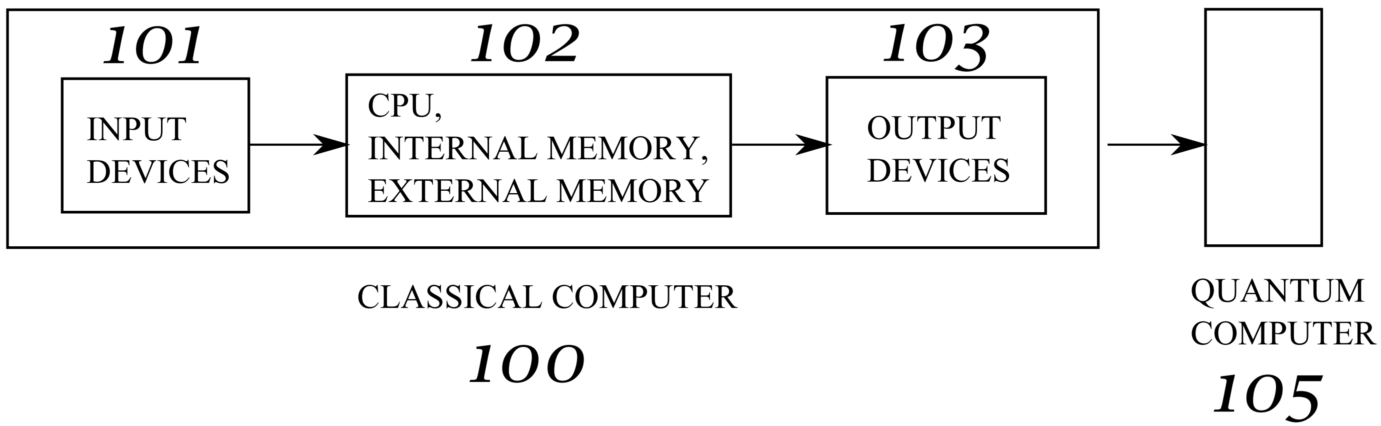
Figure 1


101
INPUT DEVICES
102
CPU,
INTERNAL MEMORY,
EXTERNAL MEMORY
103
OUTPUT DEVICES
CLASSICAL COMPUTER
100
QUANTUM COMPUTER
105

# Figure 2

$$|z_0|^2 + |z_1|^2 + \langle\chi|\chi\rangle = 1 \quad \textbf{201}$$

$$p = |z_0|^2 + |z_1|^2 \; , \quad q = 1 - p \quad \textbf{202}$$

$$|s\rangle_{\mu,\nu,\omega} = \begin{matrix} z_0\,|\psi_0\rangle_\mu \\ |0\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} z_1\,|\psi_1\rangle_\mu \\ |1\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} |\chi\rangle_{\mu,\nu} \\ |1\rangle_\omega \end{matrix} \quad \textbf{203}$$

$$|t\rangle_{\mu,\nu,\omega} = \frac{1}{\sqrt{p}} \left[ \begin{matrix} z_0\,|\psi_0\rangle_\mu \\ |0\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} z_1\,|\psi_1\rangle_\mu \\ |1\rangle_\nu \\ |0\rangle_\omega \end{matrix} \right] \quad \textbf{204}$$

$$\begin{aligned} \left[|t\rangle\,\langle t|\right]_{\mu,\nu,\omega} |s\rangle_{\mu,\nu,\omega} &= \sqrt{p} \;\; |t\rangle_{\mu,\nu,\omega} \\ \left[|0\rangle\,\langle 0|\right]_{\omega} |s\rangle_{\mu,\nu,\omega} &= \sqrt{p} \;\; |t\rangle_{\mu,\nu,\omega} \end{aligned} \quad \textbf{205}$$

$$\begin{aligned} \left[|t\rangle\,\langle t|\right]_{\mu,\nu,\omega} |t\rangle_{\mu,\nu,\omega} &= \;\; |t\rangle_{\mu,\nu,\omega} \\ \left[|0\rangle\,\langle 0|\right]_{\omega} |t\rangle_{\mu,\nu,\omega} &= \;\; |t\rangle_{\mu,\nu,\omega} \end{aligned} \quad \textbf{206}$$

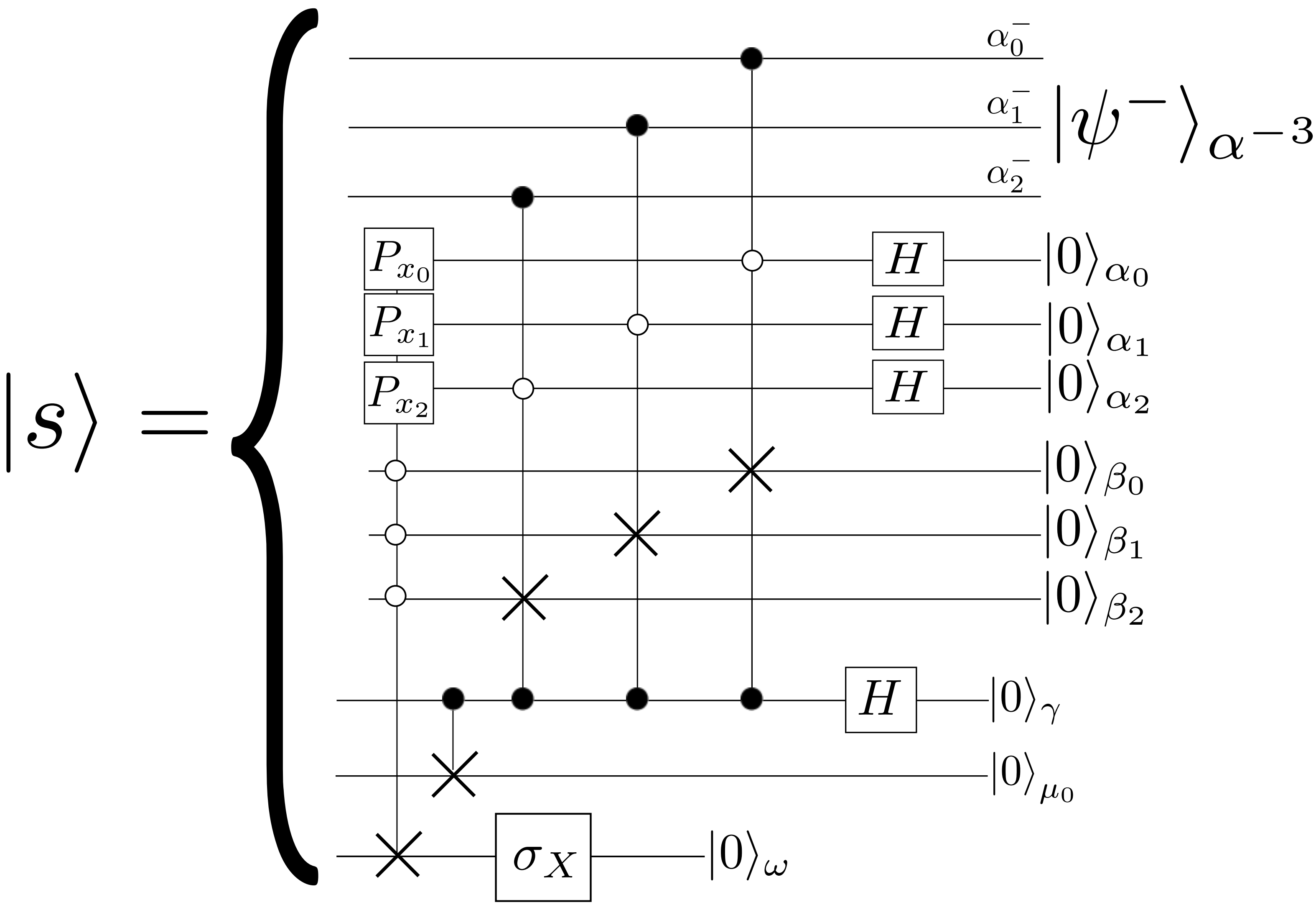
$$\langle t|s\rangle = \sqrt{p} \quad \textbf{207}$$

$$\mathrm{tr}_{\mu,\omega} \left\{ |t\rangle\,\langle t|_{\mu,\nu,\omega} \right\} = P(0)\,|0\rangle\,\langle 0|_\nu + P(1)\,|1\rangle\,\langle 1|_\nu \quad \textbf{208}$$

$$P(0) = |z_0|^2/p \; , \quad P(1) = |z_1|^2/p \quad \textbf{209}$$

$$|z_1|^2 = \frac{P(1)}{P(0)} |z_0|^2 \quad \textbf{210}$$

# *Figure 3*



|s⟩ =
α0−
α1−
α2−
|ψ−⟩α−3
Px0
Px1
Px2
H
H
H
|0⟩α0
|0⟩α1
|0⟩α2
|0⟩β0
|0⟩β1
|0⟩β2
H
|0⟩γ
|0⟩μ0
σX
|0⟩ω

# Figure 4

$$|s\rangle_{\mu,\nu,\omega} = \begin{matrix} z_1 \, |\psi_1\rangle_\mu \\ |1\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} z_0 \, |\psi_0\rangle_\mu \\ |0\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} |\chi\rangle_{\mu,\nu} \\ |1\rangle_\omega \end{matrix}$$

401

$$|\psi_1\rangle_\mu = \frac{1}{\sqrt{f(x^3)}} \sum_{x^{-3}} \theta(x^3 \geq x^{-3}) A^-(x^{-3}) \begin{matrix} |x^{-3}\rangle_{\alpha^-} \\ |x^3\rangle_\alpha \\ |1\rangle_{\mu_0} \end{matrix}$$

$$|1\rangle_\nu = \begin{bmatrix} |0^3\rangle_\beta \\ |1\rangle_\gamma \end{bmatrix}$$

$$z_1 = \frac{1}{\sqrt{2^4}} \sqrt{f(x^3)}$$

$$|\psi_0\rangle_\mu = \begin{matrix} |\psi^-\rangle_{\alpha^-} \\ |x^3\rangle_\alpha \\ |0\rangle_{\mu_0} \end{matrix}$$

402

$$|0\rangle_\nu = \begin{bmatrix} |0^3\rangle_\beta \\ |0\rangle_\gamma \end{bmatrix}$$

403

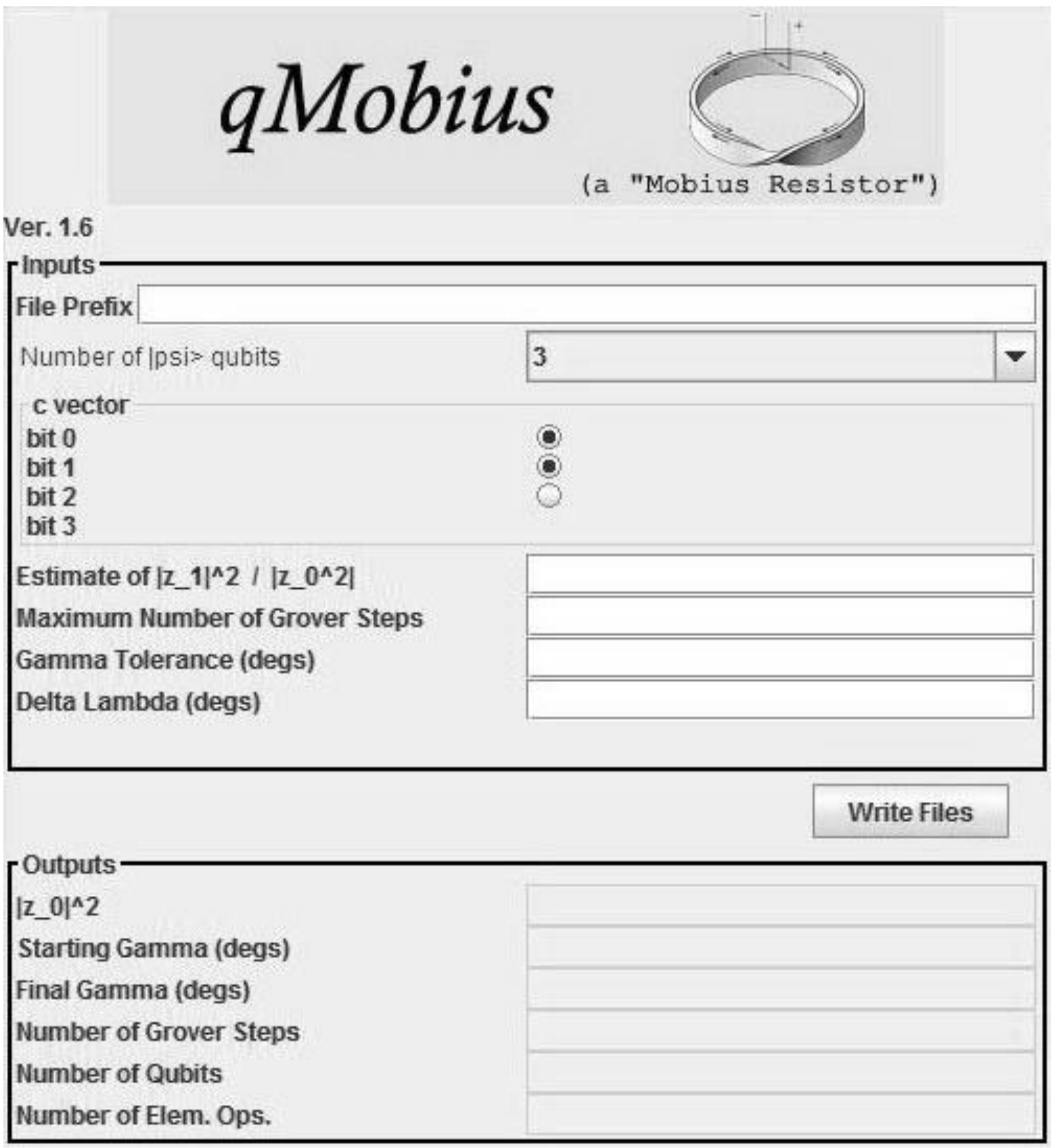
$$z_0 = \frac{1}{\sqrt{2^4}}$$

404

$$\frac{|z_1|}{|z_0|} = \sqrt{\frac{P(1)}{P(0)}}$$

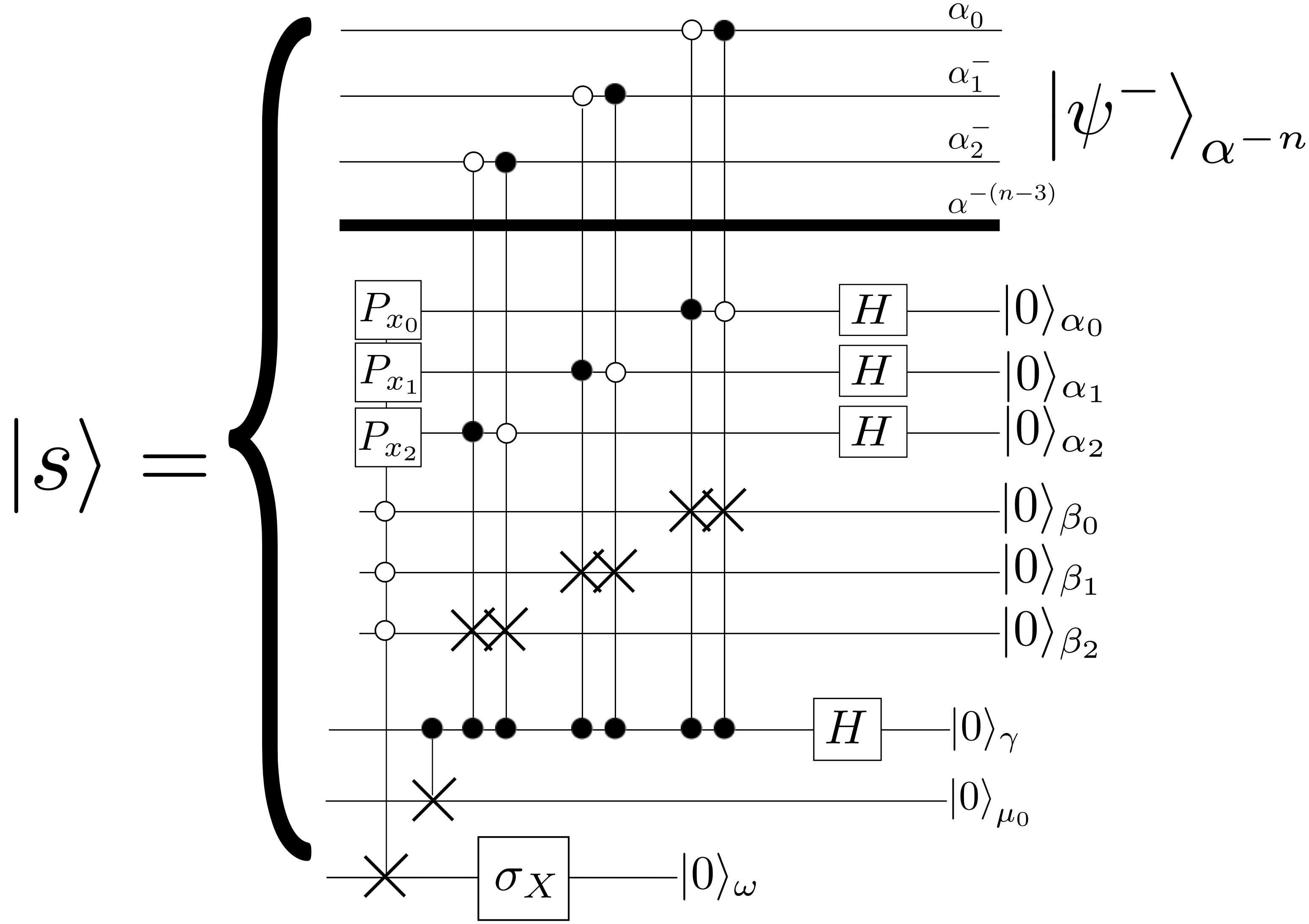
405

# Figure 5



qMobius
(a "Mobius Resistor")
Ver. 1.6
Inputs
File Prefix
Number of |psi> qubits
3
c vector
bit 0
bit 1
bit 2
bit 3
Estimate of |z_1|^2 / |z_0^2|
Maximum Number of Grover Steps
Gamma Tolerance (degs)
Delta Lambda (degs)
Write Files
Outputs
|z_0|^2
Starting Gamma (degs)
Final Gamma (degs)
Number of Grover Steps
Number of Qubits
Number of Elem. Ops.

# Figure 6



$|s\rangle =$
$\alpha_0^-$
$\alpha_1^-$
$\alpha_2^-$
$\alpha^{-(n-3)}$
$|\psi^-\rangle_{\alpha^{-n}}$
$P_{x_0}$
$P_{x_1}$
$P_{x_2}$
$H$
$H$
$H$
$H$
$|0\rangle_{\alpha_0}$
$|0\rangle_{\alpha_1}$
$|0\rangle_{\alpha_2}$
$|0\rangle_{\beta_0}$
$|0\rangle_{\beta_1}$
$|0\rangle_{\beta_2}$
$|0\rangle_{\gamma}$
$|0\rangle_{\mu_0}$
$\sigma_X$
$|0\rangle_{\omega}$

# Figure 7

$$|s\rangle_{\mu,\nu,\omega} = \begin{matrix} z_1 \, |\psi_1\rangle_\mu \\ |1\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} z_0 \, |\psi_0\rangle_\mu \\ |0\rangle_\nu \\ |0\rangle_\omega \end{matrix} + \begin{matrix} |\chi\rangle_{\mu,\nu} \\ |1\rangle_\omega \end{matrix}$$ **701**

$$|\psi_1\rangle_\mu = \frac{1}{\sqrt{P(x^3)}} \sum_{x^{-n}} \theta(x^3 = x^{-3}) A^-(x^{-n}) \begin{matrix} |x^{-n}\rangle_{\alpha^-} \\ |x^3\rangle_\alpha \\ |1\rangle_{\mu_0} \end{matrix}$$

$$|1\rangle_\nu = \begin{bmatrix} |0^3\rangle_\beta \\ |1\rangle_\gamma \end{bmatrix}$$

$$z_1 = \frac{1}{\sqrt{2^4}} \sqrt{P(x^3)}$$

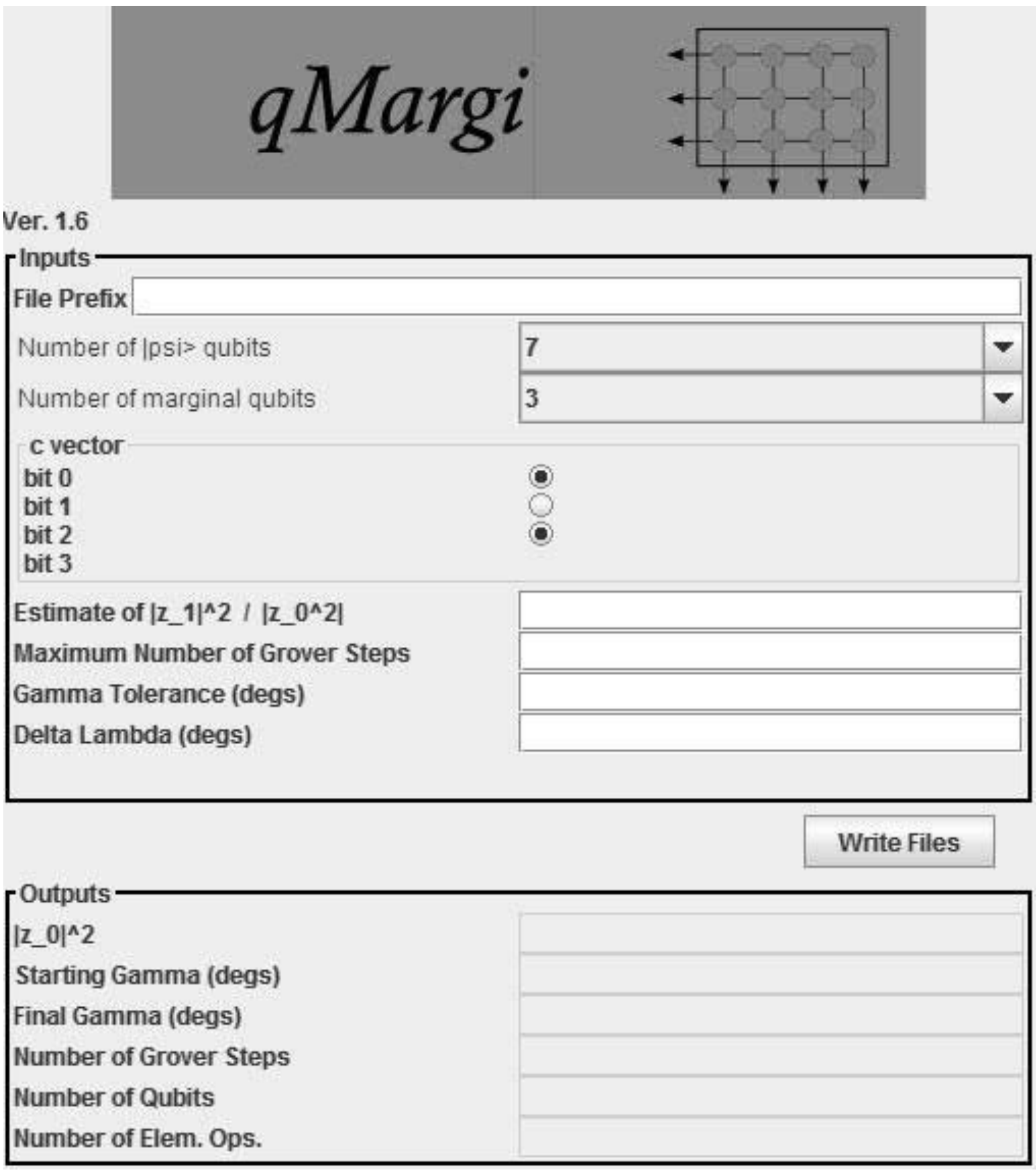
$$|\psi_0\rangle_\mu = \begin{matrix} |\psi^-\rangle_{\alpha^-} \\ |x^3\rangle_\alpha \\ |0\rangle_{\mu_0} \end{matrix}$$ **702**

$$|0\rangle_\nu = \begin{bmatrix} |0^3\rangle_\beta \\ |0\rangle_\gamma \end{bmatrix}$$ **703**

$$z_0 = \frac{1}{\sqrt{2^4}}$$ **704**

$$\frac{|z_1|}{|z_0|} = \sqrt{\frac{P(1)}{P(0)}}$$ **705**

# *Figure 8*


qMargi
Ver. 1.6
Inputs
File Prefix
Number of |psi> qubits
7
Number of marginal qubits
3
c vector
bit 0
bit 1
bit 2
bit 3
Estimate of |z_1|^2 / |z_0^2|
Maximum Number of Grover Steps
Gamma Tolerance (degs)
Delta Lambda (degs)
Write Files
Outputs
|z_0|^2
Starting Gamma (degs)
Final Gamma (degs)
Number of Grover Steps
Number of Qubits
Number of Elem. Ops.