Neutron Scattering Study of the Double Perovskite FCC Antiferromagnet Ba$_2$YRuO$_6$ J.P. CARLO, Villanova University, J.P. CLANCY, University of Toronto, K. FRITSCH, C.A. MARJERRISON, McMaster University, G.E. GRANROTH, Oak Ridge National Laboratory, H.A. DABKOWSKA, B.D. GAULIN, McMaster University — Magnetic cations in the rock-salt ordered double perovskite structure comprise a geometrically frustrated FCC network of edge-sharing tetrahedra. Previous measurements of the 4$d^3$ Ru$^{5+}$ system Ba$_2$YRuO$_6$ [1] indicated the existence of long-range commensurate antiferromagnetic order below $T_N = 36$K, a factor $f \sim 15$ lower than the Curie-Weiss temperature $\Theta_W = -522$K. We report time-of-flight neutron spectroscopy of Ba$_2$YRuO$_6$ confirming the existence of the long-range ordered state below $T_N$. The magnetic inelastic scattering extends over a bandwidth of $\sim 15$ meV, and develops a $\sim 5$ meV gap at the [100] magnetic ordering wavevector at and below $T_N$. Strong spin-orbit coupling in this $4d^3$ system is expected to result in a $j_{eff}=3/2$ magnetic moment. This is distinct from the $4d^1$, $j_{eff}=3/2$ moment which arises in its sister antiferromagnetic FCC compound, Ba$_2$YMoO$_6$, which displays an apparent singlet ground state and a $\sim 28$ meV singlet-triplet gap at low temperatures [2], matching its $-\Theta_W$ — $\sim 300$K. [1] T. Aharen et al. Phys. Rev. B 80, 134423 (2009). [2] J. P. Carlo et al. Phys. Rev. B 84, 100404(R) (2011).