Physikalisch Technische Bundesanstalt

Technology Offer

Conversion of pulsed laser radiation into CW-radiation

Pulse-to-CW converter

A radiation source which can be spectrally tuned from the UV-C into the medium IR range is most useful in vast fields of optical metrology. Only lasers with pulsed radiation can live up to this requirement whilst providing a sufficient output signal. With their easily automatable and broad spectral tunability, femtosecond laser systems would be the ideal radiation source, for instance for radiometric applications – if only their radiation were not pulsed.

The extreme pulse-to-down-time ratio of 10^{-5} causes high power peaks which can, in turn, lead to signal saturation effects in the detectors and, thus, to non-linear behaviour. The pulse-to-CW converter developed at PTB solves just this problem.

Advantages

- **conversion from pulsed quasi-CW laser radiation to real CW**
- **no disturbing interferences**
- **only minimum absorption of the signal**
- **applicable also at shorter wavelengths**
- **high radiation power**

Technical description

With this method, pulses from pulsed radiation sources with a sufficiently high repetition rate are converted into CW radiation. For this, each pulse is divided into many small partial pulses which are subjected to different times of flight on distances of different lengths. At the output of the system, they appear as temporally constant. This pulse-to-CW converter is realized via a glass-fibre bundle in which each single glass fibre has an individually defined length.

Application

Developing a pulse-to-CW converter bridged the gap that existed when powerful femtosecond (fs) laser systems were used in metrology; it is also the first time pulsed laser radiation has been converted into CW radiation. This new development now allows conventional monochromator systems to be replaced by fs laser systems whose spectral output power is up to 1,000 times higher.

Economic significance

The new pulse-to-CW converter will allow the reference and transfer standards to be calibrated with a considerably reduced measurement uncertainty in fields as important as, e.g., photovoltaics, photometry, UV radiation metrology, and reflectometry. To date, significant measurement uncertainty shares have been caused by insufficient radiation powers provided by conventional monochromator systems.

Development status

The CW converter was granted a patent: DE 10 2010 011 615 B4. The system is regularly used at PTB.

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