1) Why Beyond Standard Model phenomena?
- Dark Matter: Potential explanation in SM?
- Neutrino oscillations: Mass of neutrinos and explanation for their smallness?
- Flavor anomalies: In the heavy quark decays?
- Hierarchy problem, Matter-Antimatter asymmetry etc.

2) Probing BSM with Multileptons

Why multileptons?
- Leptons are clean isolated objects compared to jets.
- Better correspondence between true and experimentally determined values.
- At a hadron collider, lower rates for SM lepton production.

3) Standard Model Backgrounds

<table>
<thead>
<tr>
<th>Background category</th>
<th>Leading processes</th>
<th>Estimated from</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irreducible</td>
<td>WZ, ZZ, nν, Leptonic</td>
<td>Simulation</td>
<td>Normalization of LHC dataset</td>
</tr>
<tr>
<td>Isolated leptons</td>
<td>1-prong jets, Wnj</td>
<td>Data</td>
<td>Developed in 2019</td>
</tr>
<tr>
<td>Multileptons</td>
<td>Data</td>
<td>Simulation</td>
<td>MMV, TOTP, Higgs</td>
</tr>
<tr>
<td>Raw</td>
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</tbody>
</table>

4) Model-Independent Search

- Single isolated light lepton to trigger the events: ~27 GeV (μ) & ~30 GeV (e).
- Strong production: Decay to a top quark and a SM lepton of any one flavor (≥3).
- Three coupling scenarios: top-μ, top-τ, and τ-μ.

5) Model specific search

- Three years of data taking period.
- Three different models with diverse physics properties.
- Large mass range being simultaneously probed.
- Different couplings:
  - Seesaw: \( B = 0 \) or \( B = 1 \)
  - VLL: \( B = 1 \) or \( B = 2 \)
- Seven multilepton channels with different relative importance for different signals.

6) Interpreting the results

- Changing background composition in the channels needs to be considered as well while designing SRs.

7) Ensuring longevity of results

- Simplified likelihoods of the backgrounds in our model-independent signal regions also provided.