Overview of optimal observables for EFT DM sensitivity

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Status

- Added phase space VBFDM100: VBFDM with Jet 1 pT $>$ 100GeV
- Scaled the different dimensions with the effective field theory constraints:
  - D5c : $\Lambda = 3.3$ TeV
  - D5d : $\Lambda = 6.6$ TeV
  - D6a : $\Lambda = 230$ GeV
  - D6b : $\Lambda = 330$ GeV
  - This has meant that some dimensions would not be seen by any parameters
- Added ratio plots of $\frac{Z \to \nu\nu + DM}{Z \to \nu\nu}$
- Started to look at which set of distributions will give us the broadest sensitivity to dark matter models
- No jet veto is applied for QCD suppression right now, so the background QCD+EWK Z is pessimistic

Sensitivity to dark matter model over background?

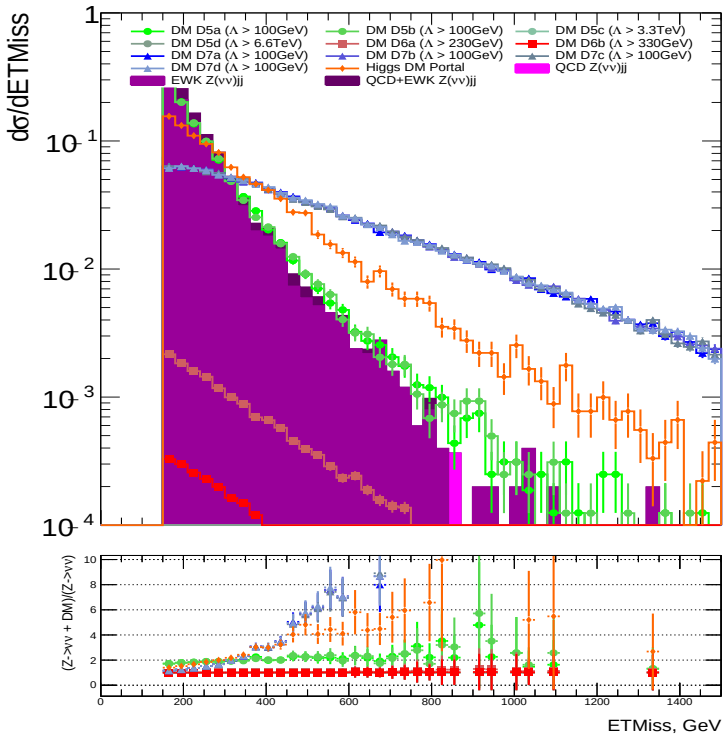
$$\frac{(Z\to\nu\nu)+DM}{Z\to\nu\nu} : Y > 10 > M > 5 > N$$

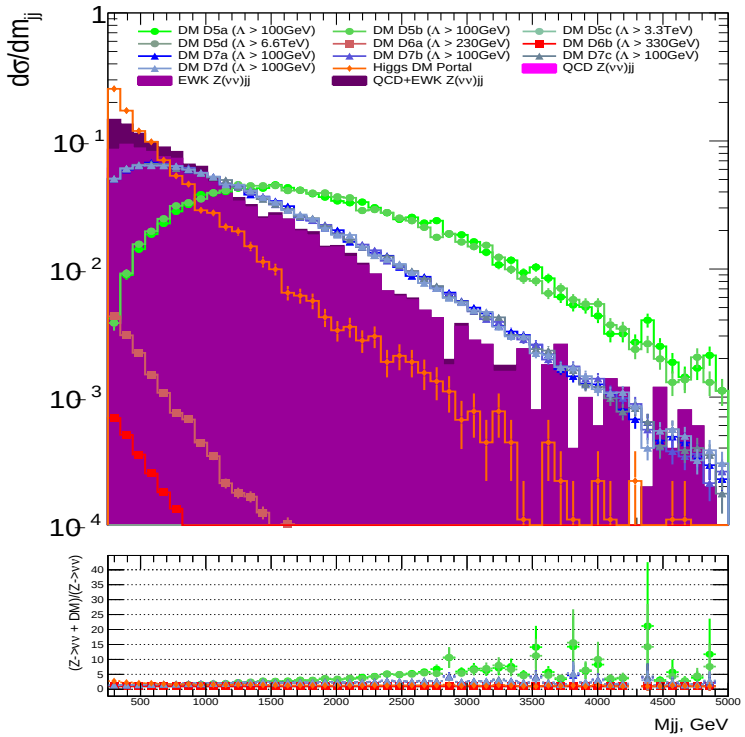
VBFDM Phase space:

Parameter	D5a	D5b	D5c	D5d	D6a	D6b	D7a	D7b	D7c	D7d
Etmiss	N	M	N	N	Y	Y	Y	Y	Y	Y
Mjj	Y	Y	N	N	N	N	M	M	M	M
Jet1pT	M	M	N	N	N	N	M	M	M	M
Jet2pT	N	N	N	N	N	N	M	M	M	M
Jet1Eta	Y	Y	N	N	N	N	N	N	N	N
Jet2Eta	M	M	N	N	N	N	N	N	N	N
DeltaEta	Y	Y	N	N	N	N	N	N	N	N
DeltaPhi	M	M	N	N	N	N	M	M	N	N

- The parameters that have good sensitivity to the most dimensions are Etmiss and Mjj for the VBFDM phase space.

These are for a DM mass of 100GeV





Sensitivity to dark matter model over background?

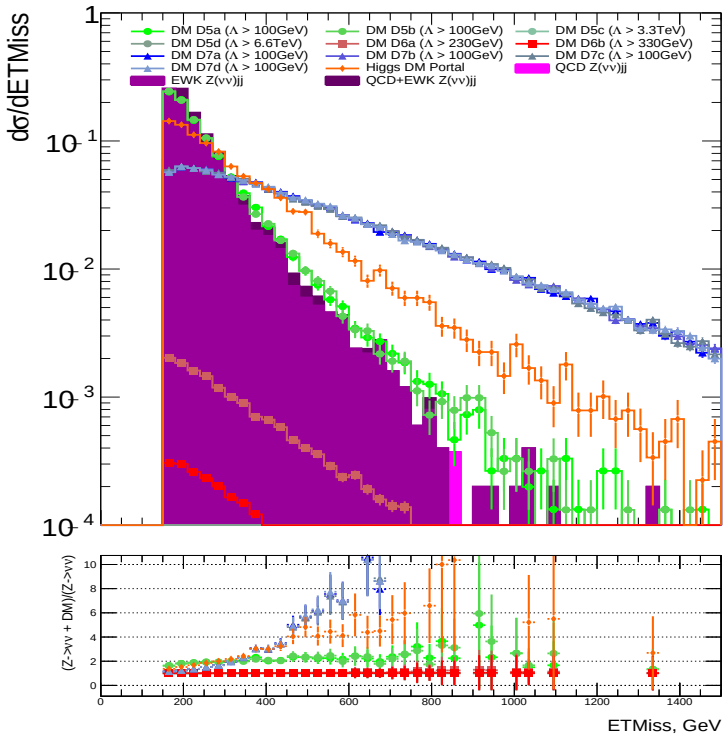
$$\frac{(Z\to\nu\nu)+DM}{Z\to\nu\nu} : Y > 10 > M > 5 > N$$

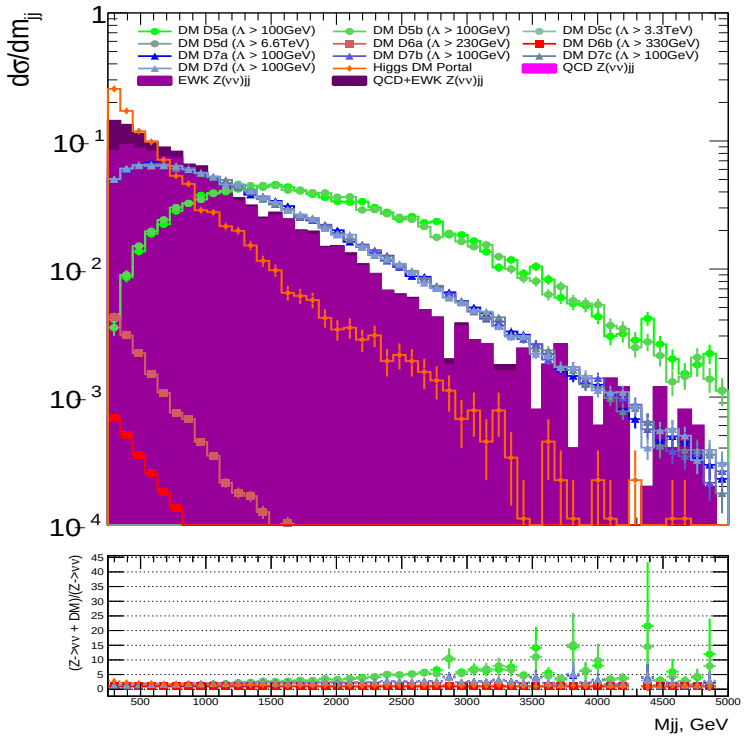
VBFDM100 Phase space:

Parameter	D5a	D5b	D5c	D5d	D6a	D6b	D7a	D7b	D7c	D7d
Etmiss	N	M	N	N	Y	Y	Y	Y	Y	Y
Mjj	Y	Y	N	N	N	N	M	M	M	M
Jet1pT	M	M	N	N	N	N	M	M	M	M
Jet2pT	N	N	N	N	N	N	M	M	M	M
Jet1Eta	Y	Y	N	N	N	N	N	N	N	N
Jet2Eta	M	M	N	N	N	N	N	N	N	N
DeltaEta	Y	Y	N	N	N	N	N	N	N	N
DeltaPhi	M	M	N	N	N	N	M	M	N	N

- The parameters that have good sensitivity to the most dimensions are Etmiss and Mjj for the VBFDM100 phase space.

These are for a DM mass of 100GeV





Sensitivity to dark matter model over background?

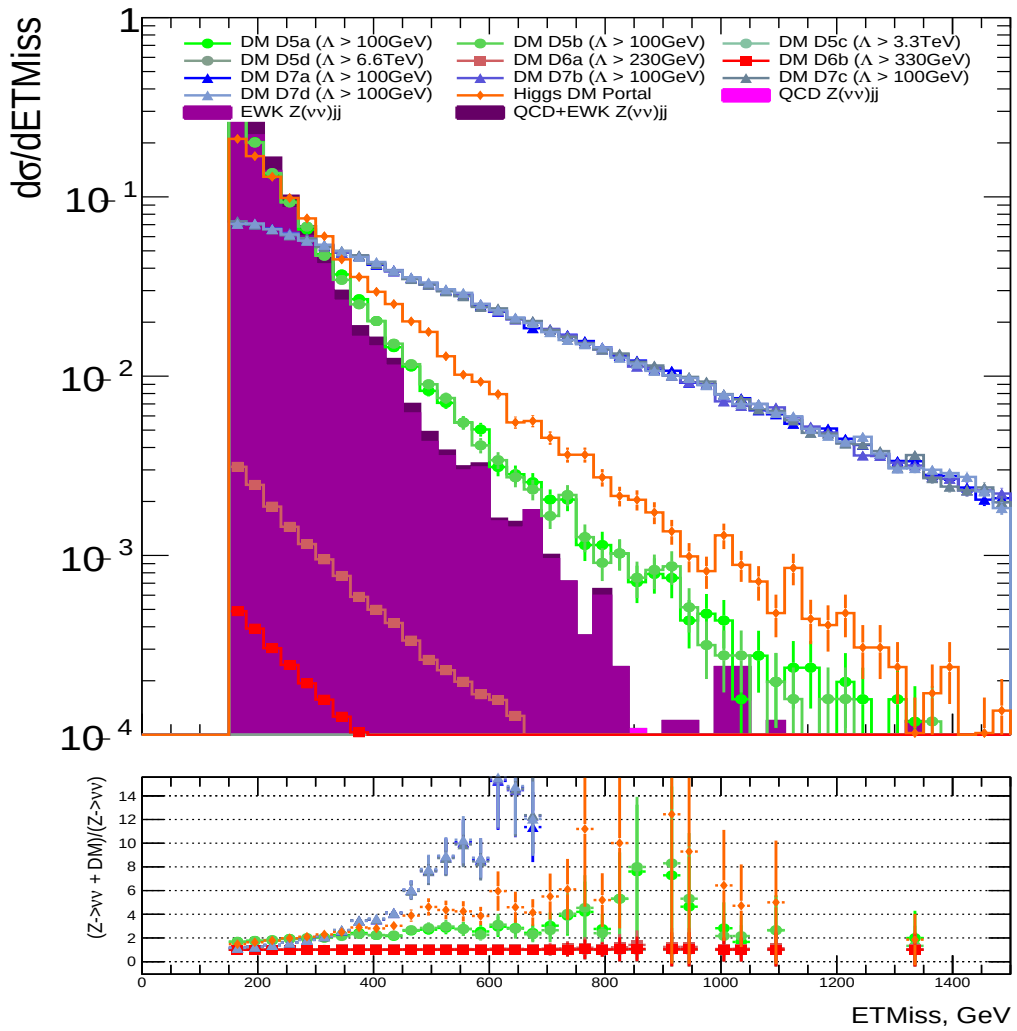
$$\frac{(Z\to\nu\nu)+DM}{Z\to\nu\nu} : Y > 10 > M > 5 > N$$

VBFDM OR Monojet Phase space:

Parameter	D5a	D5b	D5c	D5d	D6a	D6b	D7a	D7b	D7c	D7d
Etmiss	M	M	M	M	Y	Y	Y	Y	Y	Y
Mjj	Y	Y	N	N	N	N	N	N	M	M
Jet1pT	M	M	N	N	N	N	M	M	N	N
Jet2pT	N	N	N	N	N	N	M	M	M	M
Jet1Eta	Y	Y	N	N	N	N	N	N	N	N
Jet2Eta	M	M	N	N	N	N	N	N	N	N
DeltaEta	Y	Y	N	N	N	N	N	N	N	N
DeltaPhi	N	N	N	N	N	N	N	N	N	N

- The parameter that has the best sensitivity to the most dimensions is Etmiss, for the VBFDM OR Monojet phase space.

This is for a DM mass of 100GeV



- None of the dimensions scaled by the EFT constraints can bee seen here

Sensitivity to dark matter model over background?

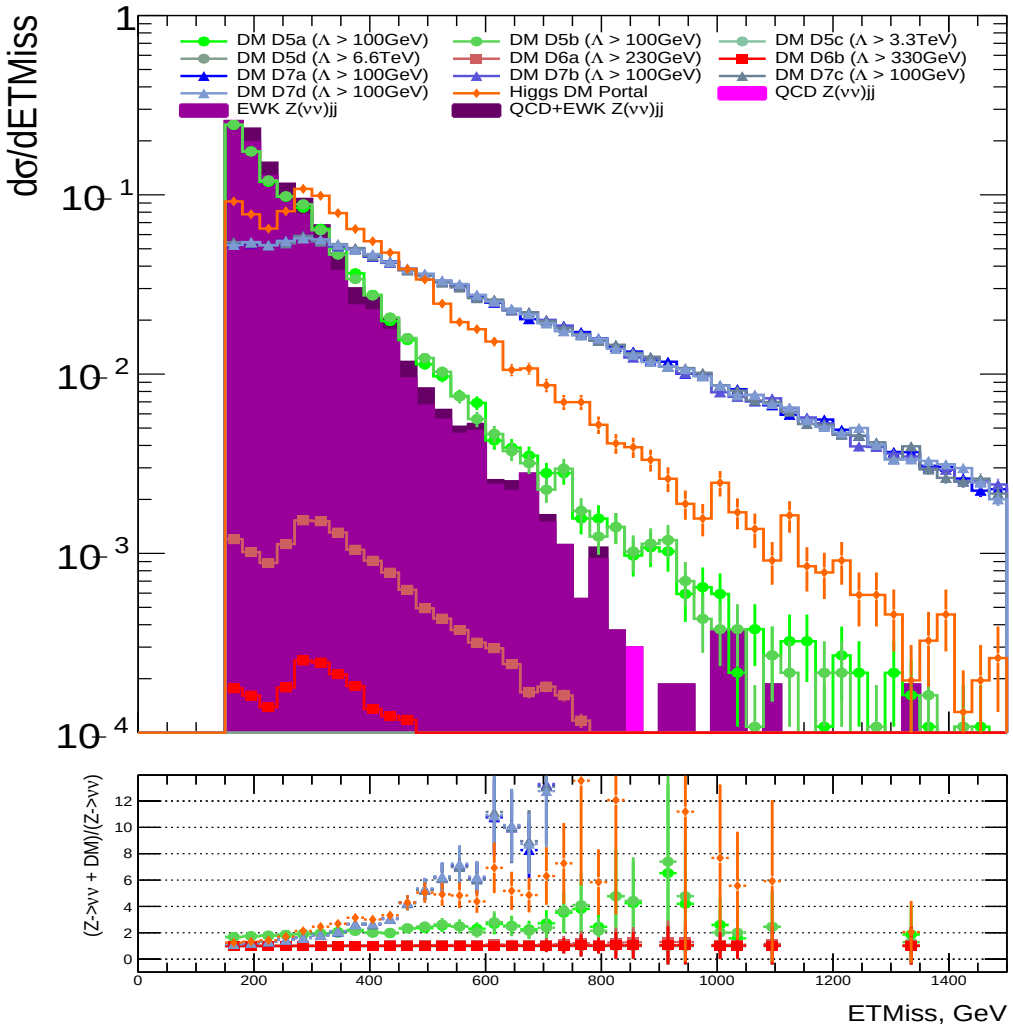
$$\frac{(Z\to\nu\nu)+DM}{Z\to\nu\nu} : Y > 10 > M > 5 > N$$

VBFDM OR Monojet High pT Phase space:

Parameter	D5a	D5b	D5c	D5d	D6a	D6b	D7a	D7b	D7c	D7d
Etmiss	M	M	N	N	Y	Y	Y	Y	Y	Y
Mjj	Y	Y	N	N	N	N	N	N	M	M
Jet1pT	M	M	N	N	N	N	M	M	N	N
Jet2pT	N	N	N	N	N	N	M	M	M	M
Jet1Eta	Y	Y	N	N	N	N	N	N	N	N
Jet2Eta	M	M	N	N	N	N	N	N	N	N
DeltaEta	Y	Y	N	N	N	N	N	N	N	N
DeltaPhi	M	M	N	N	N	N	N	N	N	N

- The parameter that has the best sensitivity to the most dimensions is Etmiss for the VBFDM OR Monojet High pT phase space.

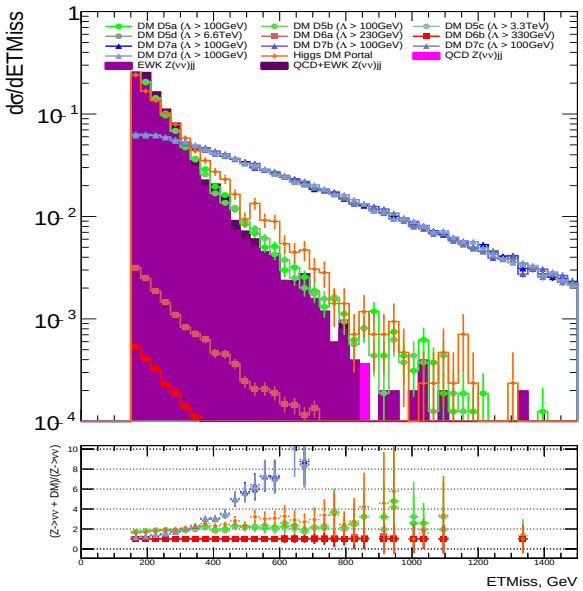
Most broadly sensitive parameter plots: VBFDM OR Monojet High pT Phase space



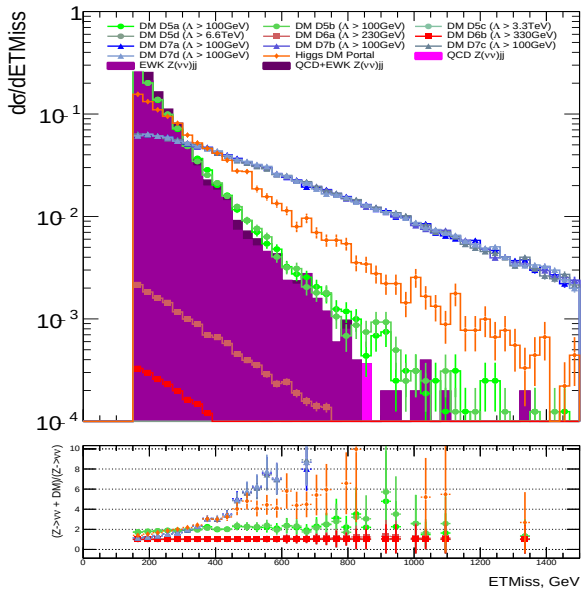
Best parameter?

- Due to the scaling with the EFT constraints, some dimensions would not be seen by any parameters. (D5c, D5d, D6a, D6b)
- Etmiss seems to be the parameter that is sensitive to the most dimensions.
- This doesn't change for the different masses that have been looked at:

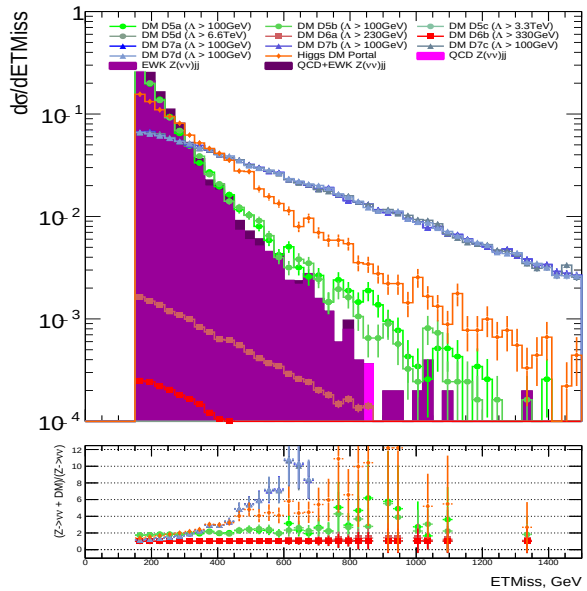
Mass = 10 GeV



Mass = 100 GeV

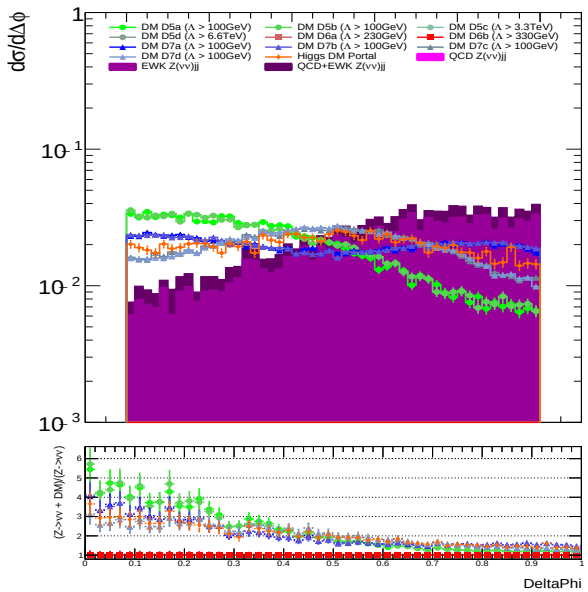


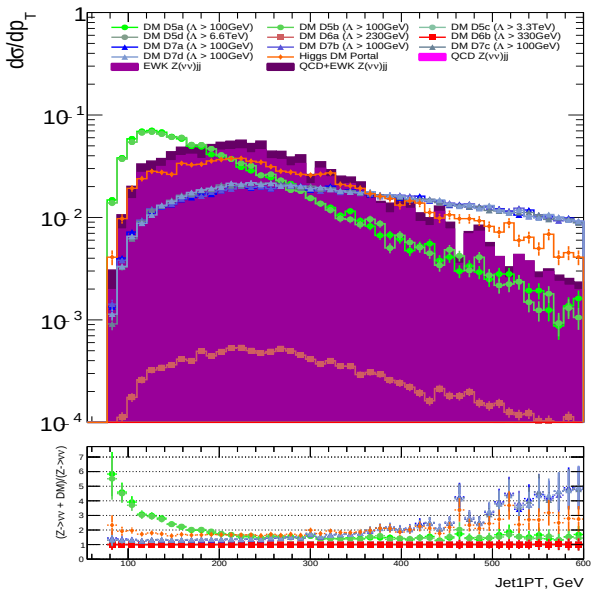
Mass = 1000 GeV

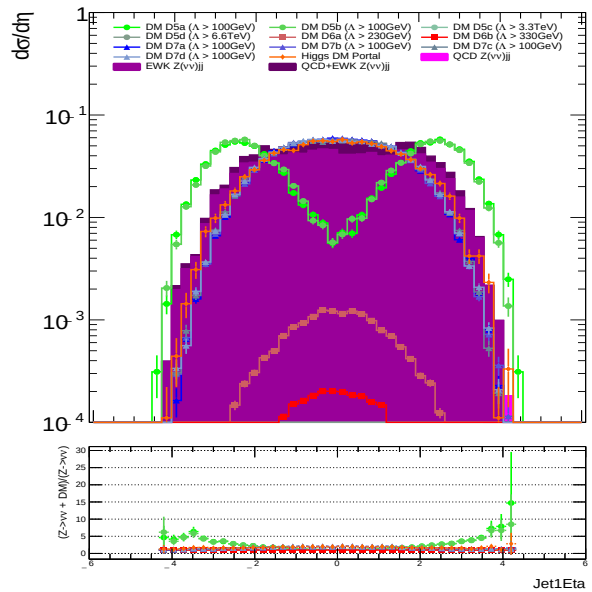


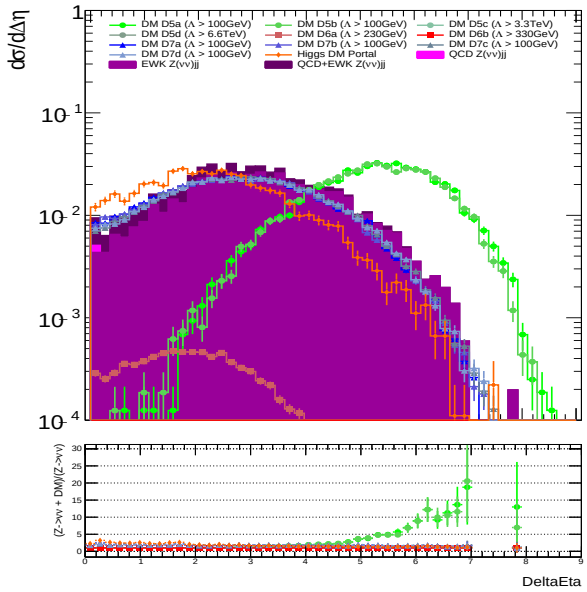
Backup slides

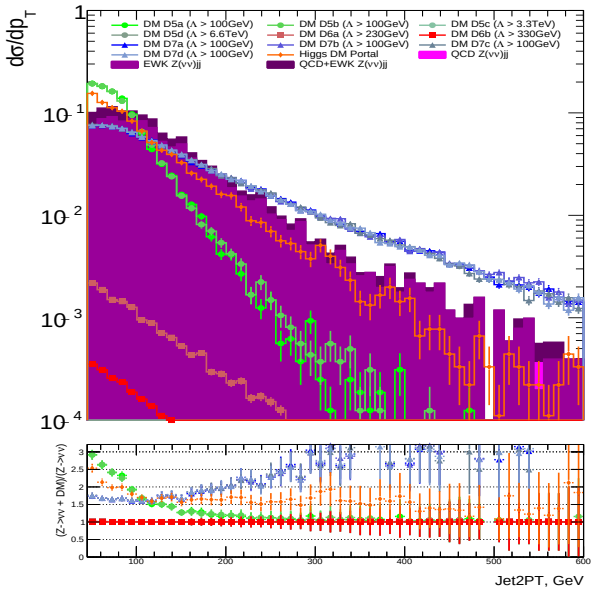
Phase space VBFDM : Other Parameters

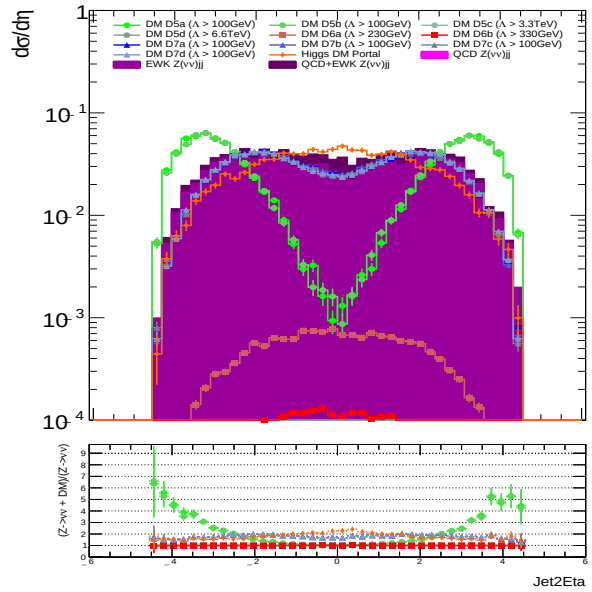




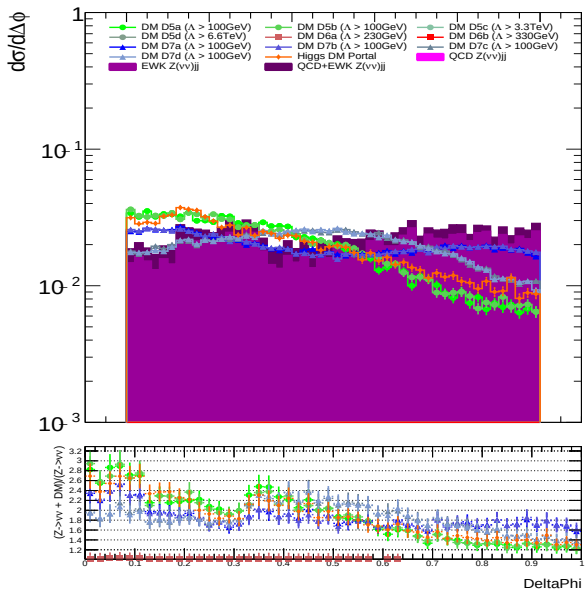


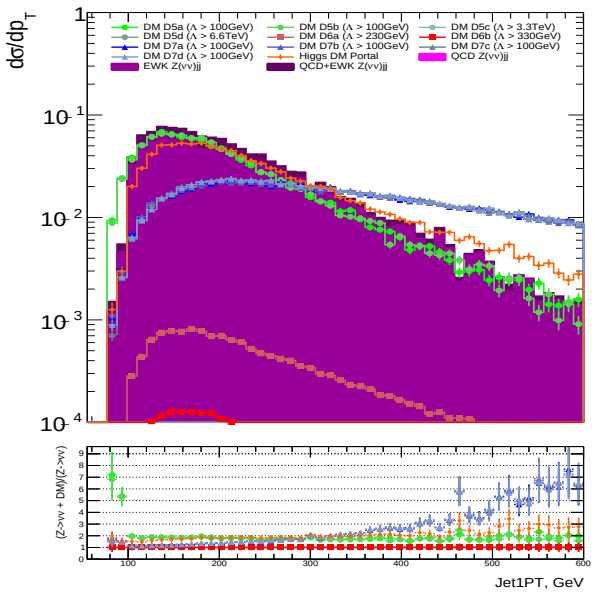


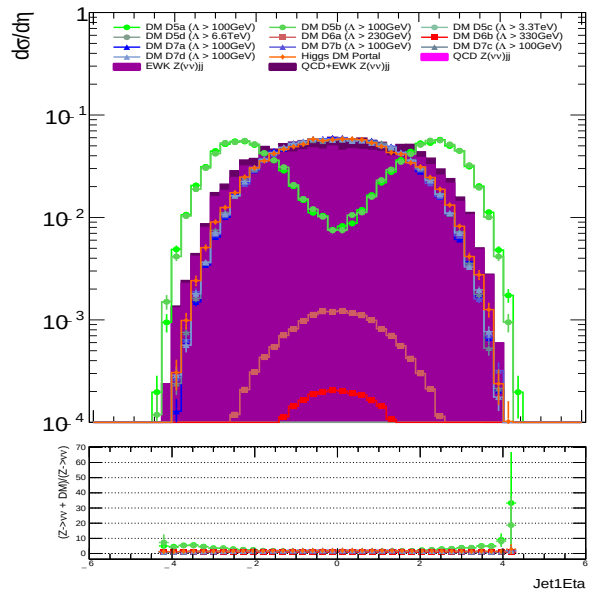


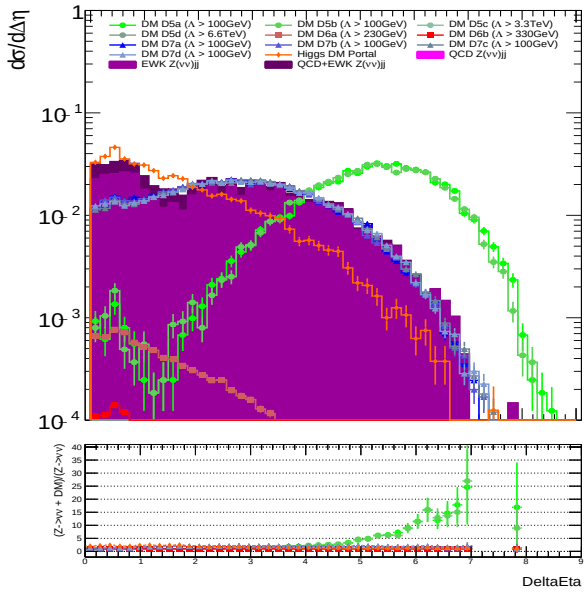


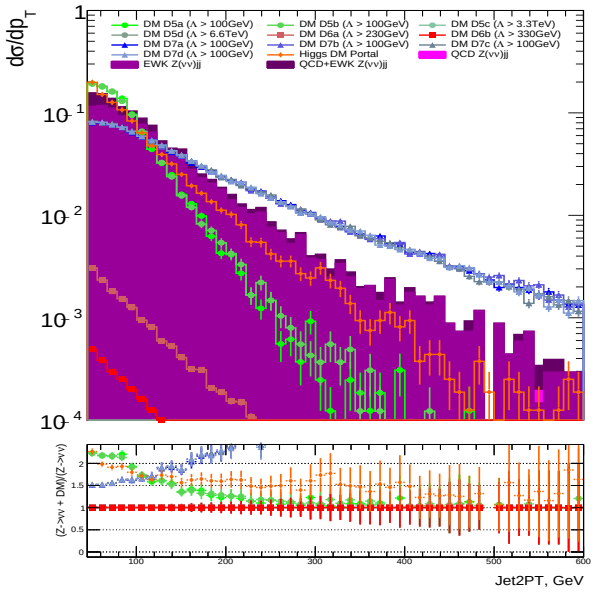
Phase space VBFDM or Monojet: Other Parameters

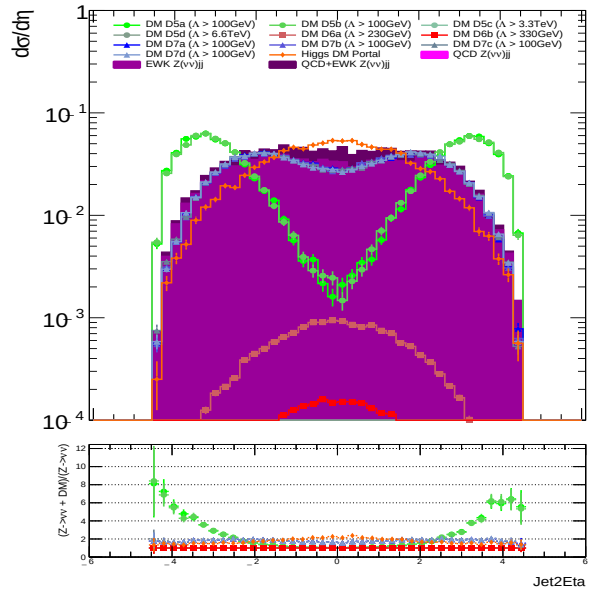












Phase space VBFDM or Monojet High pT: Other Parameters