



# Data Analysis with Python for Medical Physicists

**Online**

21<sup>st</sup> – 23<sup>rd</sup> September 2023

Malta

Endorsed by:



# EFOMP

EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS

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V/O 1715

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## Course Overview

### Course Aim

This course provides medical physicists with an introduction to basic programming concepts in Python. The course will successively build on this knowledge in order to provide participants with a wide toolkit which permits automated data collection, cleaning, determination of summary statistics and plotting.

The course is split 50:50 between lectures and hands-on work to ensure participants gain practical experience so they can start working with these tools immediately..

Participants will be provided with instructions to have a working Python installation prior to the course. Participants will also be given the lecture notes ahead of time for their perusal.

By the end of the course, participants will be competent to perform data analyses for a wide range of medical physics applications.

### Target Group

Clinical or academic medical physicists, medical physics experts or medical physics trainees working in Diagnostic Radiology, Nuclear Medicine and Radiation Oncology. Whilst the course assumes no prior programming knowledge, some programming concepts (e.g. some experience with MATLAB) would be beneficial as this is a fast-paced course covering a wide arc of topics.

### Local Organizers

Malta Association of Medical Physics (V/O 1715)

### Course Lecturer

Eric Pace, Lead Medical Physicist, Medical Physics Expert, Medical Imaging Department, Mater Dei Hospital, Malta.

## Course Content

- Basics of programming and control flow
- Functions, methods and introduction to object oriented programming. These are fundamental concepts to be able to work with data manipulation, scientific and plotting libraries. These are also essential for interacting with medical images (DICOM) and Excel / CSV files..
- Parsing potentially unstructured machine log files produced by CT, MRI and other modalities containing results from daily or weekly QC tests.
- Read data from Excel (e.g. medical physics QC test reports) or CSV (e.g. exports from dose monitoring platforms), structure this data into dataframes and perform cleaning and filtering so data is prepared for calculation of summary statistics and plotting. This is essential for 2D columnar data medical physicists often have to work with.
- Restructure data into a 2D columnar format for easy manipulation, cleaning and filtering.
- Export clean data to Excel or CSV for storage. Export settings/configurations/user settable parameters to the machine readable JSON format.
- Provide a tour of the PyCharm Integrated Development Environment (IDE) and highlight the benefits of an IDE over a plain text editor.
- Overview of plotting libraries (matplotlib, pandas, seaborn) and introduction to best practices for plotting line, bar, box and scatter plots. More complex plotting (e.g. 'small multiple' or trellis plots) will also be introduced since often medical physics data is often multi-dimensional.
- Introduction to the PyDICOM package to work with medical images (DICOM files) to extract information, including pixel data from DICOM headers, and write any modifications back to DICOM files. Overview of the concepts of DataSet, DataElement, Tag, Value Representation, Value Multiplicity and value.
- Overview of the PyLinac library

For clarity, this course does not:

- Provide an introduction to databases or SQL
- Cover numerical methods or statistical techniques

## Methods of assessment

At the end of the course participants have an option to sit for a multiple choice examination.

## Teaching methods

3 days split equally between lectures and practical sessions. These will be carried out online via Zoom and participants will be given time to work through practical examples, where individual attention in case of difficulties or questions will be provided via Breakout Rooms.

Participants will be provided with instructions to set up a working Python installation on their computer. A troubleshooting session will be organised ahead of the course to resolve any installation issues so that the course can start on time.

## Accreditation

This course is seeking accreditation by the European Board for Accreditation in Medical Physics (EBAMP). More information will be provided when available.

## Course Fee

Registration fee: €300 until 30th June 2023  
€350 from 1st July 2023

## How to Apply

Applications are accepted on a first come first serve basis through MAMP Website only. The application process consists of two steps:

1. Fill in the form on our website: <https://mamp.org.mt/home/courses/data-analysis-with-python-for-medical-physicists-september-2023/>
2. Affect payment within 5 days using your credit/debit card by clicking “here” in the website on step 1.

Should you find any issues with payments, or if you are unable to pay via debit/credit card, kindly contact us on [info@mamp.org.mt](mailto:info@mamp.org.mt).

## Scientific Programme

The course will start on Thursday morning, 21<sup>st</sup> April 2022 at 09:00 CET. It is recommended that participants are online at least 15 minutes before. Course will finish on Saturday 23<sup>rd</sup> April around 14:00. The draft programme can be found below.

### Day 1-Thursday, 21<sup>st</sup> September

Time	Lecture
08:30 – 09:00	Registration
09:00 – 10:00	Introduction: Data types, data structures, string manipulation and formatting
10:00 – 10:30	Walkthrough examples and hands-on session
10:30 – 11:00	<i>Coffee Break</i>
11:00 – 12:00	Structured Programming: Control flow, modules, functions, intro to object oriented programming
12:00 – 12:30	Hands-on session to work out exercises
12:30 – 13:30	<i>Lunch Break</i>
13:30 – 14:15	Navigating the PyCharm Integrated Development Environment
14:15 – 15:00	Overview of the PyLinac library
15:00 – 15:30	<i>Coffee Break</i>
15:30 – 17:00	Continuation of Structured programming exercises
17:00	<i>Close</i>

### Day 2-Friday, 22<sup>nd</sup> September

Time	Lecture
09:00 – 10:00	Files and Operating System: Read/write csv, JSON, Excel, directory traversal, path operations
10:00 – 10:30	Walkthrough examples and hands-on session
10:30 – 11:00	<i>Coffee Break</i>
11:00 – 12:00	Panel data 1: Creation, import, selection, filtration, vector operations
12:00 – 12:30	Walkthrough examples and hands-on session
12:30 – 13:30	<i>Lunch Break</i>
13:30 – 14:30	Panel data 2: Reshape, concatenate, split-apply-combine sub-panels
14:30 – 15:00	Walkthrough examples and hands-on session
15:00 – 15:30	<i>Coffee Break</i>
15:30 – 17:00	Panel data walkthrough examples and hands-on session
17:00	<i>Close</i>

### Day 3-Saturday, 23<sup>rd</sup> September

Time	Lecture
09:00 – 10:00	Visualisation: Plotting fundamentals using Matplotlib, Pandas, Seaborn
10:00 – 10:30	Walkthrough examples and hands-on session
10:30 – 11:00	<i>Coffee Break</i>
11:00 – 12:00	String pattern matching using Regular Expressions
12:00 – 12:30	Walkthrough examples and hands-on session
12:30 – 13:30	<i>Lunch Break</i>
13:30 – 14:30	Interacting with DICOM files: Create, read, modify, write DICOM tags
14:30 – 15:00	Walkthrough examples and hands-on session
15:00 – 15:30	<i>Coffee Break</i>
15:30 – 17:00	Multiple Choice Assessment (optional)
17:00	<i>Close</i>

### Zoom Platform

The course will be carried out on Zoom. Approximately 2 weeks prior to the course start date, you will receive 3 links. These links will give you access to the course in real time. Kindly visit the links and ensure that both your microphone and camera are working properly. Since participants are expected to have the camera on during the course, recording is NOT allowed as per GDPR regulations.

### Insurance and cancellation

MAMP does not accept liability for individual medical, travel or personal insurance. Participants are strongly advised to take out their own personal insurance policies.

In case an unforeseen event would force MAMP to cancel the meeting, the Association will reimburse the participants fully the registration fees. MAMP will not be responsible for the refund of travel and accommodation costs.

Otherwise, in case of cancellation, the course is non-refundable.

MAMP takes no responsibility for, and the provider of the virtual meeting services has represented and warranted that the services shall not contain, and that no end user shall receive from the software used to hold the virtual meeting, any virus, worm, trap door, back door, timer, clock, counter or other limiting routine, instruction or design, or other malicious, illicit or similar unrequested code, including surveillance software or routines which may, or is designed to, permit access by any person, or on its own, to erase, or otherwise harm or modify any data or any system, server, facility or other infrastructure of any end user. MAMP will not be held liable for the internet connection used in order to attend the course online.