The simulation model uses discrete event simulation to model patient flow through a hospital emergency department (ED) that consists of two routes: the Fast Track and the Main ED. It is developed using the SimPy library and models the complex interactions between patients, staff, and resources over time.

The model first generates patient arrivals using a Poisson process with exponential inter-arrival times with a mean of 15 minutes. Each patient is randomly assigned to either the Fast Track with 0.4 probability or the Main ED with 0.6 probability.

The simulation models finite resources as queueing systems, where the Fast Track has 1 nurse and 1 doctor, and the Main ED has 3 nurses, 2 doctors, and 10 beds. Each resource has a queue where patients wait when the resources are busy.

The simulation monitors wait times, service times, total times and outcomes on the patient level. On the system level, it monitors queue lengths and resource utilisation rates. It also takes a snapshot every 30 minutes for trend analysis.

The simulation produces the following key performance indicators: average total time in the ED, and wait times by resources, resource utilisation metrics, and patient outcomes. It also compares outputs of various scenarios against the baseline performance. The simulation also creates visualisation aids to provide insights on ways to improve resources.