Pseudo-scalar mediator studies

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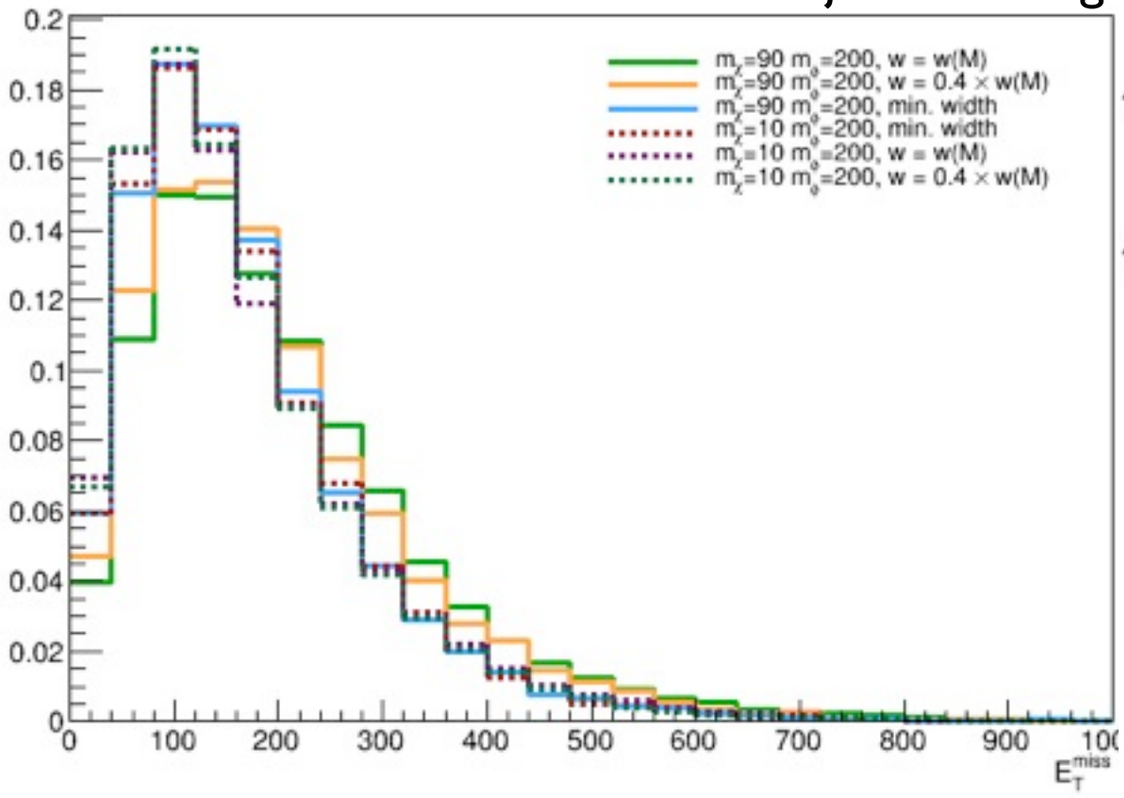
Parameter scan

- Scanning parameters
  - Process: pseudoscalar
  - Couplings: coupling mediator-SM (g_{SM}), coupling mediator-Dark Matter (g_{DM})
  - Mediator mass, M_{phi}
  - Mediator width, Γ_{phi}
  - Dark Matter (DM) mass, M_{chi}
- Can we avoid to scan on certain parameters, as for scalar case?
  - Need to check on kinematic distributions
  - If not affected only few combinations can be produced and then rescaled to correct cross section for the other possible cases

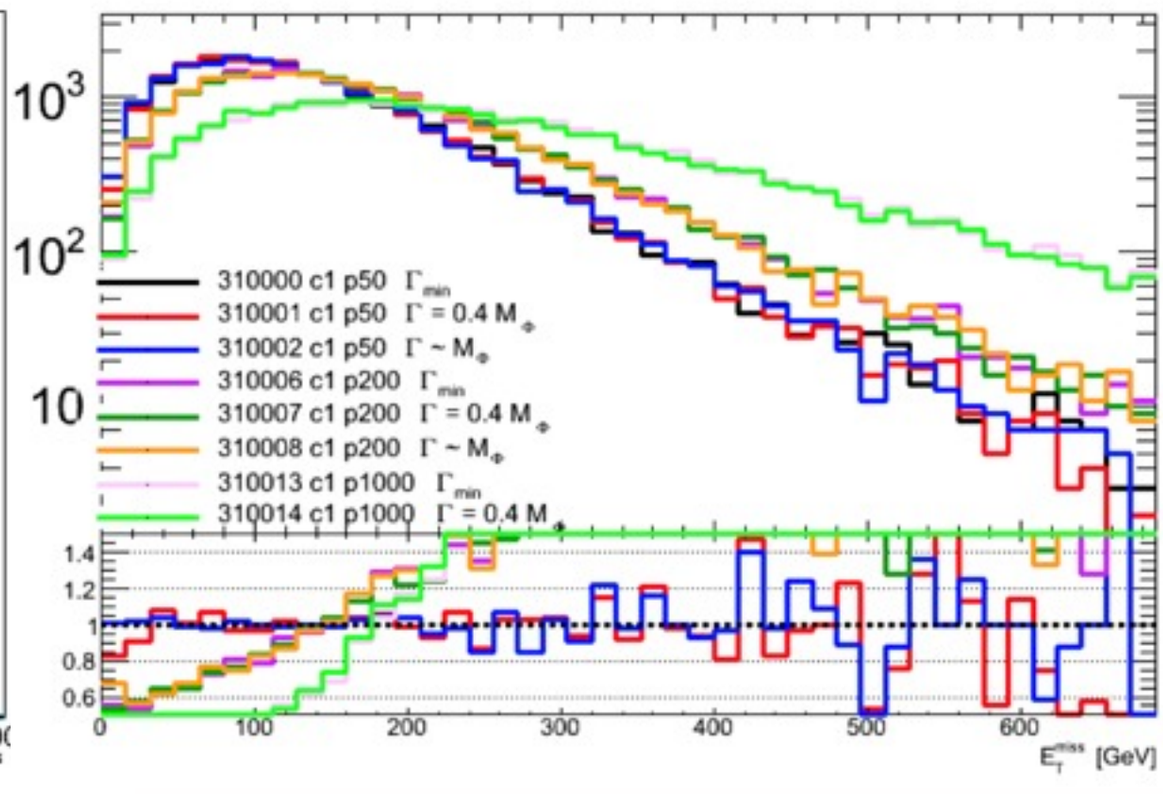
Width of the mediator

- Kinematics of most generated sample (Mchi, Mphi) do not depends on the width of the mediator
- Changes seen only close to the threshold
- Same conclusions as for scalar mediator model

Bjorn Penning



Priscilla Pani

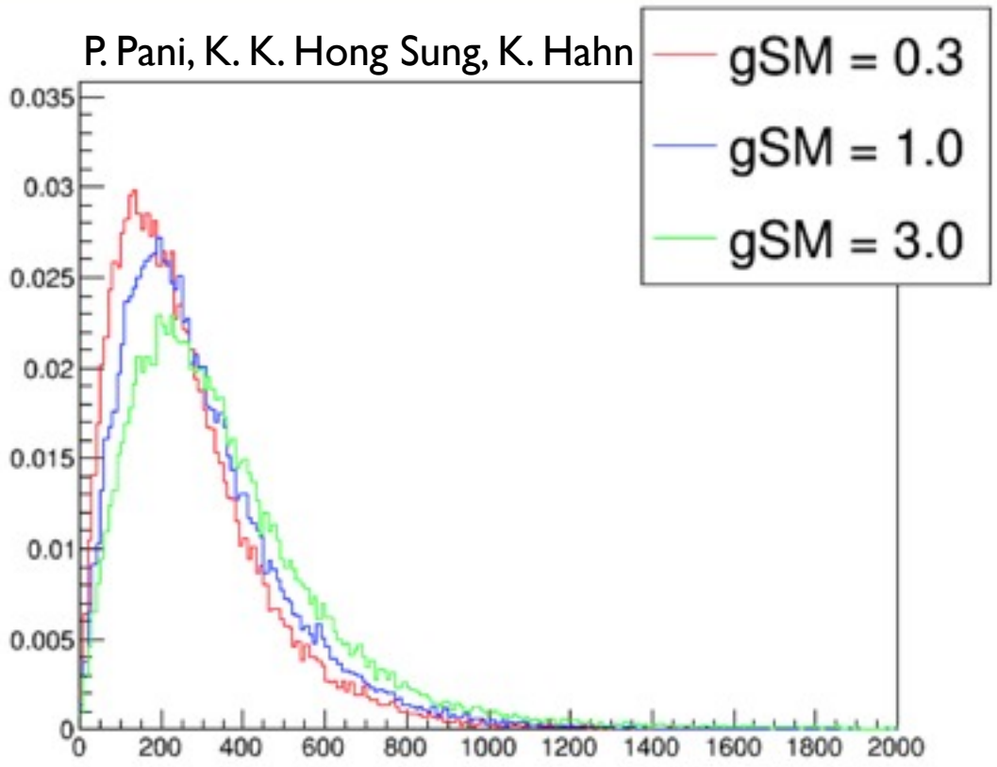


Couplings

- As shown by Priscilla, Kevin and Kristian small couplings will have very small cross-section

  - already cross section ~fb for $g_{SM} = g_{DM} = 1$

  - cross sections out or reach for first year data of next run



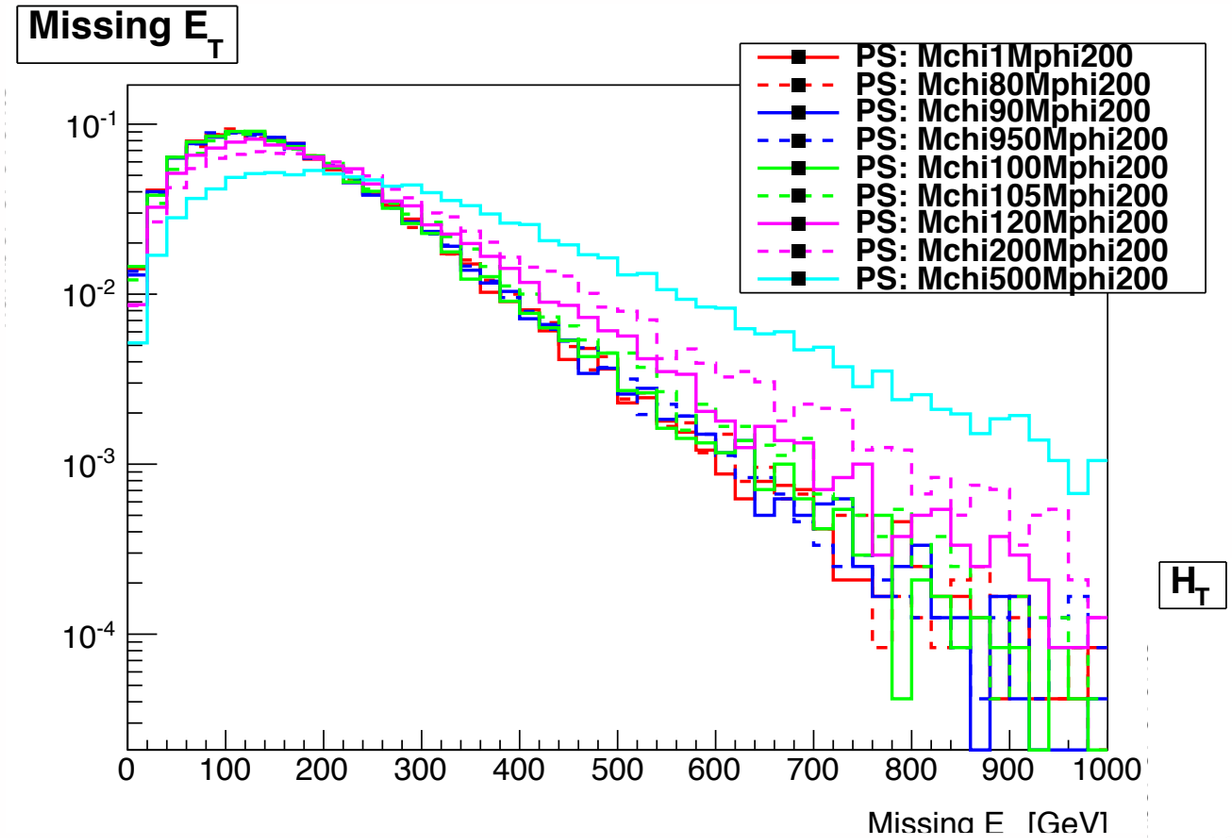
- Variation of couplings can only increase the width over the minimal value

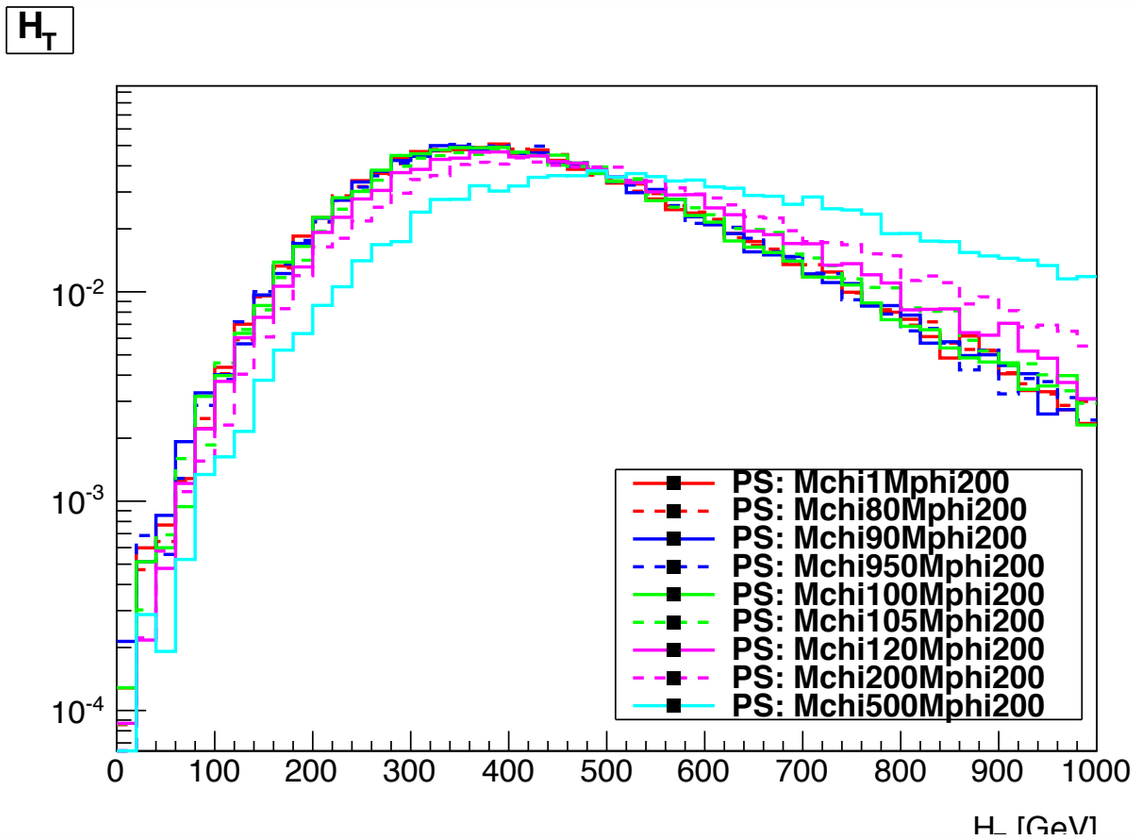
- No need to produce samples with different coupling, only the cross section will be different

- Need to converge (later) on how to translate cross section limits in the coupling plane

DM mass: Mchi

- Is the mass of the DM particle affecting the kinematic?





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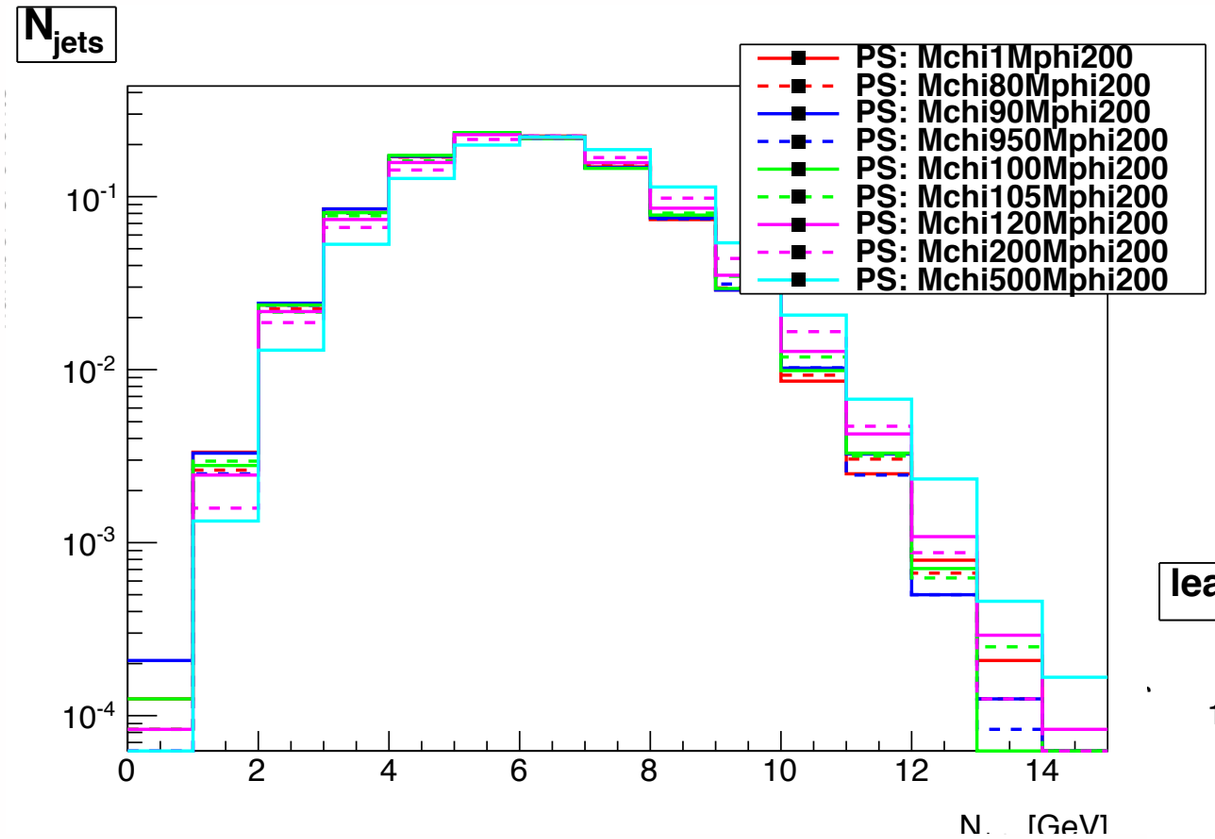
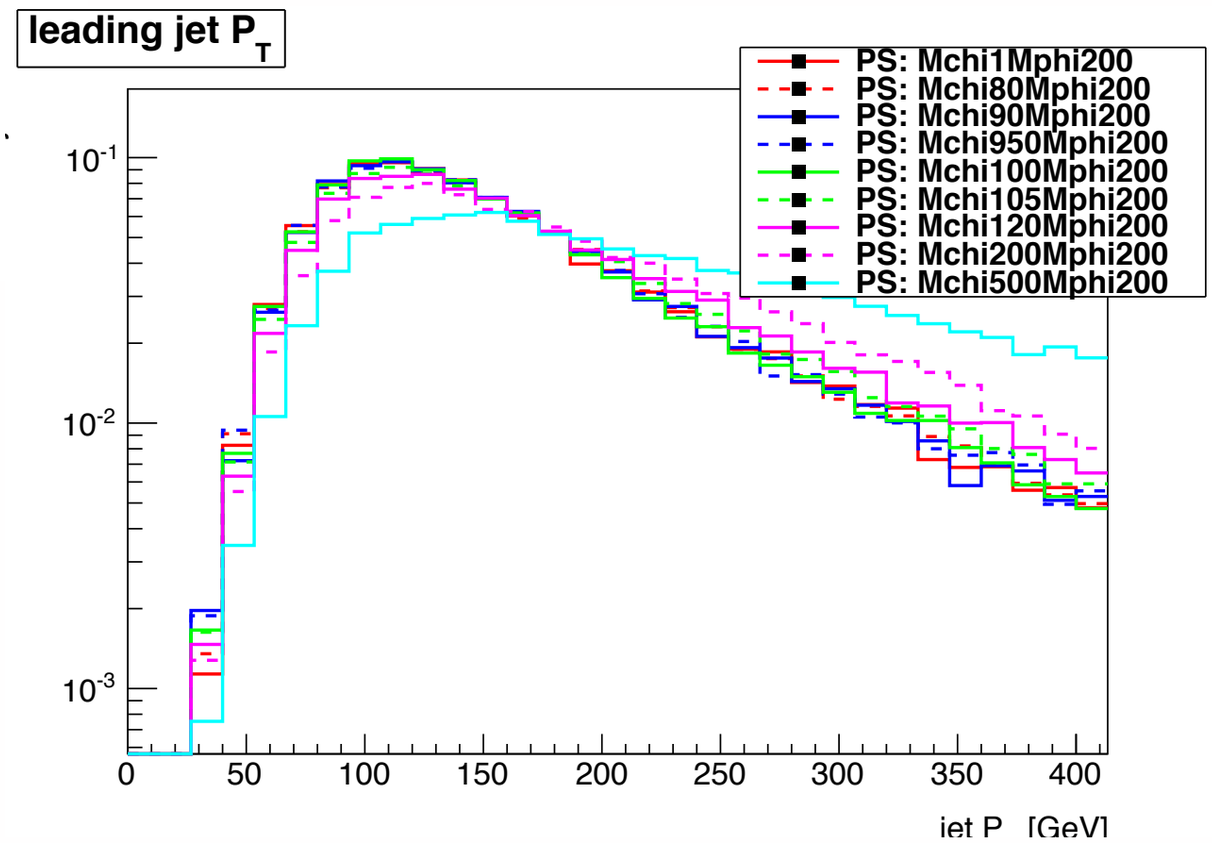
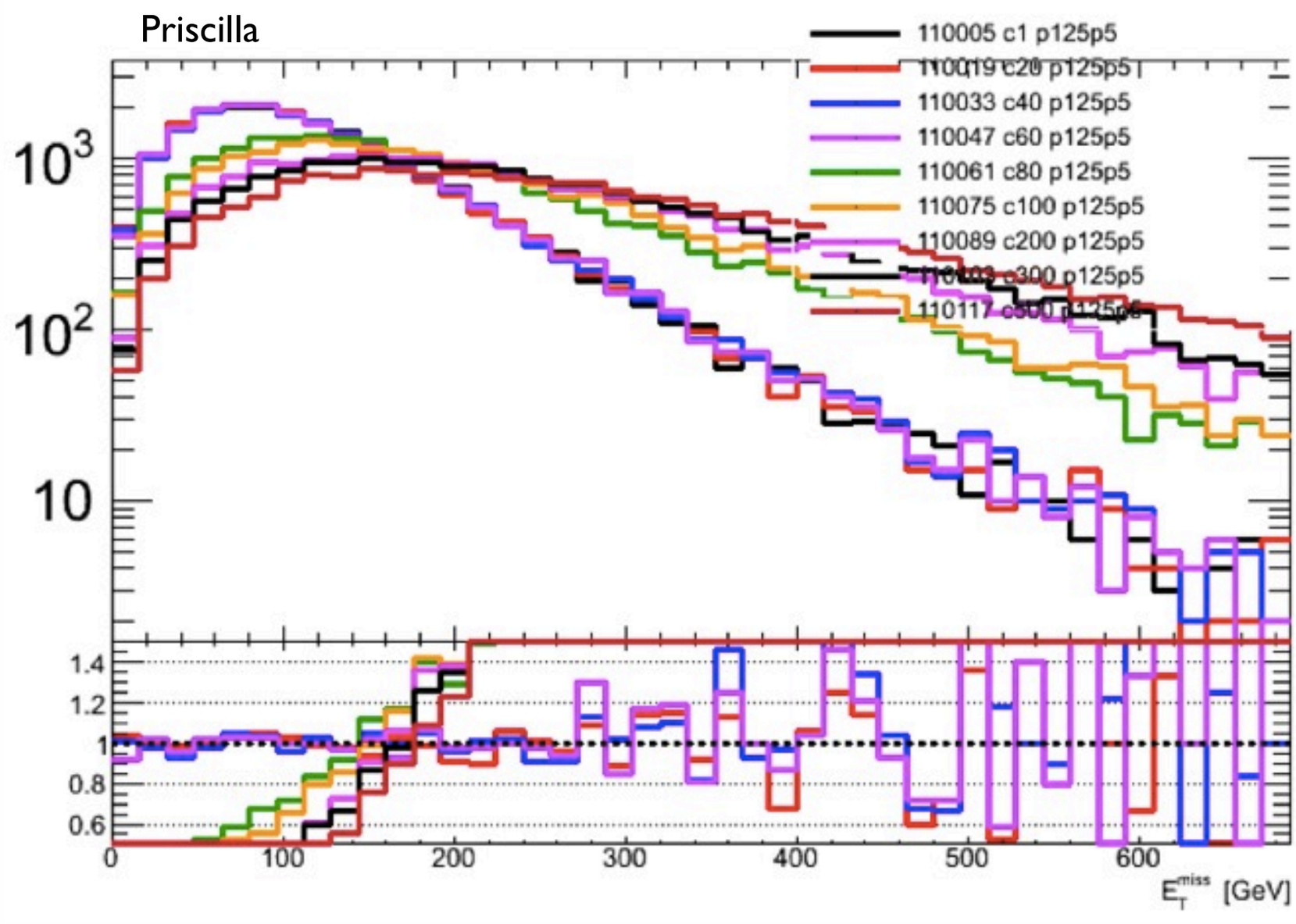




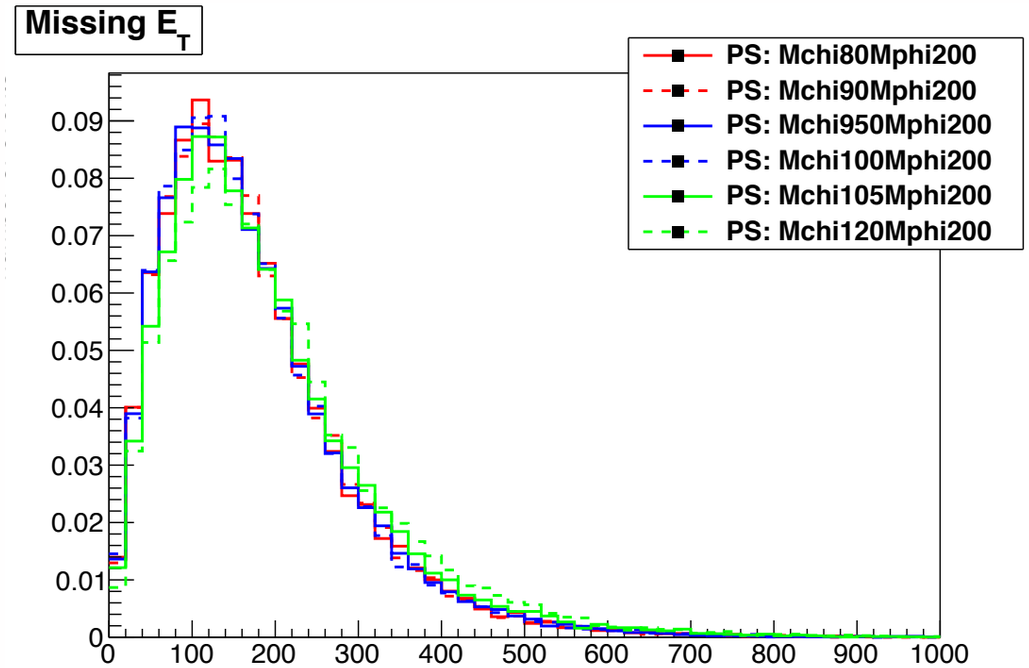
DM mass: Mchi

- same behavior for scalar model

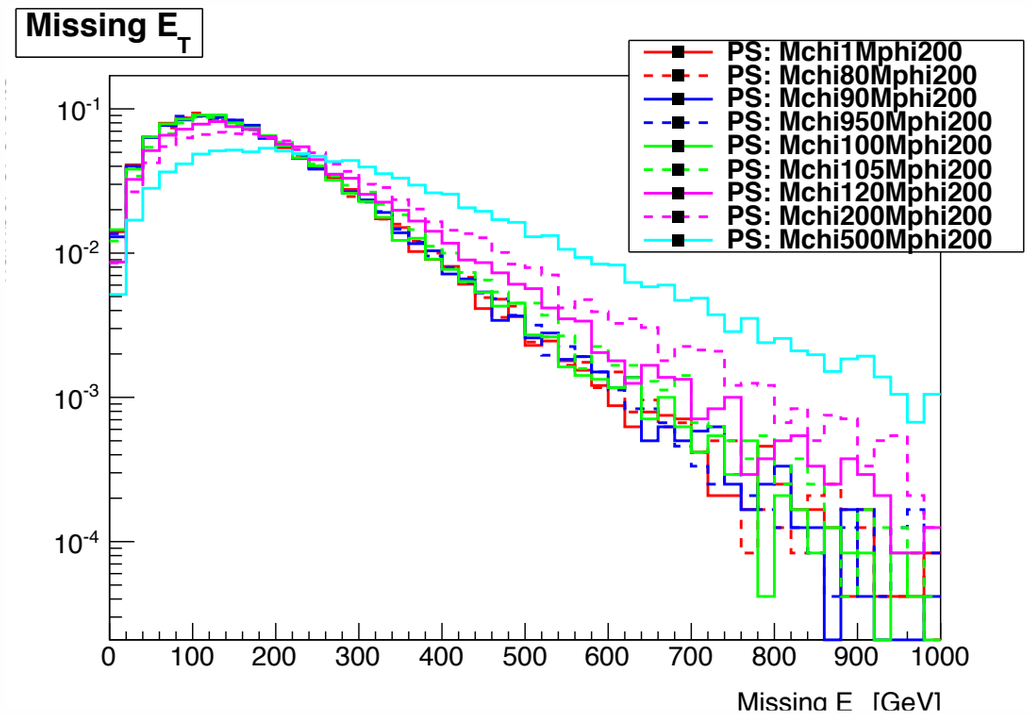


DM mass: Mchi

- On-shell (2Mchi < Mphi)
  - kinematics independent of Mchi
  - what we are measuring is the p_T of the mediator



- Off-shell (2Mchi > Mphi)
  - kinematics depends on Mchi
  - huge differences for very off-shell regimes



Conclusions

- Same “width” behavior for scalar and pseudo-scalar is observed
  - minimal width can be considered for generation, all other values have same kinematics
  - kinematics depends on the width only close to threshold as in the scalar case
- No scan on couplings for generation as a consequence of kinematics dependence from the width and the cross section that can be studied at LHC Run2 in the first year
- Kinematics depends on Mchi only for off-shell mediators
  - same case also for scalar mediator
- Need to check agreement with other models
  - expected to have the same agreement seen in scalar models