$$
\begin{aligned}
&\stackrel{\text{Bayes}}{=} \quad \eta \, \frac{p(z_t \mid x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \; p(x_{1:t-1}^{[k]} \mid u_{1:t}, z_{1:t-1}, c_{1:t})}{p(x_{1:t-1}^{[k]} \mid u_{1:t-1}, z_{1:t-1}, c_{1:t-1})} \\
&\stackrel{\text{Markov}}{=} \quad \eta \, \frac{p(z_t \mid x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \; p(x_{1:t-1}^{[k]} \mid u_{1:t-1}, z_{1:t-1}, c_{1:t-1})}{p(x_{1:t-1}^{[k]} \mid u_{1:t-1}, z_{1:t-1}, c_{1:t-1})} \\
&= \quad \eta \; p(z_t \mid x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t})
\end{aligned}
$$

The reader may notice that this expression is the inverse of our normalization constant $\eta^{[k]}$ in (13.27). Further transformations give us the following form:

(13.52)
$$
\begin{aligned}
w_t^{[k]} \quad &= \quad \eta \int p(z_t \mid x_t, x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \\
&\qquad\qquad p(x_t \mid x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \; dx_t \\
&\stackrel{\text{Markov}}{=} \quad \eta \int p(z_t \mid x_t, x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \; p(x_t \mid x_{t-1}^{[k]}, u_t) \; dx_t \\
&= \quad \eta \int \int p(z_t \mid m_{c_t}, x_t, x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \\
&\qquad p(m_{c_t} \mid x_t, x_{1:t-1}^{[k]}, u_{1:t}, z_{1:t-1}, c_{1:t}) \; dm_{c_t} \; p(x_t \mid x_{t-1}^{[k]}, u_t) \; dx_t \\
&\stackrel{\text{Markov}}{=} \quad \eta \int \underbrace{p(x_t \mid x_{t-1}^{[k]}, u_t)}_{\sim \mathcal{N}(x_t; \, g(\hat{x}_{t-1}^{[k]}, u_t), R_t)} \int \underbrace{p(z_t \mid m_{c_t}, x_t, c_t)}_{\sim \mathcal{N}(z_t; \, h(m_{c_t}, x_t), Q_t)} \\
&\qquad\qquad \underbrace{p(m_{c_t} \mid x_{1:t-1}^{[k]}, u_{1:t-1}, z_{1:t-1}, c_{1:t-1})}_{\sim \mathcal{N}(m_{c_t}; \mu_{c_t,t-1}^{[k]}, \Sigma_{c_t,t-1}^{[k]})} \; dm_{c_t} \; dx_t
\end{aligned}
$$

We find that this expression can once again be approximated by a Gaussian over measurements z_t by linearizing h. As it is easily shown, the mean of the resulting Gaussian is $\hat{z}_t$, and its covariance is

(13.53)
$$
L_t^{[t]} \quad = \quad H_x^T \; Q_t \; H_x + H_m \Sigma_{c_t,t-1}^{[k]} H_m{}^T + R_t
$$

Put differently, the (non-normalized) importance factor of the k-th particle is given by the following expression:

(13.54)
$$
w_t^{[k]} \quad = \quad |2\pi L_t^{[t]}|^{-\frac{1}{2}} \exp\left\{ -\tfrac{1}{2}(z_t - \hat{z}_t) \; L_t^{[t]-1} \; (z_t - \hat{z}_t) \right\}
$$

As in FastSLAM 1.0, particles generated in Steps 1 and 2, along with their importance factor calculated in Step 3, are collected in a temporary particle set.