Subject parameter distribution:

$$\underbrace{\begin{bmatrix}\text{T0m\_eta1}_i\\ \text{T0m\_eta2}_i\\ \text{cintStress}_i\\ \text{cintQuality}_i\\ \text{stressLoading}_i\\ \text{drift\_eta1}_i\\ \text{drift\_eta1\_eta2}_i\\ \text{drift\_eta2\_eta1}_i\\ \text{drift\_eta2}_i\\ \text{diff\_eta1}_i\\ \text{diff\_eta2\_eta1}_i\\ \text{diff\_eta2}_i\\ \text{mvarStress}_i\\ \text{mvarStress2}_i\\ \text{mvarQuality}_i\\ \text{mintStress2}_i\\ \text{T0var\_eta1}_i\\ \text{T0var\_eta2\_eta1}_i\\ \text{T0var\_eta2}_i\end{bmatrix}}_{\boldsymbol{\phi}(i)} \sim \text{tform}\left\{ \text{N}\left(\begin{bmatrix}\text{raw\_T0m\_eta1}\\ \text{raw\_T0m\_eta2}\\ \text{raw\_cintStress}\\ \text{raw\_cintQuality}\\ \text{raw\_stressLoading}\\ \text{raw\_drift\_eta1}\\ \text{raw\_drift\_eta1\_eta2}\\ \text{raw\_drift\_eta2\_eta1}\\ \text{raw\_drift\_eta2}\\ \text{raw\_diff\_eta1}\\ \text{raw\_diff\_eta2\_eta1}\\ \text{raw\_diff\_eta2}\\ \text{raw\_mvarStress}\\ \text{raw\_mvarStress2}\\ \text{raw\_mvarQuality}\\ \text{raw\_mintStress2}\\ \text{raw\_T0var\_eta1}\\ \text{raw\_T0var\_eta2\_eta1}\\ \text{raw\_T0var\_eta2}\end{bmatrix}, \begin{bmatrix}\text{rawPCov\_1\_1} & \text{rawPCov\_2\_1} & \text{rawPCov\_3\_1} & \text{rawPCov\_4\_1} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0\\ \text{rawPCov\_2\_1} & \text{rawPCov\_2\_2} & \text{rawPCov\_3\_2} & \text{rawPCov\_4\_2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0\\ \text{rawPCov\_3\_1} & \text{rawPCov\_3\_2} & \text{rawPCov\_3\_3} & \text{rawPCov\_4\_3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0\\ \text{rawPCov\_4\_1} & \text{rawPCov\_4\_2} & \text{rawPCov\_4\_3} & \text{rawPCov\_4\_4} & 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 & 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 & 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 & 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 & 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 & 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 & 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 & 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\\ 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 & 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 & 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\_initialStress} & \text{raw\_T0m\_eta1\_meanStress}\\ \text{raw\_T0m\_eta2\_initialStress} & \text{raw\_T0m\_eta2\_meanStress}\\ \text{raw\_0} & \text{raw\_cintStress\_meanStress}\\ \text{raw\_cintQuality\_initialStress} & \text{raw\_cintQuality\_meanStress}\\ \text{raw\_stressLoading\_initialStress} & \text{raw\_stressLoading\_meanStress}\\ \text{raw\_drift\_eta1\_initialStress} & \text{raw\_drift\_eta1\_meanStress}\\ \text{raw\_drift\_eta1\_eta2\_initialStress} & \text{raw\_drift\_eta1\_eta2\_meanStress}\\ \text{raw\_drift\_eta2\_eta1\_initialStress} & \text{raw\_drift\_eta2\_eta1\_meanStress}\\ \text{raw\_drift\_eta2\_initialStress} & \text{raw\_drift\_eta2\_meanStress}\\ \text{raw\_diff\_eta1\_initialStress} & \text{raw\_diff\_eta1\_meanStress}\\ \text{raw\_diff\_eta2\_eta1\_initialStress} & \text{raw\_diff\_eta2\_eta1\_meanStress}\\ \text{raw\_diff\_eta2\_initialStress} & \text{raw\_diff\_eta2\_meanStress}\\ \text{raw\_mvarStress\_initialStress} & \text{raw\_mvarStress\_meanStress}\\ \text{raw\_mvarStress2\_initialStress} & \text{raw\_mvarStress2\_meanStress}\\ \text{raw\_mvarQuality\_initialStress} & \text{raw\_mvarQuality\_meanStress}\\ \text{raw\_mintStress2\_initialStress} & \text{raw\_mintStress2\_meanStress}\\ \text{raw\_T0var\_eta1\_initialStress} & \text{raw\_T0var\_eta1\_meanStress}\\ \text{raw\_T0var\_eta2\_eta1\_initialStress} & \text{raw\_T0var\_eta2\_eta1\_meanStress}\\ \text{raw\_T0var\_eta2\_initialStress} & \text{raw\_T0var\_eta2\_meanStress}\end{bmatrix}}_{\boldsymbol{\beta}} \underbrace{\begin{bmatrix}\text{initialStress}\\ \text{meanStress}\end{bmatrix}}_{\mathbf{z}} \right\}$$

Initial latent state:

$$\underbrace{\begin{bmatrix}\text{eta1}\\ \text{eta2}\end{bmatrix}(t_0)}_{\boldsymbol{\eta}(t_0)} \sim \text{N}\left(\underbrace{\begin{bmatrix}\text{T0m\_eta1}\\ \text{T0m\_eta2}\end{bmatrix}}_{\text{T0MEANS}}, \underbrace{UcorSDtoCov\left\{\begin{bmatrix}0.001 & 0\\ 0 & 0.001\end{bmatrix}\right\}}_{\underbrace{\mathbf{Q}^*{}_{t0}}_{\text{T0VAR}}} \right)$$

Deterministic change:

$$\underbrace{\begin{bmatrix}\text{eta1}\\ \text{eta2}\end{bmatrix}(t)}_{\boldsymbol{\eta}(t)} = \left(\underbrace{\begin{bmatrix}\text{drift\_eta1} & \text{drift\_eta1\_eta2}\\ \text{drift\_eta2\_eta1} & \text{drift\_eta2}\end{bmatrix}}_{\underbrace{\mathbf{A}}_{\text{DRIFT}}} \underbrace{\begin{bmatrix}\text{eta1}\\ \text{eta2}\end{bmatrix}(t)}_{\boldsymbol{\eta}(t-1)} + \underbrace{\begin{bmatrix}\text{cintStress}\\ \text{cintQuality}\end{bmatrix}}_{\underbrace{\mathbf{b}}_{\text{CINT}}} \right) +$$

Random change:

$$\underbrace{UcorSDtoChol\left\{\begin{bmatrix}\text{diff\_eta1} & 0\\ \text{diff\_eta2\_eta1} & \text{diff\_eta2}\end{bmatrix}\right\}}_{\underbrace{\mathbf{G}}_{\text{DIFFUSION}}} \underbrace{\begin{bmatrix}W_1\\ W_2\end{bmatrix}(t)}_{\mathbf{W}(t)}$$

Observations:

$$\underbrace{\begin{bmatrix}\text{Stress}\\ \text{Stress2}\\ \text{Quality}\end{bmatrix}(t)}_{\mathbf{Y}(t)} = \underbrace{\begin{bmatrix}1 & 0\\ 0 & 0\\ \text{stressLoading} & 1\end{bmatrix}}_{\underbrace{\boldsymbol{\Lambda}}_{\text{LAMBDA}}} \underbrace{\begin{bmatrix}\text{eta1}\\ \text{eta2}\end{bmatrix}(t)}_{\boldsymbol{\eta}(t)} + \underbrace{\begin{bmatrix}0\\ \text{mintStress2}\\ 0\end{bmatrix}}_{\underbrace{\boldsymbol{\tau}}_{\text{MANIFESTMEANS}}} +$$

Observation noise:

$$\underbrace{\begin{bmatrix}\text{mvarStress} & 0 & 0\\ 0 & \text{mvarStress2} & 0\\ 0 & 0 & \text{mvarQuality}\end{bmatrix}}_{\underbrace{\boldsymbol{\Theta}}_{\text{MANIFESTVAR}}} \underbrace{\begin{bmatrix}\epsilon_1\\ \epsilon_2\\ \epsilon_3\end{bmatrix}(t)}_{\boldsymbol{\epsilon}(t)}$$

System noise distribution per time step: $\left[W_{j\in[1,2]}\right](t) \sim \text{N}(0,1)$

Observation noise distribution: $\left[\epsilon_{j\in[1,2]}\right](t) \sim \text{N}(0,1)$

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.