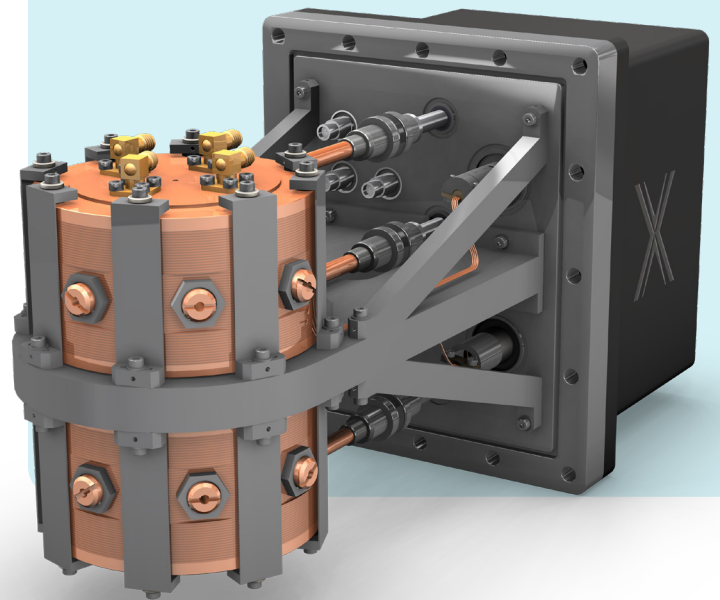




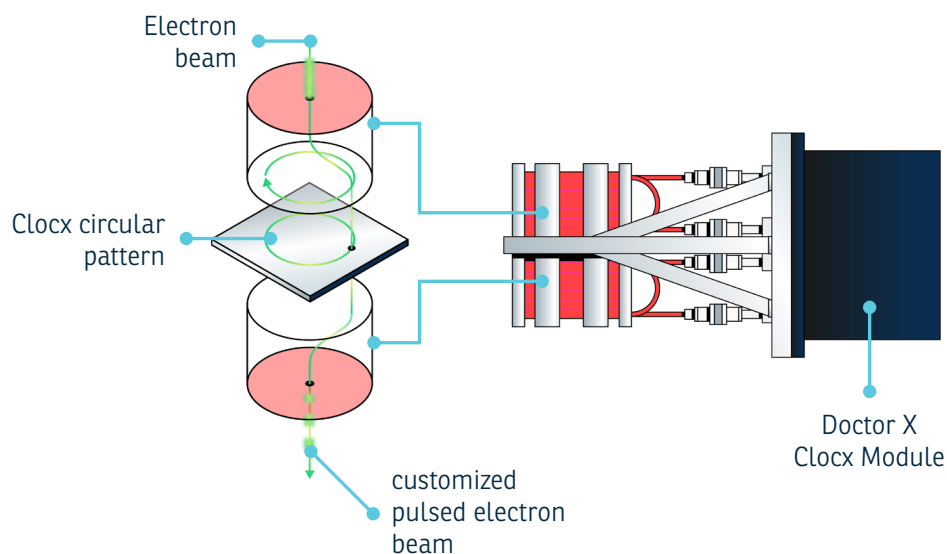
Doctor X

Clocx Module

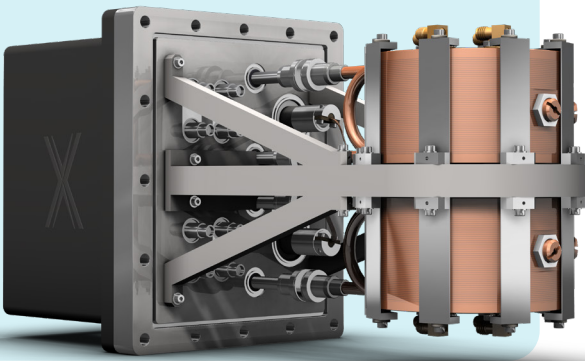
Ultrafast electron techniques for microscopy



The Clocx Module (XFEG & CFEG compatible) adds ultrafast capability to your existing transmission electron microscope with no compromise in performance. The module integrates directly into your current system, using a rotating magnetic field to convert the continuous beam into controllable pulses. Switching from normal to pulse mode takes minutes. Without the need to replace your TEM or invest in an amplified femtosecond laser for pulse generation, your setup gets full control over pulse structure with previously unobtainable flexibility.



Clocx Module



The Clocx Module consists of a modulator, an interchangeable chopping aperture, a demodulator, and a control cabinet. The module is placed between the electron gun and the condenser system of your TEM. The modulator uses a rotating magnetic field at GHz frequencies to displace the continuous beam onto a circular pattern. Time maps linearly onto the circle: each position on the circumference corresponds to a specific moment in the RF cycle, like a clock. A chopping aperture placed between modulator and demodulator selects which portions of the beam pass through. The demodulator, rotating with half period phase delay, returns the selected pulses to a straight line on the original optical axis.

The parallel displacement by the (de)modulator preserves beam angle, minimizing growth in emittance and energy spread. Peak brightness is conserved, leaving spatial resolution in pulsed mode unchanged from continuous operation. By swapping apertures with different hole patterns, you configure the pulse structure to your needs: single pulses at 2.45 GHz, higher harmonics up to THz rates, low-frequency modes from 1 to 80 MHz, or fully custom temporal profiles. A microwave synchronization output connects to your pump laser for pump-probe experiments. The module ships complete: modulator and demodulator inserts, aperture set, control cabinet with RF driver, chillers, and control software.

Specifications

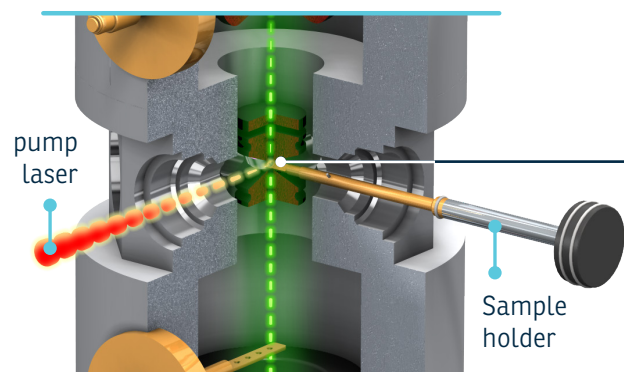
- Base frequency: 2.45 GHz
- Repetition rate: 1 MHz – THz (via aperture selection and harmonic operation)
- Pulse duration: 100 fs – 400 ps
- Pulse profiles: configurable via interchangeable apertures
- Spatial resolution: unchanged from continuous mode
- Gun compatibility: XFEG & CFEG

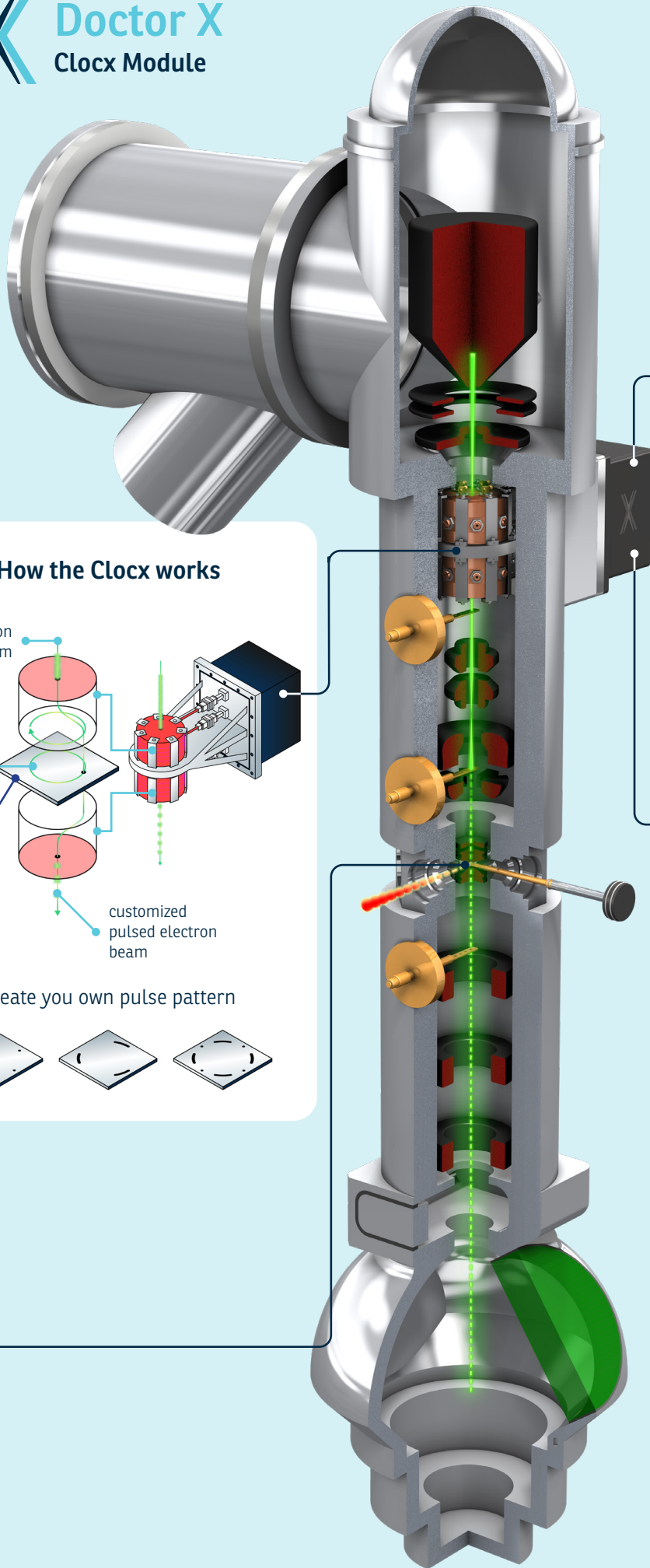
The Invisible Visible

Ultrafast processes - events that unfold on femtosecond timescales - remained invisible for decades. These processes occur too fast to be captured by conventional instruments, leaving entire classes of physical, chemical, and biological phenomena effectively out of reach. Our technology changes that.

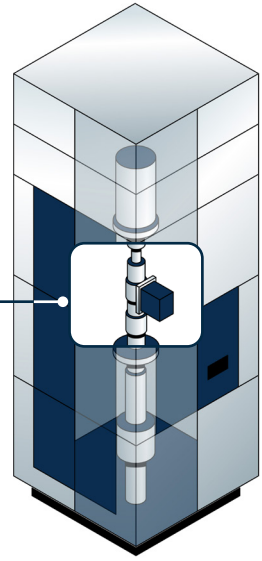
Doctor X instruments achieve superior time resolution in electron microscopy. Researchers can now observe phase transitions as they happen, watch phonons vibrate and capture photosynthesis dynamics at the molecular level. This is like moving from photography to video at the atomic scale.

In a pump probe scheme a pump laser pulse is used to excite the sample. The pulsed electron beam that probes the sample is synchronized to the laser pulse. Varying the delay between the pump and the probe allows the lissajoux to make the invisible visible.

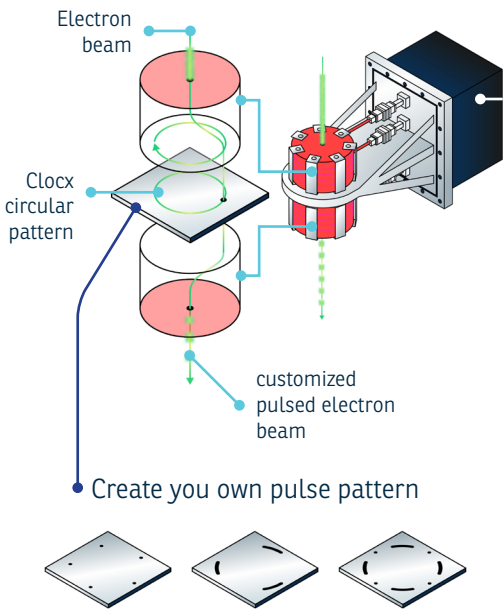




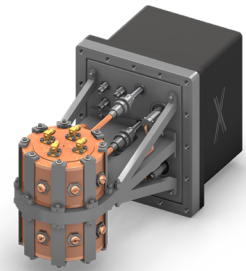
The Clox Module integration in the TEM



How the Clox works



The Clox Module consists of the RF cavity insert and a control cabinet





INDEPENDENT INSTRUMENT MAKER

Founded in 2018 by brothers Jom and Thomas Luiten, Doctor X operates as an independent instrument maker from Eindhoven, Netherlands.

[Read more on doctor-x.nl](https://doctor-x.nl)

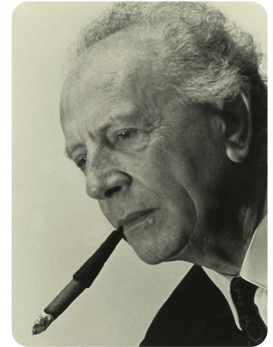
Origin Story

Doctor X was founded in 2018 by brothers Jom and Thomas Luiten. Jom developed ultrafast electron techniques at Eindhoven University of Technology. Thomas recognized the potential, and how it could be developed into instruments that scientists can actually use to further scientific endeavors.

The name honors their grandfather Xavier Wolters. By day Xavier taught Latin and Greek at a lyceum. By night he crafted replica antique clocks on a lathe and his own milling machine. His business card read "Dr. X"—a lighthearted reference to his doctorate and first initial.

Xavier's principles still guide us: work across boundaries when challenges demand it, approach every project with precision and curiosity, and never settle for less than proper.

*Dr. Xavier Wolters,
Knight in the Order of Orange-Nassau*

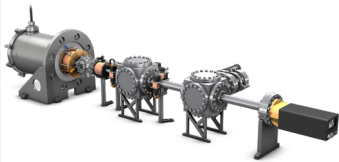


“ Doctor X makes research instruments that give scientists state-of-the-art time resolution which was previously not commercially available. ”

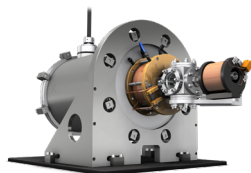
Dr. Ir. Jim Franssen
Senior Manager Research & Development

Check these Doctor X products on our website

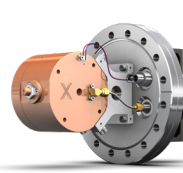
Structural Dynamics Probe



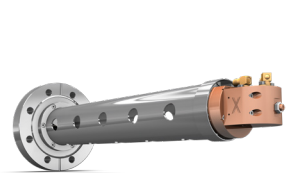
Photogun Module



Compression Module



Deflection Module



Doctor X

Doctor X BV

De Lismortel 31
5612 AR Eindhoven
The Netherlands

T +31(0)40 23 90 909
E info@doctor-x.nl
W doctor-x.nl



doctor-x.nl