



ATLAS PUB Note
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Summary Plots for Heavy Particle Searches and Long-lived Particle Searches – July 2021

The ATLAS Collaboration

The results of searches for heavy particles from the Exotics and HDBS physics groups and long-lived particles from the Exotics and SUSY physics groups are summarized in plots for a representative set of models. The latest results, up to July 2021, are included.

1 Heavy Particle Searches Summary Plot

Searches for heavy new particles have been carried out with the Run 1 and Run 2 datasets in proton–proton collisions at $\sqrt{s} = 8$ and 13 TeV.

A representative set of the most sensitive recent results is included in the summary plot shown in Figure 1. Some changes are made to include updated references and to supersede older results with new ones. New entries relative to the March 2021 version of the summary plot are as follows.

- The search for heavy W' resonance decays into $\tau\nu$ [1].
- The search for heavy W' resonance decays into tb [2].
- The search for pair production of vector-like T quark in multi-lepton+jets events with several small-radius jets, some b tagged [3].
- The search for single production of vector-like T quark in lepton+jets events with a large-radius jet and several small-radius jets, some b tagged [4].
- The search for single production of vector-like B quark in events with a large-radius jet containing two b -tagged small-radius jets and an additional small-radius jet [5].
- The search for heavy neutral leptons decaying into a multi-lepton final state [6].
- The search for pair production of $H^\pm$ with decay into $W^\pm W^\pm$ in a multi-lepton final state [7].

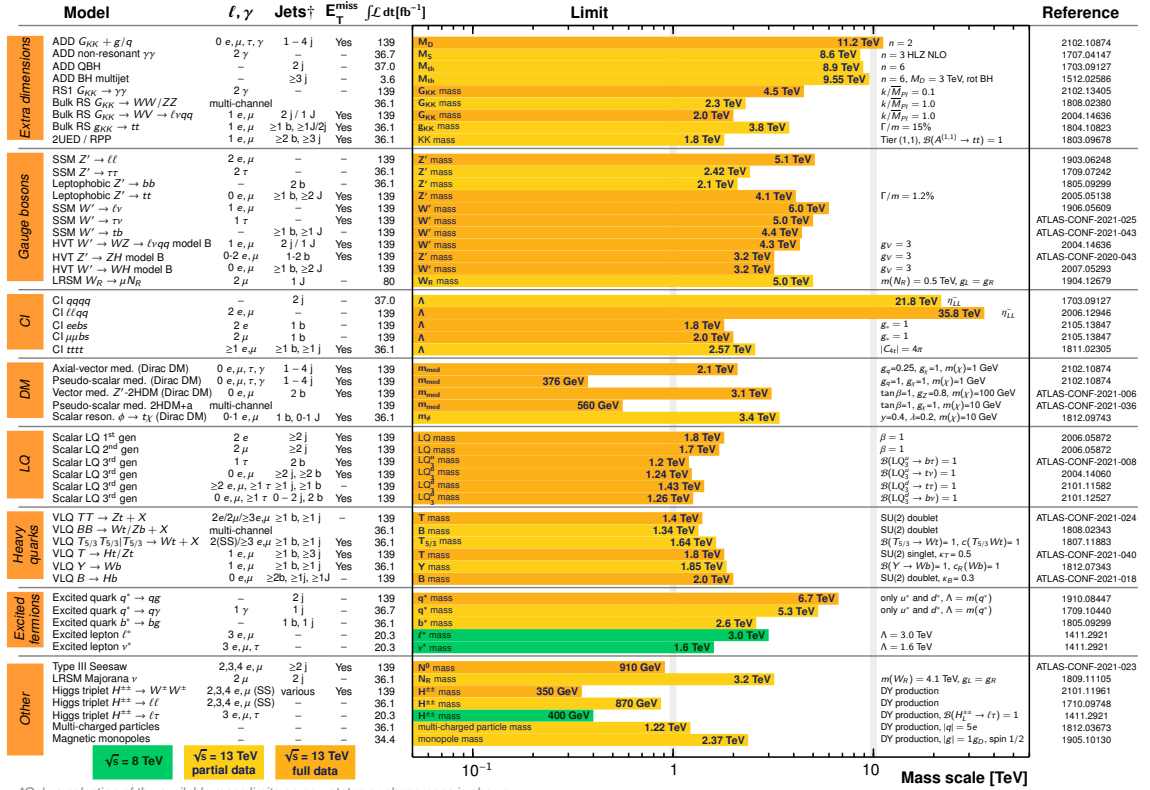
ATLAS Heavy Particle Searches* - 95% CL Upper Exclusion Limits

Status: July 2021

ATLAS Preliminary

$$\int \mathcal{L} dt = (3.6 - 139) \text{ fb}^{-1}$$

$$\sqrt{s} = 8, 13 \text{ TeV}$$



*Only a selection of the available mass limits on new states or phenomena is shown.

† Small-radius (large-radius) jets are denoted by the letter j (J).

Figure 1: Ranges of new particle masses or energy scales excluded at the 95% confidence level.

2 Long-lived Particle Searches Summary Plot

Searches for long-lived particles have been carried out with the Run 1 and Run 2 datasets in proton–proton collisions at $\sqrt{s}$ of 8 and 13 TeV.

Recent updates of the results are included in the summary plot shown in Figure 2. Some changes are made to include updated references and to supersede older results with new ones.

ATLAS Long-lived Particle Searches* - 95% CL Exclusion

Status: July 2021

ATLAS Preliminary

$$\int \mathcal{L} dt = (18.4 - 139) \text{ fb}^{-1}$$

$\sqrt{s} = 8, 13 \text{ TeV}$

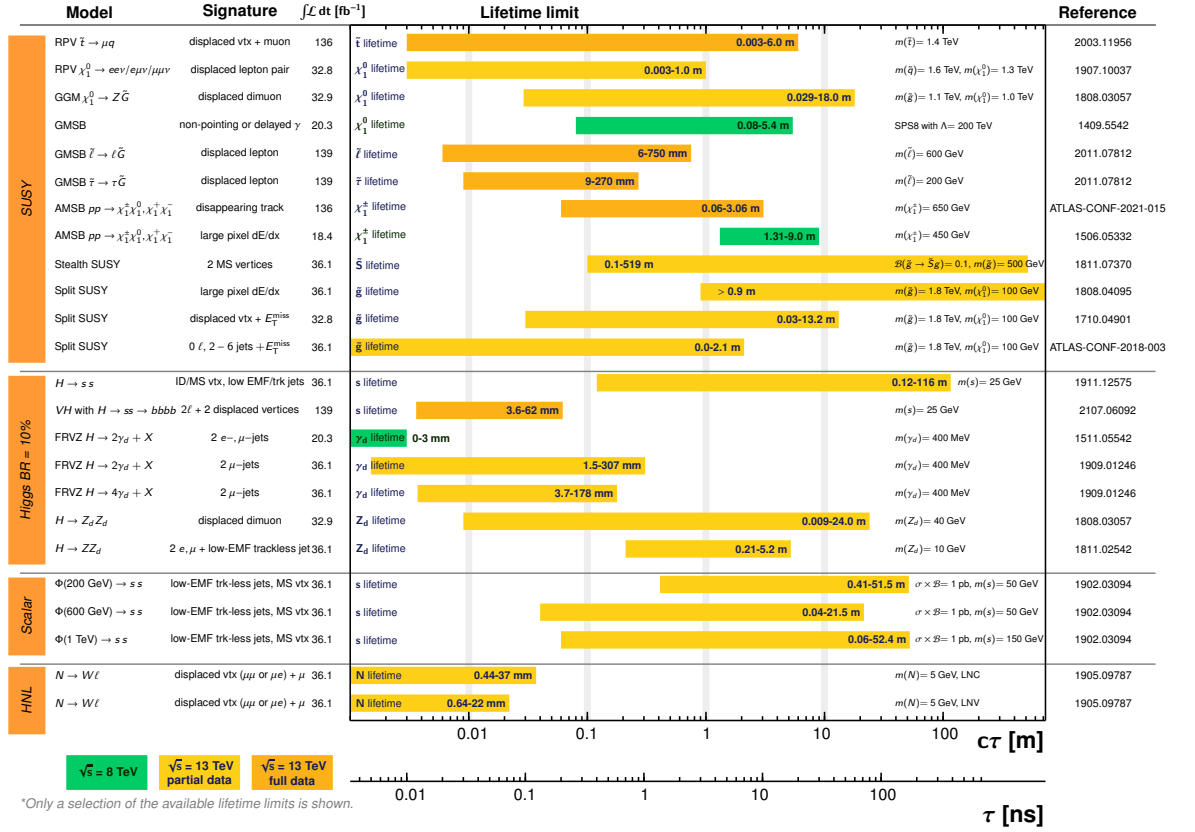


Figure 2: Ranges of new particle lifetimes excluded at the 95% confidence level.

References

- [1] ATLAS Collaboration, *Search for high-mass resonances in final states with a tau lepton and missing transverse momentum with the ATLAS detector*, ATLAS-CONF-2021-025, 2021 (cit. on p. 2).
- [2] ATLAS Collaboration, *Search for vector boson resonances decaying to a top quark and a bottom quark in the hadronic final state using pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS-CONF-2021-043, 2021 (cit. on p. 2).
- [3] ATLAS Collaboration, *Search for pair-production of vector-like quarks in pp collision events at $\sqrt{s} = 13$ TeV with at least one leptonically-decaying Z boson and a third-generation quark with the ATLAS detector*, ATLAS-CONF-2021-024, 2021 (cit. on p. 2).
- [4] ATLAS Collaboration, *Search for single production of vector-like T quarks decaying to tH and tZ in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS-CONF-2021-040, 2021 (cit. on p. 2).
- [5] ATLAS Collaboration, *Search for single vector-like B quark production and decay via $B \rightarrow bH(b\bar{b})$ in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS-CONF-2021-018, 2021, URL: <https://cds.cern.ch/record/2760012> (cit. on p. 2).
- [6] ATLAS Collaboration, *Search for type-III seesaw heavy leptons in leptonic final states in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS-CONF-2021-023, 2021 (cit. on p. 2).
- [7] ATLAS Collaboration, *Search for doubly and singly charged Higgs bosons decaying into vector bosons in multi-lepton final states with the ATLAS detector using proton–proton collisions at $\sqrt{s} = 13$ TeV*, (2021), arXiv: [2101.11961](https://arxiv.org/abs/2101.11961) [hep-ex] (cit. on p. 2).