CDF 6437

Study of Exclusive Dijet Events Using DPE Trigger Data

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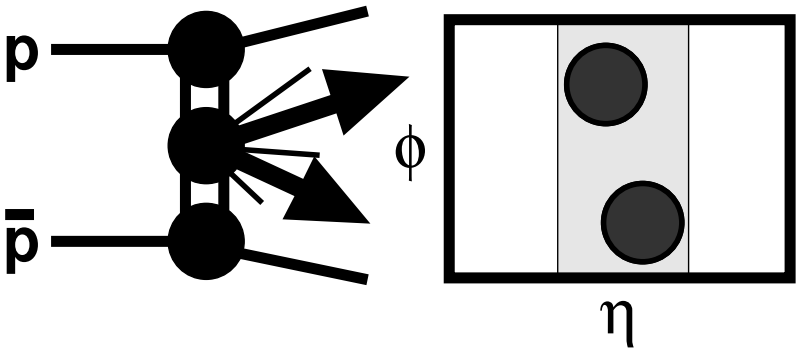


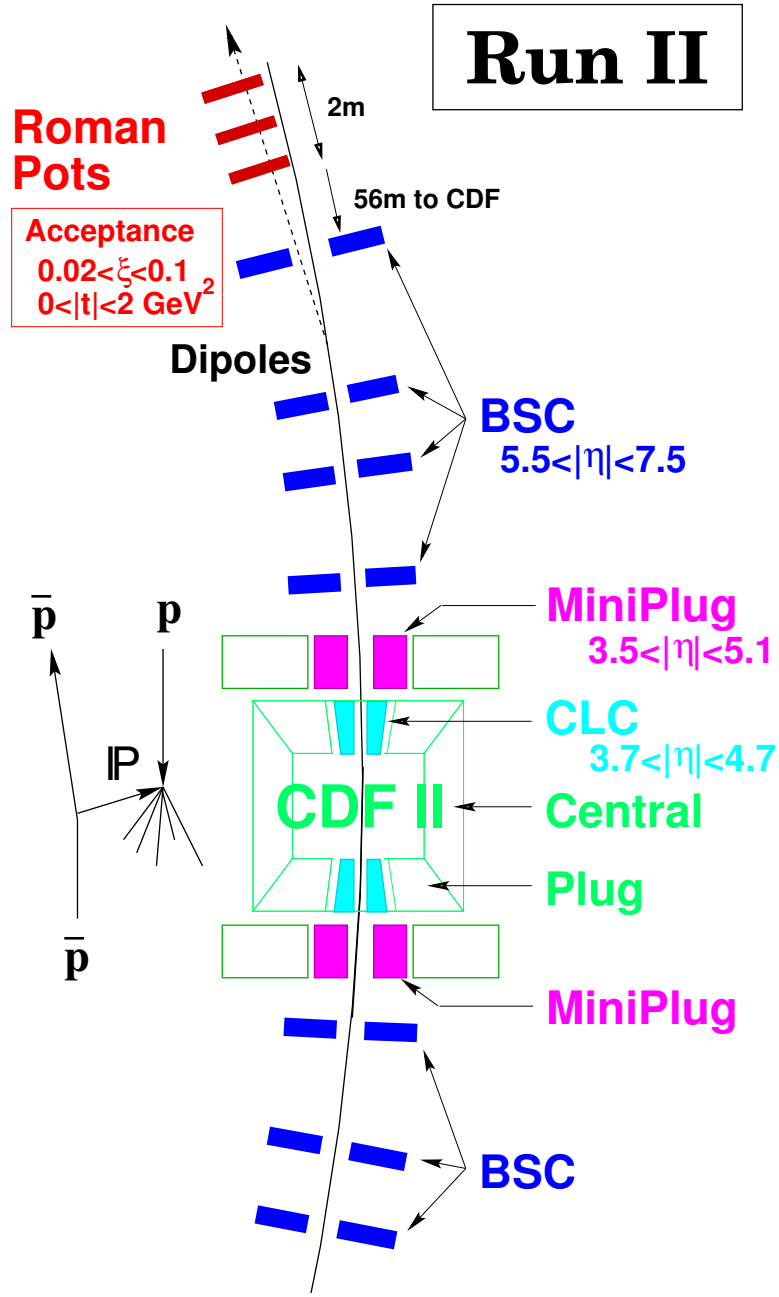
Dijet Mass Fraction $R_{jj} = \frac{M_{jj}}{M_X}$

Exclusive DPE Dijet: $R_{jj} \sim 1$

$pp \rightarrow [p' + IP] + [p' + IP] \rightarrow p' + j + j + p'$

Run I : Exclusive DPE dijet (E_T>7 GeV) : $\sigma < 3.7$ nb (95% C.L.)

Trigger



Used in main analysis:

"Dedicated DPE" trigger

- **DPE = RP + SingleTower 5GeV + BSC-East Gap**

Control Sample:

- **SD = RP + SingleTower 5GeV**
- **ND = SingleTower 5GeV**

Run 151683~155821 (DPE, SD) : 25.7±1.5 pb^{-1}

Run 152123~152949 (ND) : 6.1±0.4 pb^{-1}

Data	L1	L2	L3
DPE	RP+ST5+Egap: PS1	PS5	AUTO
SD	RP+ST5: PS1	PS100*	AUTO
ND	ST5: PS20	PS300	AUTO

*100 (~1_03-v1) ⟶ 1000 (1_03-v2~)

Data Selection

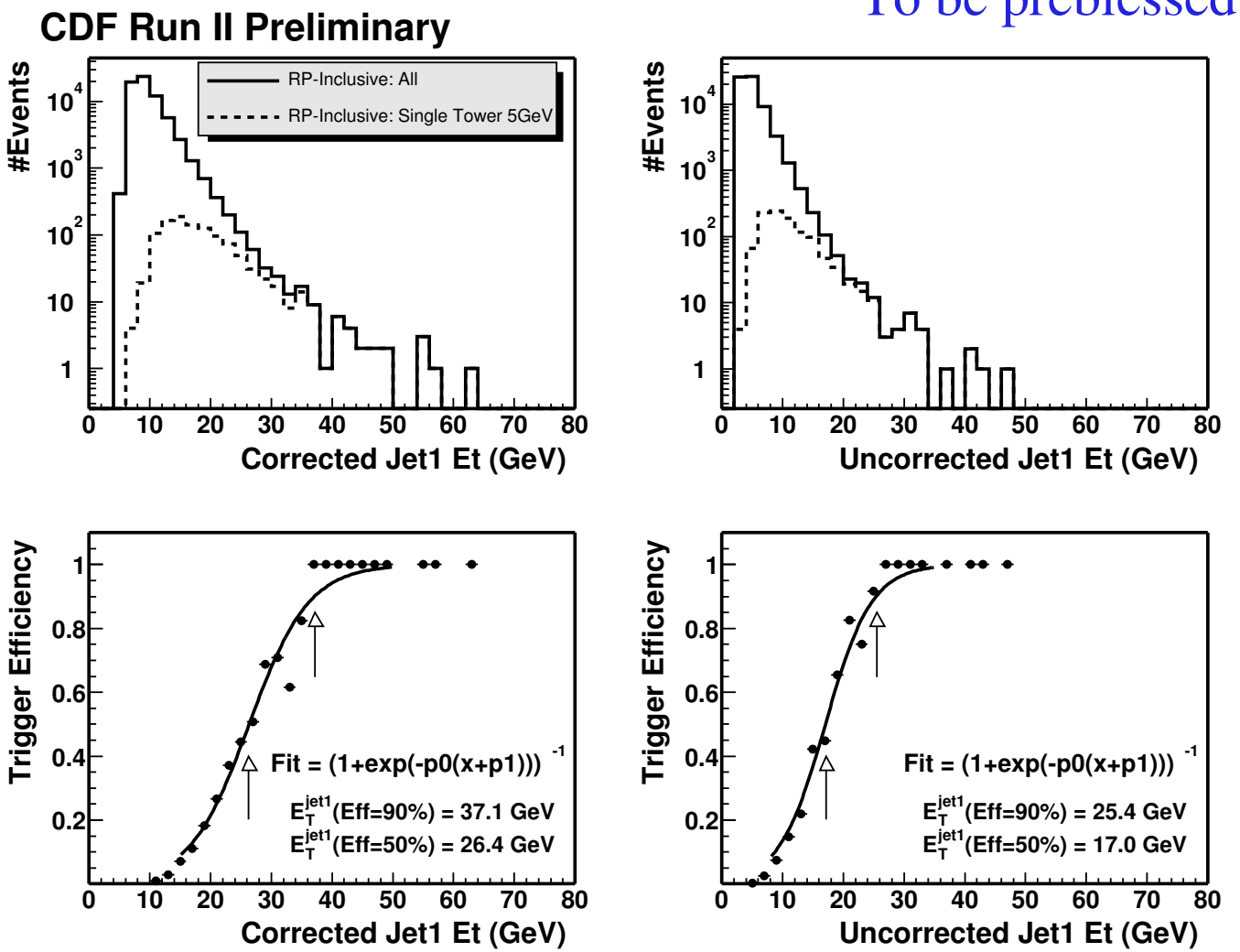
Cuts	DPE	SD	ND
Triggered Events	397K	356K	278K
$N_{vertex}(Q12) \leq 1$	365K	205K	196K
$\lvert Z_{vertex} \rvert < 60cm$	347K	195K	186K
MET significance < 6	347K	195K	186K
BSC offline cut (GAP)	317K	N/A	N/A
RP offline cut (RP-Hit)	309K	193K	N/A
Njets (R=0.7) ≥ 2	204K	158K	160K
$\lvert \eta_{det}^{jet1,2} \rvert < 2.5$	163K	122K	123K
$E_t^{jet2}(corr) > 10$ GeV	116,473	93,567	85,038
$0.01 < \xi_{\bar{p}}^{X} < 0.1$	54,552	14,956	N/A
MP-East Nhit = 0	17,101	N/A	N/A

UE correction of jets: DPE (0.37GeV), SD (0.54GeV) = Run I values (CDF-4716)
ND (1.56 GeV) = default Run II value

What Changed?

Only major change is to take into account trigger efficiency of single tower 5GeV

To be preblessed



Trigger Efficiency vs Leading Jet E_T intervals:

E_{T1}^{min}	E_{T1}^{max}	$\varepsilon(\Delta E_{T1})$
10	15	5.77±0.29%
15	20	14.4±0.7%
20	25	31.6±1.6%
25	35	66.6±3.3%
35	50	95.1±4.8%
50	110	100^{+0}_{-5}%

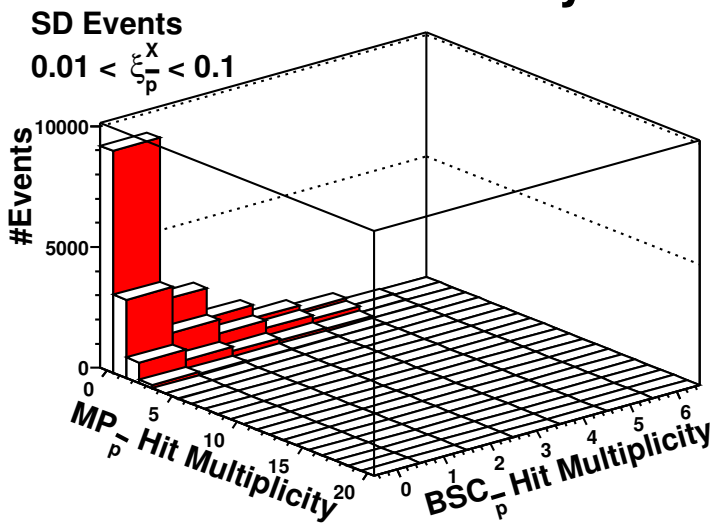
(±5% error assigned)

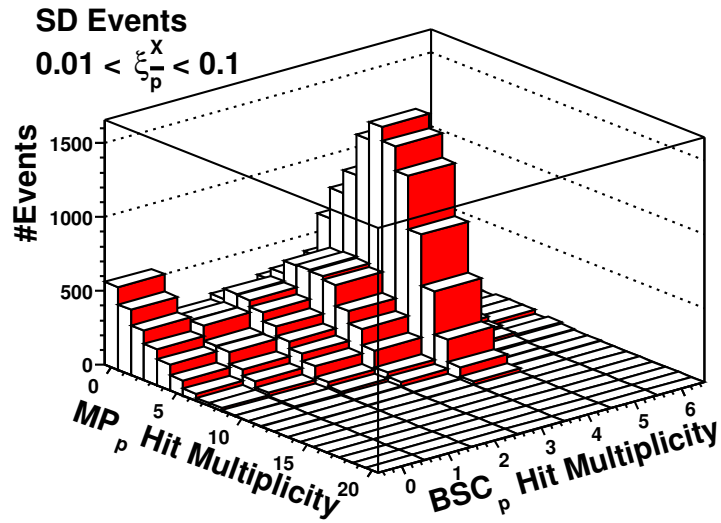
DPE Signal in SD Data

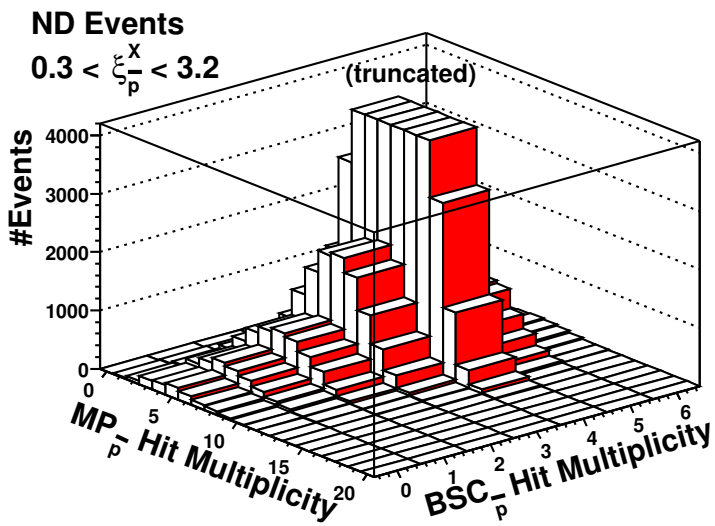
To be preblessed

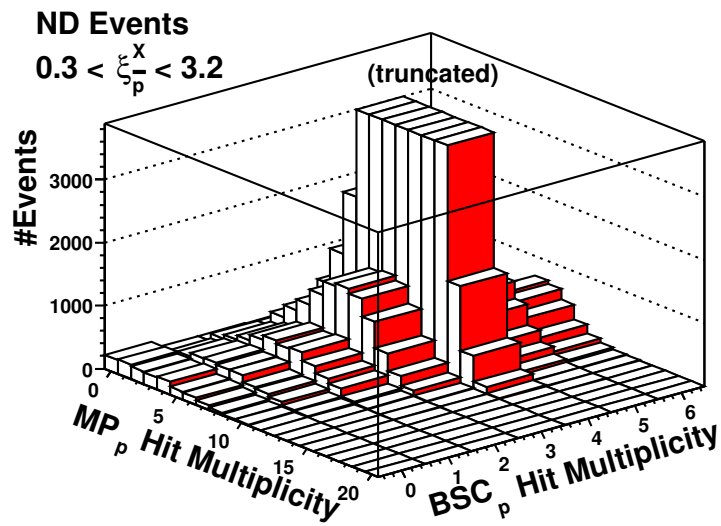
CDF Run II Preliminary

RP+Jet5





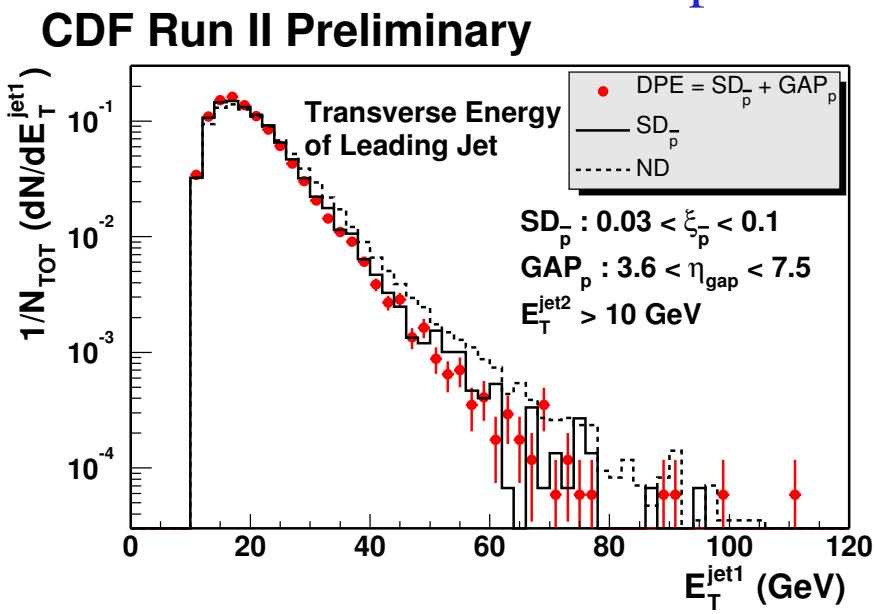


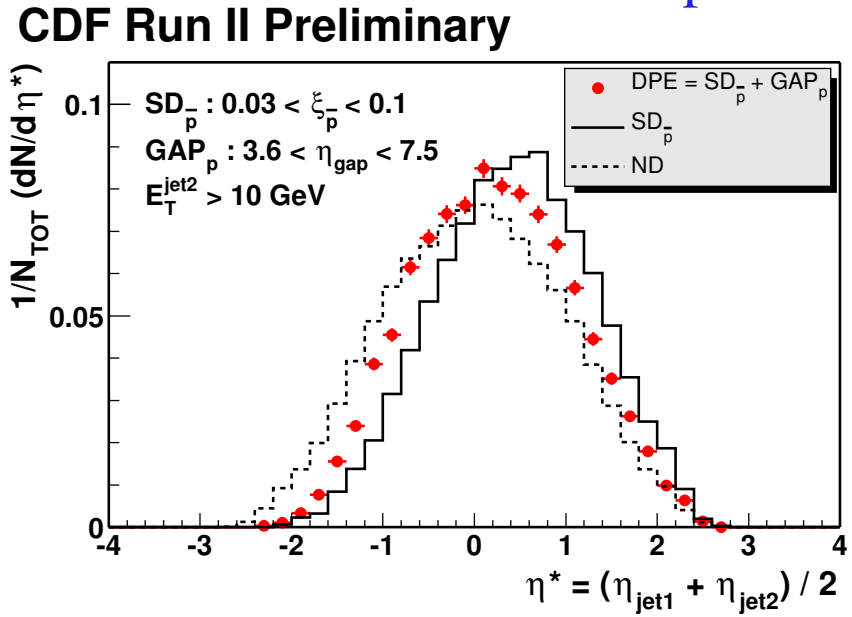


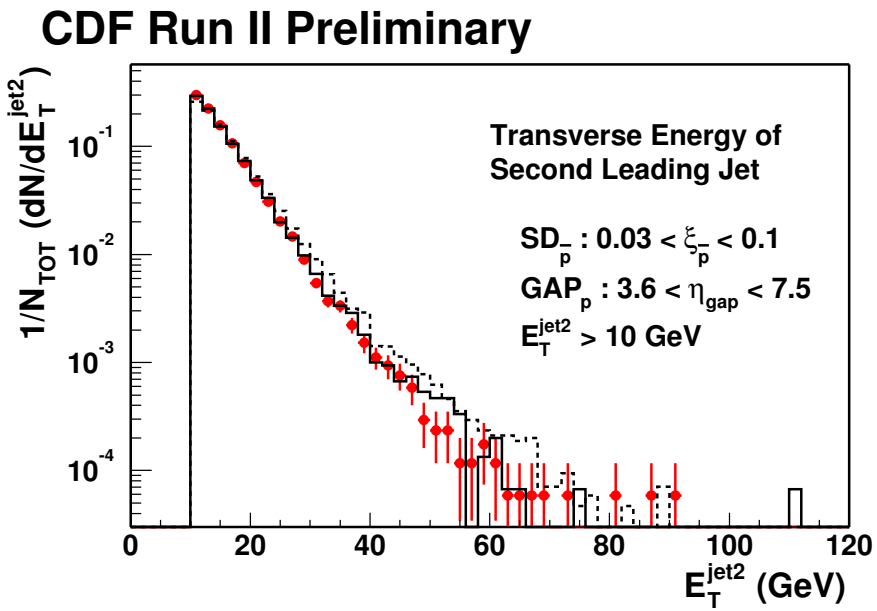
Kinematic Distribution of Jets

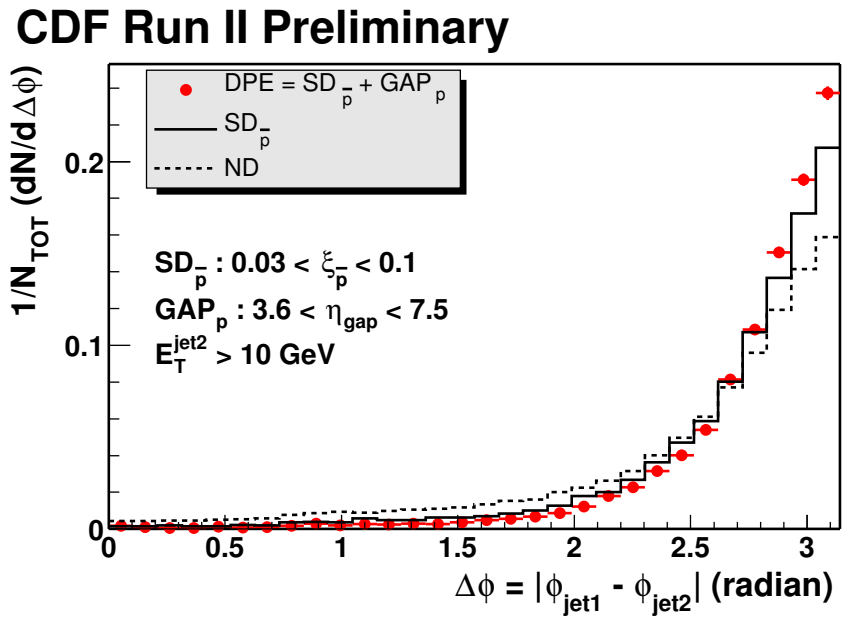
To be preblessed

To be preblessed



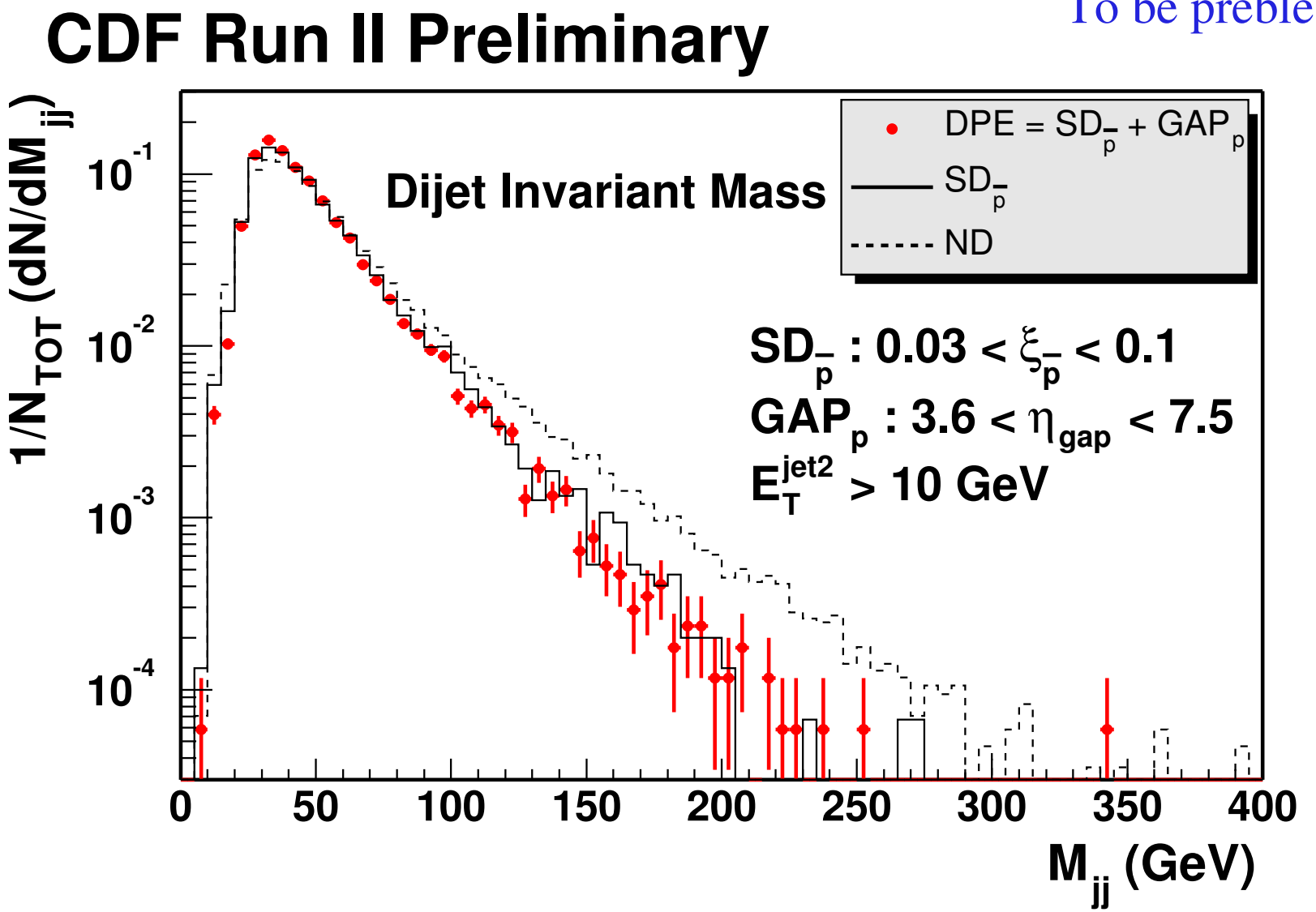




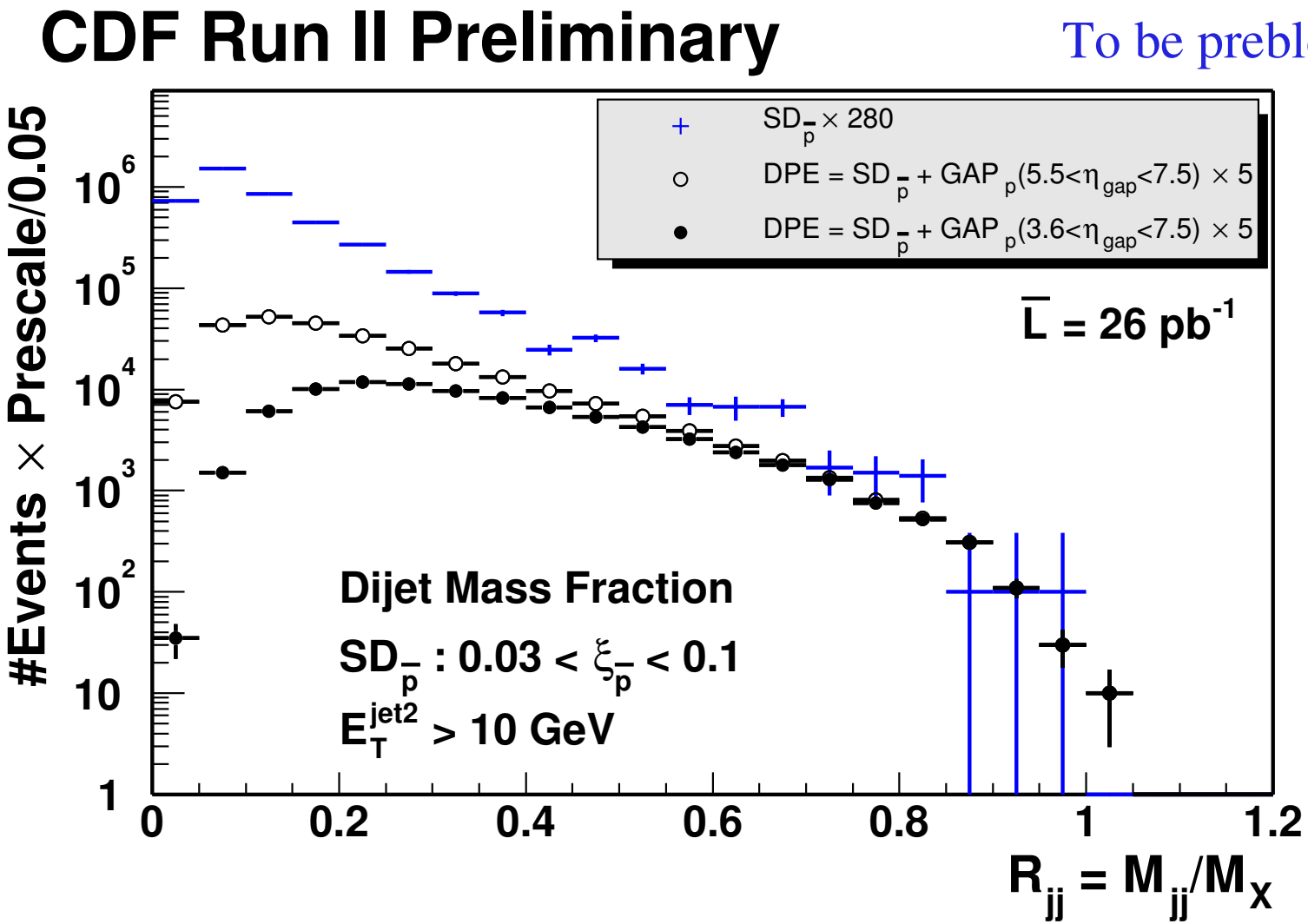


Dijet Mass

To be preblessed



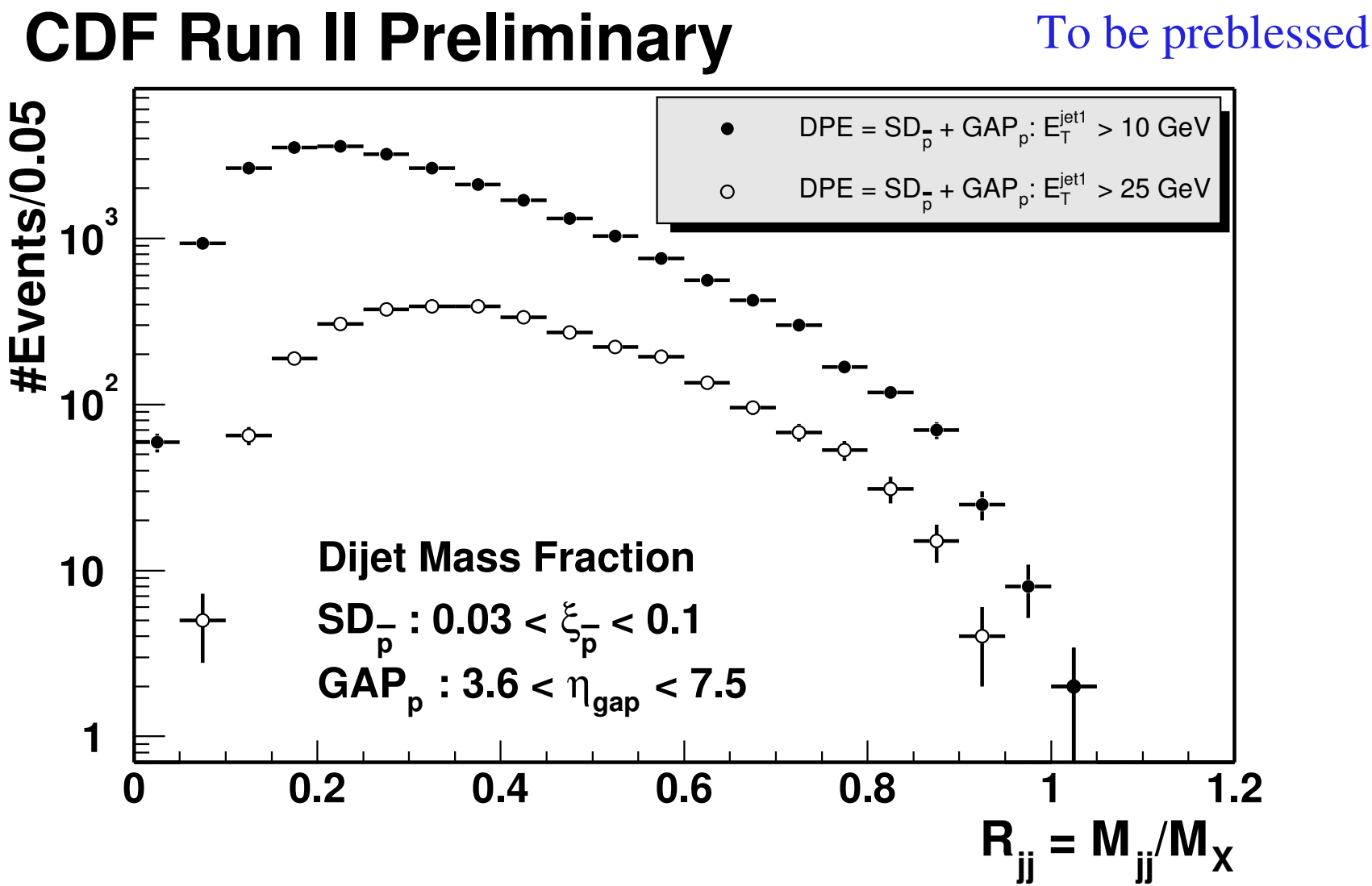
Dijet Mass Fraction - I



Dijet Mass Fraction: $R_{jj} = \frac{M_{jj}}{M_X}$

$$M_X = \sqrt{\xi_p \cdot \xi_{\bar{p}} \cdot s}$$

Dijet Mass Fraction - II



At different minimum E_T of leading jet (⟶ cross section)

Cross Section

$$\sigma_{DPE}^{excl.\ jj} = \frac{N_{DPE}(R_{jj} > 0.8)}{N_{DPE}(All)} \times \frac{N_{DPE}^{PS}}{L \cdot \epsilon \cdot A}$$

N_{DPE}^{PS} : # of observed DPE events corrected for PS → PS eff. study
corrected for multiple interactions

L : integrated luminosity

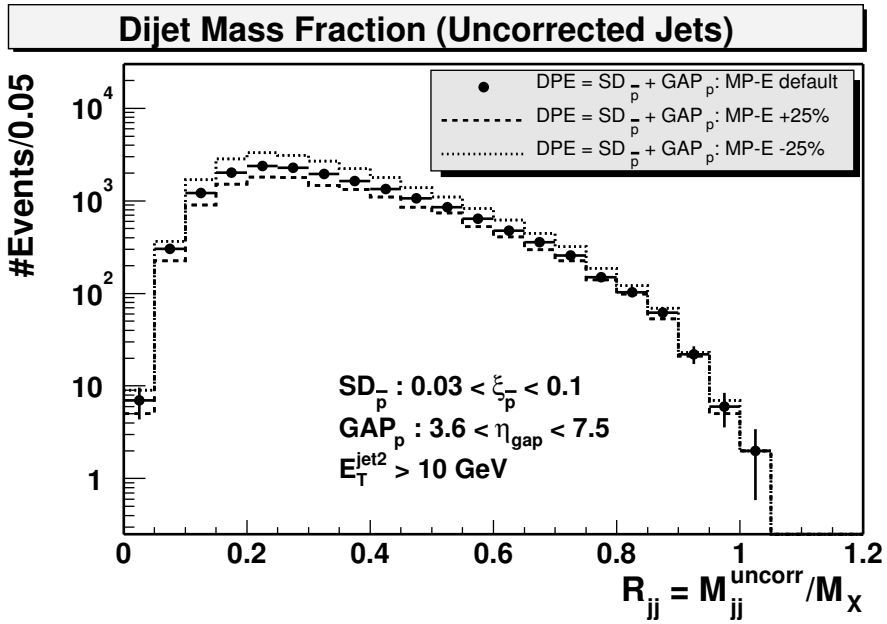
ϵ : trigger and vertex selection efficiencies of DPE events

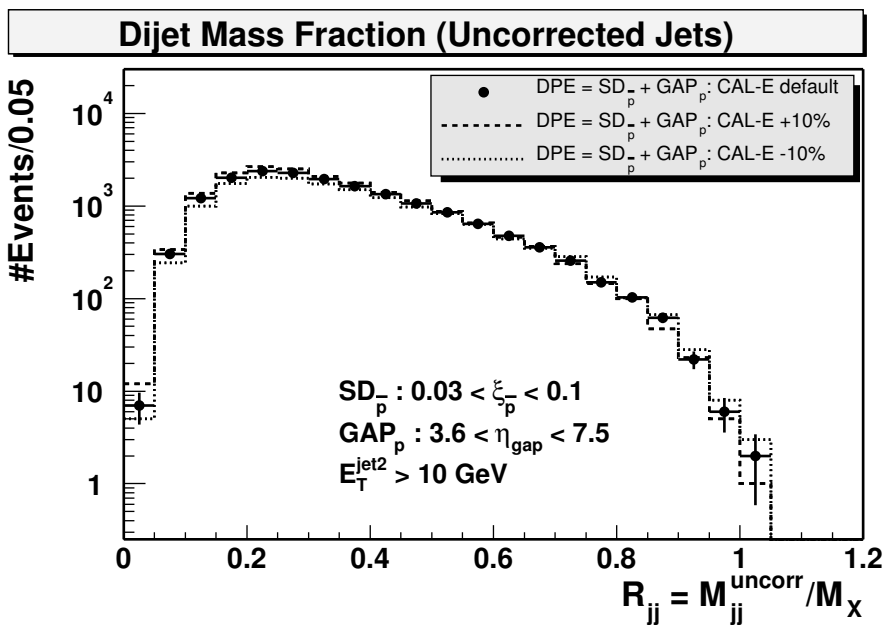
A : RP acceptance ($0.03 < \xi_{\bar{p}} < 0.1$)

$|\eta_{jet1,2}|<2.5$, $0.03<\xi_{\bar{p}}<0.1$, $3.6<\eta_{gap}<7.5$, R = 0.7 (stat. error only)

Minimum E_T^{jet1}	Cross Section $\sigma_{DPE}^{excl.\ jj}(R_{jj} > 0.8)$
10 GeV	**970 ± 65 pb**
25 GeV	**34 ± 5 pb**

Systematic Uncertainty: Cal. Energy Scale



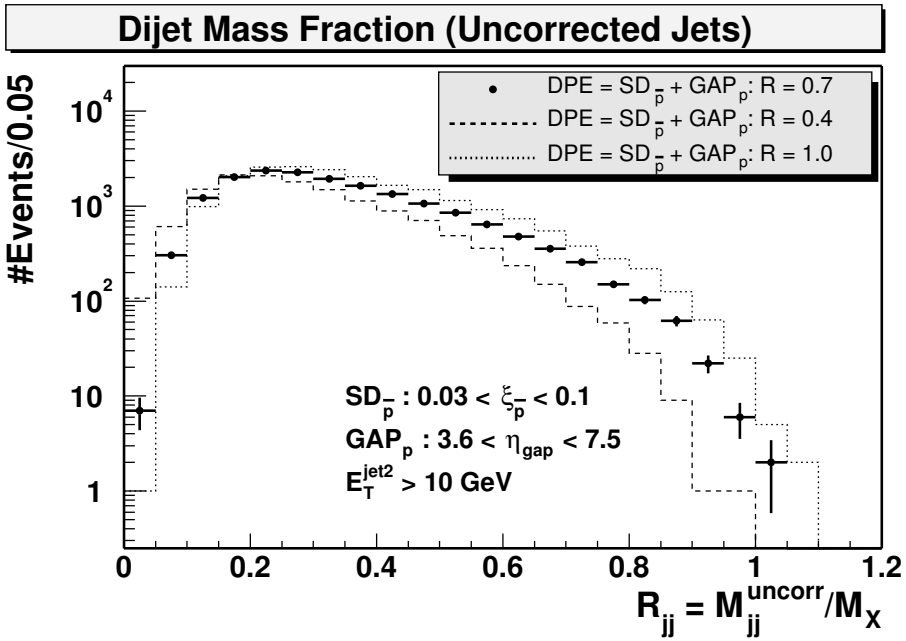


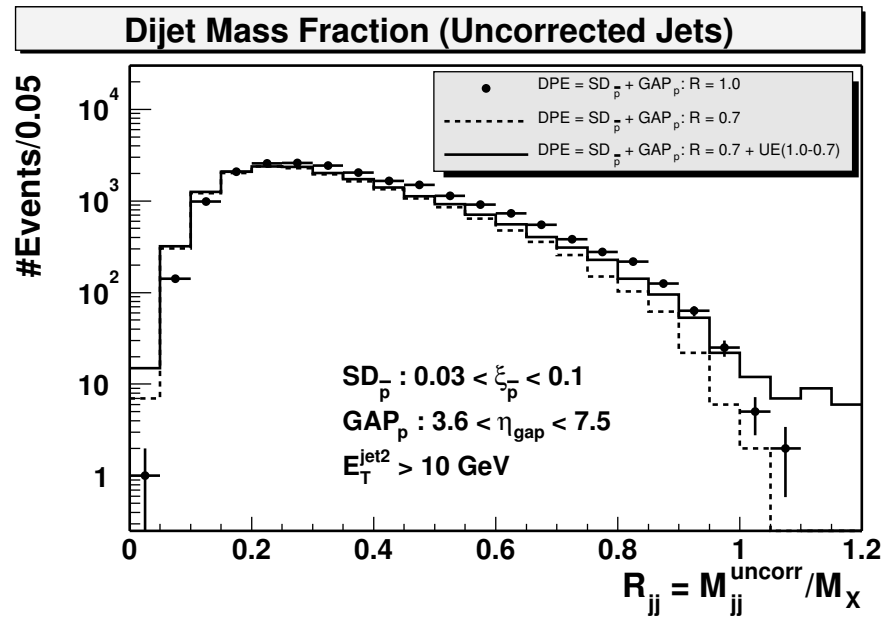
At E_T^{jet1}>10 GeV,

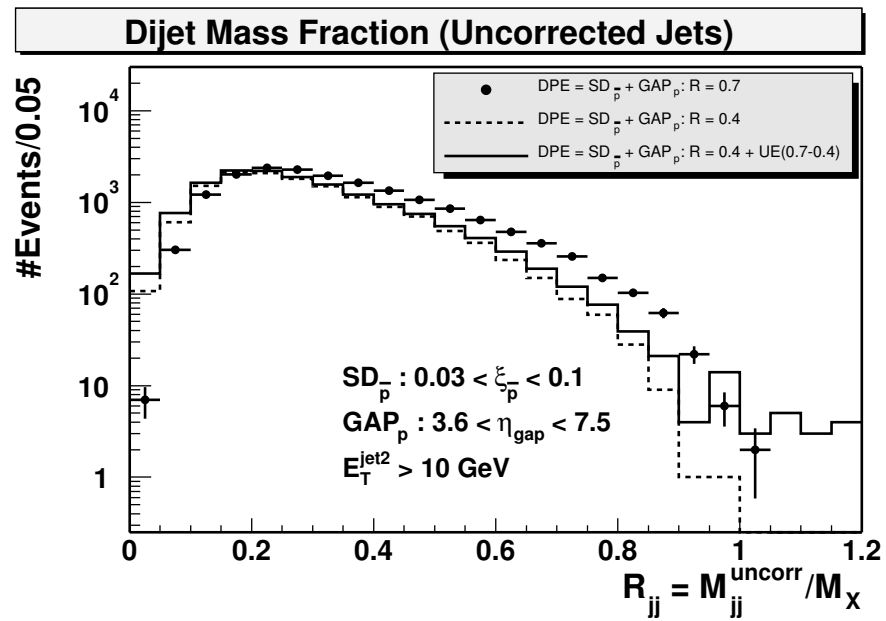
- ✔ 25% change of MP scale
  → variation of $\sigma(R_{jj}>0.8) < \pm 14\%$
- ✔ 10% change of Central+Plug scale
  → variation of $\sigma(R_{jj}>0.8) < \pm 25\%$

Evaluated at different minimum E_t^{jet1}

Systematic Uncertainty: Cone Size







Hadronization Effect:

R_{jj} depends on cone size (unless no out-of-cone and no underlying energy)

$\sigma(R_{jj}>0.8)$ for R=1.0 is similar (within 20%) to $\sigma(R_{jj}>0.8)$ for R=0.7+UE energy in annulus (R=1.0 – 0.7)

Summary of Systematics and Cross Sections

Source	Error on $\sigma(R_{jj}>0.8)$
Calorimeter (Central, Plug) Energy Scale	20(22)%
Calorimeter (MiniPlug) Energy Scale	14(19)%
Roman Pot Acceptance	10%
Trigger Efficiency	5%
Multiple Interaction Correction	6%
Luminosity	6%
TOTAL	**28(32)%** for E_{T1}^{min} = 10(25) GeV

Note: contribution from UE energy error (±30%) ~ 0.5%

To be preblessed

$|\eta_{jet1,2}|<2.5$, $0.03<\xi_{\bar{p}}<0.1$, $3.6<\eta_{gap}<7.5$, R = 0.7

Minimum E_T^{jet1}	Cross Section : $\sigma_{DPE}^{excl.\ jj}(R_{jj}>0.8)$
10 GeV	**970 ± 65(stat) ± 272(syst) pb**
25 GeV	**34 ± 5(stat) ± 10(syst) pb**