

$$\begin{array}{c}
 |\sigma_M(t_f)\rangle = \underbrace{U(t_f, t_2)|\sigma_2\rangle}_{\text{Standard shower}} + \int_{t_2}^{t_f} dt_3 \underbrace{U(t_f, t_3) [W_M(t_f, t_2), \mathcal{H}(t_3)] N(t_3, t_2)|\sigma_2\rangle}_{W_M(t_f, t_2)\mathcal{H}(t_3) - \mathcal{H}(t_3)W_M(t_f, t_2)}
 \end{array}$$