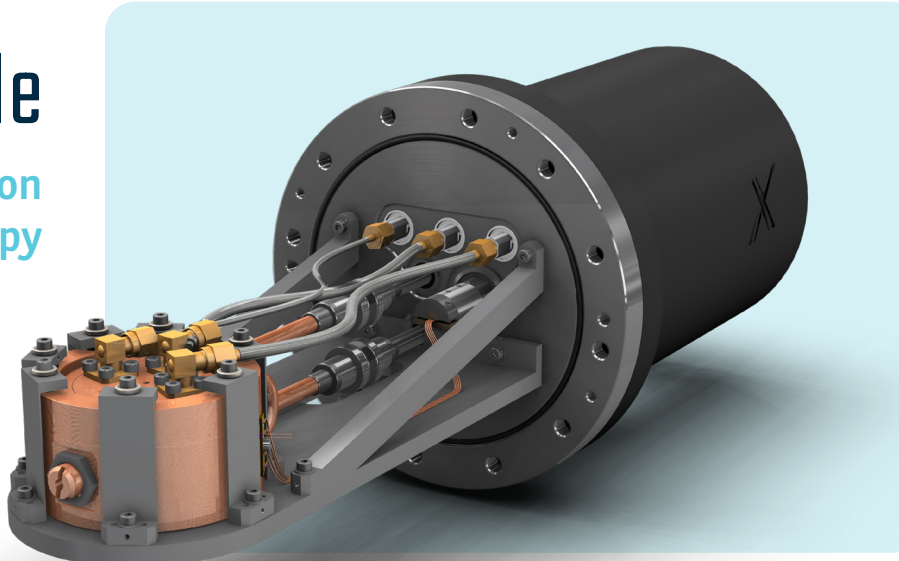
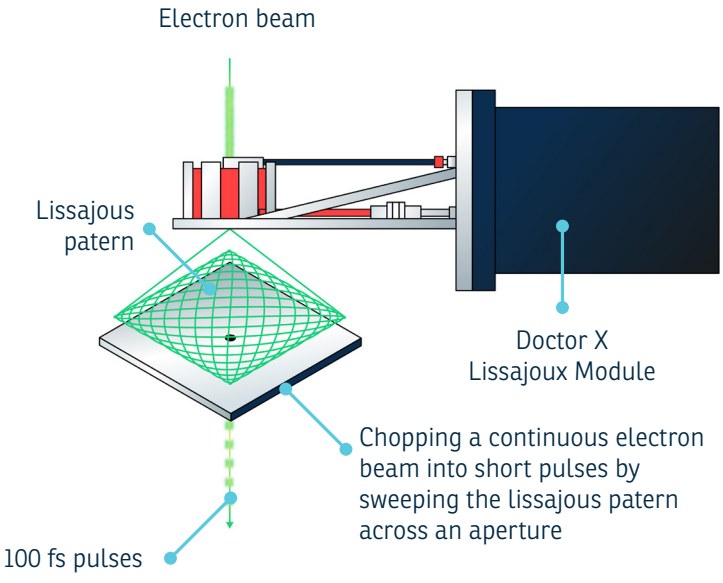
Doctor X

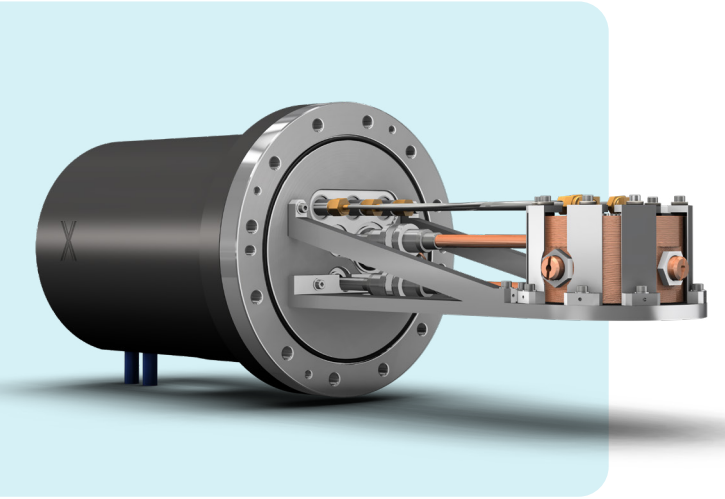
# Lissajoux Module

## Ultrafast electron techniques for microscopy



The Lissajoux 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 an RF deflection cavity to chop the continuous beam into ultrashort 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 high time resolution at previously unobtainable precision.





# Lissajoux Module

The Lissajoux Module consists of the RF deflection cavity insert and a control cabinet. The cavity insert is placed between the electron gun and the condenser system of your TEM.
The cavity makes the continuous beam trace a Lissajous pattern on the C2 condensor aperture. This produces a chopped beam with pulse lengths from 100 fs to 10 ps at a 75 MHz or 2.4 GHz repetition rate.

The gun crossover is positioned at the center of the RF cavity, preventing growth in emittance and energy spread from chopping. This means that the peak brightness is conserved, leaving spatial resolution in pulsed mode unchanged from continuous operation. The module provides a synchronization output for your pump laser, enabling pump-probe experiments. Control software is included.

The Lissajoux Module was developed with Prof. Jom Luiten and the Coherence and Quantum Technology group at Eindhoven University of Technology, and has been installed and proven across multiple systems, performing consistently over several years. The module ships complete: RF deflection cavity insert, control cabinet with RF driver, chillers, and control software.

## Specifications

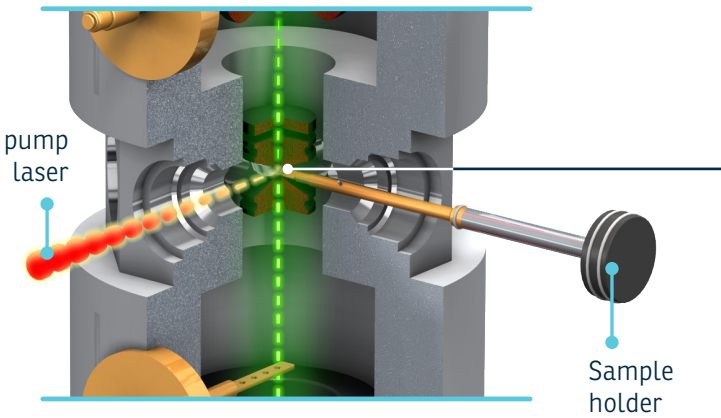
- Repetition rate: 75 MHz or 2.4 GHz
- Pulse duration: 100 fs – 10 ps
- Spatial resolution: unchanged from continuous mode
- Gun compatibility: XFEG & CFEG

# The Invisible Visible

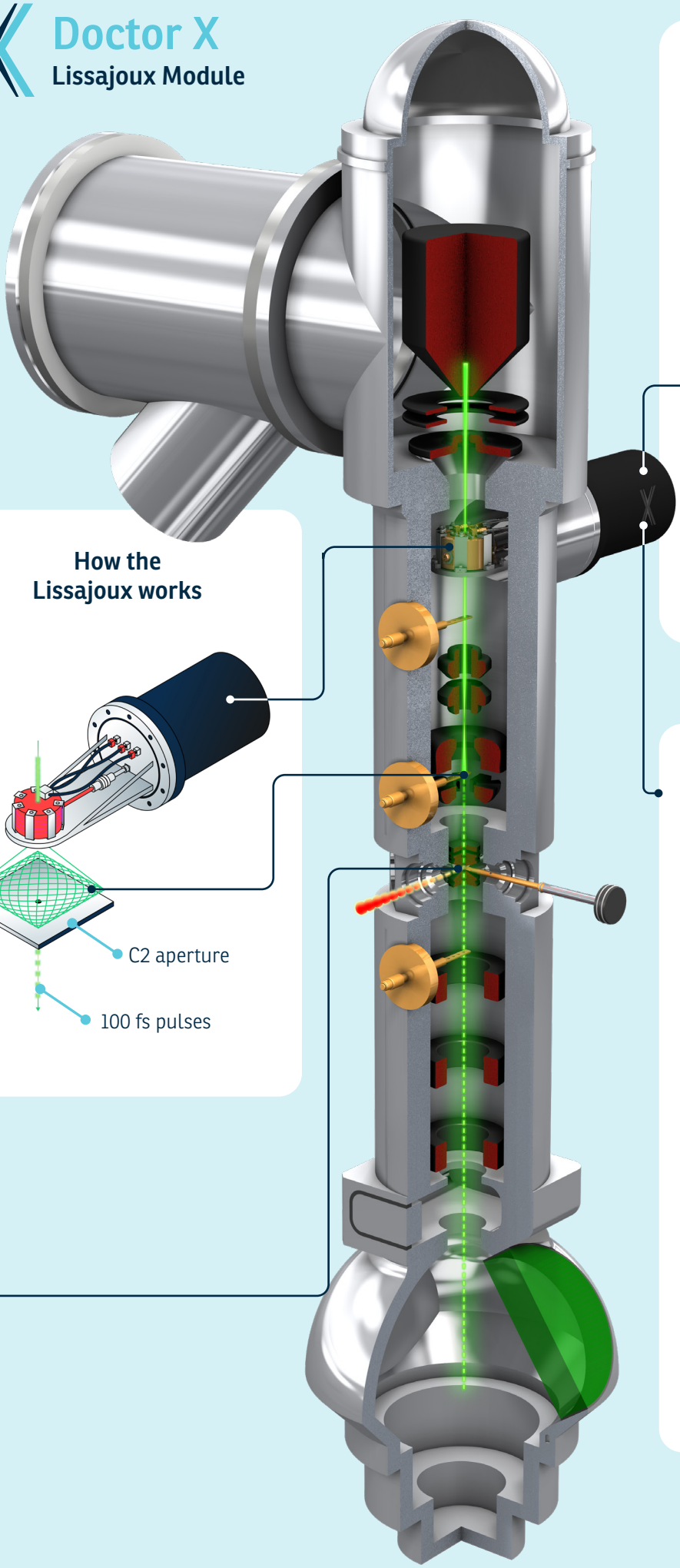
Ultrafast processes - events that unfold on femtosecond timescales - remained invisible for decades. These processes occur too fast to be captured by conventional instruments, leaving entire classes of physical, chemical, and biological phenomena effectively out of reach. Our technology changes that.

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.

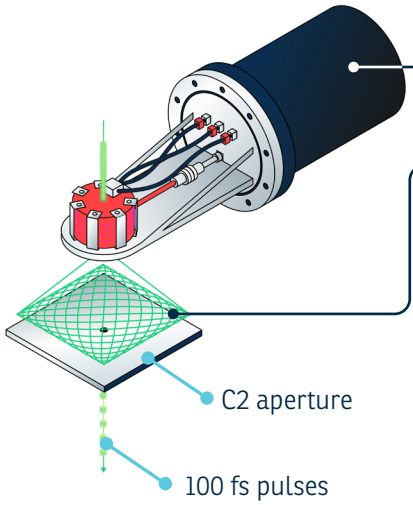
In a pump probe scheme a pump laser pulse is used to excite the sample. The pulsed electron beam that probes the sample is synchronized to the laser pulse. Varying the delay between the pump and the probe allows the lissajoux to make the invisible visible.



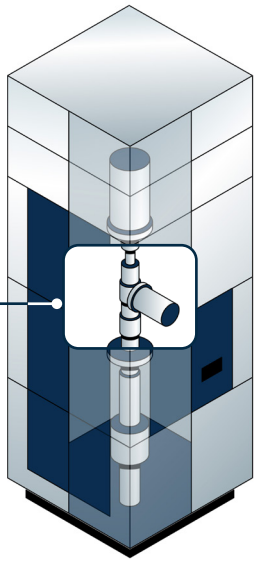
# Doctor X
## Lissajoux Module



### How the Lissajoux works




### The Lissajoux Module integration in the TEM



### The Lissajoux Module consists of the RF deflection cavity insert and a control cabinet

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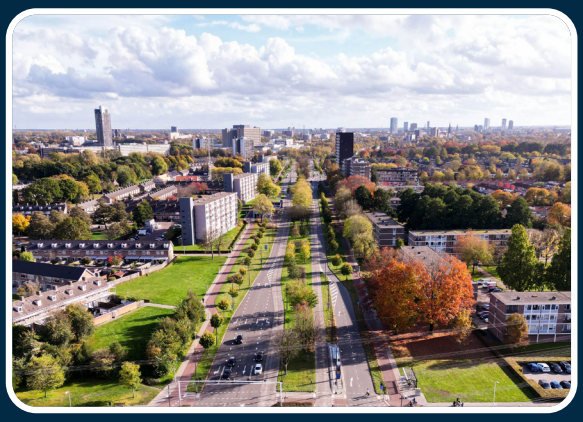


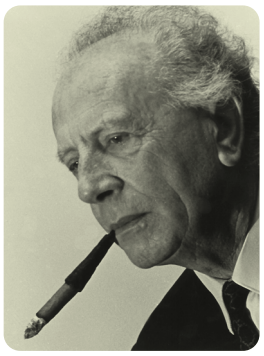
## INDEPENDENT INSTRUMENT MAKER

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**

# Origin Story

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



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.

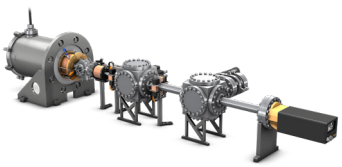
The name honors their grandfather Xavier Wolters. By day Xavier taught Latin and Greek at a lyceum. By night he crafted replica antique clocks on a lathe and his own milling machine. His business card read “Dr. X”—a lighthearted reference to his doctorate and first initial.

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.

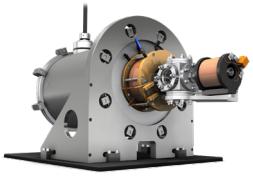
> **Doctor X makes research instruments that give scientists state-of-the-art time resolution which was previously not commercially available.**
>
> **Dr. Ir. Jim Franssen**
> Senior Manager Research & Development

## Check these Doctor X products on our website

### Structural Dynamics Probe

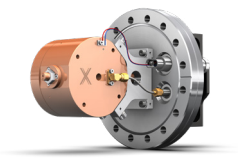


### Photogun Module



### Deflection Module

### Compression Module



Doctor X

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