Motivation
- Semileptonic decays $D_s^+ \rightarrow e^+ \nu_e \eta/\eta'$ allow access to form factor and $V_{us}$
- Experimental validation becomes important as theoretical calculations of form factor offer increasing precision [1]
- Relative branching ratio can help to investigate $\eta - \eta'$ mixing [2]

Reconstruction of Decay Channels: 1. $D_s^- \rightarrow K^+ K^- \pi^-$
- $D_s^0 D_s^-$ pairs generated from pp interaction by EvtGen at $\sqrt{s} = 4.108$ GeV
- New decay model in PandaRoot for $D_s^- \rightarrow K^+ K^- \pi^-$
- 10,000 events simulated
- Mass window: $1.968 \pm 0.25$ GeV/c²

<table>
<thead>
<tr>
<th>Mass (GeV/c²)</th>
<th>$V_e$ (μm)</th>
<th>$V_\pi$ (μm)</th>
<th>$V_\rho$ (μm)</th>
<th>$P_F$ [%]</th>
<th>$P_P$ [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>75</td>
<td>73</td>
<td>160</td>
<td>3.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Dalitz plot from PandaRoot [3] simulation agrees with experimental measurements

Kinematics of $e^+\nu_e$ and Form Factor
- Invariant mass squared of $e^+\nu_e$: $M^2(e^+\nu_e) = (E_{\nu} - E_{e})^2$
- Mass window: $|M^2(\nu_e)| < 0.1$ GeV/c²
- Form factor $f(q^2)$, kinematically accessible $q^2$ is $M^2(e^+\nu_e)$; reco. efficiency is 3.7%
- Preliminary estimation of $\sim 150$ evt/mnr with luminosity $L = 2 \times 10^{33} cm^{-2} s^{-1}$, assuming cross section is $20 mb$ [7]

Summary
- New decay model DS_DALITZ implemented in PandaRoot
- Preliminary reconstruction efficiency and production rate obtained
- Mass resolution improved comparing previous analysis [8]
- Expand kinematic fit for unmeasured neutrino

Outlook
- Include $D_1 \rightarrow \eta'\nu$ in simulation chain for study of $\eta - \eta'$ mixing
- Investigate background channels

References