Advanced Python for the Lab

The **Advanced Python for the Lab** workshop is tailored to scientists who have been working with instrumentation for at least 3 or 4 years. The scope of the workshop is to systematize best-practices, especially focusing on improving performance, extending the Python toolbox, and releasing code for a broader user base.

During the workshop we will focus more on discussions on why some patterns are worth implementing early on, such as exception handling and logging. We will discuss the limits of threading and multiprocessing while handling data, and we will work on ways to overcome those limitations.

We will also discuss how to design and document the code to allow other to build on our program and to expand it if necessary. This workshop is fast-paced and requires a deeper understanding of Python, especially objects, threads, and a holistic view of the development cycle.

The workshops are organized **on premises**, and they can accommodate **4 to 6 participants**. In total, we work during **3-full days**, and a **certificate of attendance** is provided at the end of the workshop.

Course Contents

Day 1

- **Instrumentation challenges**. Identification of patterns that repeat, abstraction via decorators. Data descriptors to cache values or to ensure compliance to instrument specifications. Threading and multiprocessing, caveats with data sharing. Locks, Events, Queues, and their limitations on performance. Memory sharing and sockets for data exchange.

Day 2

- **Software challenges**. Design software that can be used by people with different experiences. Object inheritance as a shortcut for extending programs. Saving data in different formats: from sqlite databases to HDF5. Caveats to ensure reproducibility and accessibility. Proper error handling, and logging. The limit between abstraction and readability. Implementing tests and linting to ease the onboarding of new contributors.

Day 3

- **Preparing for releases**. Documenting with sphinx and Read the Docs. Setting up a Github repository with templates, and necessary files to organize a team. Packaging a program for easy installation and distribution via PyPI. The importance of a clean development environment.
- **Open discussion**. We finish the intense workshop with an open discussion about the challenges and potential ways to overcome them. From performance to design bottlenecks, from team management to *licensing* of software.

Python for the Lab
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About the Instructor

Aquiles Carattino started developing Python programs to control the instruments in the lab where he did his PhD. He automated confocal microscopes, spectrometers, and built the electronics for signal conditioning and temperature control. After graduating, he started Python for the Lab as an attempt to spread the knowledge he had gained.

In 2019 he co-founded **Dispertech**, a company that specializes in nanoparticle characterization through optical techniques. The company leveraged Aquiles' expertise in software and hardware design to build and commercialize a prototype of the instrument in just over 6 months.

Besides Python workshops, Aquiles engages in mentoring sessions for (aspiring) entrepreneurs with a science background, gives talks at events, and supports companies with different consulting solutions.

Some companies and organizations that trusted us.

Amsterdam Laser Lab

Max-Planck-Institut für Struktur und Dynamik der Materie

Universiteit Leiden

What Students Say

"It is a very nice and well-organized course. The contents are interesting and useful."

"Gives a clear understanding of the communication between a computer and instruments. At the end of the course, I was very satisfied to write a python module to control a DAQ. And making the user interface was fun."

"Excellent course, self-contained and, in my opinion, a great steppingstone to find your way to do instrumentation with Python. I loved the hands-on approach with a simple REAL device that gives you the insights (and experience) into the typical problems you encounter when doing instrumentation for the lab. It is very valuable that the trainer shares specific tips and tricks that come from a vast experience in this field. A total must for a researcher who wants to design new tools and experiments."

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