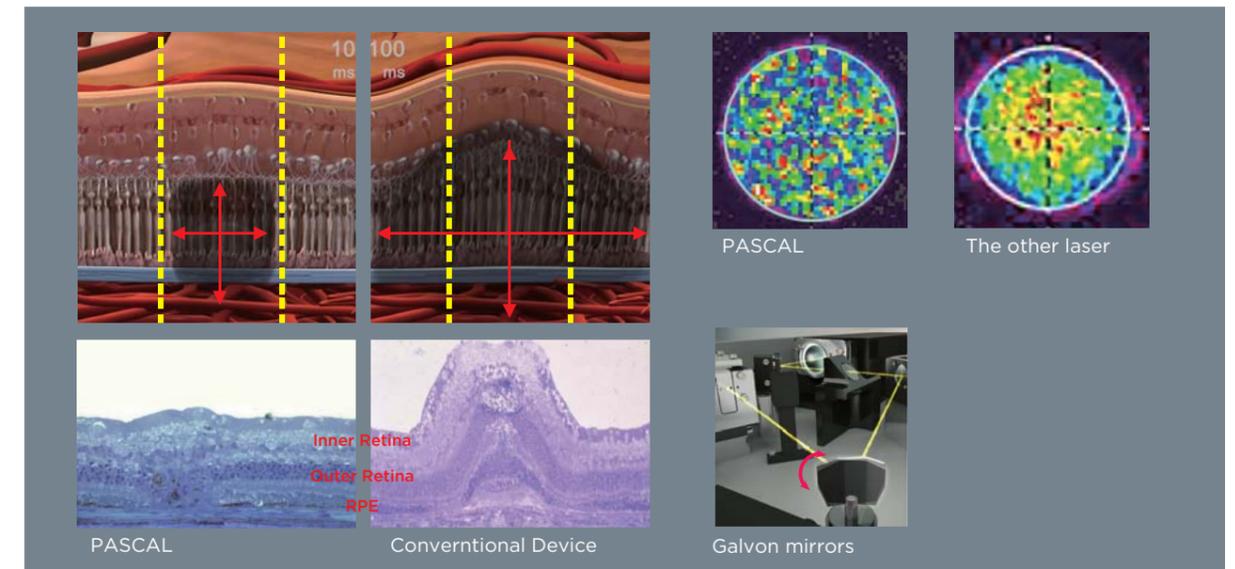
- Precise spot placements within each and every treatment pattern
- Fastest pattern treatment available with <1ms interval between pulses.

» **Multi-functional. PASCAL lasers can treat both retinal and glaucoma disorders using Endpoint Management™ and Pattern Laser Trabeculoplasty™ (PLT) technology**

» **Less-damaging clinical applications** 

- Endpoint Management™ -Photo-thermal Stimulating Retinal Laser Treatment-
 - Provides freedom to treat closer to the fovea without fear of causing retinal damage or vision loss.
 - Allows for greater physician flexibility and control in providing therapeutically effective, vision-sparing treatment of retinal disease.
 - Superior to Micropulse technology due to Landmark Patterns providing visible indicators of the treated region and "one setting" interface.
- PLT™ (Pattern Laser Trabeculoplasty)*
 - Minimally traumatic computer-guided therapy for Laser Trabeculoplasty.
 - Auto advance feature greatly increases speed and accuracy of treatment.
 - A more convenient alternative to SLT.
 - Successfully reduces IOP without scarring and burns enabling retreatment if necessary.

The PASCAL presents many clinical benefits by providing precise, patented technology in delivering each treatment pattern.



(Figure. 1)

Why choose PASCAL?

- whitepaper of the uniformity of beam profile -
The First Truly Pattern Scanning Laser-Evolved

What Sets PASCAL Apart?

Precision Spot™ Technology

PASCAL Precision Spot technology incorporates four independent fibers optics in the laser design, one fiber for each spot size (Figure 2A). A 4-fiber beam delivery is specific to Topcon PASCAL lasers and cannot be found in competing pattern laser products. Precision Spot allows for high-quality and unparalleled laser photocoagulation.

4-Fiber Beam Delivery

A 4-Fiber beam design allows for:

- Low energy density on the cornea
- Greater depth of focus for more consistent uptake
- Top hat uniform power distribution within each laser spot delivers even burn intensity
- A safer and more reliable platform when compared to single spot CW platforms

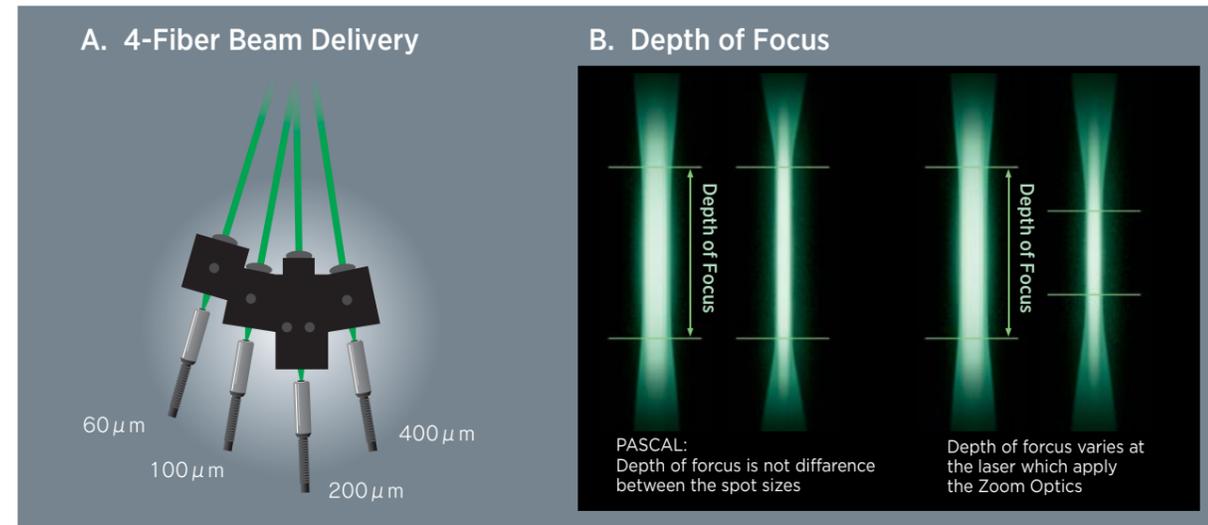
Advantages of 4-Fiber Beam Delivery

Physicians using PASCAL lasers continue to share that the consistency of the burn during photocoagulation is "better" than competing lasers. A large reason for this is due to the wide-depth of focus from the 4 fiber beam optics found in all PASCAL lasers.

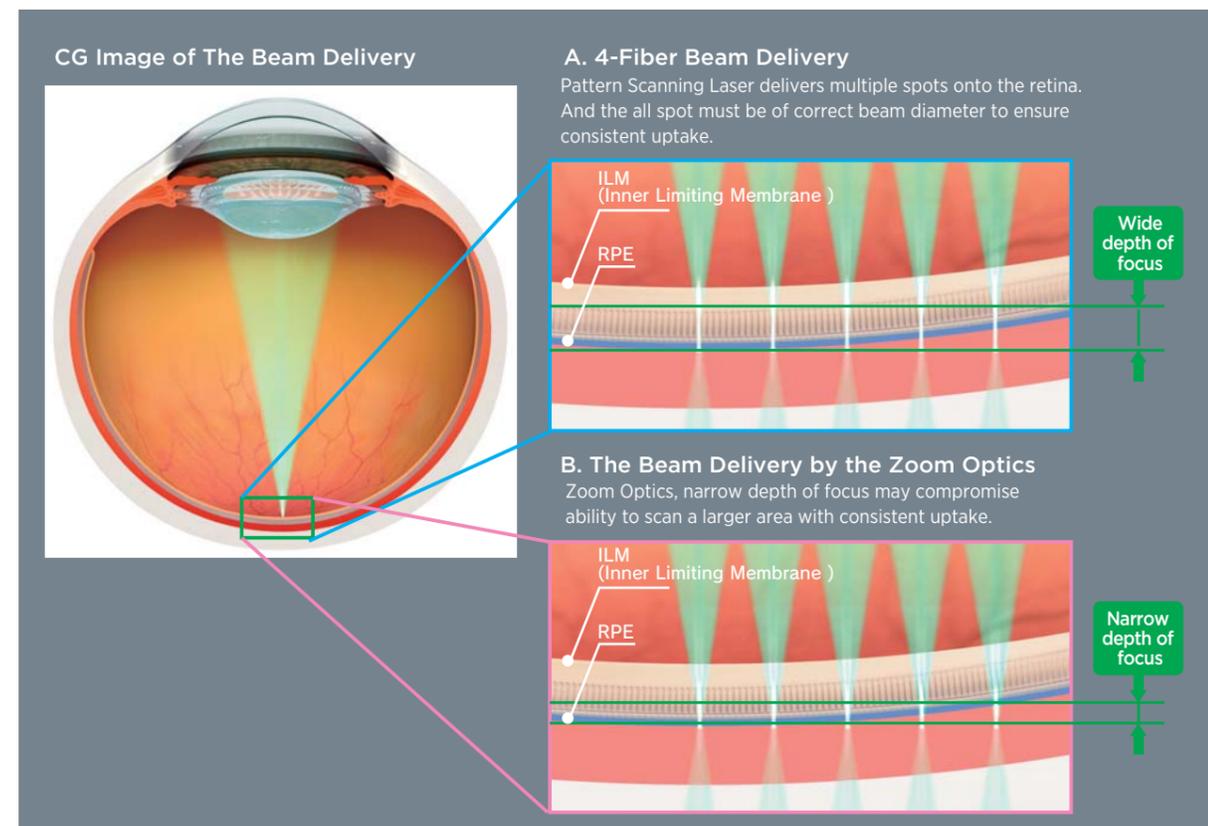
A wide-depth of focus refers to the range that an object will be in focus at a given depth (Figure 2B). In Zoom Optical Systems the "depth of focus" changes with each beam diameter. However, the PASCAL 4 fiber beams ensure the same depth of focus at all spot sizes. Competitive systems using "zoom" optics are unable to do this.

During pattern laser treatment, the laser is delivered to multiple spots on the retina. For consistent uptake, all of the treatment spots must be delivered with the correct beam diameter. Since the PASCAL has a wide depth of focus, it is possible to treat a large region of the fundus including areas of curvature. (Figure 3A). However, with Zoom

optics, a narrow depth of focus may compromise the ability to treat a larger area with consistent uptake (Figure 3B), because some spots in the pattern may be out of focus. Additionally, the lack of consistent uptake may result in the inconsistency of laser burns for each treatment region.



(Figure. 2)



(Figure. 3)

Background

Physician Experiences:

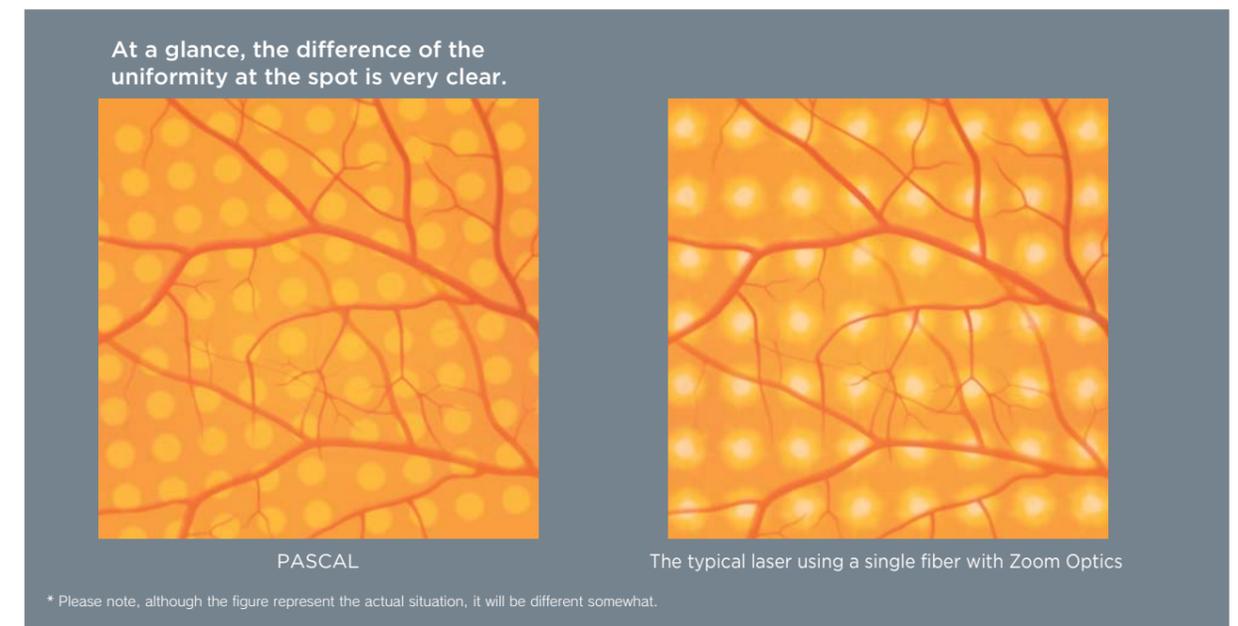
The most common comments heard from PASCAL users is the laser burns are uniform and consistent without color variability compared to other competitor's pattern scanning laser systems. Doctors have commented that the quality of the burn is also better. These favorable comments are due to several items relating to the PASCAL technology including better depth of focus and uniform energy distribution within each laser spot due to the top-hat profile

A Clear Comparison:

Most competitive pattern laser products are constructed with the combination of one fiber and a zoom optical system that varies the spot size on the retina by "defocusing" the optics to change the spot size. Figure 4 shows an illustrated comparison of traditional zoom optical system and the PASCAL technology. Notice how the laser uptake is different. There is color variability between the central portion of the laser burn and the peripheral region.

Other pattern laser photocoagulators use only 1 fiber and a zoom optical system, resulting in variable spot sizes on the retina. Figure 4 shows a comparison with traditional zoom optics and the PASCAL. Both treatment burns in this image are completely different. The treatment burns using traditional conventional laser shows uptake variability between the central portion of the burn and at the peripheral region. A major reason for this difference is due to the optics design of the two systems. PASCAL technology incorporates four separate fibers in the design, one for each spot size, which results in an easier to focus, more uniform spot.

Difference in the optical design is the major reason for this variable intensity. PASCAL technology incorporates four separate fibers in the design, one for each spot size. However, other pattern scanning technologies incorporate the combination of a single fiber and zoom optics, which varies the magnification of the projected laser spot. And this will apply as the definite difference.



(Figure. 4)

Why choose PASCAL?

Significance Superiority of PASCAL

Zoom Optics Defined:

PASCAL has a longer depth of focus compared to the zoom optics of other pattern laser systems. The difference can be defined by the following terms:

» Focused Optics:

Found in PASCAL systems, these optics provide a significant benefit for many cases such as sharp spot, uniform beam profile and wide depth of focus during treatment

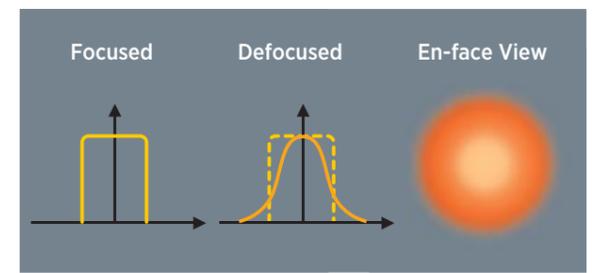
» Defocused Optics:

A beam profile of a “defocused” system (Zoom Optical System) will have a non-uniform energy distribution (Figure 5) and may result in physicians having difficulty focusing because the depth of focus is shorter.

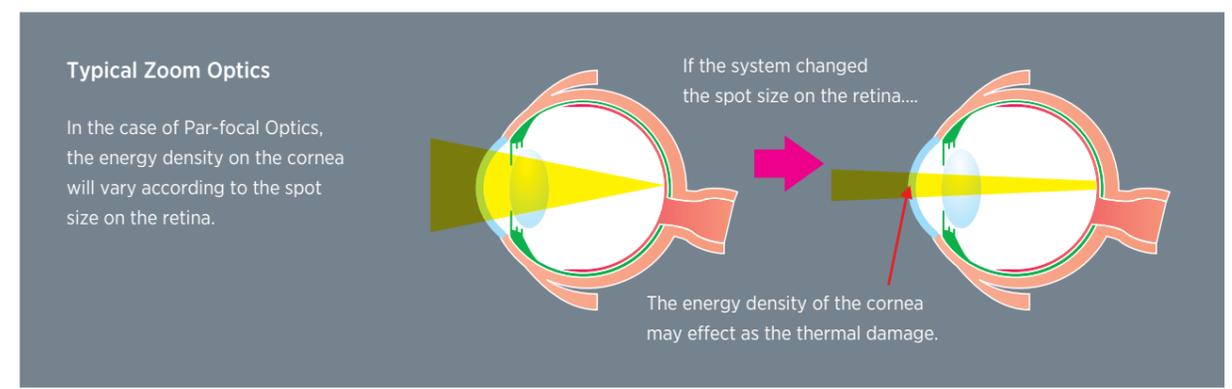
Projection optics, which produces the laser spot on the retina, is necessary for laser photocoagulation. With zoom optics, also known as parfocal lens optics, the numerical aperture for the eye will be smaller for forming a larger spot on the retina. This results increase thermal effects on the cornea caused by high energy density of the laser as it passes through (Figure 6).

Experimental Verification/ Distribution of Laser Energy

To verify that PASCAL technology is superior over zoom optics we conducted a test to measure the beam profile and test burns. It is clear that the beam profile for zoom optics has an uneven energy distribution (Figure 7). These images and the test burns on paper clearly show the difference between Top Hat and Gaussian distribution in the laser energy. A focused laser delivery has a flat beam profile known as a “Top Hat” laser energy distribution where the power is evenly distributed out to the edges of the laser beam. On the other hand, a defocused laser delivery has a Gaussian beam profile, exhibiting a hot spot in the center, so the power is not evenly distributed across the laser beam profile.



(Figure. 5)

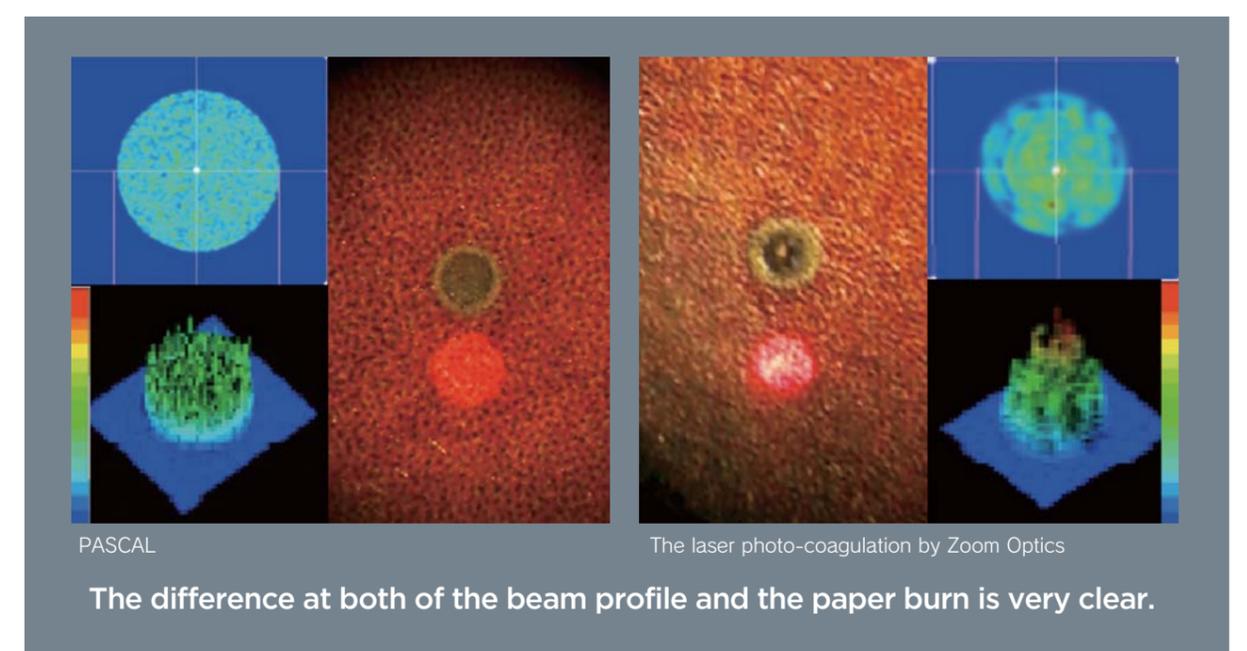


(Figure. 6)

Summary

The 4 fiber laser delivery Precision Spot design is optimized for pattern scanning and ensures consistent and uniform laser uptake even on curved areas of the retina. Even though this design is more expensive to manufacture, it was implemented to make it easier for the doctors to use pattern scanning and is a key manufacturing design feature that should be presented to our potential Customers. These differences are why PASCAL technology has been recognized by Customers as “easier to use...” and provides “better and more consistent burns” than competitive pattern scanning products.

PASCAL is not only the first pattern-scanning laser, it also incorporates the optimal design for pattern scanning. When comparing Topcon PASCAL Laser systems to the competition it is important to consider why features such as a 4-fiber design aids in the consistent uptake and its effect on clinical results.



(Figure. 7)