



CERN Workshop on Statistics and Machine Learning

16-21 September 2018

indico.cern.ch/event/747653/

The inaugural training event of



insights-itn.eu



Coordinator: Glen Cowan
RHUL Physics

Marie Skłodowska-Curie Innovative training Network INSIGHTS



~ International Training Network of Statistics for High Energy
Physics and Society, H2020-MSCA-ITN-2017 n. 765710

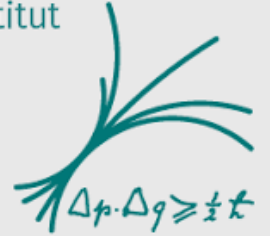
11 host institutions for Early Stage Researchers

9 partners from academia, research and industry

INSIGHTS host institutions



Max-Planck-Institut
für Physik



LUND
UNIVERSITY



Istituto Nazionale di Fisica Nucleare
Sezione di Padova

UiO



University of Oslo



PangeaFormazione
DATA SCIENCE PER IL MANAGEMENT

INSIGHTS partners from research and industry



Digitalcomoedia



ESR hosts institutes:

CH: CERN (GE)

DE: MPP (MU)

IT: INFN (NA, PD),
PANGEA (RM),
UNINA (NA)

NL: NIKHEF (AM)

NO: UIO (OS)

SE: LUND (LU)

UK: RHUL (LO),
UNIED (ED)

Other partners:

DE: C2PAP (MU)

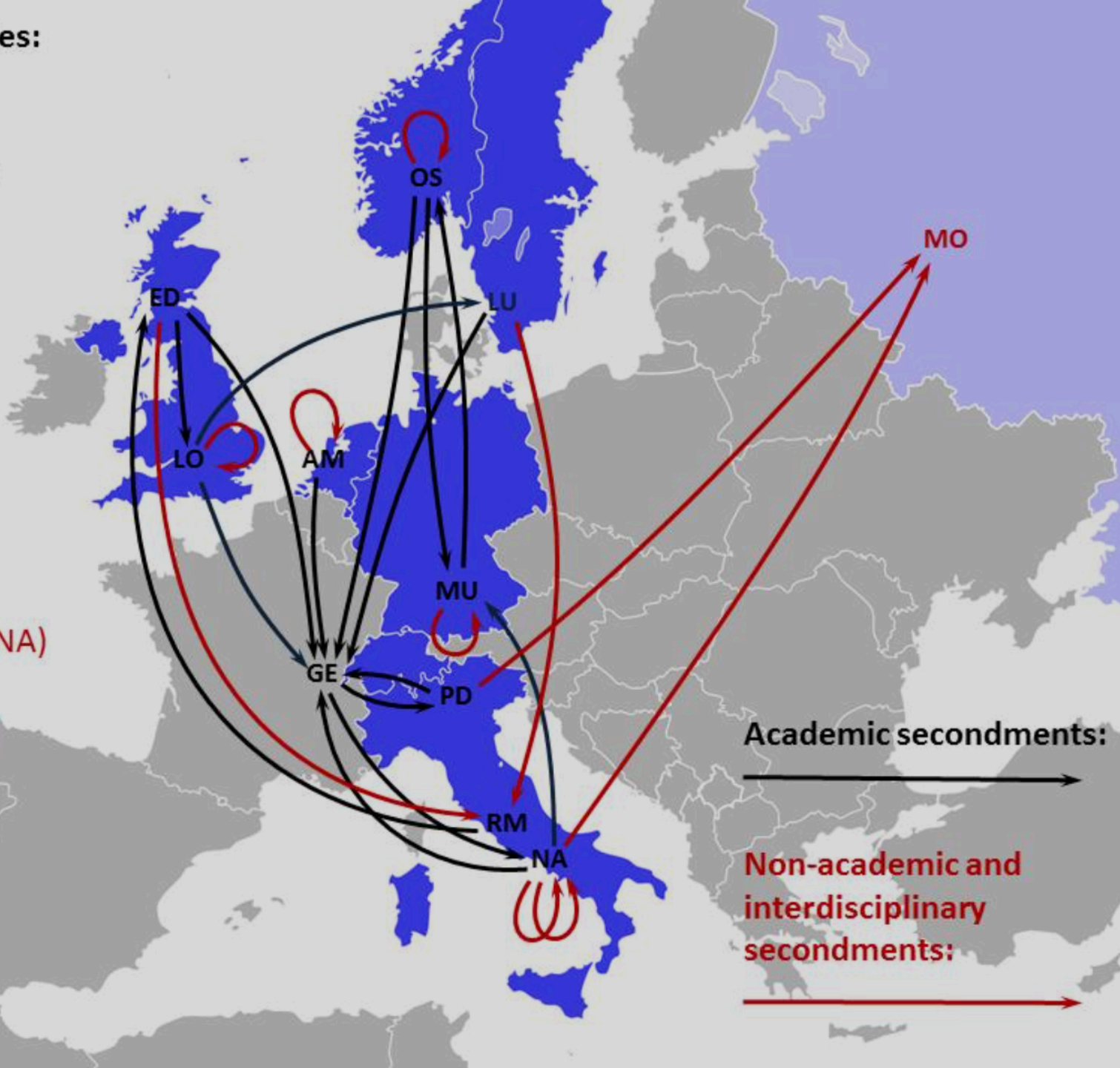
IT: DCOM, INGV (NA)

NL:KPMG (AM)

NO: CICERO (OS)

RU: YNDX (MO)

UK: FISCAL (LO)



Academic secondments:



Non-academic and interdisciplinary secondments:





Marie Skłodowska-Curie Actions

The Innovative Training Networks

Aim to train a new generation of creative, entrepreneurial and innovative early-stage researchers, able to face current and future challenges and to convert knowledge and ideas into products and services for economic and social benefit.

Our Mission

The INSIGHTS Innovative Training Network will develop advanced statistical methods, implement them in software, and apply them to solve problems in Particle Physics and other fields.

In doing so, we will create the next generation of experts not only able to investigate Nature's fundamental particles but also to solve problems of broad relevance to society.

Key aspects:

PhD from host institution

Training Events

Secondments at partner nodes

Statistics for Particle Physics, Industry and Society

Work Packages

- WP1 Statistical Methods (coord.: A. Caldwell)
- WP2 Software Tools (coord.: W. Verkerke)
- WP3 Physics Applications (coord.: A. Read)
- WP4 Statistics for Society (coord.: P. Agnoli)
- WP5 Management (coord.: G. Cowan)
- WP6 Training (coord.: L. Lista)
- WP7 Outreach (coord.: T. Dorigo)

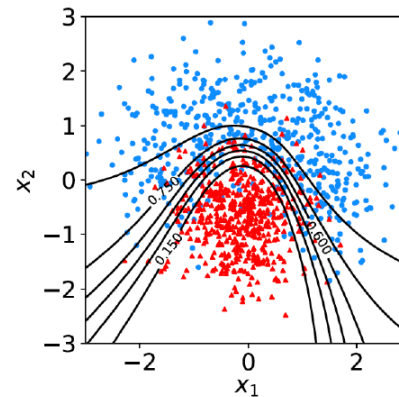
WP1 Statistical Methods

Coordinator: Allen Caldwell, MPI Munich

Statistical modeling

$$P(\mathbf{x}, \mathbf{y}, \dots | \boldsymbol{\mu}, \boldsymbol{\theta}, \dots) = \dots$$

Multivariate analysis



Bayesian computation

$$P(\lambda | \text{Data}, M) = \frac{P(\text{Data} | \lambda, M) P_0(\lambda | M)}{P(\text{Data} | M)}$$

WP2 Software Tools

Coordinator: Wouter Verkerke, NIKHEF

Modular and efficient software implementation of the statistical techniques developed in the Network will be used to integrate the methods into the general data analysis frameworks:

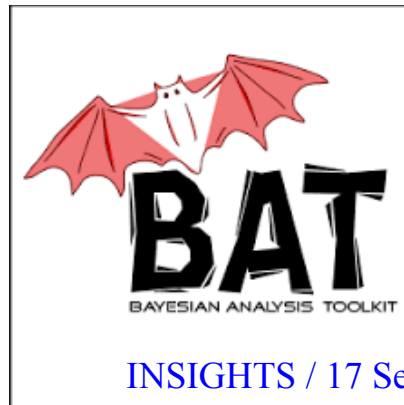
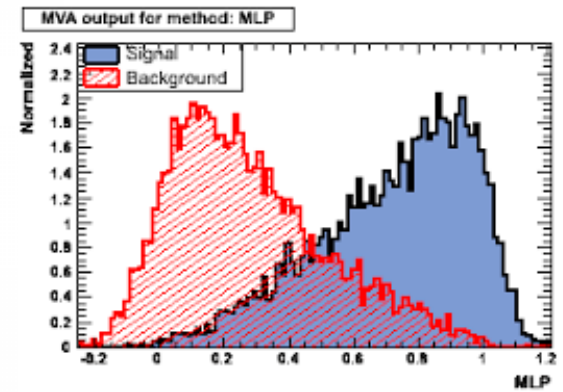
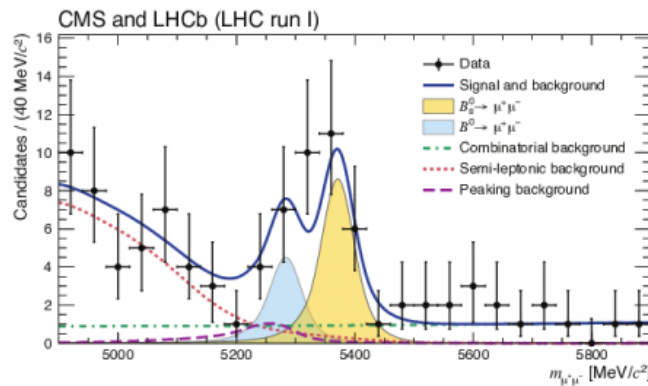
ROOT

TMVA

RooFit/RooStats

BAT

GAMBIT



WP3 Physics Applications

Coordinator – Alex Read, University of Oslo

Goal is not to develop statistical tools “in a vacuum” but to ensure they can cope with the real-world complexities of actual analyses.

Physics applications include:

LHC Physics (ATLAS and CMS)

Top and Higgs physics, search for new processes

Neutrino physics (SHiP)

Double Beta Decay (GERDA)

WP4 Statistics for Society

Coordinator: Paolo Agnoli, Pangea Formazione (Rome)

Statistics in HEP to/from our partners in research and industry:

Volcanology (INGV)

Climate Science (CICERO)

Finance (KPMG, FISCAL)

Image recognition, traffic flow (Pangea Formazione)

Image Processing (Digital Comoedia)

WP5 Management

Coordinator: Glen Cowan, RHUL



WP6 Training

Coordinator: Luca Lista, INFN Naples

Built on existing events as well as several new created by INSIGHTS, e.g., Pan-European School of Advanced Statistics at DESY

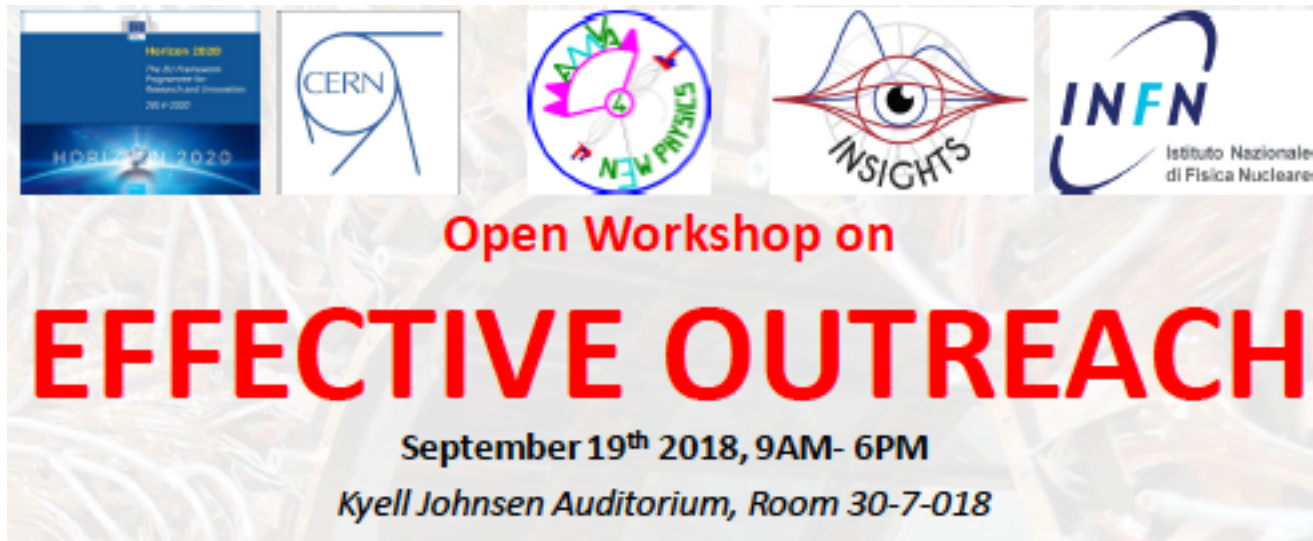
Main Training Events & Conferences	Lead Institution	Project Month (<i>estimated</i>)	Duration	Notes
DESY Terascale Statistics School 2018	DESY	7	1 week	
C++/ROOT Tutorial and Introductory workshop on statistical methods (including Scientific Misconduct, Research Integrity training, Ethics training and Open Science including Open data and Data Management Plan)	CERN	10	2 weeks	New ITN Event
NIKHEF C++ and Statistics week 2018	NIKHEF	14	1 weeks	
First Pan-European School of Advanced Statistics	DESY	18	1 weeks	New ITN Event
DESY Terascale Statistics School 2019	DESY	20	1 week	
INFN Statistics School 2019	INFN	21	1 week	
Workshop on non-academic training	UIO	22	1 week	New ITN Event
MPP Excellence School 2019	MPP	25	1 week	
RHUL Soft-skill Training Event (including Media and Writing skill training)	RHUL	27	1 week	New ITN Event
DESY Terascale Statistics School 2020	DESY	32	1 week	
Career Event at MPP	MPP	34	1 week	New ITN Event
MPP Excellence School 2020 and	MPP	37	1 week	
Second Pan-European School of Advanced Statistics	DESY	47	1 weeks	New ITN Event

WP7 Outreach

Coordinator: Tommaso Dorigo, INFN Padova

Web: insights-itn.eu → social media, blog, etc.

Outreach workshop (Wednesday!):



Horizon 2020
The EU Framework
Programme for
Research and Innovation
2014-2020

CERN

NEW PHYSICS

INSIGHTS

INFN
Istituto Nazionale
di Fisica Nucleare

Open Workshop on

EFFECTIVE OUTREACH

September 19th 2018, 9AM- 6PM
Kyell Johnsen Auditorium, Room 30-7-018

For the rest of this week

We hope you get the most out of the coming week here at CERN
(Thanks, Lorenzo, Sergei, Tommaso, et al.!)

MONDAY, 17 SEPTEMBER



10:30 → 12:30 **Introduction/Opening: Introduction, INSIGHTS closed session** 📍 503-1-001 - Council Chamber
Conveners: Glen Cowan (Royal Holloway, University of London), Lorenzo Moneta (CERN), Sergei Gleyzer (University of Florida (US))

12:30 → 14:00 **Lunch** 🕒 1h 30m

14:00 → 18:00 **Introduction to Software Development: Software Development** 📍 503-1-001 - Council Chamber
Convener: Lorenzo Moneta (CERN)

14:00 **Introduction to C++** 🕒 1h 30m
Speaker: Wouter Verkerke (Nikhef National institute for subatomic physics (NL))

15:30 **Coffee Break** 🕒 15m

15:45 **Introduction to Python** 🕒 1h 30m
Speaker: Graeme Stewart (CERN)

Wednesday: Outreach Workshop

WEDNESDAY, 19 SEPTEMBER



09:00 → 18:00

Outreach Workshop: Public Outreach Workshop/Event

📍 30-7-018 - Kjell Johnsen Audit...

Conveners: Lorenzo Moneta (CERN), Luca Malgeri (CERN), Paris Sphicas (CERN/Athens), Sergei Gleyzer (University of Florida (US)), Tancredi Carli (CERN), Tommaso Dorigo (Universita e INFN, Padova (IT))

09:00

Introduction and goals of the workshop

🕒 10m

Speaker: Tommaso Dorigo (Universita e INFN, Padova (IT))

09:10

Outreach: Just do it

🕒 30m

Speaker: Sascha Mehlhase (Ludwig Maximilians Universitat (DE))

09:40

Engaging formats for science events

🕒 30m

Discovering researchers and research inventing or adapting communication formats to be used in science events. From TVgames to improbable conversations some examples of outreach activities effectively used during science events such as science festival and the European Researchers' Night.

Speaker: Dr Leonardo Alfonsi (Psiquadro)

10:10

How Did the Higgs Boson Become a Rock Star?

🕒 30m

Speaker: Arnaud Marsollier (CERN)

10:40

coffee break

🕒 20m

11:00

Measuring the impact of the Higgs

🕒 30m

Speaker: Jonathan Butterworth (University College London (UK))

11:30

Our Universe in a Box

🕒 30m

Speaker: Claire Lee (Brookhaven National Laboratory (US))

12:00

The Universe is a Beer: The importance of fun in outreach

🕒 30m

Speaker: Steven Goldfarb (University of Melbourne (AU))

12:30

Escaping the echo chamber

🕒 30m

Speaker: Dr Patrick Koppenburg (Nikhef National institute for subatomic physics (NL))

13:00

lunch

🕒 1h 30m

14:30

Science divulgation at a literature festival

🕒 30m

Speaker: Dr Matteo Polettini

15:00

The Art and Science initiative

🕒 30m

Speaker: Dr Dario Menasce (Universita & INFN, Milano-Bicocca (IT))

15:30

Just for the kick of it - learning by playing

🕒 30m

Speaker: Joao Antunes Pequena (CERN)

16:00

coffee break

🕒 20m

16:20

Abolish Outreach!

🕒 30m

Speaker: James Beacham (Ohio State University (US))

16:50

Panel session and conclusions

🕒 40m

This session is chaired by Athina Zampara, PO of the INSIGHTS and AMVA4NewPhysics networks. All speakers are invited to a round-table discussion of the outreach actions described during the day

Speakers: Sergei Gleyzer (University of Florida (US)), Tommaso Dorigo (Universita e INFN, Padova (IT))

09:00 → 12:30 **Introduction to Statistics and Machine Learning: Statistics and Machine Learning II**

📍 40-S2-B01 - Salle Bohr

Conveners: Glen Cowan (Royal Holloway, University of London), Sergei Gleyzer (University of Florida (US))

09:00

Introduction to Statistics II

🕒 1h 30m

Speaker: Glen Cowan (Royal Holloway, University of London)

10:30

Coffee Break

🕒 30m

11:00

Introduction to Machine Learning II

🕒 1h 30m

Speaker: Sergei Gleyzer (University of Florida (US))

12:30 → 14:00

Lunch

🕒 1h 30m

14:00 → 18:00 **Hands-on Tutorials: Machine Learning Tutorials**

📍 40-S2-B01 - Salle Bohr

Conveners: Lorenzo Moneta (CERN), Sergei Gleyzer (University of Florida (US))09:00 → 12:30 **Introduction to Statistics and Machine Learning: Statistics and Machine Learning III**

📍 222-R-001

Conveners: Glen Cowan (Royal Holloway, University of London), Sergei Gleyzer (University of Florida (US))

09:00

Introduction to Statistics

🕒 1h 30m

Speaker: Glen Cowan (Royal Holloway, University of London)

10:30

Coffee Break

🕒 30m

11:00

Machine Learning and Hands-on Session

🕒 1h 30m

Speaker: Sergei Gleyzer (University of Florida (US))

12:30 → 14:00

Lunch

🕒 1h 30m

14:00 → 18:00 **Statistical and Data Analysis Tools: Introduction to Roofit and Roostats**

📍 222-R-001

Conveners: Lorenzo Moneta (CERN), Wouter Verkerke (Nikhef National institute for subatomic physics (NL))

And next week in Padova...

Workshop

Advanced Statistics for Physics Discovery

September 24-25, 2018

Department of Statistical Sciences, University of Padova

AMVA4NewPhysics (ITN Marie Curie – 2015/2019)

INSIGHTS (ITN Marie Curie – 2017/2021)

Followed on 26, 27 Sep by the INSIGHTS workshop where we will continue to get to know each other and sort out many questions for the coming 3 years:

Work Packages, Management Structures,...

So...

Welcome everyone to INSIGHTS – it's going to be a fantastic time!