WIMPs in mono-photon channel

Short description.

The search is for pair-produced WIMPS, where the presence of the interaction is detected by the observation of an ISR photon and nothing else. At ILC (but not LHC) this kind of interaction can be described in a almost model-independent way with EFT. Apart from the obvious eenunu + ISR ireducible background, also ee ee (down the beam-pipe) + ISR are the backgrounds. No dedicated signal simulation is needed; one can simply reweight the eenunu + ISR gamma-spectrum (as a function of theta and E_gamma) to be that of any signal

This benchmark in particular can probe two features:

- Photon detection and measurement.
- Hermeticity, in particular the performance of the very forward calorimeters.

Main observables.

The main (and only) direct observables for the signal is the momentum of the ISR photon, The physics observable is the exclusion/discovery WIMPs in the mediator-mass/coupling plane for different lorentz-structures of the interaction.

Optimisation deliverables.

- Gamma detection efficiency at all angles, in all relevant calorimeters.
- Rejection power of the very forward calorimeters against other activity than the ISR.

IDR plots & note.

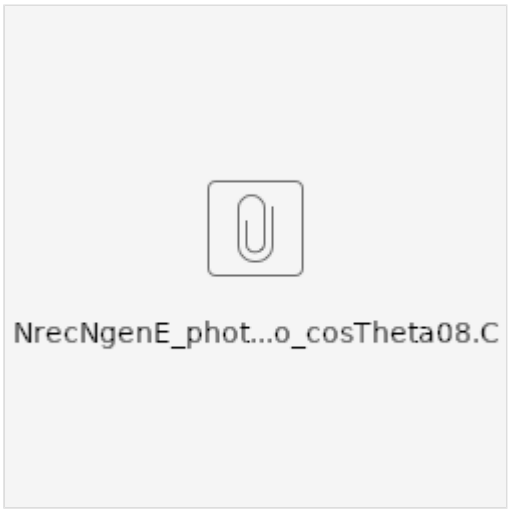
Supporting note (overleaf) : https://www.overleaf.com/project/5c5d683f9f687c21b0f5a499

pdf :

Photon reconstruction : The number of reconstructed photons per generated photon as a function of the signal photon energy.

Photon reconstruction : The number of reconstructed photons per generated photon as a function of cos_theta (left : plot only pfos identified as photon, right: plot all pfos passes cut criteria except for pid).

Extra: Same as above but plot only |cos_theta|<0.7 and |cos_theta|>0.9 cases (outside of the drop at cos_theta=0.8). This indicates the drop at cos_theta=0.8 give no effect on Nrec/Ngen vs E.



BCal vetoing (Comparing IDR-L and IDR-S)

bcalveto_eeNg_comp.pdf

bcalveto_eeNg_comp.C

Sensitivity : 95\% confidence level exclusion limits for different effective operators with a realistic sharing of the polarization at 4ab^{-1} of H20 scenario; $(--,-+,+-,++)=(10\%,40\%,40\%,10\%)$.$\sqrt{s}=500$~GeV.

Update: Now Emax < 220GeV, which was introduced to avoid Z-return events, has been removed. (But still Emax<250 is set due to a technical issue in a macro.)

1) x-axis range 1-250 GeV

sensitivity_H20_IDR.pdf

sensitivity_H20_IDR.C

2) x-axis range 1eV - 1TeV (log scale)

sensitivity_H20_IDR_logx.pdf

sensitivity_H20_IDR_logx.C

People.

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Reviewer(s): Filip Zarnecki, Moritz Habermehl

References.

Previous analyses by Christoph Bartels & al. :'Characterising WIMPs at a future e+e Linear Collider', arxiv:1206.6639. Finishing study by Moriz Habermehl & al. : 'WIMP searches at the International Linear Collider' PoS ICHEP2016 (2016) 155, arxiv:1702.05377

Moritz Habermehl : "Dark Matter at the International Linear Collider", https://inspirehep.net/record/1717582/files/Moritz_Habermehl_PhD.pdf

Code

The GitHub repository is ILDbench_WIMP in the ILDAnaSoft project.