Conor Fitzpatrick - CERN Fellowship Research Interests

The Standard Model is one of the greatest achievements in science, providing extremely accurate predictions long before experimental precision has been able to corroborate them. Many places remain in which new physics has yet to be ruled out. Of particular interest are processes involving B_s^0-$\overline{B}_s^0$ mixing in which new physics can have appreciable effects. The decay $B_s^0 \to J/\psi\phi$ is one such process. The $\mathcal{CP}$ violating phase ϕ_s in $B_s^0 \to J/\psi\phi$ is predicted to high precision in the SM, any deviation from which would be an unambiguous signal of new physics.

LHCb has collected in the first year of nominal running enough data to publish the worlds most precise measurement of ϕ_s with $B_s^0 \to J/\psi\phi$, an analysis in which I have been instrumental. Even with the present dataset, we are still an order of magnitude short of the error on the SM value.

LHCb is in an ideal position to narrow this gap, but in order to obtain comparable precision to the SM prediction a number of improvements to the present analysis can be made: A simultaneous fit to additional decays mediated by $b \to c\bar{c}s$ transitions including $B_s^0 \to J/\psi\eta$, $B_s^0 \to J/\psi\eta'$ and $B_s^0 \to J/\psi f_0(980)$ will further improve the sensitivity to both ϕ_s and the decay width difference $\Delta\Gamma_s$. Complimentary to this would be the development of enhanced selection and trigger lines for such an ensemble of decay modes. Efficiently selecting $B_s^0 \to J/\psi\eta$ and $B_s^0 \to J/\psi\eta'$ is a challenge that I would relish in particular, a task well suited to the testing and deployment of the latest multivariate analysis techniques. Finally, the inclusion of a calibrated same-side kaon tagger will enhance overall sensitivity. A CERN fellowship would be the ideal position in which I could implement these procedures.

Conor Fitzpatrick, February 21, 2012
conor.fitzpatrick@cern.ch