DETECTORS FOR DARK MATTER AT A 100 TeV COLLIDER

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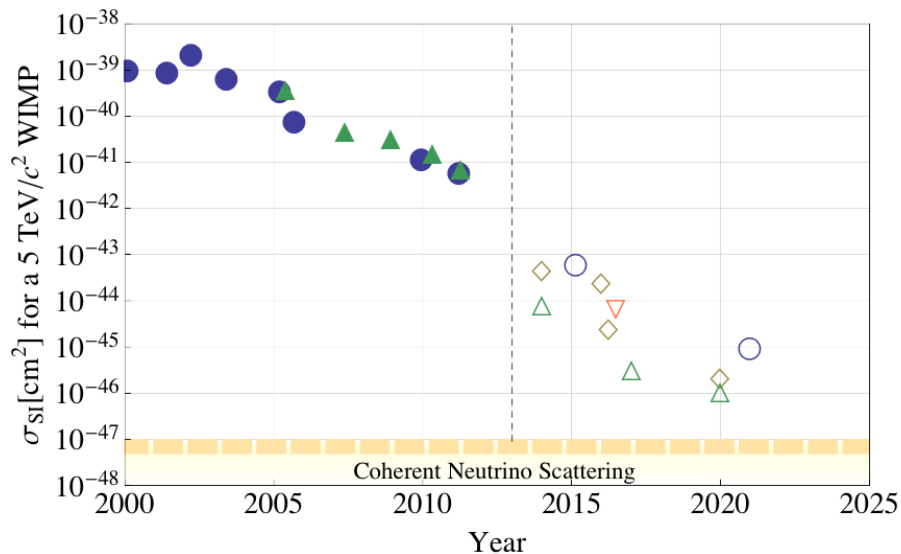
DECEMBER 5, 2015

WHERE SHOULD WE LOOK?

- Where will the other searches be at that time?

  - Direct detection will be at/past the neutrino line

  - SUSY will be really stretched…

  - What to expect from indirect detection?

  - A 100 TeV pp collider will not be able to fully describe the DM

Likely that complementarity approaches will still be essential

Evolution of the WIMP−Nucleon σ_{SI}

[arXiv:1310.8327]
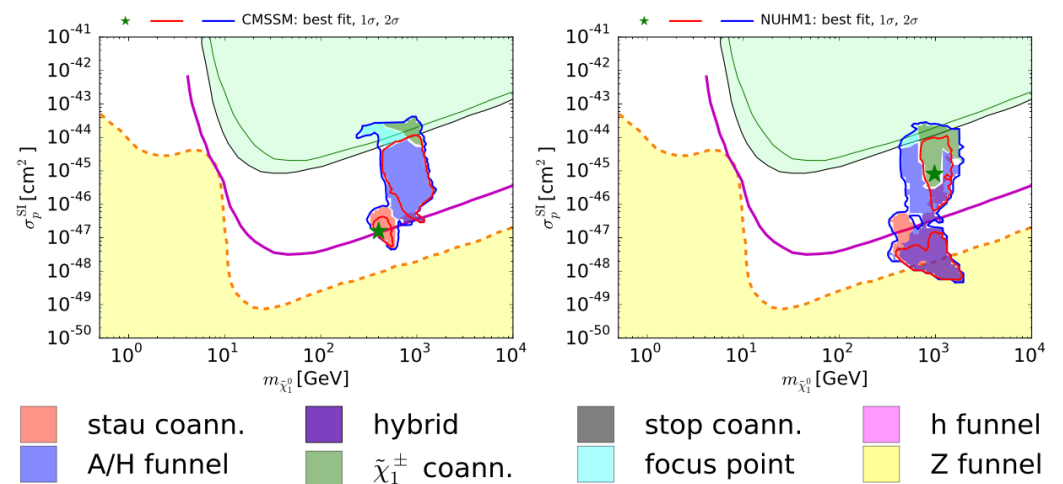
[arXiv:1508.01173]

WHAT ARE WE LOOKING FOR?

- Suggested mass range from Paddy's talk: 10 Mev to 70 TeV (+caveats)
  - High: Need to enable searches all the way up to many tens of TeV
  - Middle: Need good sensitivity at electroweak scales
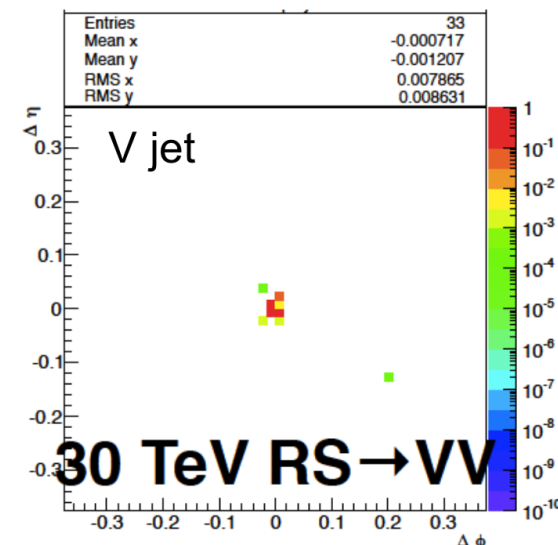 - Low: What can we do differently to do this better?

Huge dynamic range will be needed

Highly boosted jets; tracking and calorimeters pushed to limits

How to trigger on the interesting interactions?
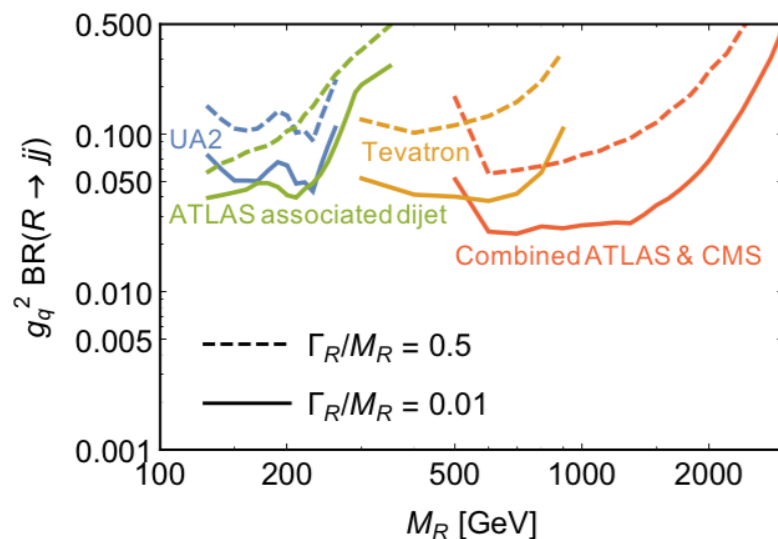
[arXiv:1503.05916]

[Pierini: http://indico.cern.ch/event/304759]

3

WHAT IS THE PHYSICS?

- Dark Matter possibilities at a 100 TeV Collider
  - ISR+MET
  - DM in the decay cascade of heavier stuff
  - SUSY co-annihilation region (compressed spectra)
  - VBF
  - Higgs portal
  - Soft tracks/photons
  - Charged-track, disappearing track, weirder stuff
- Can we use what we know about DM to make better detectors?
  - Which signatures to emphasise? Jets, gammas, leptons…
  - General-purpose detector or something more focussed?

Which if any to emphasise?

What do each imply for the detectors?

OPEN QUESTIONS

- Detector questions include...

  – Timing precision, esp for inner layers (pixels)?

  – dE/dx information in tracker?

  – Calorimeter coverage: ~4π (ILC-style) or traditional hadron collider (central)

  – Transition point for when track mis-measurement takes over?

  – How interesting are odd cases (e.g. disappearing tracks)?

  – How far forward jets for VBF?

  – Impact of pileup?

  – How to trigger?

Many studies to be done

[arXiv:1310.3675]