Appendix

Table A1 : Efficiencies of multiqubit $|\Phi\rangle$ states in noisy environment with weak measurements

θ	ϕ_N	d	w	Fidelity			CP		
				N=2	N=3	N=4	N=2	N=3	N=4
$3\pi/16$	$3\pi/8$	0.2	0.2	0.758	0.755	0.752	0.155	0.181	0.208
$3\pi/16$	$3\pi/8$	0.2	0.7	0.814	0.814	0.813	0.161	0.172	0.184
$3\pi/16$	$3\pi/8$	0.7	0.2	0.616	0.602	0.589	0.118	0.161	0.199
$3\pi/16$	$3\pi/8$	0.7	0.7	0.733	0.729	0.725	0.151	0.183	0.215
$3\pi/16$	$7\pi/16$	0.2	0.2	0.837	0.833	0.829	0.234	0.260	0.285
$3\pi/16$	$7\pi/16$	0.2	0.7	0.911	0.910	0.909	0.257	0.269	0.280
$3\pi/16$	$7\pi/16$	0.7	0.2	0.651	0.633	0.616	0.154	0.192	0.226
$3\pi/16$	$7\pi/16$	0.7	0.7	0.805	0.799	0.793	0.223	0.253	0.284
$3\pi/16$	$\pi/2$	0.2	0.2	0.864	0.861	0.857	0.262	0.287	0.313
$3\pi/16$	$\pi/2$	0.2	0.7	0.944	0.944	0.943	0.291	0.302	0.314
$3\pi/16$	$\pi/2$	0.7	0.2	0.663	0.644	0.626	0.166	0.203	0.236
$3\pi/16$	$\pi/2$	0.7	0.7	0.830	0.824	0.818	0.248	0.278	0.307
$\pi/8$	$3\pi/8$	0.2	0.2	0.772	0.770	0.768	0.018	0.035	0.054
$\pi/8$	$3\pi/8$	0.2	0.7	0.820	0.820	0.820	0.008	0.015	0.023
$\pi/8$	$3\pi/8$	0.7	0.2	0.644	0.631	0.618	0.032	0.070	0.111
$\pi/8$	$3\pi/8$	0.7	0.7	0.751	0.748	0.744	0.022	0.043	0.067
$\pi/8$	$7\pi/16$	0.2	0.2	0.855	0.853	0.851	0.101	0.118	0.136
$\pi/8$	$7\pi/16$	0.2	0.7	0.919	0.919	0.918	0.106	0.113	0.120
$\pi/8$	$7\pi/16$	0.7	0.2	0.688	0.672	0.654	0.076	0.110	0.148
$\pi/8$	$7\pi/16$	0.7	0.7	0.828	0.824	0.819	0.099	0.119	0.142
$\pi/8$	$\pi/2$	0.2	0.2	0.885	0.882	0.880	0.131	0.147	0.165
$\pi/8$	$\pi/2$	0.2	0.7	0.953	0.953	0.953	0.140	0.148	0.155
$\pi/8$	$\pi/2$	0.7	0.2	0.703	0.686	0.666	0.092	0.124	0.160
$\pi/8$	$\pi/2$	0.7	0.7	0.855	0.850	0.846	0.126	0.146	0.169
$\pi/16$	$3\pi/8$	0.2	0.2	0.783	0.782	0.782	0	0	0
$\pi/16$	$3\pi/8$	0.2	0.7	0.825	0.825	0.825	0	0	0
$\pi/16$	$3\pi/8$	0.7	0.2	0.668	0.663	0.656	0	0	0
$\pi/16$	$3\pi/8$	0.7	0.7	0.764	0.763	0.762	0	0	0
$\pi/16$	$7\pi/16$	0.2	0.2	0.869	0.867	0.868	0.005	0.010	0.016
$\pi/16$	$7\pi/16$	0.2	0.7	0.925	0.924	0.924	0.002	0.004	0.006
$\pi/16$	$7\pi/16$	0.7	0.2	0.719	0.713	0.704	0.009	0.023	0.042
$\pi/16$	$7\pi/16$	0.7	0.7	0.845	0.844	0.842	0.005	0.013	0.021
$\pi/16$	$\pi/2$	0.2	0.2	0.899	0.899	0.898	0.035	0.041	0.047
$\pi/16$	$\pi/2$	0.2	0.7	0.959	0.959	0.959	0.037	0.039	0.041
$\pi/16$	$\pi/2$	0.7	0.2	0.738	0.730	0.721	0.027	0.040	0.059
$\pi/16$	$\pi/2$	0.7	0.7	0.873	0.872	0.870	0.034	0.041	0.049

Table A2 : Efficiencies of multiqubit $|GGHZ\rangle$ states in noisy environment with weak measurement operations

θ	ϕ_N	ϕ_i $(i \neq N)$	d	w	Fidelity			CP		
					N=2	N=3	N=4	N=2	N=3	N=4
$3\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.792	0.734	0.695	0.160	0.106	0.070
$3\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.840	0.782	0.742	0.186	0.128	0.089
$3\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.635	0.583	0.553	0.080	0.040	0.020
$3\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.769	0.711	0.671	0.149	0.095	0.061
$3\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.841	0.810	0.781	0.210	0.181	0.155
$3\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.897	0.873	0.852	0.243	0.220	0.199
$3\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.660	0.612	0.578	0.104	0.069	0.044
$3\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.814	0.778	0.746	0.194	0.163	0.135
$3\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.859	0.841	0.822	0.228	0.213	0.197
$3\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.917	0.911	0.905	0.263	0.258	0.252
$3\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.668	0.623	0.589	0.113	0.080	0.055
$3\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.830	0.806	0.782	0.210	0.191	0.171
$3\pi/16$	$\pi/4$	$\pi/4$	0.2	0.2	0.878	0.858	0.839	0.246	0.230	0.213
$3\pi/16$	$\pi/4$	$\pi/4$	0.2	0.7	0.939	0.932	0.926	0.285	0.279	0.273
$3\pi/16$	$\pi/4$	$\pi/4$	0.7	0.2	0.678	0.630	0.594	0.122	0.087	0.060
$3\pi/16$	$\pi/4$	$\pi/4$	0.7	0.7	0.848	0.822	0.796	0.228	0.206	0.186
$\pi/8$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.785	0.739	0.707	0.138	0.094	0.064
$\pi/8$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.809	0.764	0.732	0.148	0.104	0.073
$\pi/8$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.679	0.622	0.583	0.089	0.049	0.026
$\pi/8$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.773	0.725	0.692	0.132	0.088	0.059
$\pi/8$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.828	0.806	0.785	0.180	0.160	0.141
$\pi/8$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.854	0.837	0.822	0.194	0.177	0.162
$\pi/8$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.706	0.657	0.615	0.117	0.084	0.058
$\pi/8$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.813	0.787	0.764	0.172	0.151	0.131
$\pi/8$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.842	0.833	0.823	0.195	0.187	0.180
$\pi/8$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.870	0.868	0.865	0.208	0.207	0.205
$\pi/8$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.716	0.671	0.631	0.127	0.099	0.073
$\pi/8$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.827	0.814	0.799	0.187	0.177	0.166
$\pi/8$	$\pi/4$	$\pi/4$	0.2	0.2	0.859	0.849	0.838	0.211	0.203	0.195
$\pi/8$	$\pi/4$	$\pi/4$	0.2	0.7	0.887	0.884	0.882	0.227	0.225	0.222
$\pi/8$	$\pi/4$	$\pi/4$	0.7	0.2	0.726	0.679	0.637	0.137	0.107	0.080
$\pi/8$	$\pi/4$	$\pi/4$	0.7	0.7	0.843	0.828	0.813	0.202	0.191	0.179
$\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.742	0.717	0.699	0.080	0.057	0.040
$\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.747	0.723	0.706	0.083	0.058	0.041
$\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.708	0.670	0.639	0.070	0.045	0.039
$\pi/16$	$\pi/8$ or $3\pi/8$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.739	0.713	0.694	0.080	0.056	0.039
$\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.767	0.757	0.748	0.106	0.096	0.088
$\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.773	0.764	0.756	0.108	0.099	0.091
$\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.729	0.702	0.672	0.092	0.077	0.062
$\pi/16$	$3\pi/16$ or $5\pi/16$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.764	0.753	0.742	0.104	0.095	0.086
$\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.2	0.2	0.776	0.774	0.771	0.114	0.113	0.112
$\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.2	0.7	0.782	0.781	0.781	0.117	0.116	0.116
$\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.7	0.2	0.737	0.715	0.689	0.099	0.090	0.078
$\pi/16$	$\pi/4$	$3\pi/16$ or $5\pi/16$	0.7	0.7	0.772	0.769	0.765	0.113	0.111	0.109
$\pi/16$	$\pi/4$	$\pi/4$	0.2	0.2	0.785	0.783	0.781	0.124	0.122	0.121
$\pi/16$	$\pi/4$	$\pi/4$	0.2	0.7	0.791	0.791	0.790	0.126	0.125	0.126
$\pi/16$	$\pi/4$	$\pi/4$	0.7	0.2	0.745	0.723	0.695	0.107	0.097	0.084
$\pi/16$	$\pi/4$	$\pi/4$	0.7	0.7	0.781	0.778	0.774	0.120	0.120	0.118

1 MS STATE

The density matrices of evolved MS states in noisy environment and with weak measurement operators are given as

$$\rho_{MS}^{AD} = \frac{1}{4}\begin{bmatrix} 2(1+d^2C_\theta^2+d^3S_\theta^2) & \sqrt{\bar{d}}d^2S_{2\theta} & 0 & 0 & 0 & 0 & 0 & 0 \\ \sqrt{\bar{d}}d^2S_{2\theta} & 2\bar{d}d^2S_\theta^2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \bar{d}d(1+d+\bar{d}C_{2\theta}) & \bar{d}^{\frac{3}{2}}dS_{2\theta} & 0 & 0 & 0 & 0 \\ 0 & 0 & \bar{d}^{\frac{3}{2}}dS_{2\theta} & 2\bar{d}^2dS_\theta^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \bar{d}d(1+d+\bar{d}C_{2\theta}) & \bar{d}^{\frac{3}{2}}dS_{2\theta} & 0 & 0 \\ 0 & 0 & 0 & 0 & \bar{d}^{\frac{3}{2}}dS_{2\theta} & 2\bar{d}^2dS_\theta^2 & 0 & 0 \\ 2\bar{d}C_\theta & 0 & 0 & 0 & 0 & 0 & \bar{d}^2(1+d+\bar{d}C_{2\theta}) & \bar{d}^{\frac{5}{2}}S_{2\theta} \\ 2\bar{d}^{\frac{3}{2}}S_\theta & 0 & 0 & 0 & 0 & 0 & \bar{d}^{\frac{5}{2}}S_{2\theta} & 2\bar{d}^3S_\theta^2 \end{bmatrix} \tag{A1}$$

and

$$\rho_{MS}^{ADWM} = \frac{1}{A}\begin{bmatrix} 2+2d^2\bar{w}^2(C_\theta^2+d\bar{w}S_\theta^2) & d^2\bar{w}^2S_{2\theta} & 0 & 0 & 0 & 0 & 2C_\theta & 2S_\theta \\ d^2\bar{w}^2S_{2\theta} & 2d^2\bar{w}^2S_\theta^2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2d\bar{w}(C_\theta^2+d\bar{w}S_\theta^2) & d\bar{w}S_{2\theta} & 0 & 0 & 0 & 0 \\ 0 & 0 & d\bar{w}S_{2\theta} & 2d\bar{w}S_\theta^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2d\bar{w}(C_\theta^2+d\bar{w}S_\theta^2) & d\bar{w}S_{2\theta} & 0 & 0 \\ 0 & 0 & 0 & 0 & d\bar{w}S_{2\theta} & 2d\bar{w}S_\theta^2 & 0 & 0 \\ 2C_\theta & 0 & 0 & 0 & 0 & 0 & 2(C_\theta^2+d\bar{w}S_\theta^2) & S_{2\theta} \\ 2S_\theta & 0 & 0 & 0 & 0 & 0 & S_{2\theta} & 2S_\theta^2 \end{bmatrix} \tag{A2}$$

here $A = 4+5d\bar{w}+4d^2\bar{w}^2+d^3\bar{w}^3-d\bar{w}(1+d\bar{w})^2C_{2\theta}$

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