ICHEP POSTER SESSION - AUGUST 8, 2016
SEARCH FOR SUSY PARTICLE
DECAYS TO Z+JETS+$E_T^{miss}$ AT ATLAS

standard model backgrounds

<table>
<thead>
<tr>
<th>Region</th>
<th>$E_T^{miss}$ [GeV]</th>
<th>$p_T$ [GeV]</th>
<th>$m_{miss}$ [GeV]</th>
<th>$\Delta m(\gamma, jets)$ [GeV]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRZ</td>
<td>&gt; 225</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
<tr>
<td>VRS</td>
<td>&lt; 90</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
<tr>
<td>VRS</td>
<td>100-200</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
<tr>
<td>VRS-2R</td>
<td>100-200</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
<tr>
<td>VRS-3R</td>
<td>&lt; 100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VRS-4R</td>
<td>100-600</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
</tbody>
</table>

Validation regions:

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<tr>
<td>VRS-WZ</td>
<td>&gt; 100</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
<tr>
<td>VRS-ZZ</td>
<td>&gt; 100</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
<tr>
<td>VRS-3L</td>
<td>&gt; 100</td>
<td>&gt; 100</td>
<td>&gt; 85</td>
<td>SF &gt; 0.4</td>
</tr>
</tbody>
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Additional backgrounds taken from MC:
- dibosons make up largest fraction
- also use tW, WW
- validation regions determine diboson agreement between data and MC
- VR-WZ has 90% purity
- VR-ZZ has >99% purity

We see excellent agreement between our predictions and data in all validation regions.

Available events:
- VRS: 56
- VR-WZ: 89
- VR-ZZ: 89
- VR-3L: 89

Total expected background events:
- 52.6 ± 9.1
- 87 ± 10
- 15.5 ± 3.4
- 6.5 ± 1.6

Flavour symmetric (t±, W±, WW and Z → νννν) events:
- 18.6 ± 1.4
- 3.3 ± 0.4
- 0.3 ± 0.2

VR-ZZ events:
- 7.5 ± 1.7
- 32 ± 10
- 15.5 ± 3.4
- 4.9 ± 1.6

VR-3L events:
- 24.8 ± 7.6
- 27 ± 2.8
- 0.2 ± 0.2

Background events:
- 1.4 ± 0.2
- 0.9 ± 0.4
- 0.04 ± 0.02
- 1.0 ± 0.1

In Run 1, the Z+jet miss SUSY search saw a 3σ excess searching for events with:
- opposite sign/same flavor leptons with an invariant mass from 81-101 GeV
- +jets
- $H_t$ (the scalar sum of jet and lepton pT) > 600 GeV
- $E_T^{miss}$ > 225 GeV
- $\Delta m(E^{miss}, jets)$ > 0.4

Our goal is to investigate this excess with the 3.2 fb$^{-1}$ of 13 TeV data collected so far, so we keep the same signal region. We use a simplified model as a signal example:

Z+jets background small at high $E_T^{miss}$, and with our cut on $\Delta m(E^{miss}, jets)$, it peaks in our signal region, so it’s still a very important background.

Model using photon + jets events:
- correct for kinematic differences
- reweight photon pT to match Zs
- smear photons to match resolutions of e and $\mu$ pairs
- normalize photon distribution after an $H_t$ cut

We observe 10 ee and 11 $\mu$ events, and exclude gluino masses up to 1.1 TeV.

See excess on-Z, but little evidence for shape differences with respect to background in SR distributions.

For flavor symmetric backgrounds:
- dominant uncertainties from statistical error
- others from MC closure, $m_t$ extrapolation, efficiency correction factors

Z+jets background:
- difference from reweighting in multiple variables ($H_t$, $E_T$, number of jets)
- other uncertainties from MC closure and statistics

Backgrounds taken from MC:
- theoretical uncertainties from scale, pdf, and cross section
- experimental uncertainties are included, but are negligible

uncertainties

We cross check with a sideband fit.

The dominant background is from flavor symmetric processes:
- t$\bar{t}$, WW, Wt, Z$\rightarrow$tt$

Assume a 2:1:1 ratio in $e\nu$ and $\mu\nu$ data to predict $e\nu$ and $\mu\nu$
- apply corrections for triggers and efficiencies
- widen the invariant mass range and correct with MC for better statistics

Validity regions:

We normalize photon distribution and smear photons to match $Z$s to match $Z$s

VR-3L 60–100
VR-WZ 100–200
VR-ZZ 100–200
VR-3L 60–100