Session Conveners: C. Doglioni, M. Schoenherr, A. Vartak
Talks by: M. Lindner, Z. Demiragli, J. Lindert, F. Kahlhoefer, C. Ohm, S-C Hsu, S. Malik

Discussion session

Key channels + precision pheno - Tuesday afternoon

Four discussion points for the next 15’

1. DM theory
2. Precision theory
3. Key DM channels at LHC
4. Challenges, not floors (neutrino/trigger)

DM Theory

- **The WIMP case is still strong**
  - **but probably less simple than initially expected**
    MSSM neutralino, interaction weaker/different than expected,...
  - **may be connected to new ideas in BSM physics**
- **Good discovery potential for on-going experiments:**
  - **direct detection experiments ➔** new XENON1T results soon…
  - **LHC**
  - **indirect detection**
- **Next-to-next generation direct detection experiments**
  - **bigger, higher costs, larger collaborations, time, …**
  - **other science topics: 0nbb, solar n's, SN, coherent scattering,…**
- **Change of strategy once DM is observed…**

- Conflicting requirements for the development of DM models to guide LHC searches

Generality	↔	Realism
Simplicity	↔	Validity
Predictivity	↔	Flexibility

- Renormalisable dark matter portal models are an excellent compromise

- Advantages:
  - Powerful guiding principles for the construction of new models
  - Each model accommodates a whole range of new signatures
  - Model remains valid (for perturbative couplings) in all kinematic regions

- Disadvantages:
  - Even simple renormalizable DM portals come with many new parameters
  - Comprehensive exploration of parameter space is challenging
  - No straight-forward comparison with non-collider searches

LHC:

- can exclude a DM candidate
- can establish a candidate
- does not test if it is DM in Univ.:
long lived? abundance?

Talks by M. Lindner and F. Kahlhoefer

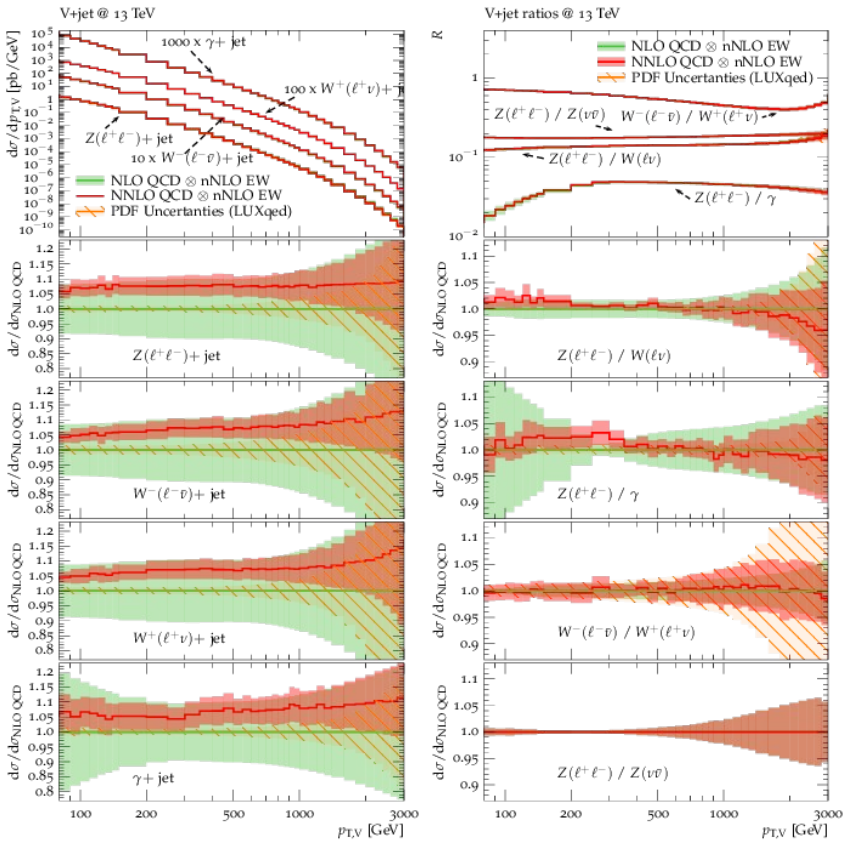
Precision theory

pT(V) (and ratios thereof) now known with sufficient precision for current DM searches in monojet searches

robust strategy defined to assess theory uncertainty in ratios of different, but related, processes

Precision goals for Run-III and HL-LHC:

- which channels, observables, ranges (analysis strategy and reach)
- what is envisaged experimental precision that should be matched by theory



Talk by J. Lindert, arXiv:1705.04664

Key DM Channels at LHC:

Experimental perspectives

Lot of progress has been made in nailing down the theoretical uncertainties on the key electroweak backgrounds in mono-X searches

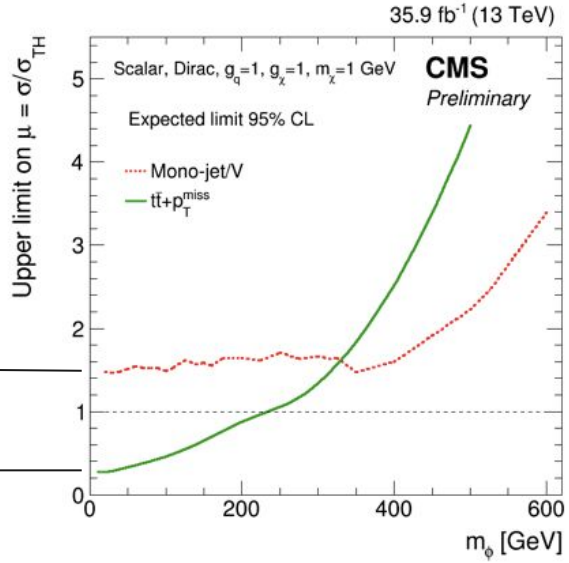
Experimental uncertainties could now be a key limiting factor for searches such as monojet at higher luminosities

Particularly when probing ~low mass mediators (e.g. spin-0)

Example

Scalar monojet limits are already getting systematics limited over the course of LHC Run-II

tt+MET limits have improved significantly



Floors and ceilings

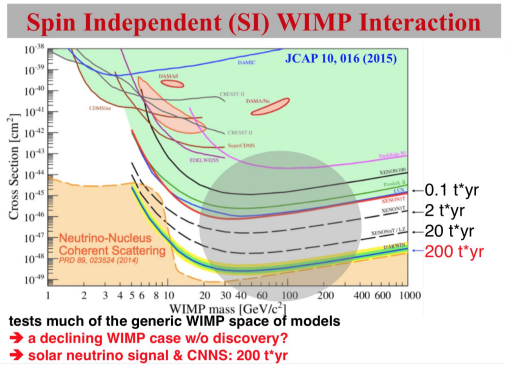
"The LHC does not care about the neutrino floor, DD does"
-> beyond directional detection, what are the prospects for treating it as an irreducible backgrounds?

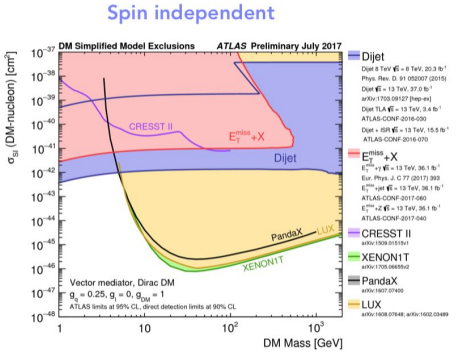
We need complementarity, not an experiment that is stronger than another -> a message for summary plots?

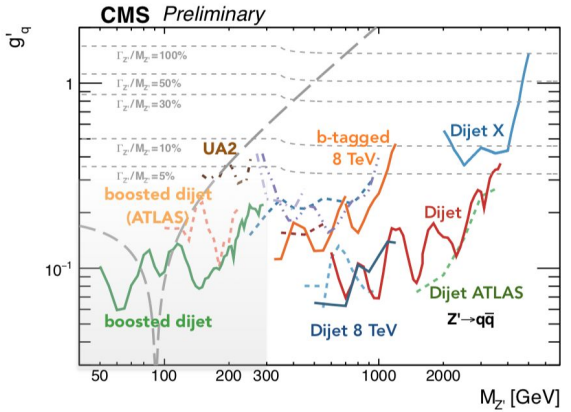
"Trigger thresholds will increase with luminosity (HL-LHC)"
"More exotic signatures are hard to trigger on"
"Mass reach will saturate (=increase slowly)"

Can the theory community encourage benchmarks to motivate alternative trigger/reconstruction/data-taking?

Note: new "dark sectors" direction of LHC DM working group







In case of extra time

Further questions/comments?

- Combinations vs comparisons, channels or experiments:
  - How-to? (unfolding, likelihood…)
  - Worth doing in case of null result?
- Physics with pile-up vs physics with prescaled triggers