

*Final
Conditions*

*rail
simulation*

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*Initial
Conditions*

*ballistic
simulation*

$$\begin{bmatrix} V_r \\ V_v \\ r \\ v \\ m \end{bmatrix}_{\text{initial conditions}} = \begin{bmatrix} V_{rail} \cdot \sin \gamma_{rail} \\ V_v \cdot \cos \gamma_{rail} \\ R_{earth} + h_{launch} + l_{rail} \cdot \sin \gamma_{rail} \\ \left(\frac{l_{rail} \cdot \cos \gamma_{rail}}{R_{earth} + h_{launch} + l_{rail} \cdot \sin \gamma_{rail}} \right) \\ m_{rail} \end{bmatrix} \quad \begin{matrix} t_{0_{ballistic}} = t_{final_{rail}} \\ x_{0_{ballistic}} = l_{rail} \cdot \cos \gamma_{rail} \approx 0 \\ \text{Final conditions} \end{matrix}$$