# EFT DM model kinematics and rates

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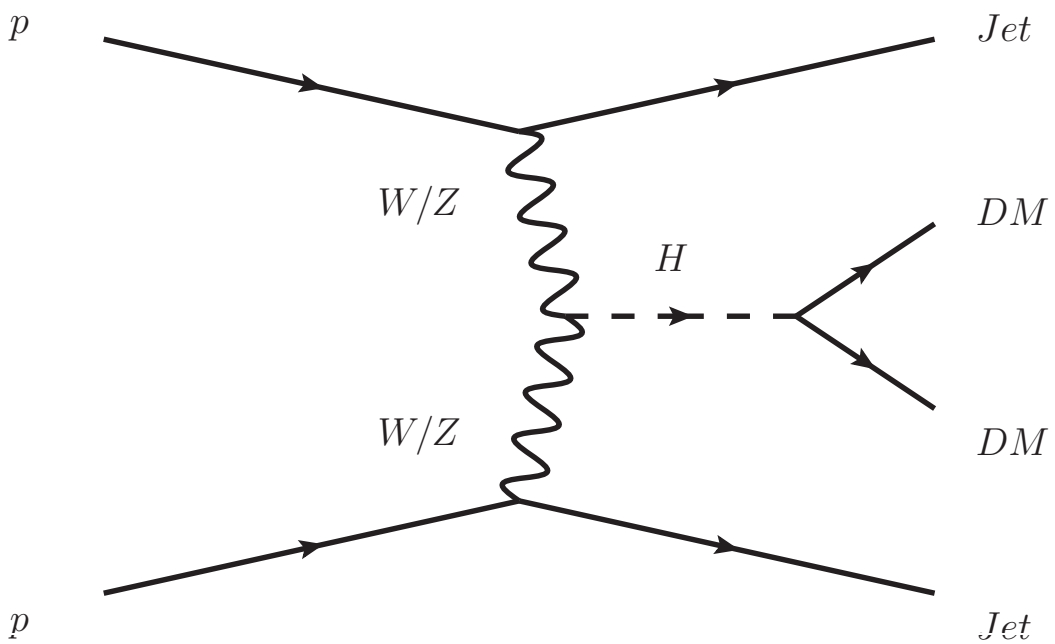
# What I've done:

- Overlaid distributions for various operators/masses.
- Automated run through and added in:
  - The Monojet HighPt and VBFDM OR Monojet HighPt phase spaces.
  - Mass 100GeV (Along with previous 10GeV and 1000GeV)
  - Dimension 5d (Along with previous 5a 5b 5c 6a 6b 7a 7b 7c 7d)
  - Higgs portal model with Higgs = 125GeV
- Ran through Rivet routine with background processes to compare to signal kinematics.
  SM( $Z \rightarrow \nu\ \bar{\nu}$ ) + j j.
- Overlaid these background distributions with the DM distributions.

# Higgs 'Dark Portal':




- Interactions are the same as the BSM EFT.
- Production of Higgs followed by a decay into dark matter.

# Phasespace Selection Cuts

**VBFZ Baseline:** Jet1PT >55 GeV; Jet2PT >45 GeV; NumJets $\geq$ 2.

**VBFZ HighMass:** Mjj >1000 GeV; Jet1PT >55 GeV; Jet2PT >45 GeV; NumJets $\geq$ 2.

**VBFZ Search:** Mjj >250 GeV; Jet1PT >55 GeV; Jet2PT >45 GeV; NumJets $\geq$ 2.

**VBFDM:** Mjj >250 GeV; Jet1PT >55 GeV; Jet2PT >45 GeV; NumJets $\geq$ 2; eta <4.4; MET >150 GeV.

**Monojet:** Jet1PT >100 GeV; NumJets $\geq$ 1; eta <4.4; MET >150 GeV.

**Monojet HighPt:** Jet1PT >250 GeV; NumJets $\geq$ 1; eta <4.4; MET >250 GeV.

**VBFDM OR Monojet:** VBFDM; Monojet.

**VBFDM OR Monojet HighPt:** VBFDM; Monojet HighPt.

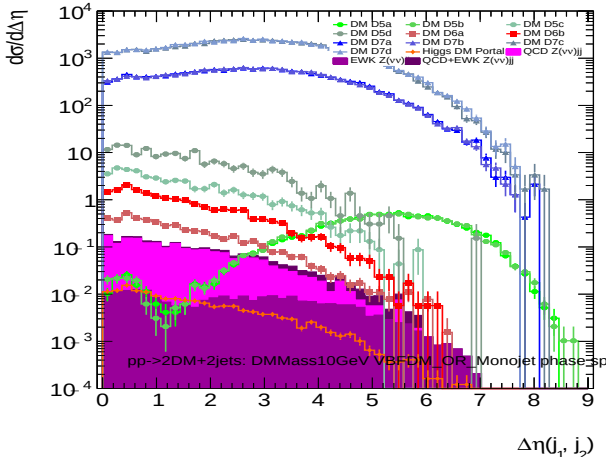
# Distributions of interest:

## Main distributions that have been produced:

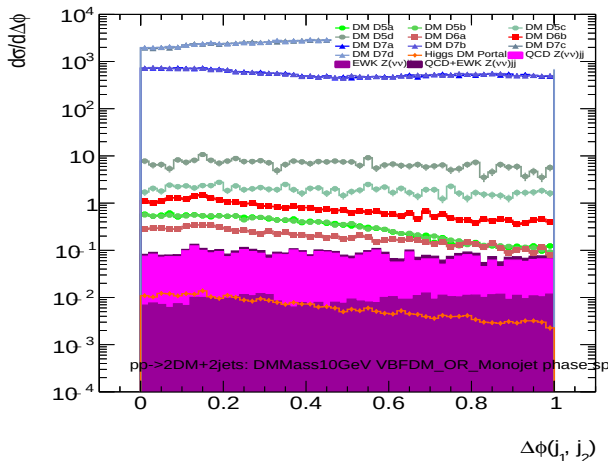
- Transverse Momentum of Jets, $P_T(j1)$ and $P_T(j2)$.
- Dijet Mass, $M_{jj}$.
- Missing Transverse Energy, $\not{E}_T$.
- Difference in Jet Angle $\Delta\phi$.
- Difference in Jet Pseudorapidity, $\Delta\eta$.

# Distributions for VBFDM OR Monojet Selection, 10 GeV

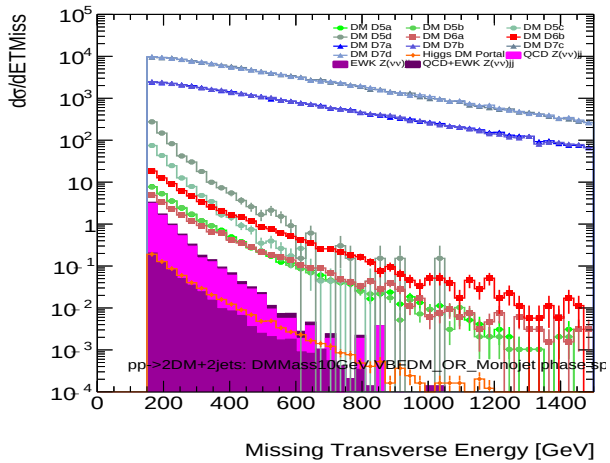
## DeltaEta



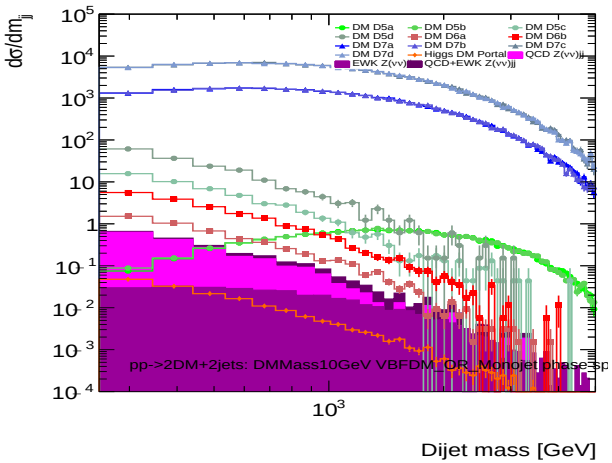

## DeltaPhi



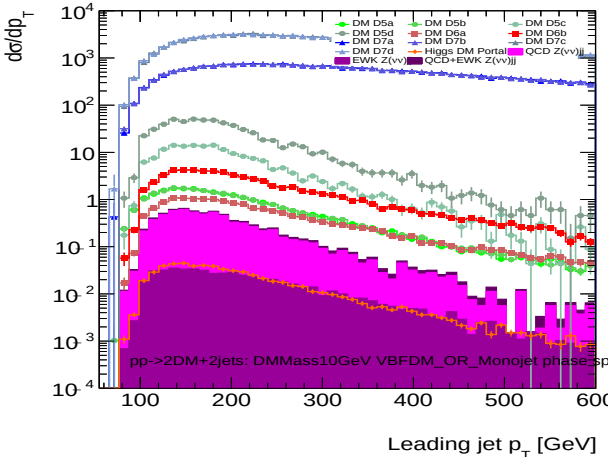

## ETMiss



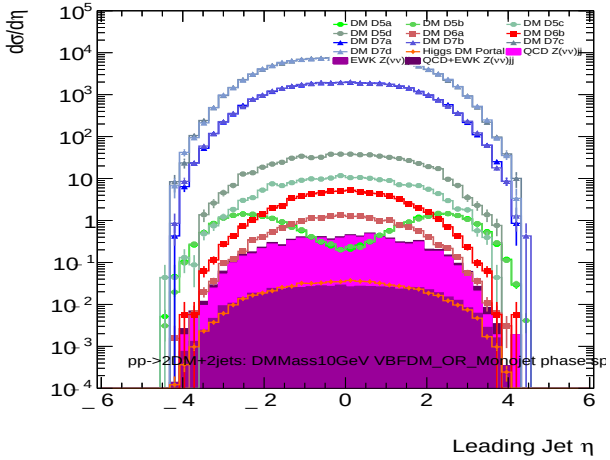

## Mjj




## Jet1PT

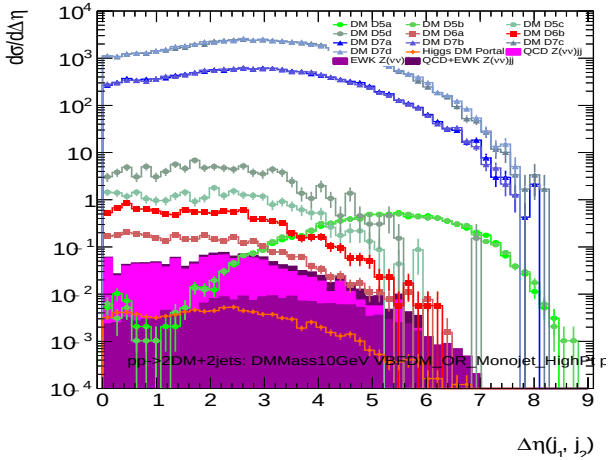



## Jet1Eta

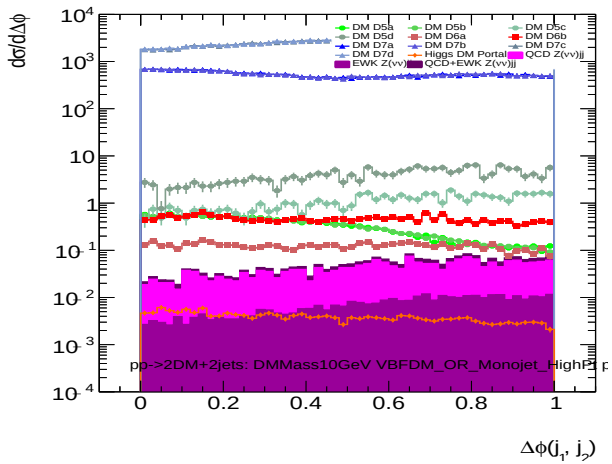


# Distributions for VBFDM OR Monojet HighPt Selection, 10 GeV

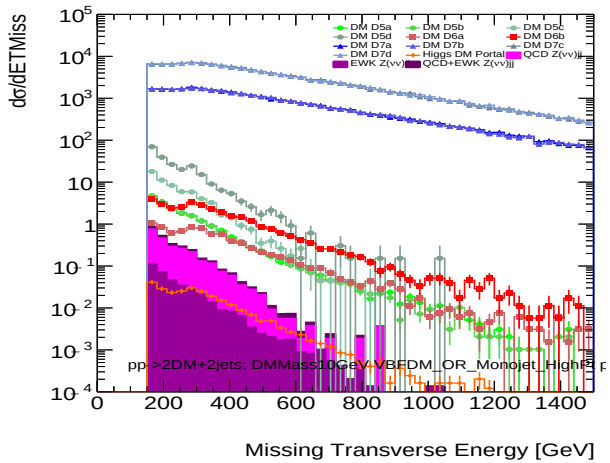
## DeltaEta



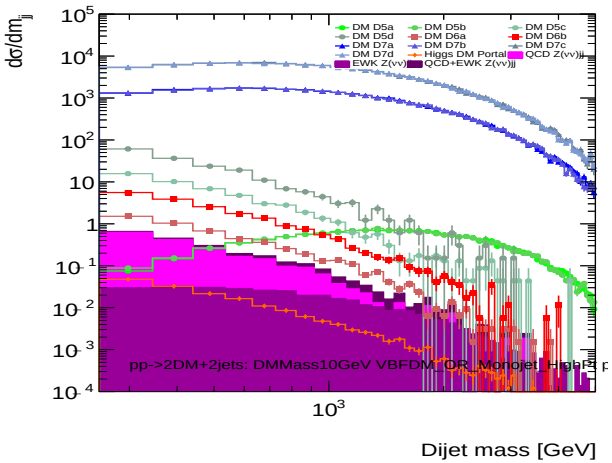

## DeltaPhi



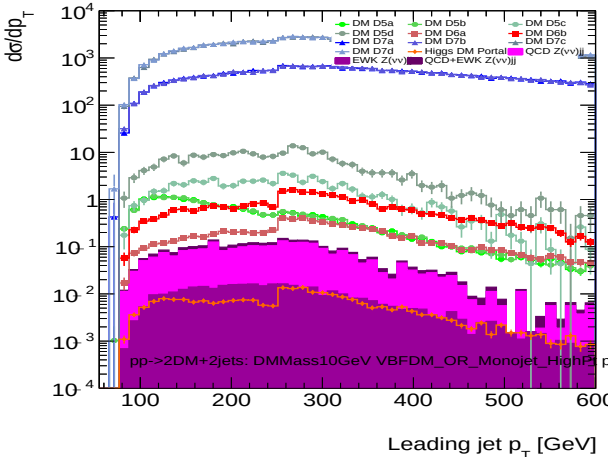

## ETMiss



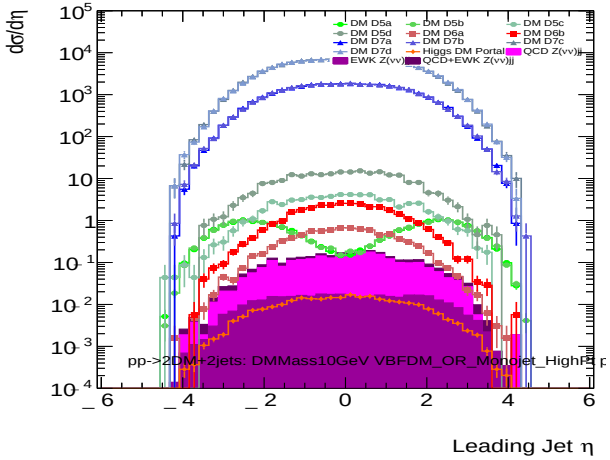

## Mjj




## Jet1PT

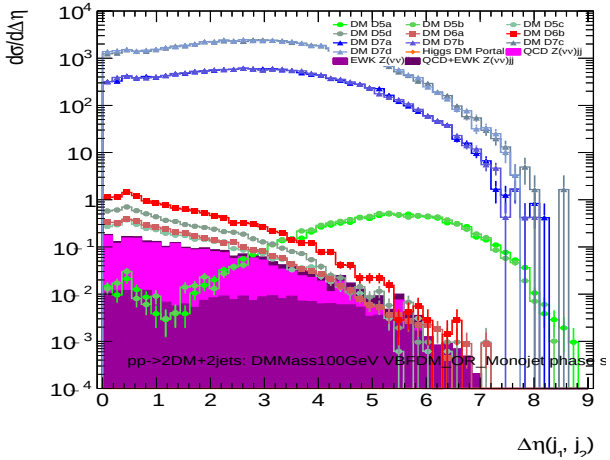



## Jet1Eta

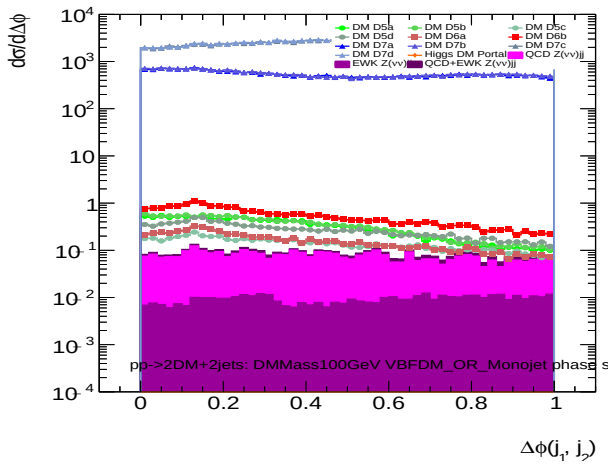


# Distributions for VBFDM OR Monojet Selection, 100 GeV

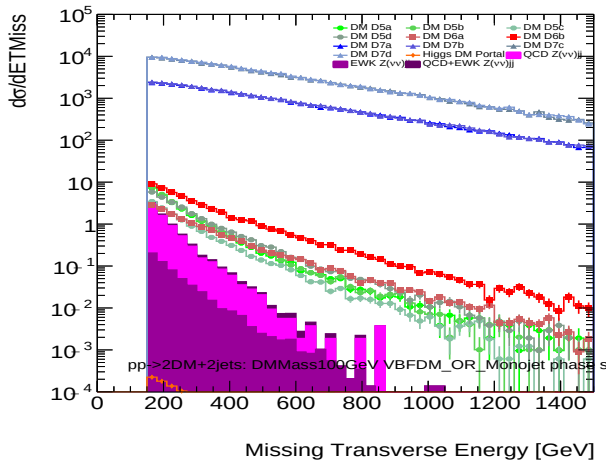
## DeltaEta



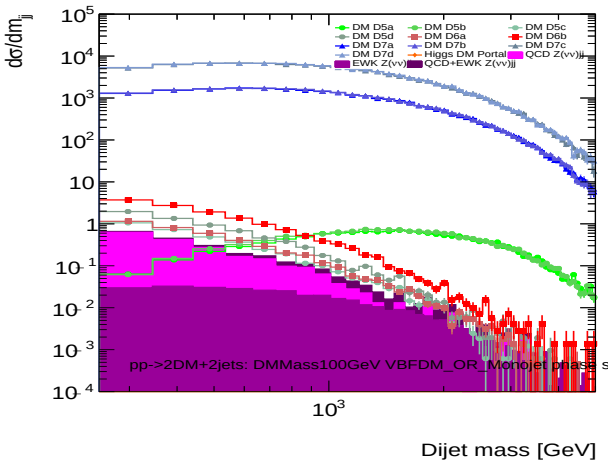

## DeltaPhi



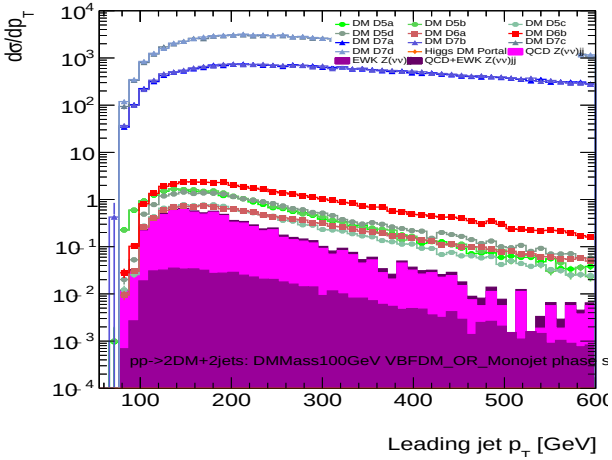

## ETMiss



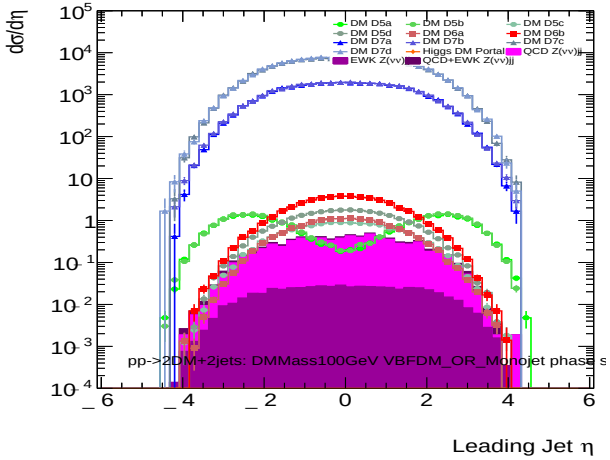

## Mjj




## Jet1PT

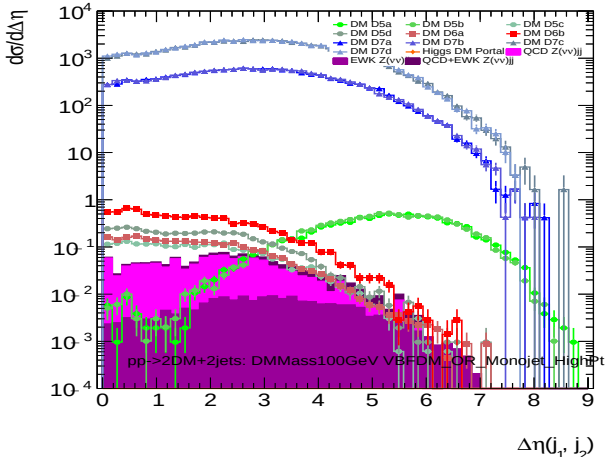



## Jet1Eta

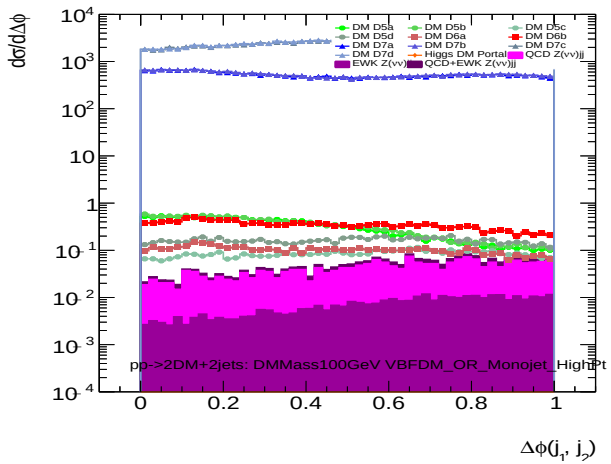


# Distributions for VBFDM OR Monojet HighPt Selection, 100 GeV

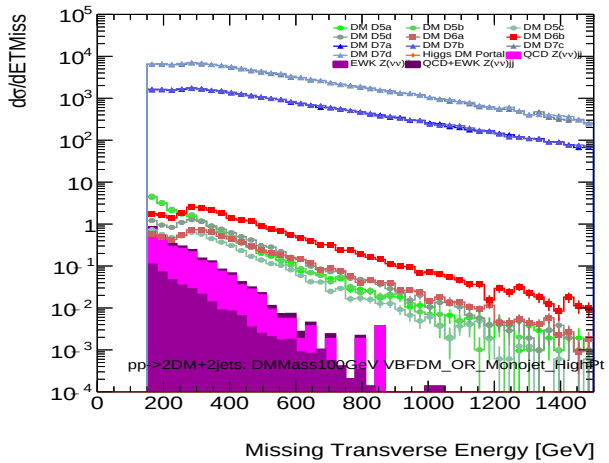
## DeltaEta



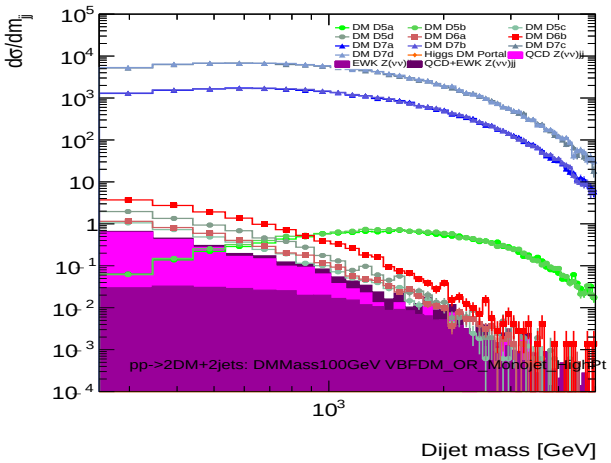

## DeltaPhi



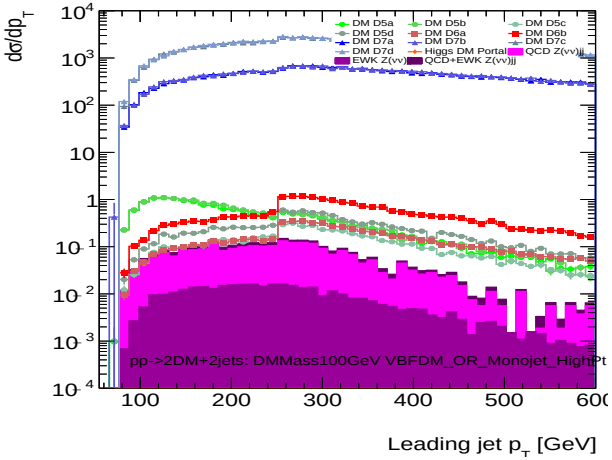

## ETMiss



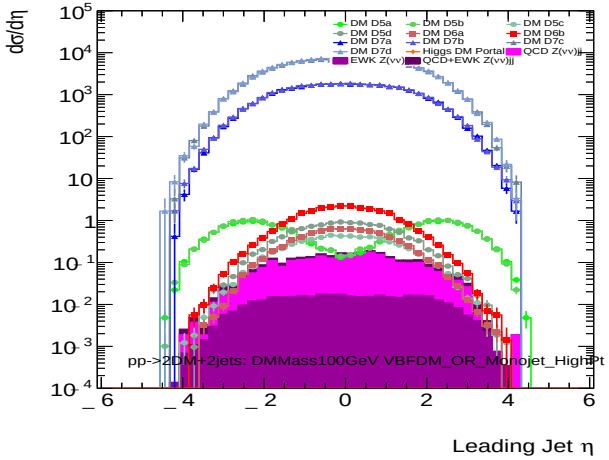

## Mjj




## Jet1PT

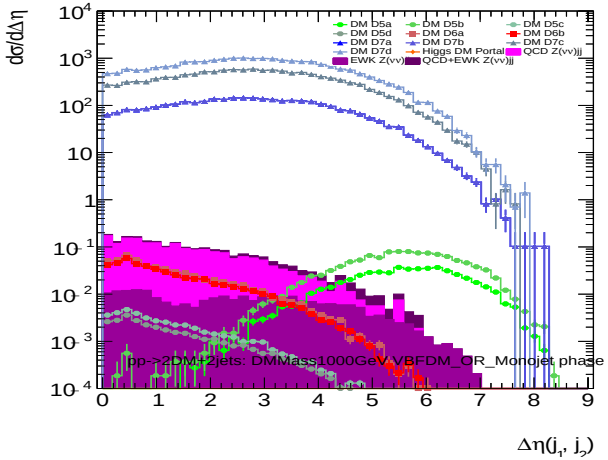



## Jet1Eta

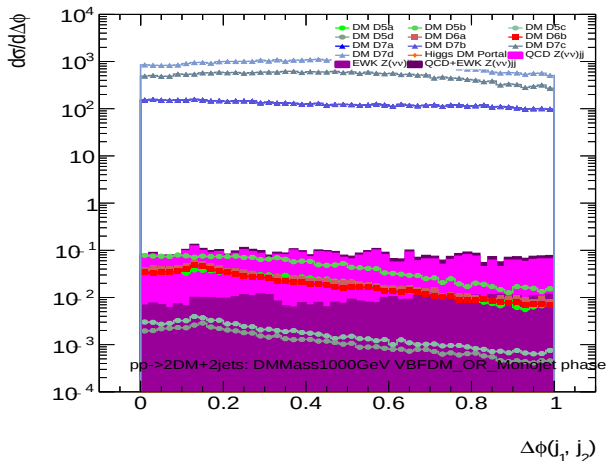


# Distributions for VBFDM OR Monojet Selection, 1000 GeV

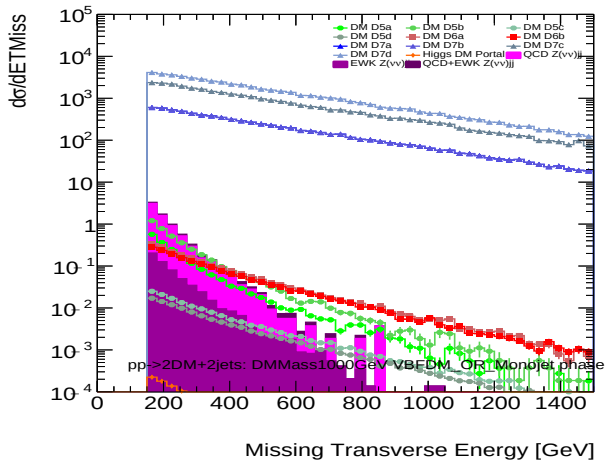
## DeltaEta



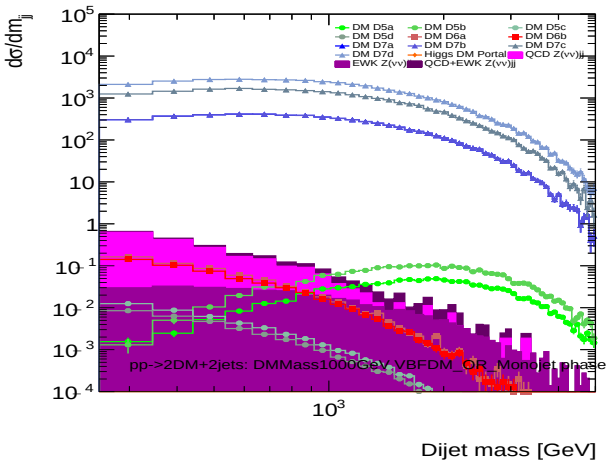

## DeltaPhi



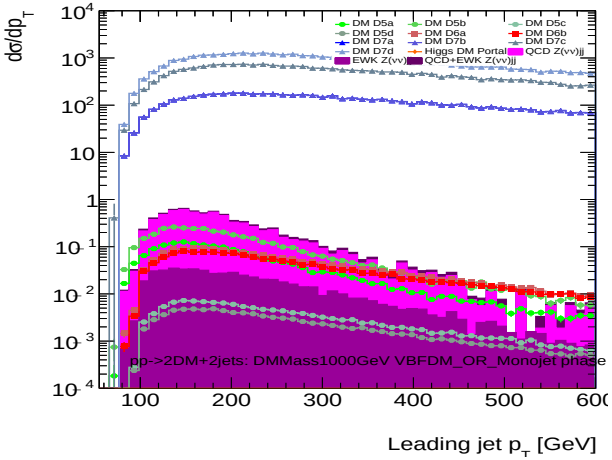

## ETMiss



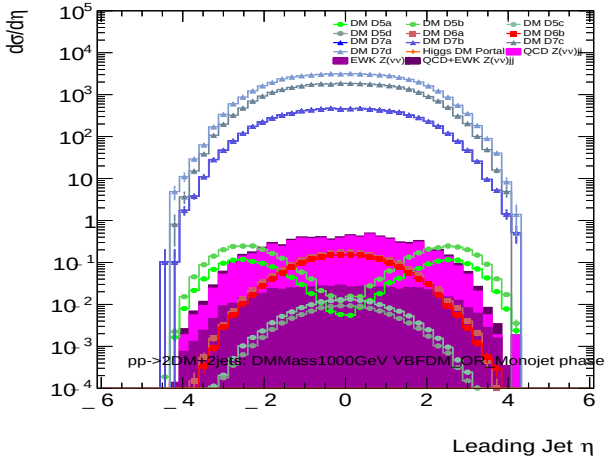

## Mjj




## Jet1PT

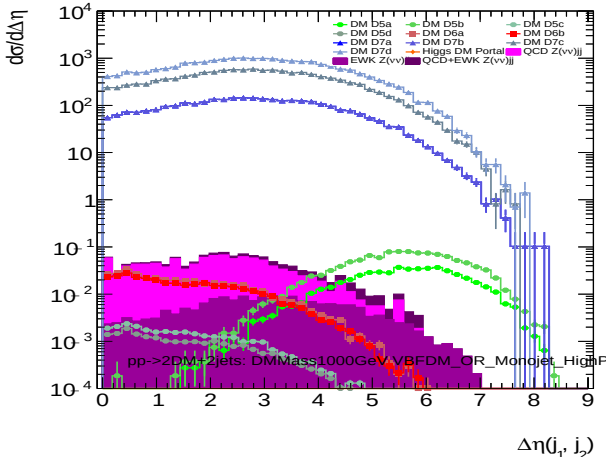



## Jet1Eta

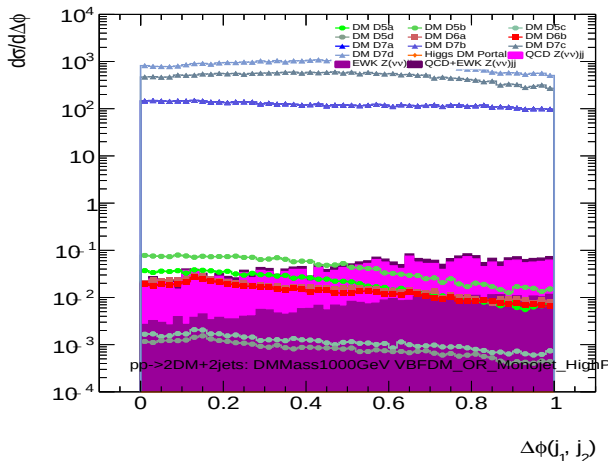


# Distributions for VBFDM OR Monojet HighPt Selection, 1000 GeV

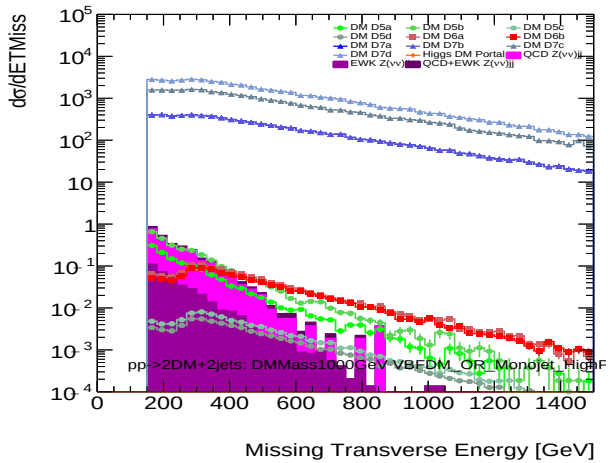
## DeltaEta



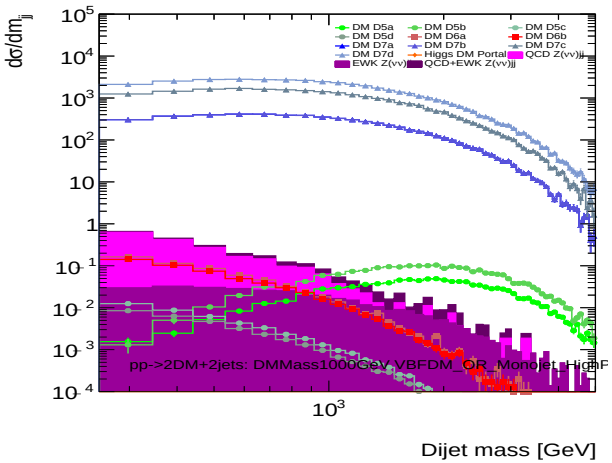

## DeltaPhi



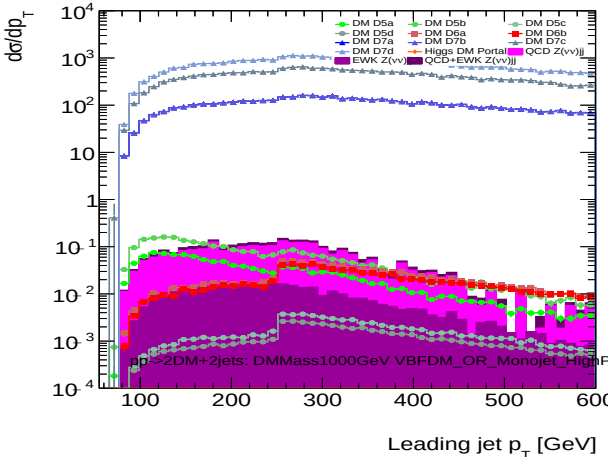

## ETMiss



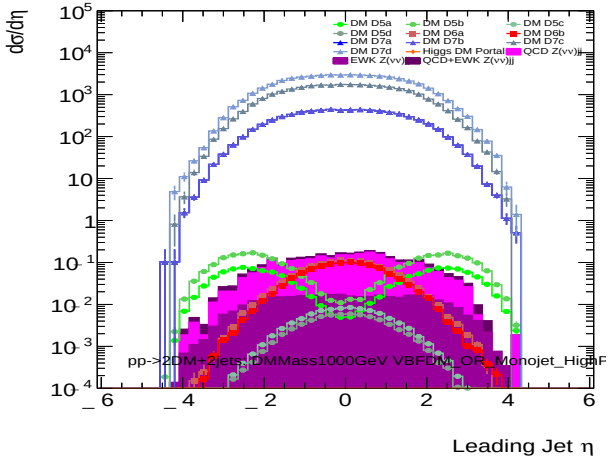

## Mjj




## Jet1PT




## Jet1Eta

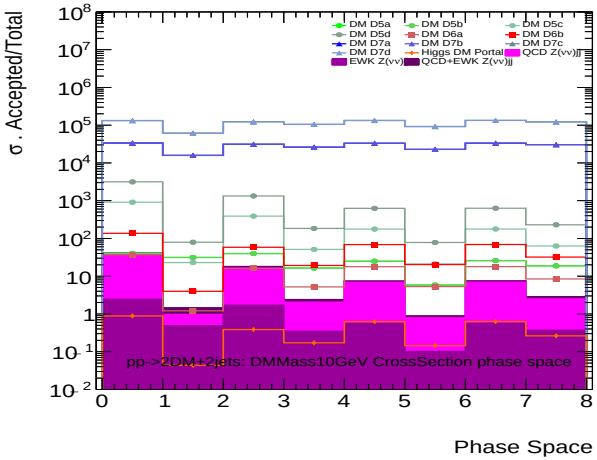


# Scaled Cross-section:

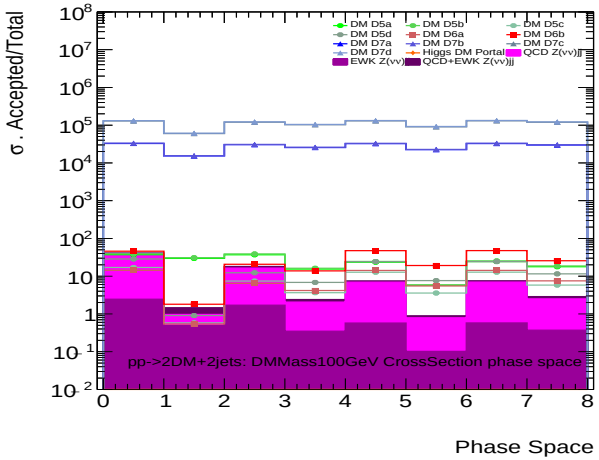
## Phase Space Key:

1 = VBFZ Baseline; 2 = VBFZ HighMass; 3 = VBFZ Baseline; 4 = VBFDM;
5 = Monojet; 6 = Monojet HighPt; 7 = VBFDM OR Monojet;
8 = VBFDM OR Monojet HighPt

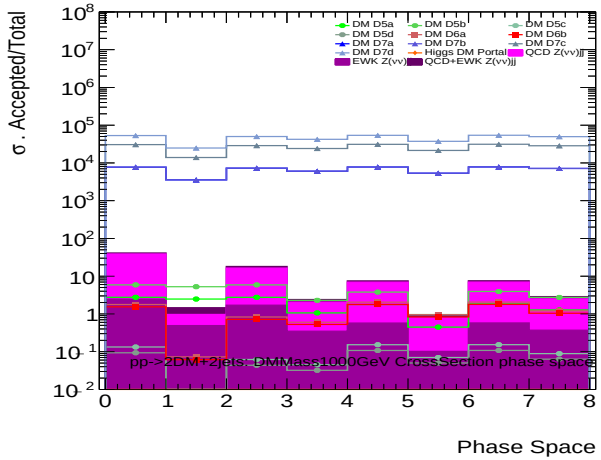
DM Mass 10 GeV




DM Mass 100 GeV

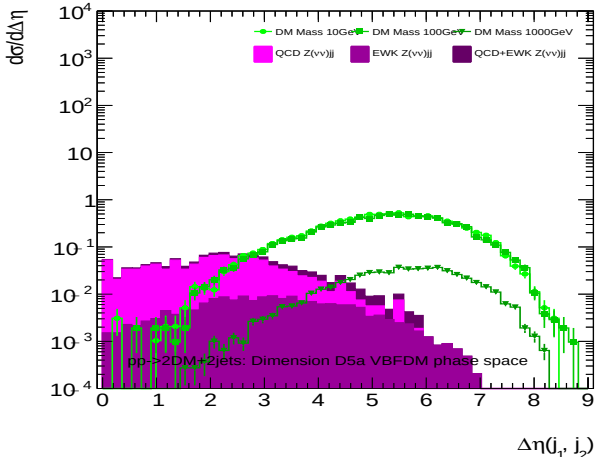



DM Mass 1000 GeV

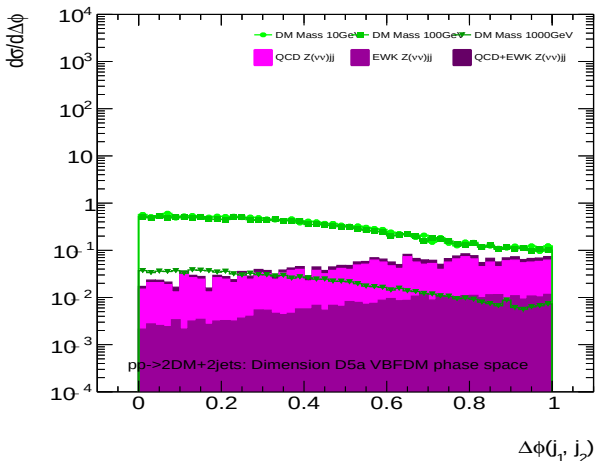


# Distributions for D5a, VBFDM Selection

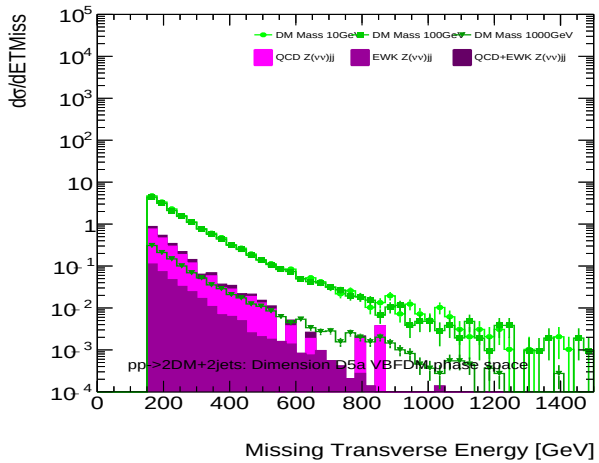
## DeltaEta



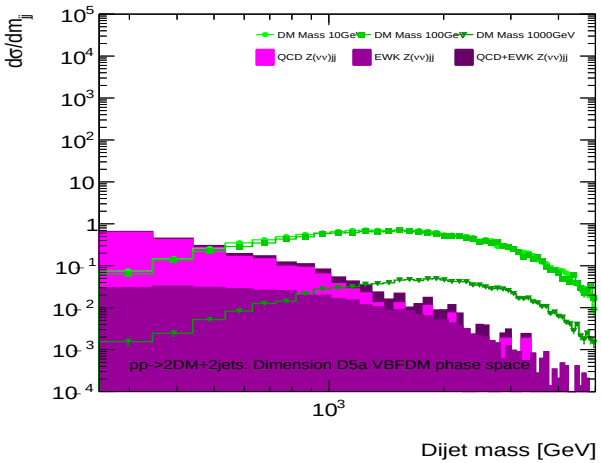

## DeltaPhi



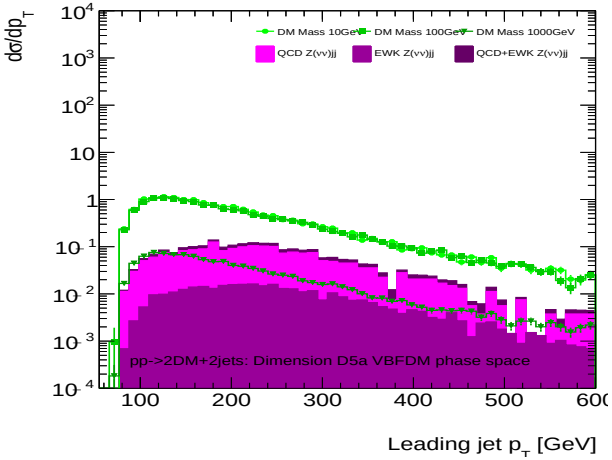

## ETMiss



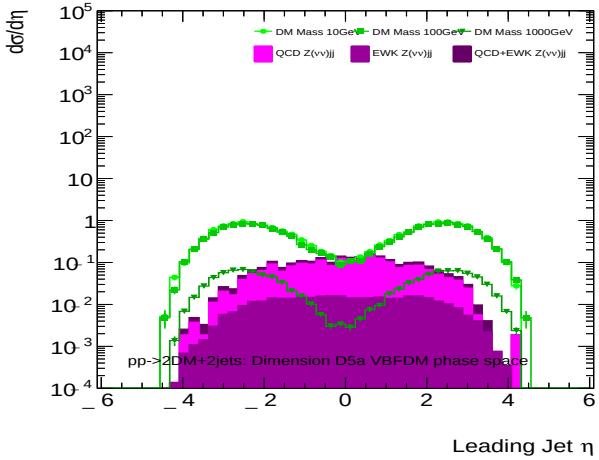

## Mjj




## Jet1PT

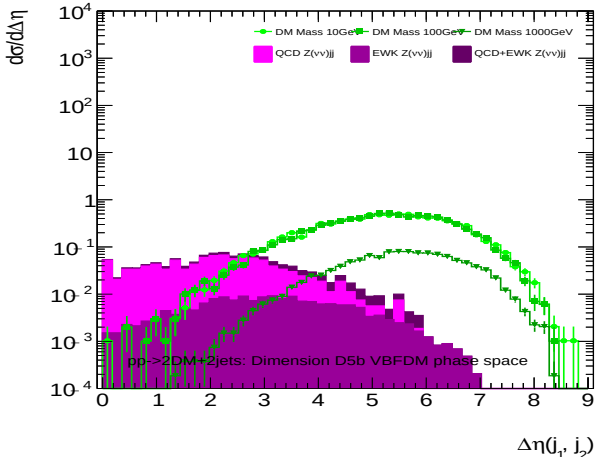



## Jet1Eta

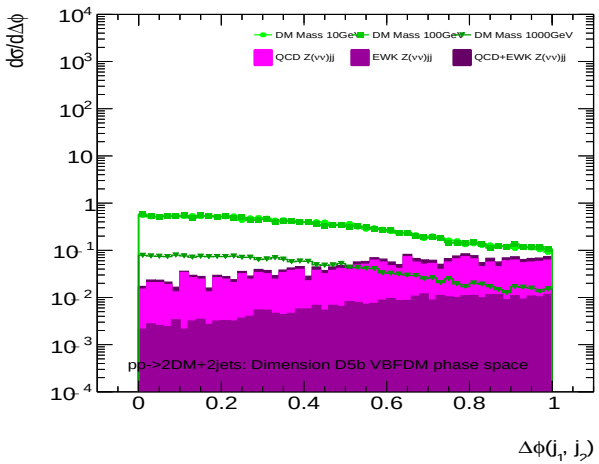


# Distributions for D5b, VBFDM Selection

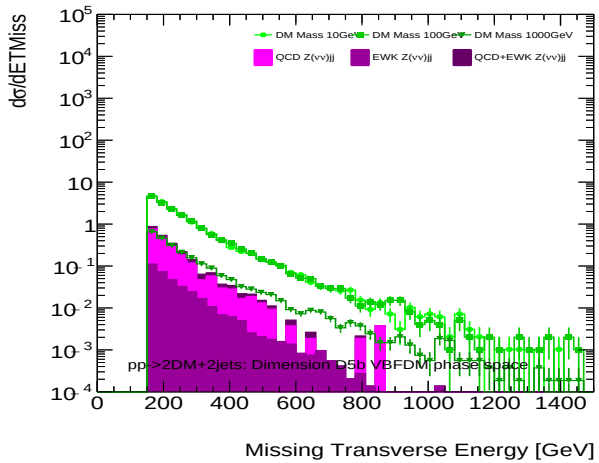
## DeltaEta



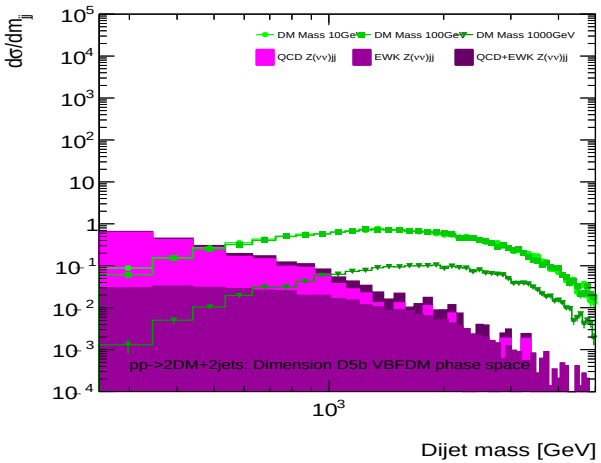

## DeltaPhi



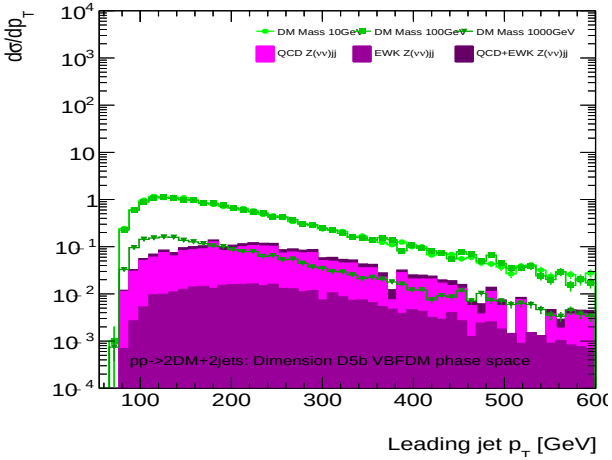

## ETMiss



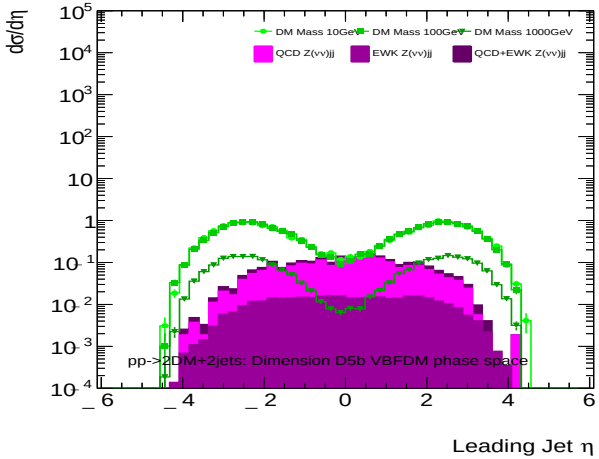

## Mjj




## Jet1PT

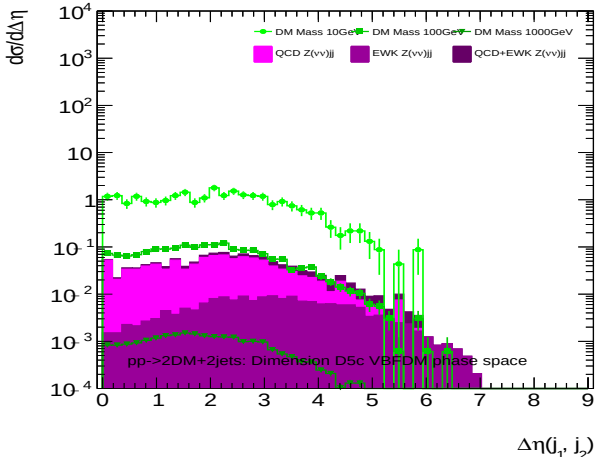



## Jet1Eta

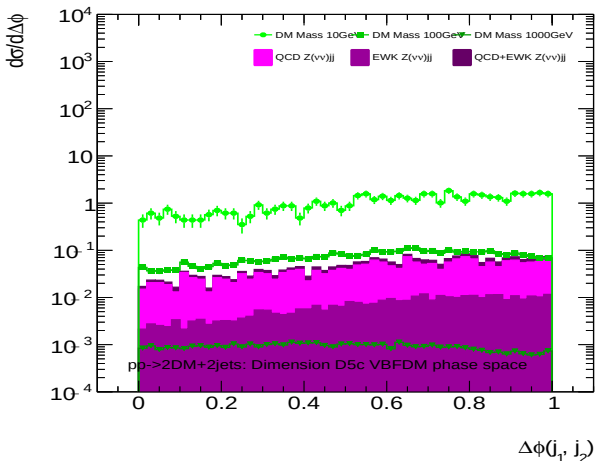


# Distributions for D5c, VBFDM Selection

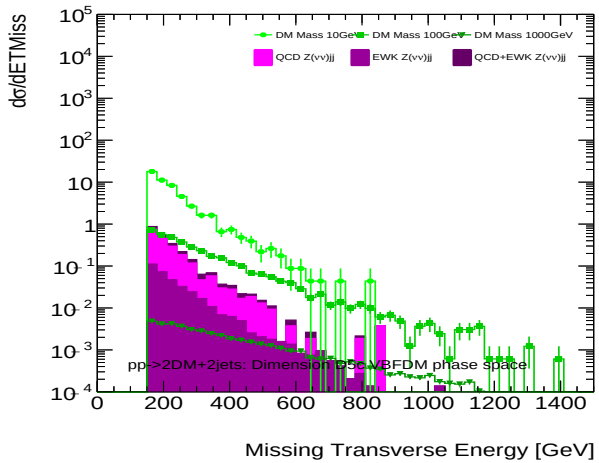
## DeltaEta



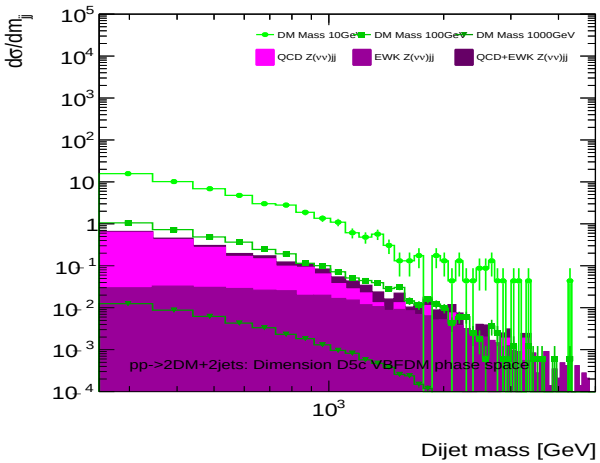

## DeltaPhi



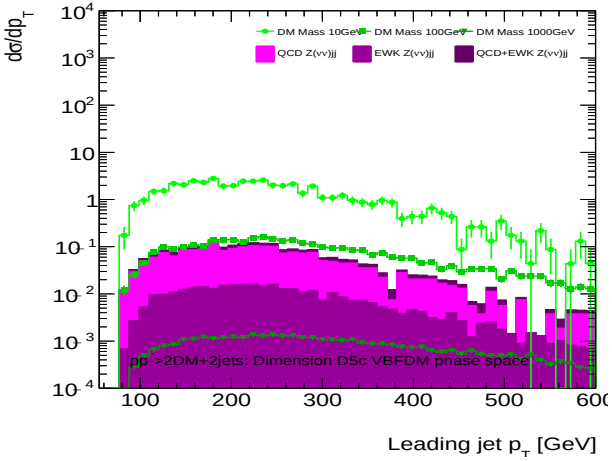

## ETMiss



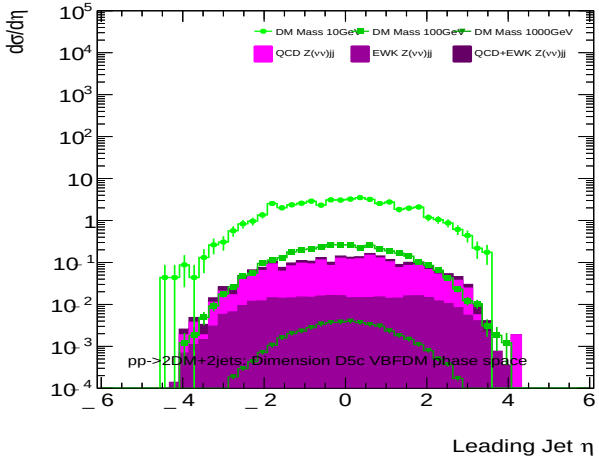

## Mjj




## Jet1PT

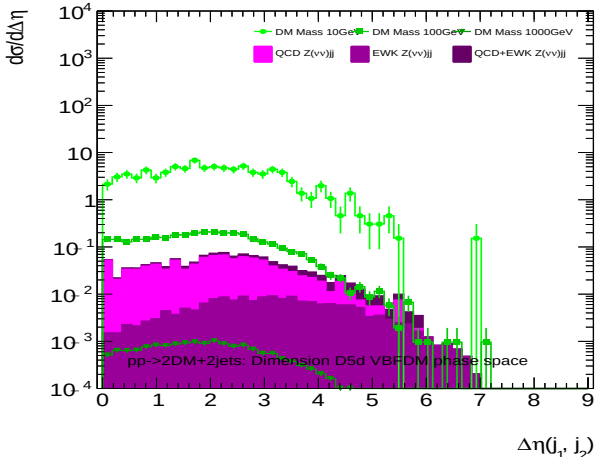



## Jet1Eta

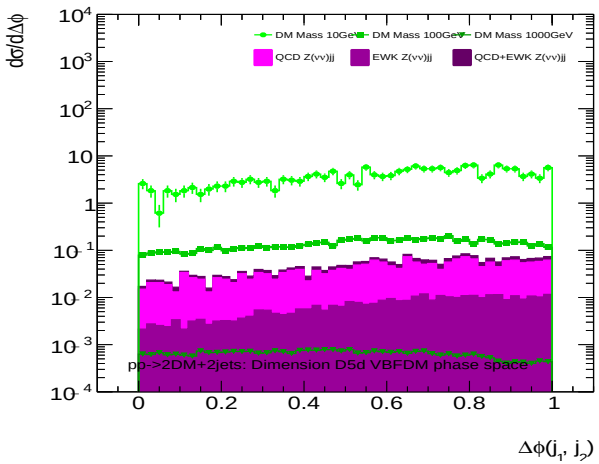


# Distributions for D5d, VBFDM Selection

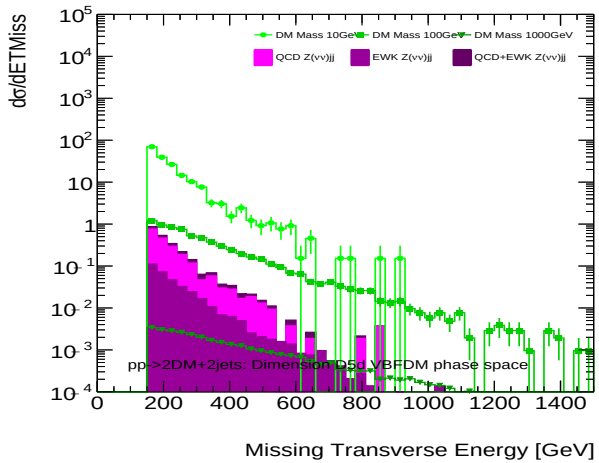
## DeltaEta



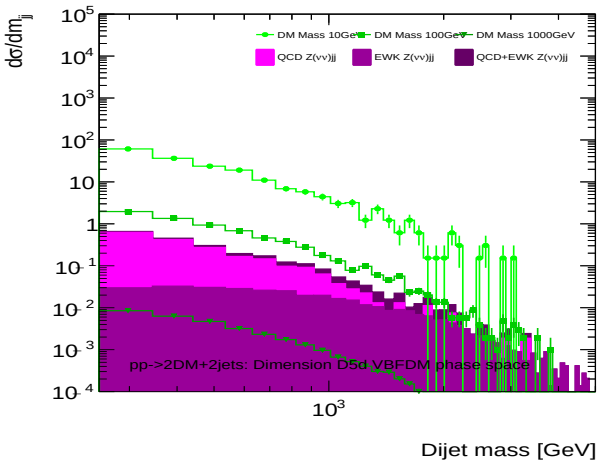

## DeltaPhi



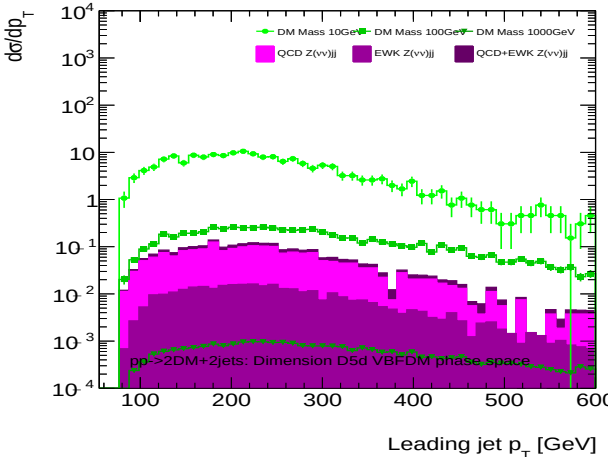

## ETMiss



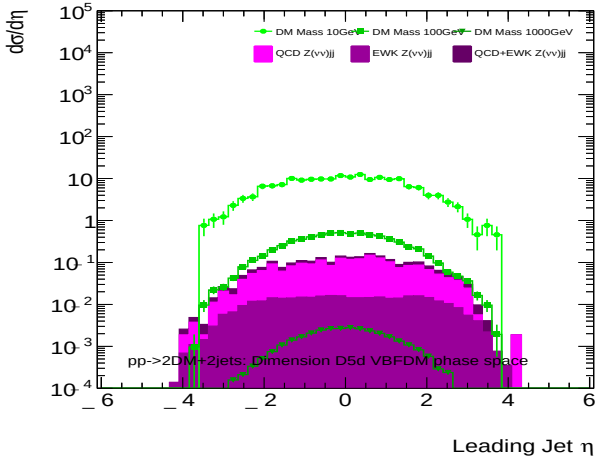

## Mjj




## Jet1PT

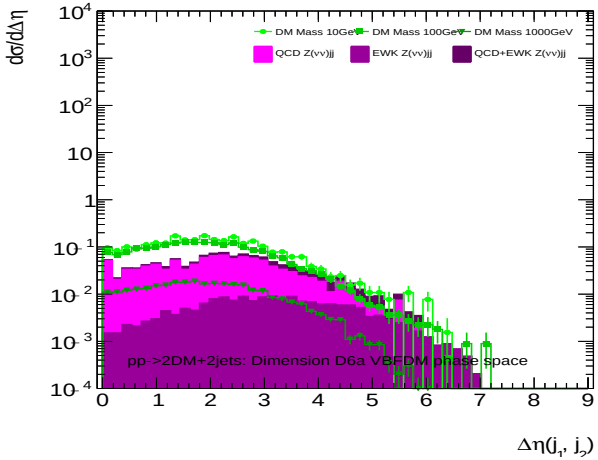



## Jet1Eta

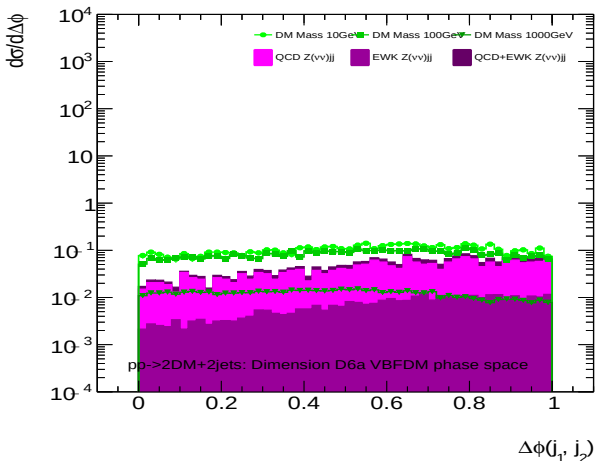


# Distributions for D6a, VBFDM Selection

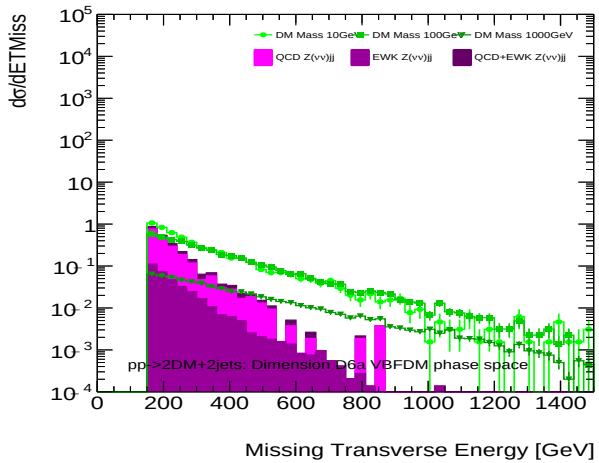
## DeltaEta



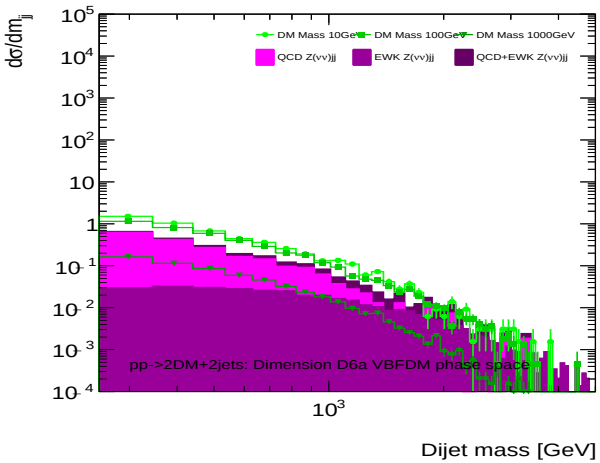

## DeltaPhi



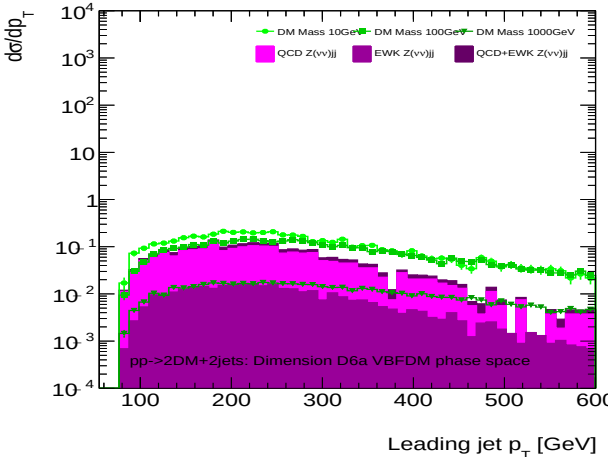

## ETMiss



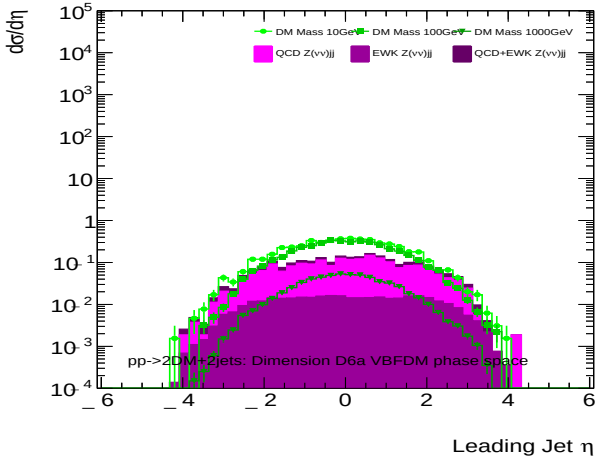

## Mjj




## Jet1PT

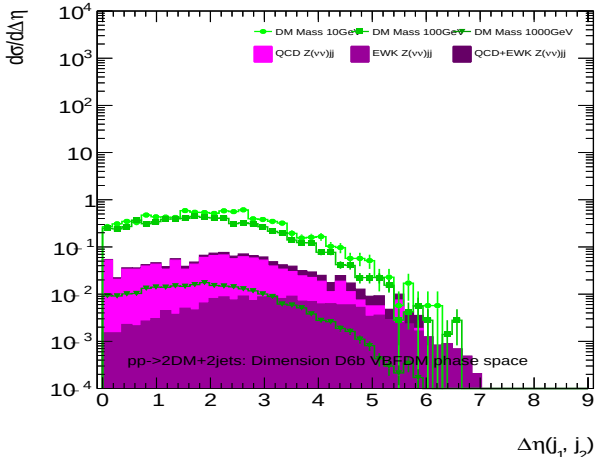



## Jet1Eta

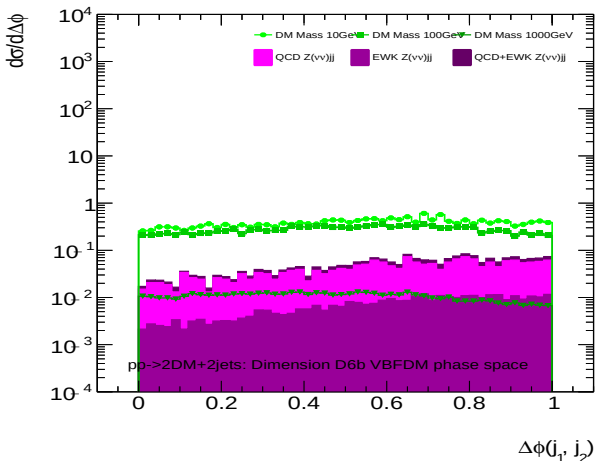


# Distributions for D6b, VBFDM Selection

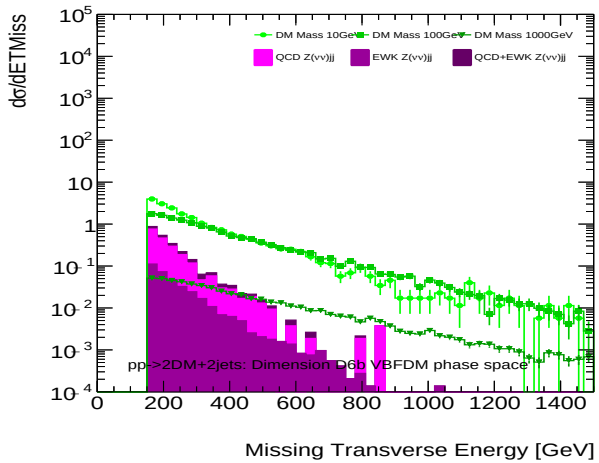
## DeltaEta



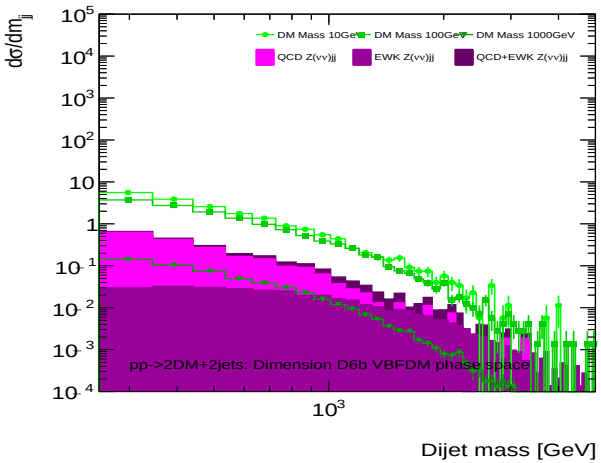

## DeltaPhi



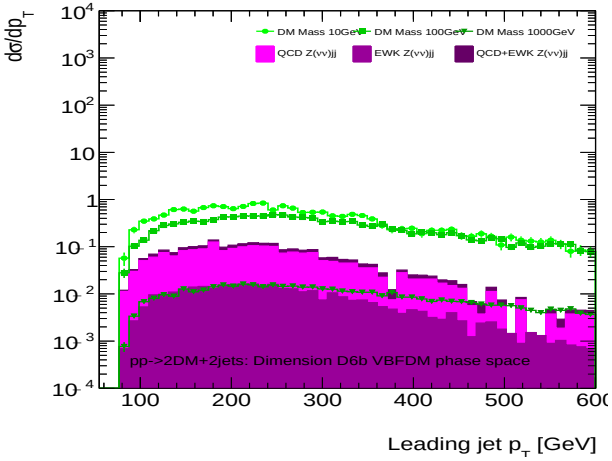

## ETMiss



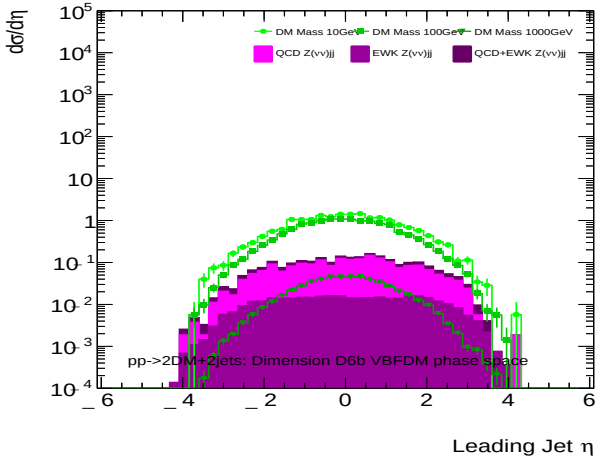

## Mjj




## Jet1PT

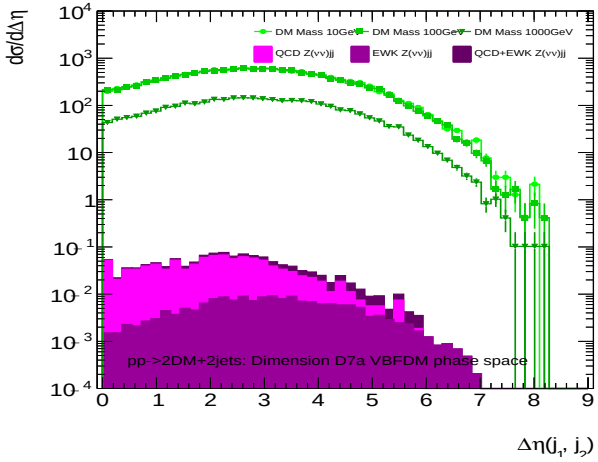



## Jet1Eta

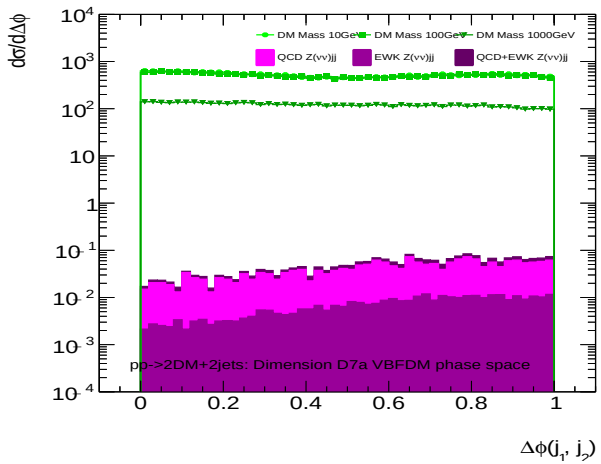


# Distributions for D7a, VBFDM Selection

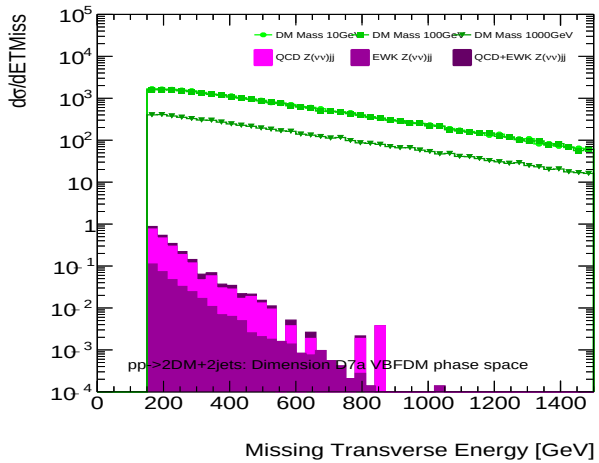
## DeltaEta



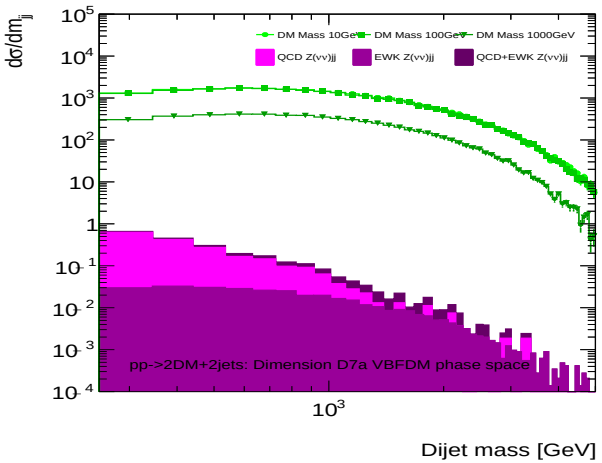

## DeltaPhi



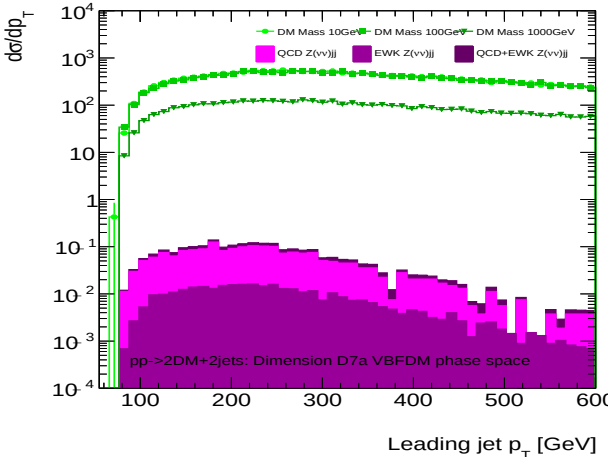

## ETMiss



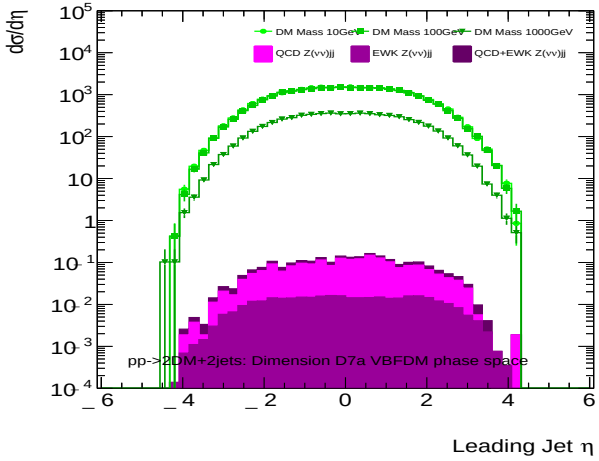

## Mjj




## Jet1PT

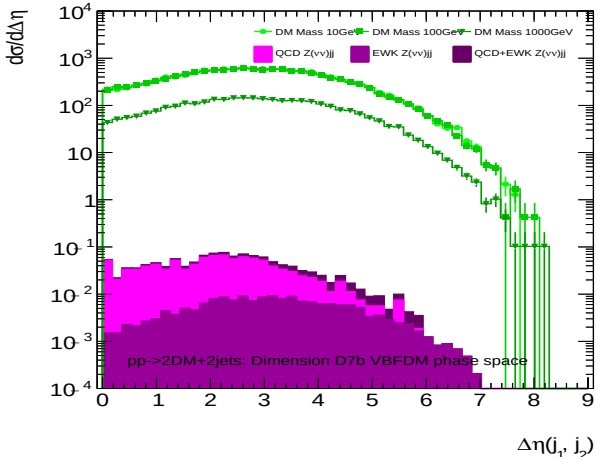



## Jet1Eta

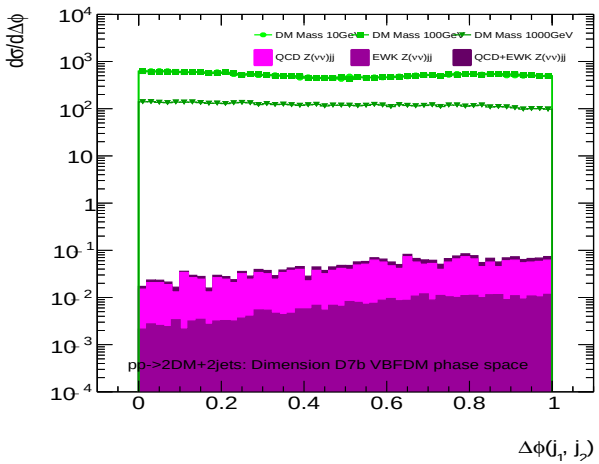


# Distributions for D7b, VBFDM Selection

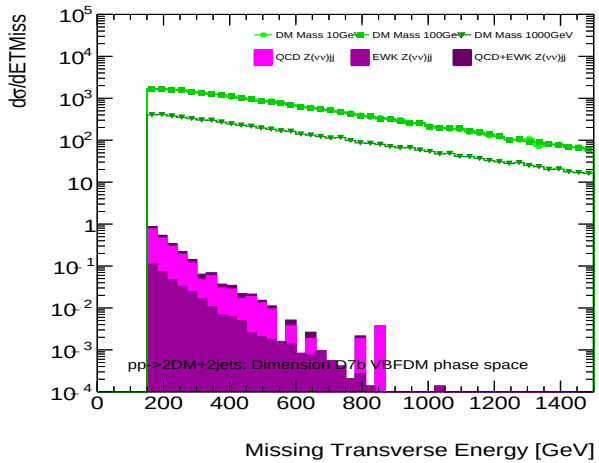
## DeltaEta



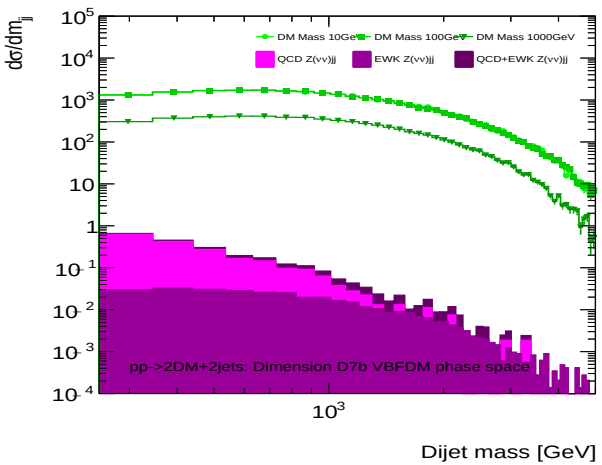

## DeltaPhi



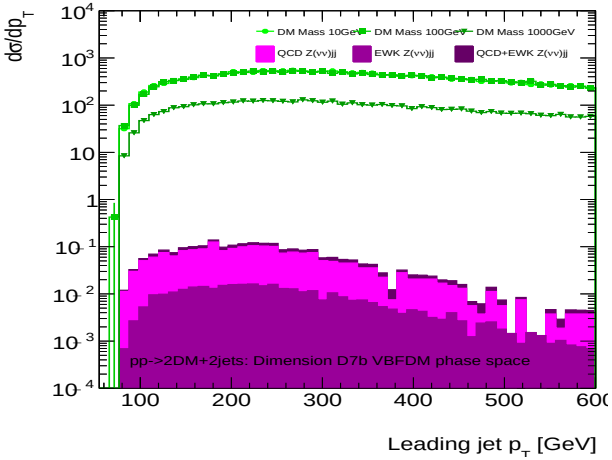

## ETMiss



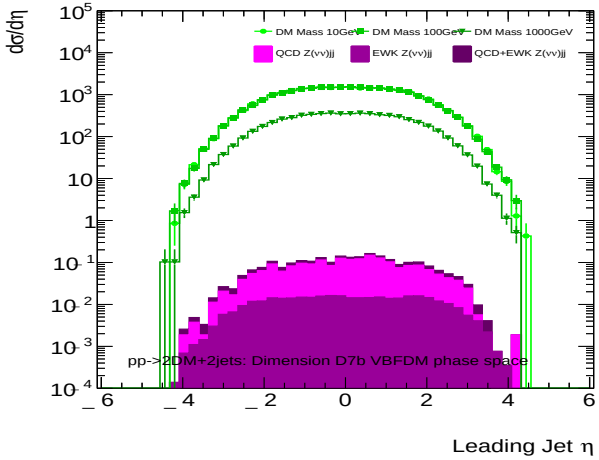

## Mjj




## Jet1PT

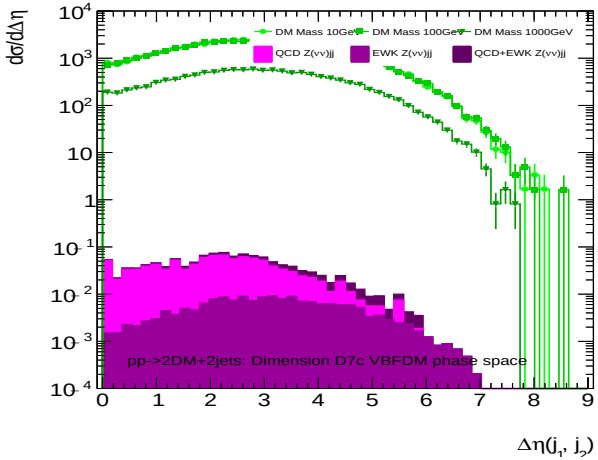



## Jet1Eta

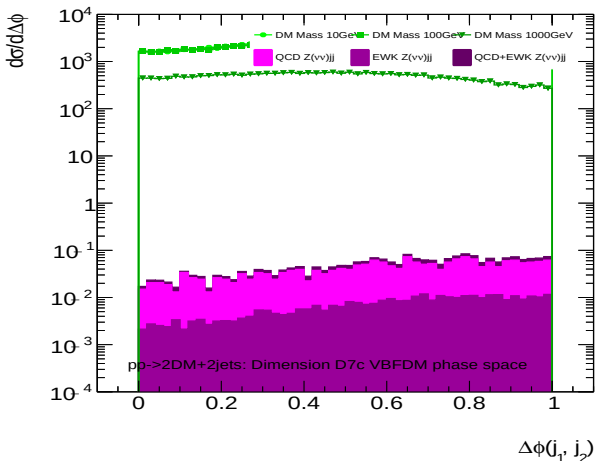


# Distributions for D7c, VBFDM Selection

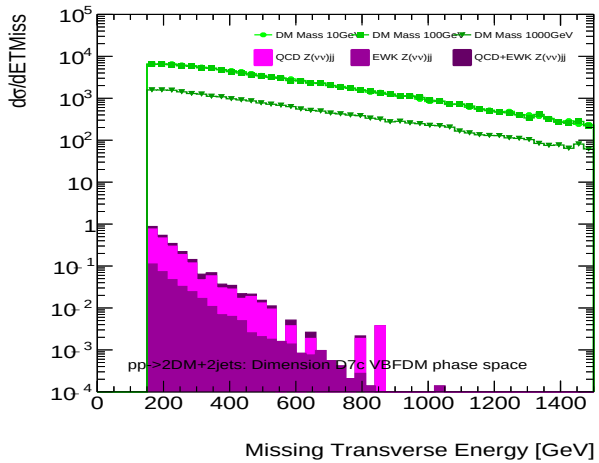
## DeltaEta



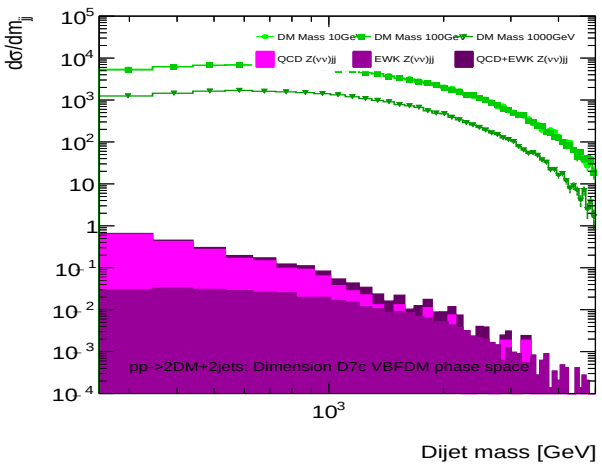

## DeltaPhi



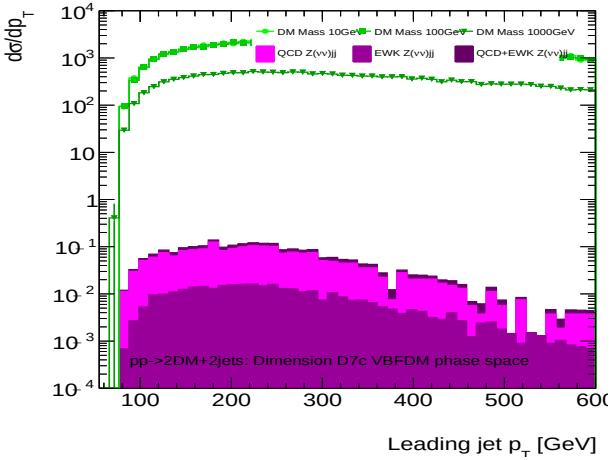

## ETMiss



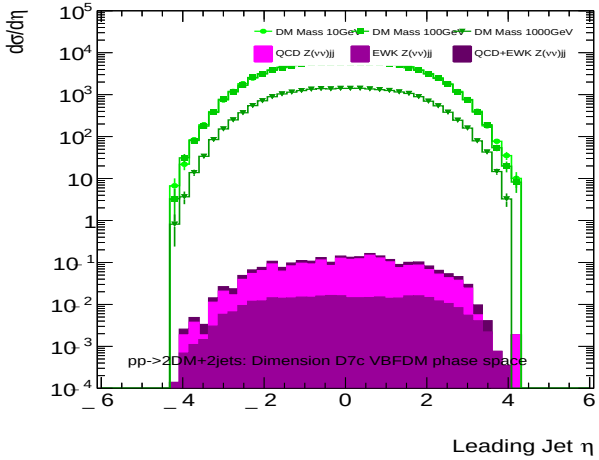

## Mjj




## Jet1PT

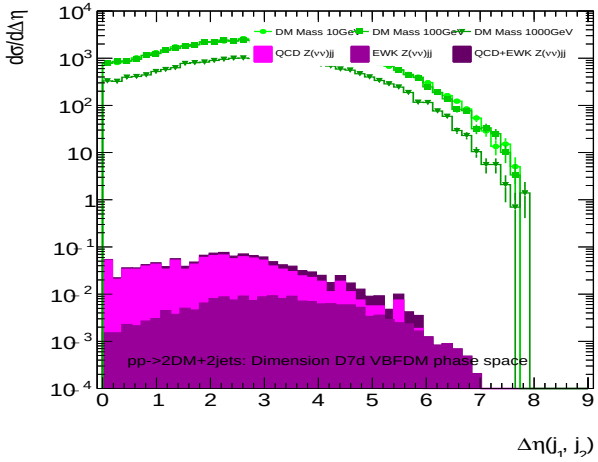



## Jet1Eta

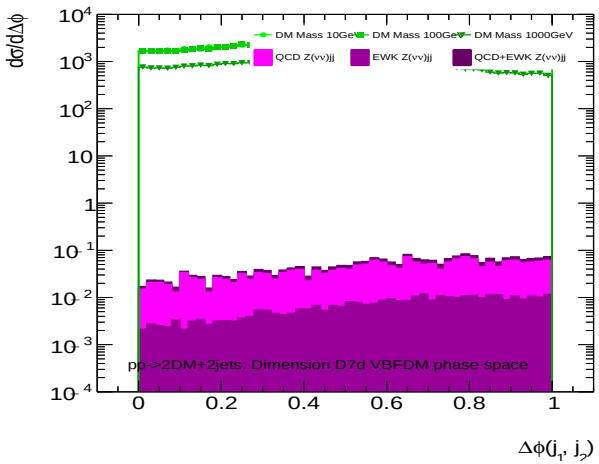


# Distributions for D7d, VBFDM Selection

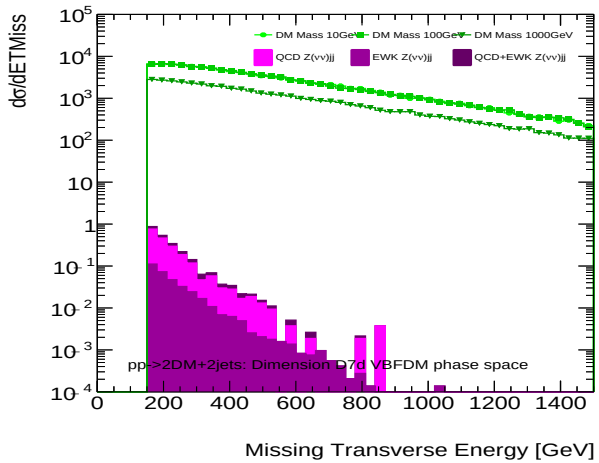
## DeltaEta



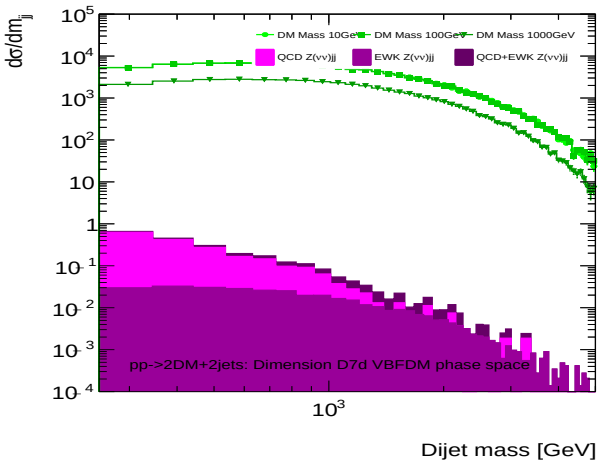

## DeltaPhi



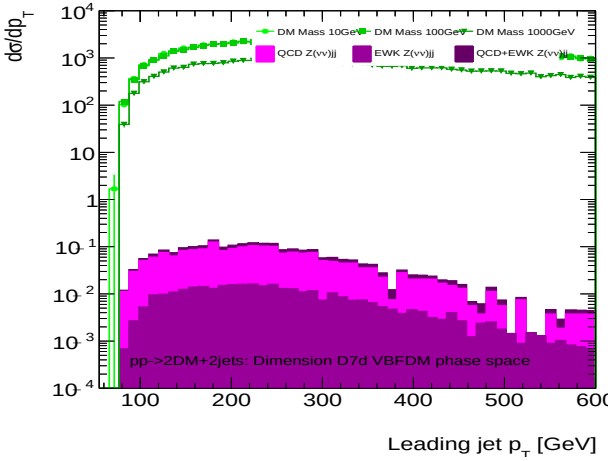

## ETMiss



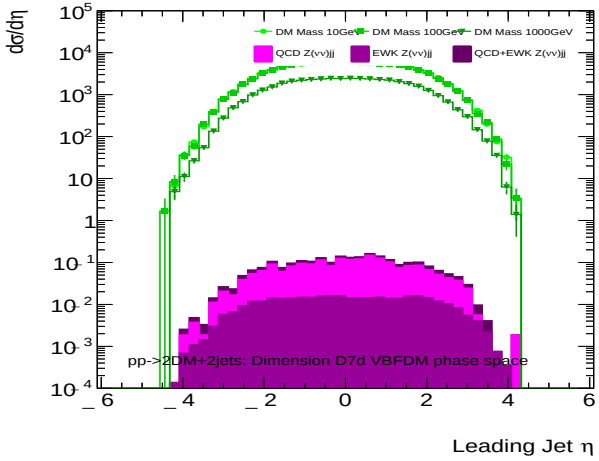

## Mjj




## Jet1PT




## Jet1Eta



# Next Steps:

- Make 2D plots from the distributions
- Look at invisible Higgs validation of Sherpa.
- Add three jet contributions.
- Make 2D plots of rates in mass and $\Lambda$.
- Any other thoughts?