A new approach to determine bulk spin polarization applied to Co$_{(1-x)}$Fe$_x$S$_2$ JONATHAN TAYLOR, SEAN GIBLIN, STFC, CLAUDIA UT-FIELD, Department of Physics University of Bristol, JONATHAN DUFFY, Department of Physics University of Warwick, STEVEN DUGDALE, Department of Physics University of Bristol, JUDE LAVEROCK, Department of Physics, University of Bristol, C. LEIGHTON, M. MANNO, Department of Chemical Engineering and Materials Science, University of Minnesota, M. ITOU, Y. SAKURAI, Japan Synchrotron Radiation Research Institute, SPring-8 — We report on a new method to determine the degree of bulk spin polarization in single crystal Co$_{(1-x)}$Fe$_x$S$_2$, by modeling magnetic Compton scattering with ab initio calculations. Spin-dependent Compton profiles were measured for CoS$_2$ and Co$_{0.9}$Fe$_{0.1}$S$_2$, along four and three different crystallographic directions respectively. The ab initio calculations were then refined by rigidly shifting the bands to provide the best fit between the calculated and experimental directional profiles for each sample. The bulk spin polarizations, $P$, corresponding to the spin-polarized density of states at the Fermi level, were then extracted from the refined calculations. The values were found to be $P = -72 \pm 6\%$ and $P = 18 \pm 7\%$ for CoS$_2$ and Co$_{0.9}$Fe$_{0.1}$S$_2$ respectively. Furthermore, determinations of $P$ weighted by the Fermi velocity ($v_F$ or $v_F^2$) were obtained, permitting a rigorous comparison with other experimental data and highlighting the experimental dependence of $P$ on $v_F$.