Subject parameter distribution:

$$\underbrace{\begin{bmatrix}\text{T0m\_eta1}_i\\ \text{cint}_i\\ \text{drift\_eta1}_i\\ \text{diff\_eta1}_i\\ \text{mvarYobs}_i\\ \text{T0var\_eta1}_i\end{bmatrix}}_{\boldsymbol{\phi}(i)} \sim \text{tform}\left\{\text{N}\left(\begin{bmatrix}\text{raw\_T0m\_eta1}\\ \text{raw\_cint}\\ \text{raw\_drift\_eta1}\\ \text{raw\_diff\_eta1}\\ \text{raw\_mvarYobs}\\ \text{raw\_T0var\_eta1}\end{bmatrix}, \begin{bmatrix}\text{rawPCov\_1\_1} & \text{rawPCov\_2\_1} & 0 & 0 & 0 & 0\\ \text{rawPCov\_2\_1} & \text{rawPCov\_2\_2} & 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0 & 0 & 0\end{bmatrix}\right) + \underbrace{\begin{bmatrix}\text{raw\_T0m\_eta1\_Cohort2} & \text{raw\_T0m\_eta1\_Cohort3} & \text{raw\_T0m\_eta1\_Cohort4}\\ \text{raw\_cint\_Cohort2} & \text{raw\_cint\_Cohort3} & \text{raw\_cint\_Cohort4}\\ \text{raw\_drift\_eta1\_Cohort2} & \text{raw\_drift\_eta1\_Cohort3} & \text{raw\_drift\_eta1\_Cohort4}\\ \text{raw\_diff\_eta1\_Cohort2} & \text{raw\_diff\_eta1\_Cohort3} & \text{raw\_diff\_eta1\_Cohort4}\\ \text{raw\_mvarYobs\_Cohort2} & \text{raw\_mvarYobs\_Cohort3} & \text{raw\_mvarYobs\_Cohort4}\\ \text{raw\_T0var\_eta1\_Cohort2} & \text{raw\_T0var\_eta1\_Cohort3} & \text{raw\_T0var\_eta1\_Cohort4}\end{bmatrix}}_{\boldsymbol{\beta}} \underbrace{\begin{bmatrix}\text{Cohort2}\\ \text{Cohort3}\\ \text{Cohort4}\end{bmatrix}}_{\mathbf{z}}\right\}$$

Initial latent state:

$$\underbrace{\left[\text{eta1}\right](t_0)}_{\boldsymbol{\eta}(t_0)} \sim \text{N}\left(\underbrace{\left[\text{T0m\_eta1}\right]}_{\text{T0MEANS}}, \underbrace{UcorSDtoCov\left\{\left[0.001\right]\right\}}_{\text{T0VAR}}\right)$$

Deterministic change:

$$\underbrace{\text{d}\left[\text{eta1}\right](t)}_{\text{d}\boldsymbol{\eta}(t)} = \left(\underbrace{\left[\text{drift\_eta1}\right]}_{\text{DRIFT}}\underbrace{\left[\text{eta1}\right](t)}_{\boldsymbol{\eta}(t)} + \underbrace{\left[\text{cint}\right]}_{\text{CINT}}\right)\text{d}t \quad +$$

Random change:

$$\underbrace{UcorSDtoChol\left\{\left[\text{diff\_eta1}\right]\right\}}_{\text{DIFFUSION}}\underbrace{\text{d}\left[W_1\right](t)}_{\text{d}\mathbf{W}(t)}$$

Observations:

$$\underbrace{\left[\text{Yobs}\right](t)}_{\mathbf{Y}(t)} = \underbrace{\left[1\right]}_{\text{LAMBDA}}\underbrace{\left[\text{eta1}\right](t)}_{\boldsymbol{\eta}(t)} + \underbrace{\left[0\right]}_{\text{MANIFESTMEANS}} \quad +$$

Observation noise:

$$\underbrace{\left[\text{mvarYobs}\right]}_{\text{MANIFESTVAR}}\underbrace{\left[\epsilon_1\right](t)}_{\boldsymbol{\epsilon}(t)}$$

System noise distribution per time step: $\Delta\left[W_{j\in[1,1]}\right](t-u) \sim \text{N}(0, t-u)$

Observation noise distribution: $\left[\epsilon_{j\in[1,1]}\right](t) \sim \text{N}(0,1)$

Note: *UcorSDtoChol* converts lower tri matrix of standard deviations and unconstrained correlations to Cholesky factor, *UcorSDtoCov* = transposed cross product of UcorSDtoChol, to give covariance, See Driver & Voelkle (2018) p11.
Individual specific notation (subscript i) only shown for subject parameter distribution – pop. means shown elsewhere.