



Figure 1 – Supplementary Information

ND patterns for the $\text{La}_{1.4}\text{Sr}_{1.6}\text{Mn}_2\text{O}_7$ (collected at 57 K on D1A – ILL – at 1.91 Å) (red line) and for the two samples considered in the paper (collected as described in the experimental): blue line for the oxygen annealed sample and black line for the argon annealed sample. Arrows in the Figure mark the two indexed ferromagnetic peaks relative to the long-range magnetic order of the $\text{La}_{1.4}\text{Sr}_{1.6}\text{Mn}_2\text{O}_7$ sample.