Title:	***Experimental Particle Physics: Advanced Tools***
Organisers:	D. Rebuzzi, A. Negri
Lecturers:	M. Pelliccioni
Duration:	24 hours
CFU:	4
Period:	II semester
Content:	The course is focused on the Standard Model of Particle Physics, approached from an experimental point of view. The main aspects of the theoretical framework and the motivations for measurements at the LHC energies will be recalled, as first. Secondly, the course will take an exercise-oriented approach, with quick reminders of the statistical theory and a large fraction of time dedicated to practical examples. An introduction to the experimental setup, techniques and limitations will be given for each topic. Real data from LHC experiments will be analysed. The main topics will be: - study of the di-muon invariant mass spectrum, fitting of the main quarkonia resonances and measurement of their properties - Study of the 4-lepton invariant mass spectrum, discovery of the Higgs boson, determination of its properties. *Fitting Tools:* Usage of the RooFit library: signal and background modelling, fitting and plotting; treatment of extended fits, Conditional Probability Density Functions, Toy Monte-Carlo generation. *Statistics Tools:* Usage of the RooStats library: hypothesis testing and p-values, Determination of Upper Limits with CLs; determination of confidence intervals with likelihood ratio; determination of probability intervals in Bayesian approaches; Bayesian numerical calculators vs Markov-Chains MC approach
Notes	The exam will consist in the presentation of a physics analysis paper, focusing on the topics discussed during the classes. Prerequisites: very basic knowledge of python and ROOT.