

## Probing same-sign WW in hadronic signatures (live)

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The production of two same-sign  $W$  bosons in association with two jets via vector boson scattering (VBS),  $ssWWjj$ , is a key probe of the mechanism of electroweak symmetry breaking, with the Higgs boson unitarising the process' cross-section. Longitudinal  $ssWWjj$  involves the spin-0 modes of the gauge bosons arising from EWSB, and is very sensitive to BSM physics.

With the Run-2 and Run-3 expected datasets, over 500 leptonic  $ssWWjj$  events are expected ( $W \rightarrow l\nu$ ,  $l=e,\mu$ ), of which 35 events have two longitudinally polarised  $W$  boson, i.e.  $ssWWjj(LL)$ . More data is expected in Run-4 at the HL-LHC, but will not be sufficient to observe the process using only leptonic decays of the  $W$  boson.

The pool of  $ssWWjj(LL)$  events can be increased significantly by considering events with at least one hadronically-decaying  $W$  (2/3 of  $W$  bosons decay hadronically). This is a very challenging final state given the large (by a few orders of magnitude) backgrounds.

We present ideas to systematically study  $ssWWjj$  VBS and the main backgrounds in semi-leptonic and hadronic VBS signatures, and, using substructure and jet charge techniques and deep learning, to extract the fraction of  $ssWWjj(LL)$  events.

This paper will rely on novel ideas to tackle the problem, and on combining existing tools and techniques in a novel way to probe the  $ssWWjj$  VBS signature. No use will be made of LHC experiment's infrastructure or codebases.

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