

\tilde{t} & χ Searches

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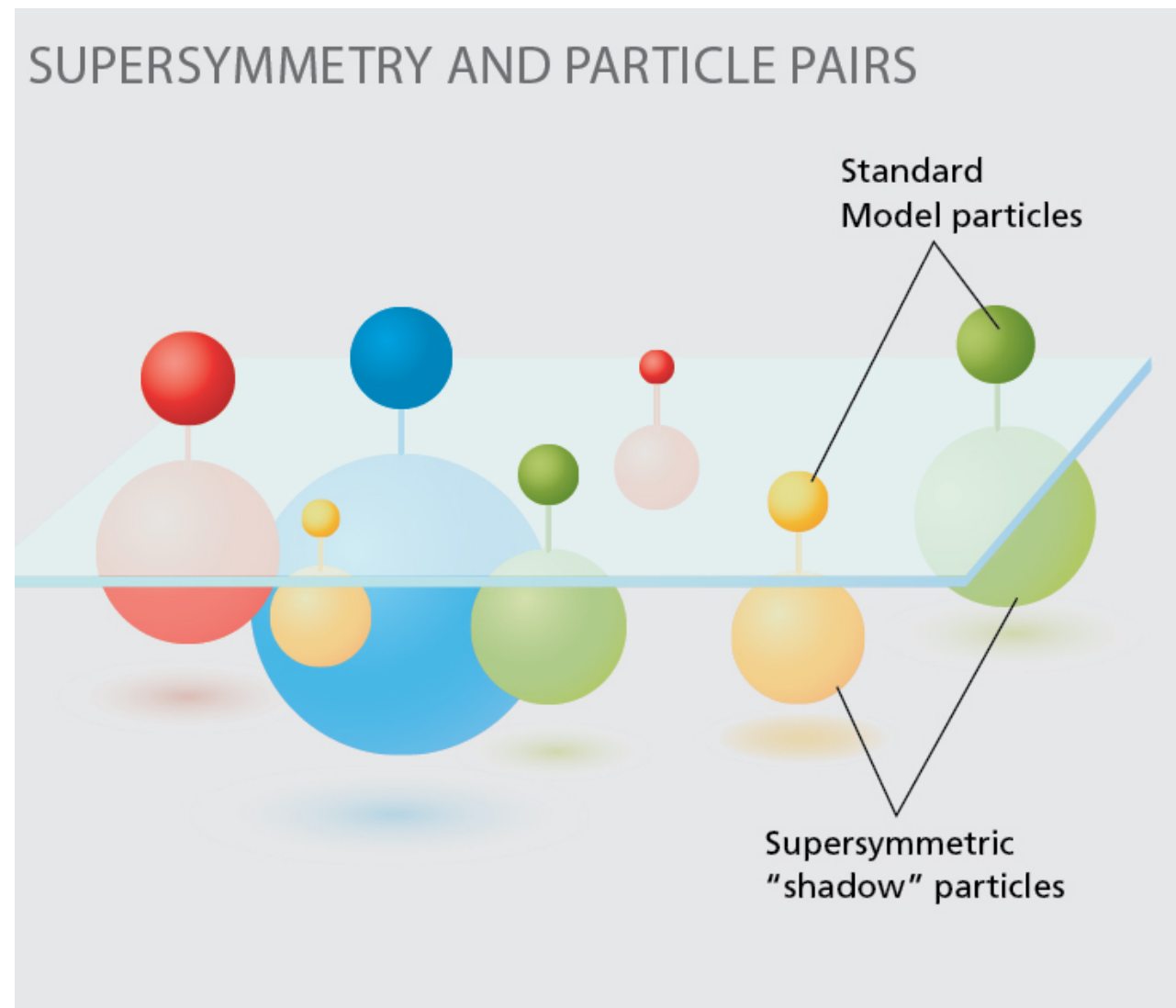
Member : Soo-Min Choi, Sumin Jeong, Dong-Woo Kang, Jinmian Lee

Reference : CMS-SUS-17-001

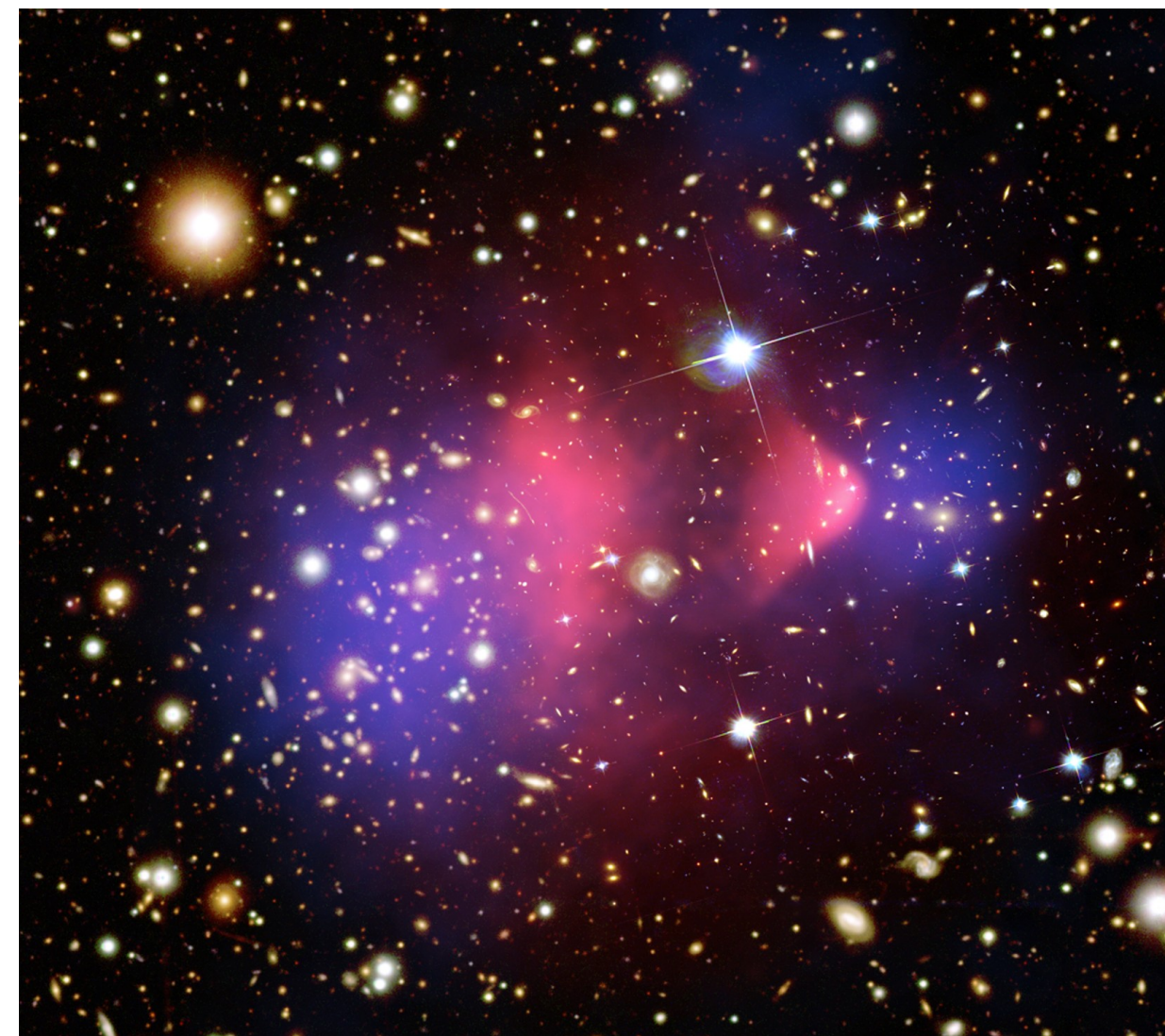
The first MadAnalysis 5 workshop on LHC recasting @ Korea
20 Aug. 2017 - 27 Aug. 2017, High-1 resort

Interesting Model / Exp. for **BSM** ?

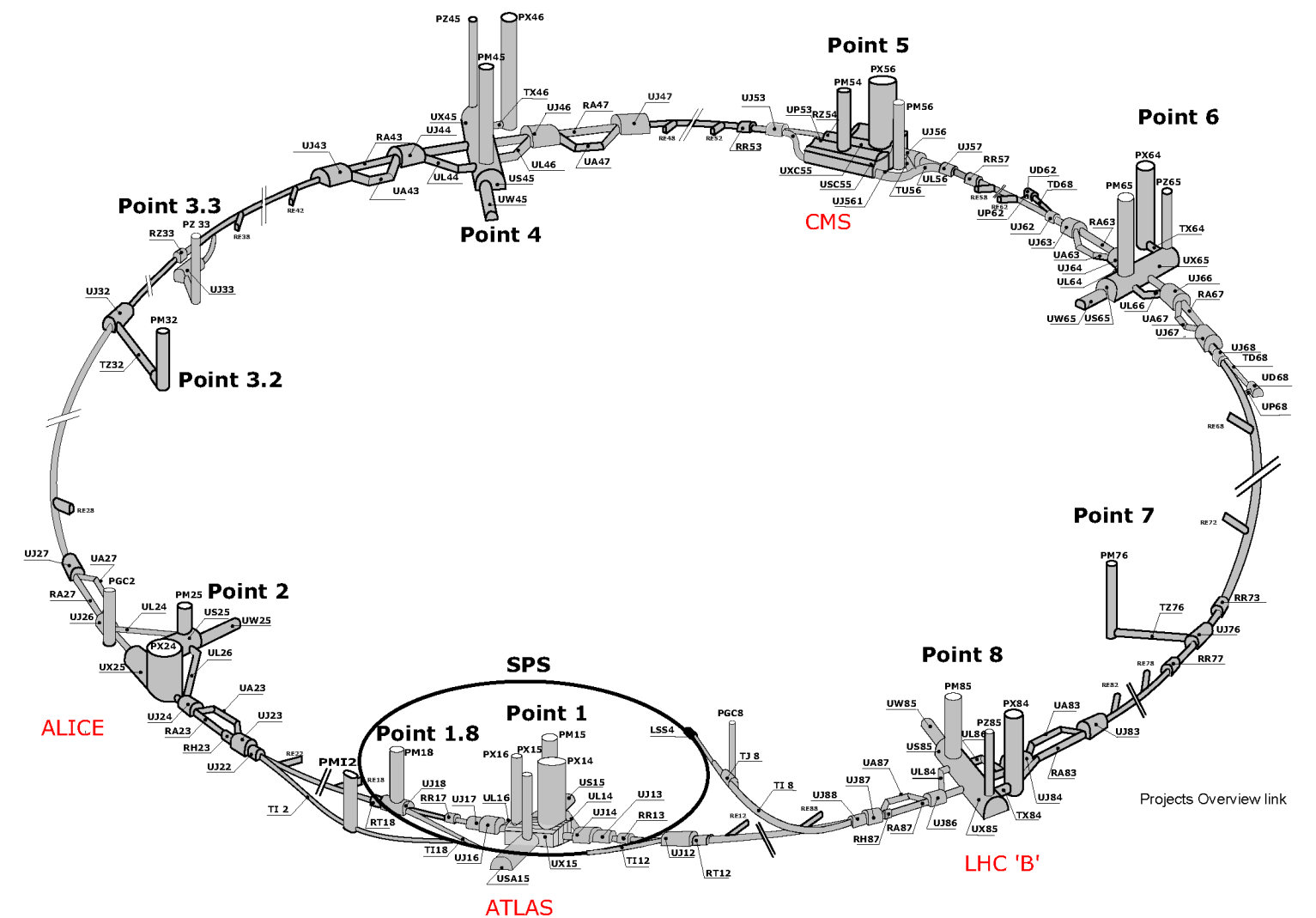
Supersymmetry



Dark Matter

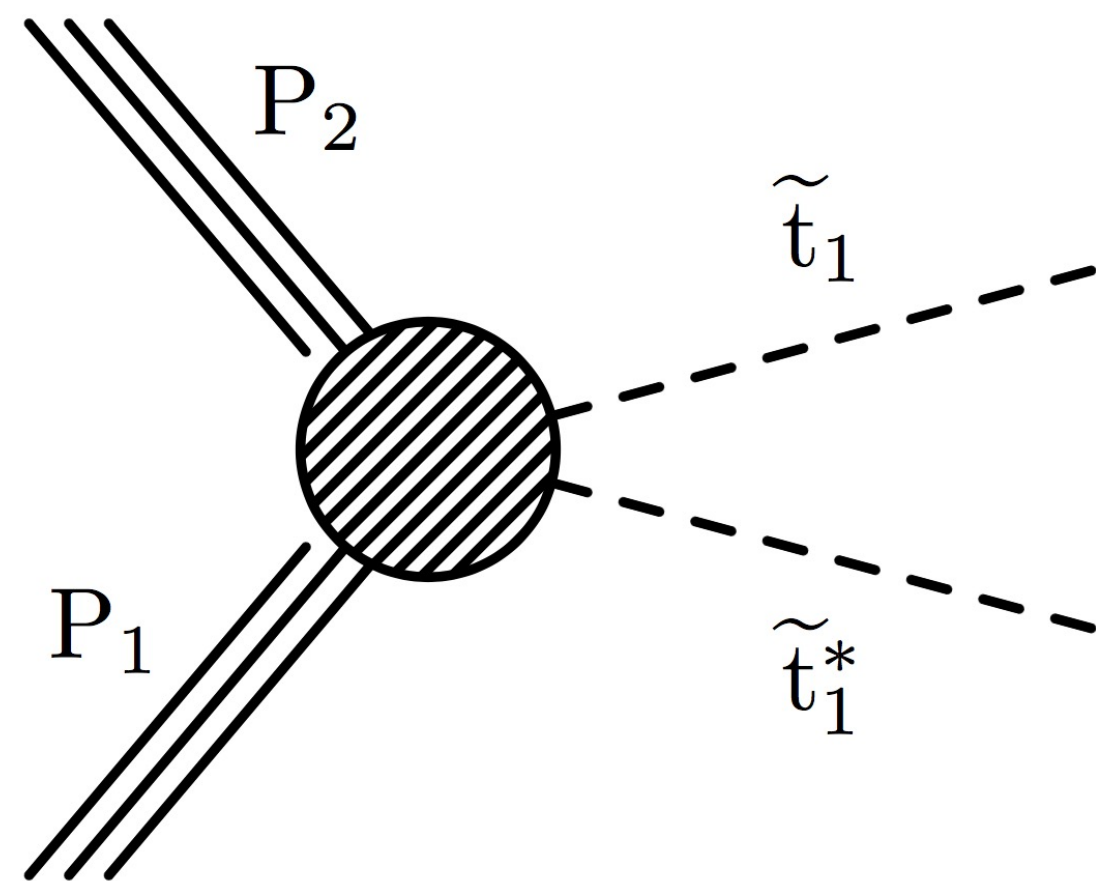


Collider



Let's generate the events for SUSY !

generate $p p > \tilde{t}_1 \tilde{t}_1^* (+ j j) @ \text{MG5}$

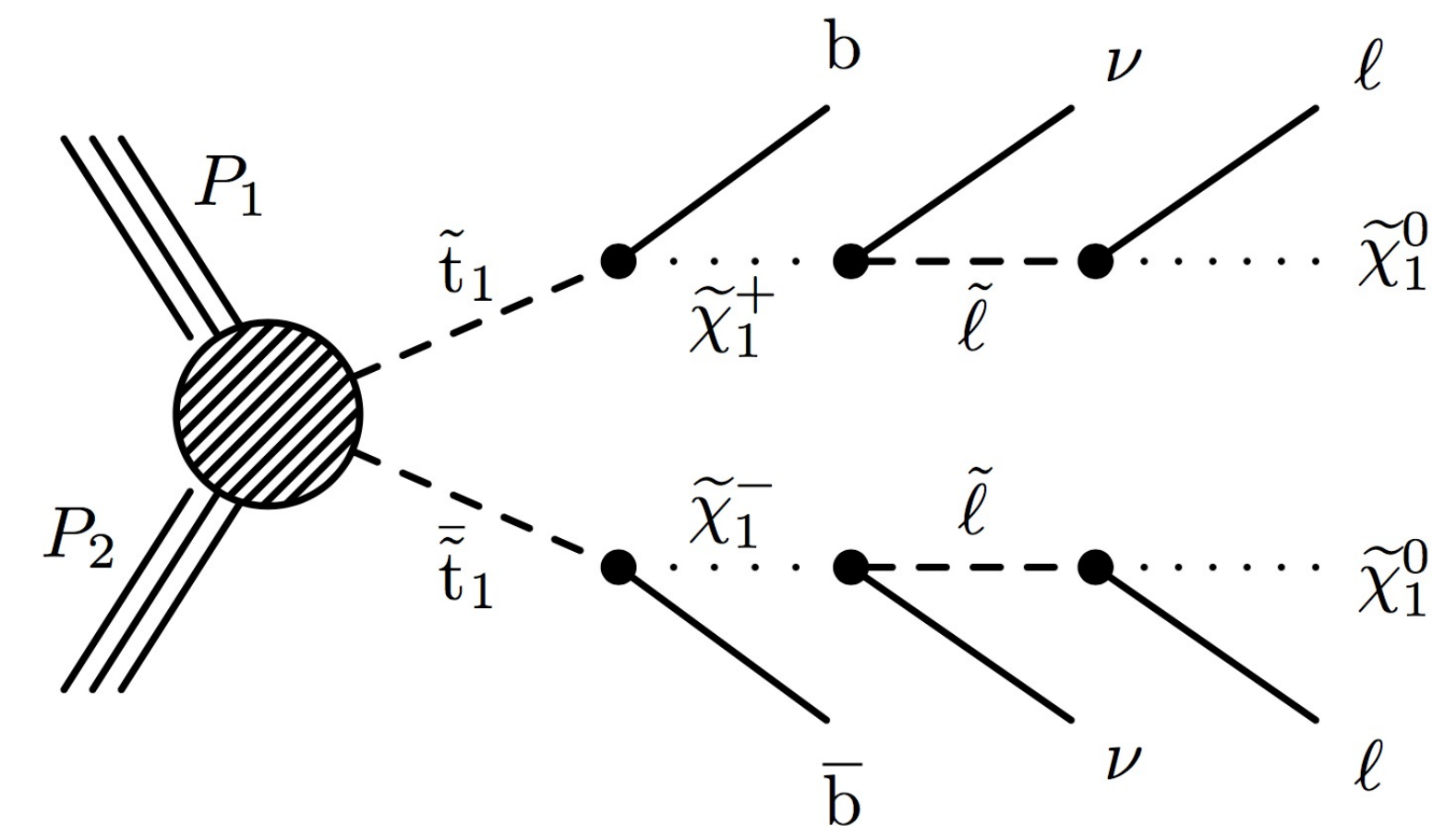
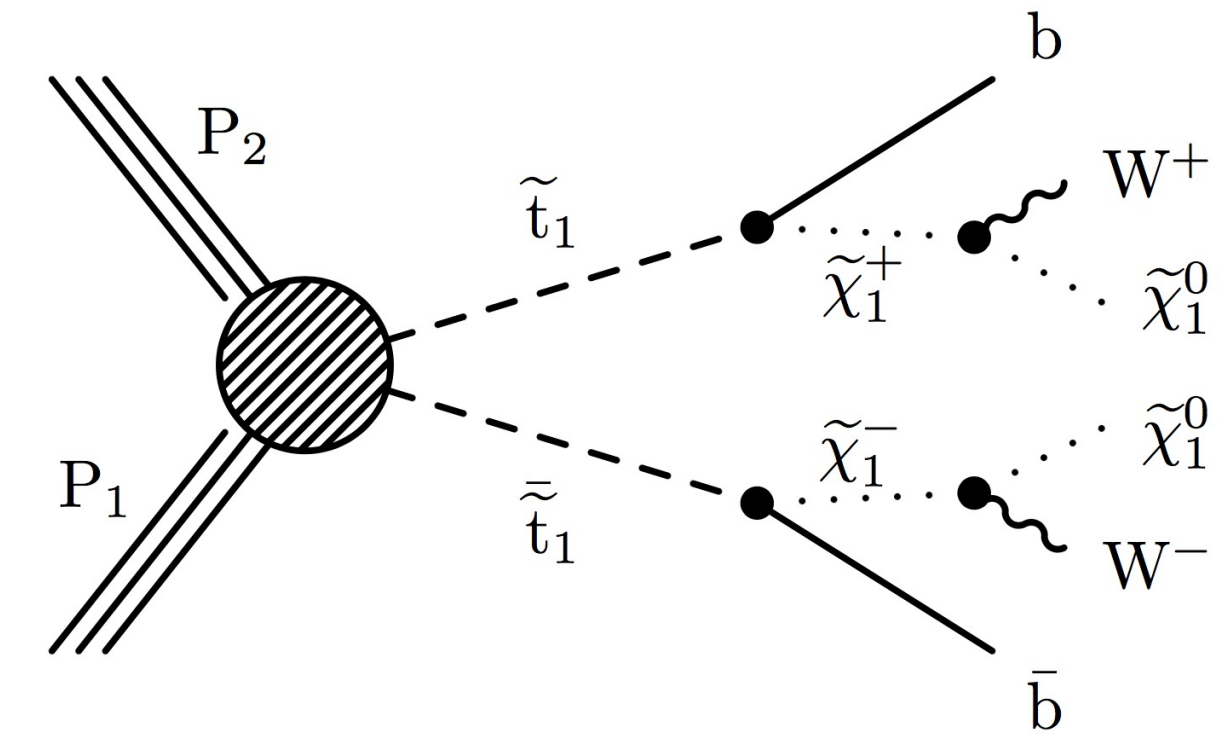
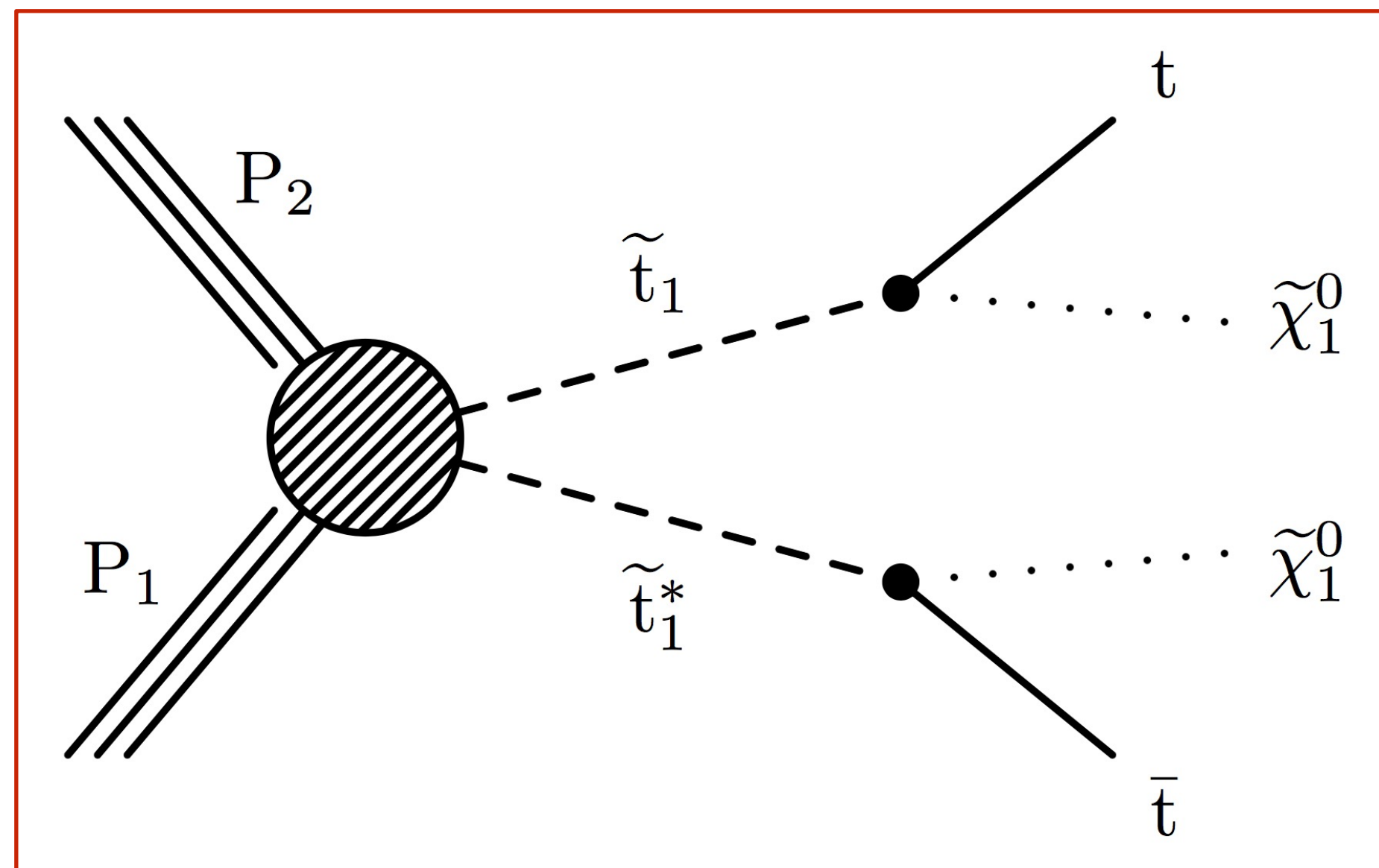


Let's generate the events for SUSY !

```

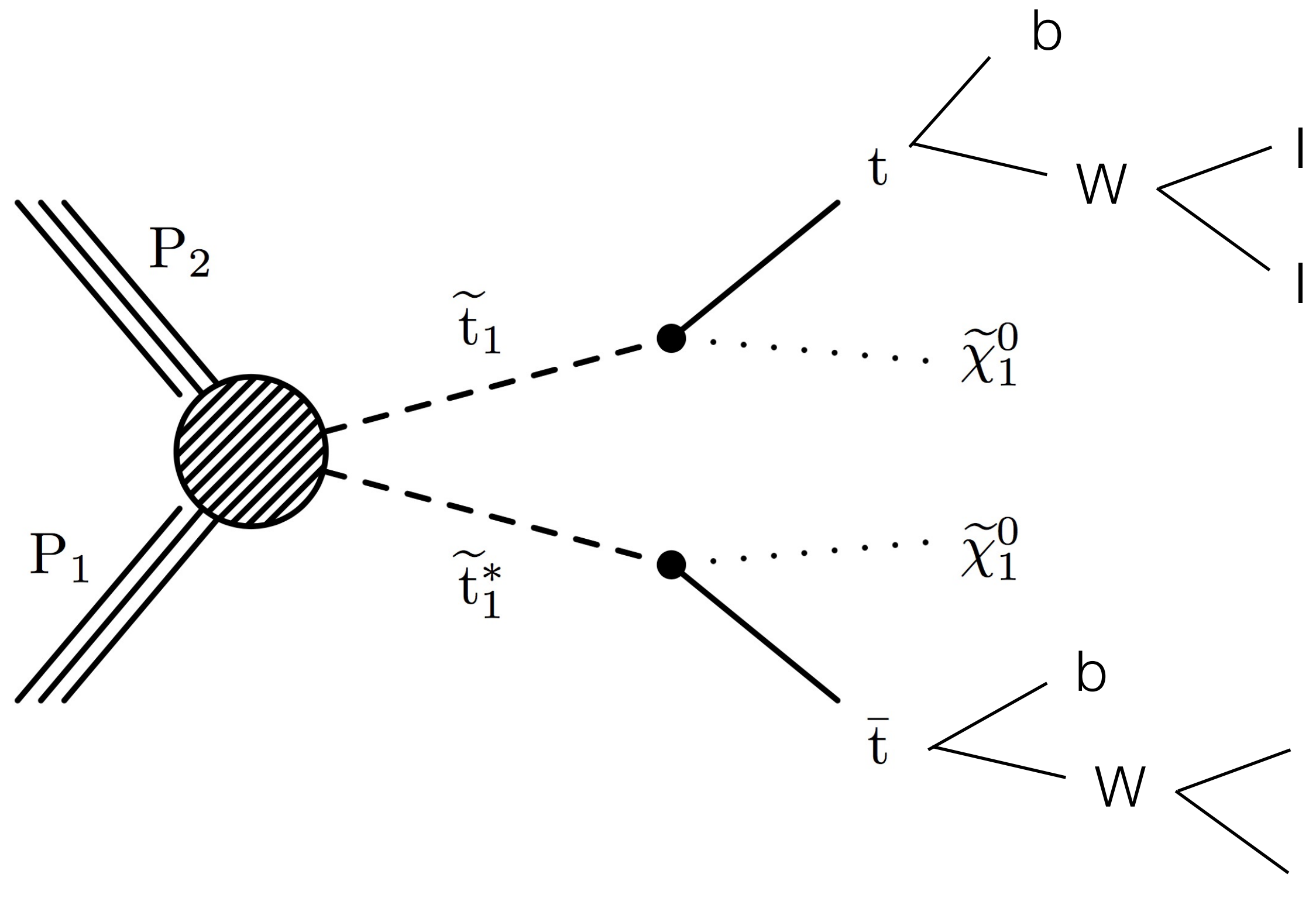
DECAY 1000006 2.021596e+00 # Stop
#      BR      NDA      ID1      ID2
1.00000000E+00  2      1000022  6
    
```

@ param_card.dat : $\tilde{t}_1 \rightarrow \tilde{\chi}_1^0 t$



Let's generate the events for SUSY !

$$(m_{\tilde{t}_1}, m_{\tilde{\chi}_1^0}) = (750, 1) \text{ \& } (600, 300)$$



```
#####
# Electron isolation, Muon isolation
#####
set DeltaRMax 0.3
set PMin 0.5
set PTRatioMax 0.12

#####
# ECAL, HCAL
#####
add EnergyFraction {100022} {0.0}

#####
# Neutrino Filter
#####
add PdgCode {100022}

#####
# b-tagging
#####
add EfficiencyFormula {0} {0.01+0.000038*pt} # mistag
add EfficiencyFormula {5} {0.6} # b-efficiency
```

Let's generate the events for SUSY !

```

JetMatching:setMad = off
JetMatching:scheme = 1
JetMatching:jetAlgorithm = 2
JetMatching:etaJetMax = 5.
JetMatching:coneRadius = 1.
JetMatching:slowJetPower = 1
JetMatching:qCut = 187.5
JetMatching:nQmatch = 5
JetMatching:nJetMax = 2
JetMatching:doShowerKt = off
6:m0 = 172.5
Check:abortIfVeto = on

Tune:preferLHAPDF = 2
Main:timesAllowErrors = 10000
Check:epTolErr = 0.01
Beams:setProductionScalesFromLHEF = off
SLHA:keepSM = on
SLHA:minMassSM = 1000.
ParticleDecays:limitTau0 = on
ParticleDecays:tau0Max = 10
ParticleDecays:allowPhotonRadiation = on

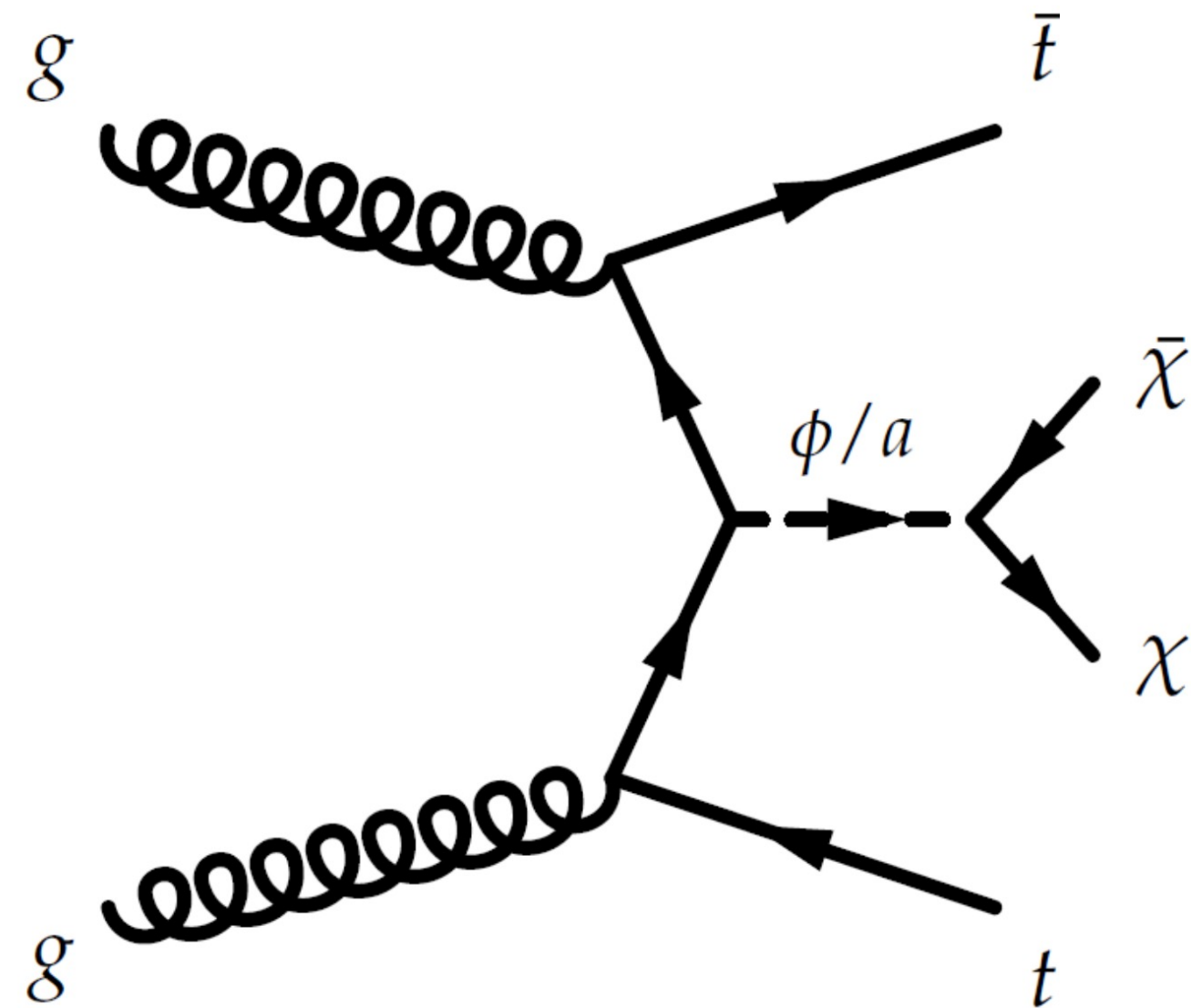
Tune:pp=14
Tune:ee=7
MultipartonInteractions:pT0Ref=2.4024
MultipartonInteractions:ecmPow=0.25208
MultipartonInteractions:expPow=1.6

#####
# Matching parameter (MLM only)
#####
1 = ickkw ! 0 no matching, 1 MLM
1.0 = alpsfact ! scale factor for QCD emission vx
False = chcluster ! cluster only according to channel diag
5 = asrgtflavor ! highest quark flavor for a_s reweight
True = auto_ptj_mjj ! Automatic setting of ptj and mjj if xqcut >0
! (turn off for VBF and single top processes)
125.0 = xqcut ! minimum kt jet measure between partons

```

Let's generate the events for DM !

$$(m_{\phi/a}, m_{\chi}) = (10, 1)$$



```
3 1.000000e+00 # gSXd # Xd-Y0 scalar coupling #
4 0.000000e+00 # gPXd # Xd-Y0 pseudo-scalar coupling #
```

```
#####
#   ECAL, HCAL
#####
add EnergyFraction {52} {0.0}
```

```
#####
# Neutrino Filter
#####
add PdgCode {52}
add PdgCode {-52}
```

```
28.75 = xqcut @ run_card.dat
```

```
JetMatching:qCut = 43.125 @ pythia*_card.dat
```

TABLE OF CUTFLOW

Cut name	ϵ SUSY (750,1) #Event : 50,000		ϵ SUSY (600,300) #Event : 75,000		ϵ DM (scalar) #Event : 120,000		ϵ DM (pseudo) #Event : 80,000	
	CMS	MA5	CMS	MA5	CMS	MA5	CMS	MA5
First condition : lepton = 2 (e or μ), opposite charge	CMS	MA5	CMS	MA5	CMS	MA5	CMS	MA5
$m(ll) \geq 20$ GeV	0.99	0.99	0.99	0.97	0.98	0.97	0.99	0.98
$ m_Z - m(ll) > 15$ GeV (SF only)	0.95	0.94	0.89	0.89	0.88	0.89	0.90	0.90
$N_{jets} \geq 2$	0.87	0.93	0.85	0.89	0.76	0.91	0.78	0.97
$N_{bjets} \geq 1$	0.73	0.84	0.83	0.83	0.79	0.81	0.78	0.81
$E_T^{miss} > 80$ GeV	0.94	0.95	0.89	0.88	0.47	0.38	0.69	0.48
$S > 5$ GeV ²	0.98	0.92	0.96	0.91	0.93	0.66	0.96	0.56
$\cos \Delta\phi(E_T^{miss}, j_1) < 0.80$	0.9	0.97	0.92	0.97	0.89	0.97	0.91	0.98
$\cos \Delta\phi(E_T^{miss}, j_2) < 0.96$	1	0.96	1	0.94	1	0.95	1	0.93
$M_{T2}(ll) > 140$ GeV	0.49	0.42	0.17	0.16	0.0039	0	0.078	0
All Cuts	0.24	0.25	0.083	0.075	0.00079	0.15	0.025	0.17

$(\chi, \phi) = (750, 1)$	SRA0	SRA1	SRA2	μ (signal strength)
CMS	1.85	4.67	2.89	0.816
MA5	2.64	5.43	2.09	0.872

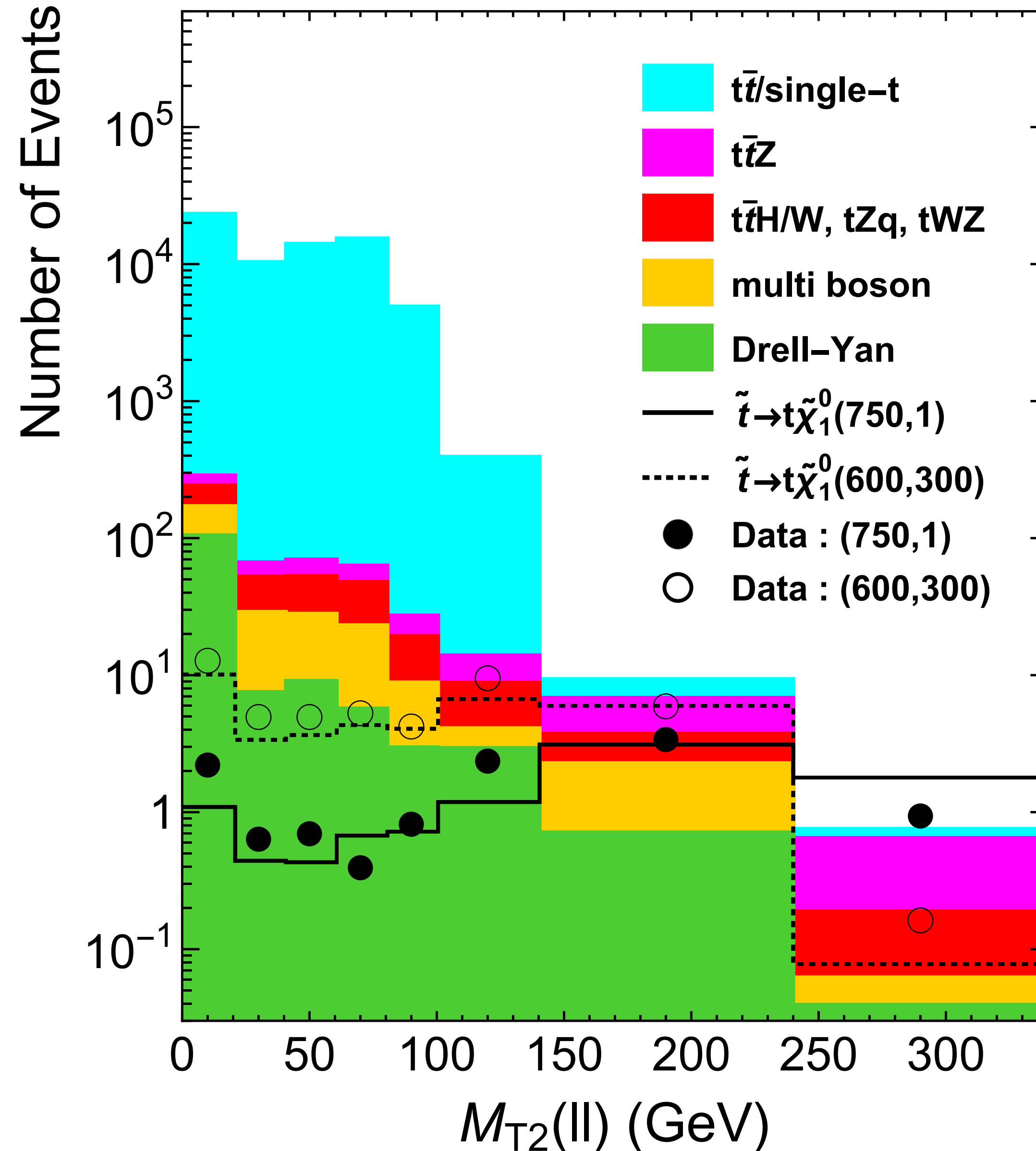
$(\chi, \phi) = (600, 300)$	SRA0	SRA1	SRA2	μ (signal strength)
CMS	5.46	9.27	0.08	0.680
MA5	6.23	7.5	0.39	0.835

- SRA0 : $E_T^{miss} \geq 200$ & $100 \leq M_{T_2}(ll) < 140$
- SRA1 : $E_T^{miss} \geq 200$ & $140 \leq M_{T_2}(ll) < 240$
- SRA2 : $E_T^{miss} \geq 80$ & $100 \leq M_{T_2}(ll) < 140$

✂ CutFlows

leptons = 2 (e or μ), opposite charge
 $m(\ell\ell) \geq 20 \text{ GeV}$
 $|m_Z - m(\ell\ell)| > 15 \text{ GeV}$ (SF only)
 $N_{\text{jets}} \geq 2$
 $N_{\text{bjets}} \geq 1$
 $E_{\text{T}}^{\text{miss}} > 80 \text{ GeV}$
 $S > 5 \text{ GeV}^{1/2}$
 $\cos \Delta\phi(E_{\text{T}}^{\text{miss}}, j_1) < 0.80$
 $\cos \Delta\phi(E_{\text{T}}^{\text{miss}}, j_2) < 0.96$
 $M_{\text{T}2}(\ell\ell) > 140 \text{ GeV}$

CMS : $L=35.9 \text{ fb}^{-1}$ (13 TeV)

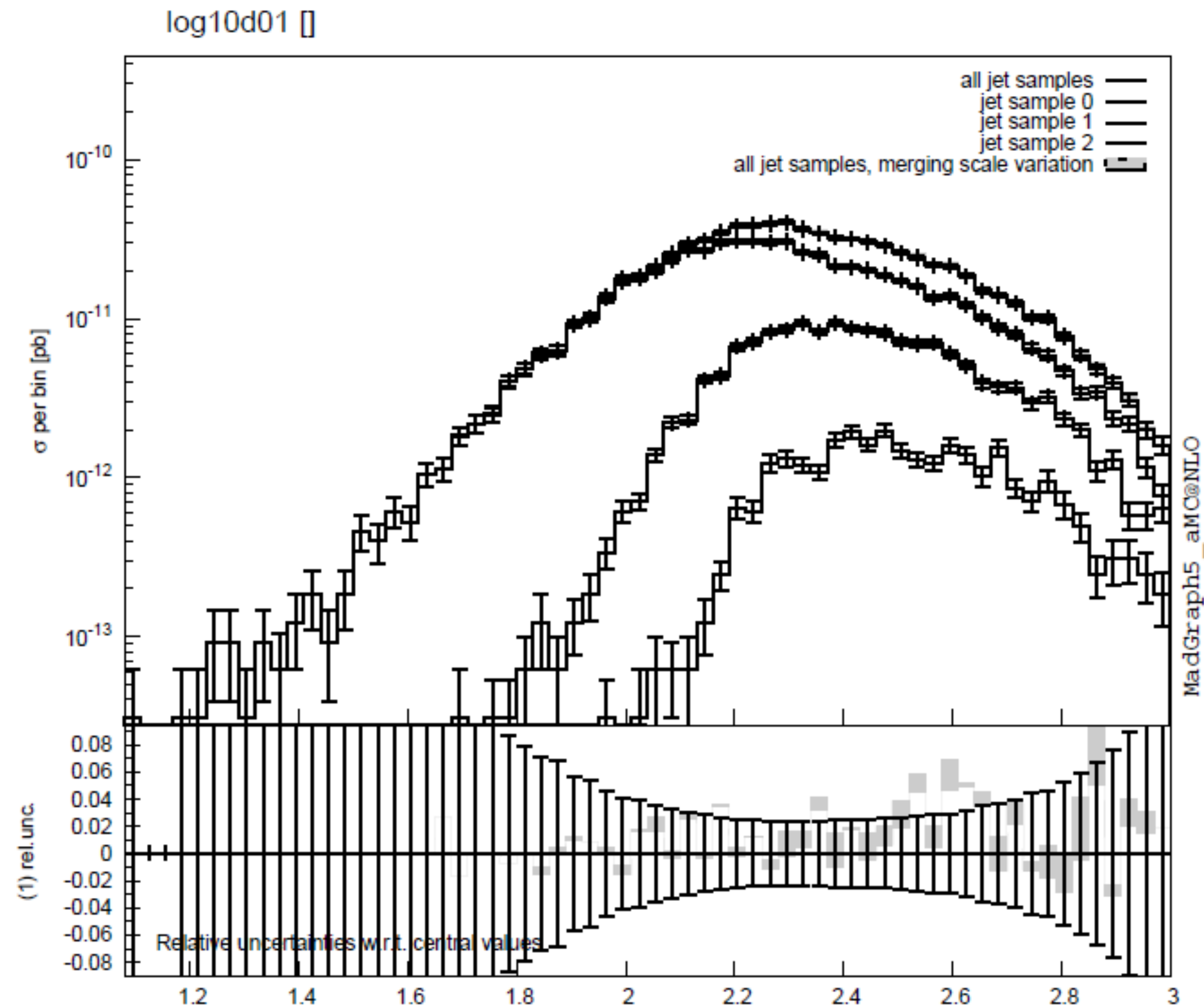


Thank you

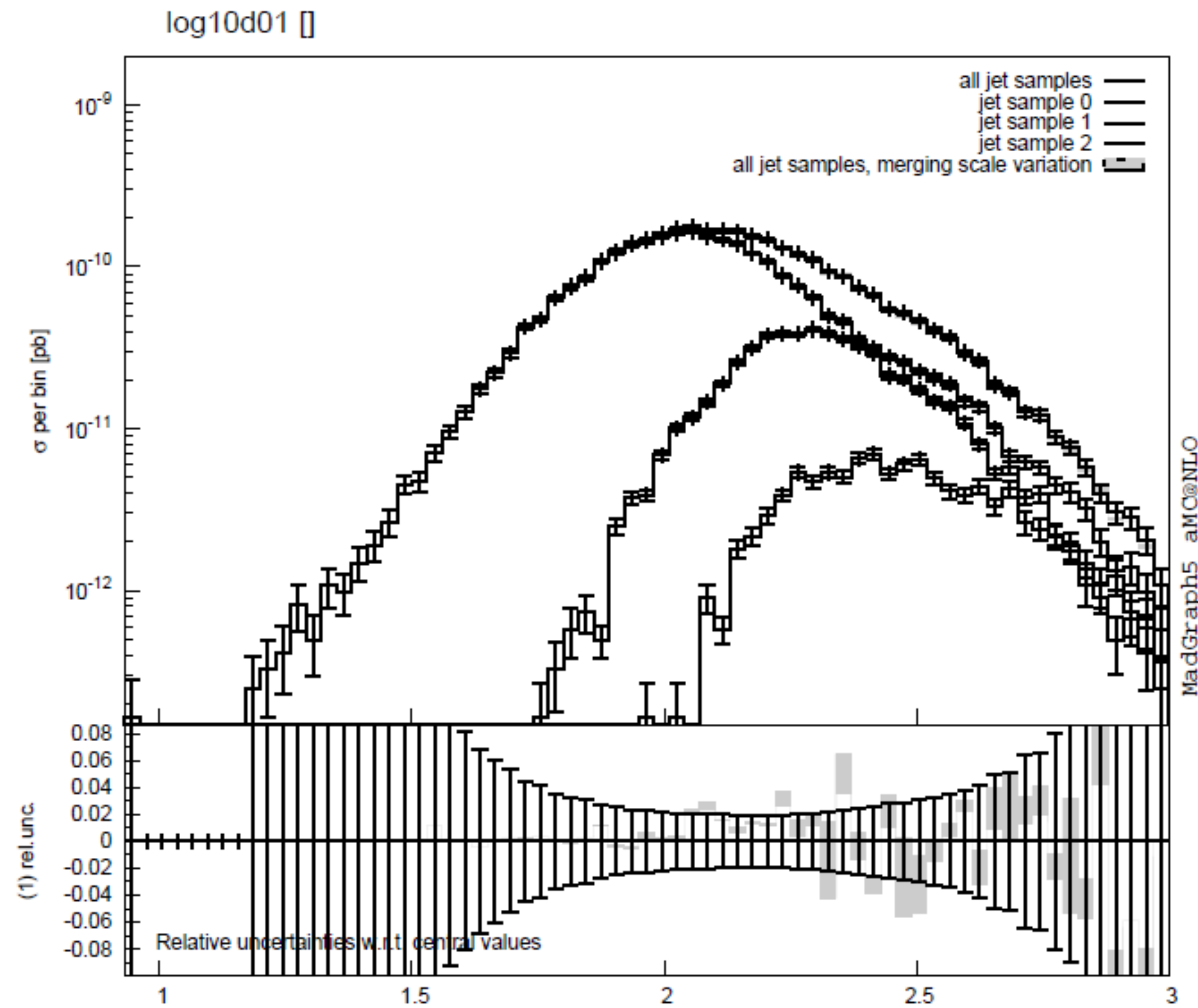
BACK UP

QCUT DJR PLOTS

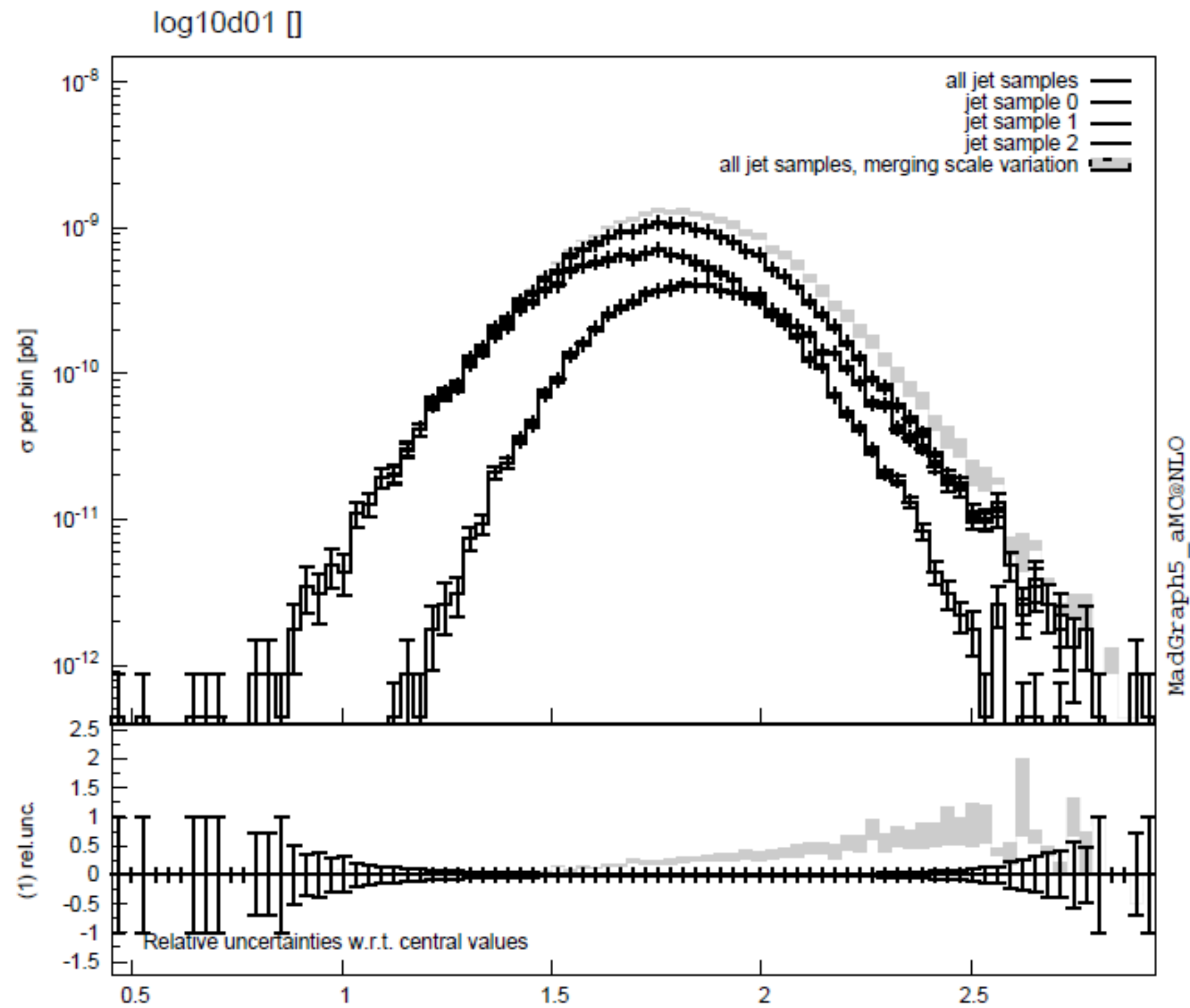
QCUT DJR PLOTS ; SUSY (750,1)



QCUT DJR PLOTS ; SUSY (600,300)



QCUT DJR PLOTS ; DM SCALAR



QCUT DJR PLOTS ; DM PSEUDO SCALAR

