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TRIUMF e-linac production of weakly-coupled MeV-mass particles

Wednesday, 18 July 2018 16:30 (30 minutes)

I will discuss backgrounds and possible scenarios using TRIUMF's existing e-linac to produce and detect MeV-mass particles, assuming the previous talks and somewhat dated PPAC submission (daqshare.triumf.ca/~trinat/darkPPAC.pdf).
The recent improved measurement of the fine-structure constant predicts a different electron g-2 compared to experiment, motivating experimentally accessible MeV-mass bosons.
Assuming zero background– essential for sensitivity to increase linearly with counting time– the highest-energy electron beam will always win, as production scales like bremsstrahlung. Yet e-linac experiment backgrounds have two natural plateaus: pion threshold and (gamma,neutron) threshold. Thermal neutrons can produce 10 MeV single-gamma events distinguishable from exotic particles only by direction, so experiments at our low e-linac energies must face this issue both from the cyclotron (the BGO array at DRAGON sees those) and the e-linac .
Neutron damage of electronics in the ISAC mass separator room may prove problematic for that location.

This motivates a scenario that disturbs neither cyclotron beamtime nor e-linac production of neutron rich nuclei:
two pulsed lasers on a photocathode to independently fill the half of the buckets left unused by ARIEL;
Doug Storey's resonant chopper after either the 10 MeV injector (below (gamma,n) threshold on many materials) or the full 35 MeV;
a high-Z detector technology with 10's of psec timing resolution to utilize the 10 psec/1.5 nsec duty cycle for Mev-mass TOF and suppress backgrounds;
a detector after 1.5 meters of tungsten-steel shielding, either in the air in the e-hall to avoid scattered neutrons from the floor or burrowed west to suppress cosmic rays one order. The 10 MeV version appears compatabile with a THz radiation source (see workshop July 5)

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Session Classification: New Directions for Ariel