

Vincent Lelasseux

PhD at LULI (École Polytechnique)

Graduated from École Centrale de Lyon

Master 2 at Lyon1

Education

| | |
|----------------|---|
| 2019-2022 | PhD: Investigation of prospects offered by multi-PW laser for experimental nuclear astrophysics (directed by Julien Fuchs) |
| 2018 | Third year specialisation: <ul style="list-style-type: none">- Nuclear energy- Materials behavior |
| 2017 | Master SYVIC (M2 SYNthesis, aging and Characterisation of nuclear industry materials) |
| 2016 | Second year specialisation: <ul style="list-style-type: none">- Nuclear engineering- Production and distribution of electric energy- How to choose a material |
| September 2014 | Admission to Ecole Centrale de Lyon, generalist engineering school |
| 2011-2014 | Preparation school, Lycée Pierre de Fermat, Toulouse, MP then MP* |
| June 2011 | Baccalauréat, S series, with high honours, Lycée Georges Cabanis, Brive la Gaillarde |

Experience

| | |
|--------------------|---|
| 2023-Now | Post-Doctoral Research Assistant – Junior Researcher at ELI-NP/IFIN-HH |
| April- August 2018 | Optimization of gamma tracking algorithms for AGATA and GRETA and superheavy nuclei structure study at CSNSM |
| Mai- August 2017 | Preparation of experiments for p-process nucleosynthesis study (study of PARIS detector at IPNL) |
| June- August 2016 | Project manager, data enhancement service offer, ASP |
| 2015-2016 | Application project (4h a week for 10 months): Presentation of an inductor in order to recharge an electric vehicle, sponsor: Magtech |
| July 2015 | Break operator and assistant varnisher, Solev (Pochet company) |

2014-2015

Execution project (4h a week for 10 months):
Ambient electromagnetic energy recovery (development of a rectifier for very low voltages), sponsor: Ampère laboratory

Most important achievements

The first most significant achievement of my scientific career would be the successful creation, characterization and experimental implementation of an efficient neutron counter in the context of high intensity laser experiment.

The first main difficulty for such a detector is to be able to differentiate neutron signal from all the other ones induced by a wide range of particles, especially X-rays, produced during high intensity laser-matter interaction. The second one is for the detector to sustain the massive electromagnetic pulse generated during a laser shot. To tackle the last, we decided to use plastic scintillator rods, each associated with a pair of photomultiplier tubes (PMTs). To differentiate the neutrons from the other signals, two techniques were used. The plastic scintillators were boron loaded in order to use the exothermic neutron capture reaction on ^{10}B . The second technique was to use high density polyethylene around the scintillators to thermalize the neutrons. This thermalization allows to increase the neutron capture cross section and hence the efficiency of the detector, and all detection event would correspond to an energy equal to the Q-value of the exothermic reaction. In addition, this thermalization process takes time and that allows to separate in time the neutron detection from most of the noise produced by other radiations or by the electromagnetic pulse.

The first step of this project was to use Geant4 simulations to optimize the dimensions of the polyethylene parts to increase the efficiency according to the expected neutron energies during the experiment. A prototype was also tested in real experimental conditions to ensure the possibility to use the scintillator/PMTs couple.

All the part of this detector array were constructed at ELI-NP. The next step would have been to characterize the detector response using a neutron source but due to COVID restrictions, it was impossible for me to come in Romania to do this before the LULI2000 experiment and this characterization actually took place after. It was done using a plutonium-beryllium source and the results were published in Review of Scientific Instruments.

The first experiment using this detector took place at LULI2000 and the goal was to measure neutron yields from the $^{51}\text{V}(p,n)^{51}\text{Cr}$ reaction. Two laser beams were used during this experiment. A 60 J picosecond pulse focused on a 23 μm plastic target was accelerating a proton beam with a classical TNSA spectrum and an energy cutoff we could vary. This protons were sent onto a natural vanadium target where the (p,n) reactions were taking place. A second 100 to 600 J nanosecond pulse was used during part of the shots to set the vanadium secondary target in a plasma state.

The signal produced by the PMTs were much more affected during this experiment than during the prototype testing. The data processing was then much more complicated than one could have expected and a thorough procedure had to be developed to ensure the quality of the event-by-event counting. After a deep analysis of the waveform

Neutron counting in high intensity Laser environment

recorded during comparable shots, I have been able to retrieve some number of neutrons produced in the solid vanadium target that are consistent with the measured cross-sections by other experimental teams. This proved the possibility to use such a method in a laser-driven environment. For the plasma case, a yet unexplained decrease has been observed and more study would be needed to understand the reason of this decrease.

Reverse Compton
gamma beam from
multi-GeV electron
beam

Another meaningful achievement was obtained during part of the commissioning campaign of E6 10 PW long focal area. After an important work we did to commission the experimental area and accelerate an electron beam to several GeVs using laser wakefield acceleration, we set a plasma mirror right after the gas slit jet to sent back the laser pulse onto the electrons it just accelerated. Doing so, through non-linear reverse Compton process, a gamma beam with a synchrotron type spectrum with critical energy of several hundreds of MeV was produced. Such beam is extremely difficult to characterize since it contains gammas with energies up to several GeVs in a bunch with a duration in the range of tens of fs. To retrieve the desired gamma spectra, we used pixelated scintillator stacks monitored by various cameras from above. After some characterization of the stack, Geant4 simulations and unfolding procedures, we were able to prove the production of laser-driven gamma rays with unprecedented energy. This works paves the way to QED investigation since the non-linear reverse Compton process which took place during this experiment is at the limit of a regime where quantum effects become dominant.

Experimental
measurement of
 $^{76}\text{Ge}(\alpha, n)^{79\text{m}}\text{Se}$
cross-section for
plasma diagnostics

The last recent noticeable achievement is the successful happening of an experiment taking place at the 3MV TANDETRON of IFIN-HH for which I was the spokesperson. The isomeric state of the ^{79}Se has a 3.9 min half-live and decay emitting a 95.7 keV gamma 9.54 % of the time. Those properties make it a promising material candidate for an activation diagnostic to measure the alpha losses in a deuterium-tritium fusion plasma. However, no experimental cross-section exists for this reaction. A previous experiment hinted to the fact that the theoretical TALYS cross-sections for the complete $^{76}\text{Ge}(\alpha, n)^{79}\text{Se}$ reaction are underestimated by approximately an order of magnitude. In consequence, we decided to measure the cross-section to the isomeric state to additionally measure the isomeric ratio. To do so, we decided to directly measure the 95.7 keV line from the decay of the isomeric state. Analysis is at its early stage but it already seems that the isomeric ratio calculated by TALYS is overestimated by even more than an order of magnitude. Despite this unexpected result compared to theory, we have been able to retrieve cross-sections for 6.5 to 9 MeV α particles.

Vincent Lelasseux

MINIMAL STANDARDS APPLICABLE AT IFIN-HH
for being awarded the professional ranks of
First Stage Researcher (Research Scientist - CS) and
Recognised Researcher (3rd rank Research Scientist - CS III)

Approved in the meeting of IFIN-HH Scientific Council of 27.02.2025 (SC Decision No. 5/27.02.2025)

Minimal Standards (at IFIN-HH)

1) IFIN-HH shall establish threshold scores ($P_{\text{threshold}}$) according to the table below.

| | First Stage Researcher (CS) | Recognised Researcher (CSIII) |
|------------------------|-----------------------------|-------------------------------|
| $P_{\text{threshold}}$ | 0.50 | 1.50 |

2) During the evaluation of the candidate's scientific activity, the score P is determined in the following manner:

$P = P_1 + P_2$, where

P_1 : for articles where the candidate is an author, but not a first author or a corresponding author: $P_1 = \sum_i a_i / n_i^{ef}$

P_2 : for articles where the candidate is a first author or a corresponding author: $P_2 = \sum_i a_i$

a_i = is the absolute Article influence score of the scientific journal where article i was published, according to its year of publication as per <http://www.eigenfactor.org/> for articles published until 2006 and Journal Citation Report (Web of Science) starting from 2007; if the publishing year cannot be found in the database, the closest year shall be chosen.

n_i^{ef} = is the actual number of authors of item i and is determined as follows:

| | |
|----------------|-----------------------|
| n_i | if $n_i \leq 5$ |
| $(n_i + 5)/2$ | if $5 < n_i \leq 15$ |
| $(n_i + 15)/3$ | if $15 < n_i \leq 75$ |
| $(n_i + 45)/4$ | if $n_i > 75$ |

where n_i is typically the number of authors of item i . In the case of HEPP (High Energy Particle Physics) publications with a large number of authors, if the article is based on an internal note of the collaboration and the candidate is a co-author of this internal note, then n_i^{ef} can be given by the number of authors in the internal note.

The capacity as first author or corresponding author shall be determined based on the mentions in the article. Articles where authors are indicated in the alphabetical order of their name and the candidate is a first author exclusively due to their name and the alphabetical order shall not be taken into account. In the case of HEPP publications with a large number of authors, if the article is based on an internal note whose approval for sending to publication was upheld by the author, then the author is considered first author.

Minimal Standards Self-Assessment Form:

| Category of Articles | Position in the List of Papers | Score | Calculation Details |
|--|--------------------------------|---|---|
| Articles in ISI Thomson Reuters ranked journals and in ISI Proceedings indexed volumes for which the candidate is not a first author or a corresponding author | 12 | 0.810 | <i>Nature Physics</i> , 2021, 17(10), 1177-1182, AIS=9.983, no of authors:22, ef no:12.33 |
| | 3 | 0.077 | <i>Matter and Radiation at Extremes</i> , 2021, 6(6) AIS=1.607, no of authors:48, ef no:21 |
| | 11 | 0.148 | <i>Astronomy & Astrophysics</i> , 2022, 665, A87 AIS=1.681, no of authors:19, ef no:11.33 |
| | 4 | 0.206 | <i>Scientific Reports</i> , 2022, 12(1), 19767 AIS=1.132, no of authors:6, ef no:5.5 |
| | 12 | 0.116 | <i>Matter and Radiation at Extremes</i> , 2022, 7(1) AIS=1.425, no of authors:22, ef no:12.33 |
| | 22 | 0.021 | <i>Physica Scripta</i> , 2025, 100(7), 075301 AIS=0.353, no of authors:36, ef no:17 |
| | 23 | 0.032 | <i>Physical Review C</i> , 2025, 112(2), 024327 AIS=0.630, no of authors:44, ef no:19.66 |
| | 23 | 0.039 | <i>Physical Review C</i> , 2025, 112(4), 044613 AIS=0.630, no of authors:33, ef no:16 |
| Articles in ISI Thomson Reuters ranked journals and in ISI Proceedings indexed volumes for which the candidate is a first author or a corresponding author | 16 | 0.043 | <i>Nucl. Instr. Meth. A</i> , 2025, 171229 AIS=0.630, no of authors:29, ef no:14.66 |
| | 1 | 0.401 | <i>Journal of Instrumentation</i> , 2020, 15(04), P04002 |
| | 1 | 0.500 | <i>Review of Scientific Instruments</i> , 2021, 92(11) |
| 1 | 0.353 | <i>Physica Scripta</i> , 2025, 100(8), 085307 | |
| TOTAL | | 2.746 | |

Vincent Lelasseux

List of publications

Most relevant scientific publications:

- Lelasseux, V., Söderström, P. A., Aogaki, S., Burdonov, K., Chen, S., Cvetinovic, A., ... & Fuchs, J. (2023). Experimental investigation of the effect of ionization on the 51V (p, n) 51Cr reaction. *arXiv preprint arXiv:2309.16340*
- Burdonov, K., Fazzini, A., Lelasseux, V., Albrecht, J., Antici, P., Ayoul, Y., ... & Fuchs, J. (2021). Characterization and performance of the Apollon short-focal-area facility following its commissioning at 1 PW level. *Matter and Radiation at Extremes*, 6(6)
- Yao, W., Fazzini, A., Chen, S. N., Burdonov, K., Antici, P., Béard, J., ... & Fuchs, J. (2021). Laboratory evidence for proton energization by collisionless shock surfing. *Nature Physics*, 17(10), 1177-1182
- Lelasseux, V., & Fuchs, J. (2020). Modelling energy deposition in TR image plate detectors for various ion types. *Journal of Instrumentation*, 15(04), P04002
- Matheron, A., Marquès, J. R., Lelasseux, V., Shou, Y., Andriyash, I. A., Phung, V. L. J., ... & Corde, S. (2024). Compton photons at the GeV scale from self-aligned collisions with a plasma mirror. *arXiv preprint arXiv:2412.19337*
- Lelasseux, V., Söderström, P. A., Aogaki, S., Burdonov, K., Cerchez, M., Chen, S. N., ... & Fuchs, J. (2021). Design and commissioning of a neutron counter adapted to high-intensity laser matter interactions. *Review of Scientific Instruments*, 92(11)
- Lelasseux, V., Testov, D., Aogaki, S., Balabanski, D. L., Dhal, A., Morris, O., ... & Turturica, G. (2025). Implementation of add-back procedure on ELIADE clover detector at the crystal level. *Physica Scripta*, 100(8), 085307
- Spohr, K. M., Bleotu, G. P., Cristea, M., Doria, D., Ivan, A., Jurca, M., ... & Zai, M. I. (2025). A new pathway towards immunotherapy-supported radiology for targeted Boron Neutron Capture Therapy (BNCT). *South East European Journal of Immunology*, 8(CITIM), 057-057
- Söderström, P. A., Markova, M., Tsoneva, N., Xu, Y., Kuşoğlu, A., Aogaki, S., ... & Wieland, O. (2025). Statistical properties and photon strength functions of the Sn 112, 114 isotopes below the neutron separation threshold. *Physical Review C*, 112(2), 024327
- Lelasseux, V. (2022). *Detection of laser-driven high flux neutrons in view of nuclear astrophysical applications* (Doctoral dissertation, Institut Polytechnique de Paris)

No patents nor authored books and volumes

List of articles/studies in extenso published in mainstream international journals:

- Lelasseux, V., & Fuchs, J. (2020). Modelling energy deposition in TR image plate detectors for various ion types. *Journal of Instrumentation*, 15(04), P04002
- Yao, W., Fazzini, A., Chen, S. N., Burdonov, K., Antici, P., Béard, J., ... & Fuchs, J. (2021). Laboratory evidence for proton energization by collisionless shock surfing. *Nature Physics*, 17(10), 1177-1182
- Burdonov, K., Fazzini, A., Lelasseux, V., Albrecht, J., Antici, P., Ayoul, Y., ... & Fuchs, J. (2021). Characterization and performance of the Apollon short-focal-area facility following its commissioning at 1 PW level. *Matter and Radiation at Extremes*, 6(6)
- Lelasseux, V., Söderström, P. A., Aogaki, S., Burdonov, K., Cerchez, M., Chen, S. N., ... & Fuchs, J. (2021). Design and commissioning of a neutron counter adapted to high-intensity

- laser matter interactions. *Review of Scientific Instruments*, 92(11)
- Fazzini, A., Yao, W., Burdonov, K., Béard, J., Chen, S. N., Ciardi, A., ... & Fuchs, J. (2022). Particle energization in colliding subcritical collisionless shocks investigated in the laboratory. *Astronomy & Astrophysics*, 665, A87
 - Horný, V., Chen, S. N., Davoine, X., Lelasseux, V., Gremillet, L., & Fuchs, J. (2022). High-flux neutron generation by laser-accelerated ions from single- and double-layer targets. *Scientific Reports*, 12(1), 19767
 - Yao, W., Fazzini, A., Chen, S. N., Burdonov, K., Antici, P., Béard, J., ... & Fuchs, J. (2022). Detailed characterization of a laboratory magnetized supercritical collisionless shock and of the associated proton energization. *Matter and Radiation at Extremes*, 7(1)
 - Söderström, P. A., Kuşoğlu, A., Aogaki, S., Balabanski, D. L., Ban, S. R., Borcea, R., ... & Ujениuc, S. (2025). Nuclear level density of ^{128}Te from $\{(\text{p}), (\text{p})^{\prime}\}$ scattering and complementary photonuclear data. *Physica Scripta*, 100(7), 075301
 - Lelasseux, V., Testov, D., Aogaki, S., Balabanski, D. L., Dhal, A., Morris, O., ... & Turturica, G. (2025). Implementation of add-back procedure on ELIADe clover detector at the crystal level. *Physica Scripta*, 100(8), 085307
 - Söderström, P. A., Markova, M., Tsoneva, N., Xu, Y., Kuşoğlu, A., Aogaki, S., ... & Wieland, O. (2025). Statistical properties and photon strength functions of the Sn 112, 114 isotopes below the neutron separation threshold. *Physical Review C*, 112(2), 024327
 - Roy, R., Testov, D. A., Balabanski, D. L., Kaur, M., Kuşoğlu, A., Lorusso, G., ... & Choudhury, D. (2025). α -induced neutron emission from Al 27: A cross-section study. *Physical Review C*, 112(4), 044613
 - Söderström, P. A., Balabanski, D. L., Cuciuc, M., Filipescu, D. M., Gheorghe, I., Kuşoğlu, A., ... & Turturică, G. V. (2025). ELIGANT-TN—ELI Gamma above neutron threshold: The thermal neutron setup. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 171229

List of other scientific papers and contributions:

- Burdonov, K., Forestier-Colleoni, P., Cayla, J. N., Ceccotti, T., Chance, S., Chaumat, V., ... & Fuchs, J. (2021). Calibration of the scintillation of cerium-doped yttrium aluminum garnet crystals irradiated by monoenergetic 4 MeV energy electrons. *arXiv preprint arXiv:2103.02497*
- Lelasseux, V., Fuchs, J., Burdonov, K., Dorard, S., Fazzini, A., Söderström, P. A., ... & Pikuz, S. (2021, September). Characterization of neutron beams generated in high-intensity interactions for nuclear physics experiments. In *2021 IEEE International Conference on Plasma Science (ICOPS)* (pp. 1-1). IEEE
- Roy, R., Choudhury, D., Testov, D. A., Balabanski, D. L., Kuşoğlu, A., Lorusso, G., ... & Tozar, T. (2024). Impact of ^{13}C Contamination on Neutron Yield Measurement in the $^{27}\text{Al}(\alpha, n)$ Reaction. In *EPJ Web of Conferences* (Vol. 297, p. 02007). EDP Sciences
- Testov, D. A., Dhal, A., Petcu, C., Aogaki, S., Balabanski, D. L., Brezeanu, M., ... & Zhu, F. (2024). Status of the ELIADe γ -ray spectrometer for NRF Experiments at ELI-NP. *IL NUOVO CIMENTO*, 100(60), 47
- Wieland, O., Giaz, A., Million, B., Bracco, A., Camera, F., Crespi, F. C. L., ... & Benouaret, N. (2025). SEARCH FOR EXTRA YIELD IN HOT Ni ISOTOPES BELOW THE GIANT DIPOLE RESONANCE. *Acta Physica Polonica B, Proceedings Supplement*, 18(2)
- Spohr, K. M., Bleotu, G. P., Cristea, M., Doria, D., Ivan, A., Jurca, M., ... & Zai, M. I. (2025).

- A new pathway towards immunotherapy-supported radiology for targeted Boron Neutron Capture Therapy (BNCT). *South East European Journal of Immunology*, 8(CITIM), 057-057
- Lelasseux, V., Ghenuche, P., Phung, V. L. J., Ahmed, H., Balabanski, D. L., Cernaianu, M. O., ... & Talposi, A. M. Broadband MeV to multi-GeV 10 PW laser-driven gamma-rays generation, characterization and possible applications. In *The Fifth International Conference on Nuclear Photonics 2025*
 - Lelasseux, V. Possible Nuclear Physics application of Laser-driven sources. In *2nd INFN School and Workshop on "High Power Lasers for fundamental Science and Applications 2025*