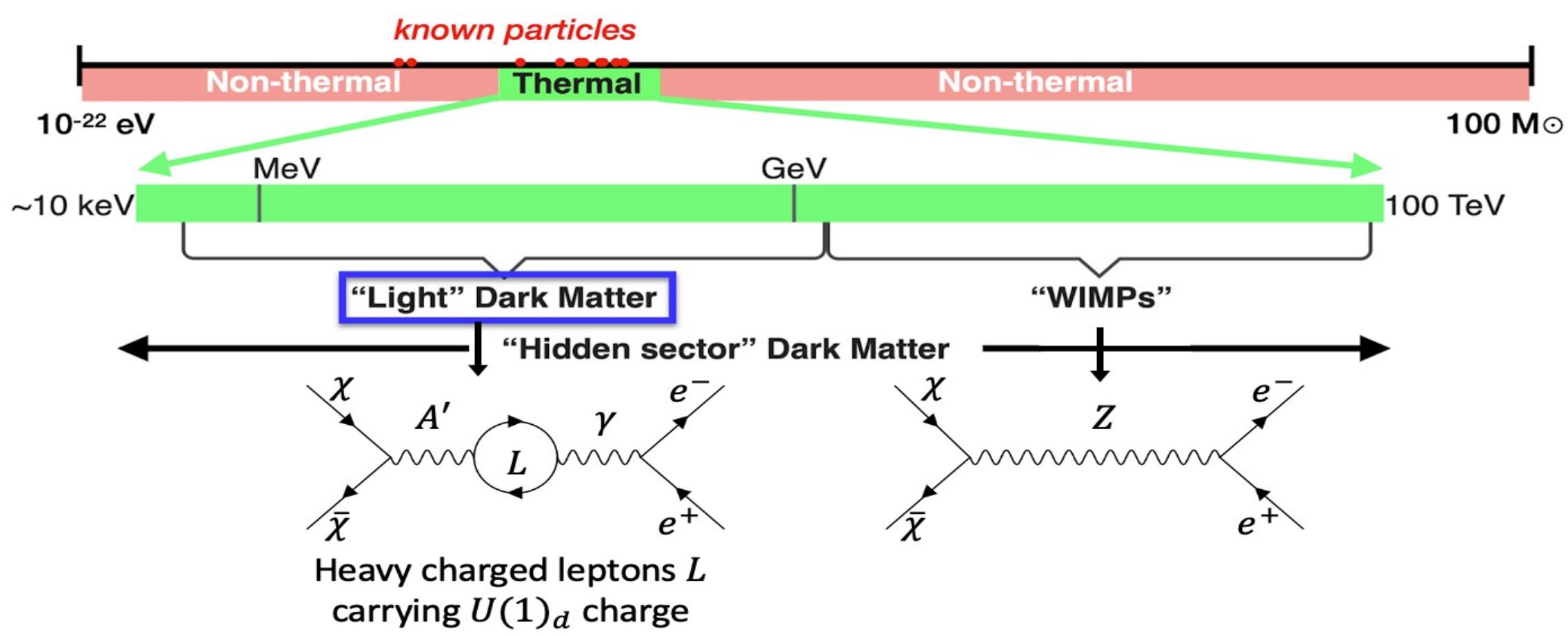
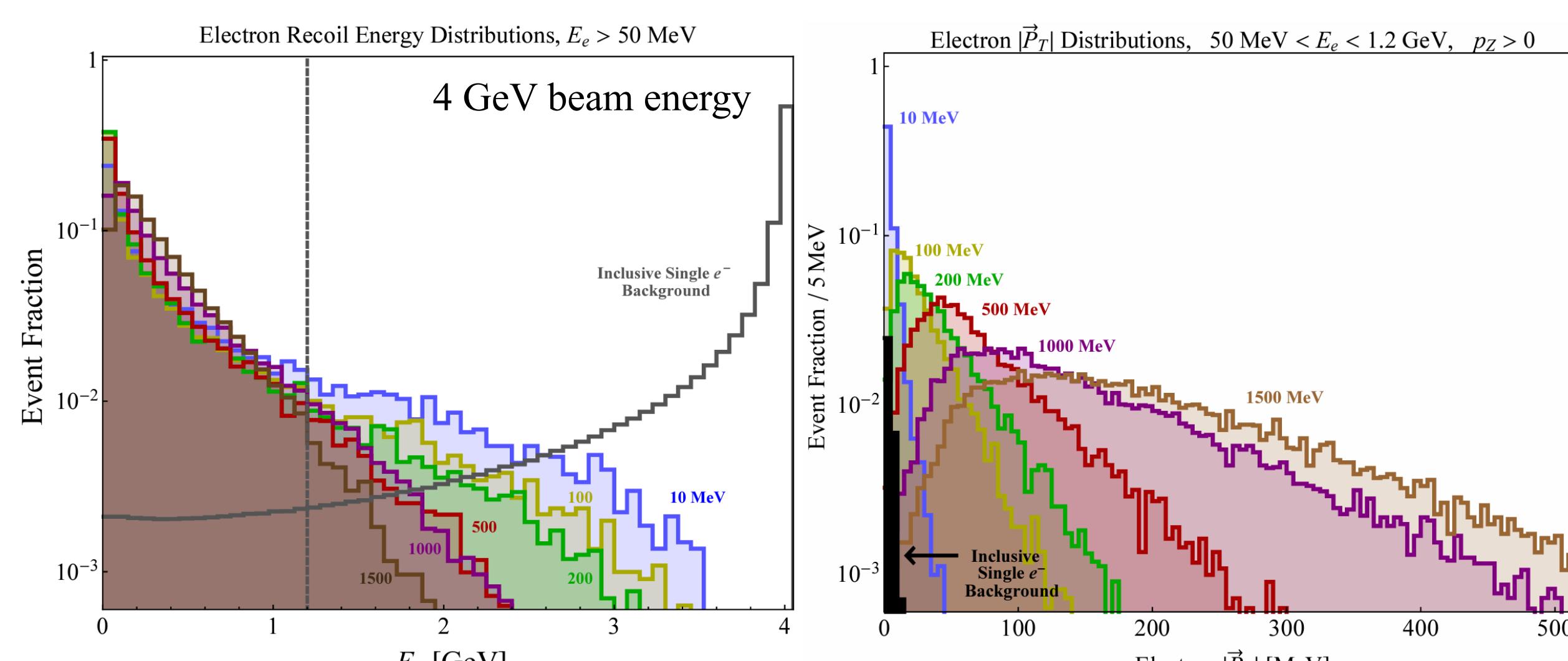


Introduction and Motivation

Astrophysical observations suggest that the Universe contains an abundant amount of dark matter. A simple and predictive model to explain this is thermal relic dark matter, which spans a mass range of ~ 10 keV up to 100 TeV. WIMPs have been a well-motivated candidate in this range, but the accessible parameter space is shrinking. In recent years, there has been increasing interest in expanding these searches to “light” dark matter in the sub-GeV mass range. The simplest prediction includes a dark photon (A') that couples to dark matter and kinetically mixes with the Standard Model photon. The Light Dark Matter eXperiment (LDMX) is a fixed target, missing momentum search for light dark matter which will be run at SLAC National Accelerator Laboratory.

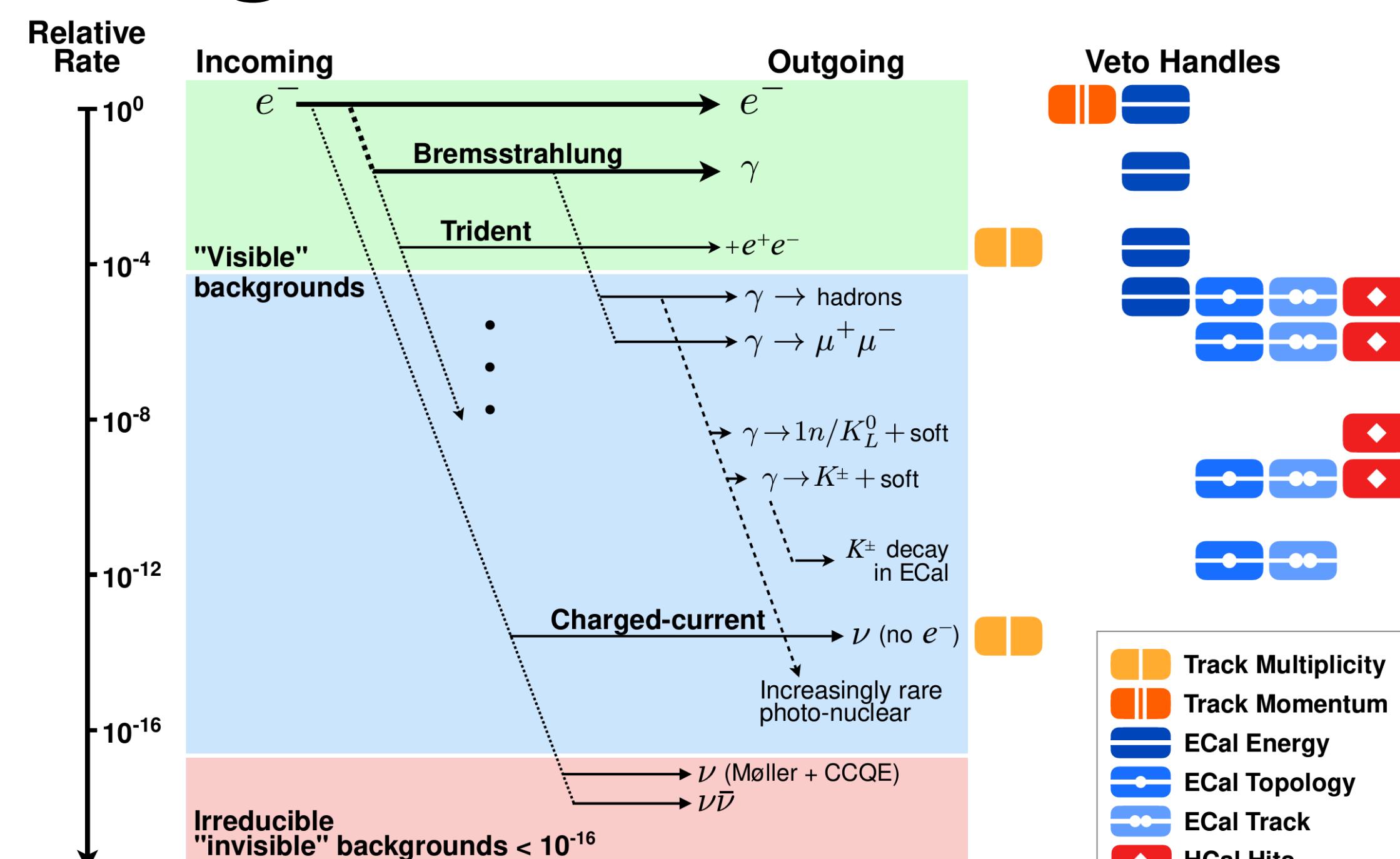


LDMX Concept and DM Kinematics



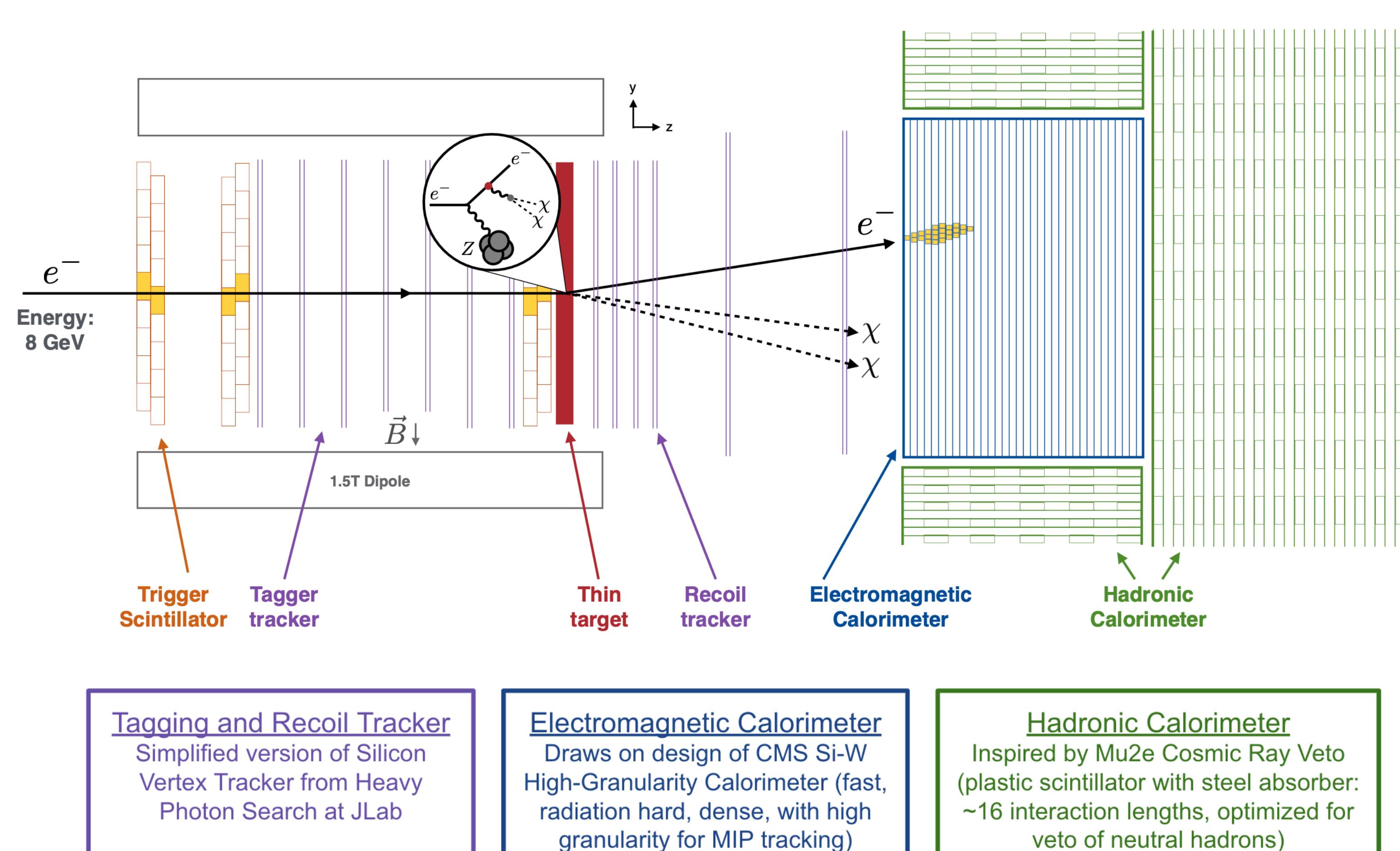
A' 's are produced through a process analogous to the primary background process (photon bremsstrahlung), but with different rates and kinematics. The massive A' takes most of the beam energy, leaving a soft recoil electron and a large amount of missing momentum in the detector. LDMX uses trackers upstream/downstream of a target to confirm the incident/recoil momentum of the electron. Calorimeters veto additional activity beyond the electron in events.

Background Production Rates

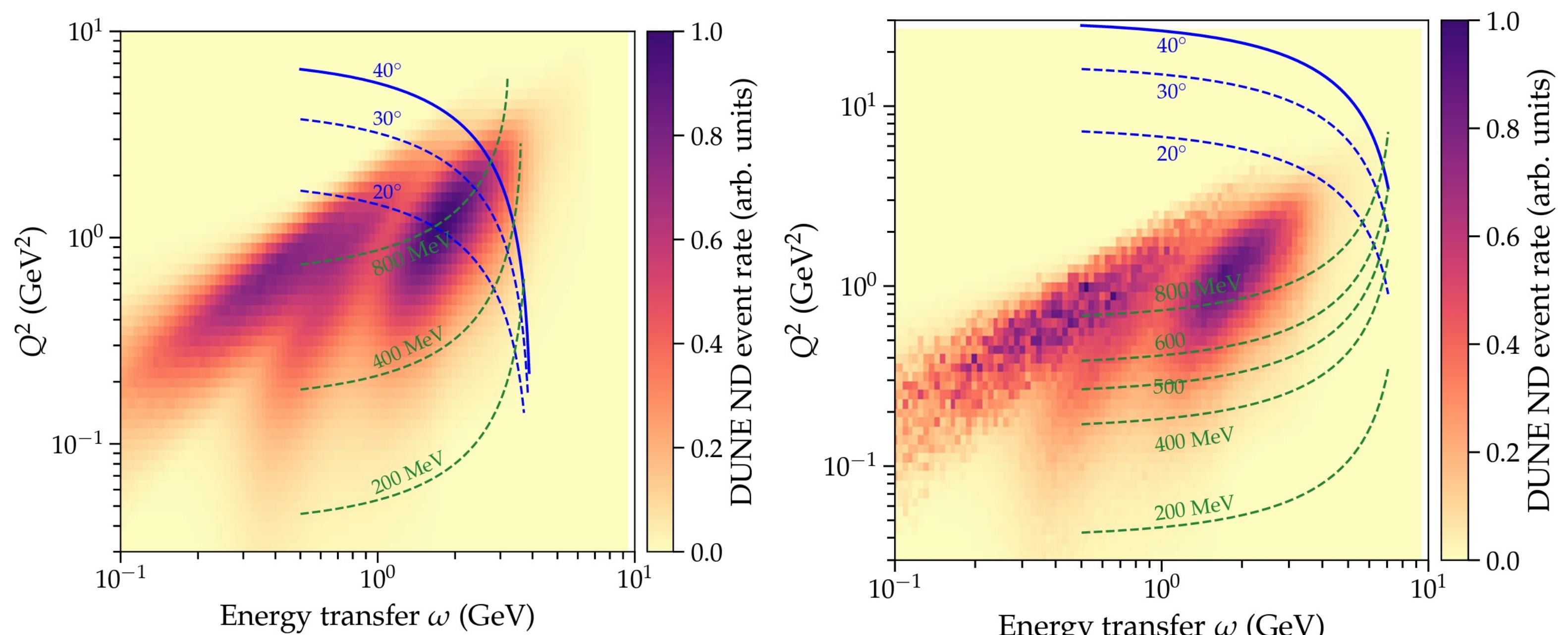


Relative rates of background processes at 8 GeV beam energy, along with the veto handles used to reject them.

LDMX Detector



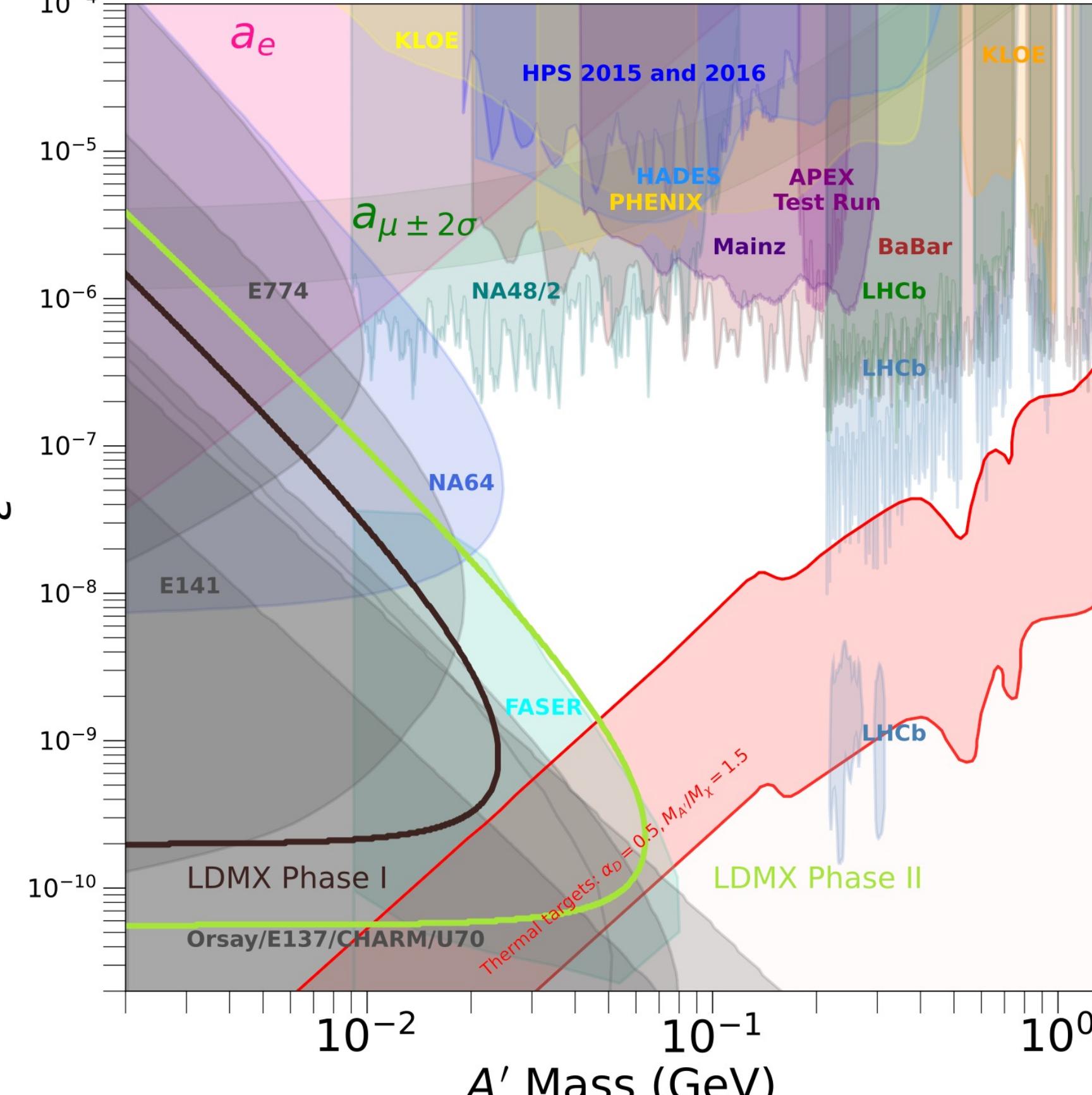
Electro-nuclear Measurements



Comparison of the phase space of neutrino-nucleon interaction events anticipated in the DUNE near detector in comparison with the LDMX detector acceptance. Both neutrino-nucleon and electron-nucleon interactions are specified as a function of the energy transfer from the incoming lepton to the hadronic system and Q^2 of the interaction process. At left (right), the overlaid lines show LDMX acceptance assuming a 4 GeV (8 GeV) beam, corresponding to a set of maximum recoil electron polar angles and minimum transverse momenta.

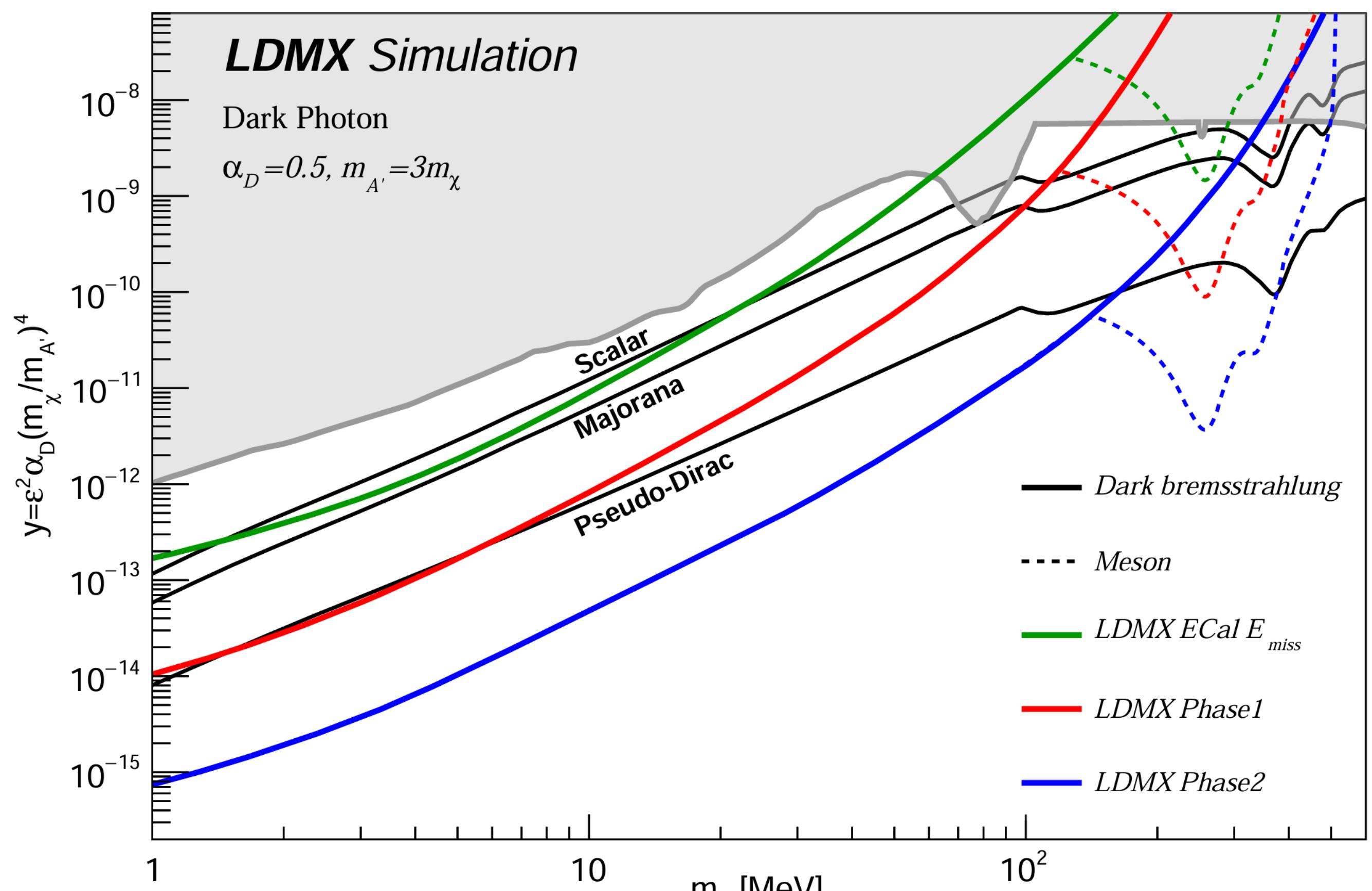
Visible Decays

LDMX Simulation Preliminary



Although optimized for a missing momentum search, LDMX is effectively a fully-instrumented beam dump experiment capable of searching for signatures of A' decays to Standard Model particles (viable if $2m_e < m_{A'} < 2m_\chi$). LDMX's sensitivity to visibly decaying A' signatures in the Hcal for a 4 GeV beam and 4×10^{14} electrons on target (LDMX Phase I) and an 8 GeV beam and 10^{16} electrons on target (LDMX Phase II). Sensitivity assumes 50% signal efficiency and 5 background events.

Projected Sensitivity



Projected reach of LDMX in the dark bremsstrahlung model at 4/8 GeV beam energies (Phase 1/2). Backgrounds are assumed to be at the level of < 1 event, supported by detailed simulation studies for the ECAL missing-energy and 4 GeV missing-momentum analyses. The A' model is used as a benchmark, but LDMX is sensitive to a broad range of sub-GeV dark matter models.

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