Claim Chart Against U.S. Patent No. 10,330,582 ("'582 patent")

As set forth in the chart below, all asserted claims of the '582 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] *An optical subsystem for a flow cytometer, the optical subsystem comprising:*	The term "optical subsystem" lacks written description support and is not enabled. The '582 specification refers only to a "Laser Diode (LD) based optical subsystem" when using the term "optical subsystem." (*See, e.g.*, '582, 2:38-40, 2:54-67, 8:35-38, 8:56-9:10, 12:62-13:26, 28:14-32:39, FIG. 1 (optical subsystem 50), FIG. 5D.) These disclosures refer to illumination optics in a flow cytometer consisting generally of (1) a laser diode; (2) a collimating lens that converts a diverging beam from the laser diode into a collimated beam with an elliptical shape; (3) a focusing lens system that reduces the laser beam at the viewing zone to a certain width in a direction perpendicular to sheath flow; and (4) a high power cylindrical focusing element placed near the viewing zone, perpendicular to the direction of flow. (*Id.*, 2:54-67.) None of these features are recited in Claim 1, and the LD optical subsystem as referenced in

[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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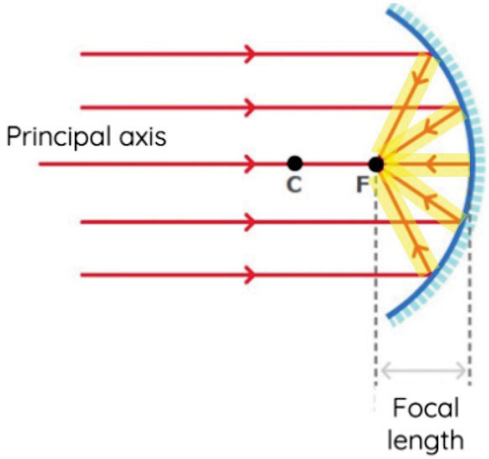
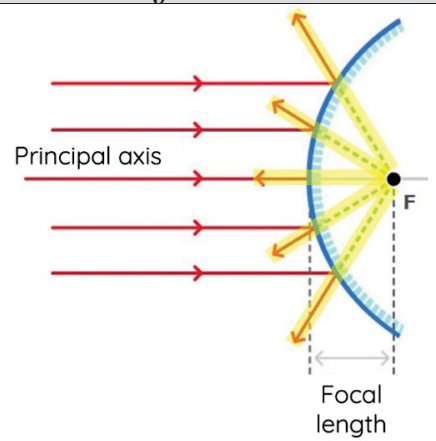
	the '582 patent – the only reference to an "optical subsystem" in the specification – contains no disclosures indicating that it can or does include the recited elements of Claim 1. In addition, this claim lacks written description support because all embodiments include a dichroic filter between the "collimating optical element" and the "optical relay element" that is absent from Claim 1's "optical subsystem" and only claimed in dependent claim 6 as a "first optical filter." The recitation of a "first optical filter" in Claim 6 indicates that Claim 1's "optical subsystem" is broader, including arrangements where the collimated beam is projected directly from the collimating optical element to the optical relay element comprising a "curved mirror." But nothing in the written description provides for or shows that the inventor was in possession of such a configuration.
1[a] *a collimating optical element arranged to receive light from a light source, the collimating optical element configured to project a collimated beam;*	The term "collimating optical element" is indefinite for the reasons set forth in Cytek's claim construction briefing and any supplemental briefing that Cytek submits in connection with an early motion for summary judgment. The term "collimated beam" is also indefinite for the reasons set forth in Cytek's claim construction briefing and discussed at the *Markman* hearing, not least because a POSA would not have understood what makes a beam of light "collimated" versus not (e.g., how much divergence before beam is not "collimated"), when a "collimated beam" is no longer "collimated" due to natural divergence within the beam, and/or under Beckman Coulter's interpretation for "collimated beam" as "nearly parallel" (e.g., a POSA would not have understood with reasonable certainty what "nearly" means). The term "light source" lacks full scope enablement and associated written description. The specification only identifies that the "[a]s shown in FIG. 25, fluorescence light going through a pinhole or emitted from the facet of a multimode optical fiber, such as the optical fiber 852 depicted in FIG. 1, forms an extended object or light source at location 901., i.e., the optical input of the WDM 90." ('582, 44:37-42.) "[L]ight going through a pinhole or emitted from the facet of a multimode optical fiber" are the only examples of a "light source" provided in the specification, but claim 1 recites a more broadly contemplated "light source." This overbroad recitation is confirmed by Claim 2 that recites "wherein the light source comprises light passing through a pinhole or light emitted from a facet of a multimode optical fiber." Claim is rendered superfluous unless claim 1's recited "light source" is broader, but the specification fails to teach or suggest any "light source" beyond the aforementioned two examples that are also found in Claim 2.

Claim Element	35 U.S.C. § 112 Positions
1[b] *an optical relay element arranged to receive at least a portion of the collimated beam from the collimating optical element,*	*See* Claim 1[c].
1[c] *the optical relay element comprising a curved mirror configured to reflect the portion of the collimated beam received from the collimating optical element to produce a first image;*	The term "curved mirror" lacks written description support for the same reasons set forth in Ground 3 of Cytek's PGR petition in PGR2025-00084, respectively, and incorporated here in its entirety (including associated exhibits). Ground 3 from Cytek's PGR petition is replicated below in relevant part. While citing to the '106 patent, the evidence and arguments apply with equal force to the '582 patent claims. Written description for the earlier-filed '772 patent, '412 patent, and PCT App. only describe concave mirrors in the WDM. (EX1002, ¶87.) The written description provides: > Light reflected from the dichroic filter **903** may impinge upon a second optical element **907**, **<u>such as a concave mirror.</u>** The **<u>concave mirror</u> 907** may a [sic] radius of curvature approximately equal to the distance between the collimating optical element **902** and the image near focusing lens **905**. The **<u>concave mirror</u> 907** therefore creates a second image of the collimating lens **902** near a second focusing lens **908**. The light beam between the **<u>concave mirror</u> 907** and the second image at the lens **908** may have substantially the same diameter as the beam of light between the collimating lens **902** and the first image near the focusing lens **905**. The relay imaging **<u>concave mirror</u> 907** therefore effectively doubles the collimated beam path without expanding the beam's diameter. ('772, 45:26-39; '412, 45:6-19; PCT App., p.170 (43:14-26) (emphasis added).) But the term "curved mirror" is broader than "concave mirror." The existence of multiple mirror types with different curvatures was well-known as of the filing dates for the '772 patent, '412

Claim Element	35 U.S.C. § 112 Positions
	patent, and PCT App. (EX1002, ¶¶84-86.) Broadly speaking, curved mirrors can be concave or convex depending on the mirror's radius of curvature. A ***positive*** radius of curvature indicates an inward curve for the mirror—a concave mirror—that causes incident light rays to ***converge*** (or become less divergent) from the surface of the mirror:  (*Id.*, ¶84.) A mirror with a ***negative*** radius of curvature indicates an outward curve for the mirror—a convex mirror—that causes incident light rays to ***diverge*** from the surface of the mirror:

Claim Element	35 U.S.C. § 112 Positions
	 (*Id*.) Even within these broad categories, concave mirrors and convex mirrors may include more specific geometries (e.g., spherical, aspherical, parabolic, ellipsoidal, hyperboloidal) that uniquely affect how incident light is shaped and will travel when reflected by the mirror. (*Id*., ¶85.) And a POSA would have understood that convex mirrors and concave mirrors are not functionally interchangeable. (*Id*., ¶¶90-91.) Nowhere in the '772 patent, '412 patent, the PCT App. or the provisional applications do the written descriptions recite a "curved mirror" or convex mirrors. (EX1002, ¶¶87, 89.) This is no accident. Because concave mirrors lessen the divergence of light rays within an incident beam of light, the written descriptions teach that they are useful to "extend the collimated distance" of a collimated beam within the WDM. (*See* '772, 45:26-39; '412, 45:6-19; PCT App., p.170 (43:14-26); EX1002, ¶¶88-89.) This teaching aligns with broader, consistent teachings in the written description about how the claimed invention propagates a collimated beam of light through its WDM cascaded 1:1 relay architecture for "efficient photodetection." (*See* '772, 45:14-17, 45:59-64; '412, 44:61-64, 45:39-44; PCT App., p.050, (43:2-5), p.051 (44:2-6); EX1002, ¶¶88-89.) In contrast, the written description lacks any "blaze marks" to indicate to a POSA that the inventors had possession of the broader "curved mirror" limitation that would necessarily include convex mirrors. (EX1002, ¶¶90-91.) Nowhere does the written description teach or suggest use of convex

Claim Element	35 U.S.C. § 112 Positions
	mirrors in a WDM as § 112(1) requires. *See, e.g., Purdue Pharma*, 230 F.3d at 1326-27 (no "blaze marks" directing POSA to specific species); *Mondis Tech.*, slip op. at 9-11 (lack of written description for broader "type of said display unit" limitation when specification only supported specific display unit). The term "curved mirror" in the '106 claims is not a stand-in for "concave mirror" but contemplates a broader set of (undisclosed) mirror types. (EX1002, ¶83 & n.2, ¶86.) In U.S. Patent No. 11,703,443 ("'443 patent") [**EX1075**], a continuation of the '106 patent that shares the same written description as the '412 patent, the applicant recited "curved mirror" in independent Claim 1 and then specified that the "curved mirror" could be a "concave mirror" in dependent Claim 6. (*See* EX1075, cls. 1 (reciting "at least one curved mirror"), 6 (reciting "the at least one curved mirror is a concave mirror.").) Claim differentiation instructs that, by reciting that the "curved mirror" may comprise "concave mirror" in a narrower dependent claim, the applicant intended for "curved mirror" to be broader. *See, e.g.*, *Phillips v. AWH Corp.*, 415 F.3d 1303, 1324-25 (Fed. Cir. 2005). (*See also* EX1002, ¶83 & n.2, ¶86.) Examiners at the European Patent Office reached the same conclusion that the written description cannot support the full scope of "curved mirror." During (still ongoing) prosecution of a foreign counterpart to the '443 patent that shares the same specification as the '106 patent, EP24151670, Patent Owner originally asserted nearly identical claims to those recited in the '443 patent, including a "curved mirror." (EX1076, p.056.) But the examiners rejected those claims on multiple grounds, including: > Furthermore in claim 1 a curved mirror is introduced, but the parent application does not disclose a generic curved mirror, but a <u>concave mirror</u> (*Id.*, p.039.) Rather than provide the examiners with citations to the written description to support "curved mirror," Patent Owner instead narrowed its claims to narrow curved mirror to the only mirror supported by the written description—a concave mirror:

	New Claims 1. A flow cytometer (40) that comprises: a multimode optical fiber (852); and a wavelength division multiplexer (WDM) (90) configured to receive light from the multimode optical fiber (852), the WDM (90) comprising: a first optical element (902); a set of dichroic filters (903, 909, 914, 915, 916, 917), wherein: the first optical element (902) is positioned in an optical path of the light received from the multimode optical fiber (852) upstream of the set of dichroic filters; and each dichroic filter of the set of dichroic filters is configured to pass a corresponding portion of multiple portions of the light received from the multimode optical fiber (852); at least one mirror (907, 910, 911, 912, 913) including at least one ~~curved~~ concave mirror, the at least one mirror configured to: receive one or more portions of the light from the set of dichroic filters; and reflect the one or more portions of the light to the set of dichroic filters; and a set of avalanche ~~detectors~~photodiodes (APDs), each ~~detector~~ APD of the set of ~~detectors~~ APDs corresponding to a dichroic filter of the set of dichroic filters and configured to receive a portion of the light at the ~~detector~~ APD that passed through the dichroic filter corresponding to the ~~detector~~APD. /

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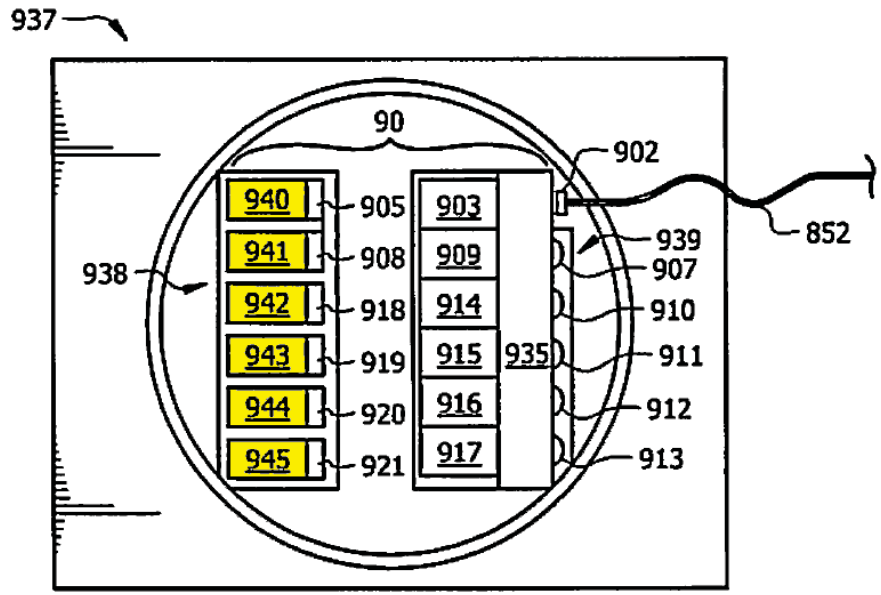
	(*Id*., p.016 (annotated).) Patent Owner then pointed to passages from the specification that only support a "concave mirror" in its remarks on the amendments: • that the curved mirror is a "concave mirror" (see Specification at paragraphs [0034], [0069]); and (*Id*., p.026.) Patent Owner also made a passing comment that the written description's generalized disclosure that "other types of refractive and/or reflective optical components may also be used to achieve the same design goal," (EX1076, p.027; *see also* '772, 4:63-64; '412, 4:59-60; PCT App., p.022 (15:20-22)), but such an argument, at best, suggests that it would be *obvious* to a POSA reading the specification to (unduly) experiment with curved mirrors that were not concave. (EX1002, ¶¶89-91.) The written description requirement is more exacting, and some unarticulated explanation of the general knowledge of a person of ordinary skill cannot bridge the gap. *Rsch. Corp. Techs.*, 627 F.3d at 870. To the extent not otherwise identified in Cytek's PGR petition, the term "curved mirror" lacks enablement for a convex mirror and the full scope of "curved mirror" that would include additional curved mirrors that a POSA would not otherwise consider a concave mirror (e.g., a distorting mirror). The term "image" is indefinite. For the reasons identified in Cytek's claim construction briefing and at the *Markman* hearing, a POSA would have understood the term "image," consistent with how the term is understood uniformly within imaging optics and based on intrinsic evidence. (*See, e.g.,* '582, FIGs. FIGs. 9A, 9B1, 9B2, 9B3, 10, 36; *id*., 24:28-33, 35:29-35, 36:33-35, 36:48-56, 51:58-52:4, 54:55-59.) Without this fundamental understanding as to the scope for "image," including nonsensical and contradictory concepts like a "collimating afocal image" demonstrates that the term "image" is indefinite. As applied to include a "collimating afocal image," the term "image" is so broadly construed as to be rendered meaningless, and a POSA would not be able to ascertain how any such "image" is a "representation of an object" when (1) no object is specifically recited in the claim; and (2) no explanation is provided in the intrinsic record to guide a POSA to understand how an "image" that can include a "collimating afocal image" could represent that object.

Claim Element	35 U.S.C. § 112 Positions
	A POSA would not be able to ascertain with reasonable certainty how an "optical relay element" could "produce a first image" versus simply reflecting the received "collimated beam," or how, for example, said "optical relay element" could "produce a first image" that would be distinguishable from any other image in the claimed system. This is especially true when reading Claim 20 alongside Claim 1, which includes the same "collimating optical element" term except Claim 20 recites that the "collimating optical element" projects a "first image," whereas the "optical relay element" projects a "second image." The term "produce a first image" is indefinite, as a POSA would be unable to ascertain with reasonable certainty how a mirror is to "produce a first image" and how that is distinguished from, e.g., later claims where an optical relay element is meant to "project a … image." (*Compare* '582, cl. 1 ("produce a first image") *with* cl. 20 ("project a second image").) The distinction between "produce" and "project" is unclear to a POSA, and the specification provides no guidance to inform how the claims draw that distinction. In addition, the term "produce a first image" lacks written description support and enablement because the specification fails to teach or suggest any curved mirror that causes light rays to converge to an image as a POSA would have understood the term. This is particularly true where, as here, the claim requires that the optical relay element "produce" an image, which would have indicated to a POSA that real image formation must occur after the "portion of the collimated beam" is reflected by the optical relay element. Rather, the specification only discloses use of concave mirrors in the disclosed WDM that control divergence within the collimated beam and do not cause the beam to converge/focus.
1[d] *a first focusing optical element arranged to receive at least a portion of the collimated beam reflected by the optical relay element;*	The term "first focusing optical element" lacks written description support and is not enabled. The specification fails to teach or suggest a "first focusing optical element" that receives any portion of a collimated beam reflected by an optical relay element. Instead, the first focusing lens in the WDM embodiments in the specification receives a portion of a collimated beam that passes through a dichroic filter. The second focusing lens in the WDM embodiments in the specification is the focusing lens that is "arranged to receive at least a portion of the collimated beam reflected by the optical relay element." A POSA would not have considered the inventor to be in possession of any WDM that includes the specific configuration of a "first focusing optical element" after the claimed optical relay element as required in Claim 1.
1[e] a*nd a first semiconductor detector,*	The term "semiconductor detector" lacks full scope enablement and written description support for the same reasons set forth in Grounds 4 and 5 of Cytek's PGR petition in PGR2025-00084, respectively, and

Claim Element	35 U.S.C. § 112 Positions
	incorporated here in their entirety (including associated exhibits). Grounds 4 and 5 are replicated below and would apply with equal force with respect to "semiconductor detector" for the '582 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 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).) ***Wands Factors Nos. 3 and 4 – State of the Prior Art at the Time of the Invention & Level of***

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

Claim Element	35 U.S.C. § 112 Positions
	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.) In addition, the term "first semiconductor detector" lacks written description support and is not enabled. The specification fails to teach or suggest a "first semiconductor detector" that receives any portion of a collimated beam reflected by an optical relay element and focused down by a "first focusing optical element." Instead, the first focusing lens in the WDM embodiments in the specification receives a portion of a collimated beam that passes through a dichroic filter, and focuses that portion of a collimated beam down to a first semiconductor detector. The second focusing lens in the WDM embodiments in the specification is the focusing lens that is "arranged to receive at least a portion of the collimated beam reflected by the optical relay element." A POSA would not have considered the inventor to be in possession of any WDM that includes the specific configuration of a "first focusing optical element" after the claimed optical relay element as required in Claim 1.
1[f] *wherein the first focusing optical element*	*See* Claims 1[d], 1[e].

Claim Element	35 U.S.C. § 112 Positions
is configured to focus the portion of the collimated beam received from the optical relay element onto the first semiconductor detector.	

Claim 2

Claim Element	35 U.S.C. § 112 Positions
2[pre] *The optical subsystem of claim 1,*	*See* Claim 1.
2[a] *further comprising the light source,*	*See* Claim 1.
2[b] *wherein the light source comprises light passing through a pinhole or light emitted from a facet of a multimode optical fiber.*	*See* Claim 1.

Claim 3

Claim Element	35 U.S.C. § 112 Positions
3[pre] *The optical subsystem of claim 2,*	*See* Claim 1.
3[a] *wherein the first focusing optical element is configured to focus the portion of the collimated beam received from the optical relay element to a size smaller than 1 millimeter in diameter.*	Claim 3 lacks written description support and enablement. The specification does not explain or provide implementation details regarding how a "first focusing optical element" may "focus the portion of the collimated beam… to a size smaller than 1 millimeter in diameter." No details are provided for the beam spot size for the incoming collimated beam, the radius of curvature or size for the "first focusing optical element" or how its geometry would allow for focusing to a "size smaller than 1 millimeter in diameter." 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 6

Claim Element	35 U.S.C. § 112 Positions
6[pre] *The optical subsystem of claim 1,*	*See* Claim 1.
6[a] *further comprising a first optical filter disposed along an optical path between the collimating optical element and the optical relay element,*	*See* Claim 1. The term "optical filter" lacks full scope enablement and associated written description. The specification only supports an "optical filter" where that filter is a dichroic filter. (*See* '443, FIG. 25, 45:18-23, 45:54-59, 46:8-11, 46:23-25.) However, the full scope of "optical filter" in Claim 6 would include, e.g., a bandpass filter that does not "separate the collimated beam into a first branch and a second branch" as required in Claim 6[b]. The specification lacks guidance, and a POSA would not have understood without undue experimentation, how an "optical filter" would "separate the collimated beam into a first branch and a second branch" if the "optical filter" consisted of a bandpass filter. The term "optical 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* '582, 2:33-35, 47:32-38, 47:49-52, 48:20-23, 48:27-31, FIGs. 29A, 29B, 29C, 30A, 30B.) Ground 5 is replicated in relevant part below, and the citations to the '107 specification are equally applicable to the '582 patent, which shares a specification. > 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.)

Claim Element	35 U.S.C. § 112 Positions
6[b] *the first optical filter configured to separate the collimated beam into a first branch and a second branch.*	*See* Claims 1, 6[a].

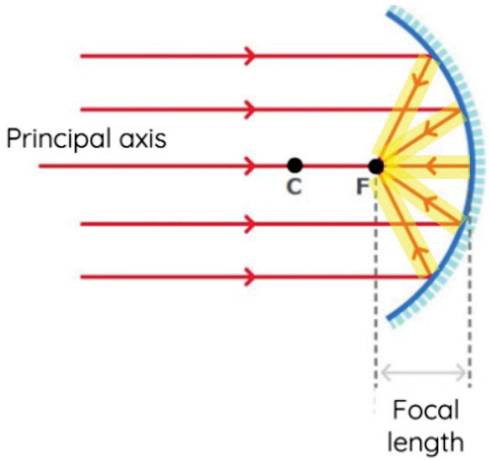
Claim 20

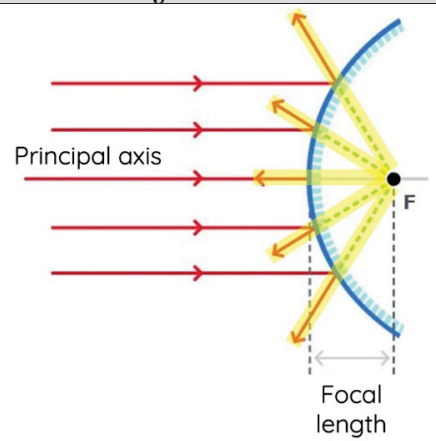
Claim Element	35 U.S.C. § 112 Positions
20[pre] *An optical subsystem for a flow cytometer, the optical subsystem comprising:*	The term "optical subsystem" lacks written description support and is not enabled. The '582 specification refers only to a "Laser Diode (LD) based optical subsystem" when using the term "optical subsystem." (*See, e.g.*, '582, 2:38-40, 2:54-67, 8:35-38, 8:56-9:10, 12:62-13:26, 28:14-32:39, FIG. 1 (optical subsystem 50), FIG. 5D.) These disclosures refer to illumination optics in a flow cytometer consisting generally of (1) a laser diode; (2) a collimating lens that converts a diverging beam from the laser diode into a collimated beam with an elliptical shape; (3) a focusing lens system that reduces the laser beam at the viewing zone to a certain width in a direction perpendicular to sheath flow; and (4) a high power cylindrical focusing element placed near the viewing zone, perpendicular to the direction of flow. (*Id.*, 2:54-67.) None of these features are recited in Claim 20, and the LD optical subsystem as referenced in the '582 patent – the only reference to an "optical subsystem" in the specification – contains no disclosures indicating that it can or does include the recited elements of Claim 20. In addition, this claim lacks written description support because all embodiments include a dichroic filter between the "collimating optical element" and the "optical relay element" that is absent from Claim 20's "optical subsystem." Nothing in the written description provides for or shows that the inventor was in possession of a configuration where a light from a collimating optical element is projected directly on to an optical relay element, where the optical relay element is a "curved mirror."
20[a] *a collimating optical element arranged to receive light from a light source, the collimating optical*	The term "collimating optical element" is indefinite for the reasons set forth in Cytek's claim construction briefing and any supplemental briefing that Cytek submits in connection with an early motion for summary judgment. The term "collimating optical element configured to project a first image" is also indefinite because a "collimating optical element" operates to collimate incident light, whereas projecting an image requires

Claim Element	35 U.S.C. § 112 Positions
element configured to project a first image; and	focusing light. A collimated beam is not a focused beam. No structure exists in the specification that both collimates and focuses light at the same time, as that would be impossible. The term "collimating optical element configured to project a first image" lacks written description and enablement for the same reasons. The specification only discloses a collimating optical element that projects an "effectively collimated" beam. BEC represented that "image" includes a "collimating afocal image" but its full scope is more expansive no structure exists to "project a first image" for any other "image" but the purported "collimating afocal image." The term "image" is indefinite. For the reasons identified in Cytek's claim construction briefing and at the *Markman* hearing, a POSA would have understood the term "image," consistent with how the term is understood uniformly within imaging optics and based on intrinsic evidence. (*See, e.g.,* '582, FIGs. FIGs. 9A, 9B1, 9B2, 9B3, 10, 36; *id*., 24:28-33, 35:29-35, 36:33-35, 36:48-56, 51:58-52:4, 54:55-59.) Without this fundamental understanding as to the scope for "image," including nonsensical and contradictory concepts like a "collimating afocal image" demonstrates that the term "image" is indefinite. As applied to include a "collimating afocal image," the term "image" is so broadly construed as to be rendered meaningless, and a POSA would not be able to ascertain how any such "image" is a "representation of an object" when (1) no object is specifically recited in the claim; and (2) no explanation is provided in the intrinsic record to guide a POSA to understand how an "image" that can include a "collimating afocal image" could represent that object. The term "project a first image" is indefinite because a POSA would have been unable to discern where a "first image" is relative to a "second image," particularly when, as BEC alleged during claim construction, said image is a purported "collimating afocal image." The term "light source" lacks full scope enablement and associated written description. The specification only identifies that the "[a]s shown in FIG. 25, fluorescence light going through a pinhole or emitted from the facet of a multimode optical fiber, such as the optical fiber 852 depicted in FIG. 1, forms an extended object or light source at location 901., i.e., the optical input of the WDM 90." ('582, 44:37-42.) "[L]ight going through a pinhole or emitted from the facet of a multimode optical fiber" are the only examples of a "light source" provided in the specification, but Claim 20 recites a more broadly contemplated "light source." This overbroad recitation is confirmed by Claims 22 and 23 that respectively recite "wherein the light source comprises an extended light source" and "wherein the light source comprises light passing

Claim Element	35 U.S.C. § 112 Positions
	through a pinhole or light emitted from a facet of a multimode optical fiber." Claims 22 and 23 are rendered superfluous unless Claim 20's recited "light source" is broader, but the specification fails to teach or suggest any "light source" beyond the aforementioned two examples that are also found in Claim 23.
20[b] *an optical relay element arranged near the first image, the optical relay element configured to receive light from the collimating optical element and to project a second image;*	The term "arranged near" in "an optical relay element arranged near the first image" is indefinite because a POSA would not have understood with reasonable certainty where the "optical relay element" is arranged for several reasons. First, the only "image" supported by the written description, as BEC identified during claim construction, is an alleged "collimating afocal image." A "collimating afocal image" forms an image at infinity, and thus the "optical relay element" must be placed "near" where the "first image" forms – at infinity – which is impossible. Second, to the extent BEC argues that a "first image" forms anywhere along the optical path because it can be an image and afocal (which is an unintelligible position), the term "arranged near the first image" is additionally indefinite because it provides no clarity as to where the "first image" is in the system, let alone how an optical component can be "arranged near" said "first image." Similarly, the term "optical relay element arranged near the first image" lacks written description support and full scope enablement because the specification fails to show that the inventor was in possession, and that the specification enables, placement of an "optical relay element" at any position within the beam path after the collimating optical element (which is purportedly how BEC defines placement of the "first image"). The term "optical relay element… configured to project a second image" is also indefinite because the specification only teaches structures that purport to control divergence in an "effectively collimated" beam (i.e., concave mirror 907), not focus light for image formation. The term "project a second image" is indefinite because a POSA would have been unable to discern where a "first image" is relative to a "second image," particularly when, as BEC alleged during claim construction, said image is a purported "collimating afocal image."
20[b][i] *wherein the size of the first image is substantially the same as*	The term "substantially the same" is indefinite because "substantially" is a term of degree that fails to provide a POSA with reasonable clarity to ascertain how close in size the first image must be to the second image for the images to be "substantially the same." The indefinite nature of this limitation is

Claim Element	35 U.S.C. § 112 Positions
the size of the second image, and	demonstrated through BEC's infringement allegations with respect to this claim element in its infringement contentions, which identify clearly different-sized beam spots as being images that are "substantially the same."
20[b][ii] *wherein the optical relay element comprises a curved mirror or a concave-shaped dichroic filter.*	The term "curved mirror" lacks written description support for the same reasons set forth in Ground 3 of Cytek's PGR petition in PGR2025-00084, respectively, and incorporated here in its entirety (including associated exhibits). Ground 3 from Cytek's PGR petition is replicated below in relevant part. While citing to the '106 patent, the evidence and arguments apply with equal force to the '582 patent claims. Written description for the earlier-filed '772 patent, '412 patent, and PCT App. only describe concave mirrors in the WDM. (EX1002, ¶87.) The written description provides: Light reflected from the dichroic filter **903** may impinge upon a second optical element **907**, **<u>such as a concave mirror.</u>** The **<u>concave mirror</u> 907** may a [sic] radius of curvature approximately equal to the distance between the collimating optical element **902** and the image near focusing lens **905**. The **<u>concave mirror</u> 907** therefore creates a second image of the collimating lens **902** near a second focusing lens **908**. The light beam between the **<u>concave mirror</u> 907** and the second image at the lens **908** may have substantially the same diameter as the beam of light between the collimating lens **902** and the first image near the focusing lens **905**. The relay imaging **<u>concave mirror</u> 907** therefore effectively doubles the collimated beam path without expanding the beam's diameter. ('772, 45:26-39; '412, 45:6-19; PCT App., p.170 (43:14-26) (emphasis added).) But the term "curved mirror" is broader than "concave mirror." The existence of multiple mirror types with different curvatures was well-known as of the filing dates for the '772 patent, '412 patent, and PCT App. (EX1002, ¶¶84-86.) Broadly speaking, curved mirrors can be concave or convex depending on the mirror's radius of curvature. A ***positive*** radius of curvature indicates an

Claim Element	35 U.S.C. § 112 Positions
	inward curve for the mirror—a concave mirror—that causes incident light rays to ***converge*** (or become less divergent) from the surface of the mirror:  (*Id.*, ¶84.) A mirror with a ***negative*** radius of curvature indicates an outward curve for the mirror—a convex mirror—that causes incident light rays to ***diverge*** from the surface of the mirror:

Claim Element	35 U.S.C. § 112 Positions
	 (*Id.*) Even within these broad categories, concave mirrors and convex mirrors may include more specific geometries (e.g., spherical, aspherical, parabolic, ellipsoidal, hyperboloidal) that uniquely affect how incident light is shaped and will travel when reflected by the mirror. (*Id.*, ¶85.) And a POSA would have understood that convex mirrors and concave mirrors are not functionally interchangeable. (*Id.*, ¶¶90-91.) Nowhere in the '772 patent, '412 patent, the PCT App. or the provisional applications do the written descriptions recite a "curved mirror" or convex mirrors. (EX1002, ¶¶87, 89.) This is no accident. Because concave mirrors lessen the divergence of light rays within an incident beam of light, the written descriptions teach that they are useful to "extend the collimated distance" of a collimated beam within the WDM. (*See* '772, 45:26-39; '412, 45:6-19; PCT App., p.170 (43:14-26); EX1002, ¶¶88-89.) This teaching aligns with broader, consistent teachings in the written description about how the claimed invention propagates a collimated beam of light through its WDM cascaded 1:1 relay architecture for "efficient photodetection." (*See* '772, 45:14-17, 45:59-64; '412, 44:61-64, 45:39-44; PCT App., p.050, (43:2-5), p.051 (44:2-6); EX1002, ¶¶88-89.) In contrast, the written description lacks any "blaze marks" to indicate to a POSA that the inventors had possession of the broader "curved mirror" limitation that would necessarily include convex mirrors. (EX1002, ¶¶90-91.) Nowhere does the written description teach or suggest use of convex

Claim Element	35 U.S.C. § 112 Positions
	mirrors in a WDM as § 112(1) requires. *See, e.g., Purdue Pharma*, 230 F.3d at 1326-27 (no "blaze marks" directing POSA to specific species); *Mondis Tech.*, slip op. at 9-11 (lack of written description for broader "type of said display unit" limitation when specification only supported specific display unit). The term "curved mirror" in the '106 claims is not a stand-in for "concave mirror" but contemplates a broader set of (undisclosed) mirror types. (EX1002, ¶83 & n.2, ¶86.) In U.S. Patent No. 11,703,443 ("'443 patent") [**EX1075**], a continuation of the '106 patent that shares the same written description as the '412 patent, the applicant recited "curved mirror" in independent Claim 1 and then specified that the "curved mirror" could be a "concave mirror" in dependent Claim 6. (*See* EX1075, cls. 1 (reciting "at least one curved mirror"), 6 (reciting "the at least one curved mirror is a concave mirror.").) Claim differentiation instructs that, by reciting that the "curved mirror" may comprise "concave mirror" in a narrower dependent claim, the applicant intended for "curved mirror" to be broader. *See, e.g.*, *Phillips v. AWH Corp*., 415 F.3d 1303, 1324-25 (Fed. Cir. 2005). (*See also* EX1002, ¶83 & n.2, ¶86.) Examiners at the European Patent Office reached the same conclusion that the written description cannot support the full scope of "curved mirror." During (still ongoing) prosecution of a foreign counterpart to the '443 patent that shares the same specification as the '106 patent, EP24151670, Patent Owner originally asserted nearly identical claims to those recited in the '443 patent, including a "curved mirror." (EX1076, p.056.) But the examiners rejected those claims on multiple grounds, including: > Furthermore in claim 1 a curved mirror is introduced, but the parent application does not disclose a generic curved mirror, but a <u>concave mirror</u> (*Id.*, p.039.) Rather than provide the examiners with citations to the written description to support "curved mirror," Patent Owner instead narrowed its claims to narrow curved mirror to the only mirror supported by the written description—a concave mirror:

New Claims

1. A flow cytometer (40) that comprises:

a multimode optical fiber (852); and

a wavelength division multiplexer (WDM) (90) configured to receive light from the multimode optical fiber (852), the WDM (90) comprising:

a first optical element (902);

a set of dichroic filters (903, 909, 914, 915, 916, 917), wherein:

the first optical element (902) is positioned in an optical path of the light received from the multimode optical fiber (852) upstream of the set of dichroic filters; and

each dichroic filter of the set of dichroic filters is configured to pass a corresponding portion of multiple portions of the light received from the multimode optical fiber (852);

at least one mirror (907, 910, 911, 912, 913) including at least one ~~curved~~ concave mirror, the at least one mirror configured to:

receive one or more portions of the light from the set of dichroic filters; and

reflect the one or more portions of the light to the set of dichroic filters; and

a set of avalanche ~~detectors~~photodiodes (APDs), each ~~detector~~ APD of the set of ~~detectors~~ APDs corresponding to a dichroic filter of the set of dichroic filters and configured to receive a portion of the light at the ~~detector~~ APD that passed through the dichroic filter corresponding to the ~~detector~~APD.

Claim Element	35 U.S.C. § 112 Positions
	(*Id*., p.016 (annotated).) Patent Owner then pointed to passages from the specification that only support a "concave mirror" in its remarks on the amendments: • that the curved mirror is a "concave mirror" (see Specification at paragraphs [0034], [0069]); and (*Id*., p.026.) Patent Owner also made a passing comment that the written description's generalized disclosure that "other types of refractive and/or reflective optical components may also be used to achieve the same design goal," (EX1076, p.027; *see also* '772, 4:63-64; '412, 4:59-60; PCT App., p.022 (15:20-22)), but such an argument, at best, suggests that it would be *obvious* to a POSA reading the specification to (unduly) experiment with curved mirrors that were not concave. (EX1002, ¶¶89-91.) The written description requirement is more exacting, and some unarticulated explanation of the general knowledge of a person of ordinary skill cannot bridge the gap. *Rsch. Corp. Techs.*, 627 F.3d at 870. To the extent not otherwise identified in Cytek's PGR petition, the term "curved mirror" lacks enablement for a convex mirror and the full scope of "curved mirror" that would include additional curved mirrors that a POSA would not otherwise consider a concave mirror (e.g., a distorting mirror).

Claim 22

Claim Element	35 U.S.C. § 112 Positions
22[pre] *The optical subsystem of claim 20,*	*See* Claim 20.
22[a] *further comprising the light source,*	*See* Claim 20.
22[b] *wherein the light source comprises an extended light source that forms an object,*	The term "extended light source" is indefinite because a POSA would be unable to ascertain with reasonable certainty the scope of the term in view of the specification and context of the claims. More specifically, the specification only identifies that the "[a]s shown in FIG. 25, fluorescence light going through a pinhole or emitted from the facet of a multimode optical fiber, such as the optical fiber 852 depicted in FIG. 1, forms an extended object or light source at location 901., i.e., the optical

Claim Element	35 U.S.C. § 112 Positions
	input of the WDM 90." ('582, 44:37-42.) Claim 23, depending from Claim 22, recites "wherein the light source comprises light passing through a pinhole or light emitted from a facet of a multimode optical fiber," indicating that "an extended light source that forms an object" must be broader. Claim 22 is superfluous unless Claim 20's recited "light source" is broader, but the specification fails to teach or suggest any "light source" beyond the aforementioned two examples that are also found in Claim 23 that depends from Claim 22.
22[c] *wherein the first image is a magnified image of the object.*	*See* Claim 20.

Claim 23

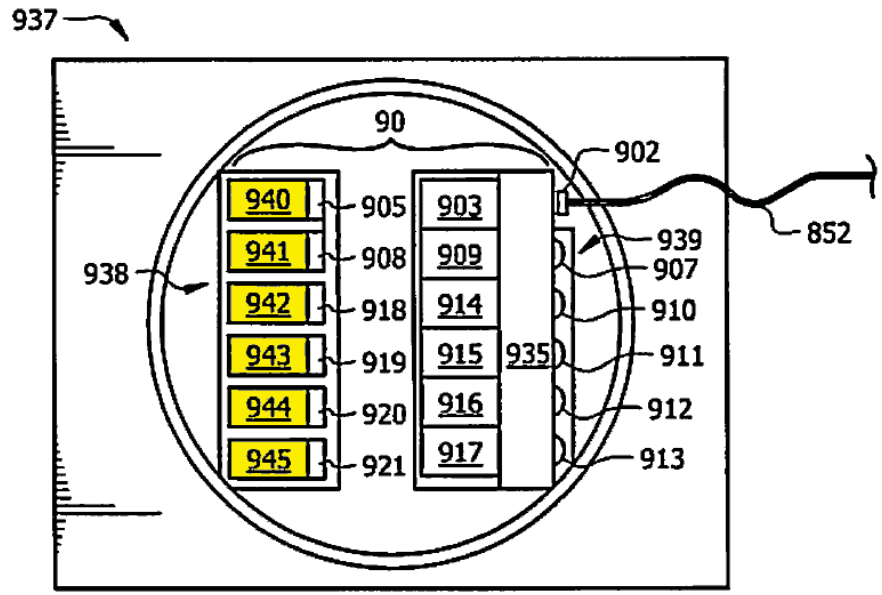
Claim Element	35 U.S.C. § 112 Positions
23[pre] *The optical subsystem of claim 22,*	*See* Claim 20.
23[a] *wherein the light source comprises light passing through a pinhole or light emitted from a facet of a multimode optical fiber.*	*See* Claim 20.

Claim 26

Claim Element	35 U.S.C. § 112 Positions
26[pre] *The optical subsystem of claim 22,*	*See* Claims 20, 22.
26[a] *further comprising a first focusing optical element arranged near the second image,*	The term "arranged near" in "first focusing optical element arranged near the second image" is indefinite because a POSA would not have understood with reasonable certainty where the "first focusing optical element" is arranged for several reasons. First, the only "image" supported by the written description, as BEC identified during claim construction, is an alleged "collimating afocal image." A "collimating afocal image" forms an image at infinity, and thus the "first focusing optical element" must be placed "near" where the "second image" forms – at infinity – which is impossible. Second, to the extent BEC argues that an "second image" forms anywhere along the optical path

Claim Element	35 U.S.C. § 112 Positions
	because it can be an image and afocal (which is an unintelligible position), the term "arranged near the second image" is additionally indefinite because it provides no clarity as to where the "second image" is in the system, let alone how an optical component can be "arranged near" said "second image." Similarly, the term "first focusing optical element arranged near the second image" lacks written description support and full scope enablement because the specification fails to show that the inventor was in possession, and that the specification enables, placement of a "first focusing optical element" at any position within the beam path after the optical relay element (which is purportedly how BEC defines placement of the "second image"). Instead, the first focusing lens in the WDM embodiments in the specification receives a portion of a collimated beam that passes through a dichroic filter. The second focusing lens in the WDM embodiments in the specification is the focusing lens that is purportedly "arranged near the second image." A POSA would not have considered the inventor to be in possession of any WDM that includes the specific configuration of a "first focusing optical element" after the claimed optical relay element as required in Claim 26.
26[b] *the first focusing optical element configured to focus the light from the optical relay element to a size smaller than the object of the light source to a first semiconductor detector.*	The term "semiconductor detector" lacks full scope enablement and written description support for the same reasons set forth in Grounds 4 and 5 of Cytek's PGR petition in PGR2025-00084, respectively, and incorporated here in their entirety (including associated exhibits). Grounds 4 and 5 are replicated below and would apply with equal force with respect to "semiconductor detector" for the '582 claims. **C. <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.*

Claim Element	35 U.S.C. § 112 Positions
	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 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 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,

Claim Element	35 U.S.C. § 112 Positions
	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. **D. <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.) In addition, the term "first semiconductor detector" lacks written description support and is not enabled. The specification fails to teach or suggest a "first semiconductor detector" that receives any portion of a collimated beam reflected by an optical relay element and focused down by a "first focusing optical element." Instead, the first focusing lens in the WDM embodiments in the specification receives a portion of a collimated beam that passes through a dichroic filter, and focuses that portion of a collimated beam down to a first semiconductor detector. The second focusing lens in the WDM embodiments in the specification is the focusing lens that is purportedly "arranged near a second image." A POSA would not have considered the inventor to be in possession of any WDM

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	that includes the specific configuration of a "first focusing optical element" after the claimed optical relay element as required in Claim 26.