



$$\sum_i \text{tr}_1 [(\hat{U}_i \otimes \hat{\rho}_i) (\dots) (\hat{U}_i^\dagger \otimes \hat{I})]$$

$$= \sum_i \hat{U}_i \text{tr}_1 [(\hat{I} \otimes \hat{\rho}_i) (\dots)] \hat{U}_i^\dagger$$