$\langle\omega|\widetilde{U}^{\dagger}{}_{1,3}(T,\vec{\alpha})\otimes I_{2,4}$

$U_{target}\otimes I_{2,4}|\omega\rangle$

$\widetilde{U}(T,\vec{\alpha})$

U_{target}

1

3

1

3

2

4

2

4