Searches for heavy long-lived charged particles with the ATLAS detector in $p$-$p$ collisions at $\sqrt{s} = 8$ TeV

Abstract
Searches for heavy long-lived charged particles (LLP) were performed on a 19.1 fb$^{-1}$ data sample from $p$-$p$ collisions at $\sqrt{s} = 8$ TeV collected by the ATLAS detector at the LHC. No excess is observed above the estimated background and limits are placed on the mass of the LLPs in various supersymmetric models: R-hadrons, directly produced charginos, stable sleptons produced directly or in cascade decays in GMSB and LeptoSUSY models.

Motivation & Signal Regions
Heavy LLPs are predicted in many extensions to the Standard Model. This analysis studies different SUSY LLP scenarios where R-parity is conserved.

R-hadrons
- Long-lived, $\tau$ or $\beta$ bound to colored SM particles to form R-Hadron
- Cuts on $p_T$, $\eta$, $p$ depend on LLP mass

Charginos
- $\chi^\pm_1$ nearly mass degenerate with $\chi^0_1$ (LSP)
- $\chi^\pm_1 \rightarrow 33\%$ expected 2 LLPs (muon like)
- $\chi^\pm_1 \rightarrow 67\%$ expected 1 LLP + MET

Signal regions:
- Full detector search (SR-RH-FD), MS info may or may not be used
- MS-Agnostic search (SR-RH-MA). Track information from ID+Calo, MS omitted

Selection
- Event selection: Good primary vertex & triggered by either Muon or MET trigger
- Candidate selection: Reconstruction quality cuts, $p_T$, $\eta$, $p$ and consistency of $\beta / \beta'$
- Division into signal-regions and $\beta$, $\beta'$ and mass cuts per SR
- Mass cuts in all searches are model dependent (In R-hadrons also the cuts on $\beta$, $\beta'$)

Sleptons
- Reconstructed mass, background estimation & expected signal:
- Cross-section upper limits:

Results & Limits on LLP cross-sections (CLs based)

Charginos
Reconstructed mass, background estimation & expected signal:

R-hadrons
Reconstructed mass, background estimation & expected signal:

Cross-section upper limits:

95% CL excluded mass regions: