Updates

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Project 5

Search for dark particles needs powerful classification methods, with the capacity to be optimized for unknown cross-sections and particle masses, and also be able to account for systematic effects ie a fully differentiable analysis framework.

- Standard Figure-Of-Merit (FOM) for known cross-sections and particle mass

$$\mathrm{FOM} = \frac{S(t)}{\sqrt{S(t) + B(t)}} \tag{1}$$

  if $S(t)$ negligible

$$\mathrm{FOM} = \frac{S(t)}{\sqrt{B(t)}} \tag{2}$$

- Punzi FOM for unknown cross-sections and particle masses, G.Punzi arxiv:0308063
  Invert of standard cross-section, $\sigma = \frac{S(t)}{\varepsilon \cdot \mathcal{L}}$, or minimum "detectable" cross-section:

$$\sigma_{\mathrm{min}} = \frac{\frac{b^2}{2} + a\sqrt{B(t)} + \frac{b}{2}\sqrt{b^2 + 4a\sqrt{B(t)} + 4B(t)}}{\varepsilon(t) \cdot \mathcal{L}} \tag{3}$$

Goal, gain HOWTO:

- How to train with a specific FOM?
- Single or mass-dependent output?
- How to take into account for systematic effects?
- Which classification method should be used?

$\eta \to \gamma\gamma\pi^0$