CALORIMETERS

Photo courtesy of Lawrence Livermore National Laboratory

A Gentec-EO calorimeter is the only reliable solution available for the largest and highest energy laser beams. Through cooperation with several leading research facilities around the world, Gentec-EO has become the expert in manufacturing, calibrating and servicing calorimeters for use in high energy inertial confinement fusion calorimetric measurement.

PRESENTATION

STATE-OF-THE-ART

We work with a wide range of materials from surface coatings to the most robust volume absorbers to provide the best solution for your specific application.

- OUTSTANDING SIGNAL TO NOISE RATIOS
- HIGH SENSITIVITY
- VACUUM COMPATIBILITY
- ATTENTION TO DETAIL AND WORKMANSHIP

gained over 40 years of experience in thermal-based energy measurement make Gentec-EO the ideal choice for all your high energy measurement needs.

ACCURATE

Using NIST traceable sources and proven calibration techniques, your Gentec-EO calorimeter is always the most accurate large aperture measurement device on the market.

With calibration uncertainties of ±3%, and repeatabilities better than ±2% for very large beams, Gentec-EO offers the very best solution for extreme energy measurement and for balancing in multi laser systems.

CUSTOMIZED

We have designed calorimeters for 16 kJ beams. We have built them for beams as large as 420 x 427 mm in aperture size, to withstand pulse energy densities of more than 15 J/cm^2.

We have also provided highly sensitive, large-aperture size calorimeters for beam energies as low as 50 mJ for the most delicate applications.

Our calorimeters span the band from 190 nm to 25 microns. Moreover, we are happy to push these limits even further. We work with a wide range of materials from surface coatings to the most robust volume absorbers to provide the best solution for your specific application.

APPLICATIONS

LASER FUSION EXPERIMENTS

Inertial confinement fusion (ICF) is a process where nuclear fusion reactions are initiated by heating and compressing a fuel target, typically in the form of a pellet that most often contains a mixture of deuterium and tritium. To compress and heat the fuel, energy is delivered to the outer layer of the target using high-energy beams of laser light.* ICF is said to reproduce the energy generation process taking place in the core of the sun.

Several laser fusion projects are underway around the world right now, their main goal is to produce a clean, reliable and nearly unlimited source of energy. All these laser fusion experiments use very high energy lasers of sereval kJ per pulse for which a Gentec-EO calorimeter is the ONLY reliable measuring device available on the market. Over the years, we have been presented with increasingly large and energetic laser pulses to be measured and we have kept pace with the world's most demanding lasers.

** Source: Wikipedia.*

LASER FUSION MECHANISM

Schematic of the stages of inertial confinement fusion using lasers. The blue arrows represent radiation; orange is blowoff; purple is inwardly transported thermal energy.

1.
Laser beams or laser-produced X-rays rapidly heat the surface of the fusion target, forming a surrounding plasma envelope.

2.
Fuel is compressed by the rocket-like blowoff of the hot surface material.

3.
During the final part of the capsule implosion, the fuel core reaches 20 times the density of lead and ignites at 100,000,000 °C.

4.
Thermonuclear burn spreads rapidly through the compressed fuel, yielding many times the input energy.

Typical pulse values for these lasers are in the range:

Aperture Sizes:
Up to 420 x 427 mm

Energy Range:
Up to 16 kJ

Pulse Widths:
Nanoseconds

Wavelengths:
From UV to NIR

FEMTOSECOND LASERS

Femtosecond lasers are developping at a very fast pace. Some lasers now feature peak powers in the Petawatts (10^{15}W). Furthermore, the beam sizes can be fairly small, which results in peak power densities too high for a standard detector. Typically, pulse values for these lasers are in the range:

Beam Sizes: Up to 160 mm Ø
Energy range: 1 J to 100 J
Pulse Widths: Femto & picosecond
Wavelengths: UV to NIR

For these, a Gentec-EO calorimeter is the only reliable solution. Furthermore, it can sometimes be used in power meter mode.

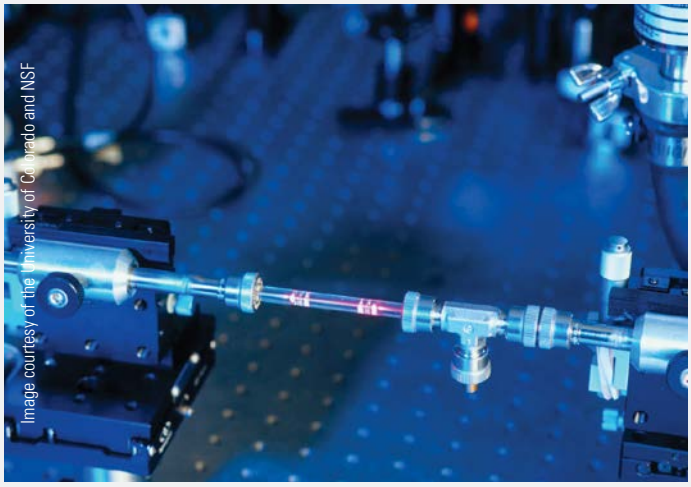


Image courtesy of the University of Colorado and NSF

TECHNICAL ASPECTS

EXAMPLES OF CUSTOM CALORIMETERS

MAIN SPECIFICATIONS	SPECTRAL RANGE	MINIMUM ENERGY	MAXIMUM ENERGY
RECTANGULAR APERTURES			
420 x 427 mm	1053 nm	500 J	16 000 J
420 x 427 mm	351/532/1053 nm	200 J	5 000 J
110 x 110 mm	351/532/1053 nm	1 J	50 J
400 x 400 mm	351/532/1053 nm	200 J	5 000 J
230 x 230 mm	532/1064 nm	100 J	1 500 J
ROUND APERTURES			
310 mm Ø	351 nm	20 J	500 J
310 mm Ø	0.35 - 1.1 µm	200 J	1 500 J
150 mm Ø	0.3 - 1.1 µm	1 J	500 J
50 mm Ø	0.19 - 10 µm	15 mJ	200 J
19 mm Ø	0.19 - 25 µm	1 mJ	2.3 J
17 mm Ø	0.19 - 10 µm	1 mJ	23 J

MONITORING

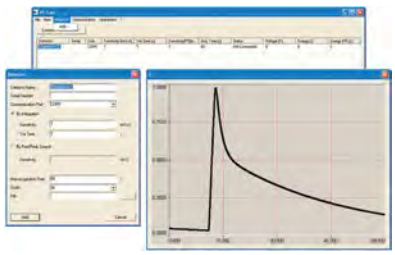
MONITOR

Dual Channel (up to 4 on request)
Power & Energy PC-Based (USB or Ethernet)

S-LINK & P-LINK

The P-LINK and S-LINK are PC-Based power and energy monitors. The S-LINK comes with 1 or 2 channels and the P-LINK with 1 or 4 channels. They are the perfect choice to be integrated into your system and used remotely. You have the choice between USB, RS-232 or Ethernet connection and both come with a complete acquisition software.
See pages **28** & **30**.

ACQUISITION SOFTWARE



Can handle several calorimeters Saves Data to the PC Graphic Display

PC-CALO

The PC-Calo is a user-friendly PC interface that reads and controls several channels simultaneously via a USB or Ethernet connection. It reads the voltage outputs of the S-LINK, saves the data in a spreadsheet, displays the data graphically and analyzes the measured energy. The parameters are entered seperately and the data can be treated individually or simultaneously.

REMOTE SYSTEM DIAGNOSTIC

Validation of the Calibration
Verification of the Signal Response

RSD

Do the on-site monitoring of your calorimeter using our special diagnostic tool. The verification is done remotely so you can control it from another location. The diagnostic includes the verification of the calorimeter's calibration and of the signal response and data acquisition.