Claim Chart Against U.S. Patent No. 12,174,107 ("'107 patent")

As set forth in the chart below, all asserted claims of the '107 patent are invalid under 35 U.S.C. § 112.[1]

Cytek's investigation is ongoing. Cytek reserves the right to modify, amend, and/or supplement these contentions as information becomes available, as discovery proceeds, as Plaintiff amends or clarifies its infringement contentions (including through expert reports), after any subsequent claim construction order, or as otherwise permitted by the Court. For clarity, the positions herein reflect Cytek's responses to Plaintiff's Disclosure of Asserted Claims and Infringement Contentions dated February 14, 2025 and its Second Election dated October 1, 2025.

Cytek's § 112 contentions are preliminary. Cytek reserves its right to amend these contentions, including if/when Plaintiff supplements or amends its infringement contentions. By making these § 112 contentions, Cytek does not make any affirmative statements with respect to its asserted §§ 102, 103, and/or non-infringement defenses but rather preserves those defenses and reserves all rights. Any discussion herein is based on Cytek's present understanding of Plaintiff's infringement contentions and/or claim constructions and should not be taken as an admission that Cytek supports, endorses, or does not dispute Plaintiff's infringement contentions and/or interpretation of the claims.

Claim 1

Claim Element	35 U.S.C. § 112 Positions
1[pre] *A flow cytometer, comprising:*	The overbroadly claimed "flow cytometer" lacks written description support and is not fully enabled. The only written description support for the '107 patent includes: "1. A flow cell through which a liquid stream, usually called a sheath flow, liquid or fluid, carries and hydrodynamically aligns cells or particles so that they pass single file through the flow cell. 2. A measuring subsystem system coupled to the flow cell that detects cells or particles passing through the flow cell and is usually either:

[1] Cytek's §112 positions herein are exemplary. For any claim limitation, Cytek may rely on excerpts cited for any other limitation and/or additional excerpts not set forth fully herein. Where an excerpt refers to or discusses a figure or figure items, that figure and any additional descriptions of that figure should be understood to be incorporated by reference as if set forth fully therein.

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Claim Element	35 U.S.C. § 112 Positions
	a. an impedance or conductivity measuring subsystem; or b. an optical illumination subsystem together with an optical sensing subsystem. 3. A conversion subsystem for converting the output signal from the measuring subsystem into computer processable data. 4. A computer for analyzing the data produced by the conversion subsystem." (*See* WO2013/181453, 1:34-2:12.) Importantly, the flow cytometer described in the specification is limited, in part, to (1) a composite microscope objective that consists of at least a concave mirror and an aberration collector plate as part of 2.b above; and a computer system that analyzes discrete peak wavelengths (e.g., bucketing) from the data produced by the conversion subsystem, as part of 4 above. The inventor did not have possession of full spectrum analysis at the time of invention and Plaintiff cannot retroactively claim full spectrum analysis when the claimed invention performs conventional emission peak wavelength analysis (e.g., binning, compensation). The fact that the claimed "flow cytometer" contemplates both conventional flow cytometers and spectral flow cytometers is highlighted by unasserted claim 9, directed toward a spectral flow cytometer that lacks written description support and enablement for the reasons set forth in Grounds 5 and 6 of Cytek's PGR petition in PGR2025-00088, respectively, and incorporated here in their entirety (including associated exhibits). Nor did the inventor have possession of, or enabled, a flow cytometer that used any optical component other than a compositive microscope objective to collect and focus fluorescent light from the cuvette in the flow cell to a multimode optical fiber. For example, nowhere in the specification does the inventor disclose that his flow cytometer incorporated a simple objective lens.

Claim Element	35 U.S.C. § 112 Positions
1[a] *an optical fiber; and*	The term "optical fiber" lacks full scope written description support and enablement for the reasons set forth in Grounds 3 and 4 of Cytek's PGR petition in PGR2025-00088, respectively, and incorporated here in their entirety (including associated exhibits). Grounds 3 and 4 from Cytek's PGR petition are replicated below. **A. <u>Ground 3</u>: Claims 1-3, 5-14 Lack Written Description Support for an "optical fiber"** Claims 1-3, 5-14 lack adequate written description because they broadly recite an "optical fiber." A POSA would have understood that Claim 1's "optical fiber" includes both single-mode and multi-mode optical fibers. (*Compare* '107, cl. 1 ("optical fiber"), *with id*., cl. 16 ("multimode optical fiber"); *see also* EX1002, ¶115.) The '107 written description provides no disclosures for how its WDM would operate with a single-mode optical fiber but instead ***distinguishes*** the purported invention from technology that relays light from a single-mode optical fiber. (*See* '107, 44:56-45:3; EX1002, ¶117.) The "problem" that the '107 purports to solve is collimating a large etendue light beam from an extended light source (e.g., a multimode optical fiber) without significantly expanding the beam diameter. (*Compare* '107, 44:33-39 , *with id*., 44:47-50; *see also id*., 44:56-45:3; EX1002, ¶116.) All embodiments refer to a WDM that demultiplexes and detects fluorescent light from an extended light source like a multimode optical fiber. (*See* '107, 44:56-61; *id*., 46:29-30, 46:41-43, 48:39-42.) A POSA would therefore have understood all references to "optical fibers" in the specification to comprise a multimode optical fiber and as teaching away from using a single-mode optical fiber with the claimed WDM. (EX1002, ¶117.) The repeated disclosures in the '107 written description and related file history show that a POSA would not have recognized the inventor to be in possession of the full scope of a WDM that broadly uses either single or multimode optical fibers, as contemplated by Claim 1. (EX1002, ¶¶118-121.)

	B. Ground 4: Claims 1-3, 5-14 Lack Full Scope Enablement for "optical fiber" Claims 1-3, 5-14 are not enabled as to "optical fiber" because they broadly encompass both single and multimode optical fibers for use with the claimed WDM. The specification lacks disclosures for using the claimed WDM with a single-mode optical fiber, and a POSA would have had to engage in undue experimentation to implement such a design. (EX1002, ¶122.) ***Wands Factor 1 – Breadth of the Claims.*** Claims 1-3, 5-14 broadly recite "optical fiber," which a POSA would have understood to include single and multimode optical fibers for use with the claimed WDM. (EX1002, ¶123.) That Claims 1-3 and 5-14 intend to encompass both single and multimode optical fibers is evident from Claim 1's broad recitation of "optical fiber" compared to Claim 16's narrower recitation of "multimode optical fiber." ***Wands Factor No. 2 – Field or Nature of the Invention***. For the same reasons discussed in *Wands* Factor No. 2 in Ground 2, Claims 1-3, 5-14 are not fully enabled. (EX1002, ¶123.) ***Wands Factors Nos. 3 and 4 – State of the Prior Art at the Time of the Invention and Level of a POSA***. A POSA at the time of the invention would have known to use multimode optical fibers to transport light in a flow cytometer from collection optics to the WDM; however, a POSA would not have known to use a single-mode optical fiber for the same. (EX1002, ¶124.) Because single-mode optical fibers do not meet the requirements of low sensitivity to mechanical manipulation/positioning, high light collection efficiency, and cost efficiency, a POSA would consider them inferior vis-à-vis multimode optical fibers for use with the claimed WDM. (EX1002, ¶124.) ***Wands Factors Nos. 5-8 – Predictability, Guidance from the Specification, Working Examples, and Amount of Experimentation***. As described in Ground 3, the '107 specification offers no guidance or working examples to enable a POSA to use the

Claim Element	35 U.S.C. § 112 Positions
	claimed WDM with a single-mode optical fiber—the specification teaches away from such use. (*Supra* n.4; EX1002, ¶125; *see also* Ground 3.) Absent any teaching or working examples of single-mode optical fiber implementation, a POSA would have had to engage in excessive experimentation to practice the claimed WDM (with APDs) using a single-mode optical fiber due to the technical obstacles of such implementation. The '107 specification explains that the optical fiber transports light in a flow cytometer gathered from the composite microscope objective to the WDM for processing. (*E.g.*, '107, 28:19-27, FIG. 1 (item **852**).) To do this, the composite microscope objective gathers and focuses light scattered and fluoresced by particles to images on an image plane, where the diameter of these images "may be less than 35 microns." (*See id.*, FIGs. 9A, 9B1, 9B2, 9B3, 34:44-67, 35:20-25.) A POSA would have understood that the optical fiber must have a core diameter at least sufficiently large as these images to avoid signal loss when implemented under these conditions. (EX1002, ¶127.) As discussed in Section V.C, while APDs have highly sensitive detection capabilities and fast response times, they also have greater signal-to-noise sensitivity. A POSA would have recognized the need for high signal collection and delivery to the claimed WDM. (EX1002, ¶131.) This need for delivering a stronger signal to the WDM would be impeded by using single-mode optical fibers. A POSA would have understood that an optical fiber having a greater core diameter and a higher numerical aperture would be needed to obtain the collection efficiency necessary to operate the claimed APD-based WDM. (EX1092, p.003-004; EX1002, ¶¶128-131.) But as the '107 specification explains, single-mode optical fibers, which are "measured in micrometers," comprise substantially smaller core diameters than multimode optical fiber, which are measured "in millimeters." ('107, 44:63-66; *compare* EX1093, *with* EX1094, EX1095; *see also* EX1002, ¶¶126-127, 132.) Accordingly, a weak resultant signal transported to the WDM by a single-mode optical fiber would provide a lower signal to noise ratio and be inadequate to allow APDs, with their inherently high dark current, to be used. (EX1002, ¶133.)

Claim Element	35 U.S.C. § 112 Positions
	* * * Given the absence of any teaching or working examples of single-mode optical fiber implementation, and the technical obstacles to such implementation, a POSA would have had to engage in undue experimentation to practice the claimed APD-based WDM using a single-mode optical fiber—even today, there are no commercially available flow cytometers that use a single-mode optical fiber with APD fluorescence detectors. (EX1002, ¶¶133-134.)
1[b] *a wavelength division multiplexer (WDM) configured to receive light from the optical fiber, wherein the WDM comprises:*	The term "wavelength division multiplexer (WDM) lacks full scope written description support and enablement for the reasons set forth in Grounds 1 and 2 of Cytek's PGR petition in PGR2025-00088, respectively, and incorporated here in their entirety (including associated exhibits). Grounds 1 and 2 from Cytek's PGR petition are replicated below. **A. <u>Ground 1</u>: The Challenged Claims Recite a "WDM" that Lacks Written Description Support** The Challenged Claims are invalid under § 112 because the recited "wavelength division (de)multiplexer" ("WDM") lacks adequate written description support absent a "collimating optical element" that projects a collimated beam. The Federal Circuit has held claims are invalid for lack of written description where they omit an element that is essential to the invention as described in the specification. *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 1479-80 (Fed. Cir. 1998) (invalidating claims directed to a sofa that did not limit the location of controls to a console despite the specification only describing console-located controls). Here, while written description support exists for a WDM that uses a "collimating optical element" to project a collimated beam through a cascaded unit-magnification relay architecture, no written description exists for the broader genus of WDM comprising filters, mirrors, and APDs recited in the '107 claims. A "collimating optical element" is necessary to project a collimated beam through the claimed WDM configuration and render it operable. (EX1002, ¶82.)

Claim Element	35 U.S.C. § 112 Positions
	1. The Omitted "Collimating Optical Element" that Projects a "Collimated Beam" is Critical to Operate the Claimed WDM The '107 specification teaches the claimed WDM separates fluorescent light into color bands using a specific configuration that ***requires*** use of a "collimating optical element" that projects a "collimated beam" throughout a cascaded unit-magnification image relay architecture. (EX1002, ¶93.) The written description makes repeated reference to using a "collimating optical element" and it is featured in every WDM embodiment. (*Id*., ¶¶93-95.) This architecture is necessary in part because the claimed WDM uses APDs, which have high noise sensitivity. (*See* '107, 44:33-53; *see also* EX1002, ¶96.) A POSA at the time of the invention would have understood this configuration to require the use of a "collimating optical element" to project a "collimated beam" through a series of mirrors and filters to enable using noise-sensitive APDs. (EX1002, ¶93.) **a. Technical Background on Light Beam Properties** Light beam rays either (1) converge (i.e., the proximity of the rays increases over distance); (2) are collimated (i.e., the proximity of the rays remains constant over distance); or (3) diverge (i.e., the proximity of the rays decreases over distance). (EX1007, p.110; *see also* EX1023, pp.009-010; EX1002, ¶¶84-85.) To produce each of these types of light beams, a POSA would have known to manipulate the distance between a light source relative to the focal length of a lens as shown below (where f is the lens's focal length, and S_O is the object's distance from the lens):

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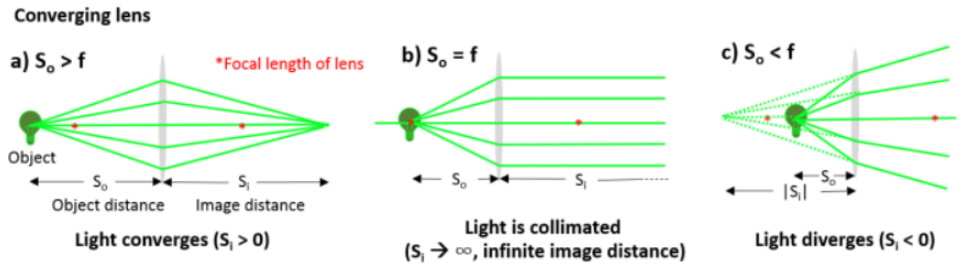
	Using this relationship, you can see why light going through a converging lens can produce three different results (this is similar to what we saw earlier for light passing through a spherical boundary). Whether the light converges, diverges, or is collimated depends on where the object is relative to the focal length of the lens:  (EX1023, pp.009-010.) Placing an object at a distance from the lens greater than the focal length results in converging light rays; placing the object at a distance equal to the focal length results in collimated/parallel rays; and placing the object at a distance less than the focal length results in diverging rays. (EX1007, p.110; EX1090, at p.006; EX1066, p.001; EX1002, ¶¶86-89.) Notably, a collimated beam from a real light source necessarily results in ***some*** divergence. This is because a real light source does not comprise a single point that can be placed at exactly the focal length of a lens. Rather, a real light source is defined by a specific diameter (*d*), which when centered on the optical axis at the focal length (*f*) of a lens (*D*), will necessarily position portions of the area within the diameter of the light source beyond the exact focal length of the lens along the optical axis. (EX1065, p.003; see also EX1066, pp.001-002; EX1002, ¶¶90-92.) Thus, real light sources "resemble groupings of multiple point sources[,]" (EX1065, p.003), such that a collimated beam comprises "light from each point on the source [that] is individually collimated[,]" (EX1065 (Fig. 1.1. caption)), as shown in the following annotated image where each point on the source (● ● ●) is "individually collimated":

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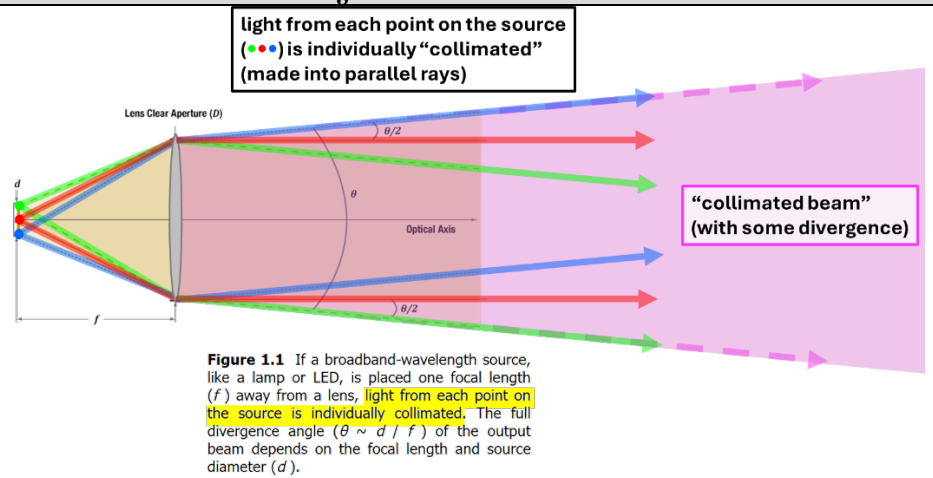


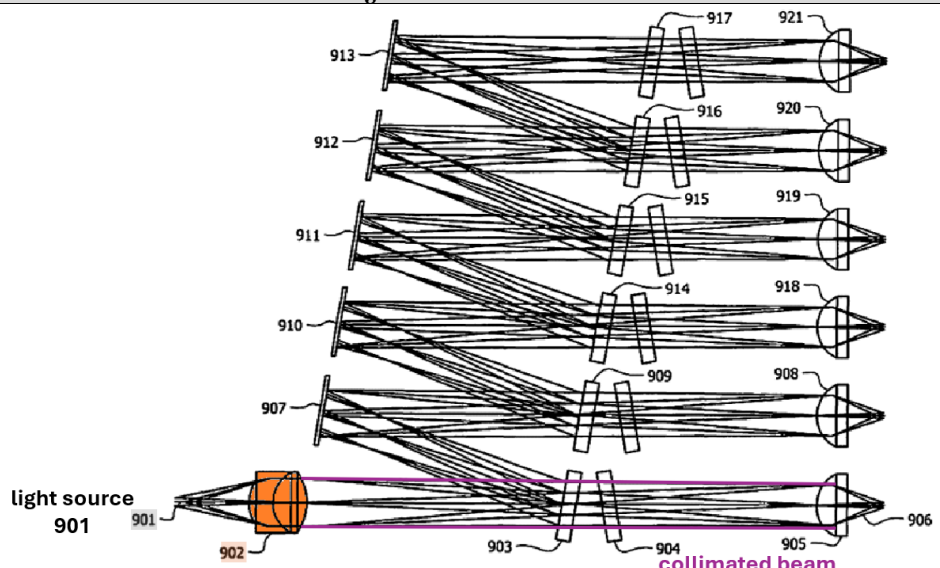
Figure 1.1 If a broadband-wavelength source, like a lamp or LED, is placed one focal length (f) away from a lens, light from each point on the source is individually collimated. The full divergence angle ($\theta \sim d / f$) of the output beam depends on the focal length and source diameter (d).

(EX1065, p.003 (annotations added); *see also* EX1066, p.001; EX1002, ¶¶90-92.)

b. The Omitted "collimating optical element" That Projects a "collimated beam" is Required to Operate the Claimed WDM

The '107 recognizes that while "efficient color separation can only be accomplished economically with [a] collimated light beam," technical hurdles exist to using a collimated beam with small area APDs. ('107, 44:33-47.) The '107 targets a "highly desirable" technology to "collimat[e] a large etendue light beam over an extended distance without significantly expanding the beam diameter" because it would "enable a WDM like device for fluorescence light detection with characteristics comparable to low noise semiconductor detectors." (*Id.*, 44:47-53.)

The '107 written description repeatedly describes using a "collimating optical element" to project a collimated light beam through a unit-magnification relay architecture. (*See* '107, 9:63-10:10, 20:31-46, 21:8-23, 20:52-60, 45:10-26, 46:34-41, FIGs. 25, 27, 28; EX1002, ¶95.) The "collimating optical element" appears in every disclosed embodiment, as shown in FIG. 25 below.

Claim Element	35 U.S.C. § 112 Positions
	 *FIG. 25* (*Id.*, FIG. 25 (annotated).) A POSA would thus have understood that the '107's goal to solve "collimating a large etendue light beam over an extended distance" requires use of a "collimating optical element" to collimate fluorescent light received into a WDM to begin with. (*Id.*, 44:47-53; *see also* EX1002, ¶96.) And a POSA at the time of the '107 invention would not have understood the inventor to be in possession of any WDM other than one comprising a "collimating optical element" to project a collimated beam through the unit-magnification image relay architecture. (EX1002, ¶¶96, 106.) The '107 written description only discloses WDM embodiments using a "collimating optical element" to project a collimated light beam. (*Id.*) Unsurprisingly, the '107 teaches ***against*** a WDM configuration using a non-collimated beam, let alone one without a collimating optical element, explaining that "efficient color separation can only be accomplished economically with [a] collimated

Claim Element	35 U.S.C. § 112 Positions
	light beam" and addressing a problem with collimating fluorescent light from an extended light source. ('107, 44:33-53; EX1002, ¶¶96, 107.) **2. The Prosecution History Confirms a "Collimating Optical Element" that Projects a "Collimated Beam" is Critical** The prosecution history for the '107 patent's family confirms that a "collimating optical element" that projects a collimated beam is critical to the claimed WDM. The claims of every application that preceded the '107 patent in its priority chain that recite a WDM includes the limitation of a "collimating optical element" that projects a collimated beam. (PCT App., pp.059, 083; EX1070, cl. 1; EX1029, pp.029-034; EX1091, cl. 1; EX1078; EX1088, cl. 1, 13, 18; *see also* EX1002, ¶¶97-103.) *** However, the Challenged Claims broadly claim a WDM comprising an "[array / plurality] of mirrors," an "[array / plurality] of filters," and an "[array / plurality] of avalanche photodiodes (APDs)" without reciting a "collimating optical element." (*See* '107, cls. 1, 16.) Thus, a POSA would have understood the Challenged Claims to recite a WDM that would operably relay a light beam without a "collimating optical element," meaning that it could relay diverging, converging, and collimated light beams. (EX1002, ¶105.) Thus, the Challenged Claims are invalid for lack of written description as to the claimed WDM, which broadly recites a WDM that lacks a "collimating optical element" and is configured for use with non-collimated light beams. (EX1002, ¶¶105-108.) **B. <u>Ground 2</u>: The Challenged Claims Lack Full Scope Enablement for a "WDM" Without a "Collimating Optical Element" That Projects a "Collimated Beam"** The Challenged Claims are not fully enabled because they broadly recite any WDM with arrays of filters, mirrors, and APDs, including WDMs that project and relay ***any*** type of light beam in ***any*** filter/mirror configuration. But the specification only teaches a WDM that uses a collimating optical element to relay a collimated beam through a

Claim Element	35 U.S.C. § 112 Positions
	unit-magnification image relay architecture, the purported "only" way to achieve economical and efficient color separation of fluorescent light. (EX1002, ¶109.) Applying the *Wands* factors demonstrates that the claimed WDM is not fully enabled. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). ***Wands Factor No. 1 – Breadth of the Claims***. The independent claims (and of what must be enabled) broadly recite WDMs that include configurations without a collimating optical element and that do not project a non-collimated light beam. (EX1002, ¶111.) The breadth of the claims would extend to, and thus require enablement for, WDM embodiments, in any conceivable configuration, that propagate an initially collimated beam, a non-focused (diverging) beam, or a focused (converging) beam through the relay architecture. The '107 specification's teachings are directed toward a cascaded unit-magnification relay architecture using a collimated beam, yet the claims omit any collimating optical element, an essential feature in the purported invention. (*Id*.) ***Wands Factors Nos. 2 and 4 – Field or Nature of the Invention and Level of Ordinary Skill***. The field of the invention is flow cytometry, fiber optics, and wavelength demultiplexing and detection. (*See* '107, 1:42-45, 2:7-10, 2:40-45.) The '107 refers to various subassemblies in the claimed flow cytometer, including a WDM that comprises a collimating optical element and propagates a collimated beam through a unit-magnification image relay architecture. (*See, e.g.*, *id.*, 4:46-65.) Applying the POSA definitions provided by either of the parties (*see* Section VII; EX1081) would not alter this *Wands* factor given the overall lack of teaching by the specification and excessive experimentation required to practice these overbroad claims. (EX1002, ¶112.) ***Wands Factors Nos. 6 and 7 – Guidance from the Specification and Working Examples.*** The '107 specification offers no teaching or working examples of a WDM that does not include a collimating optical element or that does not propagate a collimated light beam. Instead, the specification instructs that "efficient color

Claim Element	35 U.S.C. § 112 Positions
	separation can only be accomplished economically with [a] collimated light beam[.]" ('107, 44:33-53; *see also* EX1002, ¶113.) ***Wands Factors Nos. 3, 5, and 8 – State of the Art, Predictability, and Amount of Experimentation***. Given the absence of any teaching or working example from the '107 specification for a WDM that lacks a collimating optical element or that propagates a non-collimated beam, a POSA would have had to engage in excessive experimentation to practice the full scope of the claimed WDM. For example, a POSA would have had to understand how to design a WDM where filters in the array of filters receive light directly from the optical fiber for demultiplexing and processing of sufficient signal strength to overcome known technical signal-to-noise issues with APDs. (EX1002, ¶114.) As of 2012, diffraction was necessary to separate wavelengths and enable fluorescence detection systems that used diverging light with APDs. This comprised a fundamentally different technology based on different optical principles than what the '107 discloses. (*Id.*)
1[c] *an array of mirrors;*	The term "array" is indefinite because a POSA would not have understood with reasonable certainty what the scope of an "array" is, including the specific physical arrangement(s)/configuration(s) of the claimed "mirrors" to qualify as an "array" as opposed to any other physical arrangement/configuration of multiple mirrors. Claim 2's recitation that the "array of mirrors" may be "substantially linear" confirms that Claim 1's broader use of the term "array" contemplates a broader, unspecified set of physical arrangements/configurations for the "mirrors." The term "array" also fails to adequately describe to a POSA the number of minimum number of "mirrors" required to qualify as an "array." The specification fails to provide any guidance on the scope of the term "array" relative to "mirrors," as that term "array" only appears twice in irrelevant passages: (1) referencing a prior art "Geiger mode APD array" ('107, 44:14-15); and (2) identifying the "possibility of using array detectors" in the disclosed WDM (*id*, 46:21-24). Neither disclosure provides sufficient clarity for a POSA to have understood the scope of the term "array of mirrors." The term "mirrors" lacks full scope written description support and enablement with respect to any non-planar mirror other than what a POSA would consider a concave mirror (e.g.,

Claim Element	35 U.S.C. § 112 Positions
	convex mirror, distorting mirror). The term "mirror" further lacks full scope written description support and enablement with respect to "concave mirror" for the reasons set forth in Claim 3 below and incorporated here.
1[d] *an array of filters; and*	The term "array" is indefinite because a POSA would not have understood with reasonable certainty what the scope of an "array" is, including the specific physical arrangement(s)/configuration(s) of the claimed "filters" to qualify as an "array" as opposed to any other physical arrangement/configuration of multiple "filters." Claim 2's recitation that the "array of filters" may be "substantially linear" confirms that Claim 1's broader use of the term "array" contemplates a broader, unspecified set of physical arrangements/configurations for the "filters." The term "array" also fails to adequately describe to a POSA the number of minimum number of "filters" required to qualify as an "array." The specification fails to provide any guidance on the scope of the term "array" relative to "filters," as that term "array" only appears twice in irrelevant passages: (1) referencing a prior art "Geiger mode APD array" ('107, 44:14-15); and (2) identifying the "possibility of using array detectors" in the disclosed WDM (*id*, 46:21-24). Neither disclosure provides sufficient clarity for a POSA to have understood the scope of the term "array of filters." The term "filter" lacks full scope enablement and associated written description. The specification only supports an "array of filters" where the filters are dichroic filters. (*See* '107, FIG. 25, 45:27-32, 45:63-46:1, 46:17-2-, 46:32-34.) However, the full scope of "filter" in Claim 1 would include, e.g., one or more bandpass filters that do not reflect light that does not pass through the filter but instead block it. Claim 1 also indicates that the "each mirror" must "receive light reflected by a filter in the array of filters," but the specification lacks guidance, and a POSA would not have understood without undue experimentation, how a "filter" would permit "each mirror" to accomplish its recited functions if the "array of filters" consisted of one or more bandpass filters (and certainly not if each "filter" was a bandpass filter). The term "filter" further lacks full scope enablement and associated written description for filters meant to capture a full spectrum. The specification discloses a conventional flow cytometer, wherein the filters are designed solely to correlate with peaks associated with the

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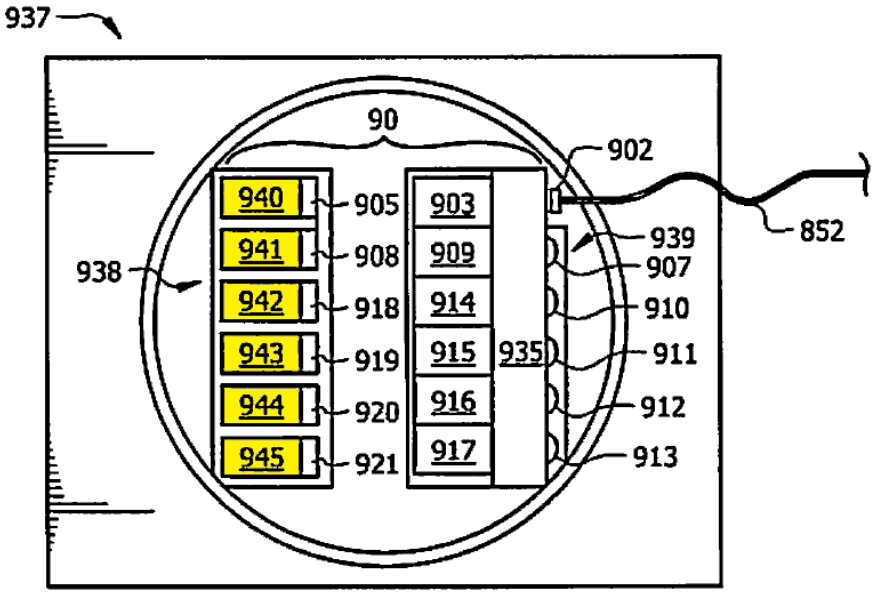
	fluorophores, as identified in Ground 5 in Cytek's PGR petition in PGR2025-00088, incorporated here (with associated exhibits). (*See also* '107, 2:42-45, 27:45-49, 47:54-56, 48:39-42, 48:53-56, FIGs. 29A, 29B, 29C, 30A, 30B.) Ground 5 is replicated in relevant part below. Nowhere in the '107 written description does the inventor describe how the claimed WDM (and its detectors) would enable SFC. The written description only describes a WDM configured for emission peak wavelength analysis performed as part of conventional flow cytometry. (*See* '107, 27:45-49; *see also* EX1002, ¶140.) This is confirmed by the '107's disclosures on a "replaceable dichroic filter assembly," which would be unnecessary in a SFC. ('107, 47:54-56, 48:39-42, 48:53-56, FIG. 30A; EX1002, ¶141.) In a SFC, filters are initially positioned before detectors and there would be no need to replace them for different applications, as the system collects the entire emission spectrum for fluorochromes and then unmixes their respective spectral signatures with computer algorithms. (EX1002, ¶141.)
1[e] *an array of avalanche photodiodes (APDs) configured to receive light that passed through one or more filters in the array of filters;*	The term "array" is indefinite because a POSA would not have understood with reasonable certainty what the scope of an "array" is, including the specific physical arrangement(s)/configuration(s) of the claimed "APDs" to qualify as an "array" as opposed to any other physical arrangement/configuration of multiple "APDs." Claim 2's recitation that the "array of filters" may be "substantially linear" confirms that Claim 1's broader use of the term "array" contemplates a broader, unspecified set of physical arrangements/configurations for the "APDs." The term "array" also fails to adequately describe to a POSA the number of minimum number of "APDs" required to qualify as an "array." The specification fails to provide any guidance on the scope of the term "array" relative to "APDs," as that term "array" only appears twice without providing any additional detail: (1) referencing a prior art "Geiger mode APD array" ('107, 44:14-15); and (2) identifying the "possibility of using array detectors" in the disclosed WDM (*id*, 46:21-24). Neither disclosure provides sufficient clarity for a POSA to have understood the scope of the term "array of avalanche photodiodes (APDs)."

Claim Element	35 U.S.C. § 112 Positions
	The term "array of avalanche photodiodes (APDs)" also lacks full scope enablement and written description support. A POSA would have understood that the term "avalanche photodiodes (APDs)" is broad and includes numerous subspecies, none of which are specified sufficient technical detail in the specification to indicate to in any way to inform the scope of the claimed APDs. The claims sweep broadly in claiming APDs at large but the specification does not teach or suggest how the various subspecies of APDs may be implemented in the claimed WDM without undue experimentation. As an example, a "carbon nanotube detector" identified in the specification is theoretically an APD, and yet the specification lacks written description support and enablement for a carbon nanotube detector for the same reasons set forth in Grounds 4 and 5 of Cytek's PGR petition in PGR2025-00084 and incorporated here in their entirety (including associated exhibits). Grounds 4 and 5 are replicated below and would apply with equal force to "APDs" with respect to the '107 claims. **A. <u>Ground 4</u>: The Challenged Claims Lack Full Scope Enablement for "semiconductor detector"** The Challenged Claims are not enabled as to "semiconductor detector." Claims are not enabled where the specification requires more than "reasonable amount of experimentation" to practice "the full scope" of the "invention as defined by its claims." *Amgen Inc. v. Sanofi*, 598 U.S. 594, 610, 612 (2023). "A patentee who chooses broad claim language must make sure the broad claims are fully enabled," including as to each claimed embodiment. *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008) (finding claim invalid where a claimed embodiment was not enabled); *see also, e.g., Trs. of Bos. Univ. v. Everlight Elecs. Co.*, 896 F.3d 1357, 1363–64 (Fed. Cir. 2018) (same); *Liebel-Flarsheim Co. v. Medrad, Inc.*, 481 F.3d 1371, 1378–79 (Fed. Cir. 2007) (same); *Auto. Techs. Int'l, Inc. v. BMW of N. Am., Inc.*, 501 F.3d 1274, 1281–85 (Fed. Cir. 2007) (same); *AK Steel Corp. v. Sollac & Ugine*, 344 F.3d 1234, 1243–44 (Fed. Cir. 2003) (same). Here, the claimed embodiments include a flow cytometer that uses a WDM with a semiconductor detector comprising a carbon nanotube detector. While the '106 specification describes "semiconductor detector" as including "carbon nanotubes

Claim Element	35 U.S.C. § 112 Positions
	detectors," this type of semiconductor detector (1) was not available by the effective filing date for the '106 patent, December 22, 2021 (nor is it available today); and (2) the '106 specification fails to teach a POSA how to make or use such a detector without undue experimentation. Applying the *Wands* factors here demonstrates that the claimed "semiconductor detector" is not fully enabled with respect to carbon nanotube detectors. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). ***Wands Factor No. 1 – Breadth of the Claims***. Claims 1 and 13 (and, therefore, dependent claims 2, 10, 11, 14, and 17) each recites a WDM that includes a "semiconductor detector(s)" to "detect and quantitate" a "band of fluorescent light." (*See* '106, cls. 1, 13; *see also* EX1002, ¶204.) A POSA reading the claims in light of the specification would have understood that "semiconductor detector" broadly claims a type of photodetectors. (EX1002, ¶204.) FIG. 25A depicts a six-port WDM **90** with photodetectors **940**, **941**, **942**, **943**, **944**, **945 (**in yellow):

Claim Element	35 U.S.C. § 112 Positions
	 *FIG. 25A* ('106, FIG. 25A; EX1002, ¶204.) Each of photodetectors **940**, **941**, **942**, **943**, **944**, **945** "can be, but is not limited to, a semiconductor detector, an avalanche photodetector (APD), and a carbon nanotube detector." ('106, 46:62-64.) The "semiconductor detector may be an avalanche photodiode or a carbon nanotube detector," (*id*., 8:39-40), indicating to a POSA that the claimed "semiconductor detector" covers ***both*** APDs and carbon nanotube detectors, (EX1002, ¶204). ***Wands Factor No. 2 – Field or Nature of the Invention***. The field of the invention is flow cytometry, fiber optics, and wavelength demultiplexing and detection. (EX1002, ¶205 (citing '106, 1:39-42).) The '106 patent refers to various subassemblies in the claimed flow cytometer, with a photodetection assembly that includes semiconductor detectors. (*Id.* (citing '106, 8:39-40, 46:62-64).)

Claim Element	35 U.S.C. § 112 Positions
	Wands Factors Nos. 3 and 4 – State of the Prior Art at the Time of the Invention & Level of Ordinary Skill. A POSA would have been aware of various types of photodetectors used in flow cytometry as of December 22, 2021, including PMTs, APDs, and silicon photodiodes. (EX1002, ¶206; EX1007, pp.151-156.) The '106 specification describes several commercialized examples of PMTs and APDs, ('106, 44:9-33), but no commercial carbon nanotube detectors. That is because, as late as December 2021 (and even today), carbon nanotube detectors were neither commercially available nor known to be applied in flow cytometry. (EX1002, ¶207; EX1080, p.001.) Carbon nanotube detectors were and continue to be the subject of ongoing experimental research and development. (EX1080, p.001 (April 2019 article concluding that carbon nanotube detectors "are good ***candidates*** for photodetector applications" (emphasis added)); EX1082, Abst., pp.001, 013 (November 2023 article describing challenges carbon nanotube detectors face before "find[ing] their way toward real applications"); EX1083, Abst., pp.001, 013 (February 2023 article explaining that "in terms of photodetector performance, there is still a gap between current [prototypes] and traditional photodetectors"); EX1084, Abst., pp.001, 002 (July 2024 article noting the "significant ***potential***" that carbon nanotube detectors have across different disciplines (emphasis added)); *see also* EX1002, ¶207.) The POSA definitions provided by the parties (*see* Section VII; EX1081, p.012) cite to areas of expertise and experience—e.g., electrical engineering, optics, physics, physical chemistry—that fall far short of the materials science and engineering experience minimally required to design and implement carbon nanotube detectors in the claimed flow cytometer. (EX1002, ¶208.) As of December 2021, carbon nanotube detectors were experimental even among ***carbon nanotube detector*** experts (and continue to be so today). (*Id*.) ***Wands Factors Nos. 6 and 7 – Guidance from the Specification & Working Examples***. By December 2021, a POSA would not have known how to build or use a carbon nanotube detector, which were not then commercially available. (EX1002, ¶209.) While the '106 specification discloses several examples and designs regarding other photodetectors (such as PMTs and APDs), it remains silent as to how a POSA

Claim Element	35 U.S.C. § 112 Positions
	would design or use a carbon nanotube detector to practice the claimed invention. The '106 specification only references carbon nanotube detectors three times as a type of semiconductor detector, ('106, 8:39-40, 52:65-67, 59:24-26), and conveys no details of its design, implementation, or use in the claimed flow cytometer. (EX1002, ¶210.) ***Wands Factors Nos. 5 and 8 – Predictability & Amount of Experimentation***. Developing new types of photodetectors for flow cytometry is highly unpredictable and requires significant experimentation across multiple design parameters. (EX1002, ¶211.) For example, adopting APDs in the field of flow cytometry over traditionally-favored PMTs required factoring in, *e.g.*, active area size, temperature dependence, detector size, quantum efficiency, signal-to-noise ratio, and spectral response range. (*Id*.) These same factors would have to be accounted for in designing and integrating carbon nanotube detectors into the claimed flow cytometer, yet the specification provides no applicable guidance. **B. <u>Ground 5</u>: The Challenged Claims Lack Written Description Support for "semiconductor detector" With Respect to Carbon Nanotube Detectors** For the same reasons detailed in Ground 4, incorporated here, the Challenged Claims lack written description support for "semiconductor detector." The written description mentions a carbon nanotube detector only three times, and only to classify it as both a photodetector and semiconductor detector. ('106, 8:39-40, 52:65-67, 59:24-26.) No blaze marks are found that indicate to a POSA that the inventor had possession of carbon nanotube detectors, especially when by December 2021 they were commercially unavailable and outside a POSA's general knowledge. (EX1002, ¶212.)
1[f] *wherein each of the filters in the array of filters is configured to receive light such that: a portion of the light passes through the filter;*	This claim element lacks full scope enablement and associated written description because it generally recites that the "filters" are "configured to: receive light…" without indicating the nature of the light incident light upon the filter. The specification only supports and enables a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" through a unit-magnification relay architecture, such that the filter is only "configured

Claim Element	35 U.S.C. § 112 Positions
and another portion of the light is reflected; and	to" receive an "effectively collimated" beam, not, a diverging (defocused) or converging (focused) beam. A POSA would not have understood the inventor to have been in possession of filters that were configured to receive diverging (defocused) or converging (focused) light, nor does the specification teach or suggest a WDM with filters configured to receive diverging (defocused) or converging (focused) light. Relatedly, the term "light" lacks full scope enablement and associated written description because the claim fails to specify the nature of the "light." But the specification only discloses and enables filters configured to light from an incident collimated beam, and it does not support or enable "light" that is converging (focused) or diverging (focused), let alone a "filter" configured to pass a corresponding portion of multiple portions of converging (focused) or diverging (focused) light. *See also* Claim 1[pre]. The specification indicates that color separation can only occur efficiently with a collimated beam, partially a consequence of the structural characteristics of the disclosed dichroic filters (e.g., passing/reflecting light based on Bragg diffraction), and its disclosures only support a WDM that includes a collimating optical element that projects an "effectively collimated beam" throughout its unit-magnification relay architecture.
1[g] *wherein each of the mirrors in the array of mirrors is configured to*: *receive light reflected by a filter in the array of filters; and reflect light to another filter in the array of filters.*	This claim element lacks full scope enablement and associated written description because it generally recites that the "mirrors" are "configured to: receive light…" without indicating the nature of the incident "light" upon the mirror. The specification only supports and enables a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" through a unit-magnification relay architecture, such that the mirror is only "configured to" receive an "effectively collimated" beam, not, a diverging (defocused) or converging (focused) beam. A POSA would not have understood the inventor to have been in possession of mirrors that were configured to receive diverging (defocused) or converging (focused) light, nor does the specification teach or suggest a WDM with filters configured to receive diverging (defocused) or converging (focused) light.

Claim 2

Claim Element	Non-Infringement Positions
2[pre] *The flow cytometer of claim 1, wherein:*	*See* Claim 1.
2[a] *the array of mirrors is substantially linear;*	The term "substantially linear" is indefinite because it fails to convey to a POSA with reasonable certainty how far off "linear" is still "substantially linear" versus being a non-linear "array of mirrors" and the specification provides no further guidance or clarity to provide a POSA with notice to draw that distinction. The specification only provides examples of a linear set of mirrors.
2[b] *the array of filters is substantially linear; and*	The term "substantially linear" is indefinite because it fails to convey to a POSA with reasonable certainty how far off "linear" is still "substantially linear" versus being a non-linear "array of filters" and the specification provides no further guidance or clarity to provide a POSA with notice to draw that distinction. The specification only provides examples of a linear set of filters.
2[c] *the array of APDs is substantially linear.*	The term "substantially linear" is indefinite because it fails to convey to a POSA with reasonable certainty how far off "linear" is still "substantially linear" versus being a non-linear "array of APDs" and the specification provides no further guidance or clarity to provide a POSA with notice to draw that distinction. The specification only provides examples of a linear set of photodetectors.

Claim 3

Claim Element	35 U.S.C. § 112 Positions
3[pre] *The flow cytometer of claim 2,*	*See* Claims 1, 2.
3[a] *wherein at least one of the mirrors in the array of mirrors is a concave mirror.*	*See* Claims 1, 2. The term "concave mirror" lacks full scope enablement and associated written description because a "concave mirror" need not be spherical nor have a particular radius of curvature, and its function to ensure the operability of the claimed WDM (including what its radius of curvature should be) is specifically associated with the nature of light incident upon the "concave mirror" (e.g., collimated, diverging (and to what degree)). Written description

Claim Element	35 U.S.C. § 112 Positions
	support for a "concave mirror," to the extent any exists, is specifically tied to a mirror that receives an "effectively collimated beam" and purports to extend the collimated distance, in the context of a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" throughout the WDM in a unit-magnification relay architecture.

Claim 5

Claim Element	35 U.S.C. § 112 Positions
5[pre] *The flow cytometer of claim 3,*	*See* Claims 1, 2.
5[a] *wherein the WDM is configured such that a portion of an optical path between the array of mirrors and the array of filters forms a zig-zag pattern.*	*See* Claims 1, 2.

Claim 16

Claim Element	35 U.S.C. § 112 Positions
16[pre] *A flow cytometer comprising:*	The overbroadly claimed "flow cytometer" lacks written description support and is not fully enabled. The only written description support for the '107 patent includes: "1. A flow cell through which a liquid stream, usually called a sheath flow, liquid or fluid, carries and hydrodynamically aligns cells or particles so that they pass single file through the flow cell. 2. A measuring subsystem system coupled to the flow cell that detects cells or particles passing through the flow cell and is usually either: a. an impedance or conductivity measuring subsystem; or b. an optical illumination subsystem together with an optical sensing subsystem.

Claim Element	35 U.S.C. § 112 Positions
	3. A conversion subsystem for converting the output signal from the measuring subsystem into computer processable data. 4. A computer for analyzing the data produced by the conversion subsystem." (*See* WO2013/181453, 1:34-2:12.) Importantly, the flow cytometer described in the specification is limited, in part, to (1) a composite microscope objective that consists of at least a concave mirror and an aberration collector plate as part of 2.b above; and a computer system that analyzes discrete peak wavelengths (e.g., bucketing) from the data produced by the conversion subsystem, as part of 4 above. The inventor did not have possession of full spectrum analysis at the time of invention and Plaintiff cannot retroactively claim full spectrum analysis when the claimed invention performs conventional emission peak wavelength analysis (e.g., binning, compensation). The fact that the claimed "flow cytometer" contemplates both conventional flow cytometers and spectral flow cytometers is highlighted by unasserted claim 9, directed toward a spectral flow cytometer that lacks written description support and enablement for the reasons set forth in Grounds 5 and 6 of Cytek's PGR petition in PGR2025-00088, respectively, and incorporated here in their entirety (including associated exhibits). Nor did the inventor have possession of, or enable, a flow cytometer that used any optical component other than a composite microscope objective to collect and focus fluorescent light from the cuvette in the flow cell to a multimode optical fiber. For example, nowhere in the specification does the inventor disclose that his flow cytometer incorporated a simple objective lens.
16[a] *a flow cell configured to permit liquid to flow through the flow cell;*	The term "flow cell" lacks full scope enablement and associated written description support. The flow cell described in the specification is limited to including a composite microscope objective that consists of at least a concave mirror and an aberration collector plate. The inventor did not have possession of, or enable, a flow cell that used any optical component other than a compositive microscope objective to collect and focus fluorescent light from the cuvette in the flow cell to a multimode optical fiber. For example, nowhere in the

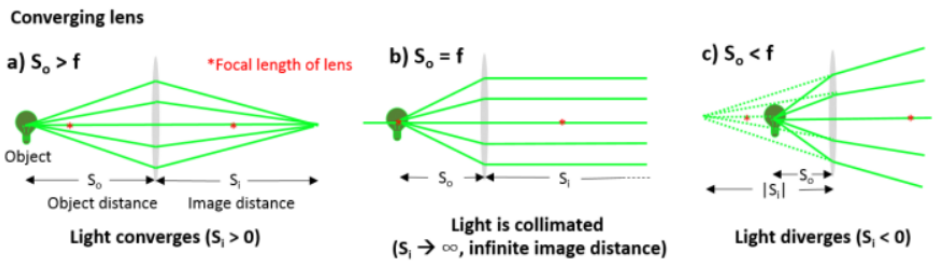
Claim Element	35 U.S.C. § 112 Positions
	specification does the inventor disclose that his flow cytometer incorporated a simple objective lens.
16[b] *a laser configured to project light into the flow cell;*	*See* Claim 16[pre].
16[c] *a multimode optical fiber configured to receive light from the flow cell; and*	The term "multimode optical fiber" lacks written description support and enablement for using any multimode optical fiber. The specification fails to provide critical implementation details that inform the scope of the claimed multimode optical fiber, including, e.g., core diameter, cladding diameter, cladding material, numerical aperture, etendue, and modal bandwidth. The term "multimode optical fiber" is also indefinite and lacks full scope written description support and enablement because the claim indicates the "multimode optical fiber" is "configured to receive light from the flow cell" when the specification only supports a multimode optical fiber that receives light from a composite microscope objective. A POSA would not have understood with reasonable clarity the full scope of being "configured to receive light from the flow cell," and what, if any, collection optics are contemplated in the "flow cell" as broadly claimed. The inventor did not have possession of, or enable, a flow cytometer that used any optical component other than a composite microscope objective to collect and focus fluorescent light from the cuvette in the flow cell to a multimode optical fiber. For example, nowhere in the specification does the inventor disclose that his flow cytometer incorporated a simple objective lens, or a flow cell without any collection optics such that the multimode optical fiber could receive light directly from a flow cell without a (composite microscope) objective.
16[d] *a wavelength division multiplexer (WDM) configured to receive light from the multimode optical fiber, wherein the WDM comprises:*	The term "wavelength division multiplexer (WDM) lacks written description support and full scope enablement for the reasons set forth in Grounds 1 and 2 of Cytek's PGR petition in PGR2025-00088, respectively, and incorporated here in their entirety (including associated exhibits). Grounds 1 and 2 from Cytek's PGR petition are replicated below. **C. <u>Ground 1</u>: The Challenged Claims Recite a "WDM" that Lacks Written Description Support**

Claim Element	35 U.S.C. § 112 Positions
	The Challenged Claims are invalid under § 112 because the recited "wavelength division (de)multiplexer" ("WDM") lacks adequate written description support absent a "collimating optical element" that projects a collimated beam. The Federal Circuit has held claims are invalid for lack of written description where they omit an element that is essential to the invention as described in the specification. *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 1479-80 (Fed. Cir. 1998) (invalidating claims directed to a sofa that did not limit the location of controls to a console despite the specification only describing console-located controls). Here, while written description support exists for a WDM that uses a "collimating optical element" to project a collimated beam through a cascaded unit-magnification relay architecture, no written description exists for the broader genus of WDM comprising filters, mirrors, and APDs recited in the '107 claims. A "collimating optical element" is necessary to project a collimated beam through the claimed WDM configuration and render it operable. (EX1002, ¶82.) **1. The Omitted "Collimating Optical Element" that Projects a "Collimated Beam" is Critical to Operate the Claimed WDM** The '107 specification teaches the claimed WDM separates fluorescent light into color bands using a specific configuration that ***requires*** use of a "collimating optical element" that projects a "collimated beam" throughout a cascaded unit-magnification image relay architecture. (EX1002, ¶93.) The written description makes repeated reference to using a "collimating optical element" and it is featured in every WDM embodiment. (*Id*., ¶¶93-95.) This architecture is necessary in part because the claimed WDM uses APDs, which have high noise sensitivity. (*See* '107, 44:33-53; *see also* EX1002, ¶96.) A POSA at the time of the invention would have understood this configuration to require the use of a "collimating optical element" to project a "collimated beam" through a series of mirrors and filters to enable using noise-sensitive APDs. (EX1002, ¶93.)

a. Technical Background on Light Beam Properties

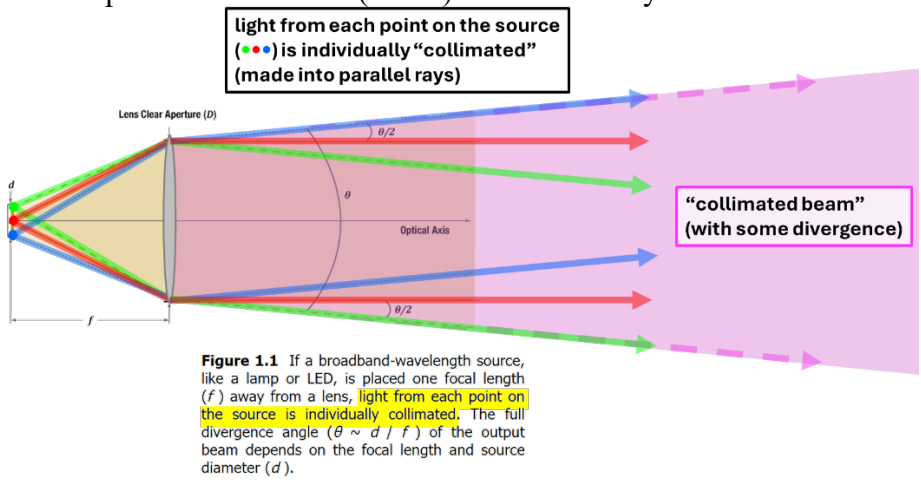
Light beam rays either (1) converge (i.e., the proximity of the rays increases over distance); (2) are collimated (i.e., the proximity of the rays remains constant over distance); or (3) diverge (i.e., the proximity of the rays decreases over distance). (EX1007, p.110; *see also* EX1023, pp.009-010; EX1002, ¶¶84-85.) To produce each of these types of light beams, a POSA would have known to manipulate the distance between a light source relative to the focal length of a lens as shown below (where ***f*** is the lens's focal length, and $\mathbf{S_O}$ is the object's distance from the lens):

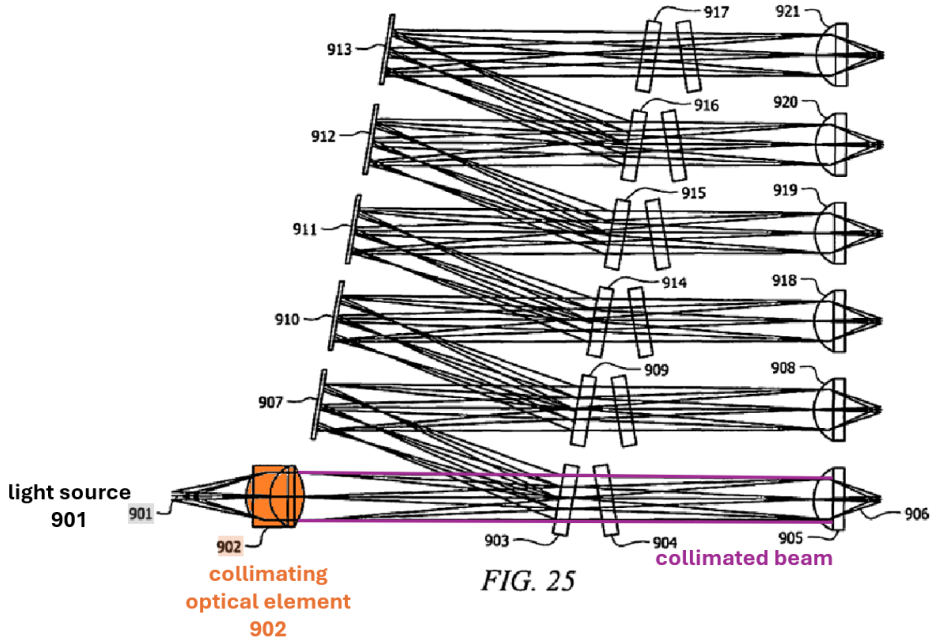
Using this relationship, you can see why light going through a converging lens can produce three different results (this is similar to what we saw earlier for light passing through a spherical boundary). Whether the light converges, diverges, or is collimated depends on where the object is relative to the focal length of the lens:



(EX1023, pp.009-010.) Placing an object at a distance from the lens greater than the focal length results in converging light rays; placing the object at a distance equal to the focal length results in collimated/parallel rays; and placing the object at a distance less than the focal length results in diverging rays. (EX1007, p.110; EX1090, at p.006; EX1066, p.001; EX1002, ¶¶86-89.)

Notably, a collimated beam from a real light source necessarily results in ***some*** divergence. This is because a real light source does not comprise a single point that can be placed at exactly the focal length of a lens. Rather, a real light source is defined by a specific diameter (*d*), which when centered on the optical axis at the focal length (*f*) of a lens (*D*), will necessarily position portions of the area within the diameter of

Claim Element	35 U.S.C. § 112 Positions
	the light source beyond the exact focal length of the lens along the optical axis. (EX1065, p.003; see also EX1066, pp.001-002; EX1002, ¶¶90-92.) Thus, real light sources "resemble groupings of multiple point sources[,]" (EX1065, p.003), such that a collimated beam comprises "light from each point on the source [that] is individually collimated[,]" (EX1065 (Fig. 1.1. caption)), as shown in the following annotated image where each point on the source (● ● ●) is "individually collimated":  **Figure 1.1** If a broadband-wavelength source, like a lamp or LED, is placed one focal length (f) away from a lens, light from each point on the source is individually collimated. The full divergence angle ($\theta \sim d / f$) of the output beam depends on the focal length and source diameter (d). (EX1065, p.003 (annotations added); *see also* EX1066, p.001; EX1002, ¶¶90-92.) **b. The Omitted "collimating optical element" That Projects a "collimated beam" is Required to Operate the Claimed WDM** The '107 recognizes that while "efficient color separation can only be accomplished economically with [a] collimated light beam," technical hurdles exist to using a collimated beam with small area APDs. ('107, 44:33-47.) The '107 targets a "highly desirable" technology to "collimat[e] a large etendue light beam over an extended distance without significantly expanding the beam diameter" because it would "enable a WDM like device for fluorescence light detection with characteristics comparable to low noise semiconductor detectors." (*Id.*, 44:47-53.)

Claim Element	35 U.S.C. § 112 Positions
	The ’107 written description repeatedly describes using a “collimating optical element” to project a collimated light beam through a unit-magnification relay architecture. (*See* ’107, 9:63-10:10, 20:31-46, 21:8-23, 20:52-60, 45:10-26, 46:34-41, FIGs. 25, 27, 28; EX1002, ¶95.) The “collimating optical element” appears in every disclosed embodiment, as shown in FIG. 25 below.  *FIG. 25* (*Id.*, FIG. 25 (annotated).) A POSA would thus have understood that the ’107’s goal to solve “collimating a large etendue light beam over an extended distance” requires use of a “collimating optical element” to collimate fluorescent light received into a WDM to begin with. (*Id.*, 44:47-53; *see also* EX1002, ¶96.) And a POSA at the time of the ’107 invention would not have understood the inventor to be in possession of any WDM other than one comprising a “collimating optical

Claim Element	35 U.S.C. § 112 Positions
	element" to project a collimated beam through the unit-magnification image relay architecture. (EX1002, ¶¶96, 106.) The '107 written description only discloses WDM embodiments using a "collimating optical element" to project a collimated light beam. (*Id*.) Unsurprisingly, the '107 teaches ***against*** a WDM configuration using a non-collimated beam, let alone one without a collimating optical element, explaining that "efficient color separation can only be accomplished economically with [a] collimated light beam" and addressing a problem with collimating fluorescent light from an extended light source. ('107, 44:33-53; EX1002, ¶¶96, 107.) **2. The Prosecution History Confirms a "Collimating Optical Element" that Projects a "Collimated Beam" is Critical** The prosecution history for the '107 patent's family confirms that a "collimating optical element" that projects a collimated beam is critical to the claimed WDM. The claims of every application that preceded the '107 patent in its priority chain that recite a WDM includes the limitation of a "collimating optical element" that projects a collimated beam. (PCT App., pp.059, 083; EX1070, cl. 1; EX1029, pp.029-034; EX1091, cl. 1; EX1078; EX1088, cl. 1, 13, 18; *see also* EX1002, ¶¶97-103.) *** However, the Challenged Claims broadly claim a WDM comprising an "[array / plurality] of mirrors," an "[array / plurality] of filters," and an "[array / plurality] of avalanche photodiodes (APDs)" without reciting a "collimating optical element." (*See* '107, cls. 1, 16.) Thus, a POSA would have understood the Challenged Claims to recite a WDM that would operably relay a light beam without a "collimating optical element," meaning that it could relay diverging, converging, and collimated light beams. (EX1002, ¶105.) Thus, the Challenged Claims are invalid for lack of written description as to the claimed WDM, which broadly recites a WDM that lacks a "collimating optical element" and is configured for use with non-collimated light beams. (EX1002, ¶¶105-108.)

D. Ground 2: The Challenged Claims Lack Full Scope Enablement for a "WDM" Without a "Collimating Optical Element" That Projects a "Collimated Beam"

The Challenged Claims are not fully enabled because they broadly recite any WDM with arrays of filters, mirrors, and APDs, including WDMs that project and relay ***any*** type of light beam in ***any*** filter/mirror configuration. But the specification only teaches a WDM that uses a collimating optical element to relay a collimated beam through a unit-magnification image relay architecture, the purported "only" way to achieve economical and efficient color separation of fluorescent light. (EX1002, ¶109.) Applying the *Wands* factors demonstrates that the claimed WDM is not fully enabled. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988).

Wands Factor No. 1 – Breadth of the Claims. The independent claims (and of what must be enabled) broadly recite WDMs that include configurations without a collimating optical element and that do not project a non-collimated light beam. (EX1002, ¶111.) The breadth of the claims would extend to, and thus require enablement for, WDM embodiments, in any conceivable configuration, that propagate an initially collimated beam, a non-focused (diverging) beam, or a focused (converging) beam through the relay architecture. The '107 specification's teachings are directed toward a cascaded unit-magnification relay architecture using a collimated beam, yet the claims omit any collimating optical element, an essential feature in the purported invention. (*Id*.)

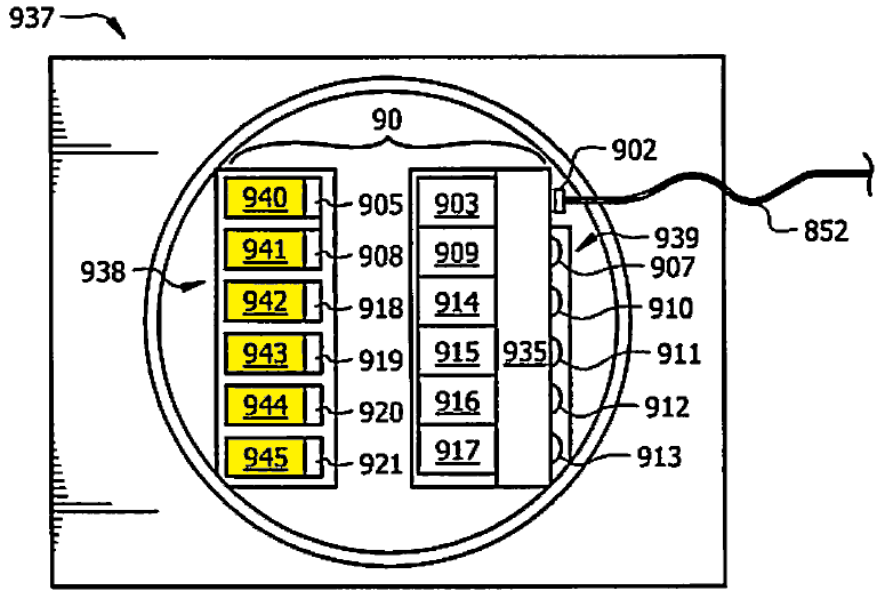
Wands Factors Nos. 2 and 4 – Field or Nature of the Invention and Level of Ordinary Skill. The field of the invention is flow cytometry, fiber optics, and wavelength demultiplexing and detection. (*See* '107, 1:42-45, 2:7-10, 2:40-45.) The '107 refers to various subassemblies in the claimed flow cytometer, including a WDM that comprises a collimating optical element and propagates a collimated beam through a unit-magnification image relay architecture. (*See, e.g.*, *id.*, 4:46-65.) Applying the POSA definitions provided by either of the parties (*see* Section VII; EX1081) would not alter this *Wands* factor given the overall lack of teaching by the specification and excessive experimentation required to practice these overbroad

Claim Element	35 U.S.C. § 112 Positions
	claims. (EX1002, ¶112.) ***Wands Factors Nos. 6 and 7 – Guidance from the Specification and Working Examples.*** The '107 specification offers no teaching or working examples of a WDM that does not include a collimating optical element or that does not propagate a collimated light beam. Instead, the specification instructs that "efficient color separation can only be accomplished economically with [a] collimated light beam[.]" ('107, 44:33-53; *see also* EX1002, ¶113.) ***Wands Factors Nos. 3, 5, and 8 – State of the Art, Predictability, and Amount of Experimentation***. Given the absence of any teaching or working example from the '107 specification for a WDM that lacks a collimating optical element or that propagates a non-collimated beam, a POSA would have had to engage in excessive experimentation to practice the full scope of the claimed WDM. For example, a POSA would have had to understand how to design a WDM where filters in the array of filters receive light directly from the optical fiber for demultiplexing and processing of sufficient signal strength to overcome known technical signal-to-noise issues with APDs. (EX1002, ¶114.) As of 2012, diffraction was necessary to separate wavelengths and enable fluorescence detection systems that used diverging light with APDs. This comprised a fundamentally different technology based on different optical principles than what the '107 discloses. (*Id.*)
16[e] *a plurality of mirrors,*	The term "mirrors" lacks full scope written description support and enablement with respect to any non-planar mirror other than what a POSA would consider a concave mirror (e.g., convex mirror, distorting mirror). The term "mirror" further lacks full scope written description support and enablement with respect to "concave mirror" for the reasons set forth in Claim 16[e][i] below and incorporated here.
16[e][i] *wherein at least one of the mirrors is a concave mirror;*	The term "concave mirror" lacks full scope enablement and associated written description because a "concave mirror" need not be spherical nor have a particular radius of curvature, and its function to ensure the operability of the claimed WDM (including what its radius of curvature should be) is specifically associated with the nature of light incident upon the

Claim Element	35 U.S.C. § 112 Positions
	"concave mirror" (e.g., collimated, diverging (and to what degree)). Written description support for a "concave mirror," to the extent any exists, is specifically tied to a mirror that receives an "effectively collimated beam" and purports to extend the collimated distance, in the context of a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" throughout the WDM in a unit-magnification relay architecture.
16[f] *a plurality of filters; and*	The term "filter" lacks full scope enablement and associated written description. The specification only supports a "plurality of filters" where the filters are dichroic filters. (*See* '107, FIG. 25, 45:27-32, 45:63-46:1, 46:17-2-, 46:32-34.) However, the full scope of "filter" in Claim 16 would include, e.g., one or more bandpass filters that do not reflect light that does not pass through the filter but instead block it. Claim 1 also indicates that the "each mirror" must "receive light reflected by a filter in the array of filters," but the specification lacks guidance, and a POSA would not have understood without undue experimentation, how a "filter" would permit "each mirror" to accomplish its recited functions if the "array of filters" consisted of one or more bandpass filters (and certainly not if each "filter" was a bandpass filter). The term "filter" further lacks full scope enablement and associated written description for filters meant to capture a full spectrum. The specification discloses a conventional flow cytometer, wherein the filters are designed solely to correlate with peaks associated with the fluorophores, as identified in Ground 5 in Cytek's PGR petition in PGR2025-00088, incorporated here (with associated exhibits). (*See also* '107, 2:42-45, 27:45-49, 47:54-56, 48:39-42, 48:53-56, FIGs. 29A, 29B, 29C, 30A, 30B.) Ground 5 is replicated in relevant part below. > Nowhere in the '107 written description does the inventor describe how the claimed WDM (and its detectors) would enable SFC. The written description only describes a WDM configured for emission peak wavelength analysis performed as part of conventional flow cytometry. (*See* '107, 27:45-49; *see also* EX1002, ¶140.) This is confirmed by the '107's disclosures on a "replaceable dichroic filter assembly," which would be unnecessary in a SFC. ('107, 47:54-56, 48:39-42, 48:53-56, FIG. 30A; EX1002, ¶141.) In a SFC, filters are initially positioned before detectors and there

Claim Element	35 U.S.C. § 112 Positions
	would be no need to replace them for different applications, as the system collects the entire emission spectrum for fluorochromes and then unmixes their respective spectral signatures with computer algorithms. (EX1002, ¶141.)
16[g] *a plurality of avalanche photodiodes (APDs) configured to receive light that passed through one or more filters of the plurality of filters;*	The term "plurality of avalanche photodiodes (APDs)" also lacks full scope enablement and written description support. A POSA would have understood that the term "avalanche photodiodes (APDs)" is broad and includes numerous subspecies, none of which are specified sufficient technical detail in the specification to indicate to in any way to inform the scope of the claimed APDs. The claims sweep broadly in claiming APDs at large but the specification does not teach or suggest how the various subspecies of APDs may be implemented in the claimed WDM without undue experimentation. As an example, a "carbon nanotube detector" identified in the specification is theoretically an APD, and yet the specification lacks written description support and enablement for a carbon nanotube detector for the same reasons set forth in Grounds 4 and 5 of Cytek's PGR petition in PGR2025-00084 and incorporated here in their entirety (including associated exhibits). Grounds 4 and 5 are replicated below and would apply with equal force to "APDs" with respect to the '106 claims. **E. <u>Ground 4</u>: The Challenged Claims Lack Full Scope Enablement for "semiconductor detector"** The Challenged Claims are not enabled as to "semiconductor detector." Claims are not enabled where the specification requires more than "reasonable amount of experimentation" to practice "the full scope" of the "invention as defined by its claims." *Amgen Inc. v. Sanofi*, 598 U.S. 594, 610, 612 (2023). "A patentee who chooses broad claim language must make sure the broad claims are fully enabled," including as to each claimed embodiment. *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008) (finding claim invalid where a claimed embodiment was not enabled); *see also, e.g., Trs. of Bos. Univ. v. Everlight Elecs. Co.*, 896 F.3d 1357, 1363–64 (Fed. Cir. 2018) (same); *Liebel-Flarsheim Co. v. Medrad, Inc.*, 481 F.3d 1371, 1378–79 (Fed. Cir. 2007) (same); *Auto. Techs. Int'l, Inc. v. BMW of N. Am., Inc.*, 501 F.3d 1274, 1281–85 (Fed. Cir. 2007) (same); *AK Steel Corp. v. Sollac & Ugine*, 344 F.3d 1234, 1243–44 (Fed. Cir. 2003) (same).

Claim Element	35 U.S.C. § 112 Positions
	Here, the claimed embodiments include a flow cytometer that uses a WDM with a semiconductor detector comprising a carbon nanotube detector. While the '106 specification describes "semiconductor detector" as including "carbon nanotubes detectors," this type of semiconductor detector (1) was not available by the effective filing date for the '106 patent, December 22, 2021 (nor is it available today); and (2) the '106 specification fails to teach a POSA how to make or use such a detector without undue experimentation. Applying the *Wands* factors here demonstrates that the claimed "semiconductor detector" is not fully enabled with respect to carbon nanotube detectors. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). ***Wands Factor No. 1 – Breadth of the Claims***. Claims 1 and 13 (and, therefore, dependent claims 2, 10, 11, 14, and 17) each recites a WDM that includes a "semiconductor detector(s)" to "detect and quantitate" a "band of fluorescent light." (*See* '106, cls. 1, 13; *see also* EX1002, ¶204.) A POSA reading the claims in light of the specification would have understood that "semiconductor detector" broadly claims a type of photodetectors. (EX1002, ¶204.) FIG. 25A depicts a six-port WDM **90** with photodetectors **940**, **941**, **942**, **943**, **944**, **945 (**in yellow):

Claim Element	35 U.S.C. § 112 Positions
	 *FIG. 25A* ('106, FIG. 25A; EX1002, ¶204.) Each of photodetectors **940**, **941**, **942**, **943**, **944**, **945** "can be, but is not limited to, a semiconductor detector, an avalanche photodetector (APD), and a carbon nanotube detector." ('106, 46:62-64.) The "semiconductor detector may be an avalanche photodiode or a carbon nanotube detector," (*id*., 8:39-40), indicating to a POSA that the claimed "semiconductor detector" covers ***both*** APDs and carbon nanotube detectors, (EX1002, ¶204). ***Wands Factor No. 2 – Field or Nature of the Invention***. The field of the invention is flow cytometry, fiber optics, and wavelength demultiplexing and detection. (EX1002, ¶205 (citing '106, 1:39-42).) The '106 patent refers to various subassemblies in the claimed flow cytometer, with a photodetection assembly that

Claim Element	35 U.S.C. § 112 Positions
	includes semiconductor detectors. (*Id.* (citing '106, 8:39-40, 46:62-64).) ***Wands Factors Nos. 3 and 4 – State of the Prior Art at the Time of the Invention & Level of Ordinary Skill***. A POSA would have been aware of various types of photodetectors used in flow cytometry as of December 22, 2021, including PMTs, APDs, and silicon photodiodes. (EX1002, ¶206; EX1007, pp.151-156.) The '106 specification describes several commercialized examples of PMTs and APDs, ('106, 44:9-33), but no commercial carbon nanotube detectors. That is because, as late as December 2021 (and even today), carbon nanotube detectors were neither commercially available nor known to be applied in flow cytometry. (EX1002, ¶207; EX1080, p.001.) Carbon nanotube detectors were and continue to be the subject of ongoing experimental research and development. (EX1080, p.001 (April 2019 article concluding that carbon nanotube detectors "are good ***candidates*** for photodetector applications" (emphasis added)); EX1082, Abst., pp.001, 013 (November 2023 article describing challenges carbon nanotube detectors face before "find[ing] their way toward real applications"); EX1083, Abst., pp.001, 013 (February 2023 article explaining that "in terms of photodetector performance, there is still a gap between current [prototypes] and traditional photodetectors"); EX1084, Abst., pp.001, 002 (July 2024 article noting the "significant ***potential***" that carbon nanotube detectors have across different disciplines (emphasis added)); *see also* EX1002, ¶207.) The POSA definitions provided by the parties (*see* Section VII; EX1081, p.012) cite to areas of expertise and experience—e.g., electrical engineering, optics, physics, physical chemistry—that fall far short of the materials science and engineering experience minimally required to design and implement carbon nanotube detectors in the claimed flow cytometer. (EX1002, ¶208.) As of December 2021, carbon nanotube detectors were experimental even among ***carbon nanotube detector*** experts (and continue to be so today). (*Id*.) ***Wands Factors Nos. 6 and 7 – Guidance from the Specification & Working Examples***. By December 2021, a POSA would not have known how to build or use a carbon nanotube detector, which were not then commercially available. (EX1002,

Claim Element	35 U.S.C. § 112 Positions
	¶209.) While the '106 specification discloses several examples and designs regarding other photodetectors (such as PMTs and APDs), it remains silent as to how a POSA would design or use a carbon nanotube detector to practice the claimed invention. The '106 specification only references carbon nanotube detectors three times as a type of semiconductor detector, ('106, 8:39-40, 52:65-67, 59:24-26), and conveys no details of its design, implementation, or use in the claimed flow cytometer. (EX1002, ¶210.) ***Wands Factors Nos. 5 and 8 – Predictability & Amount of Experimentation***. Developing new types of photodetectors for flow cytometry is highly unpredictable and requires significant experimentation across multiple design parameters. (EX1002, ¶211.) For example, adopting APDs in the field of flow cytometry over traditionally-favored PMTs required factoring in, *e.g.*, active area size, temperature dependence, detector size, quantum efficiency, signal-to-noise ratio, and spectral response range. (*Id*.) These same factors would have to be accounted for in designing and integrating carbon nanotube detectors into the claimed flow cytometer, yet the specification provides no applicable guidance. **F. <u>Ground 5</u>: The Challenged Claims Lack Written Description Support for "semiconductor detector" With Respect to Carbon Nanotube Detectors** For the same reasons detailed in Ground 4, incorporated here, the Challenged Claims lack written description support for "semiconductor detector." The written description mentions a carbon nanotube detector only three times, and only to classify it as both a photodetector and semiconductor detector. ('106, 8:39-40, 52:65-67, 59:24-26.) No blaze marks are found that indicate to a POSA that the inventor had possession of carbon nanotube detectors, especially when by December 2021 they were commercially unavailable and outside a POSA's general knowledge. (EX1002, ¶212.)
16[h] *wherein each of the plurality of filters is configured to receive light*	This claim element lacks full scope enablement and associated written description because it generally recites that the "filters" are "configured to receive light…" without indicating the

Claim Element	35 U.S.C. § 112 Positions
such that: a portion of light passes through the filter; and another portion of light is reflected; and	nature of the "light" incident light upon the filter. The specification only supports and enables a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" through a unit-magnification relay architecture, such that the filter is only "configured to" receive an "effectively collimated" beam, not, a diverging (defocused) or converging (focused) beam. A POSA would not have understood the inventor to have been in possession of filters that were configured to receive diverging (defocused) or converging (focused) light, nor does the specification teach or suggest a WDM with filters configured to receive diverging (defocused) or converging (focused) light. Relatedly, the term "light" lacks full scope enablement and associated written description because the claim fails to specify the nature of the "light." But the specification only discloses and enables filters configured to light from an incident collimated beam, and it does not support or enable "light" that is converging (focused) or diverging (focused), let alone a "filter" configured to pass a corresponding portion of multiple portions of converging (focused) or diverging (focused) light. *See also* Claim 16[d]. The specification indicates that color separation can only occur efficiently with a collimated beam, partially a consequence of the structural characteristics of the disclosed dichroic filters (e.g., passing/reflecting light based on Bragg diffraction), and its disclosures only support a WDM that includes a collimating optical element that projects an "effectively collimated beam" throughout its unit-magnification relay architecture.
16[i] *wherein each of the plurality of mirrors is configured to: receive light reflected by a filter of the plurality of filters; and reflect light to another filter of the plurality of filters.*	This claim element lacks full scope enablement and associated written description because it generally recites that the "mirrors" are "configured to: receive light…" without indicating the nature of the incident "light" upon the mirror. The specification only supports and enables a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" through a unit-magnification relay architecture, such that the mirror is only "configured to" receive an "effectively collimated" beam, not, a diverging (defocused) or converging (focused) beam. A POSA would not have understood the inventor to have been in possession of mirrors that were configured to receive diverging (defocused) or converging (focused) light, nor does the specification teach or suggest a WDM with filters configured to receive diverging (defocused) or converging (focused) light.

Claim 17

Claim Element	35 U.S.C. § 112 Positions
17[pre] *The flow cytometer of claim 16, wherein the WDM further comprises:*	*See* Claim 16.
17[a] *a plurality of focusing lenses,*	*See* Claim 16.
17[b] *wherein each of the plurality of focusing lenses is configured to focus light that passed through a filter of the plurality of filters to a spot on an APD of the plurality of APDs,*	*See* Claim 16. The term "focusing lenses … configured to focus light" lacks full scope enablement and associated written description because the claim fails to specify the nature of the "light." But the specification only discloses and enables focusing lenses configured to focus light from an incident collimated beam, and it does not support or enable "light" that is converging (focused) or diverging (focused), let alone a "focusing lens" configured to focus converging (focused) or diverging (focused) light. *See also* Claim 16[d]. The specification indicates that color separation can only occur efficiently with a collimated beam, and its disclosures only support a WDM that includes a collimating optical element that projects an "effectively collimated beam" throughout its unit-magnification relay architecture.
17[c] *wherein the spot has a diameter that is smaller than a diameter of a core of the multimode optical fiber.*	Claim 17 lacks written description support and enablement. The specification does not explain or provide implementation details regarding how a "focusing lens" may "focus light … to a spot" where "the spot has a diameter that is smaller than a diameter of a core of the multimode optical fiber." No details are provided for the beam spot size for the received light, the radius of curvature or size for the "focusing lens" or how its geometry would allow for focusing to a spot where "the spot has a diameter that is smaller than a diameter of a core of the multimode optical fiber." This claim also lacks a lower bound, which further illustrates the issues with lack of technical details in the specification to teach or suggest to a POSA how to focus the beam down to ever-smaller spot sizes, at or far below the diameter of a core of a multimode optical fiber. The lack of written description and enablement issues connected to "multimode optical fiber" in Claim 16 are also present here, as Claim 17 gauges the minimal spot size for focused light to sizing for the core of a multimode optical fiber when such a core has variable sizes depending on component dimensions / industrial applications.

Claim 18

Claim Element	35 U.S.C. § 112 Positions
18[pre] *The flow cytometer of claim 17,*	*See* Claims 16, 17.
18[a] *wherein for each of the plurality of focusing lenses, the diameter of the spot is less than 1 mm.*	Claim 18 lacks written description support and enablement. The specification does not explain or provide implementation details regarding how a "focusing lens" may "focus light … to a spot" where "the diameter of the spot is less than 1 mm." No details are provided for the beam spot size for the received light, the radius of curvature or size for the "focusing lens" or how its geometry would allow for focusing to a spot where "the diameter of the spot is less than 1 mm." This claim also lacks a lower bound, which further illustrates the issues with lack of technical details in the specification to teach or suggest to a POSA how to focus the beam down to ever-smaller spot sizes, at or far below 1 millimeter in diameter.

Claim 20

Claim Element	35 U.S.C. § 112 Positions
20[pre] *The flow cytometer of claim 16,*	*See* Claim 16.
20[a] *wherein the plurality of mirrors includes more than one concave mirror.*	The term "concave mirror" lacks full scope enablement and associated written description because a "concave mirror" need not be spherical nor have a particular radius of curvature, and its function to ensure the operability of the claimed WDM (including what its radius of curvature should be) is specifically associated with the nature of light incident upon the "concave mirror" (e.g., collimated, diverging (and to what degree)). Written description support for a "concave mirror," to the extent any exists, is specifically tied to a mirror that receives an "effectively collimated beam" and purports to extend the collimated distance, in the context of a WDM that includes a "collimating optical element" that projects an "effectively collimated beam" throughout the WDM in a unit-magnification relay architecture. In addition, the term "wherein the plurality of mirrors includes more than one concave mirror" is indefinite because the claims fails to identify where the "concave mirror" is to be located within the claimed WDM.

Claim 21

Claim Element	35 U.S.C. § 112 Positions
21[pre] *The flow cytometer of claim 20,*	*See* Claims 16, 20.
21[a] *wherein the WDM is configured such that a portion of an optical path between the plurality of mirrors and the plurality of filters forms a zig-zag pattern.*	*See* Claims 16, 20.

Claim 22

Claim Element	35 U.S.C. § 112 Positions
22[pre] *The flow cytometer of claim 21,*	*See* Claims 16, 20.
22[a] *wherein the laser is configured to emit blue light, yellow-green light, violet light, or ultraviolet light.*	*See* Claims 16, 20.

Claim 26

Claim Element	35 U.S.C. § 112 Positions
26[pre] *The flow cytometer of claim 22, wherein:*	*See* Claims 16, 20.
26[a] *the WDM further comprises a block comprising a first surface; and*	*See* Claims 16, 20. *See also* Cytek's invalidity contentions with respect to "block."
26[b] *each of the plurality of filters is coupled to the first surface of the block.*	*See* Claims 16, 20.

Claim 28

Claim Element	35 U.S.C. § 112 Positions
27[pre] *The flow cytometer of claim 26,*	*See* Claims 16, 20.

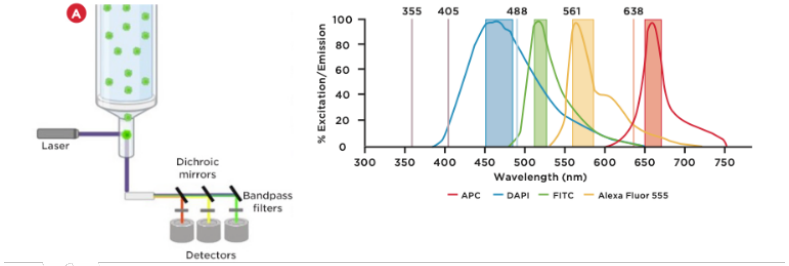
Claim Element	35 U.S.C. § 112 Positions
27[a] *wherein the flow cytometer is a benchtop flow cytometer.*	*See* Claims 16, 20.

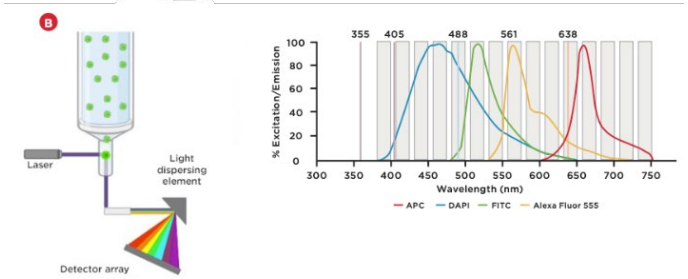
Claim 28

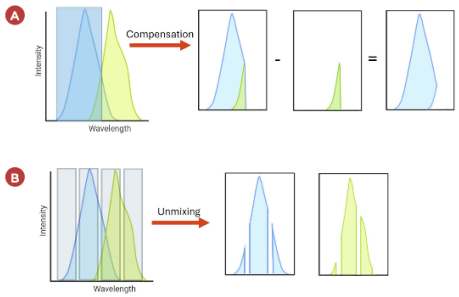
Claim Element	35 U.S.C. § 112 Positions
28[pre] *The flow cytometer of claim 26,*	*See* Claims 16, 20, 22, 26.
28[a] *wherein the flow cytometer is compact.*	The term "compact" is indefinite because a POSA would have been unable to ascertain with a reasonable certainty the scope of "compact" versus not "compact in view of the specification and the context of the claims. Moreover, the specification also does not enable, and lacks written description support for, any "flow cytometer [that] is compact."

Claim 29

Claim Element	35 U.S.C. § 112 Positions
29[pre] *The flow cytometer of claim 28,*	*See* Claims 16, 20, 28.
29[a] *wherein the WDM is capable of detecting a substantially full spectrum of visible light.*	Claim 29 lacks written description support and enablement for the reasons set forth in Grounds 5 and 6 of Cytek's PGR petition in PGR2025-00088, respectively, and incorporated here in their entirety (including associated exhibits). Grounds 5 and 6 from Cytek's PGR petition are replicated below. **A. <u>Ground 5</u>: Claims 9, 29 Lack Written Description Support** Claims 9 and 29 lack of adequate written description support because each recite a "WDM … capable of detecting a substantially full spectrum of visible light." A POSA would have understood these claims to cover non-conventional spectral flow cytometry ("SFC") within the WDM. But the '107 written description lacks any SFC disclosure, and only references detecting fluorochrome emission peaks as done in conventional flow cytometry. (EX1002, ¶135.)

Claim Element	35 U.S.C. § 112 Positions
	Conventional flow cytometers and spectral flow cytometers comprise substantially different means for detecting fluorescent light to generate different fluorescent signals, as well as substantially different methods of processing the different fluorescent signals. (EX1002, ¶¶136-139.) **Conventional flow cytometers** rely on a combination of bandpass filters and dichroic mirrors to detect fluorescent light within a few distinct color bands associated with emission peaks of the fluorochromes used to mark the different particles or cells within a sample. (EX1096; EX1097; EX1002, ¶¶136-137.)  (EX1096, FIG. 1A.) When photons within each color band enter the photodetector, the photodetector converts the photons into electrons and multiplies the electrons into an analog current signal (photocurrent). The analog current signal can be converted into an analog voltage signal. Over the time period of an event, when a laser interacts with each fluorochrome attached to a cell or particle to cause it to emit fluorescent light, the analog voltage signal forms a voltage pulse (also called a signal pulse). (EX1097.) The voltage pulse data then goes through a process called "binning," where the voltage pulse data (height, full pulse width, area) for each unit (e.g., cell) of the target material is assigned a bin, depending on its value. Compensation is then applied to the voltage pulse data to separate out spectra overlap between adjacent fluorochromes. (*Id.*; *see also* EX1002, ¶137.) In contrast, for each event, **spectral flow cytometers** capture the entire emission of fluorescent light substantially over the full visible light spectrum, with the number of detectors exceeding the number of fluorochromes used to mark particles or cells in a

Claim Element	35 U.S.C. § 112 Positions
	sample to maximize the portion of the full spectrum that is captured. (EX1096; EX1098, p.019; EX1002, ¶138.)  (EX1096, FIG. 1B.) The different wavelength bands over which fluorescent light is dispersed and detected by the detector array are shown by grey rectangles in the righthand figure. Notably, the illustrated configuration uses a light dispersing element (e.g., grating or prism instead of WDM) to disperse the fluorescent light into different wavelength bands, which is absent in the '107 claims and written description's WDM disclosures. (*See also* EX1002, ¶¶ 138, 140-141.) A "major difference" between conventional and spectral flow cytometry "lies in the way the contribution of each fluorochrome is separated from similar signals[.]" (EX1096, p.009; *see also* EX1002, ¶139.) Conventional flow cytometers use compensation to correct for overlapping spectra from adjacent fluorochromes to isolate and measure individual contributions. (EX1098, p.019; *see also* EX1002, ¶¶137-139.) In contrast, spectral flow cytometers deconvolute to "unmix" the fluorochrome signals that overlap across the spectrum using sophisticated computer algorithms that isolate fluorochromes based on distinctions in their corresponding emission profiles substantially extending across the visible light spectrum. (EX1098, p.019; *see also* EX1002, ¶¶138-139; *see also* EX1096, p.009.)

Claim Element	35 U.S.C. § 112 Positions
	 **Figure 7.** Graphical representation of differences between compensation used in traditional flow cytometry and unmixing used in spectral flow cytometry. **(A)**Graph on the left side shows overlapping spectra of 2 fluorescent signals (for example, from different fluorophores). After compensation, the overlapping signal, as seen for the blue detector, is adjusted by reducing the interference from spillover.**(B)**Graph on the left side shows data being captured by a spectral flow cytometer where unmixing process uses more detectors than fluorophores to deconvolute signals, showing individual isolated spectra for each fluorophore. Nowhere in the '107 written description does the inventor describe how the claimed WDM (and its detectors) would enable SFC. The written description only describes a WDM configured for emission peak wavelength analysis performed as part of conventional flow cytometry. (*See* '107, 27:45-49; *see also* EX1002, ¶140.) This is confirmed by the '107's disclosures on a "replaceable dichroic filter assembly," which would be unnecessary in a SFC. ('107, 47:54-56, 48:39-42, 48:53-56, FIG. 30A; EX1002, ¶141.) In a SFC, filters are initially positioned before detectors and there would be no need to replace them for different applications, as the system collects the entire emission spectrum for fluorochromes and then unmixes their respective spectral signatures with computer algorithms. (EX1002, ¶141.) The recent state of the art further supports the conclusion that Claims 9 and 29 lack written description support. (EX1002, ¶142.) As of 2023, Sony, Thermo Fisher Scientific, and Petitioner offered commercialized SFCs, and Becton Dickinson marketed a "module for spectrally enhanced cytometric analysis" with the FACSymphony A5 SE instrument. (EX1098, p.019.) Yet Patent Owner did not offer a commercialized SFC add-on or module until 2025 (over ten years after the

Claim Element	35 U.S.C. § 112 Positions
	inventor's submission of the PCT App.), when it launched a SFC module for its CytoFLEX flow cytometer. (EX1099; EX1100.) **B. <u>Ground 6</u>: Claims 9, 29 are Not Enabled** Because no written description exists for Claims 9 and 29 as to a "WDM [that] is capable of detecting a substantially full spectrum of visible light," the specification also fails to enable a POSA to practice these claims without undue experimentation. ***Wands Factor No. 1 – Breadth of the Claims.*** Claims 9 and 29 broadly recite a "WDM [that] is capable of detecting a substantially full spectrum of light," and POSA would have understood these claims to encompass techniques in SFC despite the specification's lack of enabling disclosure. (EX1002, ¶143.) ***Wands Factors Nos. 6-7 – Guidance from the Specification and Working Examples.*** The '107 specification does not provide any teachings or working examples to enable a POSA to practice the claimed WDM with SFC capabilities but instead contain multiple passages that confirm that the claimed WDM is implemented in a conventional flow cytometer that measures fluorochrome emission peak wavelength signals and performs compensation. (*See* '107, 27:45-49, 47:54-56, 48:39-42, 48:46-50, 48:53-56, FIG. 30A; *see also* Ground 5; EX1002, ¶143.) ***Wands Factors Nos. 3 & 8 – Field or Nature of the Invention, State of the Art, Level of a POSA, Predictability, and Amount of Experimentation***. A POSA would need to engage in excessive experimentation to practice Claims 9 and 29. (EX1002, ¶143.) As explained above in Ground 5, as late as 2023, SFCs had only been commercialized by a limited number of companies (and not by Patent Owner). (EX1098, p.019.) Despite the original PCT App. having been filed in May 2013, it took more than ten years for Patent Owner to develop a SFC add-on module for its commercialized CytoFLEX flow cytometer product, further demonstrating that the '107 specification would not have enabled a POSA to practice a "WDM [that] is capable of detecting a substantially full spectrum of visible light" at the time of the invention. (EX1099;

Claim Element	35 U.S.C. § 112 Positions
	EX1100.)