

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CYTEK BIOSCIENCES, INC.,
Petitioner,

v.

BECKMAN COULTER, INC.,
Patent Owner.

U.S. Patent No. 12,174,106
Case No. PGR2025-00084

PATENT OWNER'S PRELIMINARY RESPONSE

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TABLE OF EXHIBITS

Exhibit	Description
EX2001	About Beckman Coulter (https://www.beckmancoulter.com/about-beckman-coulter/history-and-innovation)
EX2002	CytoFLEX Flow Cytometer (https://www.beckman.com/flow-cytometry/research-flow-cytometers/cytoflex)
EX2003	Beckman Coulter Patents (https://www.beckman.com/patents)
EX2004	Cytek Form S-1 Registration Statement (2021)
EX2005	Information Disclosure Statement for Application No. 15/817,237 to U.S. Patent No. 10,436,697 (May 7, 2019)
EX2006	Information Disclosure Statement for Application No. 15/942,430 to U.S. Patent No. 11,333,597 (June 17, 2021)
EX2007	Reserved
EX2008	Reserved
EX2009	Reserved
EX2010	Reserved
EX2011	Reserved
EX2012	Reserved
EX2013	Transcript of Markman Hearing of September 17, 2024, Beckman Coulter, Inc. v. Cytek Biosciences, Inc., C.A. No. 24-945, D.I. 173 (D. Del. Sept. 17, 2025)
EX2014	U.S. Patent Pub. No. 2004/0165828 (“Capewell”)
EX2015	File History for U.S. Patent No. 9,746,412

EX2016	File History for U.S. Patent No. 10,330,582
EX2017	DocketNavigator, Time-to-Trial Statistics for District of Delaware (Sept. 2025)
EX2018	Reserved
EX2019	Reserved
EX2020	Reserved
EX2021	Assignment for U.S. Patent No. 8,922,778
EX2022	Assignment for U.S. Patent No. 8,605,283
EX2023	Reserved
EX2024	Request for <i>Ex Parte</i> Reexamination of U.S. Patent No. 10,330,582 B2 Under 35 U.S.C. §§ 302-307 and 37 C.F.R. § 1.510 <i>et seq.</i>
EX2025	Reserved
EX2026	Reserved
EX2027	Reserved
EX2028	Declaration of David Schaafsma, Ph.D.
EX2029	Shapiro, Practical Flow Cytometry (2003), Chapter 7
EX2030	U.S. Patent No. 10,330,582
EX2031	Marcus Nebeling, CWDM: Lower Cost for More Capacity in the Short-Haul, Fiber Network Engineering (July 3, 2002)
EX2032	Telecommunication Standardization Sector of ITU, Recommendation G.694.2, Spectral Grids for WDM Applications: CWDM Wavelength Grid (Dec. 2003)
EX2033	Telecommunication Standardization Sector of ITU, Recommendation G.694.1, Spectral Grids for WDM Applications: DWDM Frequency

	Grid (June 2002)
EX2034	Order Denying Request for <i>Ex Parte</i> Reexamination, Application/Control Number: 90/015,441 (Oct. 6, 2025)
EX2035	M. Arumugam, <i>Optical Fiber Communication—An Overview</i> , 57 Pramana J. Physics 849 (2001)
EX2036	B.E.A. Saleh and M.C. Teich, <i>Fundamentals of Photonics</i> , 2d. Ed. 2007, Chapters 1, 24 (“Saleh”)
EX2037	Warren J. Smith, <i>Modern Optical Engineering</i> (3d ed. 2000, Chapter 9 (“Smith”)
EX2038	W.T. Welford, <i>Optics</i> (3d ed. 1990), Chapter 8 (“Welford”)
EX2039	Mohammad Azadeh, <i>Fiber Optics Engineering</i> (2009), Chapters 1, 2, 6 (“Azadeh”)
EX2040	Cytek’s 35 U.S.C. § 112 Contentions – Exhibit A U.S. Patent No. 10,330,582, <i>Beckman Coulter, Inc. v. Cytek Biosciences, Inc.</i> , C.A. No. 24-945, (D. Del. October 22, 2025)
EX2041	Cytek’s Election of Asserted Prior Art Grounds, C.A. No. 24-945 (D. Del. Oct. 22, 2025)
EX2042	Amended Scheduling Order, <i>Beckman Coulter, Inc. v. Cytek Biosciences, Inc.</i> , C.A. No. 24-945, D.I. 198 (D. Del. Nov. 5, 2025)
EX2043	U.S. Provisional Patent Application No. 61/715,819 (“5819 Prov.”)
EX2044	Reserved
EX2045	Reserved
EX2046	Reserved
EX2047	Xinjian Zhou et al., <i>Color Detection Using Chromophore-Nanotube Hybrid Devices</i> , 9 Nano Letters 1028 (2009)

I. Introduction

U.S. Patent No. 12,174,106 (the “’106 patent”) claims groundbreaking innovations in flow cytometers. Beckman Coulter, Inc. (“Patent Owner”) utilizes the innovations claimed in the ’106 patent in its CytoFLEX Flow Cytometers and Sorters. EX2003. Before the family that led to the ’106 patent was filed, no one in the field of flow cytometry recognized how a wavelength division multiplexer (WDM), as claimed in the ’106 patent, could be used to improve light detection in a flow cytometer.

Cytek Biosciences, Inc.’s (“Petitioner” or “Cytek”) Petition for post-grant review (“Pet.”) should not be instituted for several reasons. First, the ’106 patent is a pre-AIA patent and is ineligible for PGR. The ’106 patent claims priority to applications filed before March 16, 2013, and it was examined as a pre-AIA application. Petitioner argues that the ’106 patent is PGR-eligible because “curved mirror” and “semiconductor detector” allegedly lack support and the patent is therefore not entitled to its priority date. The PTO has already rejected Petitioner’s arguments as to “curved mirror” in denying Petitioner’s request for reexamination of a patent in the same family, finding that “curved mirror” “is clearly supported” by the specification. EX2034 at 4. Petitioner’s arguments as to “semiconductor detector” similarly fail because there is ample support in the ’106 patent

specification and its priority application, which explicitly discloses using “semiconductor detectors.” Institution should therefore be denied as this proceeding is not available for the ’106 patent.

Second, Petitioner has failed to demonstrate a reasonable likelihood that the ’106 patent claims are invalid. Petitioner’s obviousness challenges to the ’106 patent’s inventions are based on two Grounds that each propose taking a component of an optical communications system and inserting it into a flow cytometry system. Specifically, Petitioner proposes removing fluorescence detection components in Chandler (a particle analyzer) or Oostman (a flow cytometry system) and replacing them with Goodman’s demultiplexer device (an optical communications system). But the only evidence Petitioner submits that suggests adapting optical communications technology into a flow cytometer, apart from its expert’s conclusory assertion, is the *’106 patent itself*. Petitioner’s Goodman reference views comparable technologies as spacecrafts and cable television systems, not flow cytometry. And Frazier, Petitioner’s only flow cytometry reference that even considers optical communications technology, viewed the technology as incompatible with its goals for flow cytometry.

Petitioner’s motivation to combine and reasonable expectation of success analysis is limited to just a handful of pages and does not engage with any limitations

of the independent claims. Rather than offering detailed evidence, Petitioner relies solely on its expert's conclusory assertions that a person of ordinary skill in the art (POSA) would spot flaws in Chandler's or Oostman's disclosures and would look to entirely replace their detection subsystems with a subsystem used in optical communications, supposedly leading to the inventions claimed in the '106 patent. But Petitioner fails to provide any explanation of why, during the decade between the publication of its primary references and the '106 patent's priority date, no one actually combined the references in this way. That is because the purported deficiencies in Chandler or Oostman were all in fact *benefits* over prior art flow cytometers, and so a POSA would not have understood that Petitioner's proposed combinations would have resulted in an improved system. Petitioner's conclusory statements fall far short of establishing a motivation to combine the references. Because Petitioner's obviousness analysis is deficient at every level, it cannot justify institution of *inter partes* review on any claim.

Petitioner's has also failed to demonstrate a reasonable likelihood of invalidity under § 112. Petitioner does not demonstrate that the claims lack written description support for "curved mirror" for the same reasons its priority analysis fails. Nor does Petitioner demonstrate that the claims lack enablement or written description support

for “semiconductor detector” with respect to carbon nanotubes. Instead, Petitioner relies on fundamental misunderstandings of fact and law.

Institution of *inter partes* review of all challenged claims of the ’106 patent should be denied.

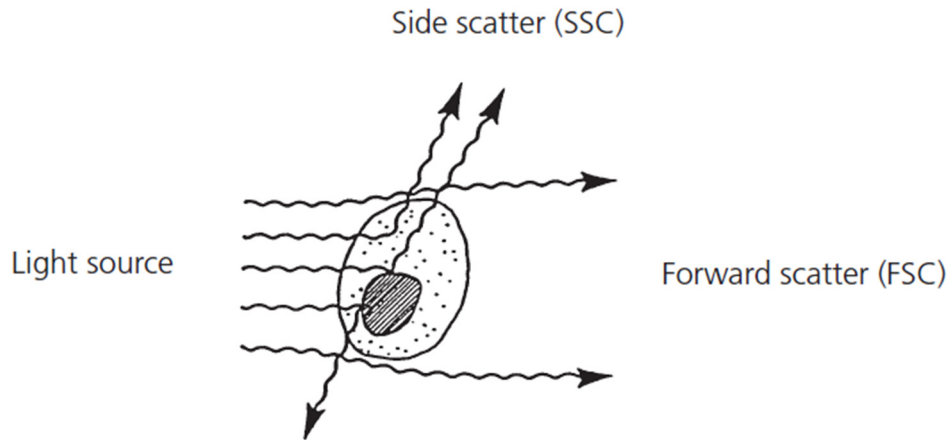
II. Technology Background

A. Basics of Flow Cytometers

In a flow cytometer, cells move in single file through a flow channel where they are illuminated by light, typically from a laser. EX1004 at 10, 17. When the light interacts with the cell, the light will scatter in multiple directions. *Id.* at 19-20; EX2023 at 100-01. Flow cytometers collect and analyze this light to measure multiple parameters of the cells. EX1001, 1:46-52. Flow cytometers perform this analysis on thousands of cells per second. *Id.* Flow cytometry has numerous uses in research and medicine, including cell sorting, rare cell detection, and diagnostics. *Id.*; EX1004 at 10; EX2028, ¶26.

1. Scattered Light Detection

Flow cytometers typically measure light scattered from the cells in two directions: forward (along the direction of the laser beam) and around 90 degrees to the side (side scatter), shown below.



EX2023 at 100. Light scattered in the forward direction provides information on how large the cell is: larger cells produce wider scattering. EX2028, ¶27. Light scattered in the forward direction is typically stronger in signal than side scattered light and can be detected by a forward scatter detector. EX2023 at 100; EX2028, ¶27.

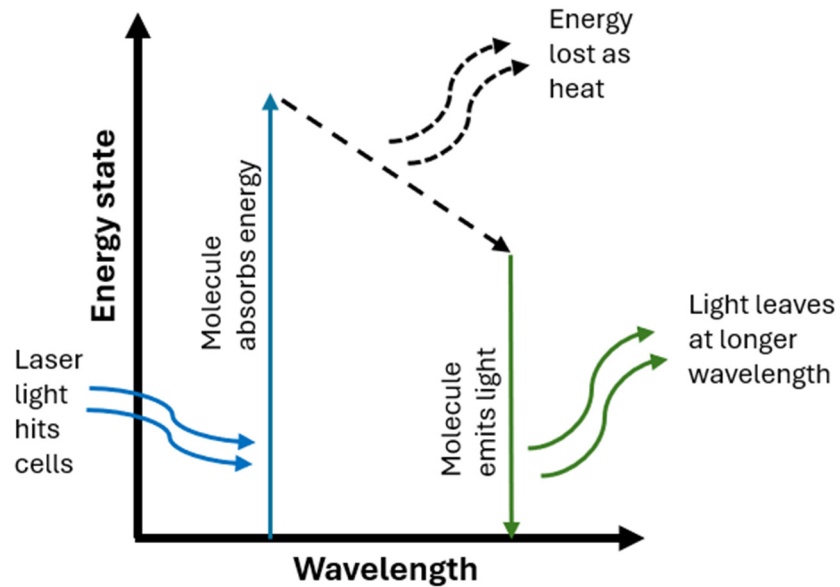
Light scattered in the side direction is used to measure and identify cells by their shape and internal structure and is both weaker and physically more spread out in all directions than forward scattered light. See EX2023 at 100; EX2028, ¶28. To capture as much of this scattered light as possible, flow cytometers use optical components having large openings to collect light (termed “apertures”). EX1004 at 19-20. These types of optical components produce a light beam with a wide diameter and high divergence. The combination of the aperture size and divergence angles is often referred to as “étendue,” and flow cytometer optical systems typically require

the étendue to be large to collect scattered light. EX1001, 45:10-23; *see also* EX2028, ¶28. Side scattered light typically has a significantly lower signal than forward scattered light, and fluorescent light has an even lower signal than side scattered light. *See* EX1004 at 23-24; EX2028, ¶29.

2. Fluorescence Detection

In addition to forward and side scattering measurements, some flow cytometers also use fluorescent light to detect additional properties of the cells. EX1004 at 10; EX1007 at 33; EX2028, ¶30.

When using fluorescence in flow cytometry, cells are labeled with molecules called fluorophores, which are typically attached to antibodies specific for certain cell surface proteins. EX1004 at 10; EX1007 at 33. Atoms or molecules in these fluorophores absorb light at specific wavelengths, at which point they become “excited” and momentarily move to a higher energy level. EX2028, ¶31. When these atoms or molecules fall back to their original state, they can emit light of a lower energy (i.e., longer wavelength) than the light they initially absorbed. *Id.*



EX2028, ¶31 (adapted from EX1007 at 103). This emitted light, which varies in wavelength¹ depending on the fluorophore, is then analyzed by the flow cytometer using detectors. EX2028, ¶31.

Since fluorescent light is collected from individual cells as part of the side scattered light and is thus similarly weak and diffuse, prior to the '106 patent, PMTs had been the detector typically used for fluorescent light detection in flow cytometers. EX1004 at 23-24; EX1007 at 154; EX2028, ¶¶32-35.

¹ Fluorophores used in flow cytometry emit various wavelengths across the visible spectrum. EX1007, 68; EX1001, 57:64-66; EX2028, ¶31 n.1.

B. Basics of Optical Communications Detection

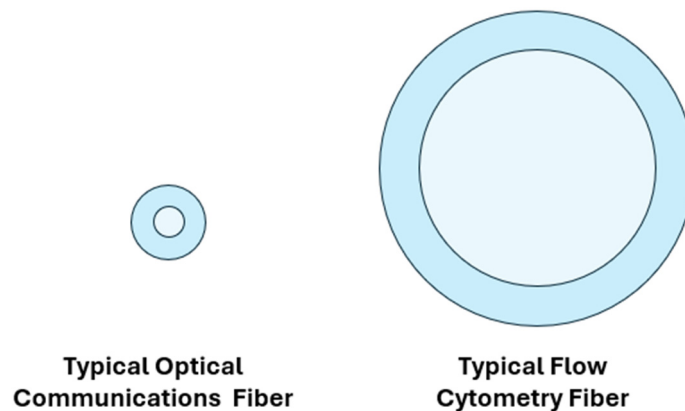
Optical communications refers to the transmission of information—such as with internet traffic and voice or video communication—through optical fibers using light as the carrier signal. EX2036 at 1073. Telecommunications systems increase data transmission capacity by encoding different signals in different wavelengths of light. EX2036 at 1104-05; EX2039 at 50-51. This involves combining (or multiplexing) light from multiple lasers at various wavelengths into one narrow light beam at the signal source and transmitting the combined/multiplexed light signals through an optical fiber. EX2036 at 1104-05. At the destination, a device then separates out (or demultiplexes) the light signals from those lasers according to wavelength. *Id.*; EX2028, ¶36.

C. Flow Cytometry Fluorescence Detection and Optical Communications Signal Detection Have Multiple Key Differences

In optical communications, light in a small range of wavelengths is transmitted directly from a laser into a fiber. *See* EX2035 at 850, 861. But in flow cytometry fluorescence detection, as discussed above in Section II.A, the collected light is scattered from cells, resulting in a wide cone of weak light (i.e., high étendue). Prior to the '106 patent, it was understood that these fundamental differences result in many design differences between flow cytometers and optical communications systems. EX2028, ¶37.

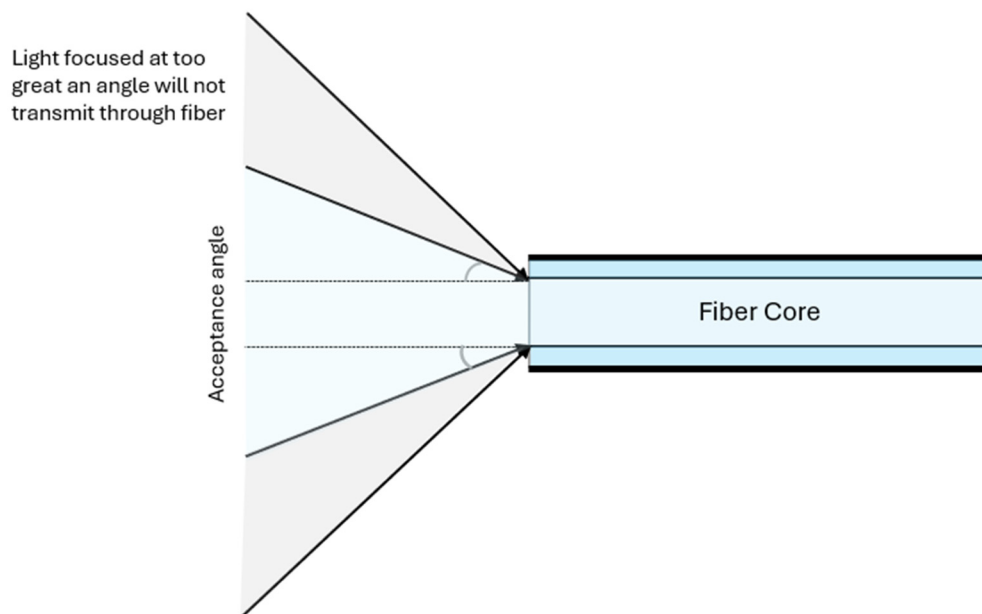
1. Different Optical Fibers

Flow cytometers typically use optical fibers with much greater core diameters than the fibers used in optical communications systems. *See, e.g.*, EX1007 at 148-49; EX2036 at 1076. Optical communications systems use fibers with core diameters ranging from less than 10 microns to around 50 or 62.5 microns. EX2035 at 851-53; EX2036 at 1076. In contrast, to collect the wide cone of light scattered from cells, flow cytometers typically use optical fibers with large numerical apertures having core diameters at least *ten times larger* than those in optical communications. *See* EX1007 at 148-49 (discussing how “[l]ight collection is limited by the N.A. of the fiber or waveguide” and discussing numerical apertures above 0.4).



EX2028, ¶38.

Fibers from optical communications were not treated as interchangeable with fibers in flow cytometry. EX2028, ¶¶39-40. For example, if light collected in flow cytometry was used with a typical optical communications fiber, the light beam would either (1) be too wide to enter the narrow fiber opening, or (2) have to be focused at such extreme angles that the light would be rejected from the fiber. *Id.* This latter limitation can be understood as an acceptance angle:



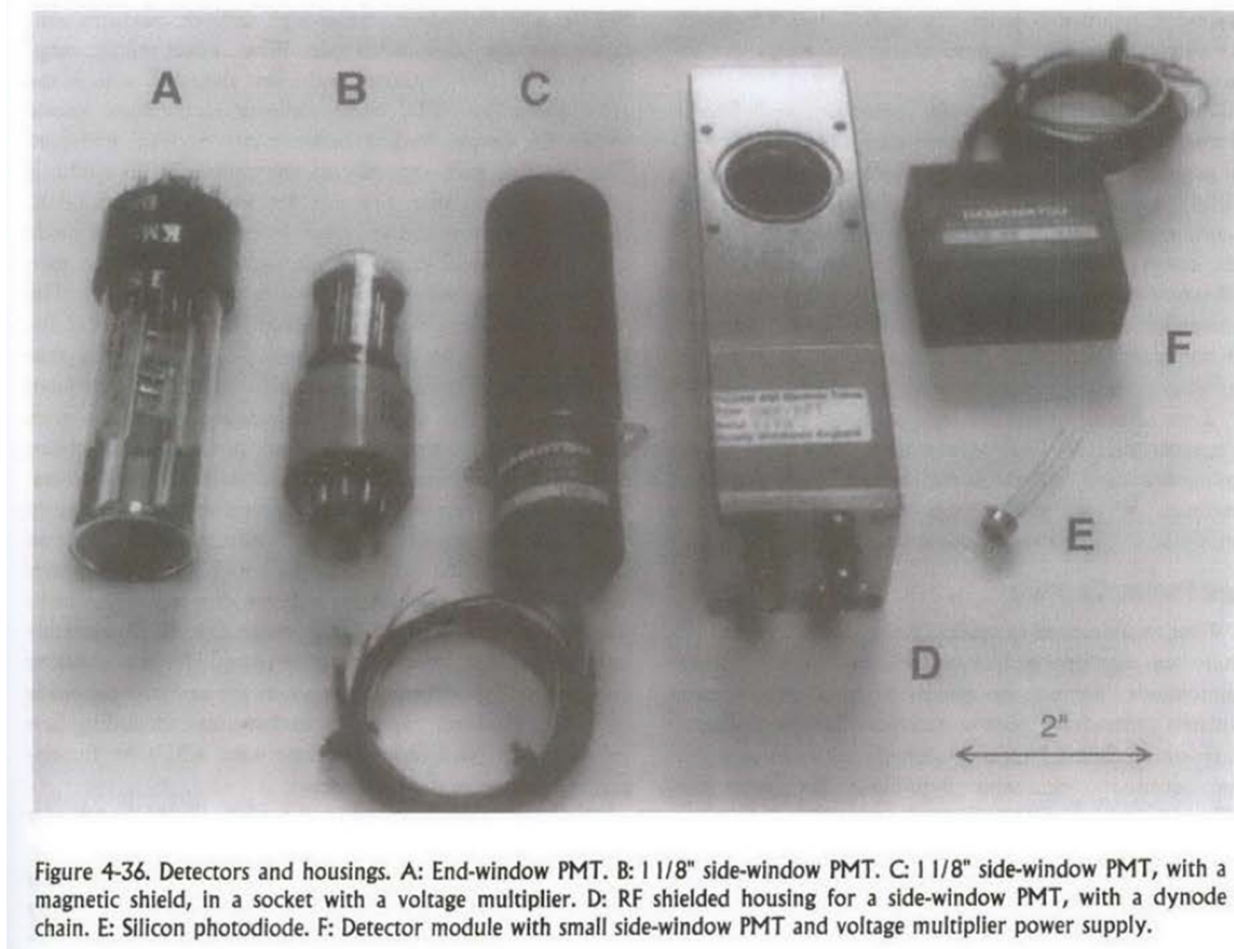
EX2028, ¶¶39-40 (adapted from EX2036 at 16); EX2037 at 282-83; EX2038 at 135-36.

2. Different Detectors

Semiconductor detectors for detecting light are photodetectors that use semiconductor materials to convert light into an electrical signal. EX2028, ¶41;

EX2039 at 157-60. When light hits the semiconductor material, photons are absorbed, creating a current or voltage proportional to the light intensity. *Id.* The output signal can then be processed for measurement. *Id.* Optical communication devices “almost exclusively” use diodes, either photodiodes or avalanche photodiodes (APDs) depending on the application, which are both types of semiconductor detectors. EX2039 at 173. Both photodiodes and APDs “provide very good responsivity in the wavelengths used in fiber optics.” EX2039 at 173; EX2028, ¶42.

Before the inventions described in the '106 patent, flow cytometers historically used PMTs for fluorescence detection. PMTs are not semiconductor detectors but instead make use of a vacuum tube. EX2028, ¶43. Specifically, they use the photoelectric effect, whereby photons strike a photocathode releasing electrons, which are then multiplied inside the tube. *Id.* If used in flow cytometers, photodiodes were primarily used for measuring the comparatively stronger forward scattered light. *Id.*



EX1007 at 154 (showing relative sizes of PMTs (Figure 4-36 A-C) and photodiodes (Figure 4-36 E)); EX2028, ¶43.

Compared to signals in optical communications, the fluorescence intensity in flow cytometry can be over 1,000,000 times weaker.² PMTs are bulky, fragile, and expensive, but they can amplify signals from low light conditions with excellent noise characteristics while also being tolerant of wide, diffuse light beams with their large active areas. *See* EX1004 at 24 (“Photomultipliers are photosensitive electron tubes with a more restricted spectral response [than diodes], but with high gain and good signal-to-noise characteristics suitable for the detection of weak

² Optical communications networks measure signal in decibel-milliwatts, a logarithmic scale proportional to milliwatts. EX2039 at 23-24. Optical communications signals typically range in milliwatts or microwatts. *Id.* Dr. Schaafsma explains how this correlates to *trillions* of photons per second or more. EX2028, ¶44. In contrast, in flow cytometry fluorescent light detection, only “*hundreds* of photons are likely to be emitted from each fluorescent molecule in or on a cell during the cell’s traverse of an illuminating beam at a wavelength at or near the molecule’s excitation maximum.” EX2029 at 283 (all emphasis added unless otherwise stated). Indeed, “even the most efficient fluorescence collection optics collect no more than about 20% of the total emission from cells,” meaning many such photons will not even reach the detector. *Id.*; EX2028, ¶44.

fluorescence.”); EX1007 at 152-153. In contrast to PMTs, an APD with equivalent size active area would produce a high amount of background noise. *See* EX1001, 44:14-20. Thus, before the inventions of the ’106 patent, the large diverging beam (i.e., high étendue) prevented the use of APDs and other small area detectors in flow cytometry. *See* EX1001, 44:47-53, 45:10-23. Prior art flow cytometers did not have mechanisms that enabled maintaining the beam diameter and focusing it down to sufficiently small spot sizes. *Id.* at 44:34-45:23. Thus, PMTs had been the detector of choice for fluorescence detection in flow cytometry for decades. *See id.* at 44:6-33; EX2028, ¶¶45-50.

III. Level of Ordinary Skill in the Art

For purposes of this POPR, Patent Owner does not currently dispute Petitioner’s proposed definition of a POSA. Pet. at 14; EX1002, ¶14. If a trial is instituted, Patent Owner reserves the right to submit a different definition than proposed by Petitioner. EX2028, ¶¶23-25.

IV. Claim Construction

The district court held two claim construction hearings, one of which was after the petition was filed. EX1103; EX2013. The Court construed the ’106 patent claim terms as follows:

Term	'106 Patent Claim	Construction
“first dichroic filter” and “second dichroic filter”	Claim 1	Plain and ordinary meaning. EX2013, 5:21-22.
“first curved mirror” and “second curved mirror”	Claim 1	First curved mirror and second curved mirror are in sequence. EX2013, 27:3-12.
“portion of the”	Claims 1	“subset of the spectrum of the wavelength of the.” EX2013, 92:21-24.

The Court declined to construe “collecting optical element” in claims 1, 2, 13 of the ’106 patent and “collimating optical element” in claims 1 and 13 as moot. *Id.* at 199:6-204:3.³ The Court did not construe any other claim limitations, and no further

³ Petitioner states that the Court indicated both terms were means-plus-function, Pet. at 34-35, 41, but the Court confirmed that its means-plus function construction was only applicable to “optical element” as used in U.S. Patent No. 11,703,443. *See* EX2013, 39:17-41:7.

claim limitations in the '106 patent are before the Court at this time. EX2028, ¶¶51-52.

V. Overview of the Asserted References

A. Goodman

U.S. Patent No. 6,542,306 (“Goodman”—EX1016) is a patent arising from an application filed on March 16, 2001. Goodman solely describes components for optical communications systems. EX1016, 2:7-14, 3:47-50. It describes an alternative light detection system for optical communications, primarily for use in “wide wavelength division multiplexing (WWDM) systems.” EX1016, 5:41-47. “WWDM” was not an industry-defined term by the time Goodman issued in 2004, but from the description in Goodman (wavelengths centered at 1310 nm and spaced 25 nm apart), its primary use case was for coarse wavelength division multiplexing (CWDM). EX1016, 2:21-29, EX2032 at 3; EX2028, ¶53.

Goodman describes demultiplexing devices that are “low cost,” “easy to mold and fabricate accurately,” and that could be produced at scale and easily inserted into optical systems ranging from “spacecraft and aircraft applications to closed circuit and cable television systems.” EX1016, 3:47-67, 6:62-64, 2:10-13. Goodman discloses a zig-zag configuration for the path of the light beam travelling through its device:

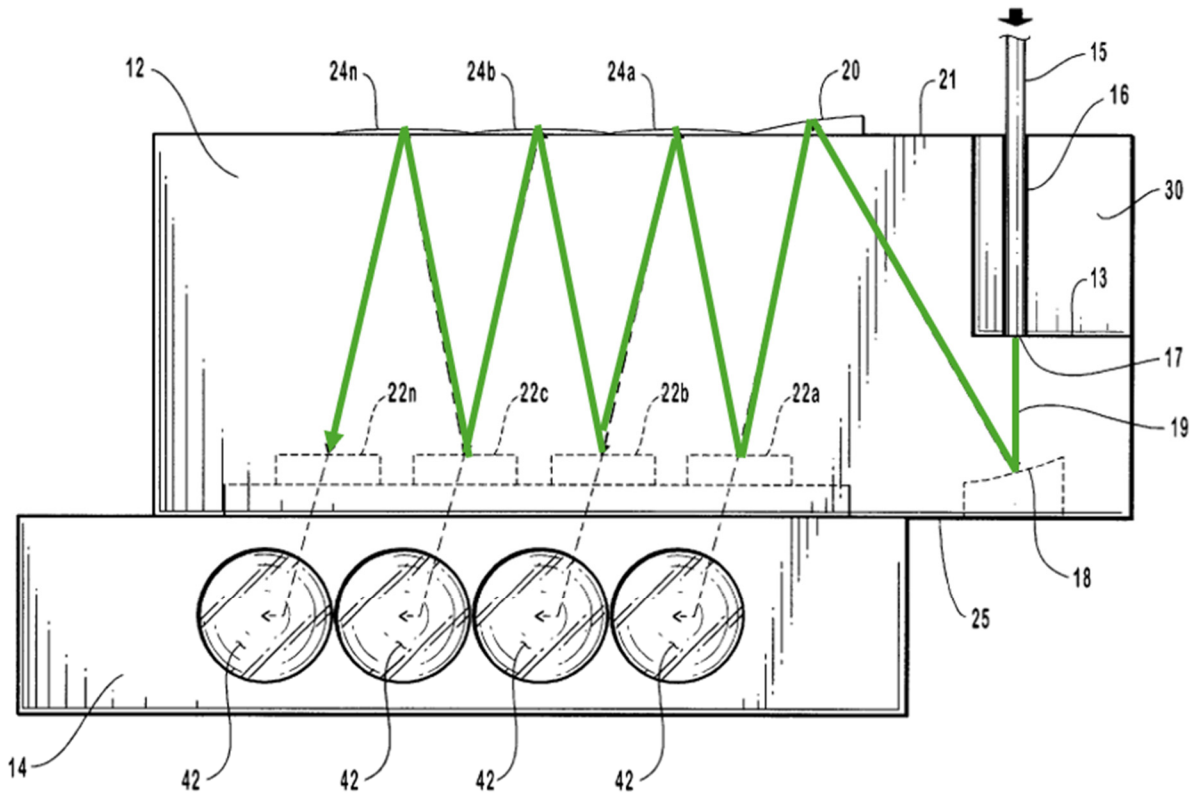


FIG. 1

EX1016 at FIG. 1 (annotated); EX2028, ¶55. Light coming into Goodman’s demultiplexing device from optical fiber 15 contacts two mirrors 18 and 20 before being directed into a series of filters and reflectors. EX1016, 7:17-8:27. Light passing through the filters goes through a beam-directing member, is reflected at a 90-degree angle, and is then focused to detectors outside the demultiplexing device. *Id.* at 11:8-16; EX2028, ¶¶54-55.

Goodman’s optical block and beam-directing member are both preferably “formed of a moldable thermoplastic material” so as to “facilitat[e] high volume

production at low cost.” EX1016, 6:60-64. As Goodman’s device is not designed to be customized or adjusted after its manufacture, its filters are “affixed therein such as by an optical adhesive.” *Id.* at 8:44-47; EX2028, ¶56.

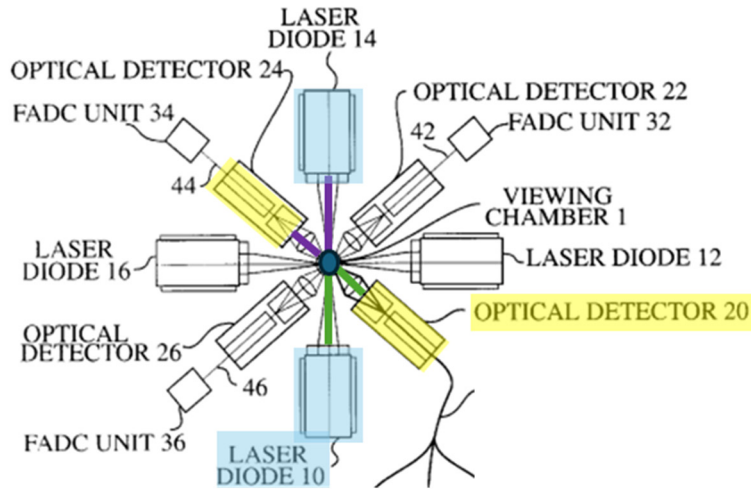
B. Chandler

U.S. Patent No. 6,139,800 (“Chandler”—EX1051) is a patent arising from an application filed by Luminex Corporation on June 22, 1998, and is directed to a particle analyzer used to measure multiple fluorescence wavelengths. In particular, the device detects fluorescent microspheres or particles coated with tags that bind to molecules of interest to be detected in a sample fluid (e.g., antigens, antibodies, cell receptors). EX1051, 2:1-10, 3:38-65, 9:5-10, 10:1-5; EX2028, ¶57.

Chandler’s particle analyzer is intended to address specific limitations to fluorescence detection in conventional flow cytometers. Specifically, the number of fluorescent labels that could be simultaneously measured with one laser was restricted to two or three dyes due to dye properties and wavelength overlap. EX1051, 2:1-10; *id.* at 2:37-42; *see also id.* at 2:30-32 (“I have determined that the properties of the fluorescent dyes themselves limit this flow cytometric technique to about three different wavelengths.”). This limited the analysis that could have been done on any one sample, and required multiple runs for meaningful analysis, which in turn required a larger quantity of the sample. *Id.* at 2:42-51. The prior art

addressed this problem by using two lasers of different wavelengths, each focused on a different spot along the flow stream. *Id.* at 2:61-67. But since the measurements are taken at different times and location, it can be impossible to know if measurements are made on the same particle, because even the slightest flow turbulence can mix particles and cause errors. *Id.* at 3:8-17; EX2028, ¶¶58-59.

To address those limitations in fluorescence detection, Chandler proposes a system to enable excitation and detection of multiple fluorescence emissions at substantially the same time. EX1051, 3:38-41. Chandler's system uses multiple lasers (10, 12, 14, 16) of different excitation wavelengths and angled in different directions so that their focal regions are substantially overlapping to ensure that the same particle is excited by all lasers—each laser is positionally paired with an optical detector (20, 22, 24, 26) that detects emissions resulting from excitation by its paired laser. *Id.* at 7:1-34. For example, in the annotated figure below, laser diode 10 is paired with optical detector 20, such that optical detector 20 receives the emissions from the laser diode 10's excitation of the particle (green); whereas laser diode 14 has a different excitation wavelength that is received by optical detector 24 (purple), as depicted below:



Id. at FIG. 4 (annotated); EX2028, ¶60. In one exemplary embodiment, Chandler’s system operates the different lasers sequentially, with each laser turning on and off in turn as each single particle passes through the detection location. EX1051, 10:16-20; EX2028, ¶61.

The optical detector gathers emissions from the particles in the flow cell and “transmit[s] them a respective multi-mode fiber optic cable” that splits and directs each beam through multiple different band-pass filters in a filtering, amplification, and digital conversion (FADC) unit. EX1051, 7:10-54.

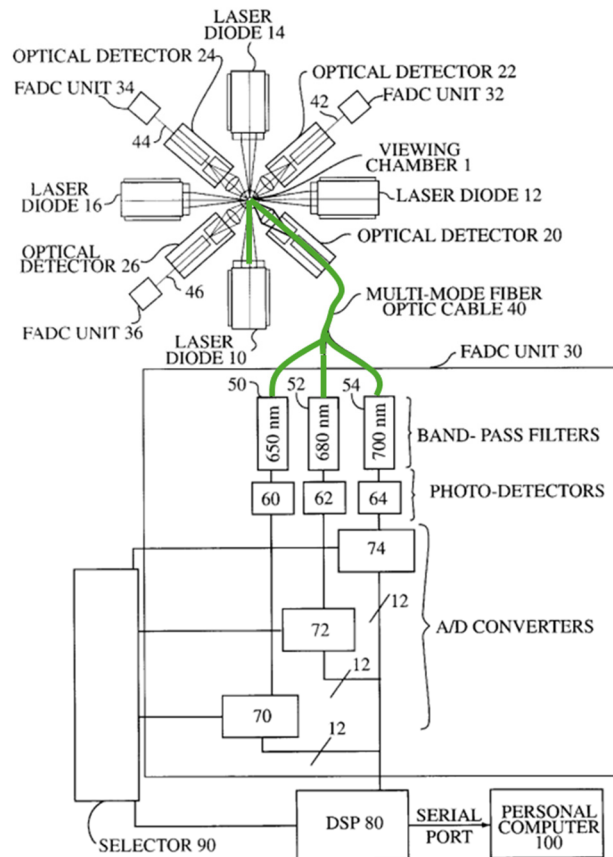


FIG. 4

Id. at FIG. 4 (annotated to show the light path from one laser to an FADC unit); EX2028, ¶62. The band-pass filters isolate the specific wavelengths corresponding to each dye, and the signals are detected, amplified, digitized, and processed. EX1051, 8:6-50. This way, multiple wavelengths in each FADC unit can be detected. *Id.* at 7:24-34; EX2028, ¶63.

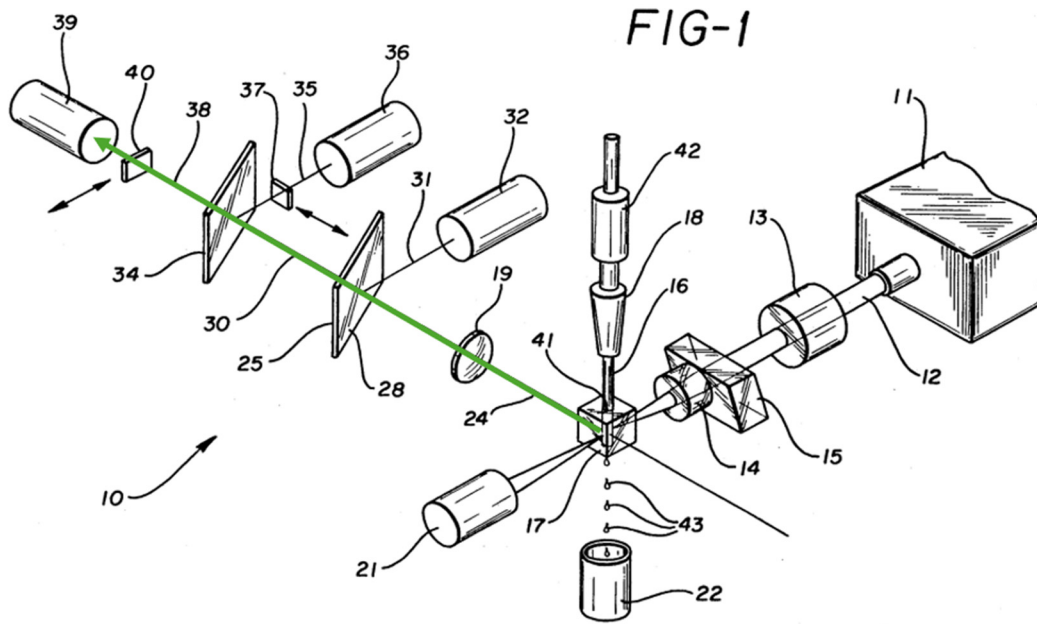
Chandler explains that its approach of using multi-mode optical fiber cables to split the beam is better than using beam splitters or other components to spectrally separate bands. EX1051, 11:38-50 (“The beam splitter approach, however,

generally increases the size and manufacturing complexity, in contrast to the simpler and/or more compact and/or less expensive optical detector/multi-mode fiber optic cable approach.”); EX2028, ¶64. Chandler’s system utilizing microspheres operates at higher fluorescence levels than continuous flow cytometers such as Oostman (discussed below). EX2028, ¶58.

C. Oostman

U.S. Patent No. 6,683,314 (“Oostman”—EX1005) is a patent arising from an application filed on August 28, 2001, and is directed to fluorescence detection instruments (e.g., in a flow cytometer) capable of separating more fluorescent colors over smaller areas than prior art flow cytometers. EX1005, 4:10-13, 4:65-5:2; EX2028, ¶65.

Oostman discloses two primary improvements over prior art flow cytometers. EX1005, 3:44-57, 4:14-16, 6:40-7:36, 8:18-9:3. The first improvement is changing the path of the fluorescent light: in the prior art, light from a flow cytometer would go along one straight optical path, and planar beam splitters would reflect certain wavelengths of light to detectors. *Id.* at 1:54-2:16. The optical path of light in the prior art to Oostman is annotated in green below:



EX1005 at FIG. 1 (annotated); EX2028, ¶66. Light passing through beam splitters has loss from absorption compared to light reflected, so the signal attenuates as it passes through each beam splitter. See EX1005, 3:29-34, 4:16-24. Oostman flips this strategy, so that light transmitted through each beam splitter would go straight to a detector, and light would repeatedly be reflected across planar beam splitters in a zig-zag pattern:

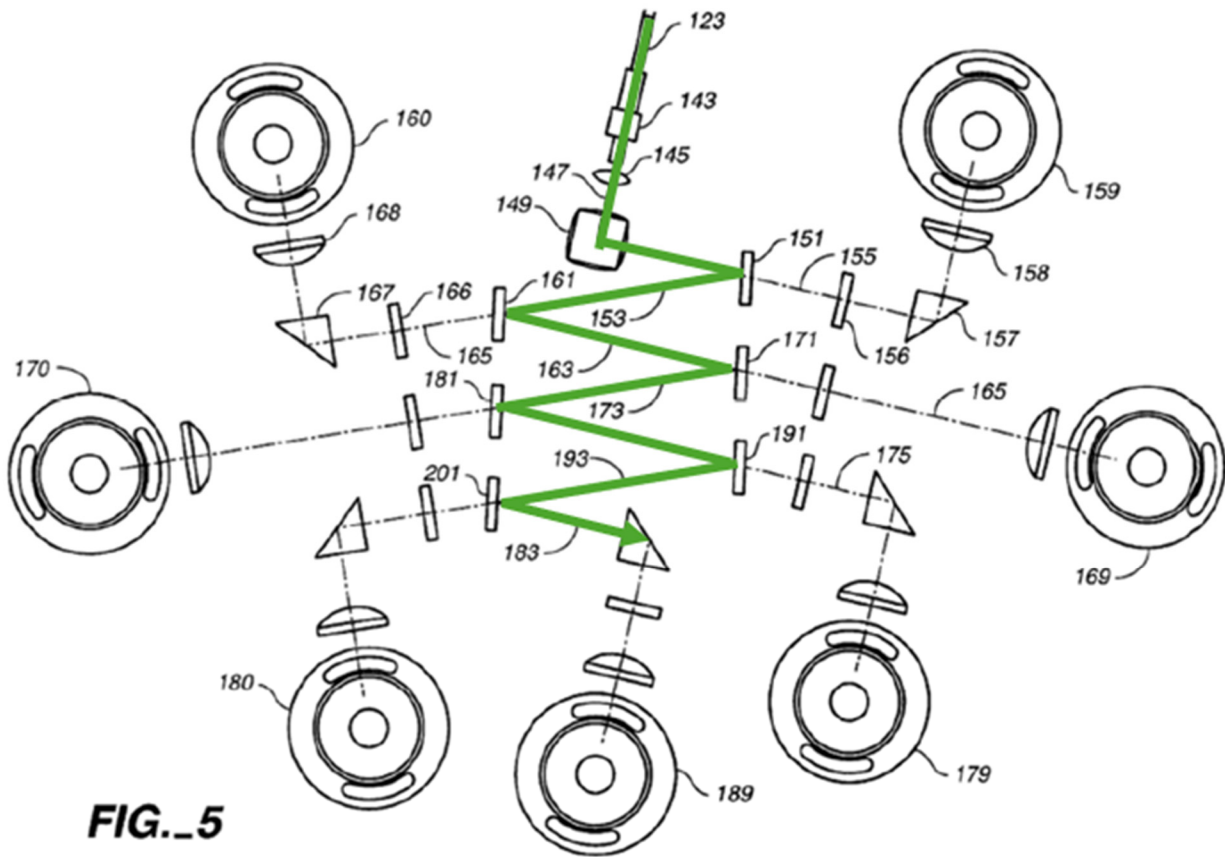


FIG. 5

EX1005 at FIG. 5 (annotated); *id.* at 3:44-57, 6:40-7:34; EX2028, ¶66.

Oostman’s second improvement is developing an alternative optical path and PMT detector arrangement. FIG. 5 of Oostman depicts a zig-zag optical path, but use of PMTs means the overall detector cluster size is still large. *See* EX1005, 7:34-36; EX2028, ¶67. Therefore, Oostman proposes an alternative “star-shaped pattern yielding a more compact polygonal arrangement of detectors.” EX1005, 7:34-36.

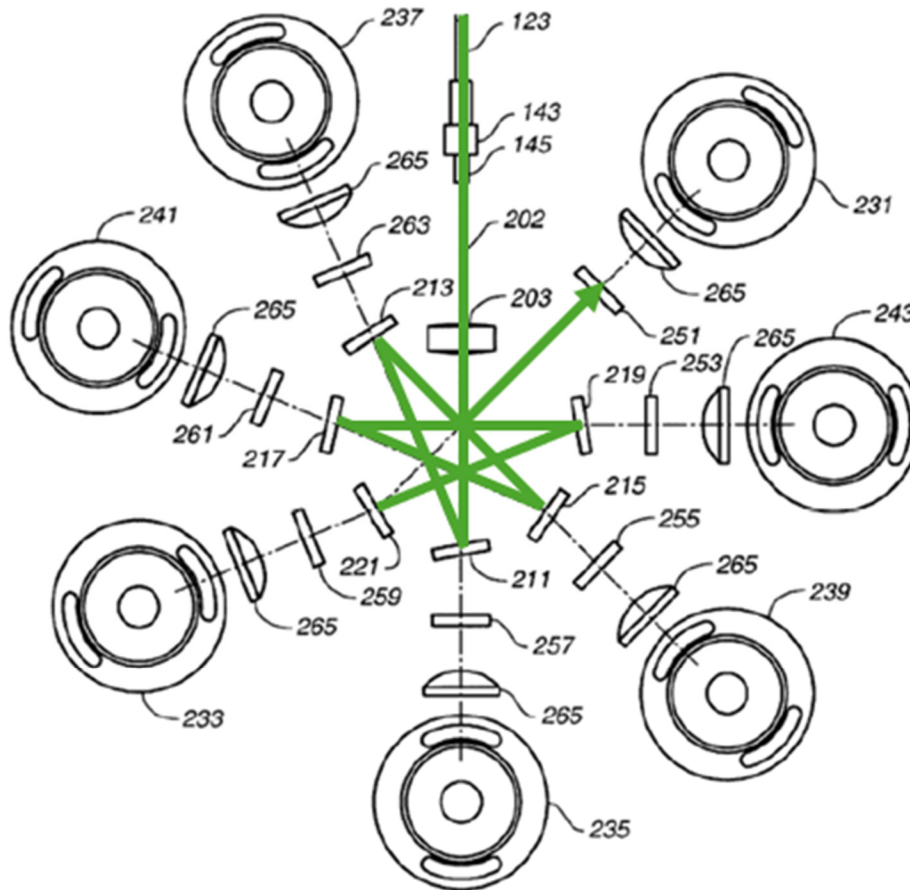


FIG. 6

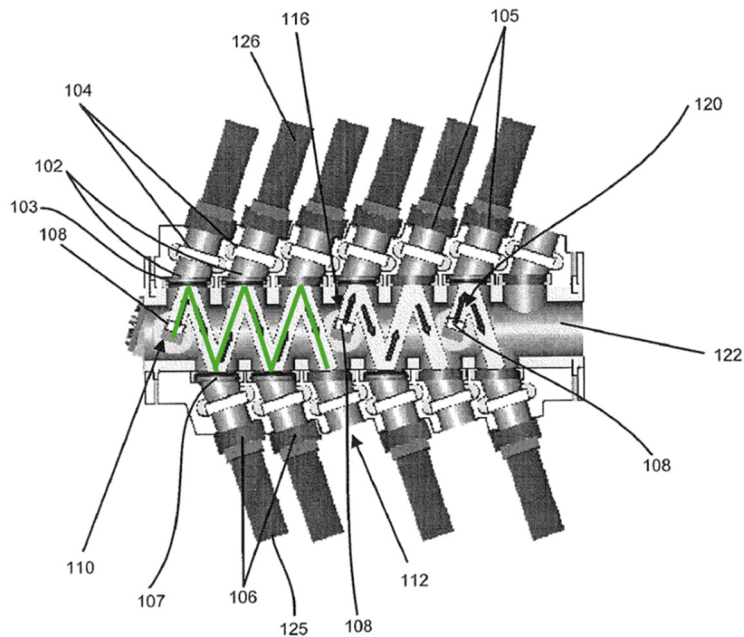
EX1005 at FIG. 6 (annotated); EX2028, ¶67. Oostman emphasizes the ability to add more detector clusters in a modular fashion, remove and replace beam splitters depending on the application, and adjust the clusters to improve light detection for specific applications. EX1005, 4:14-16, 8:18-9:3; EX2028, ¶67.

D. Frazier

U.S. Patent No. 8,284,402 (“Frazier”—EX1009) is a patent directed to fluorescence detection assemblies in flow cytometry using an optical alignment

assembly to introduce an output beam into an array of filters. EX1009 at Abstract; EX2028, ¶68.

In Frazier's detector assembly (100), light beams are introduced through a beam reflecting element such as a prism (108) to a dichroic filter (102), which splits the beam so that a portion of the beam goes through the filter and further through a bandpass filter (104) to isolate a desired band to each detector (e.g., 125, 126) in a detection port (112) for detection, and another portion is reflected to the next dichroic filter which captures a band of different wavelengths, while the remaining bands are reflected onward. EX1009, 4:55-5:11. The below annotation shows the beam as it is reflected through the central boulevard (122) to its final detector.



EX1009, FIG. 1 (annotated); EX2028, ¶70.

Frazier seeks to improve previous detector assemblies by providing assemblies that can be customizable, so that the number of dichroic filters and detectors associated with each light beam can be varied. *Id.* at 2:50-59; EX2028, ¶69.

Frazier discusses a reference from optical communications, U.S. Patent No. 4,244,045 (Nosu) which claimed priority to the 1970s and described a single detector array configuration. EX1009, 2:9-46. Frazier states that using assemblies Nosu would not be beneficial for Frazier's customization goals because Nosu's "prefabricated blocks" were not "customizable to accommodate multiple light beams, each of which may require separation of a different amount of wavelengths." *Id.*; EX2028, ¶71.

VI. Overview of U.S. Patent No. 12,174,106

The '106 patent is titled "Flow Cytometer" and was filed on December 22, 2021. EX1001, Cover; EX2028, ¶72. The '106 patent claims the benefit of applications filed on or after May 2012. *Id.* The '106 patent names Yong Qin Chen as the sole inventor. *Id.*

The '106 patent sought to enhance the performance of flow cytometers while making them more compact and easier to use. EX1001, 2:18-23. The '106 patent describes innovative, compact wavelength division multiplexers ("WDMs") that

permit the use of low noise, millimeter-sized detectors not previously used in flow cytometry, resulting in improved sample analysis and a smaller instrument footprint. *Id.* at 2:29-34, 45:49-46:21; EX2028, ¶73.

Flow cytometer detection systems present different challenges from light detection in other fields. For example, unlike in optical communications, flow cytometers must detect light with a wide range of wavelengths of unknown and uncontrolled signal strength. *See* EX1016, 2:20-64; EX1007 at 67, 151. Furthermore, in flow cytometry, light typically enters a detection system from a large optical fiber which produces a much larger light beam than the laser beam detected in optical communications. EX1001, 45:3-23. This presents challenges in controlling the light beam over an extended distance and focusing the beam onto the detectors, as needed for effective detection. *Id.* at 44:47-67. The '106 patent recognized and overcame these challenges with its innovative WDM designs. EX2028, ¶¶74-75.

VII. Relevant Prosecution History

The '106 patent issued on December 24, 2024 after three years of extensive and thorough prosecution. EX2028, ¶76. One of the references Petitioner relies on in Ground 2, Oostman (EX1005),⁴ was a central focus. EX2028, ¶81.

Specifically, on February 15, 2024, the Examiner rejected the claims as anticipated by Oostman. EX1003 at 262-266. On April 9, 2024, Applicant amended the claims and explained that the focusing elements in Oostman receive the laser beam, not the fluorescent light from the illuminated fluorescent substance, and thus are not configured to collect and focus fluorescent light emitted by a particle illuminated by the light source. *Id.* at 276-283. Applicant also explained that the “curved mirror” limitation was not taught by Oostman because Oostman does not state that its dichroic mirrors are curved, and at most, Oostman depicts each dichroic mirror as having a planar, rather than curved, reflective surface. *Id.* at 284. Additionally, Applicant explained that Oostman does not teach “a first dichroic filter” in addition to a “first curved mirror,” which were required to be distinct components. *Id.* at 284-285.

⁴ The published application (US2003/0048539) of U.S. Patent No. 6,683,314 was relied on during prosecution. *See* EX1003 at 261-266, 305-312, 441-446.

On May 2, 2024, the Examiner rejected the pending claims as obvious over Oostman. *Id.* at 306-312. The Examiner recognized that “Oostman fail[s] to explicitly specify the constructional make-up of the dichroic mirror and/or the elements of the dichroic mirror make-up as being separated instead of integrated as a single unit, and the shape of the filter which made-up the dichroic mirror as being curve[d].” *Id.* at 308; *see also id.* (“Oostman fail[s] to teach the constructional changes in the system the dichroic mirror of the claim(s)...”). However, the Examiner stated, without citing any support from the prior art, that it would have been obvious to vary the design. *Id.* at 308.

On May 21, 2024, in an applicant-initiated telephonic interview, Applicant explained how Oostman differs from the claimed invention, including “the limitation of a wavelength division multiplexer (WDM) configured to separate into color bands the fluorescent light collected by the collecting optical element, the WDM including, a collimating optical element arranged to receive the fluorescent light collected by the collecting optical element, the collimating optical element configured to collimate the fluorescent light, as depicted in drawing fig. 25 is separate from a collecting optical element configured to collect and focus fluorescent light emitted by a particle.” *Id.* at 316. In response, the Examiner agreed that Oostman does not

teach this particular limitation as a separate element, but indicated that a further search would be required. *Id.*

On June 4, 2024, Applicant further amended the claims under the After Final Consideration Pilot Program for AFCP 2.0 to recite “that the fluorescent light leaving the collecting optical element converges.” *Id.* at 321-326, 329. Applicant also amended the claims to recite that the collimating optical element “is separate from the collecting optical element.” *Id.* at 321-326, 330. Applicant explained that Oostman’s objective lens 19 could not be mapped to both the collecting optical element and collimating optical element as separate elements. *Id.* at 329-330.

On June 17, 2024, the Examiner issued an Advisory Action, stating that it would not enter Applicant’s proposed amendments under the Pilot Program. *Id.* at 358-359. On July 18, 2024, Applicant amended the claims in the manner set forth in the previously-presented amendments. *Id.* at 376-385.

On August 9, 2024, on an examiner-initiated interview, the Examiner indicated that they would allow some of the claims but issue a rejection of other claims over Oostman, unless they were amended to recite a “collimating element” in addition to the “collecting optical element.” *Id.* at 403. Subsequently, Applicant agreed to amend the claims per the Examiner’s request and filed proposed claim amendments. *Id.* at 404-411. On August 15, 2024, the Examiner allowed some

claims, but continued to reject others over Oostman. *Id.* at 439-445. On August 20, 2024, the Examiner and Applicant had another interview, where Applicant agreed to amend the claims to make the case allowable. *Id.* at 490. On August 30, 2024, Applicant amended the previously-rejected independent claim to require “a collimating optical element that is separate from the collecting optical element.” *Id.* at 478.

On September 11, 2024, the Examiner allowed the '106 patent claims, explaining:

The closest prior art reference of Oostman, JR. et al. (2003/0048539 A 1) discloses a flow cytometer.

However, Oostman, JR. fail to disclose, teach or suggest a collimating optical element that is separate from the collecting optical element and is arranged to receive the fluorescent light collected by the collecting optical element, the collimating optical element configured to collimate the fluorescent light, as claimed and as specified in the present application specification. This argument is persuasive. Therefore, the rejections are withdrawn.

Id. at 527; EX2028, ¶82.

In addition to Oostman, the Examiner verified that it considered two of Petitioner’s other references, Goodman (Grounds 1 & 2) and Frazier (Ground 2), as well:

PGR2025-00084
 Patent No. 12,174,106
 Patent Owner Preliminary Response

A72	6542306	4/1/03	Goodman
A73	6572255	6/3/03	Husher
A74	6608682	8/19/03	Ortyn et al.
A75	6618143	9/9/03	Roche et al.
A76	6638481	10/28/03	Sklar et al.
A77	6647175	11/11/03	LoRegio et al.
A78	6683314	1/27/04	Oostman Jr. et al.
A79	6713019	3/30/04	Ozasa et al.
A80	6748133	6/9/04	Liu et al.
A81	6767188	7/27/04	Vrano et al.
A82	6768593	7/27/04	Jutamulla
A83	6788409	9/7/04	Goodwin
A84	6794671	9/21/04	Nicoli et al.
A85	6813017	11/2/04	Hoffman et al.
A86	6839367	1/4/05	Nagamatsu et al.
A87	6870679	3/22/05	Randall et al.
A88	6870876	3/22/05	Chen et al.

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A139	8284402	10/9/12	Frazier et al.
A140	8337096	12/25/12	Shen et al.
A141	8345237	1/1/13	Tsukii et al.
A142	8405048	3/26/13	Hayashi
A143	8432541	4/30/13	Rich
A144	8436371	5/7/13	Medendorp Jr., et al.
A145	8436963	5/7/13	Kaduchak et al.
A146	8488244	7/16/13	Li et al.
A147	8507279	8/13/13	Ball et al.
A148	20020081744	06/27/02	Chan et al.
A149	20020067895	06/06/02	Flanders
A150	20020141902	10/3/02	Ozasa et al.
A151	20030142720	7/3/03	Bradburn et al.
A152	20040031521	02/19/04	Vrano et al.
A153	20040218194	11/4/04	Joregenson et al.
A154	2004165828	08/26/04	Capewell et al.

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EXAMINER: /ISIAKA O AKANBI/	DATE CONSIDERED: 02/10/2024
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EX1003 at 231, 234 (annotated); EX2028, ¶79. The Examiner also considered U.S. Patent No. 7,505,131 (“Roth-131”—EX1045), which, like Chandler (Ground 1), was assigned to the Luminex Corporation. EX1003 at 233; EX2028, ¶80.

Accordingly, the ’106 patent issued on December 24, 2025. EX1003 at 565; EX2028, ¶83.

The ’106 patent is also a continuation in a family of patents that has also undergone thorough prosecution, including multiple prior-art rejections by multiple examiners. During prosecution of the ’106 patent’s grandparent application, in addition to considering Oostman, the Examiner also considered U.S. Patent Pub. No. 2004/0165828 (“Capewell”—EX2014), a reference from the optical communications field (like Goodman). EX2015 at 1070-1071. The Examiner combined Oostman’s flow cytometer with Capewell’s optical communications WDM, alleging that the references were “[i]n a similar field of endeavor.” *Id.*

Applicant made no amendments in response, explaining that “the fluorescence detection instrument, as taught by Oostman, and the optical communication system, as taught by Capewell, are actually different kinds of optical systems with different sizes of light sources,” and therefore obviousness was not established. *Id.* at 1107-1109. The Examiner found these arguments “persuasive.” *Id.* at 1132; EX2028, ¶77.

During prosecution of another related patent, the ’582 patent, which shares the same specification as the ’106 patent, the Examiner also rejected the claims based on Oostman. EX2016 at 537-542. Applicant overcame this rejection as well. EX2015 at 599; EX2028, ¶78.

VIII. The PTO Has Already Rejected Petitioner’s Request for Reexamination of Patent Claims in the Same Family Based on the Same 112 and Prior Art Grounds

On October 6, 2025, the PTO issued an order denying Petitioner’s request for *ex parte* reexamination of claims of the ’582 patent. EX2034. The ’582 patent is in the same family as the ’106 patent, claims priority to the same applications and shares the same specification, and is being asserted against Petitioner in the parallel district court litigation. *See* Paper 7 at 3-4.

Like all of the challenged claims of the ’106 patent, the ’582 patent claims require a “curved mirror.” EX2030, cls. 1, 14. Petitioner first argued that the patent claims reciting a “curved mirror” are not entitled to the ’582 patent’s November 26,

2014 filing date. This is the same argument made here as to why PGR is supposedly available for the '106 patent and is Petitioner's basis for Ground 3. *Compare* EX2024 at 26-33 *with* Pet. at 14-23, 79-80; *see also infra* Section IX. The PTO rejected the argument, stating that "curved mirror" "is clearly supported" by the specification. EX2034 at 4. The PTO also rejected multiple proposed substantial new questions of patentability (SNQs) based on Chandler and Goodman (Ground 1 here) and Oostman, Goodman, and Frazier (Ground 2 here). EX2034 at 11-15. The PTO found that Goodman's failure to disclose a "curved mirror" was fatal to all of Petitioner's claims of obviousness. *Id.* at 11-15. The PTO has thus already denied Petitioner's validity challenges involving the same claim limitations and the same references at issue here.

IX. Institution Should Be Denied Because the '106 Patent Is Not PGR-Eligible

The '106 patent claims priority to applications including at least including at least provisional application 61/715,819 filed on October 18, 2012 ("5819 Prov." —EX2043); EX2028, ¶84. The '106 patent was thus examined under the "pre-AIA first to invent provisions." EX1003 at 261. Nonetheless, Petitioner files this proceeding as a PGR under 35 U.S.C. § 321(c) and 37 C.F.R. § 42.202(a).

Petitioner first argues that the '106 patent is PGR-eligible because its priority applications allegedly do not provide support for "curved mirror." Pet. at 14-23.

According to Petitioner, because the priority documents did not use the exact words “curved mirror” and instead teach a “concave mirror,” a POSA would not have understood the inventors to have been in possession of a “curved mirror” as of the filing date of the priority applications. *Id.* at 16-17; EX2028, ¶85. This argument has not only already been rejected by the PTO during Petitioner’s request for *ex parte* reexamination of claims of the ’582 patent (*see supra* Section VIII), it is also contrary to the claim’s plain language when viewed as a whole.

Petitioner attempts to improperly import an *ipsis verbis* requirement for curved mirror. But this is not the law. Instead, the written description requirement is met if a POSA would have understood the inventor to be in possession of the claimed invention at the time of filing, regardless of whether the exact words are presented. *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed. Cir. 1991); *Martin v. Johnson*, 454 F.2d 746, 751 (C.C.P.A. 1972) (“the description need not be in *ipsis verbis* [i.e., “in the same words”] to be sufficient”).

The “curved mirror” limitation in view of the claim language, taken as a whole, and the specification, plainly refers to a concave mirror. A POSA would have understood that the claimed curved mirror must have positive optical power (be able to increase convergence of a beam of light) in order to achieve the stated goals of the inventions. EX2028, ¶¶86-90. The claims expressly require that a curved mirror

is “configured to reflect the portion of the fluorescent light towards the first semiconductor detector” (EX1001, cl. 1), or “configured to sequentially reflect different color bands of the fluorescent light collected by the collecting optical element after the fluorescent light has passed through the collimating optical element” (*id.* at cl. 13). Furthermore, the specification describes that its inventive WDM is for separating light from an extended light source, without expanding the beam diameter, by using an image relay architecture. EX1001, 57:49-59:26. As Petitioner admits, “[b]ecause 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.” Pet. at 20. Independent claims 1 and 13 recite a “collimating optical element” and curved mirrors that receive fluorescent light after it has passed through the collimating optical element. EX1001, cls. 1, 13. Thus, a POSA would have understood that reference to a concave mirror in the specification is a reference to a mirror that has a curvature to it and has positive optical power to achieve these functions. *Id.* Thus, a POSA would necessarily understand that the “curved mirror” as recited in the ’106 patent claims is a mirror with positive optical power – the concave mirror as described in the specification – in order for the light to travel through the WDM as claimed. EX2028, ¶¶88-89.

A “curved mirror” is supported by the ’106 patent and its priority applications, including at least the ’5819 provisional filed in 2012. The table below shows, for example, that nearly identical language in the ’106 patent specification appears in the ’5819 provisional application:

EX1001 (’106 patent)	EX2043 (’5819 provisional)
“In one embodiment of a WDM, the first optical element is a lens and the second element is a concave mirror, although it is apparent to those skilled in the art that other types of refractive and/or reflective optical components may also be used to achieve the same design goal.” EX1001, 5:1-5.	“In one exemplary embodiment of the present invention, the said first optical element is a lens and the said second element is a concave mirror, although it is apparent to those skilled in the art that other types of refractive and/or reflective optical components may also be used to achieve the same design goal.” EX2043 at [0008].

Compare also EX1001, FIG. 25 *with* EX2043, FIG. 1; EX2028, ¶¶91-92.

Petitioner’s claim differentiation argument (Pet. at 21) that the ’443 patent recites curved mirror in an independent claim and concave mirror in a dependent claim fails on its face and as a matter of law. EX2028, ¶93. Specifically, the ’443 patent claims are not instructive here because it is a *child* application, not in the ’106

patent's priority chain. Contrary to Petitioner's argument, the doctrine of claim differentiation is "not as strong across related patents as it would be if the different claim limitations appeared in the same patent." *Clare v. Chrysler Group LLC*, 819 F.3d 1323, 1330 (Fed. Cir. 2016). Furthermore, claim 6 of the '443 patent recites additional limitations that narrow independent claim 1's filter to include at least one dichroic filter so it is not necessarily the case that the doctrine of claim differentiation dictates that curved mirror must include convex mirrors. Pet. at 20-21; *see also Apple, Inc. v. Ameranth, Inc.* 842 F.3d 1229, 1238 (Fed. Cir. 2016) ("This court has declined to apply the doctrine of claim differentiation where "the claims are not otherwise identical in scope."). Regardless, even if claim differentiation were applicable, this doctrine is not sufficiently strong to overcome clear teachings from specification and claims. *See Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1332 (Fed. Cir. 2009) (claim differentiation is only "a rule of thumb that does not trump the clear import of the specification") (citation omitted); *World Class Tech. Corp. v. Ormco Corp.*, 769 F.3d 1120, 1126 (Fed. Cir. 2014) ("[C]laim drafting often involves finding different expressions to define the same invention.... [E]ven the presumption of different claim scope is overcome by a contrary construction dictated by the written description.... *A fortiori*, we will not draw [the proposed] inference from claim 6 here, where the inference is not even needed to maintain different claim

scope.”) (citation omitted); *Netcraft Corp. v. eBay, Inc.*, 549 F.3d 1394, 1400 n.1 (Fed. Cir. 2008).

Petitioner’s discussion of a European counterpart to the ’443 patent (not the ’106 patent) that received rejections under European patent law for curved mirror (Pet. at 21) has no bearing here either. Federal Circuit precedent is clear that European patent prosecution is not relevant to USPTO examination. *AIA Eng’g v. Magotteaux Int’l*, 657 F.3d 1264, 1279 (Fed. Cir. 2011) (declining to consider foreign applications because “theories and laws of patentability vary from country to country, as do examination practices”). Moreover, the claims that were rejected by the European Patent Office differed significantly than the claims here; namely, they did not require that the curved mirror be “configured to reflect the portion of the fluorescent light towards the first semiconductor detector” (EX1001, cl. 1), or “configured to sequentially reflect different color bands of the fluorescent light collected by the collecting optical element after the fluorescent light has passed through the collimating optical element” (*id.* at cl. 13). EX1076 at 056.

Petitioner’s second argument for PGR-eligibility—that there is no support for “semiconductor detector” (Pet. at 23)—is also unfounded. This limitation is supported by the ’106 patent and its priority applications, including at least the ’5819 provisional filed in 2012. The table below shows, for example, that nearly identical

language in the '106 patent specification appears in the '5819 provisional application:

EX1001 ('106 patent)	EX2043 ('5819 provisional)
“In particular, multiple colored bands present in the beam of light can be separated using dichroic filters located among the optical path with the separated light being tightly focused into small spots compatible with low noise semiconductor photodetectors.” EX1001, 4:62-67.	“In particular, multiple colored bands can be separated using dichroic filters along the optical path and tightly focused into small spots compatible with low noise semiconductor detectors.” EX2043 at [0007].

Compare also EX1001, FIG. 25 *with* EX2043, FIG. 1; EX2028, ¶¶94-95. Petitioner’s written description arguments on “semiconductor detector” incorporated from Ground 5 all fail for the reasons explained below in Section X.B.

Thus, because the '106 patent is not available for PGR review, this proceeding should not be instituted.

X. Institution Should Be Denied Because Petitioner Has Failed to Demonstrate a Reasonable Likelihood that the Challenged Claims Are Obvious or Invalid Under § 112

The Petition fails to establish a reasonable likelihood that the Petitioner will prevail on at least one of the challenged claims. Petitioner fails to show the claims are invalid for at least three reasons. *First*, Petitioner has failed to show that the references cited in either Ground of the Petition disclose or render obvious a WDM for a flow cytometer as required by all claims. *Second*, Petitioner has failed to show that a POSA would view Goodman as analogous art to the claimed inventions or would combine Goodman and Chandler/Oostman, and instead asserts motivations for combining the prior art references that are based on hindsight and ignore the disclosures of the references themselves. *Third*, Petitioner fails to demonstrate a reasonable expectation of success in combining these disparate references. *Fourth*, Petitioner fails to show a lack of written description or enablement. EX2028, ¶96.

A. The Petition Fails To Demonstrate Obviousness of the Challenged Claims (Grounds 1 & 2)

1. No Ground Discloses All of the Challenged Claim Limitations

i. Petitioner Fails to Demonstrate that Chandler and Goodman Disclose “a wavelength division multiplexer (WDM)” for “[a] flow cytometer” (Ground 1)

All of the challenged claims require a “wavelength division multiplexer” for use in “a flow cytometer.” See EX1001, cls. 13, 14, 17; EX2028, ¶97. Petitioner

relies on Chandler's FADC unit as purportedly disclosing a WDM (Pet. at 39-40), but based on Petitioner's own characterization, Chandler actually teaches away from using a WDM. Petitioner states, "A POSA would have known that a 'wavelength division [de]multiplexer' or 'WDM' refers to the optical components that demultiplex light into [] color bands. [] WDMs accomplish spectral separation through the use of filters, mirrors, and lenses to separate light into color bands and focus those color bands into photodetectors." *Id.* at 7-8; EX2028, ¶98. By contrast, Chandler's FADC units split a beam of fluorescent light into three separate fibers and directs the light in each fiber through a *different* wavelength-specific bandpass filter. For example, rather than directing all light having a wavelength of 650 nm to the 650 nm band-pass filter, Chandler's system splits all wavelengths of light into three separate fibers and then passes each beam through one of three different bandpass filters, EX1051, 7:35-54, which divides the signal for each channel in the FADC. EX2028, ¶¶61-62, 98. Chandler teaches that its approach is sufficient and preferable for its system. EX1051, 11:38-50. In fact, Chandler acknowledges but teaches against using a "beam splitter approach" (i.e., a WDM as characterized by Petitioner) because it "generally increases the size and manufacturing complexity, in contrast to the simpler and/or more compact and/or less expensive optical

detector/multi-mode fiber optic cable approach.” EX1051, 11:38-50; EX2028, ¶¶99-100. Thus, Petitioner fails to show that Chandler discloses a WDM.

Petitioner proposes incorporating Goodman’s demultiplexing configuration into Chandler’s system by “replac[ing] the branched configuration from Chandler’s FADC unit(s)” to render obvious a “WDM” for a “flow cytometer.” Pet. at 39-40. As explained in detail below, a POSA would not have been motivated to replace the fluorescence detectors from Chandler with Goodman’s demultiplexing device because of the fundamental differences between detecting light for optical communications and detecting scattered fluorescent light in a particle analyzer. *See infra* Section X.A.2, X.A.3, X.A.4; EX2028, ¶¶101-103, 106-160. Petitioner also fails to recognize that a POSA would neither view Goodman as analogous art to the claimed inventions nor combine Goodman and Chandler. *See infra* Section X.A.3; EX2028, ¶¶128-132. Petitioner’s motivations for combining the prior art references are based on hindsight and ignore the disclosures of the references themselves. EX2028, ¶103.

Petitioner’s combination thus fails to disclose or render obvious a WDM for a flow cytometer. EX2028, ¶¶97-103. Institution should therefore be denied. *See, e.g., Liberty Energy Inc. v. U.S. Well Services, LLC*, IPR2025-00066, Paper 10 at 19 (PTAB Apr. 29, 2025) (denying institution because Petitioner failed to establish why

a POSA would have combined prior art references that use their components for “different types of devices” and “are designed for different purposes”); *R.J. Reynolds Vapor Co. v. Philip Morris Prods. S.A.*, IPR2021-00826, Paper 11 at 15 (PTAB Nov. 9, 2021) (“Petitioner’s rationale for combining Alarcon and Rabin does not account adequately for these fundamental differences between Alarcon’s electronic cigarette and Rabin’s capillary force vaporizer.”).

ii. *Petitioner Fails to Demonstrate that Oostman, Goodman, and Frazier Disclose “a wavelength division multiplexer (WDM)” for “[a] flow cytometer” (Ground 2)*

To argue that a “wavelength division multiplexer” for use in “a flow cytometer” is disclosed in Oostman with Goodman and Frazier (Ground 2), Petitioner’s combination proposes incorporating Goodman’s demultiplexing device into Oostman’s flow cytometer. Pet. at 60-61. This combination ignores that a POSA would not have been motivated to replace the detection module of Oostman with Goodman’s demultiplexing device because of the fundamental differences between detecting light for optical communications and detecting scattered fluorescent light in flow cytometry. *See infra* Section X.A.2, X.A.3, X.A.4; EX2028, ¶¶104, 106-160.

Petitioner’s combination thus fails to render obvious a WDM for a flow cytometer. EX2028, ¶104. Institution should therefore be denied. *See, e.g., Liberty*

Energy, IPR2025-00066, Paper 10 at 19; *R.J. Reynolds Vapor*, IPR2021-00826, Paper 11 at 15.

iii. Petitioner Fails to Demonstrate that Oostman, Goodman, and Frazier Disclose “a collimating optical element that is separate from the collecting optical element” (Ground 2)

All of the challenged claims require “a collimating optical element that is separate from the collecting optical element.” *See* EX1001, cl. 13. Petitioner argues that its proposed combination would have placed Oostman’s collimating lens “at a focal length of the collimating lens from the output end of optical fiber **15** but before imaging element **18**.” *Pet.* at 68-69. However, Goodman’s optical block is a monolithic and made from plastic or glass, (i.e., a solid plastic or glass block), EX1016, 6:56-67, as are lenses, *e.g.*, Oostman at 10:4-15. A POSA would have recognized that incorporating a lens *inside* a monolithic plastic or glass optical block (i.e., placing a glass lens inside a solid glass block while still having the lens function as a lens) would have been extremely impractical. EX2028, ¶105. Moreover, molding an optical block while also incorporating a lens in the middle of the glass would completely negate any of the purported benefits of cost or ease of manufacture that Petitioner describes. EX2028, ¶105. Thus, a POSA would not have been motivated to incorporate a collimating lens inside Goodman’s optical block as proposed.

2. A POSA Would Not Have Looked to a Reference from Optical Communications to Solve Problems in Flow Cytometry

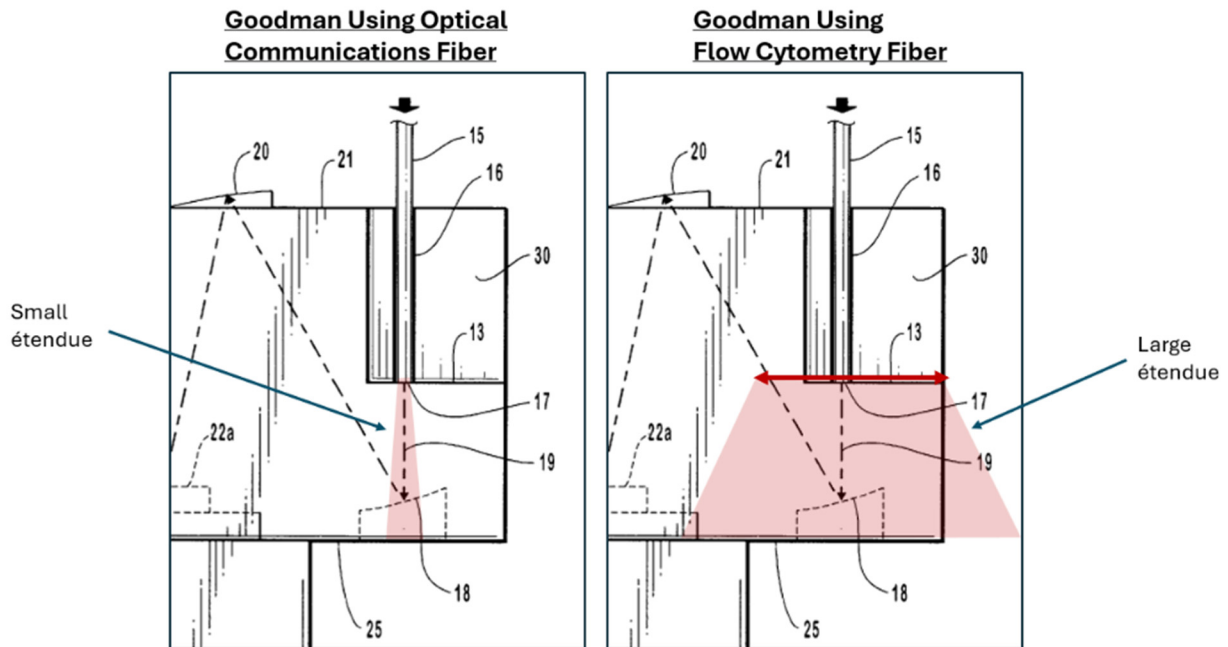
Petitioner fails to establish why a POSA would have been motivated to combine the prior art references to arrive at the claimed WDM for a flow cytometer. The fields of optical communications and flow cytometry faced entirely different problems. EX2028, ¶106. The light detection system built for Goodman was in a different type of device, it was designed for a different purpose, and it addressed different problems than the light detection systems in Chandler and Oostman.⁵ *Id.* at ¶107. Petitioner fails to account for these differences and explain why a POSA would have been motivated to combine these references to arrive at the claimed wavelength division multiplexer (WDM) for a flow cytometer. *Id.*

⁵ Chandler's specific disclosure is best characterized as a particle analyzer, which utilizes microspheres and operates at higher fluorescence intensity than continuous flow cytometers such as in Oostman, *see, e.g.*, EX1001, 47:39-43, but these fluorescence levels are still far lower than the light detected in side scatter, forward scatter, or signals in optical communications and the fluorescent light in Chandler is still collected into a large core optical fiber. EX2028, ¶112.

One fundamental difference between an optical communications system and the devices of Oostman and Chandler is how light propagates in the systems. Optical communications systems, like Goodman, detect intense light at narrow infrared wavelength ranges with light beams having a small diameter. *See* EX1016, 5:42-47, 2:20-29; EX2036 at 1080 (discussing how “narrow spectral widths” are “critical for the efficient operation of 1.3 and 1.55 μm wavelength-division-multiplexed (WDM) optical communications systems”). In contrast, fluorescence detection systems such as those disclosed in Chandler and Oostman needed to detect a wide range of wavelengths of unknown and uncontrolled signal strength in the visible light spectrum. *See* EX1016, 2:20-64; EX1007 at 67, 151. Thus, even if a POSA were motivated to improve or modify Chandler or Oostman, they would not have considered doing so by integrating Goodman’s light detection device because of the significant differences in the light propagation between the two systems. EX2028, ¶¶106-114.

The significant differences in the light that travels through, and is ultimately detected by, the two different systems in Chandler/Oostman and Goodman demonstrates the incompatibility and inoperability of Petitioner’s combination. For example, the imaging optical element 18 (e.g., imaging mirror) in Goodman’s demultiplexing device is not configured to receive light from an optical fiber as would

be used in Chandler or Oostman (which as discussed in the background are large core optical fibers), but instead from an optical communications optical fiber that is at least ten times smaller in diameter than the optical fibers used in Chandler or Oostman. EX1016, 7:17-30. Goodman's imaging optical element 18, as designed for optical communications, would thus fail to reflect the majority of the light coming from a flow cytometer or particle analyzer optical fiber because of the significantly larger etendue or spread of the light emerging from such as fiber optic. *See supra* Section II.C.1; EX2028, ¶116. The differences in the light path are illustrated below:



EX1016 at FIG. 1 (annotated); EX2028, ¶116. The only way to make Goodman partially workable would be to reduce the distance from the fiber 15 to the imaging optical element 18. EX2028, ¶116. However, the necessary distance would be so small that the light reflected by the mirror would not clear the fiber coupling 30 to reach mirror 20 and would severely limit Chandler’s and Oostman’s ability to detect fluorescent light.⁶ *Id.*; see *Deere & Co. v. David’s Sozer V-Lov System, Inc.*, IPR2024-01442, Paper 10 at 40 (PTAB Mar. 18, 2025) (“[W]here a prior art reference’s modification—in order to satisfy the claim language—would render ‘inoperable for its intended purpose,’ the reference ‘teaches away from the ... proposed modification.’”) (quoting *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984)); see also EX2028, ¶¶115-116.

Petitioner does not address these fundamental incompatibilities. Instead, Petitioner asserts without evidence that a POSA would have identified numerous deficiencies in Chandler and Oostman. For Chandler, Petitioner contends a POSA would have “naturally have consulted alternate WDM arrangements” (Pet. at 29).

⁶ Conversely, Goodman’s optical communications optical fiber, being significantly smaller than that typically used in flow cytometry, would fail to transmit much of the fluorescent light. See *supra* Section II.C.1; EX2028, ¶116.

For Oostman, Petitioner states a POSA “would have predictably” substituted “Oostman’s detector array cluster arrangements with Goodman’s ... demultiplexers.” Pet. at 60. Yet in the nearly ten years since Goodman, Chandler, and Oostman published, there is no art identified by Petitioner combining these disclosures or suggesting to do so until the inventions of the ’106 patent.⁷ EX2028, ¶¶117-118.

Petitioner, seeking to minimize the differences between these fields, alleges that Goodman is in the same field as the alleged inventions by being broadly “related to optical fibers” and “modular optical instruments for color separation and detection.” Pet. at 29, 61. But Petitioner’s high-level characterization of the ’106 patent’s field being related to “optical instruments” overgeneralizes the field. *See R.J. Reynolds*, IPR2021-00826, Paper 11 at 15 (finding no motivation to combine and noting that Petitioner’s characterization of the field was “overly broad”); *see also* EX2028, ¶119.

⁷ The only flow cytometry reference Petitioner identifies as even acknowledging an optical communication device is Frazier, which rejected the teachings in those disclosures because it viewed “prefabricated blocks” as not optimal compared to more “customizable” options. EX1009, 2:9-46; EX2028, ¶118.

In fact, Goodman and Petitioner's cited references only further support the conclusion that Goodman and other optical communication references are directed to completely different fields with completely different problems than flow cytometry and the '106 patent. Nothing in Goodman implies that its inventions can or should be used in flow cytometry or any life sciences application. Goodman states its devices "are particularly suited for use in wide wavelength division multiplexing (WDM) systems," i.e., wavelengths centered at 1310 nm with channel spacing 25 nm apart, far above flow cytometry's typical visible light wavelength ranges. EX1016, 5:42-47, 2:20-29, EX1001, 57:64-66. Petitioner points to Goodman's statements that its invention "is easy to incorporate into other optical systems," (Pet. at 30-31) (citing EX1016, 3:65-67); however, Goodman already makes clear what optical systems it is referring to: "The scope of applications for WDM devices ranges from spacecraft and aircraft applications to closed circuit and cable television systems." EX1016, 2:10-13; EX2028, ¶120.

As for flow cytometry/particle analyzer references, Petitioner does not contend that its references contain any suggestion that POSAs would have considered optical communications art as being within the same field or reasonably pertinent to problems in flow cytometry. Indeed, the *only life sciences reference* Petitioner identifies as even mentioning art from optical communications is Frazier

in Ground 2. Pet. at 60-61. However, Frazier merely identifies a single detector array configuration from a patent claiming priority to the 1970s, and then explicitly rejects that reference's disclosures as *not beneficial* for Frazier's goals. EX1009, 2:9-46 (discussing and rejecting a reference from optical communications because its "prefabricated blocks" were not optimal compared to more "customizable" options). EX2028, ¶¶121-123.

Rather than provide support from prior art, Petitioner relies on two statements from the '106 patent itself discussing its inventions. See Pet. at 29, 31, 61-62. This is improper, and nevertheless, Petitioner misconstrues the statements in the patent. EX2028, ¶124.

First, Petitioner's excerpted quote leaves out the specification's explanation that it is "[a]s a result" of the claimed inventions, which allow, e.g., for "extend[ing] the collimated optical path length without large beam expansion," that "WDM techniques well-established in the optical communication industry can be readily adapted for fluorescence light detection," EX1001, 4:57-67. The fact that techniques from a different field can be adapted "[a]s a result" of the claimed invention simply demonstrates how to now adapt WDMs from a different field using the benefit of the claimed inventions. See *Sci. Plastic Prods., Inc. v. Biotage AB*, 766 F.3d 1355, 1359 (Fed. Cir. 2014) (whether prior art is analogous is analyzed with "the foresight

of a person of ordinary skill, not with the hindsight of the inventor’s successful achievement”); *see also* EX2028, ¶125.

Second, Petitioner’s cherry-picked quote from the specification, that color separation devices in flow cytometry “are almost identical in function and architecture to the wavelength division multiplexers (WDM) widely used in optical communication” (Pet. at 31, 61-62 (citing EX1001, 44:39-47)), omits the very next sentence, which emphasizes fundamental differences between optical communications and flow cytometry, and the challenges therein. Specifically, the specification explains that light in flow cytometry enters a detection system from a large optical fiber which produces a much larger light beam than produced in optical communications. EX1001, 45:3-23; *see supra* Section II.C.1. The ’106 patent explains that this presents challenges in controlling the light beam over an extended distance and focusing the beam onto the detectors, as needed for effective detection. EX1001, 44:47-67. Indeed, the ’106 patent states that these fundamental differences “prevent[ed] the use of small area APD in fluorescence detection instrumentation,” despite APDs having “wide acceptance [] in optical communication.” *Id.* at 44:34-67; *see also* EX2028, ¶126.

Petitioner’s unsupported assertions that a POSA would have combined a demultiplexing device from optical communications to improve a flow cytometer is

pure hindsight. See *Liberty Energy*, IPR2025-00066, Paper 10 at 12 (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007) and warning to “be aware ‘of the distortion caused by hindsight bias and [] be cautious of arguments reliant upon *ex post* reasoning”); *R.J. Reynolds*, IPR2021-00826, Paper 11 at 18 (“That lack of explanation [as to how disclosed advantages of one reference were applicable to another] appears on this record as a classic exercise of impermissible hindsight reconstruction.”). Petitioner makes no attempt to explain how Goodman’s demultiplexing device would work with light emitted from a flow cytometry fiber optic (or how Goodman’s fiber optic would work in a flow cytometer). Petitioner proposes no modifications to Goodman that would allow it to function as a flow cytometry WDM as recited in independent claim 13. Nor does Petitioner rely on any disclosure from Chandler or Oostman in the alternative. Petitioner’s combinations thus fails to render obvious a “wavelength division multiplexer (WDM)” for use in “a flow cytometer.” EX2028, ¶127.

3. Petitioner Fails to Show that Goodman Is Analogous Art to the Claimed Inventions

Prior art references must qualify as “analogous art” to be considered in an obviousness analysis. *K-TEC, Inc. v. Vita-Mix Corp.*, 696 F.3d 1364, 1375 (Fed. Cir. 2012). To be “analogous art,” the reference must (1) be from “the same field of endeavor;” or (2) be “reasonably pertinent to the particular problem with which the

inventor is involved.” *Id.* Notwithstanding Petitioner’s two-sentence explanation in each Ground, Pet. at 29, 62, and for similar reasons as discussed above in Section X.A.2, Goodman (EX1016) is **not** analogous art that can be afforded any weight in the obviousness analysis. EX2028, ¶¶128-129.

First, Petitioner’s overly broad characterization of the field of endeavor ignores the “explanations of the invention’s subject matter in the patent application, including the embodiments, function, and structure of the claimed invention.” *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1380 (Fed. Cir. 2019) (citation omitted). As Petitioner concedes, Goodman is related to a **different** field of endeavor—the “field of optical communications,” not flow cytometry. Pet. at 1; EX2028, ¶130.

Second, Petitioner improperly argues that Goodman and the ’106 patent were directed to the overly general problem of “efficiently demultiplexing and detecting light.” Pet. at 29. This ignores that the ’106 patent specifically describes the problems that its inventor was able to solve: to create “an improved flow cytometer” that is “reliable, compact and easy to manufacture,” and “provides a Wavelength Division Multiplexing (WDM) system to separate a light beam into multiple colored bands” that “may be compatible with low noise semiconductor detectors” and “may be reconfigurable.” EX1001, 2:1-40. A POSA faced with these same problems, e.g.,

how to control and focus a large, diffuse beam diameter over an extended distance would not have found optical communications references dealing with intense light with narrow beam diameters “reasonably pertinent to the particular problem with which the inventor is involved.” *See K-TEC*, 696 F.3d at 1375; *see also* EX2028, ¶¶131-132.

4. Chandler and Oostman Would Not Be Improved By Goodman

Even if a POSA would have considered teachings from optical communications, Petitioner has not demonstrated that a POSA would have looked to Goodman to modify Chandler or Oostman. Petitioner argues that a POSA reviewing Chandler or Oostman would have immediately become aware of various purported shortcomings in its fluorescence detection design, and that Goodman would solve these shortcomings. Pet. at 28-31, 60-61. However, Petitioner provides no explanation or rationale beyond its expert’s verbatim say-so, and these “conclusory statements” do not provide “some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *See Wasica Finance GmbH v. Continental Automotive Systems, Inc.*, 853 F.3d 1272, 1286 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Indeed, both Chandler and Oostman’s disclosure expressly contradicts Petitioner’s conclusory assertions, as discussed below. EX2028, ¶133.

i. The proposed combinations would remove Chandler and Oostman's features that improve the prior art

Petitioner puts forth various arguments, largely supported only by expert say-so, to suggest that a POSA would have substituted Chandler's branched configuration of bandpass filters within its FADC units (Pet. at 28-29) or Oostman's detector array cluster arrangements (Pet. at 60-61) with Goodman's demultiplexer. But as discussed below, these arguments fails because there is *no evidence* to support this claim. In fact, a POSA would not want to remove these features from Chandler and Oostman because they were *features to improve* the prior art, including Goodman. EX2028, ¶134.

First, Petitioner argues that a POSA would have sought to "reduce the footprint" of Chandler's FADC units (Pet. at 29) or the flow cytometer in Oostman (Pet. at 62), but both arguments are entirely conclusory and supported only by its expert's say-so. For Chandler, Petitioner argues that "Chandler's branched configuration in the FADC units was suboptimal" for making "small and inexpensive" devices without "sacrificing detection capabilities." Pet. at 29 (citing EX1051, 3:51-55). For Oostman, Petitioner says even less, and simply assumes without explanation that the proposed combination would "reduce footprint of a flow cytometer while expanding color separation and increasing detection sensitivity

capabilities.” Pet. at 62. Petitioner provides no reason why Goodman would reduce the size of Chandler or Oostman and cites no supporting evidence. EX2028, ¶135.

In particular, Petitioner does not provide any evidence or even argue that Goodman would provide an improvement other than bare citations to Goodman in Ground 1 stating its design “is easily scalable” (Pet. at 30 (citing EX1016, 3:48-67)). Indeed, Goodman discloses its preferred embodiment has four “wavelength selective elements [e.g., filters] 22a-22n,” which corresponds to four channels for wavelength separation and four detectors. EX1016, 8:28-29. And while Goodman contemplates that more wavelength selective elements may be added to separate additional wavelengths, it specifically notes that the number of channels is limited by “the attenuation of the beam of light that will occur and the number of wavelength channels that can be multiplexed.” EX1016, 8:27-35. In other words, Goodman teaches that there are practical limits for how many channels its device can maintain a strong beam of light for demultiplexing. A POSA would have understood that this practical challenge of maintaining signal strength is similarly present in flow cytometry, and a POSA would thus not assume that Goodman provides for a way to reduce the footprint in Chandler’s or Oostman’s systems. *See, e.g.*, EX1005, 3:42-57, 4:16-24; EX2031 at 4, 8-9; EX2028, ¶¶139-141.

There is also no evidence that Goodman’s demultiplexing device would allow an increased number of detectors compared to one of Chandler’s FADC units or Oostman’s detector clusters. Thus, Petitioner’s conclusory arguments—which Petitioner relies solely on expert say-so for support—are at best irrelevant because one would still need to use multiple of Goodman’s demultiplexing devices. But even if Goodman did allow for more filters and detectors in one device, Goodman would similarly just “redistribute[]” the footprint in only a vertical or horizontal direction (i.e., one long row of filters and detectors).⁸ Petitioner does not attempt to explain how the orientation in Goodman would reduce a flow cytometer’s footprint compared to Chandler or Oostman or what effect doing so would have on Chandler’s or Oostman’s functionality. EX2028, ¶¶136-142.

Petitioner also ignores that a POSA would not have been motivated to remove the FADC units from Chandler or the detector array cluster arrangements from Oostman because each reference expressly describes those components as a *feature* of the invention and an *improvement* over the prior art, not a constraint of its device.

⁸ As discussed in Section X.A.3.i, Petitioner cites no evidence that Oostman’s configuration is actually more compact than Goodman’s when accounting for the size of PMTs, with which Oostman is configured to operate. EX2028, ¶145 n.2.

Chandler states that “an advantage to using such a multiplexing technique would be a reduction in complexity and/or cost of the overall flow cytometer resulting from fewer photo-detectors and fewer A/D converters being needed.” EX1051, 12:8-1. And Oostman states that “[b]y using reflective transfer legs for most detectors, the detectors may be clustered in a polygonal arrangement of between five and ten light detectors in a common plane” and its “apparatus is modular because a greater number of fibers can feed a greater number of clusters.” EX1005, 3:42-55, 4:14-16; EX2028, ¶¶137-139. Indeed, Oostman states that, due to its detector clusters, “the instrument of the present invention has a wide spectral response.” EX1005, 6:36-39. As Petitioner concedes, Oostman’s device was expressly designed to “provide an improved system for detecting fluorescent light having multiple colors emitted from a target using a greater number of detectors than has been achieved in the prior art.” Pet. at 26 (quoting EX1005, 2:60-63); *see also id.* (quoting EX1005, 4:14-16); EX2028, ¶138.

Thus, Petitioner’s rationale for combining Goodman with Chandler or Oostman ignores the express improvements over the prior art and instead suggests that improvement be replaced. Petitioner fails to explain why a POSA would be motivated to take such action. Instead, Petitioner’s argument is merely a hindsight

driven approach that attempts to arrive at the claimed invention. EX2028, ¶¶144-146.

- ii. *Chandler's FADC units and Oostman's detector clusters are intentional design choices that would be negated by Goodman's optical block and Frazier teaches against using an optical block*

Chandler and Oostman were both designed for problems specific to fluorescent detection, and incorporating Goodman's design would not benefit either system.

Regarding Chandler's system, Petitioner proposes replacing one or more of Chandler's FADC units with Goodman's configuration to achieve "more color separation per light source," Pet. at 29, 40, but Chandler teaches that more color separation per light source is not useful for its purposes. For example, Chandler states that "[a]t any given excitation wavelength [i.e., for any one laser exciting dyes at a specific wavelength], I have determined that there are often only about two or three commercially available dyes that emit a spectrum of wavelengths narrow enough and sufficiently separated enough that they are individually measurable simultaneously." EX1051, 2:37-42; *see also id.* at 2:30-32 ("I have determined that the properties of the fluorescent dyes themselves limit this flow cytometric technique to about three different wavelengths."). Chandler's proposed solution to this problem is to use multiple lasers (i.e., multiple light sources) angled in different

directions to excite dyes at multiple wavelengths. *Id.* at 7:1-8:8; FIG. 4; *see also id.* at 7:24-34 (“Each optical detector can be associated with an adjacent, near, or operationally responsive laser diode. Optical detector 20 detects emissions resulting from excitation by, for example, laser diode 10; optical detector 22 detects emissions resulting from excitation by, for example, laser diode 12, and the like.”). With this configuration, some light scattered from every laser will hit the different collecting elements, but each of the four FADC units has its *own* set of bandpass filters to filter the wavelengths emitted from each laser. Incorporating Goodman’s configuration into each one of Chandler’s FADC units—even if each of Goodman’s configuration can detect more than three channels—would provide no benefit to Chandler because of Chandler’s self-described limitations on the number of channels that would be useful in each branch. EX2028, ¶¶147-148.

For Oostman, Petitioner points to Goodman’s “optical block” to provide “[o]ptical alignment” that would be useful “in Oostman’s non-integrated designs where light propagates through air and optical components are oriented/fixated through holders,” (Pet. at 60-61). This argument is flawed for multiple reasons. EX2028, ¶149.

First, Oostman rejects a fixed, prefabricated configuration for wavelength detection. Goodman’s prefabricated optical block configuration with integrated

filters, *see* EX1016, 8:37-50, 10:45-59, cl. 9, goes against Oostman’s express teachings of providing an adjustable flow cytometer. EX1005, 8:35-40 (“The dichroic mirror holders and the filter holders are mounted in vertically removable housings so that dichroic mirrors and associated filters may be interchanged or replaced.”); *see also, e.g.,* EX1009, 2:27-38. Optical communications demultiplexing devices have industry-standard channels that rarely, if ever, need to be changed, and predictable inputs of light size and intensity entering the demultiplexing device. *See, e.g.,* EX2032; EX2033; EX2028, ¶151. Meanwhile, Oostman recites interchangeability of its detector clusters as a feature of its invention, not a limitation. *See, e.g.,* EX1005, 8:19-20 (“Each lens 265 is movable for adjusting the focal spot during calibration of the instrument.”), 8:35-40; *see also id.* at 5:62-6:5; 8:48-9:3; EX2028, ¶¶150-151.

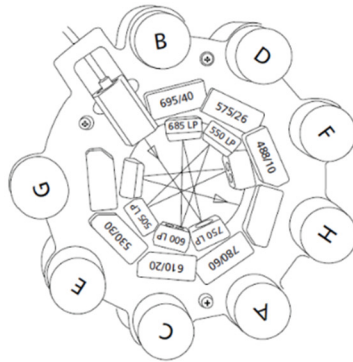
In contrast to Oostman, Goodman, consistent with standards for optical communications demultiplexing devices, discloses using adhesives for permanently affixing its filters 22a-22n to its optical block, meaning that the filters cannot be easily switched. EX1016, 8:44-47; EX2028, ¶152. Frazier, which is part of this proposed combination, cites similar considerations as key reasons to reject application of an optical communications device for its life sciences fluorescence detection instruments. *See* EX1009, 2:27-38. For example, the BD LSR Fortessa

(which is marked with Oostman’s patent, EX2023 at 2) has multiple variations of mirror/filter combinations depending on the fluorochromes:

Five-color blue laser configuration

The following map shows the five-color configuration for the 488-nm blue laser.

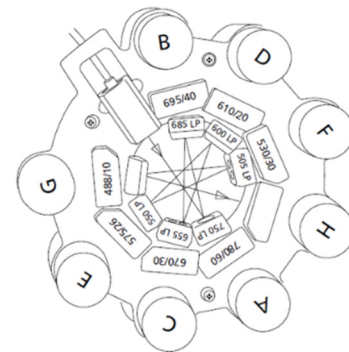
PMT	LP mirror	BP filter	Fluorochromes
A	750	780/60	PE-Cy7
B	685	695/40	PerCP-Cy5.5
C	600	610/20	PE-Texas Red®
D	550	575/26	PE
E	505	530/30	FTTC, Alexa Fluor® 488
F	Blank	488/10	SSC



Six-color blue laser configuration

The following map shows the six-color configuration for the 488-nm blue laser.

PMT	LP mirror	BP filter	Fluorochromes
A	750	780/60	PE-Cy7
B	685	695/40	PerCP-Cy5.5
C	655	670/30	PE-Cy5
D	600	610/20	PE-Texas Red®
E	550	575/26	PE
F	505	530/30	FTTC, Alexa Fluor® 488
G	Blank	488/10	SSC



EX2023 at 140-141 (annotated). EX2028, ¶152.

Second, Oostman provides its own features for adjusting alignment. Petitioner contends alignment challenges would motivate a POSA to use Goodman’s optical block. Pet. at 60. But Petitioner ignores that Oostman teaches that the option of adjusting alignment is an important feature for its flow cytometers and its detector clusters. *E.g.*, EX1005, 8:49-50 (“The beam splitter mirror 321 is held in a mirror holder frame *at a desired angle.*”), 8:61-65 (emphasizing ability to adjust focusing lenses to focus light at more sensitive spots on PMTs). And Oostman discloses its detector clusters made with mechanically-stabilized mounts (*see, e.g.*, Oostman FIG.

7) that allow correction of alignment issues such that using adhesives such as in Goodman were not the only (or even best) way of achieving alignment and mechanical stability. *See* EX2023 at 140-141; *see also* EX1005, 5:63-6:23, cl. 32. EX2028, ¶¶153-154.

iii. Petitioner does not explain why a POSA would select Goodman's zig-zag pattern

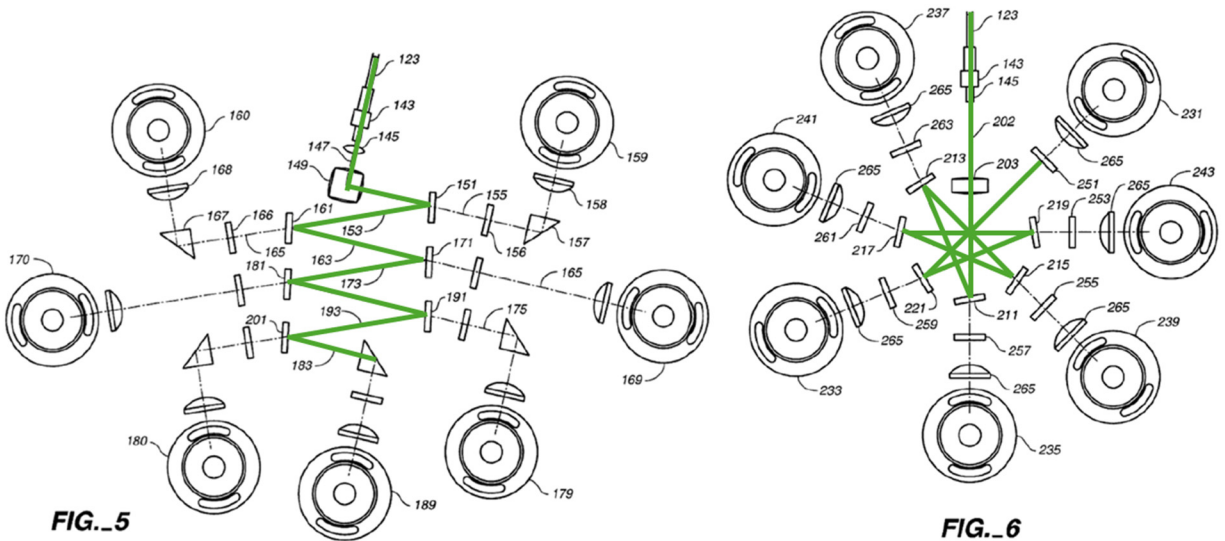
Petitioner also argues it would have been obvious to try Goodman's demultiplexing device in Chandler's system because Goodman's zig-zag pattern is a known alternative to Chandler's branched configuration. *Pet.* at 30-31. Petitioner similarly argues it would have been obvious to try Goodman's demultiplexing device in Oostman's system because Goodman's zig-zag configuration is more "modular" and "efficient." *Id.* at 61. Petitioner does not explain how a POSA would adapt Goodman for Chandler's system, or whether, if adapted, Goodman's demultiplexing device would actually improve Chandler's system. "It is not enough merely to quote the comparative advantages disclosed in [one prior art reference] without explaining why a POSA would have expected to achieve similar improvements when modifying a different device...disclosed in" another reference. *R.J. Reynolds*, IPR2021-00826, Paper 11 at 21-22. EX2028, ¶¶155-156.

Nor does Petitioner attempt to explain why Goodman's demultiplexing device would be chosen over Oostman's star-shaped flow cytometer. Indeed, Petitioner

ignores that Oostman discloses that its star-shaped configuration is *more compact* than a zig-zag configuration:

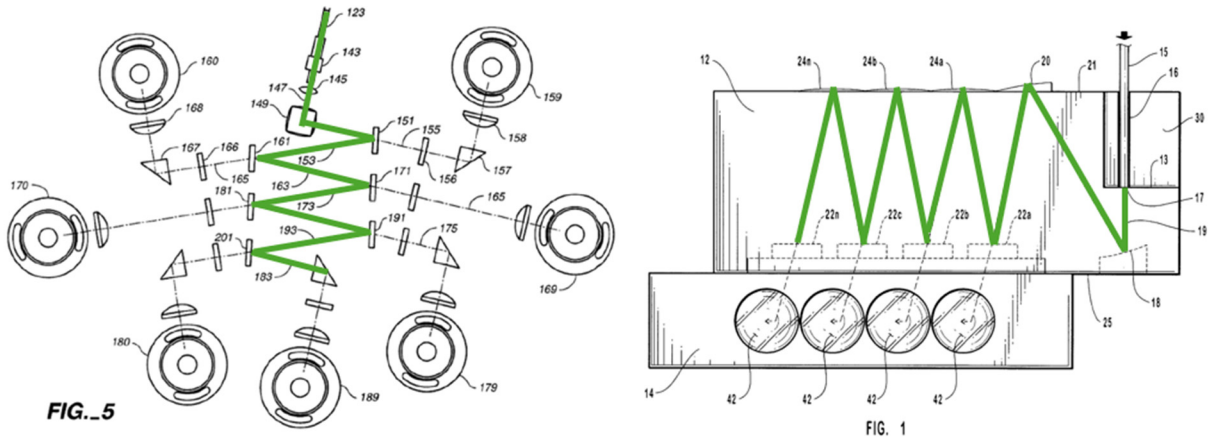
In FIG. 5, the transfer leg forwarded upstream from one beam Splitter to the next follows a zigzag pattern. In FIG. 6, the transfer legs intersect in a star-shaped pattern yielding a *more compact* polygonal arrangement of detectors.

EX1005, 7:32-36.



EX1005 at FIGS. 5 and 6 (annotated). EX2028, ¶157. As Oostman itself makes clear, Oostman's star-shaped cluster design was an intentional departure from other detector array patterns and was designed to provide a narrow and compact optical path while accounting for its PMT detectors. See EX1005, 7:32-36, 8:21:40; see

also EX1001, 44:9-33. Petitioner misleadingly describes Oostman FIG. 5 as a “polygonal WDM [],” Pet. at 61, but the light path annotated below demonstrates a zig-zag configuration. Petitioner provides no explanation as to why a POSA would jettison Oostman’s star-shaped configuration for Goodman’s zig-zag configuration when Oostman already discloses that a zig-zag configuration is less compact than its star-shaped configuration in FIG. 6:



EX1005 at FIGS. 5 (annotated); EX1016 at FIG. 1 (annotated). EX2028, ¶158.

The petition fails to provide any reason why a skilled artisan would add features from one prior art system to another that were already contemplated by the second reference but were not preferred. *See MacDermid, Inc. v. Rohm and Haas Electronics Materials LLC*, PGR2016-00017, Paper 11 at 14-15 (PTAB Oct. 19, 2016) (denying institution where combination relied on substituting a component

that from one reference that the other reference taught was “not preferred”); *see also Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882, 887 (Fed. Cir. 2024) (“The mere fact that these possible arrangements existed in the prior art does not provide a reason that a skilled artisan would ... make this substitution....”); *R.J. Reynolds*, IPR2021-00826, Paper 11 at 21 (“Petitioner does not explain how or why eliminating this intentional gap would minimize heating of unnecessary thermal mass, improve response times, or reduce the maximum heater temperature in a device, such as Alarcon’s, that produces vapor by an entirely different mechanism....”). EX2028, ¶157-158.

5. Petitioner Fails to Explain How Goodman Would Improve Chandler or Oostman Specifically

For Ground 1, Petitioner reproduces a series of six quotes from Goodman’s summary section to contend that “Goodman teaches improvements aligned to Chandler’s design goals.” Pet. at 30. These quotes do not explain how Chandler would specifically be improved, nor Oostman to the extent relied upon in Ground 2. EX2028, ¶161.

The first four quotes Petitioner relies on are all directed towards ease of fabrication; however, Petitioner provides no explanation how or why Goodman’s manufacturing method would be simpler to manufacture than Chandler’s or Oostman’s, or even if it was, why such benefits would outweigh Chandler’s and

Oostman’s benefits of customizability and reduced size. Petitioner’s fifth quote, that Goodman’s WDM is “easy to incorporate into other optical systems,” Pet. at 30, ignores that Goodman’s description of relevant applications for its technology was “spacecraft and aircraft applications” and “closed circuit and cable television systems,” not flow cytometry. EX1016, 2:10-13. And Petitioner’s final quote, that Goodman “is easily scalable or modified,” ignores that both Chandler’s and Oostman’s systems are each similarly, or more, easily scalable as discussed above. *See* Section X.A.3.i; *see also* EX2028, ¶¶162-163.

Furthermore, Petitioner does not attempt to explain why, rather than modify Chandler’s or Oostman’s configuration, a POSA would have changed every other aspect of Chandler’s and Oostman’s design (e.g., its lenses, mirrors, filters, etc.), in favor of Goodman, or even more drastically, jettison Chandler’s FADC units or Oostman’s detector clusters completely and just try to plug in Goodman’s demultiplexing device. *See Axonics, Inc. v. Medtronic, Inc.*, 73 F.4th 950, 957 (Fed. Cir. 2023) (“The proper inquiry is whether the relevant artisan would be motivated to make the combination to arrive at the claims’ actual limitations[.]”); *Free-Flow Packaging Int’l, Inc. v. Automated Packaging Sys., Inc.*, IPR2016-00444, Paper 8 at 13 (PTAB Jun. 22, 2016) (requiring “‘some articulated reasoning with some rational underpinning’ to combine the known elements in the manner required in the claim

at issue”) (quoting *KSR*, 550 U.S. at 418). It is not enough to provide some motivation to change certain features of a reference and assume, without analysis, that a POSA would have made multiple additional changes to achieve the claimed invention. Petitioner’s motivation to combine analysis is completely absent in this respect, and should be rejected for this additional reason. EX2028, ¶¶164-166.

B. Petitioner Fails to Demonstrate a Reasonable Expectation of Success for Either Combination

In each obviousness Ground, Petitioner devotes a single paragraph of its Petition to argue that a POSA would have had a reasonable expectation of success in implementing Goodman’s WDM into Chandler or Oostman. Pet. at 31, 61-62. But Petitioner’s sole evidence on this front are (1) two statements from Goodman stating its WDM could be incorporated into other generic optical systems; and (2) statements from the ’106 patent itself. Each of these pieces of evidence are flawed, and Petitioner fails to meaningfully engage with actual facts in assessing reasonable expectation of success. *See Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (noting that reasonable expectation of success “requires a ‘plausible rational [sic] as to why the prior art references would have worked together’”) (quoting *Power-One, Inc. v. Artsyn Techs., Inc.*, 599 F.3d 1343, 1351 (Fed. Cir. 2010)); *see also* EX2028, ¶167.

First, as discussed above, Goodman’s generalized statements do not explain how its optical communications demultiplexing device could be incorporated into a flow cytometer fluorescence detection system, and Goodman itself states that relevant applications for its technology range from “spacecraft and aircraft applications to closed circuit and cable television systems.” EX1016, 2:10-14; *see supra* Section X.A.2. None of these applications have any connection to life science fluorescence detection systems, and Petitioner has not explained how a POSA would have had a reasonable expectation of success based on this general statement. EX2028, ¶169.

Second, as discussed above, the statements cited from the ’106 specification, actually highlight the *challenges* in translating WDMs from optical communications to flow cytometry prior to the inventions disclosed in the ’106 patent. EX1001, 45:10-45:27. And regardless, the obviousness inquiry is not whether a POSA, reading a patent specification, would have had a reasonable expectation of success in achieving the inventions disclosed therein—it is whether a POSA would have had a reasonable expectation of success *in view of the prior art*. *PAR Pharmaceutical, Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014) (“Proper analysis under § 103 requires, *inter alia*, consideration of ... (2) *whether the prior art* would also have revealed that in so making or carrying out [a claimed invention], those of

ordinary skill would have a reasonable expectation of success.”) (citations omitted); *see also Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985) (“[O]ne should not go about determining obviousness under § 103 by inquiring into what *patentees* (i.e., inventors) would have known or would likely have done, faced with the revelations of references.”); *Amgen Inc. v. F. Hoffman-La Roche Ltd*, 580 F.3d 1340, 1363 (Fed. Cir. 2009) (quoting *Standard Oil*, 774 F.2d at 454, to support that an inventor’s “personal expectations are not conclusive of an ordinarily skilled artisan’s reasonable expectations”). EX2028, ¶170.

Finally, though Petitioner proposes incorporating Goodman’s entire detection system into Chandler’s system or Oostman’s flow cytometer, Petitioner does nothing to explain how a POSA would have reasonably expected Goodman’s entire system to work. For example, Petitioner does not explain whether Goodman’s imaging elements 18 and 20 would function when receiving light from a large diameter flow cytometry fiber optic which produces light at an etendue hundreds of times greater than what they were designed for, nor whether Goodman’s optical communications fiber optic would receive sufficient fluorescent light, nor whether Goodman’s detectors designed for optical communications would be operable in a flow cytometer. Petitioner’s conclusory statements on reasonable expectation of success fall short of “some articulated reasoning with some rational underpinning to support

the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (internal citations omitted). EX2028, ¶¶171-173.

For the foregoing reasons, Petitioner fails to show a reasonable likelihood of invalidity based on obviousness.

XI. The Petition Fails To Demonstrate a Lack of Written Description or Enablement of the Challenged Claims

A. Petitioner Does Not Demonstrate Lack of Written Description for a “curved mirror” (Ground 3)

Petitioner relies solely on its priority analysis to further argue that the claims lack written description for a “curved mirror.” Pet. at 79-80. For the reasons described above in Section IX, this argument is unfounded. Thus, Petitioner fails to show the claims lack written description for a “curved mirror.”

B. Petitioner Does Not Demonstrate Lack of Enablement for “semiconductor detector” (Ground 4)

Petitioner’s arguments that the claimed “semiconductor detector” is not fully enabled with respect to carbon nanotube detectors (Pet. at 80-85) rests on fundamental misunderstandings of fact and law.

First, Petitioner’s characterization of the field or nature of the invention as “flow cytometry, fiber optics, and wavelength demultiplexing and detection” (Pet. at 82) fails to recognize a benefit of the claimed inventions is that the beam diameter

of the fluorescent light for detection is maintained and thus can be focused into a small spot making detection compatible with small area semiconductor photodetectors in general, which would include carbon nanotube detectors. *E.g.*, EX1001, 45:37-40; EX2028, ¶¶73-74.

Second, Petitioner's arguments are factually flawed. Petitioner argues that carbon nanotube detectors were not "known to be applied in flow cytometry" and that a POSA would not have "the materials science and engineering experience minimally required to design and implement carbon nanotube detectors in the claimed flow cytometer." Pet. at 83-84. That is patentably false. Carbon nanotube detectors had already been shown as viable for life sciences fluorescent detection before the '106 patent's priority date, and particularly before Petitioner's asserted earliest priority date of 2012. For example, in 2008, Zhou et al. demonstrated nanoscale color detection using a single-walled carbon nanotube functionalized with azobenzene chromophores, and explained that its detector was capable of "controlled detection of visible light of low intensity in narrow ranges of wavelengths." EX2047; EX2028, ¶¶178-179.

Third, Petitioner's arguments that carbon nanotube detectors were not sold commercially or had not yet been perfected are based on a flawed understanding of the enablement standard. Enablement does not require a POSA "make and use a

perfected, commercially viable embodiment absent a claim limitation to that effect.” *CFMT, Inc. v. Yieldup Intern. Corp.*, 349 F.3d 1333, 1338 (Fed. Cir. 2003). All that is required for enablement is that a POSA would have been able to use a carbon nanotube detector and have it function in a flow cytometer without undue experimentation. Indeed, some experimentation is acceptable. *See, e.g., Cephalon, Inc. v. Watson Pharms., Inc.*, 707 F.3d 1330, 1336 (Fed. Cir. 2013) (“[A] reasonable amount of routine experimentation required to practice a claimed invention does not violate the enablement requirement.”); *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988) (“The key word is ‘undue,’ not ‘experimentation.’”). Further, even if commercial vendors were not themselves marketing carbon nanotube detectors, a POSA would have been able to acquire such detectors from any of the research laboratories that were publishing work on carbon nanotube detectors. Petitioner does not argue that carbon nanotube detectors would not have been functional in a flow cytometer as claimed nor explain any technical reasons why any experimentation that may (or may not) be needed would amount to *undue* experimentation.

Fourth, as Petitioner necessarily acknowledged (Pet. at 84), the specification demonstrates working examples for APDs - a semiconductor species, and also discusses how the inventions can be used for semiconductor detectors more broadly.

Specifically, the specification instructs how to maintain beam diameter through a flow cytometer WDM to be able to focus light to a small spot size. *See, e.g.*, EX1001, 4:57-67, 9:56-10:3, 45:32-40, 45:62-65, 46:10-21, 58:11-16, 58:56-59:1. Thus, the specification explains how its invention works with semiconductor detectors that are improved by small spot sizes, which includes carbon nanotube detectors.

Fifth, relying only on its expert say-so, Petitioner argues that “[d]eveloping new types of photodetectors for flow cytometry is highly unpredictable and requires significant experimentation across multiple design parameters.” Pet. at 84-85. Again, this is not the legal standard for enablement. *See CFMT*, 439 F.3d at 1338 (enablement does not require a POSA to “make and use a perfected, commercially viable embodiment absent a claim limitation to that effect”). In any event, the inventions of the ’106 patent allow for light to be focused to a small spot size for use with small active area semiconductor detectors such as carbon nanotube detectors. Petitioner again does not argue that carbon nanotube detectors would not *work* in the flow cytometers as claimed, but simply complains they were not commercially available.

Thus, Petitioner fails to show the claims lack enablement for a “semiconductor detector.”

1. Petitioner Does Not Demonstrate Lack of Written Description for “semiconductor detector” With Respect to Carbon Nanotube Detectors (Ground 5)

Petitioner’s arguments that the claimed “semiconductor detector” with respect to carbon nanotube detectors lacks written description support (Pet. at 85) similarly fails for the reasons explained above in Section IX, as well as due to further fundamental misunderstandings of written description law.

Petitioner states that “[t]he written description mentions a carbon nanotube detector only three times, and only to classify it as both a photodetector and semiconductor detector.... 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.” Pet. at 85. This misunderstands the “blaze mark” analysis and its application to evaluating whether claims meet the written description requirement. “Blaze marks” are relevant when evaluating support for a claimed sub-genus or species to evaluate whether the disclosure of the specification guides a POSA to the claimed embodiment. *See, e.g., In re Ruschig*, 379 F.2d 990, 994-95 (CCPA 1967); *Regents of the University of Minnesota v. Gilead Sciences*, 61 F.4th 1350, 1358 (Fed.

Cir. 2023).⁹ Here, the claims do not recite carbon nanotubes, and so whether there are blaze marks guiding a POSA to them is irrelevant to assessing written description support for the claims.

Instead, for a claimed genus, disclosure of relevant, identifying characteristics, such as structure or other physical and/or chemical properties, functional characteristics coupled with a known or disclosed correlation between function and structure, or by a combination of such identifying characteristics, are sufficient to show the inventor was in possession of the claimed genus. *See Regents of the University of Cal. v. Eli Lilly*, 119 F.3d 1559, 1568 (Fed. Cir. 1997). There is no requirement for a specific number of species to be identified, and in fact disclosure of a single species can support a generic claim so long as the disclosure would suggest to a POSA the inventor possessed the claimed genus. *See e.g., In re Rasmussen*, 650 F.2d 1212, 1215 (C.C.P.A. 1981); *Bilstad v. Wakalopulos*, 386 F.3d

⁹ These same cases further exemplify how the blaze marks analysis is typically reserved for patents claiming a specific chemical compound or sub-genus of compounds that falls within a broader genus but was not specifically recited. *See, e.g., Regents*, 61 F.4th at 1358 (“After failing to establish that P1 claim 47 constitutes an *ipsis verbis* disclosure, Minnesota attempts to recast this claim as a blaze mark.”).

1116, 1124 (Fed. Cir. 2004) (“Thus, our predecessor court recognized that disclosure of a single species within a genus may be enough support for a claim directed to the genus.”) (citing *Rasmussen*, 650 F.2d at 1215). There is no requirement that the disclosure contain “either examples or an actual reduction to practice”; rather, the critical inquiry is whether the patentee has provided a description that “in a definite way identifies the claimed invention” in sufficient detail that a person of ordinary skill would understand that the inventor was in possession of it at the time of filing. *Ariad Pharmas., Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1350, 1352 (Fed. Cir. 2010); *Koito Mfg. Co., Ltd. v. Turn-Key-Tech, LLC*, 381 F.3d 1142, 1154 (Fed. Cir. 2004). Here, Petitioner concedes that the specification recites using carbon nanotube detectors as one exemplary semiconductor detector. Pet. at 80-81; EX1001, 8:39-41, 46:62-64, 52:65-67, 59:24-26. As one of a small number of semiconductor detectors specifically called out in the specification, the specification clearly provides adequate direction which reasonably would lead a POSA to the claimed semiconductor detectors. Indeed, semiconductor detectors for detecting light are photodetectors that use semiconductor materials to convert light into an electrical signal. EX2028, ¶175. Thus, the claimed element has clear physical, chemical, and functional properties that the inventor clearly possessed as of the filing of the provisional application. A POSA would understand, the inventor possessed a

detector that converts light into an electric signal and it is made of a semiconductor material.

Thus, the specification “has provided a description that ‘in a definite way identifies the claimed invention’ in sufficient detail that a person of ordinary skill would understand that the inventor was in possession of it at the time of filing.” *Alcon Rsch. Ltd. v. Barr Lab’ys, Inc.*, 745 F.3d 1180, 1190–91 (Fed. Cir. 2014) (internal citations omitted). In sum, Petitioner fails to show the claims lack written description for a “semiconductor detector.”

XII. CONCLUSION

For the above reasons, Patent Owner respectfully requests that the Board deny Petitioner’s Petition for *inter partes* review of the ’106 patent in its entirety.

Respectfully submitted,

Dated: December 23, 2025

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CERTIFICATE UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Patent Owner Preliminary Response totals 14,807 words, which is less than the 18,700 words allowed under 37 CFR § 42.24(a)(1)(ii).

Respectfully submitted,

Dated: December 23, 2025

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CERTIFICATE OF SERVICE

I hereby certify that on December 23, 2025, I caused a true and correct copy of the following materials:

- Patent Owner's Preliminary Response
- Exhibit List
- Word Count Certification Under 37 CFR § 42.24(d)
- Exhibits for Patent Owner's Preliminary Response (EX2013, EX2016, EX2028-2029, EX2031-2033, EX2035-2039, EX2047)

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