Contribution ID: **61** Type: **Parallel Sessions**

Prospects of measuring the CKM matrix element V_{ts} at the LHC

Friday 6 July 2012 13:45 (15 minutes)

We study the prospects of measuring the CKM matrix element $|V_{ts}|$ at the LHC with the top quarks produced in the processes $pp \to t\bar{t}X$ and $pp \to t/\bar{t}X$, and the subsequent decays $t \to W^+ s$ and $\bar{t} \to W^- \bar{s}$. To reduce the jet activity in top quark decays, we insist on tagging the $W^\pm$ leptonically, $W^\pm \to \ell^\pm \nu_\ell$ ($\ell = e, \mu, \tau$), and analyse the anticipated jet profiles in the signal process $t \to Ws$ and the dominant background from the decay $t \to Wb$. To that end, we analyse the $V0$ (K^0 and Λ) distributions in the s- and b-quark jets concentrating on the energy and transverse momentum distributions of these particles. The $V0$s emanating from the $t \to Wb$ branch have displaced decay vertexes from the interaction point due to the weak decays $b \to c \to s$ and the b-quark jets are rich in charged leptons. Hence, the absence of secondary vertexes and of the energetic charged leptons in the jet provide additional (b-jet vs. s-jet) discrimination in top quark decays. These distributions are used to train a boosted decision tree (BDT), a technique used successfully in measuring the CKM matrix element $|V_{tb}|$ in single top production at the Tevatron.
Using the BDT classifier, and a variant of it called BDTD, which makes use of decorrelated variables, we calculate the BDT(D)-response functions corresponding to the signal ($t \to Ws$) and background ($t \to Wb$). Detailed simulations undertaken by us with the Monte Carlo generator PYTHIA are used to estimate the background rejection versus signal efficiency for three representative LHC energies $\sqrt{s} = 7$ TeV, 10 TeV and 14 TeV, of which only the analysis for the $\sqrt{s} = 14$ TeV case is shown in detail. We argue that a benchmark with 10\% accuracy for the signal $t \to Ws$) at a background ($t \to Wb$) rejection by a factor 10^3 (required due to the anticipated value of the ratio $|V_{ts}|^2/|V_{tb}|^2 \simeq 1.6 \times 10^{-3}$) can be achieved at the LHC@14 TeV with an integrated luminosity of 10 fb^{-1}.

Author: Prof. BARREIRO, Fernando (Universidad Autonoma De Madrid (ES))

Co-authors: Prof. ALI, Ahmed (DESY, Hamburg, Germany); Dr LAGOURI, Theodota (UAM, Madrid, Spain)

Presenter: Prof. BARREIRO, Fernando (Universidad Autonoma De Madrid (ES))

Session Classification: Room 217 - Heavy Ion Collisions / B-Physics / CP Violation - TR5/7/9

Track Classification: Track 7. CP Violation, CKM, Rare Decays, Meson Spectroscopy