



ESR19: Hosted by IFJ PAN



ESR19

- 18 months on Higgs Tools budget, starting in 2014 (exact date TBD), remaining 18 months to be financed from Polish resources;
- supervisor: Zbigniew Wąs (TBC);
- co-supervisors: Olga Shekhovtsova or Andreas van Hameren or Elżbieta Richter-Wąs (TBC depending on applicant interests).

Workpackage 2 and 3

- Task 2.1: SM Higgs production/couplings predictions and measurements;
- Task 3.1.2 Fast simulation and reconstruction tools for the LHC;
- Task 3.1.3 Matrix element techniques for Higgs signals.

Target at τ lepton production and/or decay simulation. Channels with τ leptons are important for studies and measurement of Higgs properties:

- better understanding and simulation can help to reduce systematic errors. Experimental data from Belle and BaBar remain largely unexplored for that purpose;
- simulation of τ signal and background processes is necessary in a flexible way.

Connections with ATLAS and CMS collaborators (in particular ETH Zurich, Freiburg, Annecy, also Athens and NIKHEF) outside network Bonn, Aachen.



ESR19: Why IFJ PAN?



Extensive programme over a long period of time:

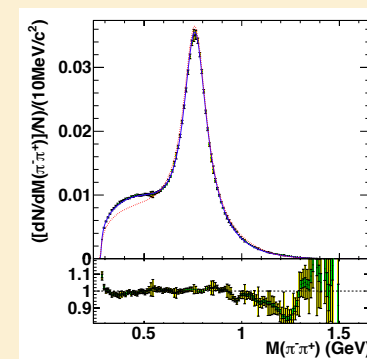
- on τ lepton reconstruction and observation in ATLAS, also on light leptons, ER-W multi year coordinator of ATLAS Higgs and tau working groups;
- expertise in construction of Monte Carlo programs for τ lepton production and decay.

Permanent staff currently involved:

- Stanisław Jadach, Andreas van Hameren, Elżbieta Richter-Wąs, Zbigniew Wąs;
- also two postdocs and one PhD student.

Many τ studies with IFJ PAN contributions: [Monte Carlo program for tau decays](#) used since 20+ years combined with fit environment for τ data.

LHC: $H \rightarrow \tau\tau$, $Z \rightarrow \tau\tau$ (TauSpinner Universal Tau interface).



tau simulations: production and decay is an obvious necessary step in studies of Higgs boson properties and of New Physics signatures.

- already now, our first results for better simulations of τ decays are published (see fig. above)
- first version of TauSpinner for manipulation of τ production processes published as well.



ESR19: What?



“Easy” measurements have been done

- need to work harder to get at the next layer; “pattern recognition in extreme conditions” is a challenge.

ESR19 would work directly on

- work on τ decay Monte Carlo library TAUOLA and software for fits;
- modelling of τ decays based on own analytic results and BaBar data;
- modelling of τ signatures at LHC.

Role as “**trainee**” for LHC activities

- theoretical calculation and development of Monte Carlo tool e.g. for reweighting of VBF $qq \rightarrow H+2\text{jets}$ and gluon fusion $gg \rightarrow H+2\text{jets}$ processes or for theoretical systematic error;
- implementation of MC tool TauSpinner into software environment of LHC.

Role as “**trainer**” for LHC activities

- feasibility of applying proposed new tools within ATLAS or CMS;
- understanding and interpretation of experimental measurements and limits.