Ricerca di una nuova risonanza W’ nel canale-s a $\sqrt{s}$ = 13 TeV con il rivelatore CMS al LHC

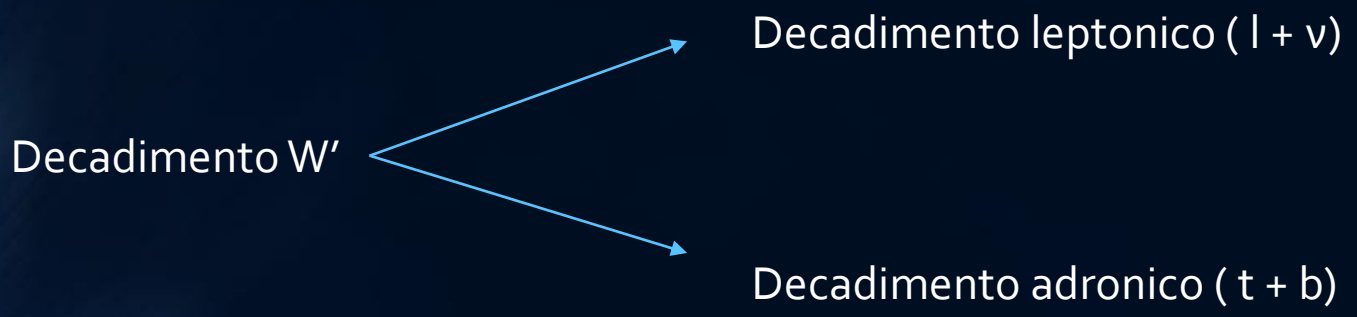
W’

In fisica delle particelle, W’ è un bosone di gauge ipotetico che deriva dall’estensione della simmetria elettrodebole del modello standard.

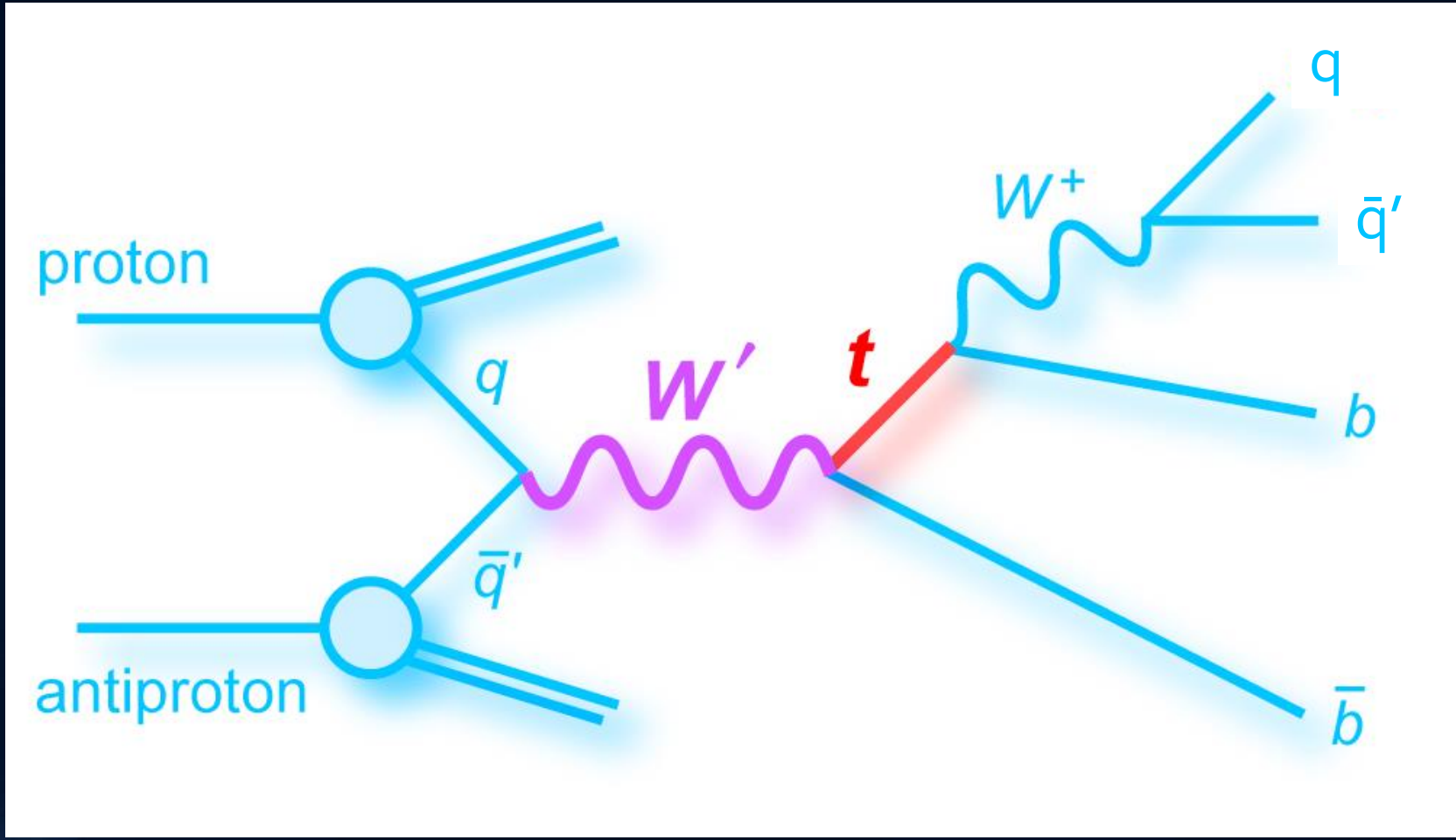
Carica = ± 1 (in unità di carica elettrica elementare)

Spin = 1

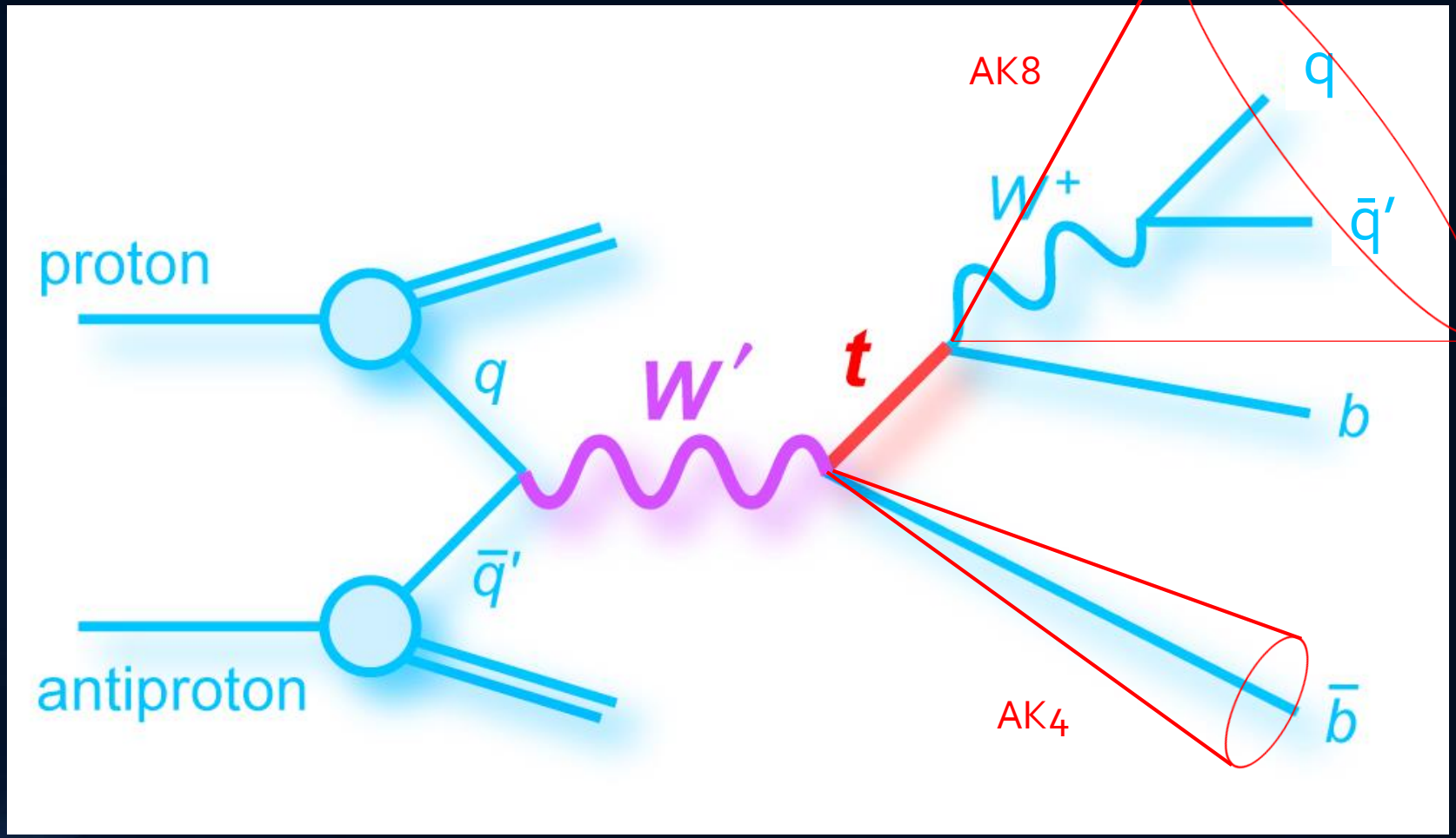
Massa = sconosciuta (O(TeV))



SEGNALE

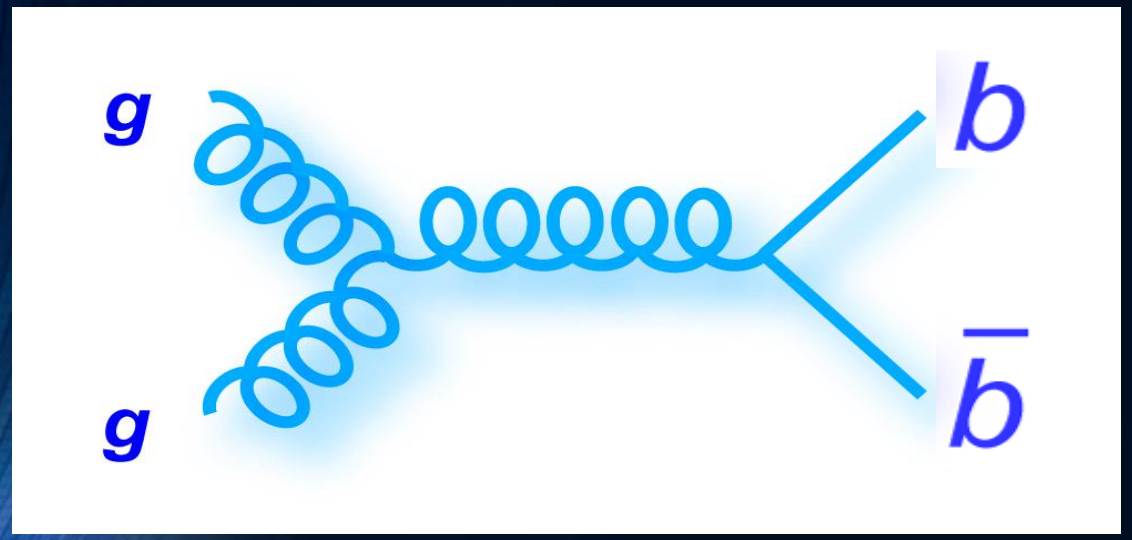


SEGNALE

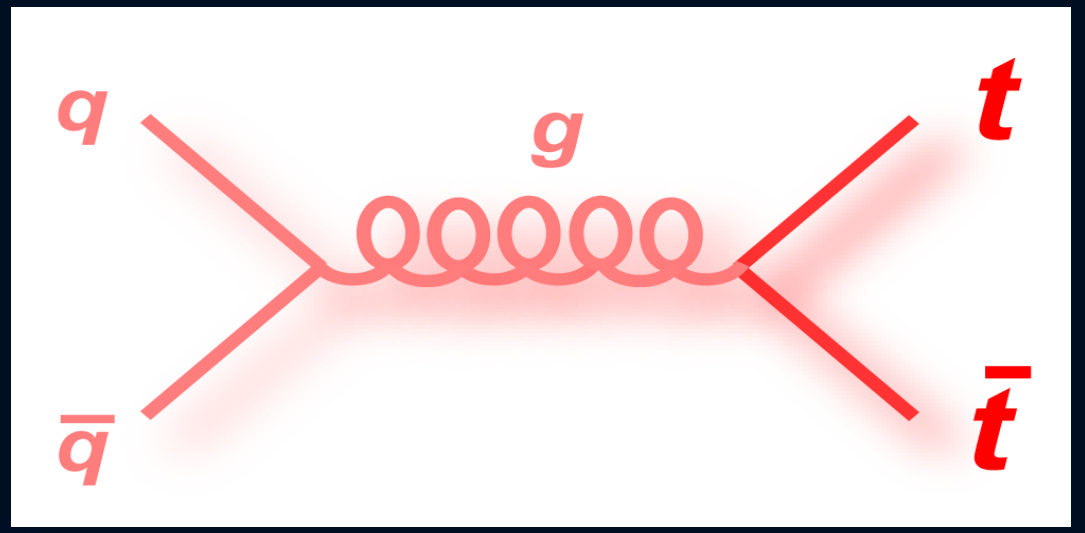


FONDO

QCD multijet



$t\bar{t}$



SELEZIONI

- Trigger : HT > 800 GeV
- Pre-selezione: no leptoni, almeno 1 AK8, almeno 1 AK4
- Jet AK8 prodotto dal quark top (AK8 top):
  - 150 GeV < m < 220 GeV
  - Pt > 400 GeV
  - $\frac{\tau_3}{\tau_2} < 0.8$
  - sottojet b-taggato
- No overlap tra *fat jet* e *narrow jet* ($\Delta R = \sqrt{\Delta\phi^2 + \Delta\eta^2} > 1.2$)
- AK4 b-taggato (CSV > 0.8484)

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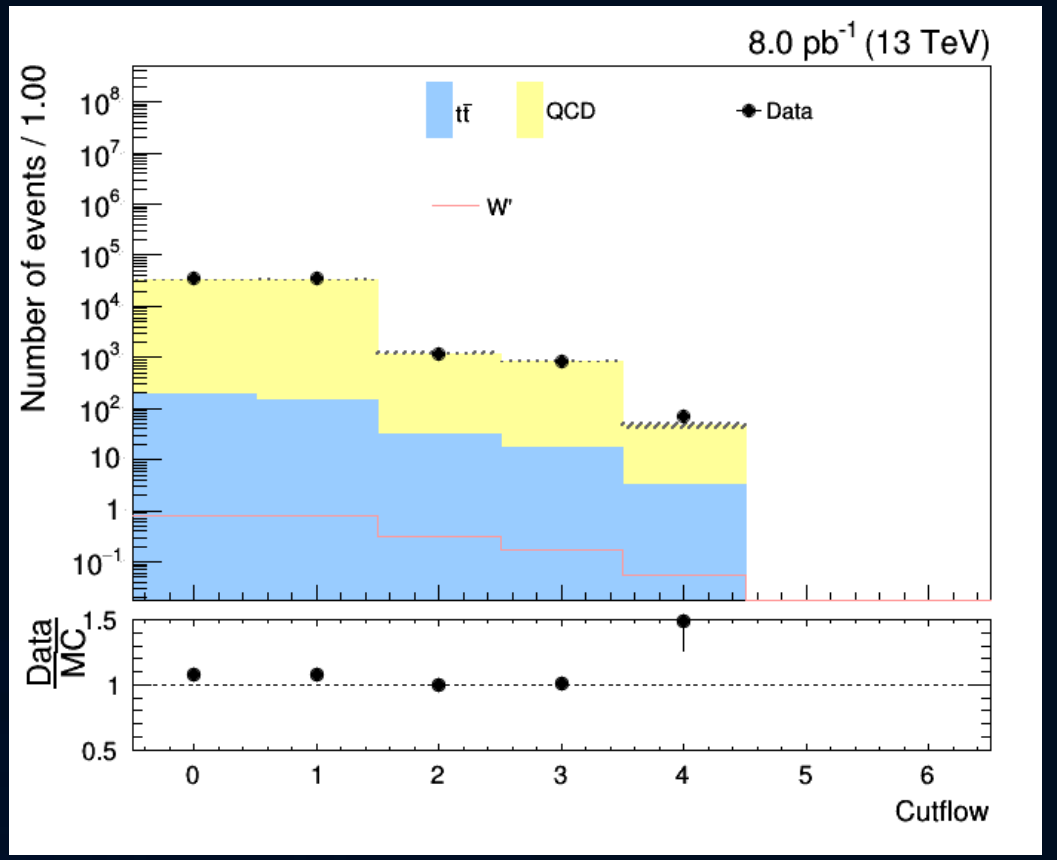
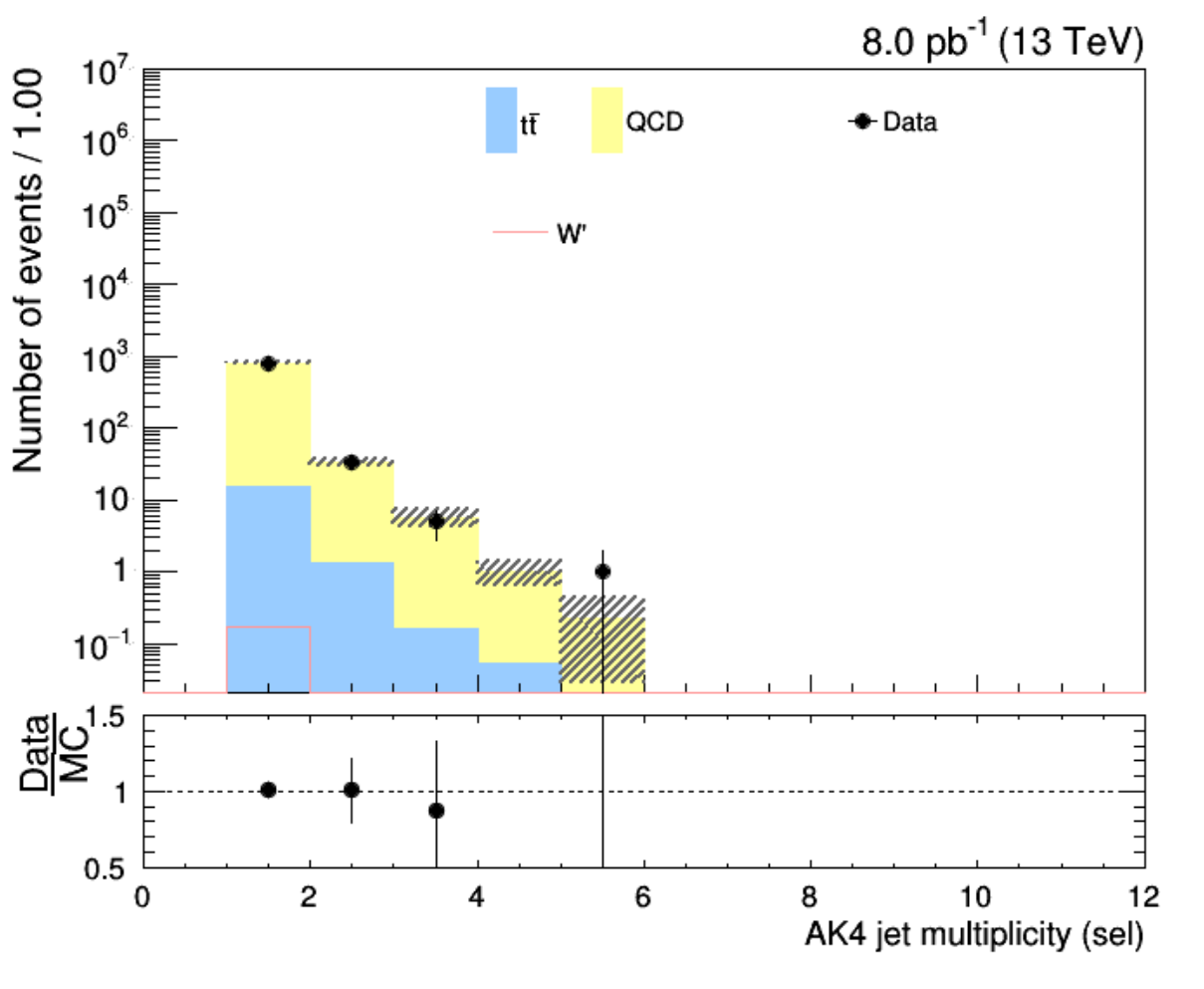
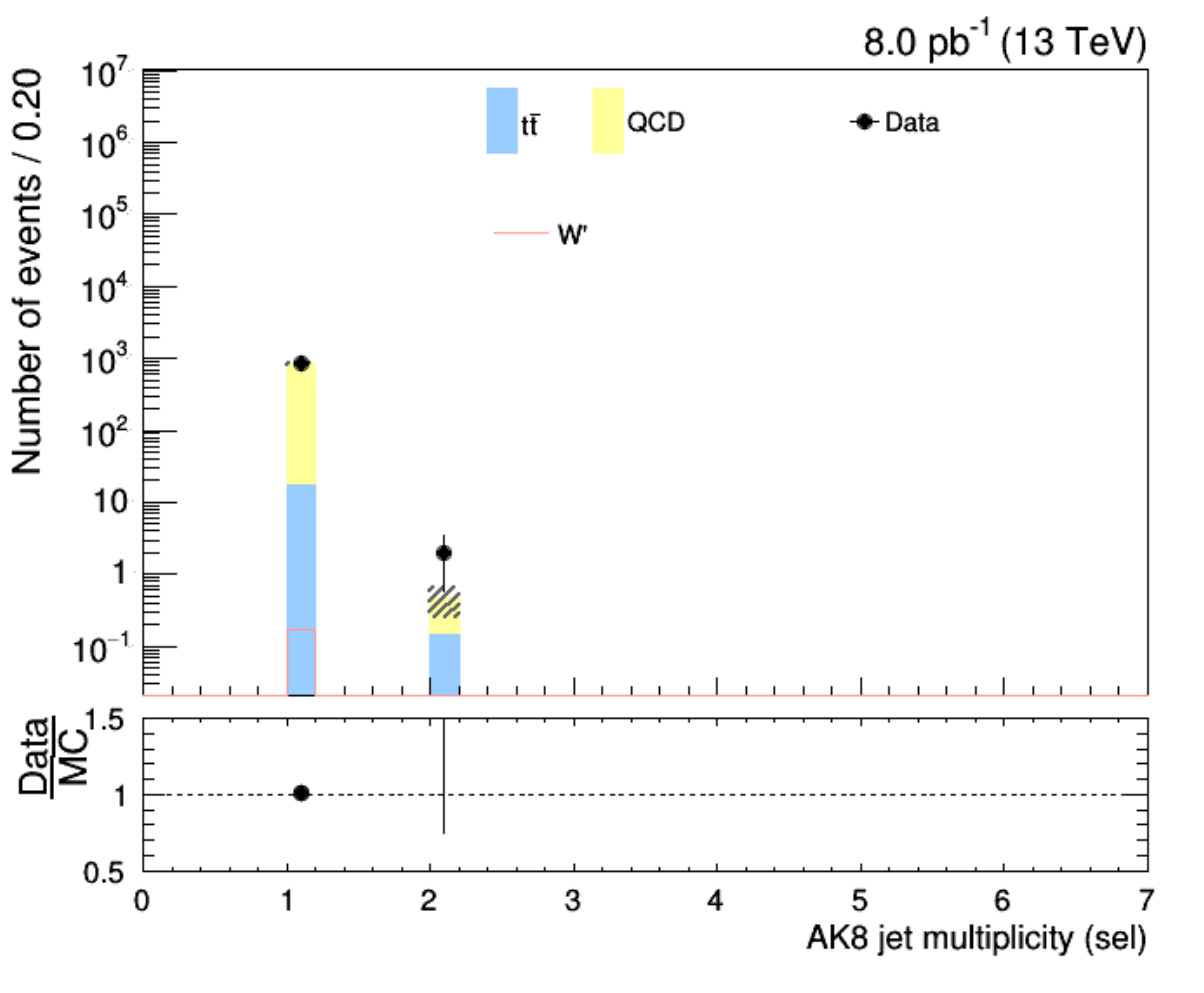
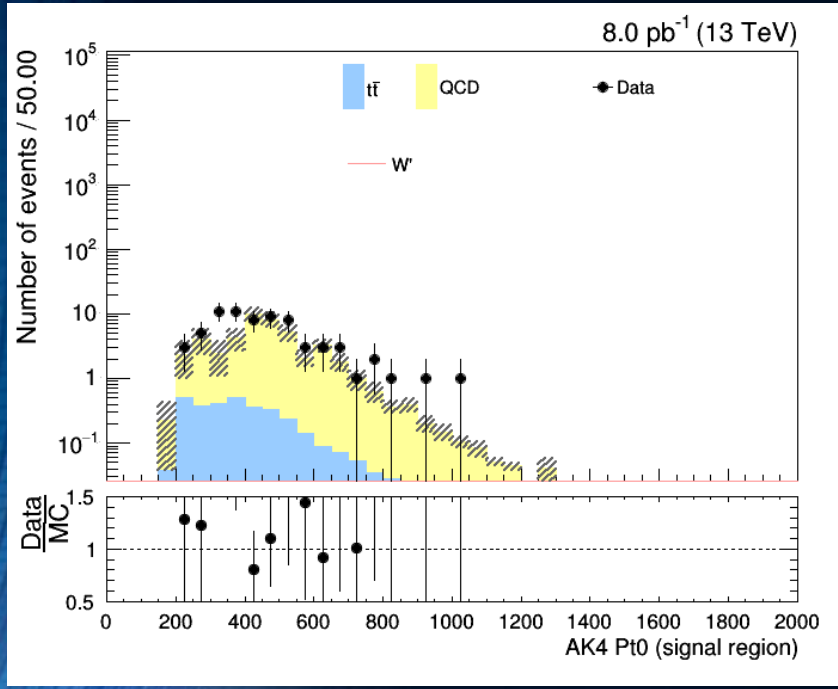


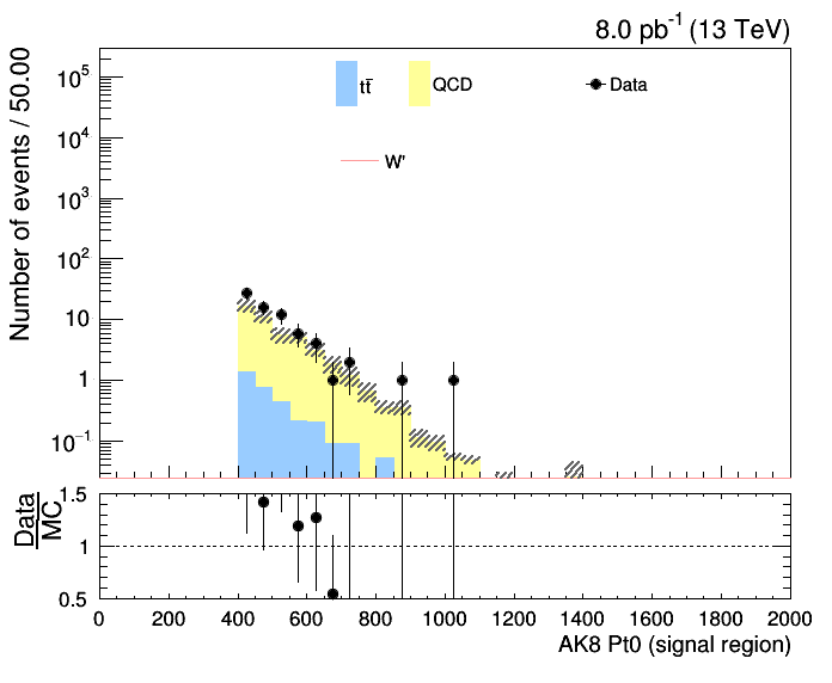
MOLTEPLICITA' DEI JET

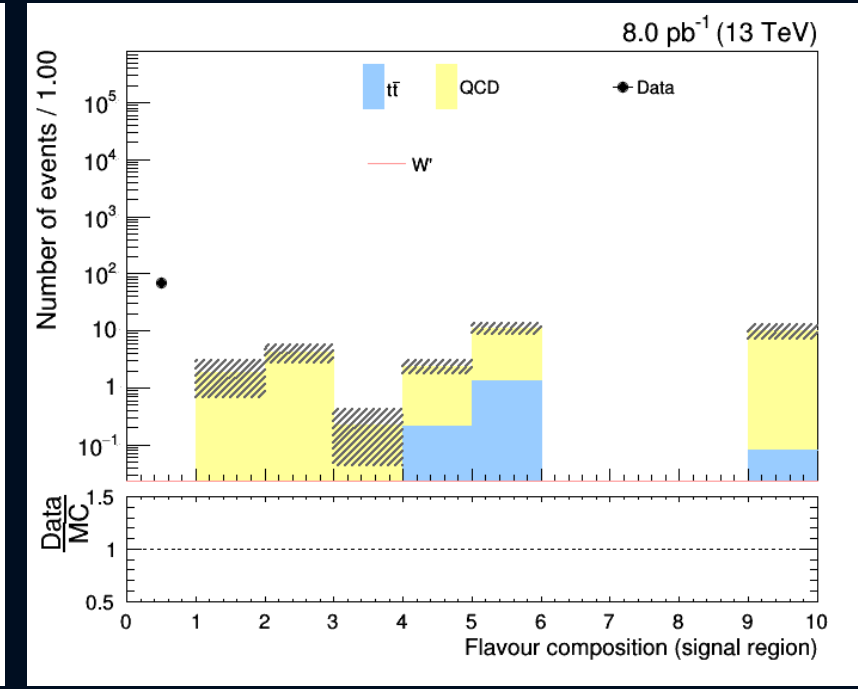




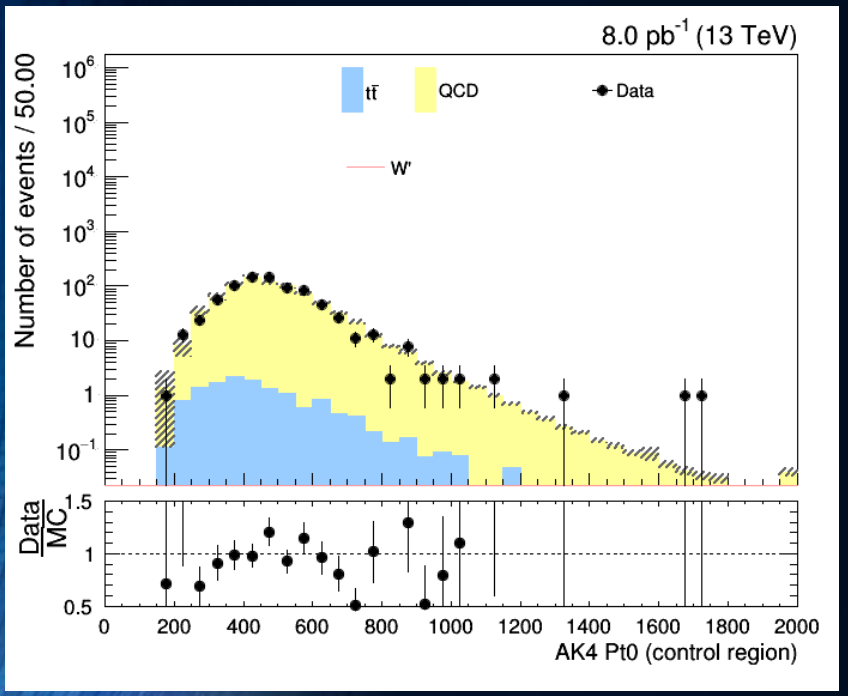
REGIONE DI SEGNALE

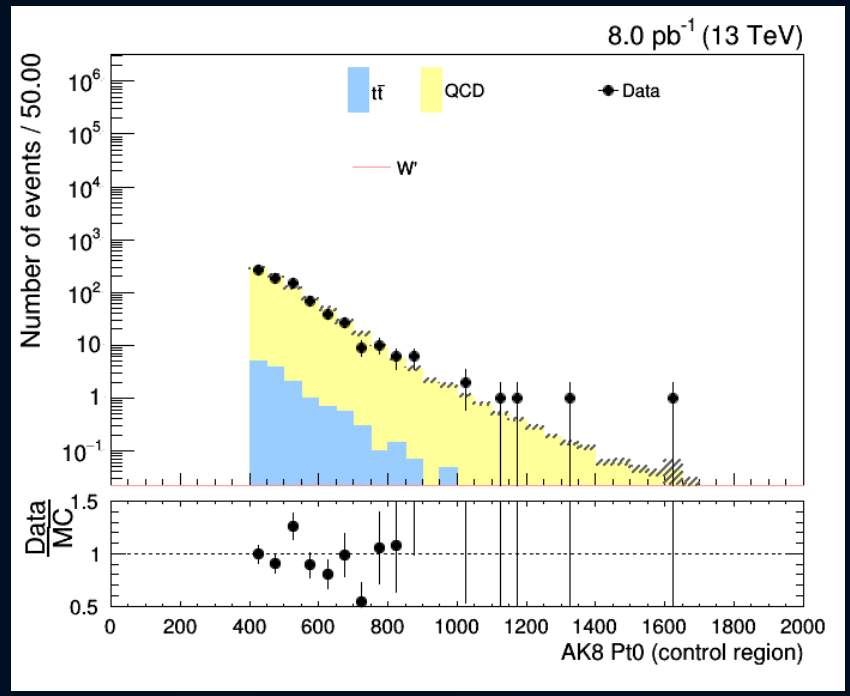


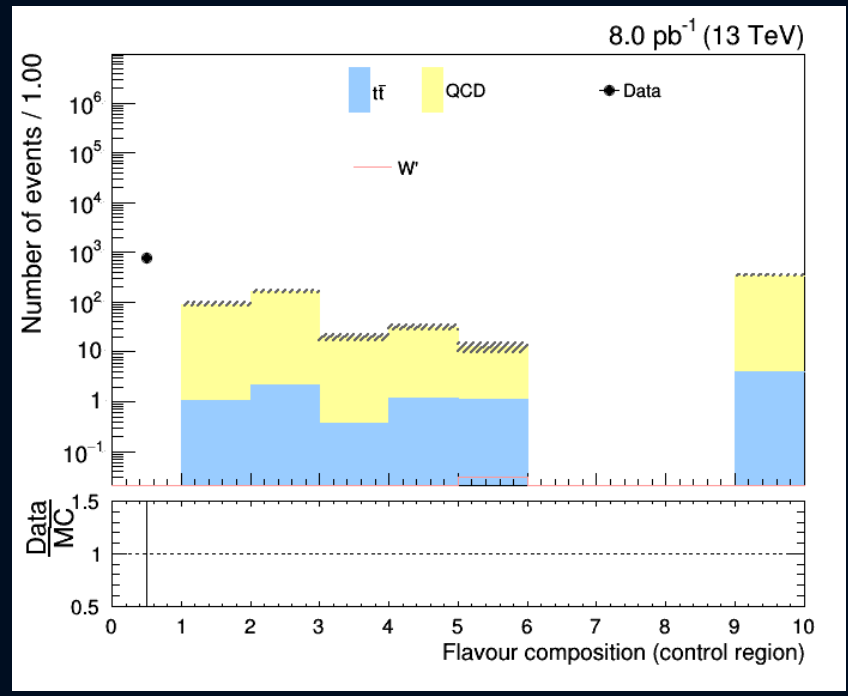




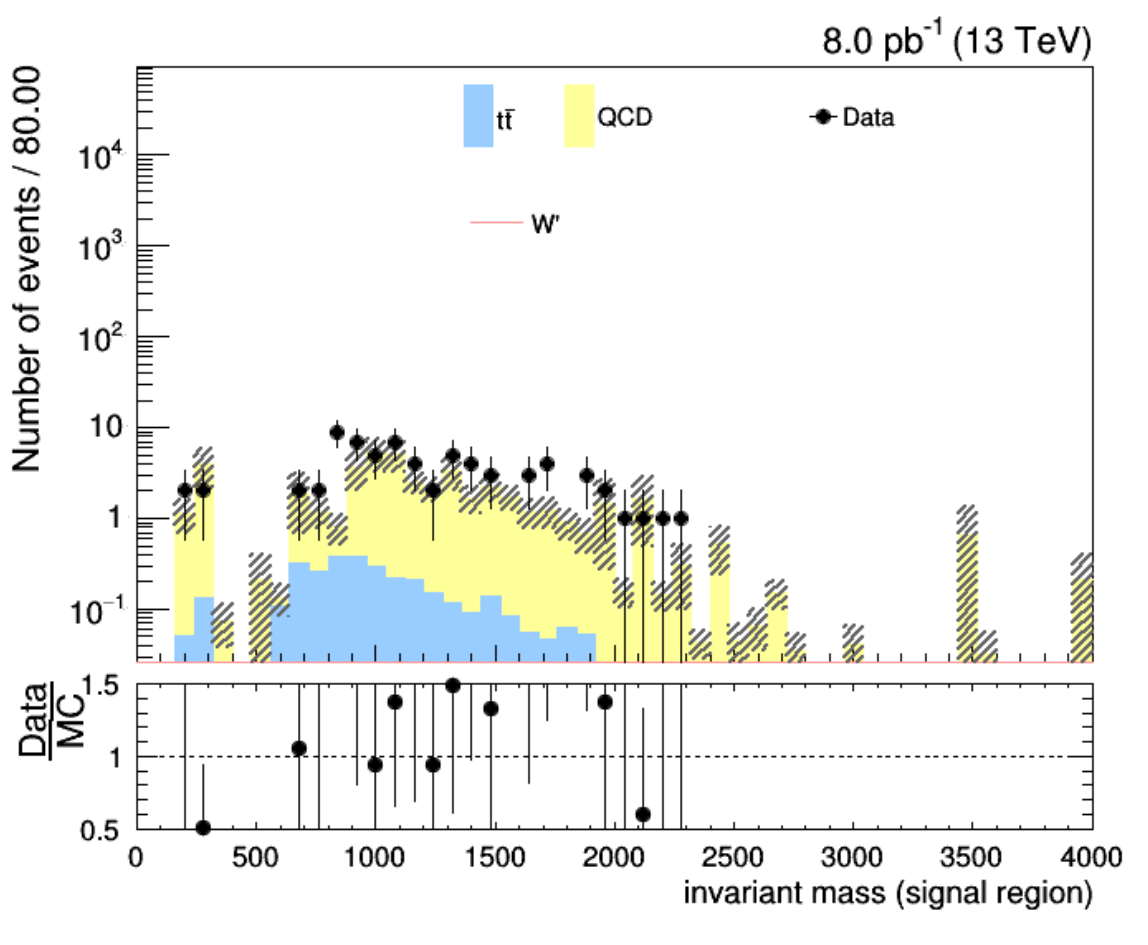
REGIONE DI CONTROLLO

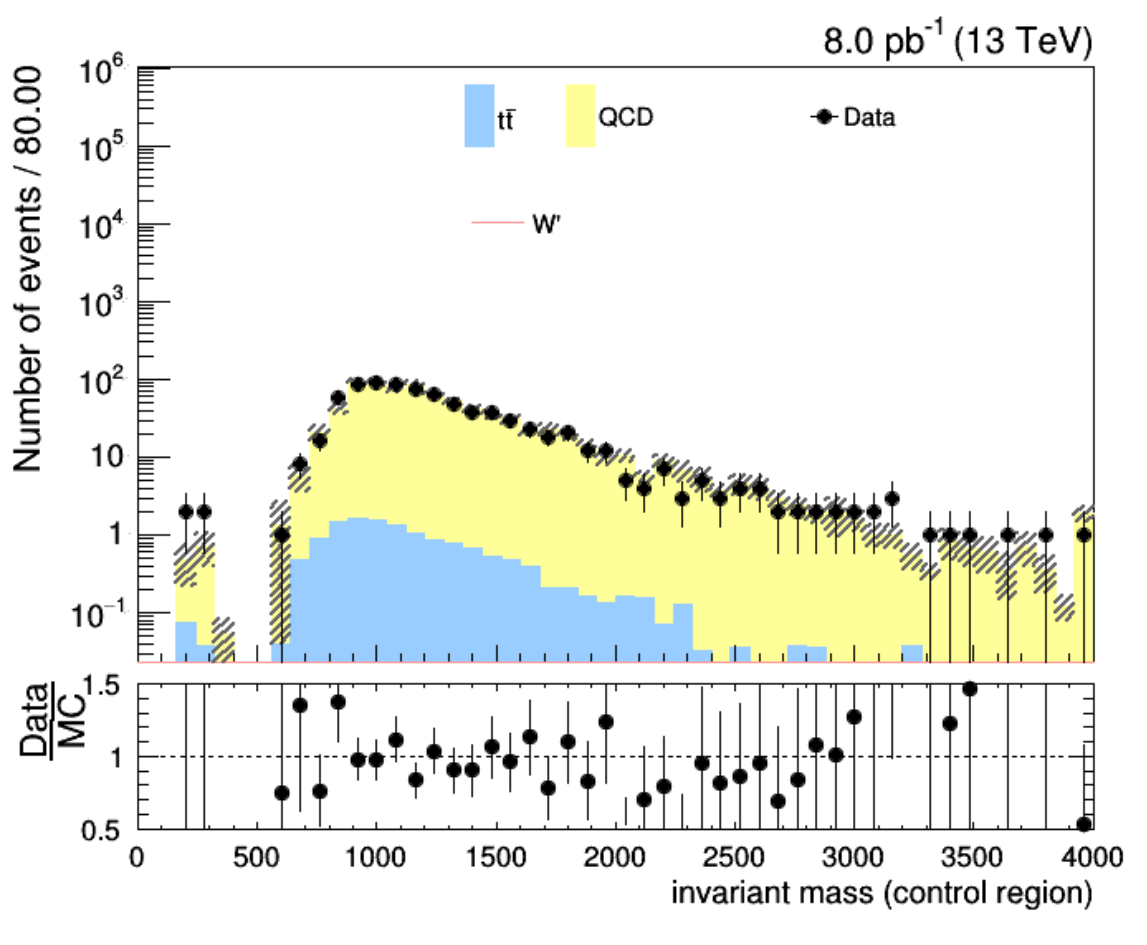






MASSA INVARIANTE





WORK IN PROGRESS…

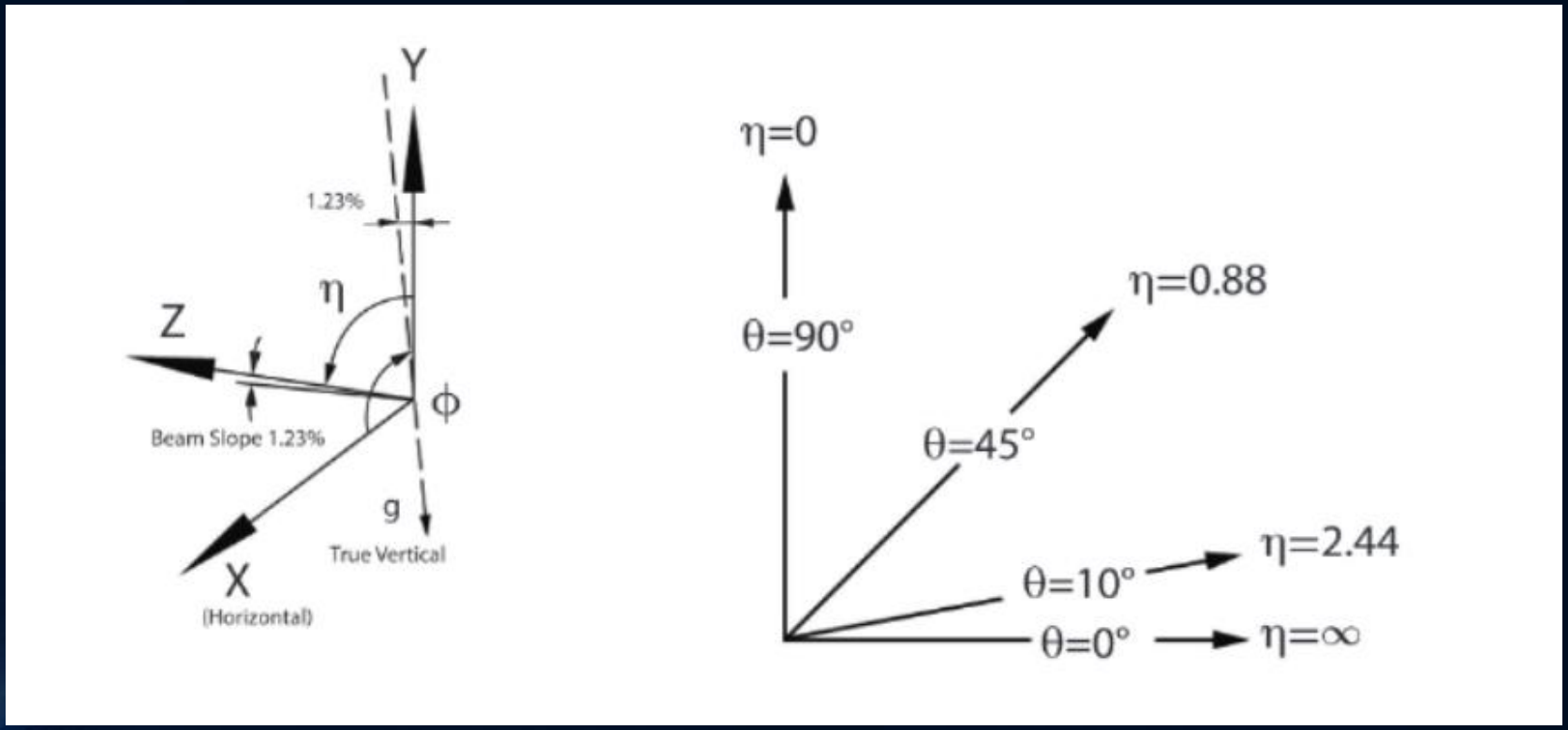
- Ottimizzare la selezione
- Sviluppare un metodo data driven per prendere la shape dalla regione di controllo
- Provare la regione di controllo ottenuta invertendo il taglio sulla massa del top
- Girare sui dati
- Aggiungere le sistematiche

FINE

BACKUP

R è il raggio parametro usato per definire la porzione di angolo solido coperto dal jet.

$$R = \sqrt{\phi^2 + \eta^2} \qquad \text{con} \qquad \eta = -ln\left(tg\ \frac{\theta}{2}\right)$$



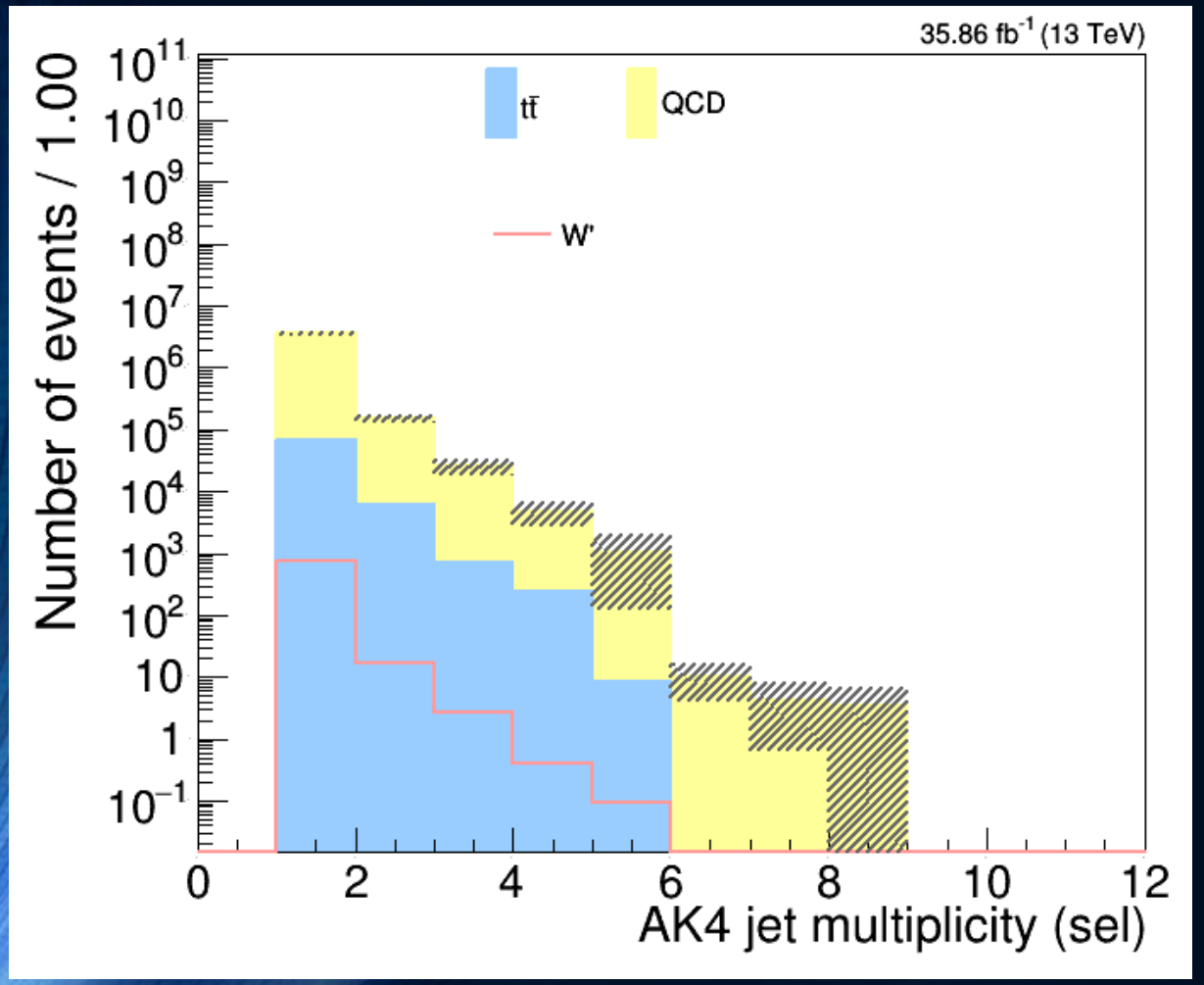
CUTFLOW

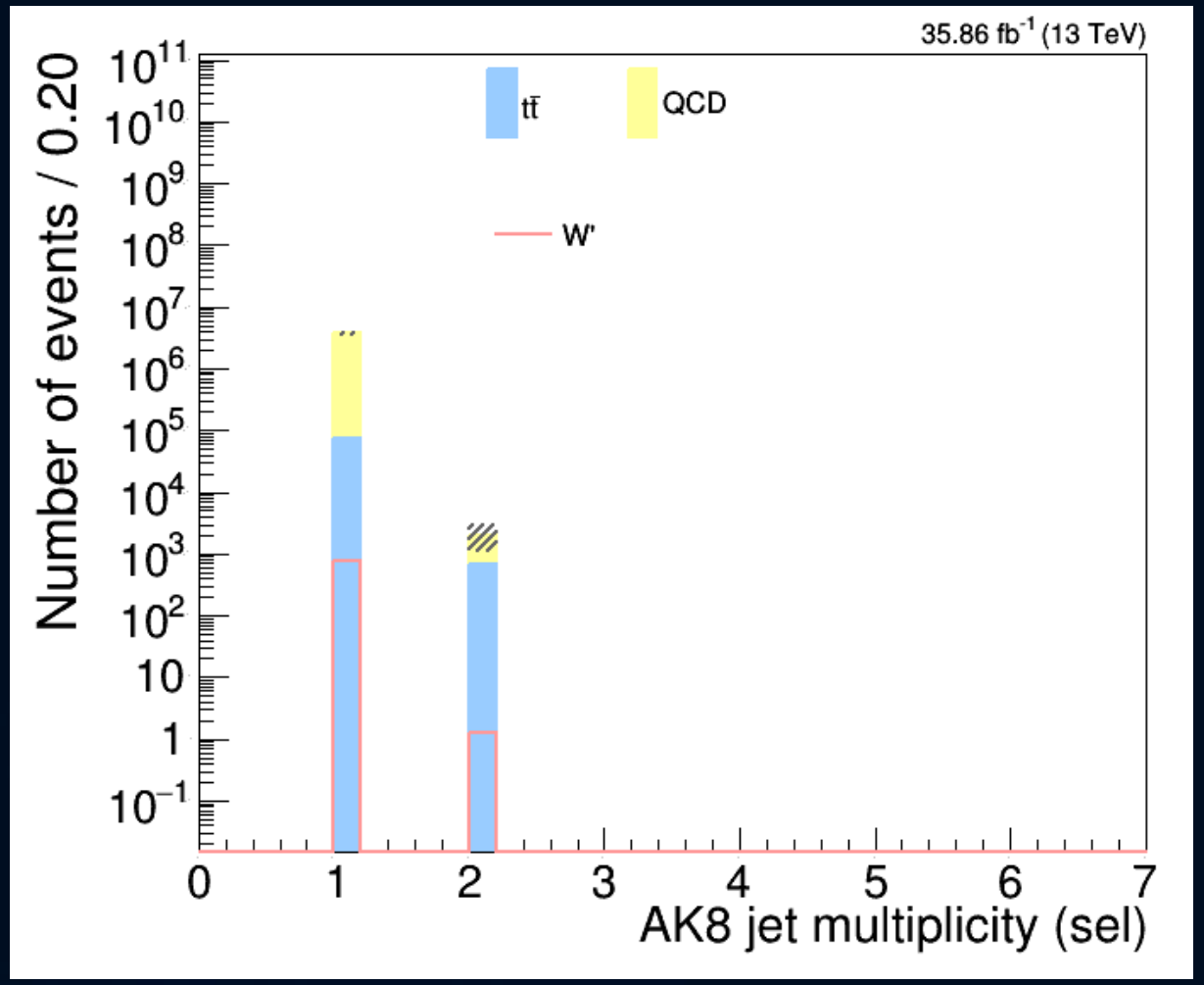
	W′	tt̄	QCD	Dati
Entires	4700	395694	506347	221141
Trigger	40632	11778	40411	36290
Pre-selezione	40243	8776	401365	35800
AK8 top	16443	1839	31407	1200
$\Delta R > 1.2$	8916	1014	20618	847
AK4 b-taggato	2786	194	1392	70
AK4 no b-taggato	6130	820	19226	777

σ

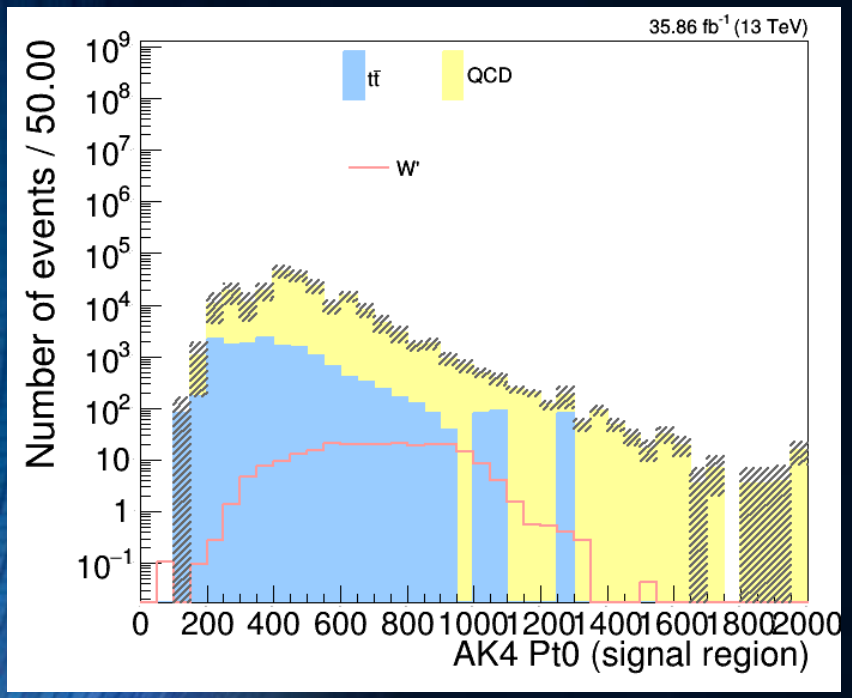
	σ (pb)
W'	0.11459
$t\bar{t}$	831.76
QCD 300-500	347700
QCD 500-700	32100
QCD 700-1000	6831
QCD 1000-1500	1207
QCD 1500-2000	120
QCD 2000-inf	25

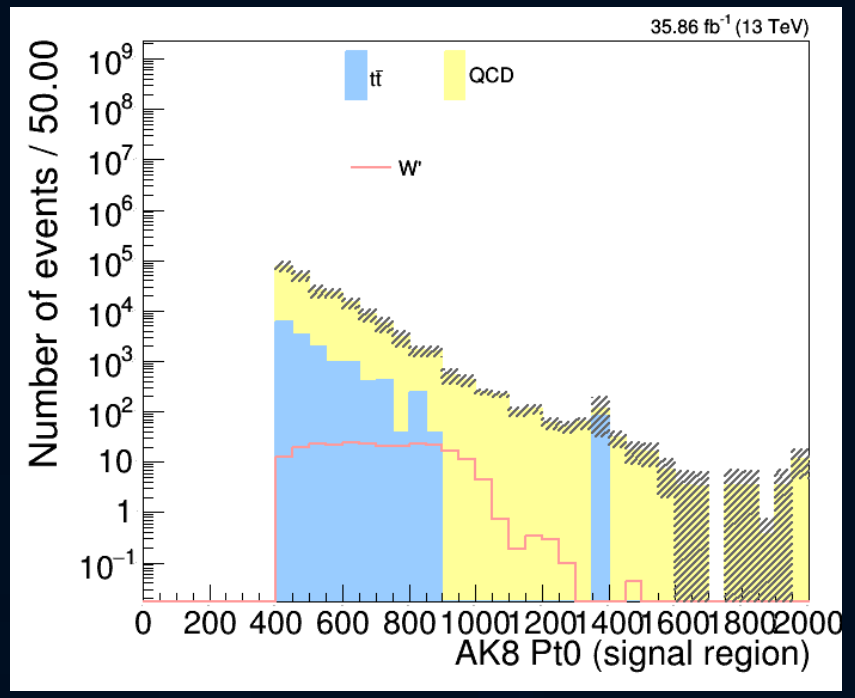
MOLTEPLICITA' DEI JET

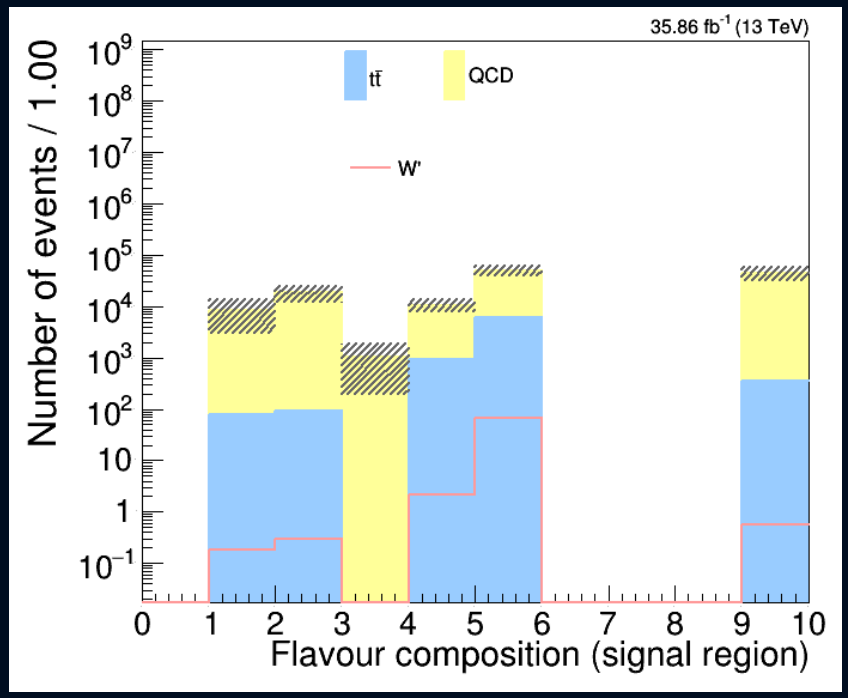




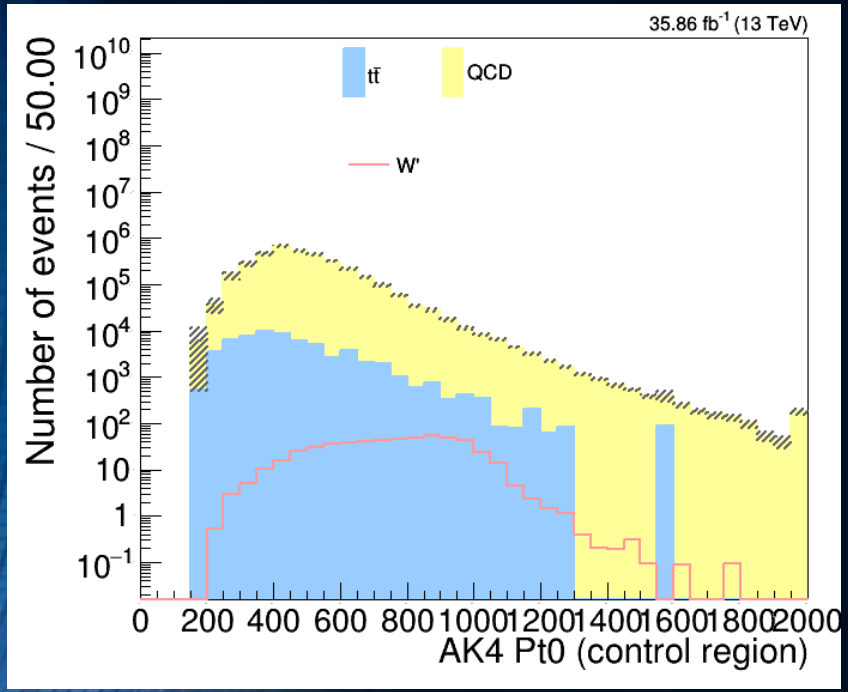
REGIONE DI SEGNALE

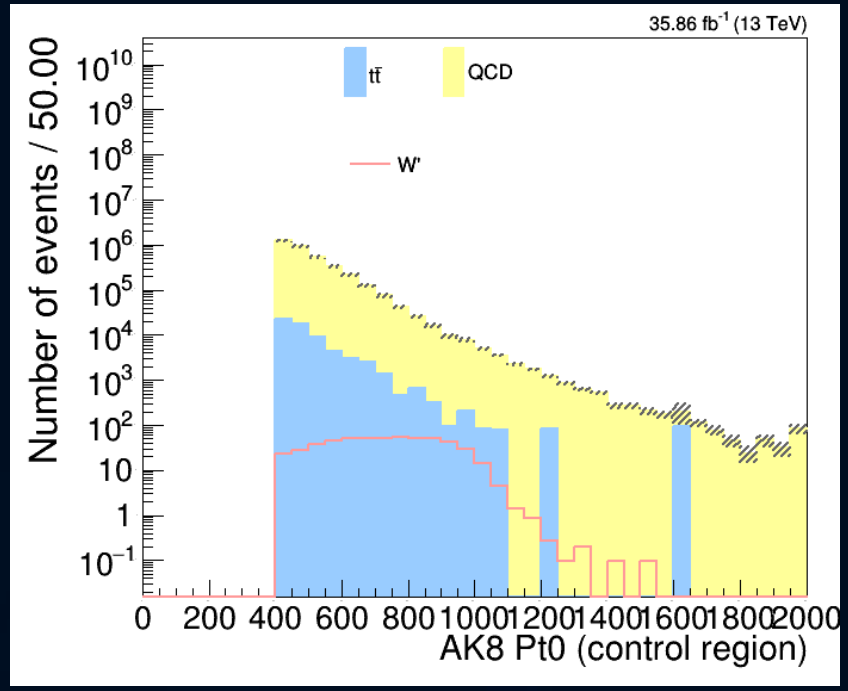


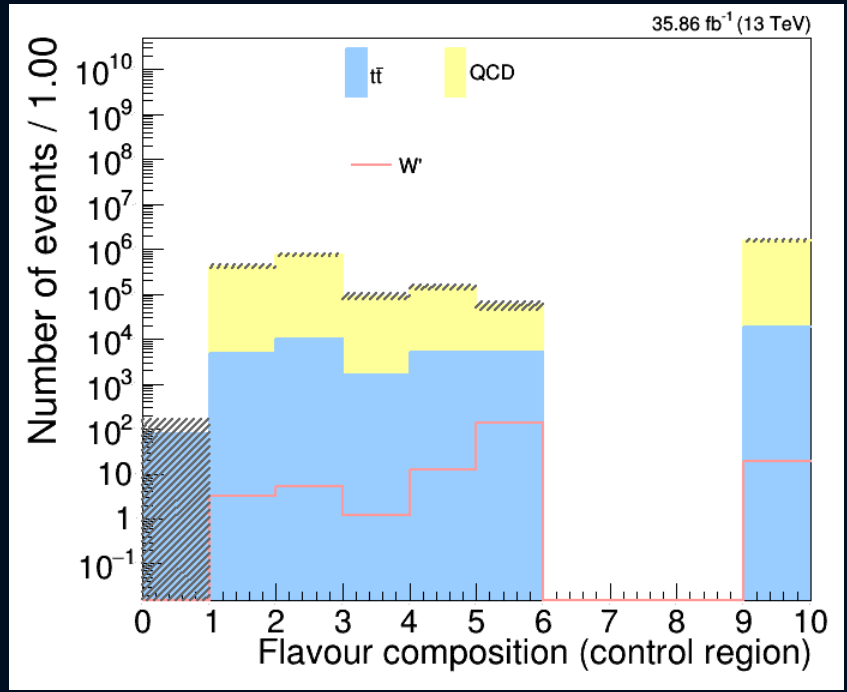




REGIONE DI CONTROLLO







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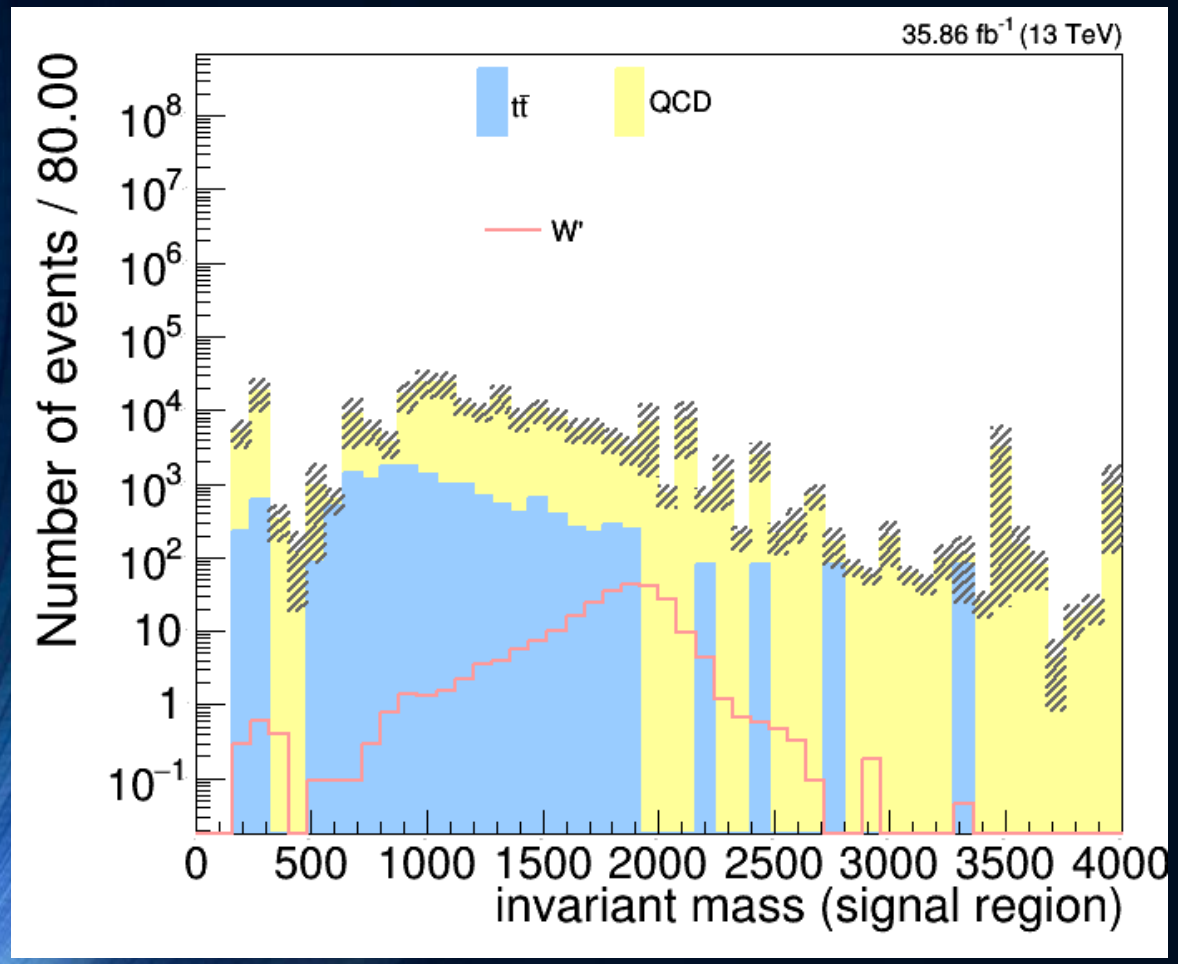

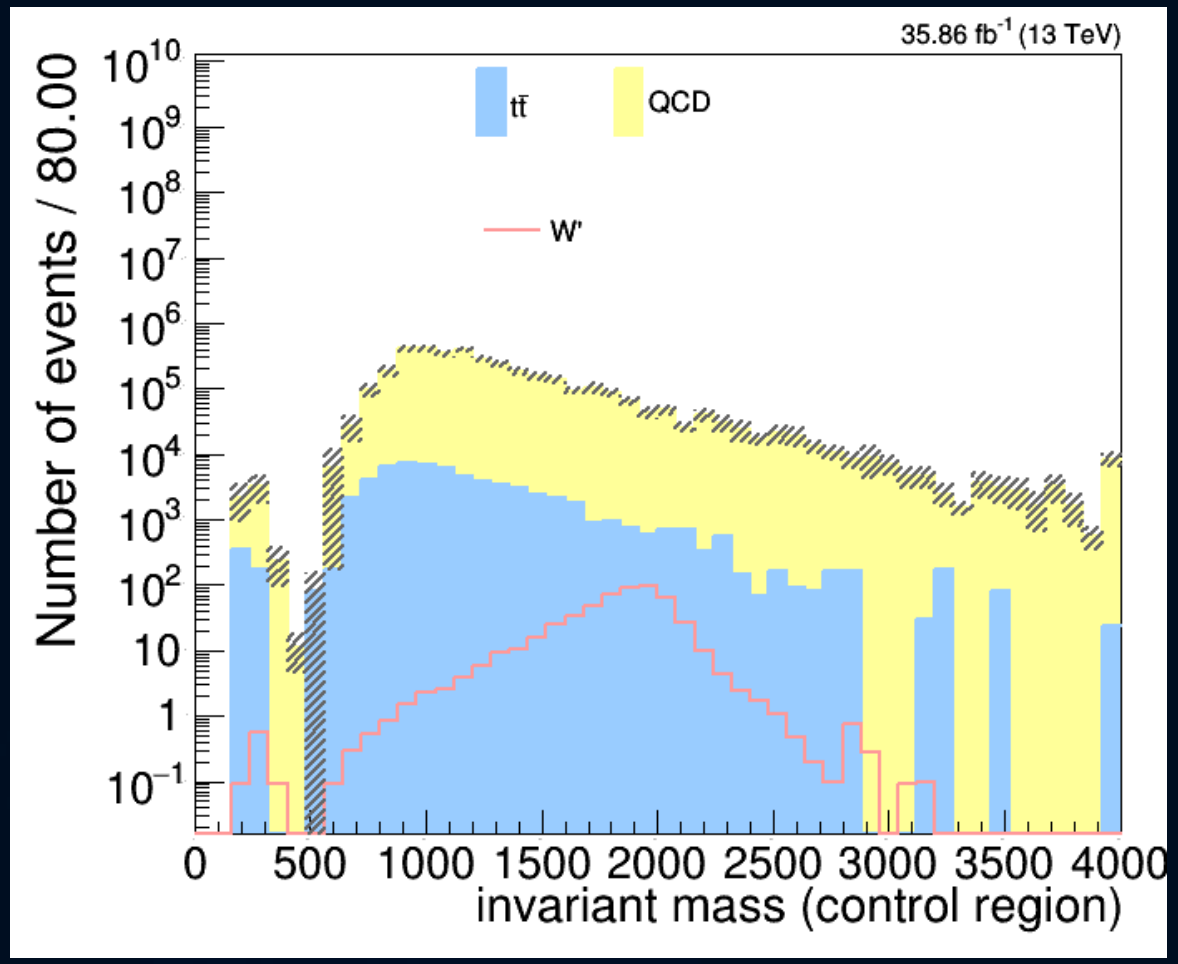

MASSA INVARIANTE

$$M = \sqrt{\left(\sum_i E_i\right)^2 - \left(\sum_i \vec{p}_i\right)^2}$$

$$p^2 = p_x^2 + p_y^2 + p_z^2$$

$$p_x = p_T \cos\phi$$
$$p_y = p_T \operatorname{sen}\phi$$
$$p_z = p_T \operatorname{senh}\eta$$

$$|p| = p_T \cosh\eta$$