Alessandro Manfredini
Curriculum Vitae
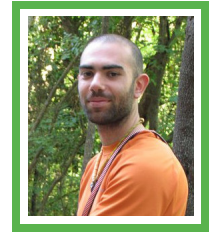
Personal Details

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Work Experience

2021–Present	**Software Engineer**. *Arktis Radiation Detectors*, Zürich, Switzerland.
2018–2021	**Postdoctoral Fellow in Experimental Physics**. *University Of Zürich*, Zürich, Switzerland.
2014–2018	**Postdoctoral Fellow in Experimental Physics**. *Weizmann Institute of Science*, Rehovot, Israel.

Education

2011–2014	**Ph.D. Student in Experimental Particle Physics.** *Max-Planck Institute For Physics*, Munich, Germany.
2008–2010	**Master of Science in Nuclear and Sub-nuclear Physics.** *University of Roma Tre*, Rome, Italy.

About Me

My main expertise are in data intensive statistical analyses and the Internet of Things. For the last two years I was employed in the development/maintainance of the software stack for enviromental monitors in the field of radiation protection. I have been professionally programming in C++, Python and JavaScript for more than six years. I am experienced with micro-service architecture design, Docker and orchestration with Kubernetes. I have experience with SQL and NoSQL databases and modern streaming libraries like Apache Arrow. I'm passionate about code testing, and once I've finished programming, I love to go rock climbing.

Software Engineer at Arktis

2021–Present Arktis is a company that designs innovative solutions for radiation detection. The most common products are Radiation Portal Monitors, which are systems equipped with a variety of sensors (radiation detectors, lidar, camera, temperature, humidity) and an embedded PC for realtime data analysis.

Software Stack: Being a small company I've been developing and maintaining the entire software stack, from sensor readout and detecors calibration to event data analysis, web interface and user experience. *My main responsability is to design algorithms that efficiently identify in real-time the radioactive isotopes based on the recorded energy spectra.*

Machine Learning: I've been designing and training deep learning models (Keras/Tensorflow) for spectral identification using radiation detectors data. I've also developed a neural-network that classifies road traffic conditions (in the vicinity of the sensors) using camera images.

Research During Second Postdoc

2018–2021 I joined the group of Prof. Laura Baudis as co-leader of an ERC funded R&D project for the future DARWIN dark matter detector (more info here). I was responsible for the design of a fully automated experiment monitoring and control system based on industrial Programmable Logic Controllers (PLC) and state of the art of big-data tools. I designed innovative IoT gateways (OPC-Proxy and IoTpy) that allows to connect the data-taking sensors with the micro-services infrastructure of our back-end. We use Kubernetes to orchestrate a series of services that includes Prometheus, Grafana, NodeJs and Apache Kafka. Finally, I designed the graphical user interface of our system, allowing to control the experiment remotely from a browser.

Research During First Postdoc

2014–2018 I joined the XENON dark matter project in the group of Prof. Ran Budnik. The XENON collaboration consist of more than 100 physicist from all over the world.

Statistics: For two years I was co-leading the statistical inference team of the XENON1T experiment, where I performed hypothesis testing with computation of the confidence intervals and developed the statistical model of the experiment.

Slow Control: I was part of the XENON1T slow control developers team. My main contribution was to design the safety and motion control systems for a set of motors and belts used to move calibration sources in the experiment. I also developed the high voltage module controller, and the safety system of the experiment's water recirculation facility.

Research During Ph.D.

I joined the ATLAS experiment at CERN in 2011 under the supervision of Dr. Sandra Kortner. I was part of the ATLAS Beyond Standard Model Higgs sub-group. I contributed to the neutral MSSM Higgs boson search of which I was one of the main analyzer. My contribution was focused on the estimation of the backgrounds and their systematics, the implementation of the probability model for hypothesis testing, and on studies aimed to improve the signal sensitivity at low mass employing flavor tagging techniques.

Thesis Title: "Search for Neutral MSSM Higgs Bosons in $A/h/H \to \tau^+\tau^- \to e\mu + 4\nu$ Decays with the ATLAS Detector."

Software Skills

Programming Languages — Proficient in C++, Python, JavaScript, TypeScript, HTML, CSS. Experience with C#.

Data Analysis and Statistics — Proficient with SciPy, NumPy and Pandas libraries.

Deep Learning — Basic knowledge of Keras and TensorFlow.

Web Tools — SQL (PostgreSQL) and NoSQL (MongoDB) databases. Server-side programming with NodeJS, Twisted and Django. Experience with Websocket and SSE. Experience with the lit-element front-end framework (for custom-elements) and Redux.

Communication Protocols — RS232, TCP-IP sockets, gRPC, Arrow, OPC, MQTT.

Monitoring — Experience with Prometheus, AlertManager, InfluxDB and Grafana.

Cloud — Experience with Google Cloud Platform, Kubernetes, Docker.

Big Data — Operative knowledge of Apache Kafka.

Automation — Experience with PLC ladder diagram and structured text programming.

My Git Repositories

Xephyr — A statistical framework (C++).
ImperaJS — An app-state managment framework (Javascript).
Brick-Element — A web-component generator (Javascript).
OPC-Proxy — A modular OPC gateway (C#).
JaS-HMI — A Javascript Human-Machine-Interface framework.
IOTpy — A Python framework to expose devices trough REST API.

Language Skills

Mother tongue — Italian

English — Fluent - (CEFR C1)

German — Basic - (CEFR A2/B1)