ttH Modelling

- ATLAS situation for ttH for Run-I presented by E. Shabalina: https://indico.cern.ch/event/280998/
- Using PowHel for ttH modelling (Europhys.Lett.96:11001,2011)
    - NLO Matrix Element Calculation
    - Top decayed by Pythia - no top spin information to decay products (though small effect)

- Initial studies of aMC@NLO ttH Modelling for Run-II
    - This would preserve top spin effects in decay products
    - Check of scales (dynamic and static)
    - The goal is to move to ttH(anything) aMC@NLO model for Run-II

- New NLO EW calculation (arXiv:1407.0823 and arXiv:1407.1110)
    - Critical for top-Yukawa coupling measurement
    - Reduction in XS+BR uncertainties - which are important for $H \rightarrow \gamma\gamma$ in Run-II with more data

- tH samples from MG+Pythia8 4F scheme with heavy b, PDF: CT10
    - 4F Scheme gives better kinematics of spectator b
    - Samples produced at k_t = +1,0,-1
    - Yukawa coupling measurement will be goal in Run-II
    - Need a dedicated analysis to focus on this tH measurement

tt+bb Background Modelling

- Background modelling **very important** in ttH(bb)
    - Need very good model of tt+bb and tt+cc
    - Current attempt in ATLAS: tt+bb modelling using Powheg+Pythia - NLO generator 5F scheme
    - Gluon splitting only production mechanism of bb pairs in Powheg
    - tt+b produced via b from 5F PDF
    - However: *Very good model of data*

- Studies to compare Powheg and Madgraph
    - Found very good agreement in tt+b(b) or tt+c(c) categories, even with missing ME contribution of tt+b(b) in Powheg+Pythia

- tt+bb at NLO from Sherpa 2.0

- ***tt+bb modelling is the leading uncertainty in ttH(bb)***
- 50 % normalization uncertainty + re-weigthing uncertainty to match tt differential cross section measurement
    - This measurement will be crucial at the start of Run-II

- Analysis based on Neural Network built on event and object kinematics: we saw with Alpgen, some kinematic variables mis-modelled, for this reason, we need to understand the modelling of the background before we can observe ttH in the bb decay channel.