United States District Court,
S.D. New York.

Carl Zeiss JENA GmbH and Carl Zeiss, Inc,
Plaintiffs.
v.
BIO-RAD LABORATORIES, INC., and CORNELL RESEARCH FOUNDATION, INC,
Defendants.
BIO-RAD LABORATORIES, INC., and CORNELL RESEARCH FOUNDATION, INC,
Counterclaim-Plaintiffs.
v.
Carl Zeiss JENA GmbH and Carl Zeiss, Inc,
Counterclaim-Defendants.

No. 98 CV 8012(RCC)

Feb. 5, 2002.

OPINION & ORDER

CASEY**, D.J.**

I. Background

On July 23, 1991, the U.S. Patent and Trademark Office (PTO) issued Patent 5,034,613 ("the '613 patent") entitled, "Two-photon Laser Microscopy," to Winfried Denk, James P. Strickler and Watt W. Webb. Defendant Cornell Research Foundation, Inc. ("Cornell") owns the patent and has granted exclusive rights to its Co-Defendant Bio-Rad Laboratories, Inc. ("Bio-Rad") (collectively "Defendants"). Plaintiffs Carl Zeiss Jena GmbH and Carl Zeiss, Inc. (collectively "Zeiss" or "Plaintiffs") seek a declaratory judgment of noninfringement, invalidity and unenforceability of the '613 patent. Additionally, Plaintiffs allege false representation under the Lanham Act, common law tortious interference and unfair competition under the common law and violation of New York State General Business Law s. 360-1. Defendants, in turn, have counterclaimed for infringement of the patent. In *Markman v. Westview Instruments,* the Supreme Court held that the interpretation of a patent's claims is a matter of law reserved for the court while the question of infringement is for a jury. 517 U.S. 370, 372 (1996). Accordingly, this Court held a *Markman* hearing on August 28-30, 2001 to construe the disputed claims. On the basis of the parties' claim construction briefs, the subsequent hearing, the parties' stipulated glossary of technical terms and the Court's reading of the patent, the Court now construes the claims at issue.

II. Claim Construction

A. Legal Standard

The purpose of claim construction is to determine "the meaning and scope of the patent claims asserted to

be infringed." Markman v. Westview Instruments, 52 F.3d 967, 976 (Fed.Cir.1995) (*en banc*), *aff'd,* 517 U.S. 370 (1996). The court must give to the disputed terms "their ordinary and accustomed meaning as understood by one of ordinary skill in the art" at the time of patent application. Dow Chem. Co. v. Sumitomo Chem. Co. Ltd., 257 F.3d 1364, 1372 (Fed.Cir.2001) (citing Hockerson-Halberstadt, Inc. v. Avia Group Int'l, Inc., 222 F.3d 951, 955 (Fed Cir.2000)); Wiener v. NEC Elecs., Inc., 102 F.3d 534, 539 (Fed.Cir.1996) (noting courts must construe a term's meaning as it was understood on the patent application date); *see also* Optical Prods. Dev. Corp. v. Dimensional Media Assocs., Inc., 134 F.Supp.2d 320, 326 (S.D.N.Y.2001) (explaining "the hypothetical person of ordinary skill in the art is presumed, as a matter of law, to know of all prior art references in the same or analogous fields, regardless of his or her specific level of educational or vocational training") (citing In re Gorman, 933 F.2d 982, 986 (Fed.Cir.1991)).

The task of construction begins with intrinsic sources, that is, the sources available to the public in ascertaining the scope of the patent. Intrinsic evidence encompasses the patent itself, including the claims and specification, and the prosecution history. It is "the most significant source of the legally operative meaning of disputed claim language." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed.Cir.1996); Comark Communications, Inc. v. Harris Corp., 156 F.3d 1182, 1186 (Fed.Cir.1998).

The words and phrases of the claims are the starting point for claim construction and they are to be given their ordinary and customary meaning. Novo Nordisk A/S v. Becton Dickinson & Co., No. 96 Civ. 9506(BSJ), 2000 WL 294852, at (S.D.N.Y. Mar. 21, 2000). A patentee may give the words and phrases a different meaning, but that special definition must be clearly stated in the specification or history. Vitronics Corp. v. Conceptronic, Inc., 90 F.3d at 1582; *see also* Intellectual Prop. Dev. v. UA Columbia Cablevision of Westchester, Inc., No. 94 Civ. 6296(SS), 1998 WL 142346, at (S.D.N.Y. Mar. 26, 1998) ("[T]he subjective intent of the inventor when using a particular term is of no probative weight in defining the scope of the claim ... except as documented in the specification.").

Further, the claims "must be read in view of the specification, of which they are a part." Markman v. Westview Instruments, 52 F.3d at 979. The specification is defined by statute as the portion of the patent that includes the description of the invention. It "shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains ... to make and use the same." 35 U.S.C. s. 112, para. 1. The claims, on the other hand, define the limits of the invention. They must "particularly point out and distinctly claim" what the applicant regards as the invention. 35 U.S.C. s. 112, para. 2; Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 77 F. Supp .2d 446, 450 n. 2 (S.D.N.Y.1999) (explaining the claims are also technically part of the specification, but "general usage distinguishes between the specification and the claims as separate parts of the patent"). While the Court closely examines the specification, it heeds the Federal Circuit's warning that "limitations from the specification are not to be read into the claims." Comark Communications, Inc. v. Harris Corp., 156 F.3d at 1186. The claims are not to be limited to "any preferred or illustrative embodiment contained in the specification." Karlin Tech. Inc. v. Surgical Dynamics, Inc., 177 F.3d 968, 973 (Fed.Cir.1999) (citing Virginia Panel Corp. v. Mac Panel Co., 133 F.3d 860, 866 (Fed Cir.1997)); Markman v. Westview Instruments, 52 F .3d at 980 ("The written description part of the specification itself does not delimit the right to exclude. That is the function and purpose of the claims.").

A final piece of intrinsic evidence, the prosecution history-which may include the record of proceedings before the PTO, the patentee's representations regarding the scope of the patent and a review of the prior art-should also be considered if it has been admitted into evidence. Vitronics Corp. v. Conceptronic, Inc., 90 F.3d at 1582 (finding prosecution history to be "of critical significance in determining the meaning of the

claims").

If the intrinsic evidence is not sufficient to construe the claims, the court may turn to extrinsic evidence. Key Pharm. v. Hercon Labs. Corp., 161 F.3d 709, 716 (Fed.Cir.1999). Extrinsic evidence is "external to the patent and file history" and includes expert testimony, inventor testimony, dictionaries, technical treatises and articles. Vitronics Corp. v. Conceptronic, 90 F.3d at 1584. While not always necessary to construe the patent's claims, this type of evidence also may help the court understand the patent's technical terminology. *Id*. ("[T]rial courts generally can hear expert testimony for background and education on the technology implicated by the presented claim construction issues, and trial courts have broad discretion in this regard."). Extrinsic evidence may not be used, however, to construe a claim in a manner that is contrary to the intrinsic evidence. Key Pharm. v. Hercon Labs. Corp., 161 F.3d at 716.

B. Means-plus and Step-plus-Function Elements

Here, the majority of the disputed terms will be construed according to the standard claim construction rules, using intrinsic evidence and turning to extrinsic evidence if necessary. However, there are four phrases at issue which Plaintiffs submit should be interpreted as means-plus-function or step-plus-function elements in accordance with 35 U.S.C. s. 112, para. 6. FN1 Under the statute, patent applicants may use a shortcut and express a combination claim as a means-for or step-for performing a specified function without reciting the structure, material or acts required to support that function. If the court construes the claim as a means-plus or step-plus-function element, the statute dictates that its interpretation must include the corresponding structure, material or acts, or their equivalents, described in the specification. Section 112, para. 6 is essentially a statutory quid pro quo. Kemco Sales, Inc. v. Control Papers Co., Inc., 208 F.3d 1352, 1360 (Fed.Cir.2000). For the claim to include the unrecited structure, material or acts, the patent applicant must describe in the specification the structure, material or acts which perform the specified function. Valmont Indus., Inc. v. Reinke Mfg. Co., 983 F.2d 1039, 1042 (Fed.Cir.1993). "The structure disclosed in the specification is a 'corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim. This duty to link or associate structure to function is the quid pro quo for the convenience of employing s. 112, para. 6." B. Braun Medical Inc. v. Abbott Labs., 124 F.3d 1419, 1424 (Fed.Cir.1997).

FN1. Section 112, para. 6 of title 35 states: "An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claims shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof."

The court must determine whether the disputed language is a means-plus-function or step-plus-function claim. If it is a combination claim, the court will construe the claim as s. 112, para. 6 dictates. If the court finds that the phrase is not a combination claim, it will be construed according to standard claim construction rules. Envirco Corp. v. Clestra Cleanroom, Inc. 209 F.3d 1360, 1365 (Fed.Cir.2000). Determining whether a phrase is in fact a means-plus-function or step-plus-function element is a question of law for the court. Kemco Sales, Inc. v. Control Papers Co., Inc., 208 F.3d at 1360.

The first step in determining whether a particular claim element is a means-plus or step-plus element is to determine whether the element includes the phrase "means for" or "step for" and whether it specifies a particular function. Personalized Media Communications, LLC v. ITC, 161 F.3d 696, 704 & n. 10

(Fed.Cir.1998) (noting use of word "means" in the claim creates a rebuttable presumption that s. 112, para. 6 applies); Greenberg v. Ethicon Endo-Surgery, Inc., 91 F.3d 1580, 1583 (Fed.Cir.1996) (same); *Al-* Site Corp. v. VSI Int'l Inc., 174 F.3d 1308, 1320 (Fed.Cir.1990) (same); Seal-Flex, Inc. v. Athletic Track & Court Const., 172 F.3d 836, 849 (Fed.Cir.1999) (noting neither "step" or "steps of" presumptively invoke s. 112, para. 6, but the term "step for" does). The presumption is rebutted and the phrase is not a means-plus or step-plus function element if the claim itself recites sufficiently definite structure, material or acts to perform the claimed function. Personalized Media Communications, LLC v. ITC, 161 F.3d at 704 & n. 10; York Prods. Inc. v. Central Tractor Farm & Family Ctr., 99 F.3d 1568, 1574 (Fed.Cir.1996); Cole v. Kimberly-Clark Corp., 102 F.3d 524, 531 (Fed.Cir.1996); Seal-Flex, Inc. v. Athletic Track & Court Const., 172 F.3d at 849.

Alternatively, the absence of the terms "means" or "step for" creates the rebuttable presumption that s. 112, para. 6 has not been invoked. Personalized Media Communications, LLC v. ITC, 161 F.3d at 704 & n. 10; Mas-Hamilton Group v. LaGard, Inc., 156 F.3d 1206, 1213-15 (Fed.Cir.1998); *Al-* Site Corp. v. VSI Int'l Inc., 174 F.3d at 1320; Seal-Flex, Inc. v. Athletic Track & Court Const., 172 F.3d at 849. This presumption can be overcome if the claim limitation does not recite a sufficiently definite structure or act to perform the claimed function. Personalized Media Communications, LLC v. ITC, 161 F.3d at 704 & n. 10; *Cole v. Kimberly-Clark Corp.,* 102 F.3d 531; Seal-Flex, Inc. v. Athletic Track & Court Const., 172 F.3d at 849.

The parties agree that the word "means" does not appear in the two elements Plaintiffs claim are means-plus-function elements, nor do the words "steps for" appear in the two elements Plaintiffs claim are step-plus-function elements. Accordingly, Plaintiffs bear the burden of overcoming the presumption that s. 112, para. 6 will not apply.

III. The ' 613 Patent

A. The Claimed Invention

Turning to the patent at issue, with one-photon fluorescence microscopy, the specimen to be examined is stained with a fluorescent dye, which emits fluorescent light after a high energy light photon from a laser excites the fluorophores in the stained specimen. That fluorescent light creates an image of the specimen. The '613 Patent is directed to two-photon microscopy. At the most elementary level, with two-photon microscopy, the fluorophores in the specimen simultaneously absorb two low energy light photons, which, in turn, excite the fluorophore. Again, the resulting fluorescent light creates an image of the specimen without the risk of photobleaching and other limits of one-photon microscopy.

B. The Terms at Issue

The following claim terms of the '613 Patent are in dispute:

(1) The term "target material" in claims one, two, five through twelve and fourteen through sixteen. Defendants submit that "target material" simply means the specimen or object that is imaged by the laser scanning microscope. Plaintiffs argue the term means a specimen that has an ultraviolet (UV) excitable fluorophore. In support of Defendants' position, their expert, Dr. Ian Walmsley, explained that the patent itself states that the target material is the substance that will be "imaged." FN2 '613 Patent 9 :64. FN3 Dr. Walmsley also testified that the specification treats "target" and "specimen" synonymously. '613 Patent 4 :39. Finally, in the prosecution history, target material is explained as something that "includes a fluorescent material that is responsive to short wavelength light." Prosecution History, Defendants' *Markman* Ex. 5 at

117 (hereinafter "Prosecution History"). Notably, this description does not require the definition that target material be excited in the UV range.

FN2. Dr. Walmsley is the Chair of Experimental Physics in the Department of Atomic and Laser Physics at the University of Oxford. He received his bachelor's degree in physics from the University of London and his doctorate in optics from the University of Rochester. He has taught, lectured and published extensively on the subject of optics. Walmsley Curriculum Vitae, Defendants' *Markman* Ex. 32. The Court recognized Dr. Walmsley as an expert in non-linear and ultrafast optics, atomic molecular physics and optical system design. Dr. Walmsley stated that a person of ordinary skill in the art would have a bachelor's degree in a technical field such as physics, optical electrical engineering or biophysics, plus one or two years of experience using lasers or imaging. Before testifying, Dr. Walmsley had reviewed the patent's claims and specification and the prior art. Tr. 154-157.

FN3. Throughout this opinion, where appropriate, the Court will cite to the '613 Patent in column:line format.

Plaintiffs' expert, Dr. Scott Fraser defined target material as "target material labeled with a UV responsive fluorescent dye." FN4 Tr. 436. Dr. Fraser agreed that the only difference between his understanding of "target material" and that of the Defendants' was that he urged the presence of a UV excitable dye, based on his understanding that the short wavelength range specified in the patent is synonymous with the UV range. Tr. 438. According to Dr. Fraser, all the dyes mentioned in the specification are UV excitable. Tr. 439. On cross examination, Dr. Fraser testified that the target material did not need to fluoresce for purposes of claim 7. Tr. 480-81. Yet, earlier in his testimony he had said the term should have the same definition wherever it appears in the patent. Tr. 442.

FN4. Dr. Fraser received his bachelor's degree with honors in physics from Harvey Mudd College and a Ph.D. with distinction in biophysics from Johns Hopkins University. He is a professor of biology and a director of the Biological Imaging Center at the California Institute of Technology. He has lectured and published extensively. The Court notes he is on the Board of Directors for Carl Zeiss, Inc. as an outside member and advises on the sales and service of products. Fraser Expert Report, Plaintiffs' *Markman* Ex. 52. The Court recognized Dr. Scott Fraser as an expert in the field of imaging technology, including laser scanning microscopy and the use of ultra fast lasers as they relate to that field. Tr. 406. Dr. Fraser's understanding of a person of ordinary skill in the art is "somebody that has a bachelor's level degree in biology or one of the physical sciences or engineering and that has one to two years of practical experience in microscopy or imaging science." Tr. 431-32.

The Court will not read an unsupported limitation into the term "target material." Comark Communications, 156 F.3d at 1186. In fact, contrary to Plaintiffs' assertion, the patent is clear that the target material can fluoresce in something other than the UV range. '613 Patent at 6:50 (describing fluorescence at 315 nanometers, in the ultraviolet region); 6:53 (describing fluorescence at 535 nanometers, in the visible light region). Accordingly, the Court interprets the term to mean: "The specimen or object that is imaged by the laser scanning microscope."

(2) In claim one, the term "short wavelength spectral range." The term refers to the photons that will excite

the fluorophore in the target material. Defendants contend that this phrase should be given its ordinary meaning and that, while the specification includes examples of short wavelength, it does not specify a particular definition. Rather, short wavelength is relative to the long wavelength light photons emitted by the laser, as recited in claim element 1[c], and depends on the particular target material. Plaintiffs allege that the specification requires that the term be limited to 315 nanometers (nm) or the UV wavelength range. '613 Patent at 6:6 ("short wavelength, for example, ultraviolet"); 7:33-44 (describing figure 2).

For the Defendants, Dr. Walmsley testified that a person of ordinary skill in the art would interpret the phrase to mean the excitation wavelength associated with the target material, that is, the wavelength that causes the fluorophore in the target material to fluoresce. Tr. 124. Dr. Walmsley asserted that language in the patent made the meaning of this phrase quite clear. For example, claim one states that "[t]he target material [to be imaged includes] fluorescent means responsive to excitation by photons in short wavelength spectral range to produce characteristic fluorescence." '613 Patent at 9:65-68. According to Dr. Walmsley, the definition of "short" depends on the target material, since the exciting short wavelength is a "characteristic" of the fluorophore in the target material. Tr. 181. Dr. Walmsley explained that the short wavelengths are the absorption wavelengths and are related to the long wavelengths.FN5 He also explained that a person of ordinary skill in the art would not expect the term short wavelength range to be limited to 315 nm or the ultraviolet range and pointed to several places in the patent that supported his interpretation. *See, e.g.,* '613 Patent Abstract ("[F]luorophores having single photon absorption in the short (ultraviolet or visible) wavelength range are excited by a stream of strongly focused subpicosecond pulses of laser light of relatively long (red or infrared) wavelength range."); 6:48-53 ("Thus, for example, two photons in the visible red region at 630 nm would combine to excite a fluorophore which normally absorbs light in the ultraviolet region at 315 nm, while two photons in the infrared region of, for example, 1070 nm, would excite a fluorophore which absorbs at 535 nm in the visible light region."); 5:68-6:10 ("To accomplish this, the laser produces a very short pulsed laser beam of high instantaneous power and of a relatively long wavelength, for example in the visible red or the infrared range. This light is directed to a specimen containing a fluorophore normally excited by a single photon in the short wavelength, for example, ultraviolet range ....").

FN5. As will be explained below, Dr. Walmsley stated that the long wavelength is also a characteristic of the target material and is the laser light that illuminates the target material. Tr. 175.

Additionally, Dr. Walmsley testified that the prosecution history supported his interpretation. The patent examiner originally rejected the terms "short" and "long" wavelength spectral range as being indefinite. In response, the applicants explained that "the terms as used in the claim are relative, with the target material including the fluorophore which is excited by short wavelength light whereas the applied light pulses are of a relatively long wavelength to which the fluorophore would not normally respond. The particular wavelengths are a function of a fluorophore to be detected, the point of the invention being that the fluorophore will respond to two photons of the long wavelength." Prosecution History at 88 & 107. After this explanation by the applicants the patent examiner allowed the claims. Tr. 196

Finally, Defendants' second expert, Dr. Karel Svoboda, defined short wavelength spectral range as "the characteristic fluorescence of the fluorophore that one is imaging, but it is clearly referred to as short compared to the long wavelength spectral range that is used for exciting the fluorophore." FN6 Tr. 334. He testified that the term is as precise as the subject matter allows because "two photon excitation microscopy can be done with fluorophores that have characteristic fluorescence in many regions of the wavelength spectrum, and so short wavelength spectral range certainly covers all those and some more." Tr. 335.

FN6. The Court recognized Dr. Svoboda as an expert in the field of two-photon microscopy. Dr. Svoboda received his bachelor's degree *cum laude* in physics from Cornell and a doctorate in biophysics from Harvard. He has extensive research and teaching experience and has lectured and published frequently. He is currently an associate professor at Cold Springs Harbor Laboratory and the State University of New York at Stony Brook. Curriculum Vitae of Karel Svoboda, Defendants' *Markman* Ex. 31. Dr. Svoboda testified that a person of ordinary skill in the art at the time of the invention would have a bachelor's degree in physiology, biophysics, physics or engineering, some postgraduate education and some experience with microscopy and laser scanning microscopy. *See* Tr. 318-19.

Plaintiffs' expert, Dr. Fraser, testified that short is synonymous with ultraviolet and pointed to the patent in support. Tr. 446; '613 Patent 2 :57-58 ("a short wavelength, typically ultraviolet"), 3:65-4:1 ("normally requires excitation by light in the ultraviolet range"), 6:3-10 ("short wavelength, for example ultraviolet range"). Although ultraviolet is clearly given as an example of the short wavelength range and Dr. Fraser testified that the term "for example" would not narrow the definition, he claims ultraviolet is the only example offered. Tr. 464-65.

The Court finds that Plaintiffs' interpretation of "short wavelength range" is unsupported by the intrinsic evidence. The abstract clearly states that short can be in the ultraviolet or visible range. The patent provides an example contemplating absorption in the visible light region. '613 Patent 6 :53. Also, the inventors explained in the prosecution history that "short wavelength range" depends on the target material's fluorophore and the long wavelength illuminating light. Accordingly, the Court adopts the Defendants' definition: "This short wavelength light has a wavelength that is shorter than the wavelength of the long wavelength light recited in claim element 1[c]. The specific wavelengths of the 'short' and 'long' wavelengths recited in Claim 1 depend on the particular fluorophore used in the target material."

(3) In claims one, two, four, six and eight, the term "long wavelength spectral range." FN7 According to Defendants, the term means light of such a wavelength that the fluorophore in the target material will not fluoresce in response to the absorption of one photon, but will fluoresce when the energies of two photons of that wavelength are absorbed and combine. '613 Patent at 5:68; 6 :10, 47-53. Defendants contend that it is unnecessary and perhaps misleading to fix a numerical range for the term. Again, according to Defendants, the term is relative, it is longer than the "short wavelength spectral range" and depends on the fluorophore in the target material. Plaintiffs argue that the specification supports a meaning of 630 nanometers or at least the red spectral region. '613 Patent, 6:31, 47; 7 :33-50.

FN7. Defendants state that the terms "long wavelength," "long wavelength spectral range," "long wavelength light," and "long wavelength impinging light pulses" are used as synonyms throughout the '613 Patent. Tr. 186.

On behalf of the Defendants, Dr. Walmsley explained that the long wavelength is used to illuminate the fluorophore and it has a specific relationship to the short wavelength and to the particular target material as demonstrated by the patent in the equation at the bottom of column six as well as equation two. Tr. 187. For instance, the abstract explains that "the relationship between the long and short wavelength range indicates they are both variable, that they depend on the particular fluorophore, and that the long wavelength range could lie in the red or the infrared spectral range." Tr. 193. Dr. Walmsley testified that to a person of

ordinary skill in the art the term would mean "light of a particular wavelength that will cause two photon excitation in the sample." Tr. 188; '613 Patent at 5:16 ("The light emitted by the fluorescent material in the specimen is at a wavelength that is specific to the fluorophore contained in the specimen and thus is a different wavelength than the incident light."); 5:64 ("[T]he present invention utilizes two-photon excitation of a fluorophore which has a one-photon absorption peak at a wavelength which overlaps one-half that of the exciting light.").

The prosecution history provides the same support for Defendants' interpretation of long wavelength range as it did for their interpretation of short wavelength range. *See* supra; Prosecution History at 107-08. Finally, Defendants' second expert testified that the term cannot be limited to 630 nanometers or the red range. Dr. Svoboda explained that fluorophores appear in many different colors and, as a result, the corresponding long wavelength spectral ranges will appear in many colors, red to infrared. Tr. 338.

Plaintiffs' expert, Dr. Fraser testified that a person of ordinary skill in the art would find long wavelength range means 630 nanometers because the patent equates the term with the red spectral range in several instances. Tr. 460. Additionally, Dr. Fraser stated that at the time of the patent, two-photon laser microscopy could only be accomplished with a colliding pulse mode locked laser, which delivers 630 nm light. Tr. 462. However, on cross examination, Dr. Fraser stated that 700 nm, 750 nm and 800 nm could be perceived as the color red. Tr. 501-02.

Again, the patent language is clear. The long wavelength is relative and can be in the red or infrared range. '613 Patent at Abstract ("relatively long (red or infrared)"); 4:68 ("a relatively long wavelength, preferably in the visible red or near infrared spectral range"), 6:1 ("relatively long wavelength, for example in the visible red or the infrared range"). The prosecution history is also clear. The term is relative and depends on the target material. Prosecution History at 107. The Court will not limit the definition to the embodiment in the patent where there is no indication that the applicants so intended. Karlin Tech. Inc. v.. Surgical Dynamics, Inc., 177 F.3d at 973 (Fed.Cir.1999); *cf.* Scimed Life Systems v. Advanced Cardiovascular, 242 F.3d 1337, 1343-44 (Fed.Cir.2001) (limiting definition to preferred embodiment where patent language expressly disclaimed any other embodiment). The terms "long wavelength spectral range," "long wavelength," "said long wavelength light" and "said long wavelength impinging light pulses" therefore mean: "The light produced by the laser is of such a wavelength that the fluorophore in the target material will not fluoresce in response to the absorption of one photon, but will fluoresce when the energies of two photons of that wavelength are absorbed and combined. Long wavelength means longer than the short wavelength spectral range light of claim element 1[a] or the predetermined wavelength of claim element 7[a]. The specific wavelengths depend on the particular fluorophore used in the target material."

(4) In claims one, two and seven, the term "subpicosecond." A picosecond is 10^{-12} seconds, or one trillionth of a second. Defendants submit that "subpicosecond" should be given its ordinary meaning, which is anything less than a picosecond. Plaintiffs admit that read out of context, subpicosecond would mean "less than a picosecond." In fact, an expert retained by Zeiss testified during his deposition that subpicosecond means "something less than one picosecond." Tr. 396 (reading June 16, 2000 deposition testimony of Dr. Colin Sheppard). However, according to the Plaintiffs, when subpicosecond is read in light of the specification, the term must mean about 100 femtoseconds. FN8 '613 Patent 2 :45-48 (referring to 100 femtoseconds as "these subpicosecond pulses"); 3:17-22 ("means of a stream of fast, high intensity, femtosecond pulses"), 65 (same).

FN8. A femtosecond is 10^{-15} second.

Defendants' expert, Dr. Walmsley testified that a person of ordinary skill would understand a subpicosecond to be less than one picosecond. Tr. 197. While the patent offers 100 femtoseconds as an example of a picosecond, it is not the only definition. *See* '613 Patent at 2:46-48 (offering 100 femtoseconds as an example of subpicosecond). For example, the patent describes a possible laser light source as "a colliding pulse, mode-locked dye laser generating pulses of light having a wavelength in the red region of the spectrum, for example about 630 nanometers, with the pulses having less than 100 femtoseconds duration ...." '613 Patent 6 :34-37. Further, according to Dr. Walmsley, equation 2 of the patent demonstrates that "one can vary the pulse duration consistent with obtaining enough fluorescence to obtain an image." Tr. 283 (citing '613 Patent 7 :11). Additionally, the inventors explained in the prosecution history that a subpicosecond pulse has a width of less than one times 10 to the minus 12 seconds. Prosecution History at 118; Tr. 201.

Dr. Fraser testified for Plaintiffs that subpicosecond is defined as being 100 femtosecond pulses. Tr. 449. However, he admits that in isolation "subpicosecond" would be anything less than 10 to the minus 12 seconds. Tr. 449, 517. Yet, he insists that 100 femtoseconds is not an example of subpicosecond, it is the definition. Tr. 518. He testified that the patent language itself supports his definition because it refers to 100 femtosecond pulses as "these subpicosecond pulses." Tr. 451; '613 Patent 2 :45. Additionally, he testified that at the time of the invention the laser community used the term subpicosecond for lasers of about 100 femtosecond pulses. Tr. 451. Further, Dr. Fraser pointed to a piece of prosecution history in which the applicants describe the embodiment and, according to Dr. Fraser, equate subpicosecond with 100 femtoseconds. *See* Plaintiffs' *Markman* Exhibit 87. However, the memorandum Dr. Fraser refers to states the pulses are "approximately 100 femtoseconds." Finally, in response to Dr. Walmsley's reliance on equation 2, Dr. Fraser testified that the equation concerns the two photon effect and does not teach pulse length.

The Court is mindful of its responsibility to impart the ordinary meaning to disputed claim terms. Further, the specification cannot be used to read a limitation into a claim term. Comark Communications, Inc. v. Harris Corp., 156 F.3d at 1186. The '613 Patent uses 100 femtoseconds as an example of a picosecond, but it is not used as a precise definition. '613 Patent 6 :34 ("with the pulses having less than 100 femtoseconds duration"). Additionally, the prosecution history states a subpicosecond pulse has a width of less than one times 10 to the minus 12 seconds, it does not define subpicosecond as 100 femtoseconds. Prosecution History at 118. Accordingly, the Court construes the term "subpicosecond" as "less than one picosecond."

(5) In claims one and three, the term "high instantaneous energy ." FN9 Defendants argue that the term must be read in light of the entire claim and that a person of ordinary skill in the art would understand the term to mean that the light pulses from the laser have enough energy or power to produce fluorescence when two photons of long wavelength light are absorbed and their energies are combined in the fluorophore. '613 Patent 2 :32-59; 3 :9-22; 6 :22-24. In their claim construction brief, Plaintiffs argued the term should mean about 25 milliwatts, consistent with the definition in the specification. '613 Patent 7 :40.

FN9. Defendants claim "high instantaneous energy" and "high intensity" are synonyms in the patent.

In support of Defendants' position, Dr. Walmsley testified that one of ordinary skill in the art would understand the term to mean the "instantaneous intensity required to produce two photon fluorescence in the target material." Tr. 206. The patent demonstrates that the high instantaneous energy is determined by

reference to the particular fluorophore. Tr. 208; '613 Patent 2 :52 ("Because of the high instantaneous power provided by the very short duration intense pulses focused to the diffraction limit, there is an appreciable probability that a fluorophore, contained in the target material, and normally excitable by a single high energy photon having a short wavelength, typically ultraviolet, will absorb two long wavelength photons from the laser source simultaneously."). Dr. Walmsley explained that equation two in the patent demonstrates that the level of energy depends on the power of the laser, pulse duration and repetition rate. Tr. 211-13. The prosecution history also supplies a definition. It states the long wavelength pulses provide "sufficient instantaneous power to produce simultaneous absorption of two incident photons to excite fluorescence in the target material." Prosecution History at 117.

Further, Defendants' second expert, Dr. Svoboda, explained that high instantaneous energy is required to make two photon microscopy work. Tr. 319-20 (discussing '613 Patent at 2:52, 3:9, 6:22). More importantly, Dr. Svoboda explained that the 25 milliwatts referred to in the patent refers to the average power of the laser. Tr. 325; '613 Patent at 7:42. High instantaneous power refers to the "very, very high power that occurs only very, very briefly during a pulse. The average power, though, is much lower than the peak power because it's averaged over the whole time ...." Tr. 325. If 25 milliwatts was used as the instantaneous energy intensity, Dr. Svoboda believes it would take a week to form an image. Tr. 327.

At the *Markman* hearing, Plaintiffs appeared to abandon their dispute concerning this term. Dr. Fraser testified that high instantaneous energy did not have to be constrained to 25 milliwatts. Tr. 534. Accordingly, the Court interprets the terms "high instantaneous energy" and "high intensity" to mean: "The pulses of light generated by the laser produce sufficient energy so that two photons will be absorbed by the fluorophore in the target material to produce fluorescence."

(6) In claim one, the term "high repetition rate." This term is used to characterize the rate of subpicosecond laser light pulses directed at the target material. According to Defendants, the use of 80 megahertz (MHz) in the specification is only an example and not a precise definition. Rather, a high repetition rate is one in which the laser light pulses are repeated frequently enough so that a fluorophore that is normally excitable by a single high energy photon with a short wavelength will absorb two long wavelength photons from the laser source simultaneously to produce fluorescence. Plaintiffs, on the other hand, argue that the specification dictates that the rate be about 80 MHz. '613 Patent 2 :48 ("repetition rate of about 80MHz"); 6:38 ("at about 80 MHz repetition rate"); 7:5 (same).

On behalf of the Defendants, Dr. Walmsley explained that the patent language demonstrates that the term relates to a stream of rapidly repeating high intensity pulses of light. Tr. 204; *see e.g .,* '613 Patent 3 :13 ("stream of fast, high intensity pulses"), equation two (demonstrating inventors understood the rate to be variable). He also explained that in his field of expertise tens of megahertz to hundreds of megahertz would be considered a high repetition rate. Tr. 205. Dr. Svoboda added that to a person of ordinary skill the term would mean a rate "sufficiently high for practical two-photon excitation microscopy." Tr. 341.

Dr. Fraser testified that a colliding pulse mode locked laser is offered as the only embodiment of the patent and it had a repetition rate of 80 megahertz. On cross examination, he admitted that the repetition rate could vary according to equation two in the patent. Tr. 532.

Again, the Court will not limit the term to the one embodiment described in the patent. Karlin, 177 F.3d at 973. As it is agreed that equation two allows for a variable repetition rate, the Court will not limit the term to 80 megahertz. Accordingly, the Court interprets the term to mean: "The light pulses produced by the laser

are repeated at a rate high enough so that a fluorophore normally excitable by a single high energy photon having a short wavelength will absorb two long wavelength photons from the laser source simultaneously to produce fluorescence and an image may be acquired in a practical amount of time."

(7) In claims five, eight and nine, the term "red wavelength spectral range." Defendants submit that the term "red wavelength spectral range" should be given its ordinary meaning and that to people skilled in the art, that range is approximately 620 to 800 nanometers. Plaintiffs argue the specification only provides for a definition of about 630 nanometers, but would agree to a range of 615 to 685 nm. '613 Patent at 6:48; 7 :43-44; Plaintiffs' Proposed Claim Construction Order.

Defendants' expert, Dr. Walmsley, explained that a person of ordinary skill in the art would understand the term to mean that there is a "range of wavelengths associated with this light and that it had to do ... with illuminating the particular fluorophore in the target material." Tr. 223-24. He explained the range is somewhat indefinite in that people of ordinary skill in the art understand that it is not precisely defined. Tr. 224. 630 nanometers is given as an example of light in the red spectral range, it is not a definition. Tr. 226. Dr. Walmsley submitted that figure 2 of the patent contemplates a situation in which red would be 730 nm. Tr. 228. Further, he testified that what people see as red can vary because the determination is somewhat physiological, but generally the range is 600 to 800 nm. In support of this range, Dr. Walmsley read from two textbooks that described red as 622 to 780 nm and 620 to 800 nm, respectively. Tr. 232-35. Additionally, Dr. Walmsley testified that Zeiss' own website describes the red range as including 780 nanometers. Tr. 304. Dr. Svoboda testified that the term is somewhat opaque in that people do not agree on a precise range, he has seen 600 to 800 nm as the broadest range and 620 to 750 nm as the narrowest. Tr. 343.

Dr. Fraser testified in support of Plaintiffs' definition that people skilled in the art would understand the red range to include 615 to 685 nm. Tr. 500. Yet, as discussed above, he admitted that up to 800 nm could be seen as red. Tr. 502.

As the Court is not convinced that the patent or its prosecution history provides definitive guidance on this term, it must rely on extrinsic evidence to determine what people skilled in the art in 1991 understood the red range to cover. Key Pharm. v. Hercon Labs. Corp., 161 F.3d 709, 716 (Fed.Cir.1999) (approving use of extrinsic sources when intrinsic evidence is not sufficient to construe a patent term); Wiener v. NEC Elecs. Inc., 102 F.3d 534, 539 (Fed.Cir.1996) (noting the Court must consider the term's meaning at the time of patent application). Dr. Walmsley read from a textbook entitled *Optics,* by Eugene Hecht. The book was originally published in 1974 and reprinted with corrections in 1990. It supported a red range from 622 to 780 nanometers. Defendants' *Markman* Exhibit 9.FN10 Accordingly, since the Plaintiffs' expert agreed that the red range could begin as low as 615 nanometers and the *Optics* textbook supports an upper limit of 780 nanometers, the Court will define the red spectral range as "615-780 nanometers."

FN10. The second text from which Dr. Walmsley read was *Chemistry,* by James Birk, published in 1994. Defendants' *Markman* Exhibit 8. Although it supports a definition of red in the 620-800 nanometer range, the Court will not rely on it since it was published after the '613 Patent was accepted.

(8) In claim one, the phrase "a source of subpicosecond monochromatic coherent light pulses of high instantaneous energy ... to produce in target material at said object plane simultaneous absorption of two incident photons to thereby excite characteristic fluorescence." Plaintiffs assert this phrase, which is combined from two separate paragraphs (1[c] and [e]), must be read together as a means-plus-function

clause. Plaintiffs argue that the first portion of the phrase describes a means of producing light pulses and the second portion recites the function of producing in the target material a simultaneous absorption of two incident photons. According to Plaintiffs, there is no recited structure in the claim for the performance of the function. Thus, Plaintiffs submit, the structure must be garnered from the specification, which, they submit, dictates that the structure be a colliding pulse mode-locked dye laser.

Defendants disagree. Defendants argue that the word "means" is not used in the term, the specification does not specify a function that necessarily corresponds to this claim element and the claim element provides sufficient structure, thus making s. 112, para. 6 inapplicable. For example, Defendants argue that the terms "light source," "subpicosecond monochromatic coherent light pulses," "light pulses of high instantaneous energy intensity comprised of photons in a long wavelength spectral range" and "pulses having a high repetition rate" are all recited in claim one and establish sufficient structure and material for the claim-that is, a laser. Tr. 345.

The applicants were clear and signaled their invocation of the means-plus-function analysis with the word "means" throughout the patent. *See, e.g.,* '613 Patent 9 :64 ("stage means"); 10:1 ("lens means"). In the claim elements that the parties agree are to be interpreted as means-plus-function elements, there is no description of structure provided. That is not the case here where sufficient structure is recited. Because the word "means" does not appear in the phrase at issue, the Plaintiffs must overcome the presumption that s. 112, para. 6 will not apply. The Plaintiffs have not met their burden. The Court finds there is sufficient structure recited in the claim and the phrase will not be construed as a means-plus-function element.

(9) In claim seven, the phrase "a laser source of subpicosecond laser light pulses, ... producing in the region of said focal point a two photon excitation energy level." Plaintiffs argue this phrase, also taken from two paragraphs (7[c] and [d]), must be construed together as a means-plus-function element. According to the Plaintiffs, there is no recited structure for performing the function of producing a two photon excitation energy level in the focal point. Again, Plaintiffs argue the structure should be read from the specification and should be construed as a colliding pulse mode-locked dye laser. Defendants respond that the term "means" does not appear in this element. Further, definite structure and material is recited, thus making s. 112, para. 6 inapplicable. For example, the term "laser source" by itself recites a structure, that is, a laser.

For the same reasons the Court refused to interpret the previous phrase as a means-plus-function element, it again declines to do so here.

(10) In their claim construction brief, Plaintiffs argued that the phrase "illuminating said sample with a beam of rapidly repeating, intense, subpicosecond pulses of laser light ... to produce an illumination intensity sufficiently high at said focal point to produce molecular excitation and fluorescence of said sample by simultaneous absorption of two incident photons," taken from paragraphs [b] and [c] in claim 17, is a step-plus-function element. The step of "illuminating said sample with a beam of rapidly repeating, intense subpicosecond pulses of laser light" does not by itself perform the function of producing "an illumination intensity sufficiently high at said focal point to produce molecular excitation and fluorescence of said sample by simultaneous absorption of two incident photons." Accordingly, Plaintiffs argue the act must be limited to illuminating the sample with a beam from a colliding mode-locked dye laser and its equivalents.

Similarly, in claim 21, Plaintiffs argued that the phrase "illuminating said sample with a beam of rapidly repeating, intense, subpicosecond pulses of laser light ... to produce an illumination intensity sufficiently high at said focal point to produce molecular excitation and consequent release of caged biologically active

compounds by simultaneous absorption of two incident photons," from paragraphs [b] and [c] is a step-plus-function element. They submit that the step of "illuminating said sample with a beam of rapidly repeating, intense subpicosecond pulses of laser light" does not on its own perform the function of producing "an illumination intensity sufficiently high only at said focal point to produce molecular excitation and consequent release of caged biologically active compounds by simultaneous absorption of two incident photons." Accordingly, in Plaintiffs' view, the only act that can be construed from the claim is illuminating the sample with a beam from a colliding pulse mode-locked dye laser and its equivalents.

With respect to both phrases, Defendants respond that the phrase "step for" does not appear in this element, that the claim recites acts and Plaintiffs cannot overcome the presumption that it is not a step-for-function element. Further, according to the Defendants the element do not specify a corresponding function, as required by the statute. The Court agrees. At the *Markman* hearing, Plaintiffs did not provide any testimony or evidence on these two phrases and did not overcome the presumption that step-plus-function analysis would not apply. Tr. 531. Accordingly, the Court finds that neither of these two phrase is a step-plus-function element.

So ordered.

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