

Optical Module CBC



AI Overview

A CBC optical module is a precision assembly that combines multiple laser beams coherently to achieve higher power and superior beam quality. Overview A Coherent Beam Combination (CBC) module is an optical system designed to combine multiple laser beams into a single, high-quality output beam. By controlling the relative phase of each input beam, CBC modules enable constructive interference, resulting in increased brightness and power while maintaining excellent beam quality ($M^2 \sim 1$) in the far field. These modules are widely used in high-power laser applications, including aerospace, defense, material processing, space missions, and scientific research.

Key Features

- Phase Control:** CBC modules use ultrafast phase modulators and tunable optical delay lines to synchronize the temporal phase of all beams, ensuring coherent superposition.
- Beam Shaping:** Output beams can be collimated, tiled, and shaped for specific applications, allowing flexible beam profiles and steering.
- Scalability:** Modern CBC modules can combine dozens to hundreds of laser channels (e.g., 127–217 channels) without degrading beam quality, enabling extremely high laser powers.
- Rugged and Modular Design:** CBC assemblies are often designed as compact, modular units that simplify integration, reduce system complexity, and improve mechanical robustness.
- High Efficiency:** CBC modules can achieve high Power in the Bucket (PiB), with demonstrated improvements of 20–81% over traditional Gaussian beam combining systems.

Applications

- Industrial Fabrication:** High-power, high-quality beams for cutting, welding, and additive manufacturing.
- Defense and Aerospace:** Directed energy systems, counterspace applications, and laser-based tracking.
- Scientific Research:** Particle accelerators, inertial confinement fusion, and advanced laser experiments.
- Space Operations:** Space debris removal and satellite laser communication systems.

Advantages Over Other Techniques

Compared to spectral beam combining, CBC modules provide high...

Article Content

Technical note / Optics modules

1. Overview The optics module is comprised of Si photodiodes, optical components, and current-to-voltage conversion circuit. Our lineup includes filter type spectroscopic modules (C13398 series)

Challenges in coherent beam combining of high power fiber ...

Challenges involved in the CBC of fiber lasers such as the influence of source coherence on the combining efficiency, limitations in high power fiber amplifiers, phase noise sources in the

Optics | CBC AMERICA

Our Industrial Optics Division provides lenses, cameras and equipment for Machine Vision (Image Processing, Automated Inspection, Robotics, Identification,

Coherent Laser Beam Combining

optical nonlinearities currently limit near-DL output from single lasers to an order of magnitude lower power, around 10 kW. Actively phase-locked coherent beam combination (CBC) of laser amplifiers fi

Laser array of coherent beam combination system revisited: angular ...

Abstract: Coherent beam combination (CBC) of fiber lasers holds promise for achieving high brightness laser systems, which have given rise to widespread applications such as particle accelerator, space

PowerPhotonic showcases CBC module at Photonics West

At #photonicswest2025 PowerPhotonic, along with various other beam shapers and optics, presented their much discussed, cutting edge, CBC module . The Coherent Beam Combining Module (CBC

Coherent Beam Combination Assembly

This modular assembly not only streamlines the coherent beam combination process but also provides unmatched precision and optimization. Elevate your

Spectral Beam Combining | Exail

Spectral Combination of laser beams In the Spectral Beam Combination technique (SBC), the different laser power beams emitting a continuous signal, centred on

PowerPhotonic showcases CBC module at Photonics West

The Coherent Beam Combining Module (CBC module) from PowerPhotonic works by controlling the shape and size of each individual beam, and because of this it provides unparalleled improvements...

PowerPhotonic's Coherent Beam Combining Module

The CBC optics module is designed for emerging applications in defence, space, industry and cutting-edge science, where high-beam quality (high brightness)

Multi-dimensional wavefront manipulation of phased fiber laser array ...

We demonstrate the principle of generating the approximate spherical convergent light waves by wavefront manipulation for conformal transmission and coherent beam combining (CBC)

PowerPhotonic's Coherent Beam Combining Module

The challenge of combining multiple fiber laser outputs into a single, high power, high brightness beam has been addressed with PowerPhotonic 's Coherent

Modbox 2000 nm 4 or 8 Channels with phase modulation control

The ModBox-CBC-2000nm is a proven and robust multi-channels phase modulation solution for multibeam coherent combination.

PowerPhotonic's Coherent Beam Combining Module

PowerPhotonic's new white paper on laser Coherent Beam Combining (CBC) gives an overview of how its new module solves, through the novel application of

Coherent Beam Combining | Exail

Exail offers optimized photonics solutions to develop Directed Energy Laser systems by using the Coherent Beam Combining (CBC) technique.

PowerPoint Presentation

Sophistication of the fully corrected CBC combiner module is worth these real world advantages Recent Advances on CBC Modules Since 2022, PowerPhotonic has: o Optimized design sets of wafer-scale

Beam Combining for High Brightness | Ferdinand-Braun

Novel amplifiers are suitable for this purpose, whose optical power is combined by means of CBC to form a nearly diffraction-limited beam. These methods have

Harnessing artificial intelligence for coherent beam combination

Traditional phase control algorithms face challenges in large-scale CBC systems due to low control bandwidth. With the rapid development of artificial intelligence (AI) technologies,

(PDF) Demonstration of Coherent Beam Combining for

We report the demonstration of a novel free space optical (FSO) communication scheme utilizing transmitter-side coherent beam combining

Realization of large energy proportion in the central lobe

This work presents a promising structure for the achievement of large energy proportion in the central lobe in high power fiber laser CBC systems.

Coherent beam combining of 7 fiber amplifiers based on all-fiber ...

Thirdly, the power scaling capability of optical fiber amplifiers needs to be further studied. To cope with the challenges, this paper built a CBC system of 7 channels to verify the internal phase

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Spectral vs. Coherent Beam Combining: How Do They

Coherent Beam Combination (CBC) and Spectral Beam Combination (SBC) are both capable of combining large numbers of optical beams. These

Coherent Beam Combining

This modular assembly not only streamlines the coherent beam combination process but also provides unmatched precision and optimization. Elevate your

ModBox-CBC-1064nm

Additionally, iXblue phase modulator is well known to be the best planar phase modulator in the NIR featuring the highest optical input power handling capability. The component selection makes the

Coherent Beam Combining (CBC) and modulation

Known for its superior optical input power handling capability, the ModBox CBC is an accurate, adjustable, and reliable phase-lock modulation solution ideal for

PowerPoint Presentation

Design and manufacture of precision fused silica wafer-scale freeform optics. Providing optics and assemblies for high power laser applications. Shipping products since 2006 to industrial, imaging,

(PDF) Optical Angular Momentum Beam Generation

This work provides insight into the basic principles of CBC and the search for an alternative, namely optical angular momentum (OAM) generation

Contact Us

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