TOPTICA’s TeraFlash smart utilizes a proprietary laser modulation scheme dubbed ECOPS (“electronically controlled optical sampling”). The approach employs two femtosecond lasers rather than one, eliminating the need for a mechanical delay. This results in extremely high measurement speeds: the TeraFlash smart acquires 1600 complete terahertz waveforms per second. In a “single-shot” measurement, the system achieves a time-domain dynamic range of > 50 dB and a spectral bandwidth of 3 THz. Within one second of averaging, the time-domain dynamic range increases to > 80 dB and the bandwidth reaches 4.5 THz. The system enables terahertz-based thickness gauging at unprecedented speed, and lends itself particularly to measurements on rapidly moving samples, e.g. conveyor belts, papermaking machines, or extrusion lines.

Terahertz spectrum of air with water vapor lines, obtained with the TeraFlash smart. With 1000 averages, the spectrum spans almost 5 THz – within a measurement time as short as 600 milliseconds.

**Time-domain dynamic vs. measurement time.** Yellow and black symbols denote measurement speeds of 1600 traces/s and 200 traces/s, respectively.

**Key Features**

- Enables fastest terahertz-based thickness measurements to-date
- Proprietary ECOPS technology
- Robust design
- 1600 pulse traces/s @ 150 ps scan length
## Specifications TeraFlash smart

| Components            | 2 synchronized femtosecond lasers  
|                       | SM/PM fiber delivery  
|                       | Electronic delay  
|                       | 2 InGaAs photoconductive switches  
|                       | Electronics for data acquisition  
| Laser wavelength      | 1560 nm  
| Laser pulse width     | typ. 80 fs  
| Laser repetition rate | 80 MHz  
| External fiber length | 10.8 m  
| Terahertz emitter     | #EK-001123: InGaAs/InP photoconductive switch with 100 µm strip-line antenna, 0.3 m fiber pigtail  
| Terahertz receiver    | #EK-001125: InGaAs/InP photoconductive switch with 25 µm dipole antenna, 10 µm gap, 0.3 m fiber pigtail, integrated preamplifier  
| Antenna package       | Cylindrical, 25 mm, integrated Si lens and SM/PM fiber pigtail  
| Scan range            | 150 ps / 400 ps / 700 ps  
| Scan speed            | 1600 traces/s (150 ps)  
|                       | 800 traces/s (400 ps)  
|                       | 200 traces/s (700 ps)  
| Spectral range        | 0.1 – 4.5 THz, in < 1 s  
| Average terahertz power | typ. 30 µW  
| Time-domain dynamic range | typ. > 50 dB in < 1 ms  
|                       | 80 dB in 1 s  
| Spectral peak dynamic range | typ. 35 dB in < 1 ms  
|                       | > 60 dB in 1 sec  
| Useable terahertz path length | 10 – 180 cm, adjustable via software (electronic phase shift)  
| Frequency resolution @ max. scan range | < 1.5 GHz  
| Computer interface    | Ethernet and USB, Data streaming via USB  
| Computer software     | LabView-based GUI, included  
| Size (H x W x D)      | 200 x 450 x 440 mm³  
| System weight         | 20 kg  
| Operating voltage     | 24 V DC, power supply included  
| Accessories           | Transmission optomechanics, Reflection head  

### Schematic diagram of the TeraFlash smart

Blue lines depict electric signals, red lines the optical signals. The black arrows depict the momentary difference in repetition rates.

**Further reading:**