My research interests lie in the development of instruments and methods to expand our view of matter. I mainly work with sources based on ultrafast lasers to produce ultrashort pulses of X-rays and electrons, to probe samples that have a societal and/or biological relevance, using imaging techniques often based on coherent diffraction.

Academic experience

Sep 2019 - Present

For my current **Post-doctoral research** at **Laboratoire d'Optique Appliquée (France)** with Prof. J. Faure, for which I successfully applied for the **École Polytechnique Junior Postdoc Grant**, I returned to the field of **Laser Wakefield Acceleration** (LWFA) that my internship introduced me to. LWFA is a technique which allows building **compact sources of ultrashort bunches of relativistic electrons**, based on the interaction of an ultrashort laser pulse with a plasma. The goals of my postdoc are to improve the control over the **source technology** and apply it to experiments in **electron diffraction** and **radiobiology**.

Oct 2015 - Jun 2019

Ph.D. Thesis : Broadband Coherent X-ray Diffractive Imaging and Developments towards a High Repetition Rate mid-IR driven keV High Harmonic Source

I performed my PhD research in the **Ultrafast Nanophotonics Group** at **CEA (France)**, under supervision of H. Merdji, and in the **Attoscience and Ultrafast Optics Group** of J. Biegert at **ICFO (Spain)**. I developed a method for Coherent Diffractive Imaging (CDI) using broad spectra. CDI is a powerful imaging method that does not need lenses, and is therefore often used in EUV/X-ray microscopy, on synchrotron, FEL or High-Harmonic Generation (HHG) sources. I developed Broadband CDI to perform imaging of biological samples on a 'water window' HHG source at ICFO. I validated my method on a supercontinuum source **(IOGS, France)** and a **synchrotron (Soleil, France)**. Additionally, I worked on innovative ways to combine laser pulse compression and HHG on a 3-micron OPCPA at ICFO. Finally, I **organized research stays at MPL (Erlangen, Germany) and LMB (Uppsala, Sweden)**. I enjoyed a **high degree of academic freedom** during my PhD, developing my own ideas, devising and running experiments, applying for synchrotron beamtime and nurturing international collaborations. I also like to share my work with a broader audience, as exemplified by the **prizes** I won for the best presentation at the 2017 "PhD Days" of the doctoral school and at the writing competition of the Dutch Physical Society.

Feb 2012 - Jun 2015

Master Applied Physics, Delft University of Technology

- **6-month Internship in Laser Wakefield Acceleration** at BELLA Center, **LBNL (Berkeley)**, supervised by J. van Tilborg and W. Leemans. Here I learned many technical skills that proved essential for the rest of my career, on **femtosecond lasers**, **vacuum systems** and **electron detection**. I also attended the 'Introduction to **Neurobiology'** course (**UC Berkeley**) out of curiosity.
- **Master thesis** at the **Reactor Institute Delft:**
  "Paving the way for a neutron imaging setup at the Reactor Institute Delft"
  A project with large **academic freedom**: I set up a proof-of-principle neutron imaging beamline, identified the needs of possible end users in the Netherlands (e.g. Rijksmuseum, the National Cultural Heritage Agency, university departments, Unilever, FrieslandCampina) and organised a **research stay at PSI** (Switzerland). **My results were used to attract financing** for the imaging beamline FISH, currently in operation at the RID. This project demonstrates my **independence, initiative, and affinity with societally relevant research**.
- **Summer University** for Plasma Physics and Fusion Research at the **Max-Planck-Institut für Plasmaphysik** (Germany).
- **Semester abroad** at **Universidad de Zaragoza (Spain, Erasmus Programme)**

Sep 2008 - Feb 2012 **Bachelor Applied Physics, Delft University of Technology**

- **Thesis** at the Cees Dekker Lab, **Kavli Institute of Nanoscience**:
  "Maximizing the data throughput in multiplexed magnetic tweezers experiments using directed DNA tethering."
  A crucial aspect here was the validation that was offered through a combination of Atomic Force Microscopy and fluorescence microscopy, which showed the value of combining different techniques and collaborating with people with different expertise.
- **Feasibility study** at AN College Patna **(India)** on electrifying remote villages with solar panels involving local farmers and students, as part of the minor on International Entrepreneurship & Development.
- **Head editor and writer** of magazine of the study-association (Run: +/- 1100 copies)

Sep 2002 - Jul 2008 **Gymnasium**, St. Vituscollege, Bussum
(Highest level of pre-university education in the Netherlands)

- **Leiden Advanced Pre-university Programme for Top students, Leiden University**. Focus on nano-technology and quantum mechanics.

Peer-Review Publications

2021

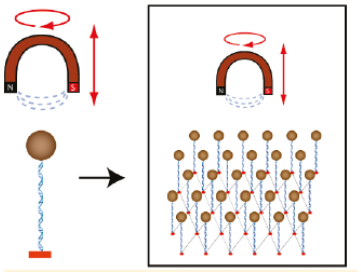
- **J. Huijts**, L. Rovige, I.A. Andriyash, A. Vernier, M. Ouillé, J. Kaur, Z. Cheng, R. Lopez-Martens and J. Faure, **Waveform Control of Relativistic Electron Dynamics in Laser-Plasma Acceleration**, Physical Review X 12 (1), 011036 **(2022)** In this paper we show that in our experiments we can not only observe, but even control the CEP effects described in the paper below. This shows that we are able to achieve an unprecedentedly high level of control over this complex source of ultrafast electron bunches.
- **J. Huijts**, I. Andriyash, L. Rovige, A. Vernier and J. Faure, **Identifying observable carrier-envelope phase effects in laser wakefield acceleration with near-single-cycle pulses**, *Physics of Plasmas* **28** (4), 043101 **(2021)** (cover article). One of the subjects of my post-doc is to research the effect of the carrier-envelope-phase (the exact shape of the electric field of the laser) on the LWFA process. In this paper I use simulations to identify how these effects could be observed in an experiment, which makes it a preparation for the paper above.
- L. Rovige, **J.Huijts**, [13 others] and J. Faure, **Symmetric and asymmetric shocked gas jets for laser-plasma experiments**, *Review of Scientific Instruments* **92**, 083302 **(2021)**. Reports on a design study of gas jets for our experiments in laser wakefield acceleration.
- L. Rovige, **J. Huijts**, [13 others] and J. Faure, "**Optimization and stabilization of a kilohertz laser-plasma accelerator**", Physics of Plasmas **28** (3), 033105 **(2021)**. A parametric study of laser wakefield acceleration as a function of varying laser pulse length (from 3.5 to 10 fs) and plasma density.
- M. Cavallone, L. Rovige, **J. Huijts**, E. Bayart, R. Delorme, A. Vernier, P.G. Jorge, R. Moeckli, E. Deutsch, J. Faure and A. Flacco, **Dosimetric characterisation and application to radiation biology of a kHz laser-driven electron beam**, *Applied Physics B* **127** (57), **(2021)**. We make use of the stability of our electron source to apply it to a radiobiology experiment: in collaboration with radiobiologists we performed a dosimetric characterization of our source and irradiated different types of cancer cells. My job was to run the accelerator, meeting the needs of the radiobiologists. These results demonstrate my ability to collaborate with people from different disciplines and my affinity with biological applications.

2020
- L. Rovige, **J. Huijts**, A. Vernier, V. Tomkus, V. Girdauskas, G. Raciukaitis, J. Dudutis, V. Stankevic, P. Gecys, M. Ouillé, Z. Cheng, R. Lopez-Martens and J. Faure, **Demonstration of stable long-term operation of a kilohertz laser-plasma accelerator**, Physical Review Accelerators and Beams **23**, 093401 **(2020)**. In this paper we show we achieved stable, hands-off operation of our LWFA source over 5 hours or 18 million shots, which is a world record and shows that the source can be used for applications.
- **J. Huijts**, S. Fernandez, D. Gauthier, M. Kholodtsova, A. Maghraoui, K. Medjoubi, A. Somogyi, W. Boutu and H. Merdji, **Broadband Coherent Diffractive Imaging**, *Nature Photonics* **14** (10), 618-622 **(2020)**. The main result of my PhD research. I came up with the idea for the Broadband CDI method, wrote the algorithm, performed the first test experiment on a supercontinuum source, applied for synchrotron beamtime which was approved, lead the synchrotron experiment, analysed the data and wrote most of the paper. At each of these steps I received crucial support of e.g. the co-authors, but this paper shows I am capable of leading a research project from idea to publication. Led to an invited presentation at CLEO 2021.

2019
- J. Duarte, R. Cassin, **J. Huijts**, B. Iwan, F. Fortuna, L. Delbecq, H. Chapman, M. Fajardo, M. Kovacev, W. Boutu and H. Merdji, **Computed stereo lensless X-ray imaging**, *Nature Photonics* **13**, 449-453 (2019). An experiment in which we showed stereo imaging (obtaining volumetric information from two angularly separated views) using XUV and X-ray radiation.

2015
- J. van Tilborg, S. Steinke, C.G.R. Geddes, N.H. Matlis, B.H. Shaw, A.J. Gonsalves, **J.V. Huijts**, K. Nakamura, J. Daniels, C.B. Schroeder, C. Benedetti, E. Esarey, S.S. Bulanov, N.A. Bobrova, P.V. Sasorov, and W.P. Leemans, **Active plasma lensing for relativistic laser-plasma-accelerated electron beams,** *Physical Review Letters* **115** (18), 184802 **(2015).** When coupling two laser-wakefield accelerators ('stages'), we observed that the second stage could act as a tunable lens for the electron beam produced in the first stage. My contributions to this experiment were several improvements to this complex setup and data acquisition during the experiment, together with J. van Tilborg and S. Steinke.

2011
- I. De Vlaminck, T. Henighan, M. T. J. van Loenhout, I. Pfeiffer, **J. V. Huijts**, J. W. J. Kerssemakers, A. J. Katan, A. van Langen-Suurling, E. van der Drift, C. Wyman, and C. Dekker, **Highly parallel magnetic tweezers by targeted DNA tethering,** *Nano Letters* **11** (12), 5489-5493 **(2011).** In my Bachelor's thesis project at the Kavli Institute of Nanoscience (Delft), a magnetic tweezer setup, which typically allows to measure the mechanical properties of a single (bio-)molecule, was modified with the goal to simultaneously measure hundreds of single molecules (Fig. 3). This allows to study rare events in DNA-protein interactions. My contribution was the optimisation of a nano-patterning process in the sample preparation which causes the distribution of the molecules in the field of view to no longer be random but on a hexagonal grid. This increased the throughput by an order of magnitude (1.15eπ to be exact) and allowed to determine the mechanical behaviour of 357 DNA molecules in a single measurement. This again demonstrates my affinity for physics research with a biochemical application.



Other output

2021 • J. Huijts, **Kleurrijke diffractie maakt ultrasnelle microscopie mogelijk.** *Nederlands Tijdschrift voor Natuurkunde* **87** (4), 14 **(2021)** (in Dutch)**.** I won the yearly competition organized by the magazine of the Dutch Physical Society, where the challenge is to explain one's PhD research to a general audience of physicists in a way that is both accurate and accessible. It shows that I am capable of disseminating my results to a broad audience.

2019 • J. Huijts, **Broadband Coherent X-ray Diffractive Imaging and Developments towards a High Repetition Rate mid-IR Driven keV High Harmonic Source.** PhD thesis, Université Paris-Saclay **(2019)**. My PhD thesis which shows the development of the Broadband CDI technique, but also the developments on combined pulse compression and High Harmonic Generation on a 3 micron OPCPA laser.

• **Numerical monochromatization algorithm** on online repository **GitHub (2019).** I made my algorithm publicly available so other researchers could build upon my work. I have indeed been contacted by 5 PhD students and postdocs from all over the world who use my algorithm for their research.

Conferences & meetings

2021 • **Carrier-envelope-phase effects in Laser Wakefield Acceleration with near-single-cycle pulses (invited talk)** ELI-Beamlines User Conference (virtual, ~80 attendees)
• **Attosecond Coherent Diffractive Imaging (invited talk)** Conference on Lasers and Electro Optics (CLEO FM10.1, virtual, # of attendees unknown)

2020 • **Latest Results on kHz Laser Wakefield Acceleration** (talk) ELI-Beamlines User Conference (virtual, ~100 attendees)

2018 • **Broadband Coherent Diffractive imaging** (poster) GDR Ultrafast Phenomena (Paris, ~250 attendees)
• **Mid-IR driven HHG** (talk) Attosecond and Ultrafast Physics VI (Benasque, ~25 attendees)

2017 • **Monochromatization Algorithm for Broadband Nanoscale Imaging in the Water Window** (talk) Voxel FET-OPEN Meeting (Madrid, ~30 attendees)
• **Broadband Coherent Diffractive Imaging** (poster) GDR Ultrafast Phenomena (Paris, ~250 attendees)
• **Broadband CDI and HHG with 3 micron pulses** (talk) Attosecond and Ultrafast Physics V (Benasque, ~25 attendees)

Prizes

2021 **First prize** in the yearly competition of the magazine of the Dutch Physical Society.

2017 **Session Prize for the best presentation** at the PhD Days of the doctoral school (EDOM).

Languages

Dutch	English	French	Italian	Spanish
Native	Fluent	B2	B1	B1

Other skills

Python	Matlab	CAD	Prototyping