Questions for theorists

Modelling

- ME is now modelled with MG5, with showering by Pythia8 (using HV module). Is this optimal? Possible to do all in Pythia? Otherwise is it ok to factorize the hard process from the dark shower effects like in regular QCD?
- Does the dark QCD emissions in the shower proceed in a way different than SM QCD emissions? That is, are they soft and collinear?
- For semivisible jets, the Cohen et al model leads to events with high jet multiplicity, can we make the search less model-dependant? As in, can any model be fed through HV to give svjs?
- Stable baryons seem to be missing in our Pythia logs and are not mentioned in the HV documentation. Can we include & see stable dark baryons in Pythia HV, and if so how? If the stable baryons should constitute ~10% of our dark jets, is it reasonable to neglect these?
- Can one set the mass of the eta separately from the masses of the pions? substitute etas for different kinds of dark sector particles.
- Do the dark quarks in general undergo Cabibbo mixing? Should they?

Analysis strategy

- Are the observables, selection strategies proposed optimal?
- Is the s-channel svj search potentially useful or covered by dijet bounds? Interplay with LLP scenarios?
- Which theoretical uncertainties should we include? Especially concerning the “generator uncertainty”, because we only have one setup available for each process. Does it make sense to vary the renormalisation scale to estimate the theoretical uncertainty on e.g. track multiplicity of dark jets? *Ties to point 1 in the previous slide.*
- Is the substructure of svj’s expected to be different than a light q/g jet? It seems to be the case, so understanding it better will be useful.