We add two real scalar fields, $\phi^1$ and $\phi^2$. They are singlets under all SM
gauge groups. Their mass terms are\n\[ L_{s.m.} = -\frac{m_1^2}{2} \phi_1^2 - \frac{m_2^2}{2} \phi_2^2 - m_{12}^2 \phi_1 \phi_2. \]  
(1)
We will call mass eigenstates $\Phi_1$ and $\Phi_2$, and their eigenmasses $M_1$ and $M_2$, respectively, and we will assume that $M_1 < M_2$.
We add two Dirac fermion fields, $U$ and $E$. Their SM quantum numbers
are those of the SM $u_R$ and $e_R$, respectively. These fields have mass terms
\[ L_{f.m.} = M_U \bar{U} U + M_E \bar{E} E. \]  
(2)
They interact with scalars via
\[ L_{\text{Yuk}} = \lambda_1 \phi_1 \bar{U} P_R u + \lambda_2 \phi_2 \bar{U} P_R u + \lambda'_1 \phi_1 \bar{E} P_R e + \lambda'_2 \phi_2 \bar{E} P_R e, \]  
(3)
where $u$ and $e$ are the SM up-quark and electron fields. Note that there is a
$Z_2$ symmetry under which all fields we added ($\phi_{1,2}$, $U$, $E$) flip sign, while all
SM fields do not, so the new particles must be pair-produced and the lightest
new particle (LNP) is stable. This same $Z_2$ also forbids $U - u$ and $E - e$
mixing via Yukawas with the SM Higgs.
We will assume the following ordering of masses:
\[ M_U > M_2 > M_L > M_1, \]  
(4)
so that $\Phi_1$ is the LNP. Not having any SM interactions, it appears as MET
in the detector. The goal of the tutorial is to simulate the process
\[ pp \rightarrow \bar{U} U, \]  
(5)
at a 8 TeV LHC, and the subsequent $U$ decays:
\[ U \rightarrow u \Phi_1, \]  
(6)
\[ U \rightarrow u \Phi_2, \Phi_2 \rightarrow e E, \ E \rightarrow e \Phi_1. \]  
(7)

\footnote{All Lagrangian parameters, here and below, are assumed to be real}