

Annexe X

Distributions de contrôle – $H \rightarrow \tau\tau$

Cette annexe présente des distributions de contrôle avant ajustement des paramètres de nuisance sur les événements utilisés dans l'analyse des événements $H \rightarrow \tau\tau$ présentée dans le chapitre 4. La sélection est « inclusive », les événements sont ceux sélectionnés par la définition de la région de signal, sans coupure sur m_T^ℓ (canaux $\mu\tau_h, e\tau_h$) ni D_ζ (canal $e\mu$).

Pour chacune des trois années de prise de données (2016, 2017, 2018) et chacun des quatre canaux ($\tau_h\tau_h, \mu\tau_h, e\tau_h, e\mu$), les distributions de plusieurs variables sont données.

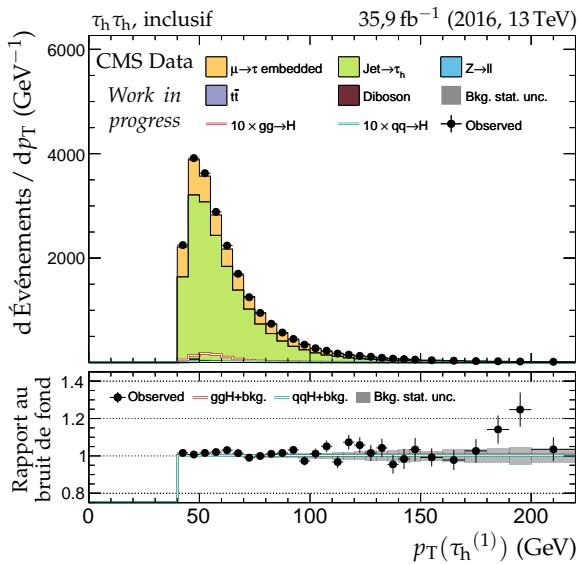
Dans chacun des graphiques, les données observées (points noirs) sont comparées à la modélisation des bruits de fond (histogrammes remplis en couleur et empilés). Les bandes grisées correspondent à l'incertitude statistique totale sur le bruit de fond. Le rapport au bruit de fond est donné dans la partie inférieure des graphiques.

Certaines de ces distributions de contrôle, en particulier :

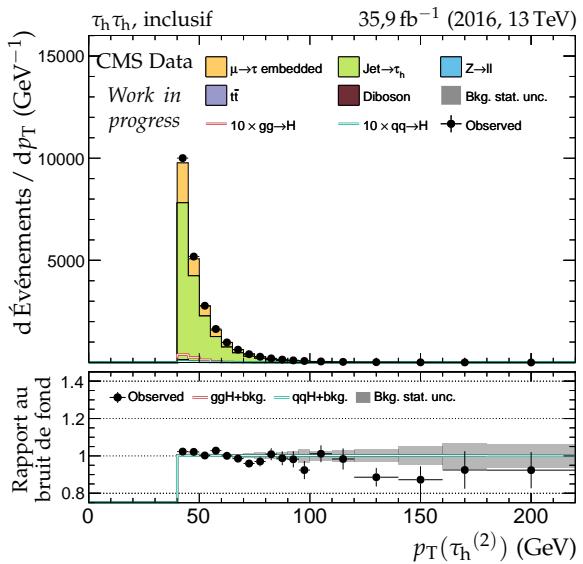
- le nombre de vertex d'empilement;
- la pseudo-rapidité du τ_h de plus haut p_T ;
- les jets issus de quarks b ;

présentent un mauvais accord entre données observées et estimations. De plus amples investigations seront menées en vue de la soutenance.

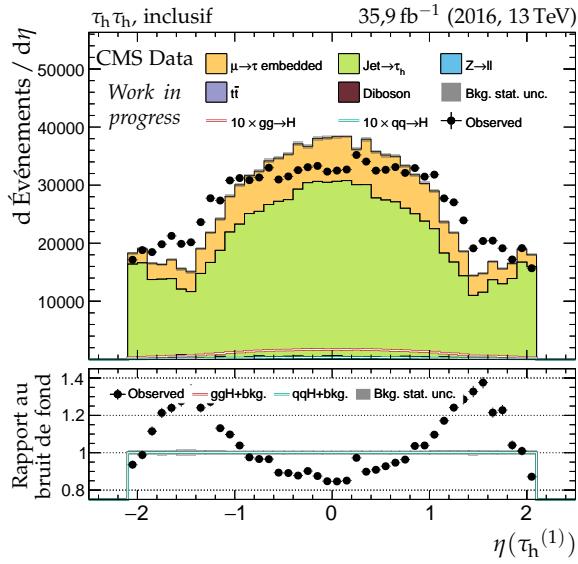
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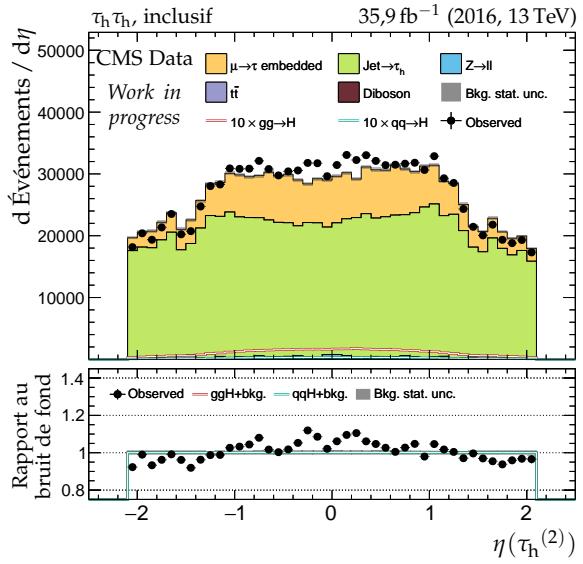
(a) Impulsion transverse du lepton 1 ($\tau_h^{(1)}$).



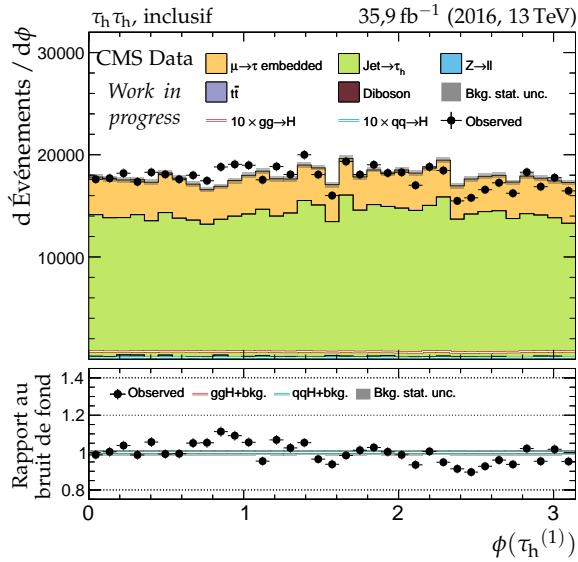
(b) Impulsion transverse du lepton 2 ($\tau_h^{(2)}$).



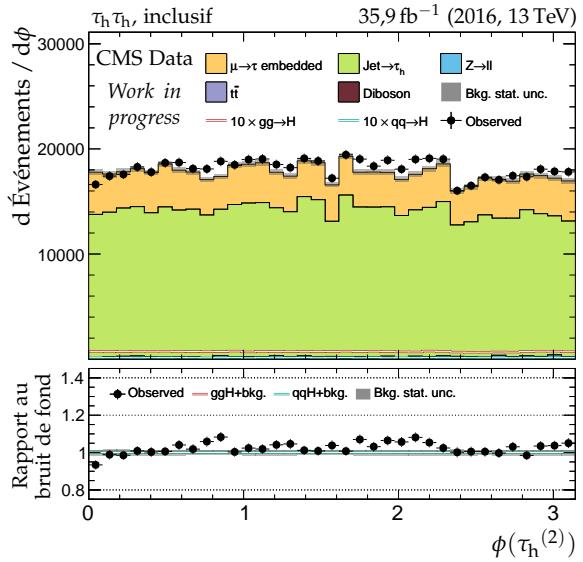
(c) Pseudo-rapidité du lepton 1 ($\tau_h^{(1)}$).



(d) Pseudo-rapidité du lepton 2 ($\tau_h^{(2)}$).

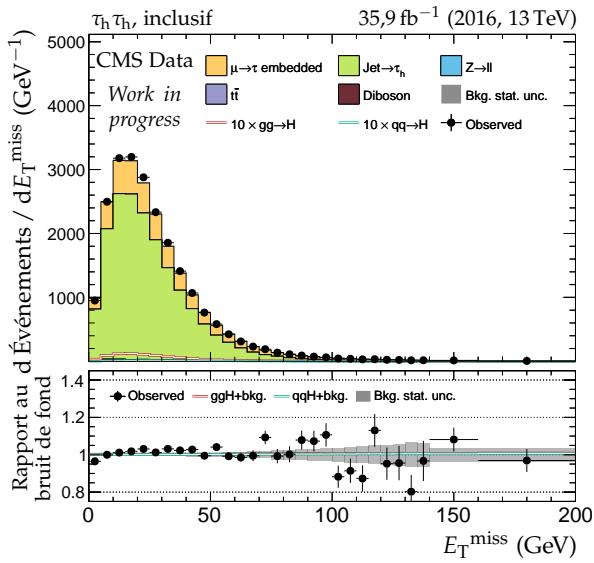


(e) Angle azimutal du lepton 1 ($\tau_h^{(1)}$).

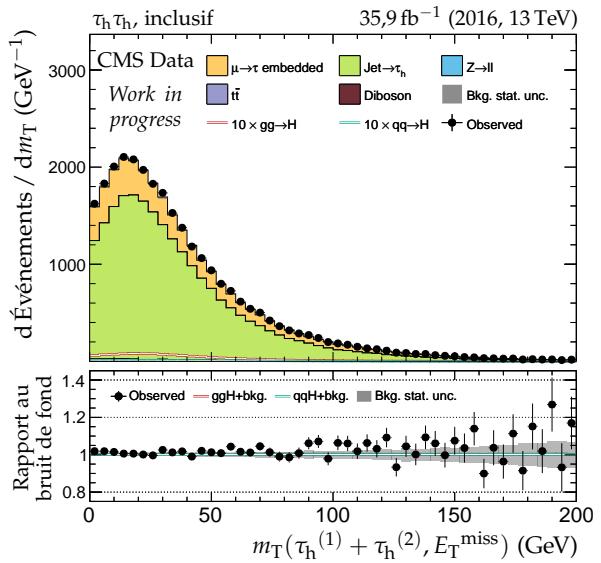


(f) Angle azimutal du lepton 2 ($\tau_h^{(2)}$).

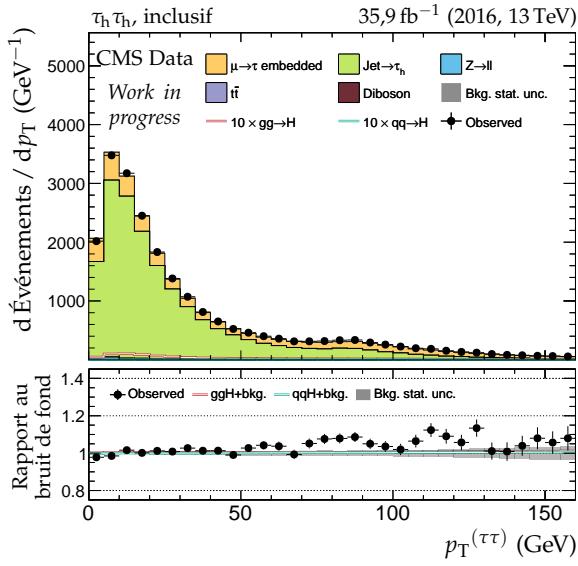
Figure X.1 – Canal $\tau_h \tau_h$, 2016 : cinématique des leptons ($\tau_h^{(1)}, \tau_h^{(2)}$).



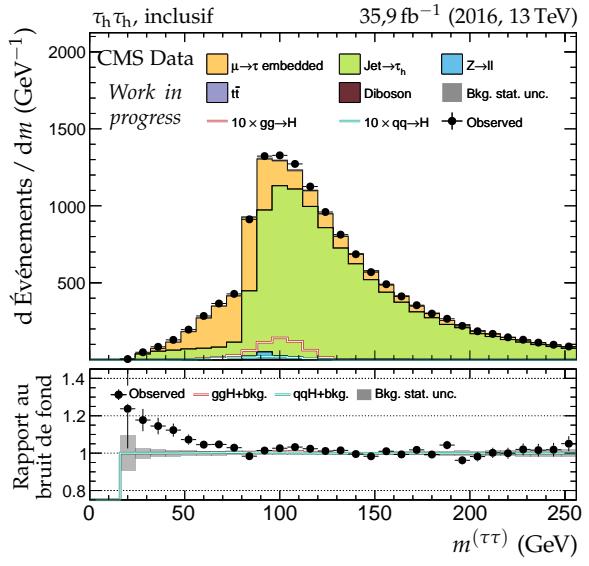
(a) Énergie transverse manquante.



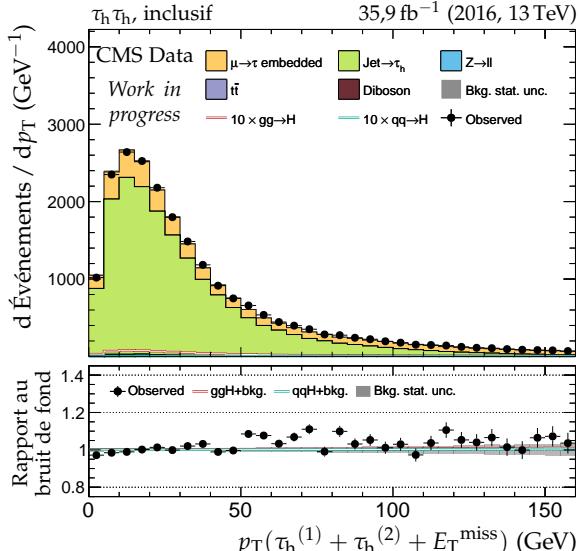
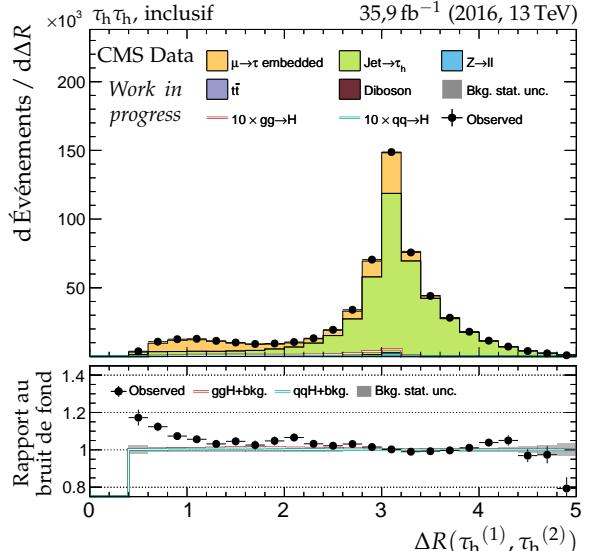
(b) Masse transverse du dilepton.



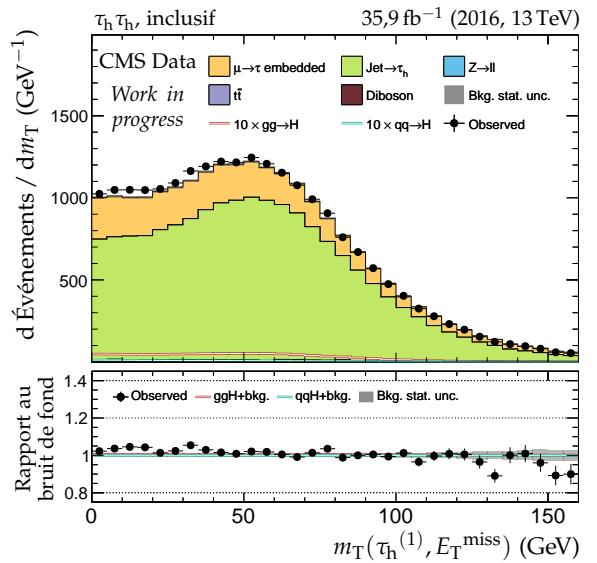
(c) Impulsion transverse du dilepton.



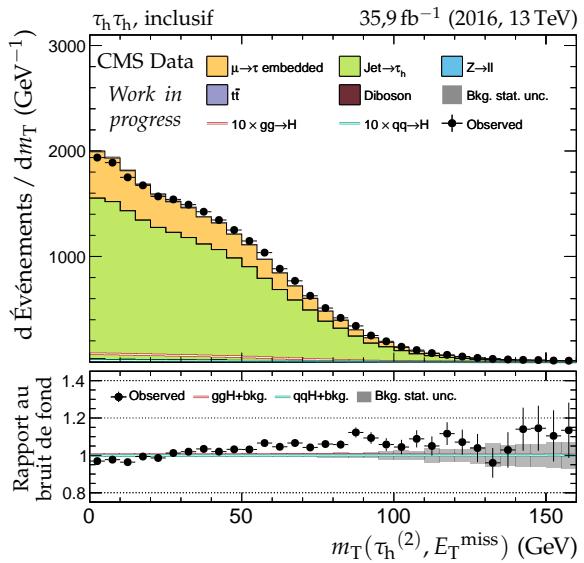
(d) Masse visible du dilepton.

(e) Impulsion transverse du système di- τ .(f) Distance ΔR entre les leptons ($\tau_h^{(1)}, \tau_h^{(2)}$).**Figure X.2 – Canal $\tau_h \tau_h$, 2016 : dilepton et énergie transverse manquante.**

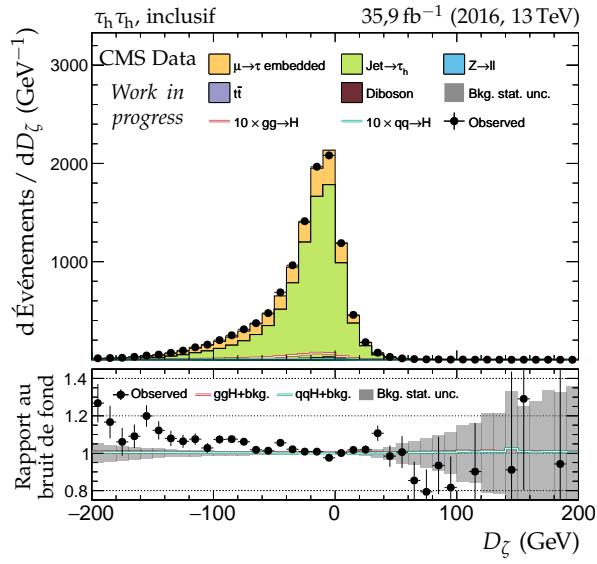
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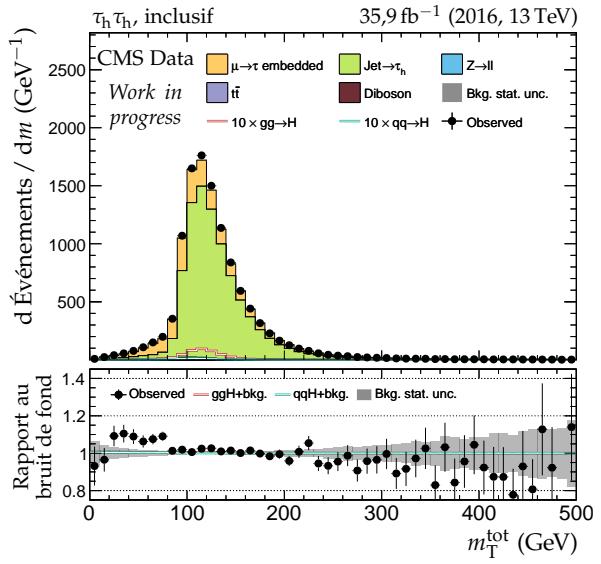
(a) Masse transverse du lepton 1 ($\tau_h^{(1)}$).



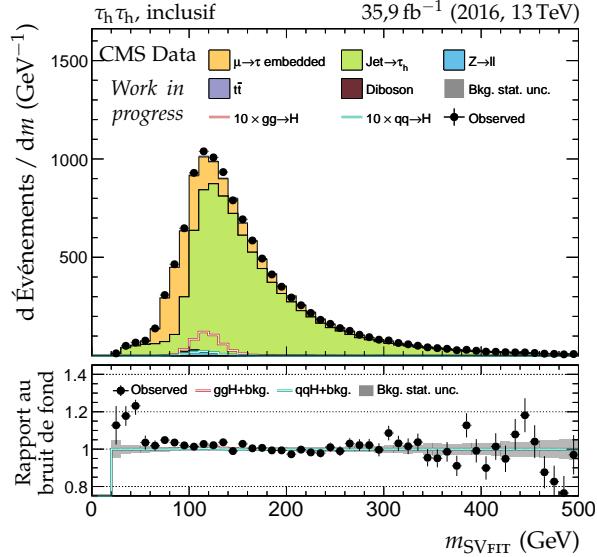
(b) Masse transverse du lepton 2 ($\tau_h^{(2)}$).



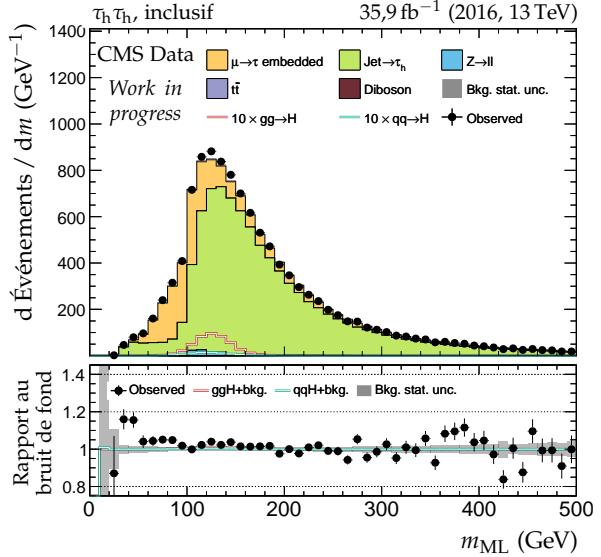
(c) Valeur de D_ζ .



(d) Masse transverse totale.



(e) Masse du système di- τ d'après SVFIT.



(f) Masse du système di- τ d'après le ML.

Figure X.3 – Canal $\tau_h \tau_h$, 2016 : masses transverses, D_ζ et masses.

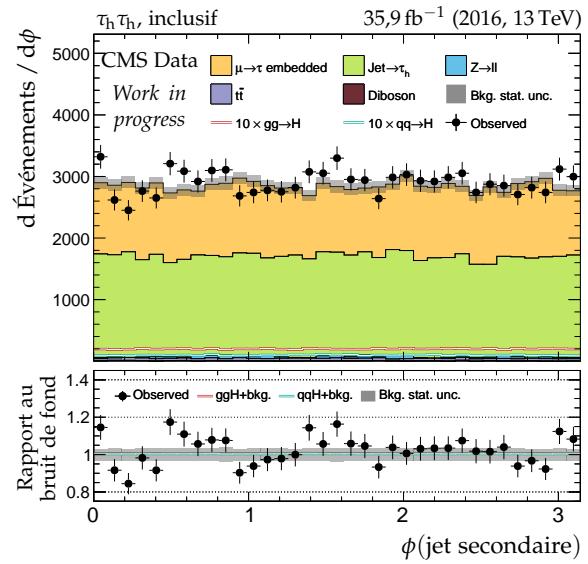
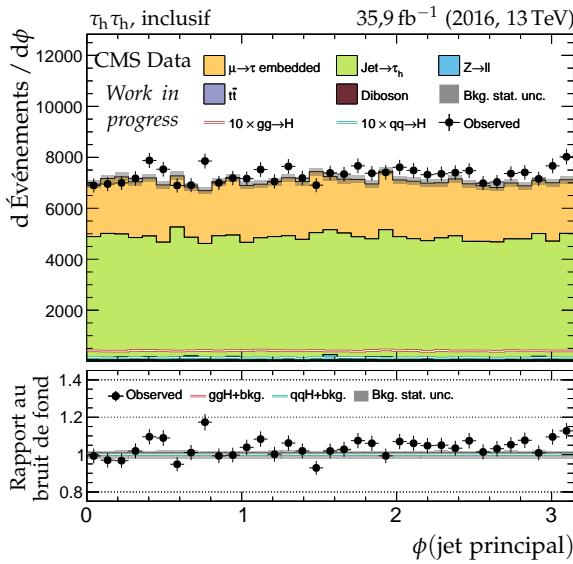
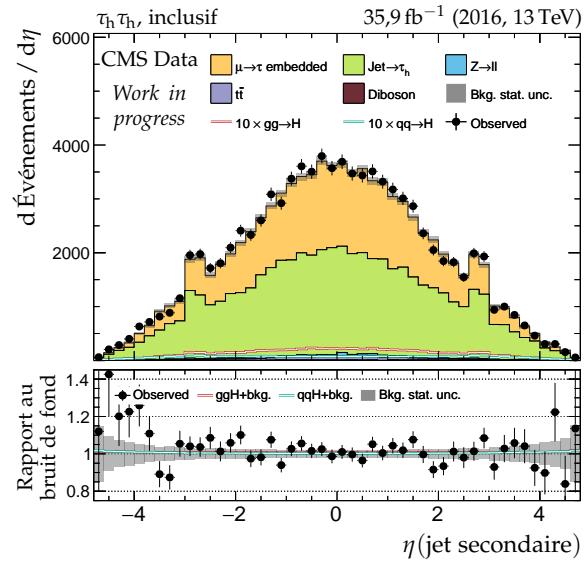
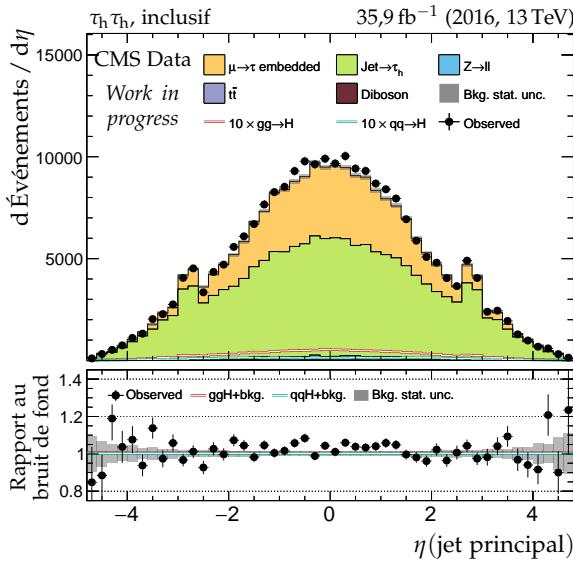
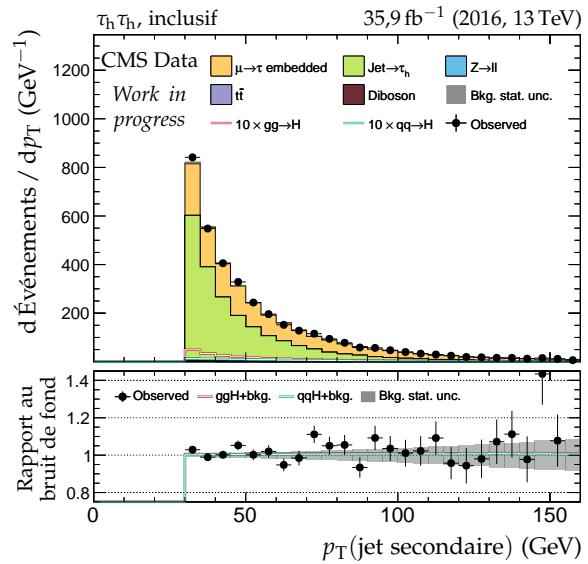
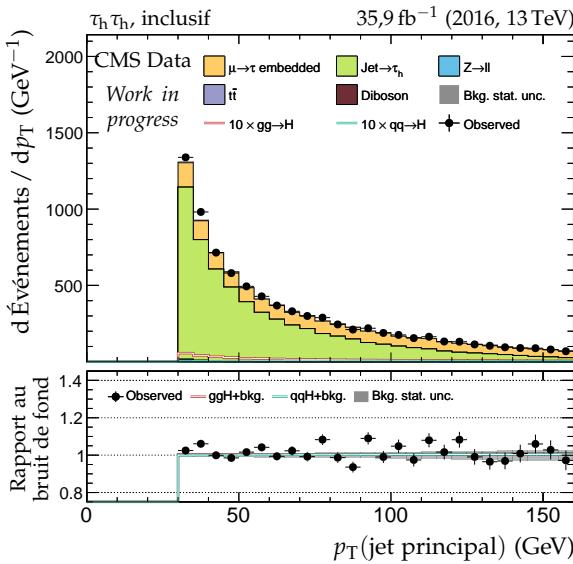


Figure X.4 – Canal $\tau_h \tau_h$, 2016 : cinématique des deux jets principaux.

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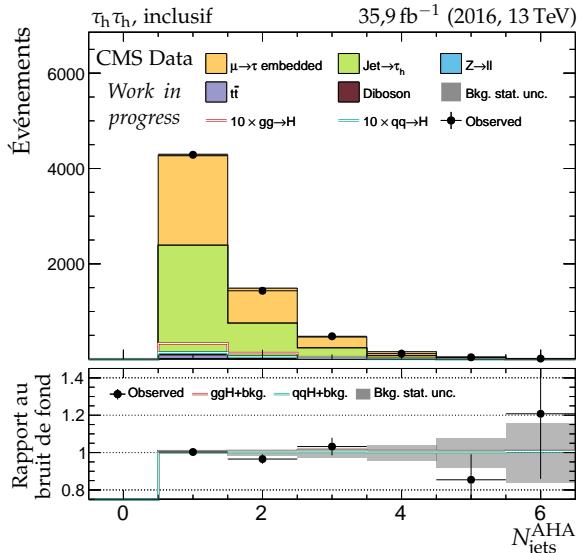
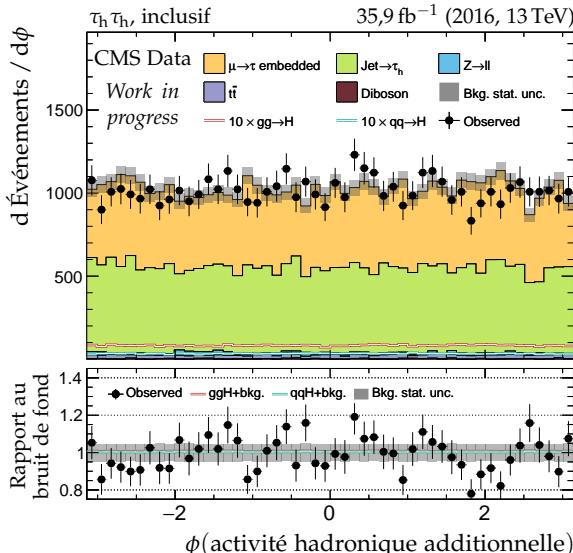
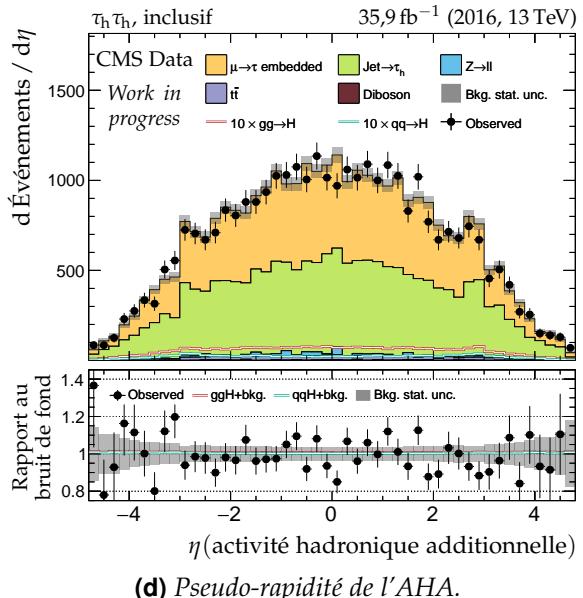
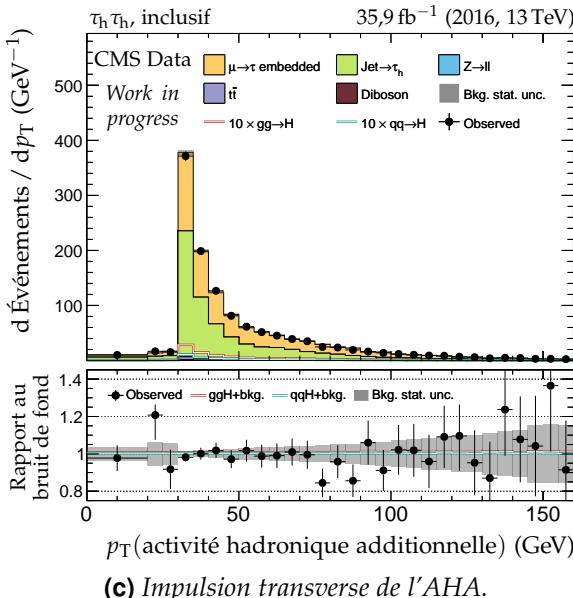
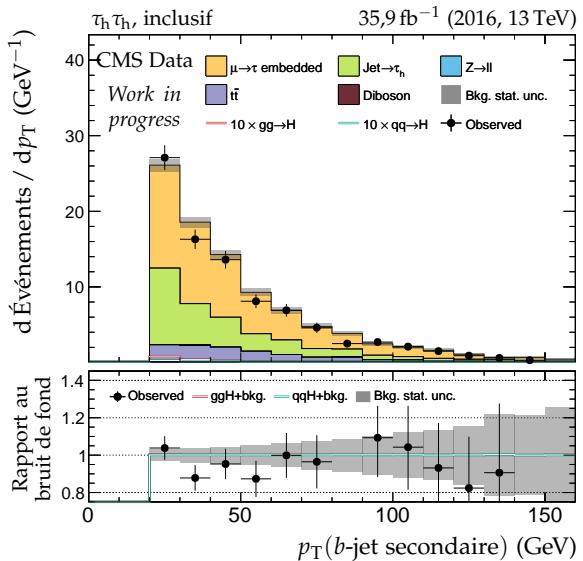
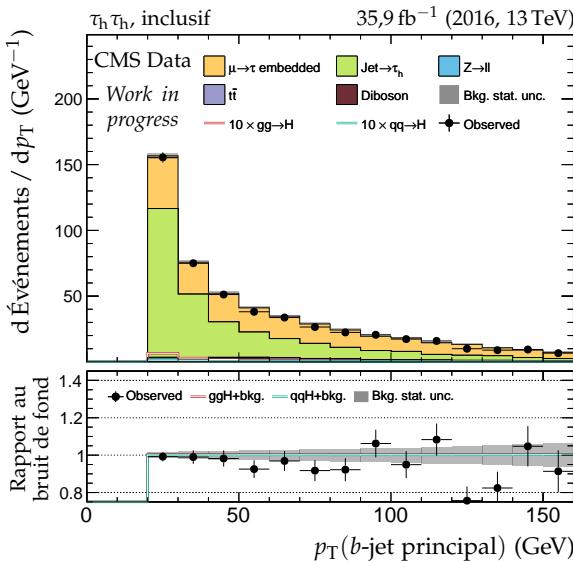


Figure X.5 – Canal $\tau_h \tau_h$, 2016 : b-jets et activité hadronique additionnelle.

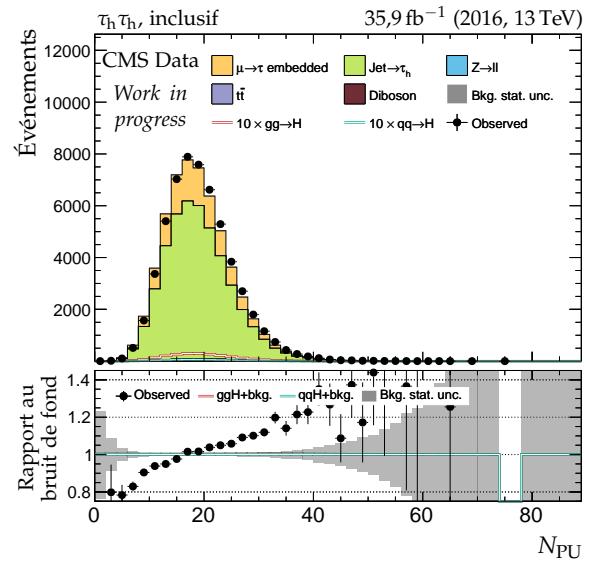
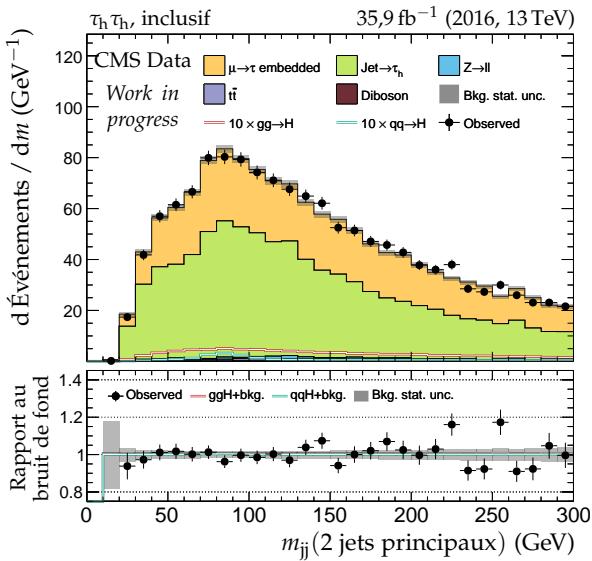
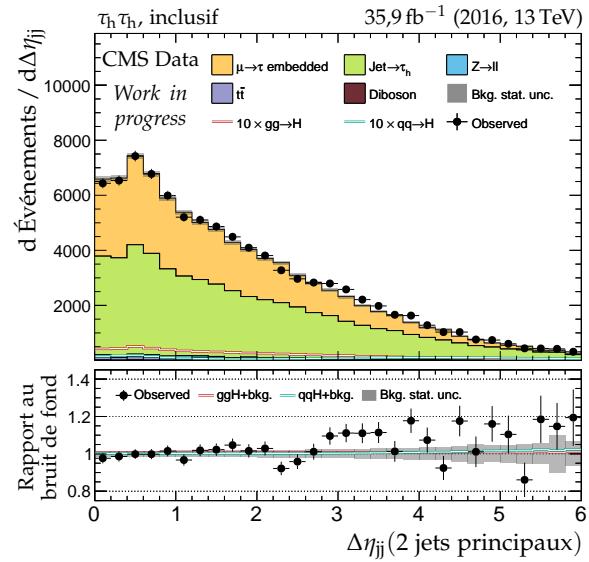
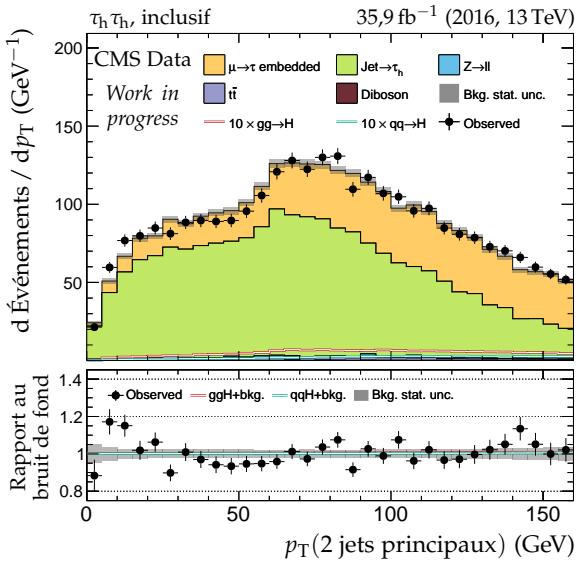
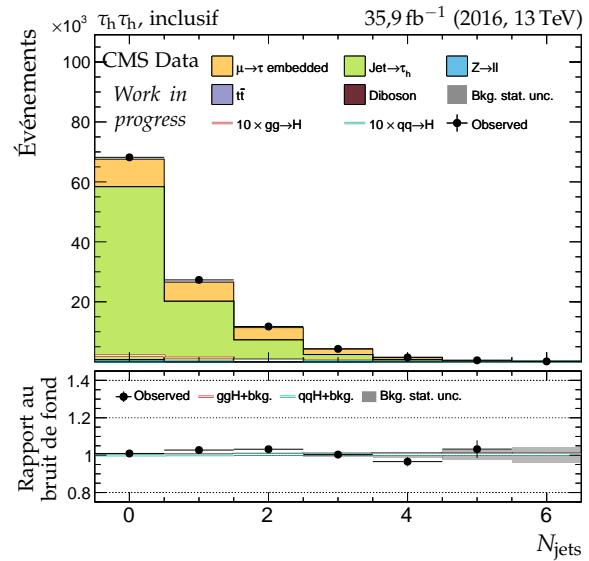
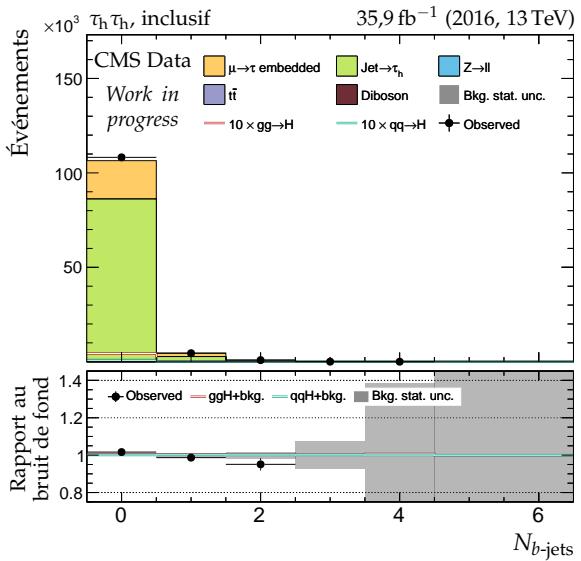
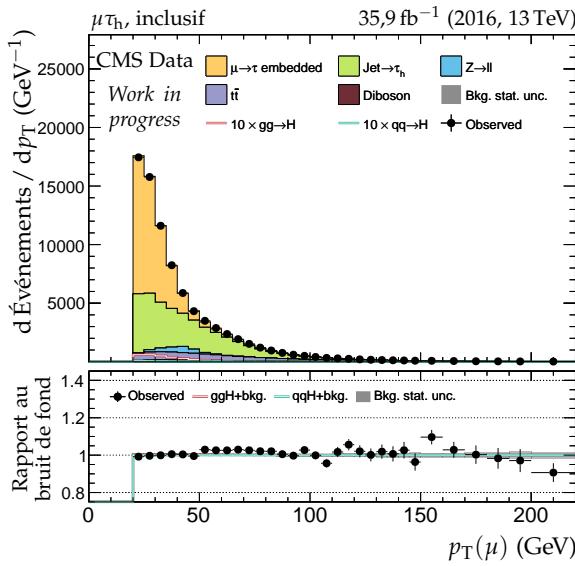
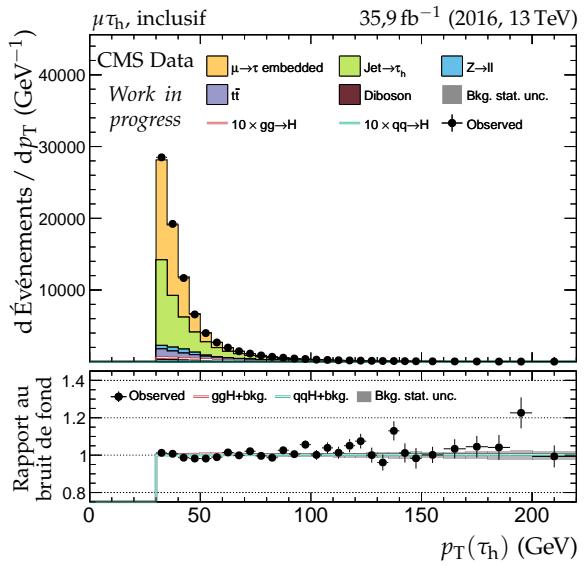


Figure X.6 – Canal $\tau_h \tau_h$, 2016 : nombre de jets, système des deux jets principaux et empilement.

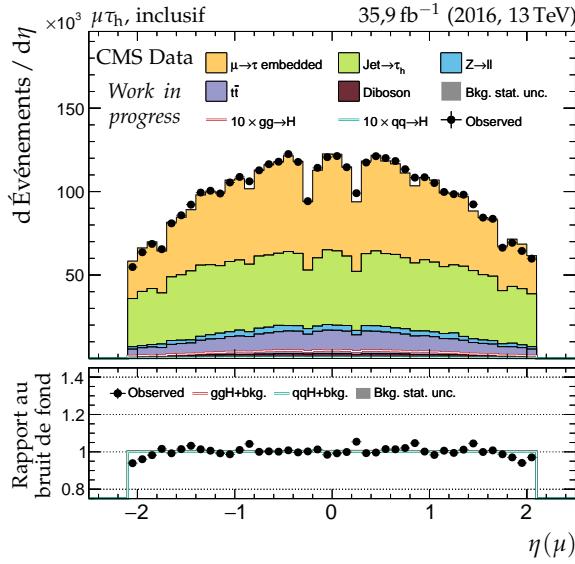
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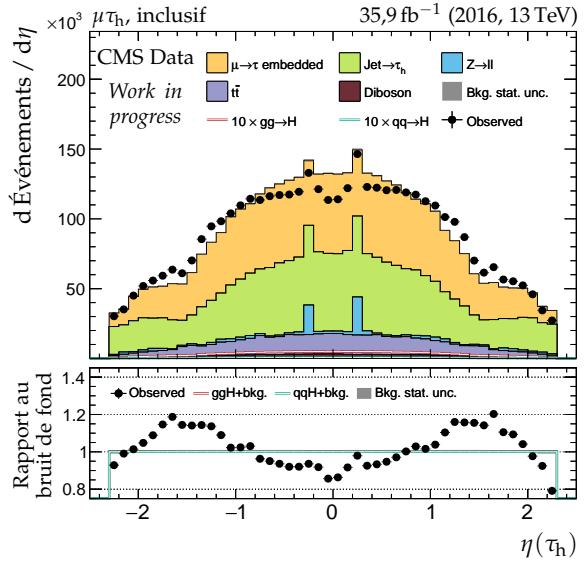
(a) Impulsion transverse du lepton 1 (μ).



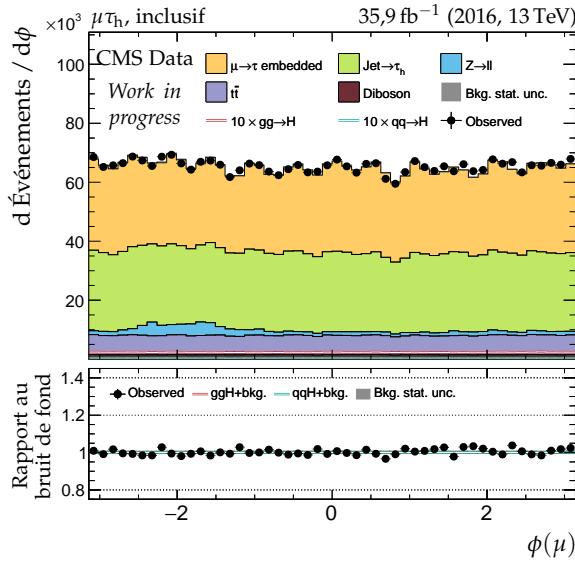
(b) Impulsion transverse du lepton 2 (τ_h).



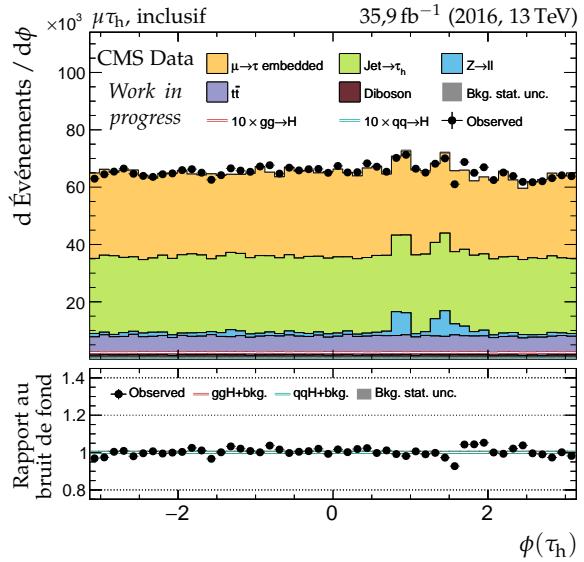
(c) Pseudo-rapidité du lepton 1 (μ).



(d) Pseudo-rapidité du lepton 2 (τ_h).

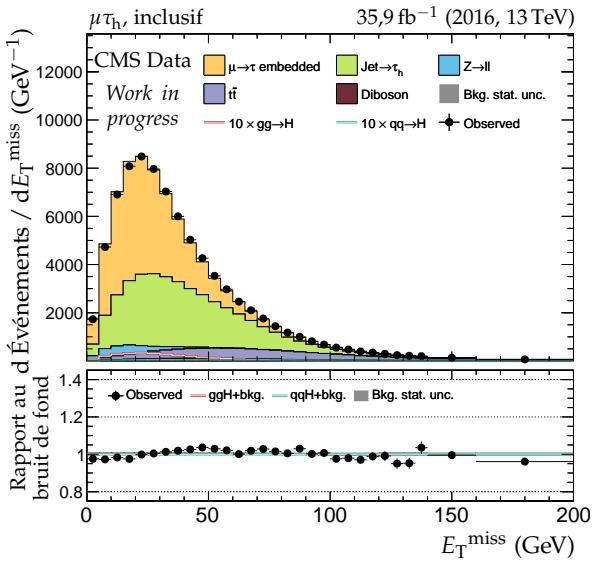


(e) Angle azimutal du lepton 1 (μ).

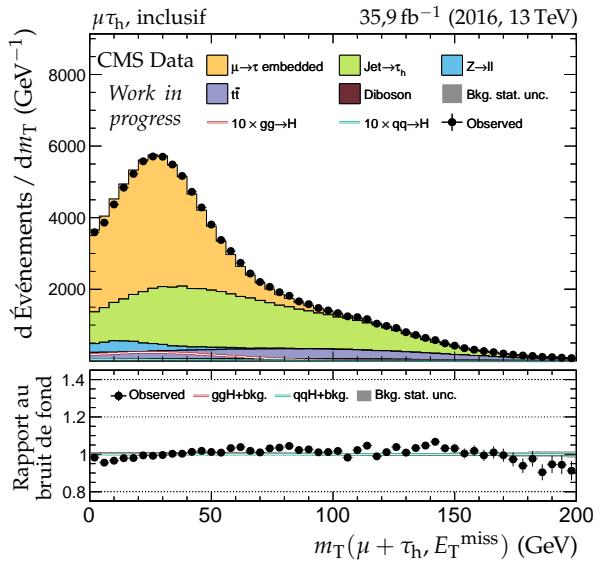


(f) Angle azimutal du lepton 2 (τ_h).

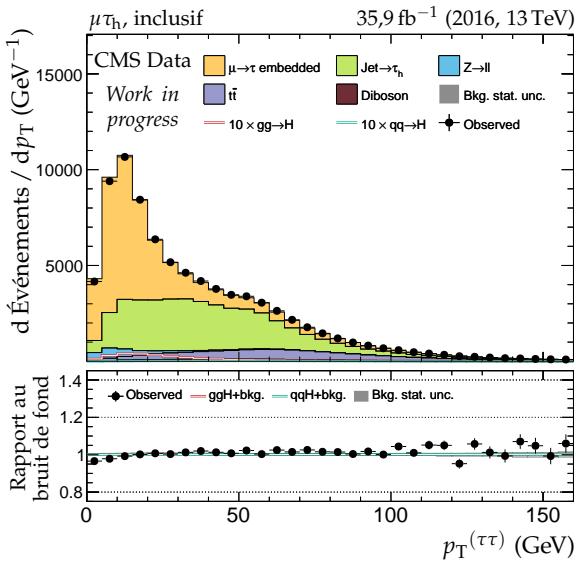
Figure X.7 – Canal $\mu\tau_h$, 2016 : cinématique des leptons (μ, τ_h).



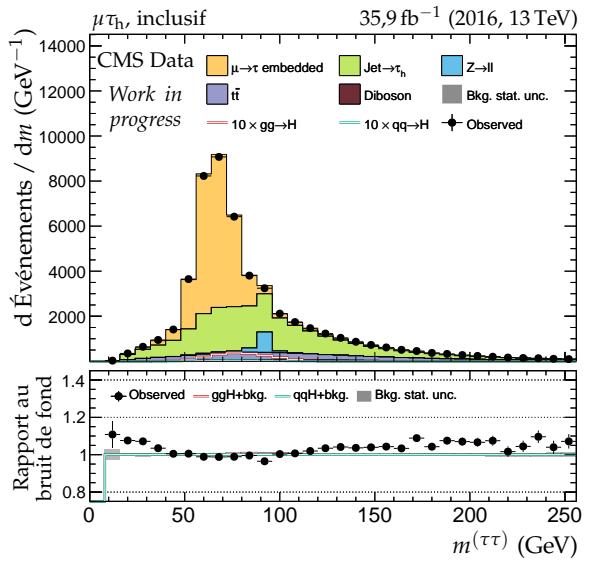
(a) Énergie transverse manquante.



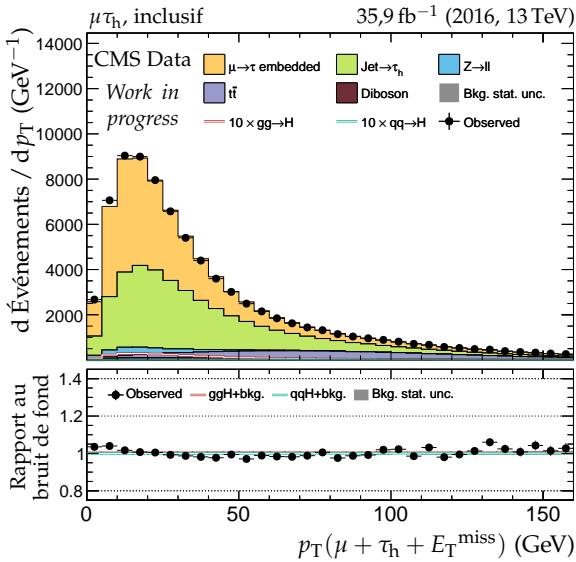
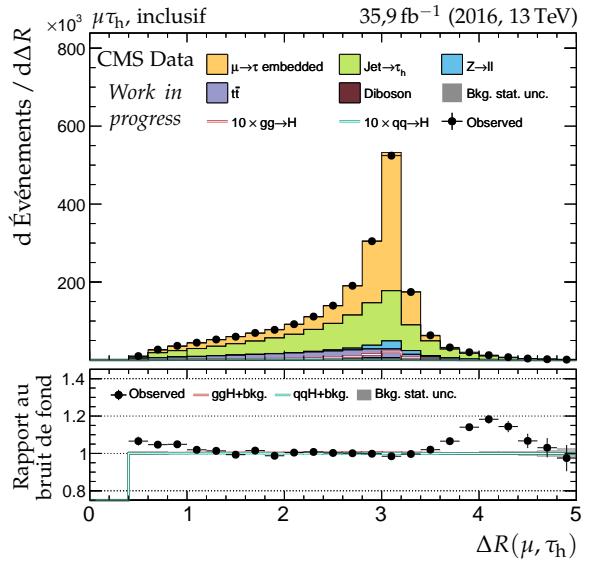
(b) Masse transverse du dilepton.

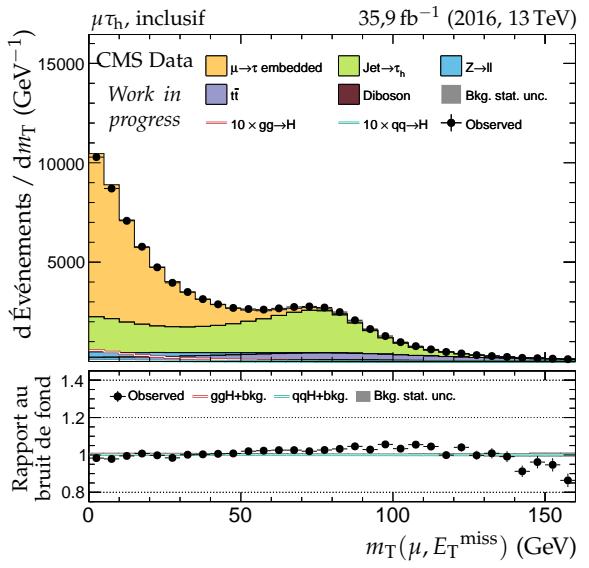


(c) Impulsion transverse du dilepton.

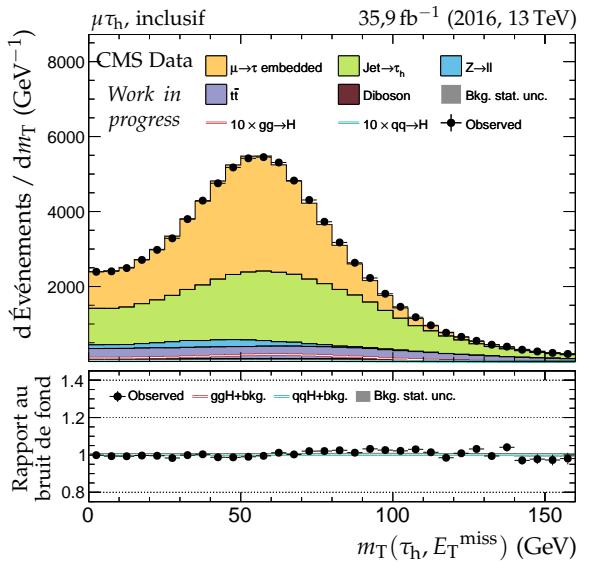


(d) Masse visible du dilepton.

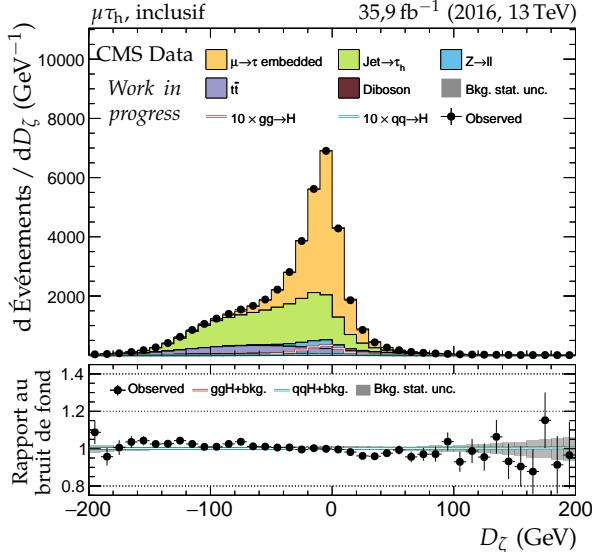
(e) Impulsion transverse du système di- τ .(f) Distance ΔR entre les leptons (μ, τ_h).**Figure X.8 – Canal $\mu\tau_h$, 2016 : dilepton et énergie transverse manquante.**



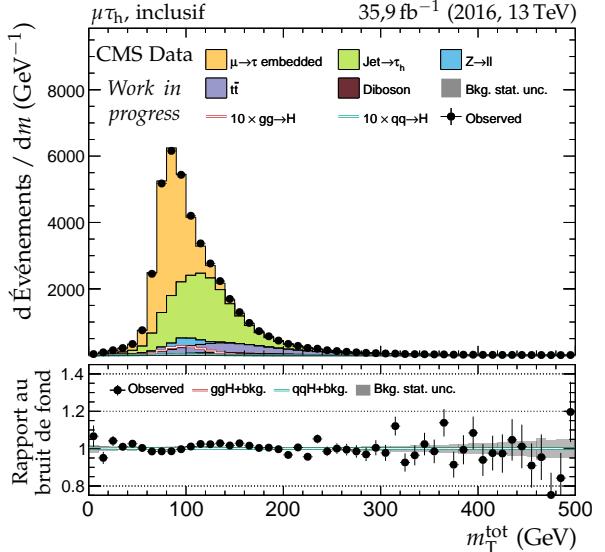
(a) Masse transverse du lepton 1 (μ).



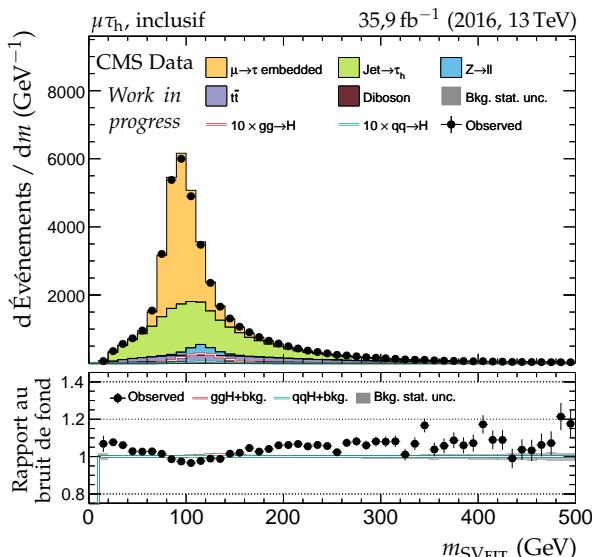
(b) Masse transverse du lepton 2 (τ_h).



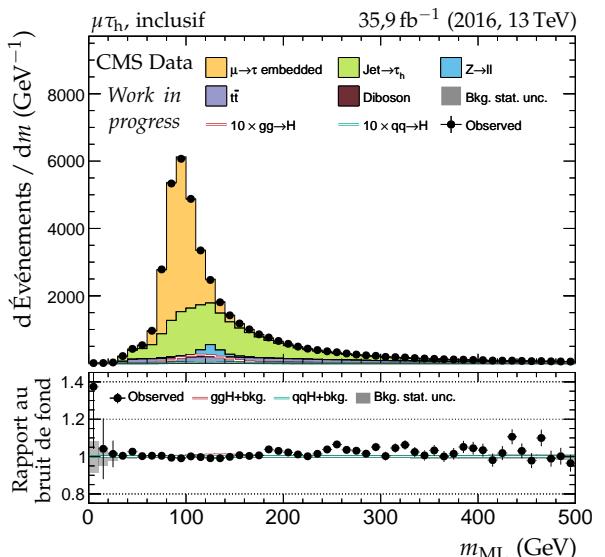
(c) Valeur de D_ζ .



(d) Masse transverse totale.

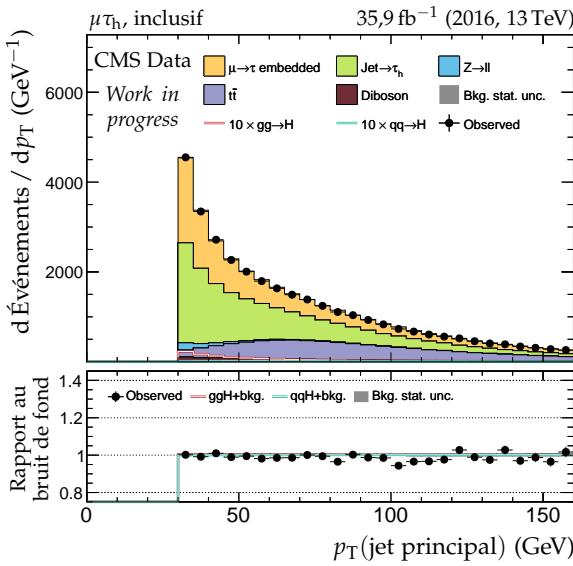


(e) Masse du système di- τ d'après SVFIT.

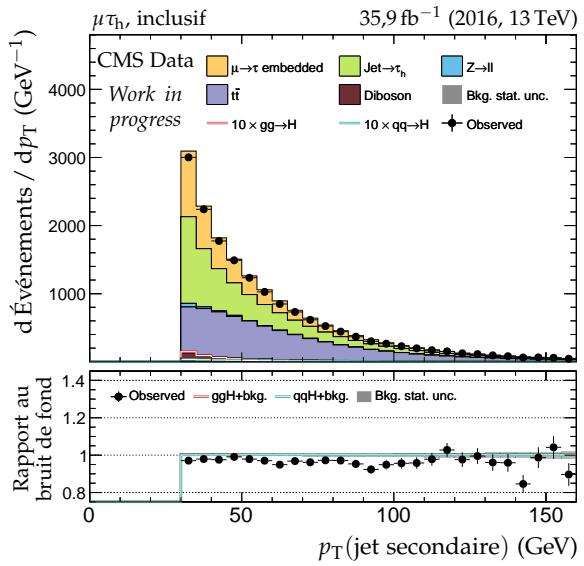


(f) Masse du système di- τ d'après le ML.

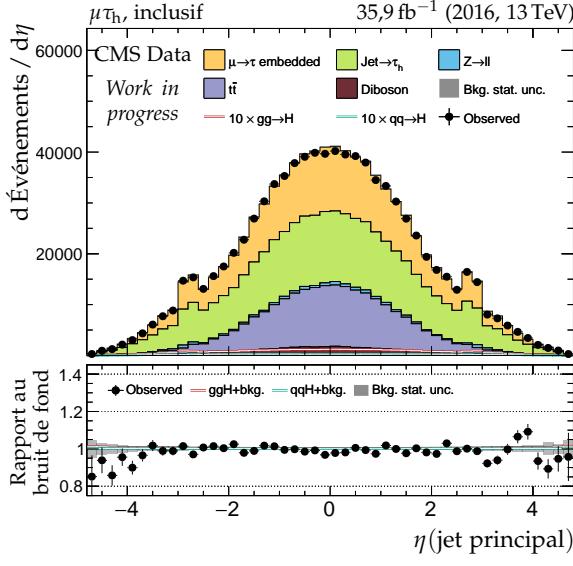
Figure X.9 – Canal $\mu\tau_h$, 2016 : masses transverses, D_ζ et masses.



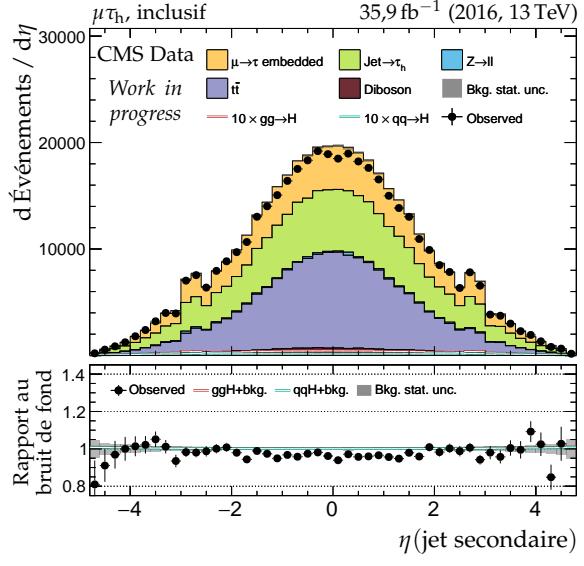
(a) Impulsion transverse du jet principal.



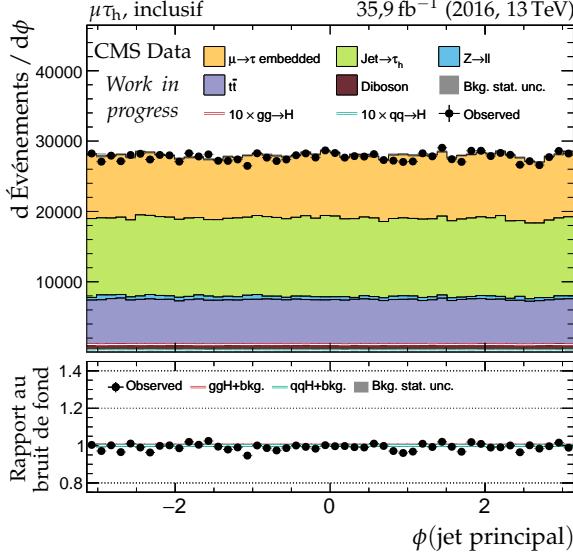
(b) Impulsion transverse du jet secondaire.



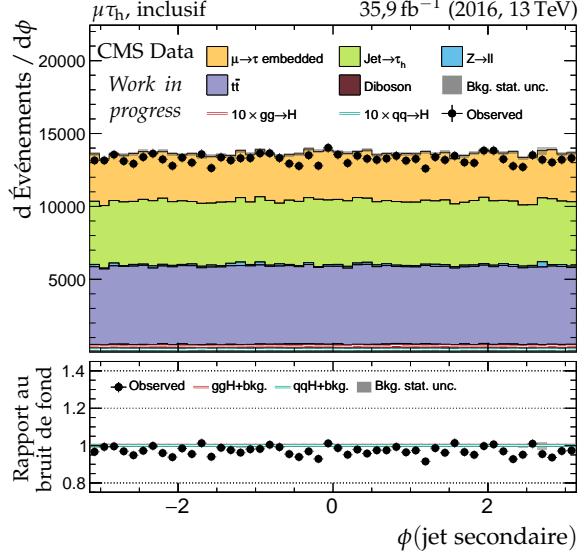
(c) Pseudo-rapidité du jet principal.



(d) Pseudo-rapidité du jet secondaire.

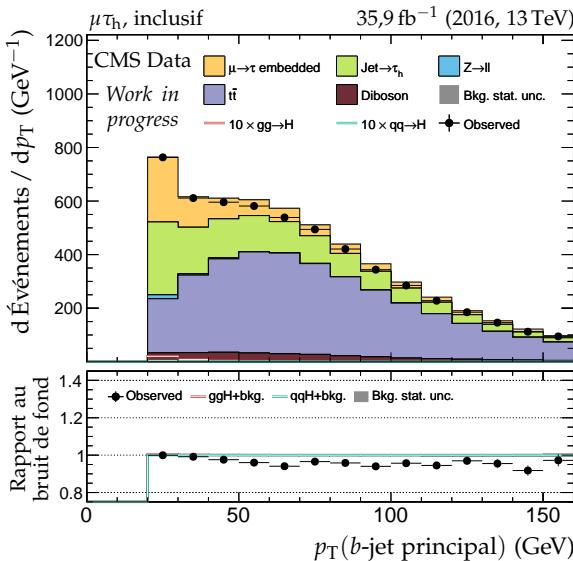


(e) Angle azimutal du jet principal.

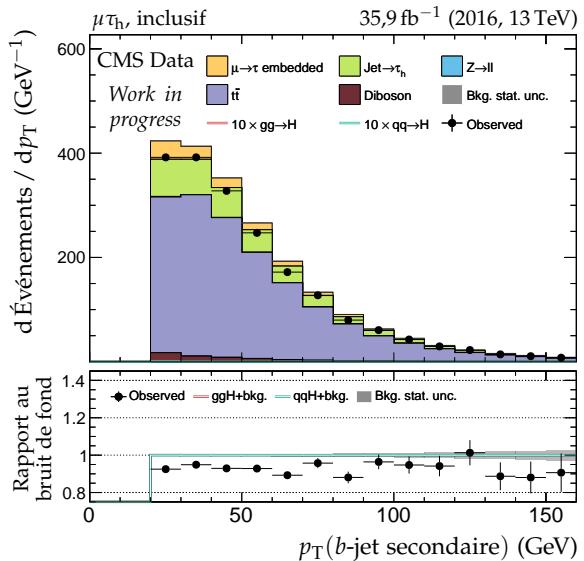


(f) Angle azimutal du jet secondaire.

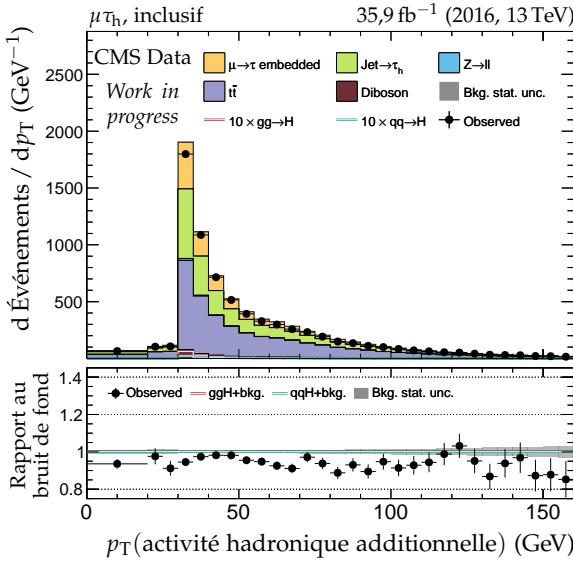
Figure X.10 – Canal $\mu\tau_h$, 2016 : cinématique des deux jets principaux.



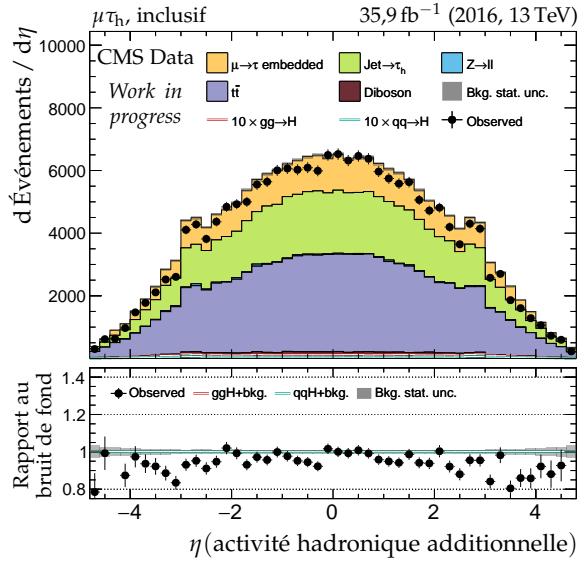
(a) Impulsion transverse du b-jet principal.



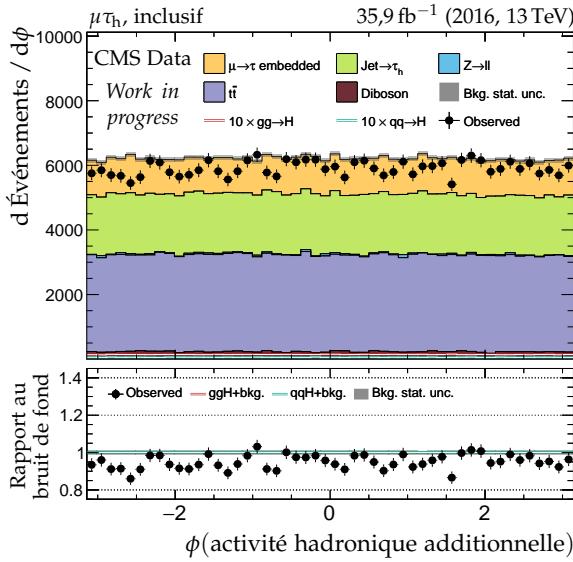
(b) Impulsion transverse du b-jet secondaire.



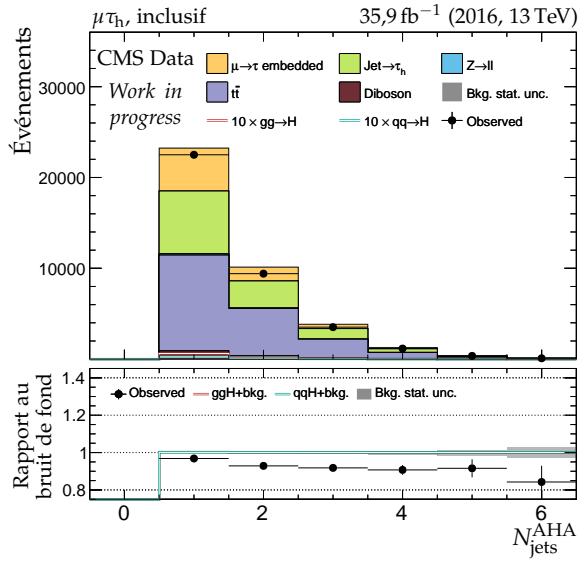
(c) Impulsion transverse de l’AHA.



(d) Pseudo-rapidité de l’AHA.



(e) Angle azimutal de l’AHA.



(f) Nombre de jets dans l’AHA.

Figure X.11 – Canal $\mu \tau_h$, 2016 : b-jets et activité hadronique additionnelle.

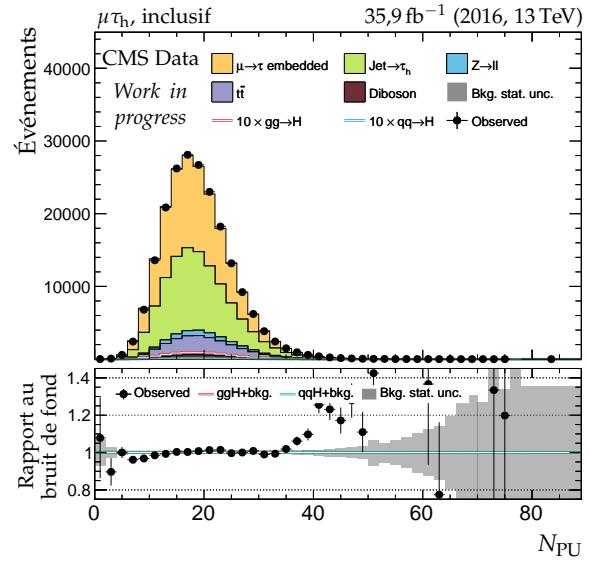
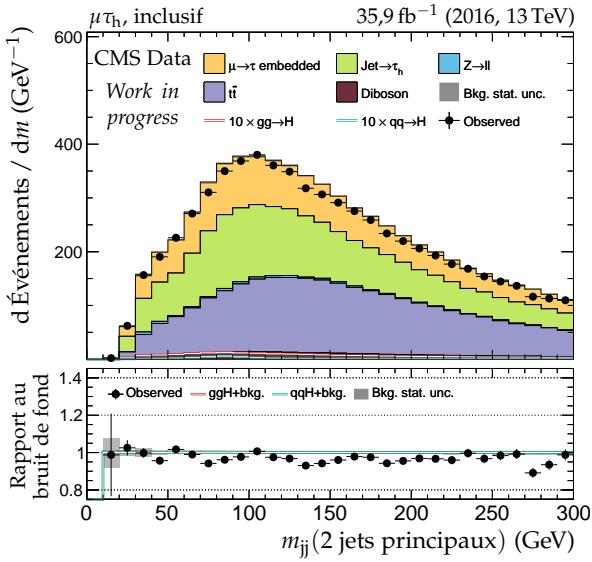
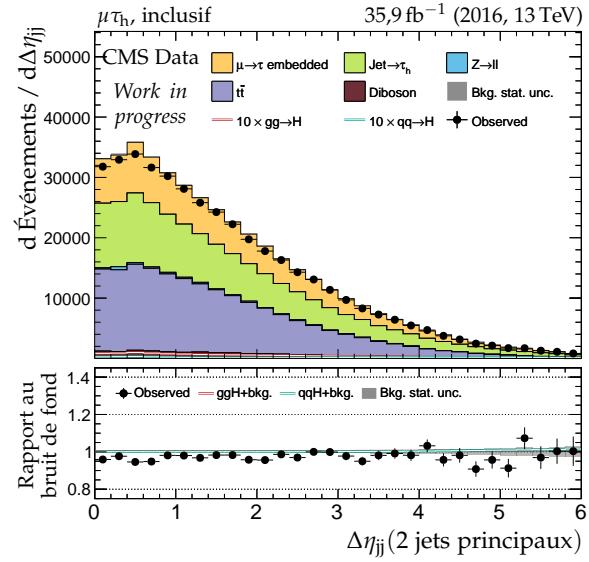
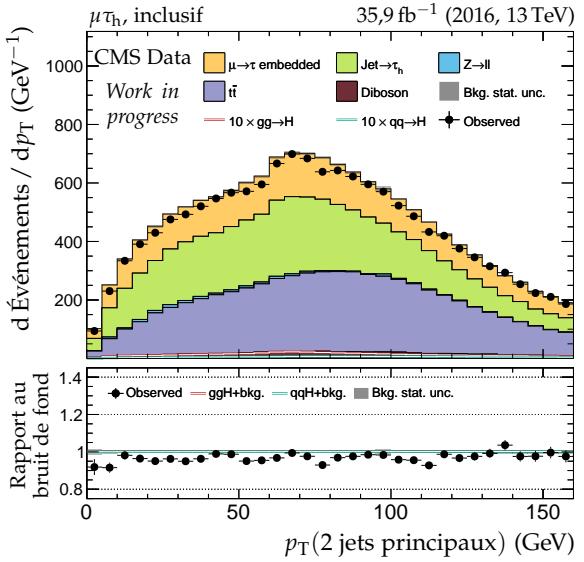
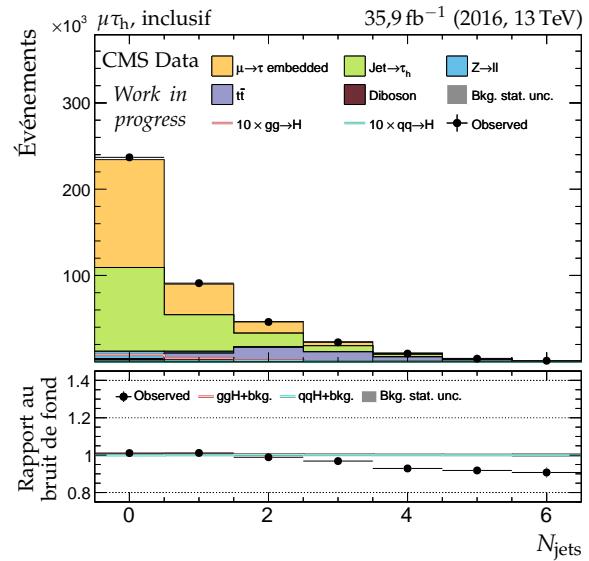
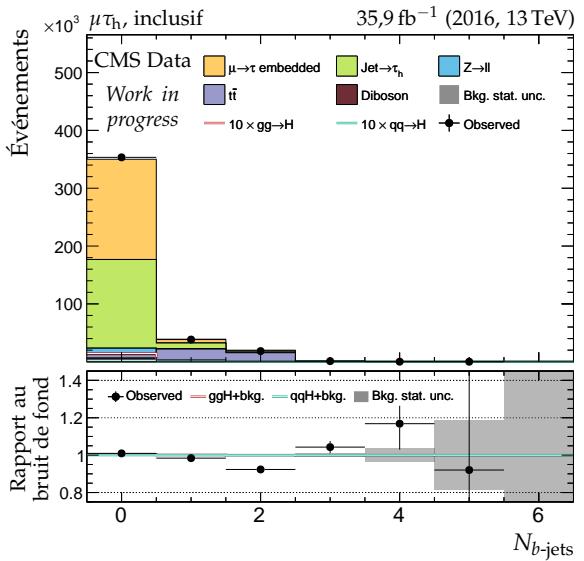


Figure X.12 – Canal $\mu\tau_h$, 2016 : nombre de jets, système des deux jets principaux et empilement.

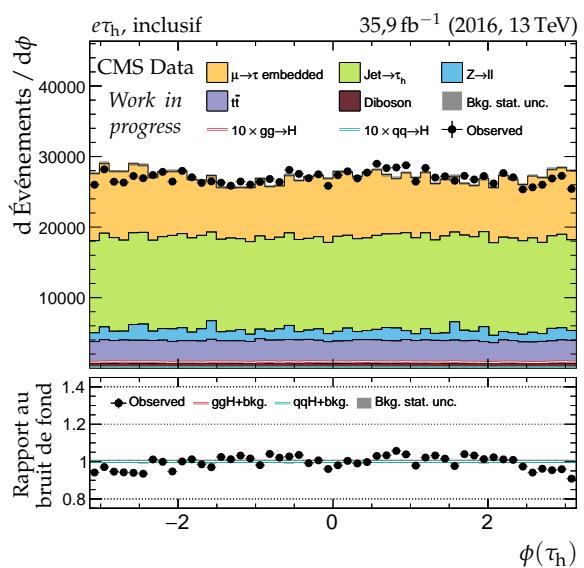
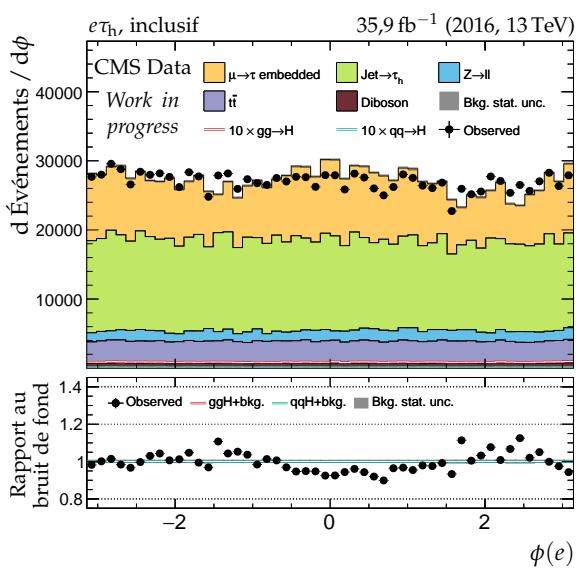
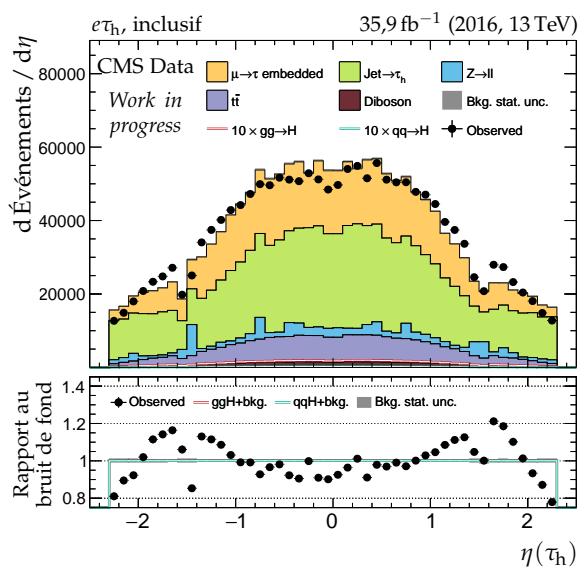
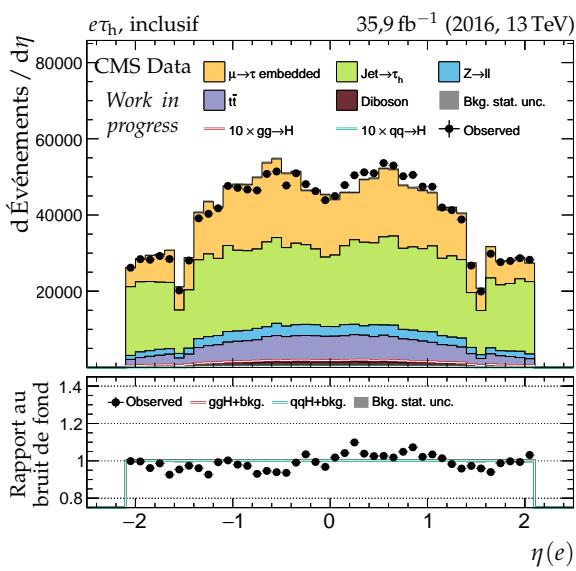
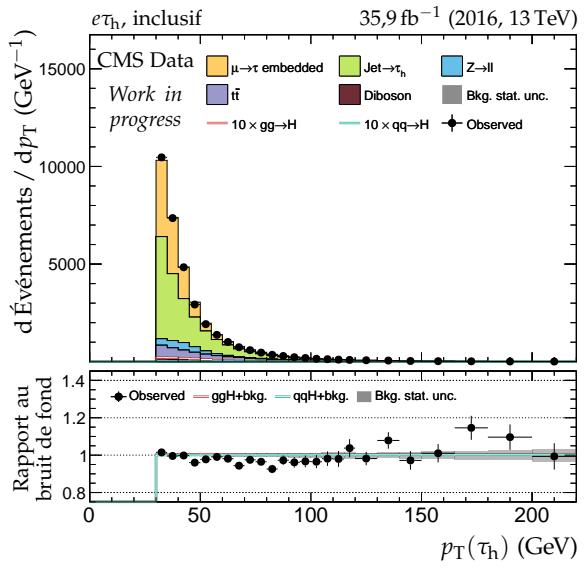
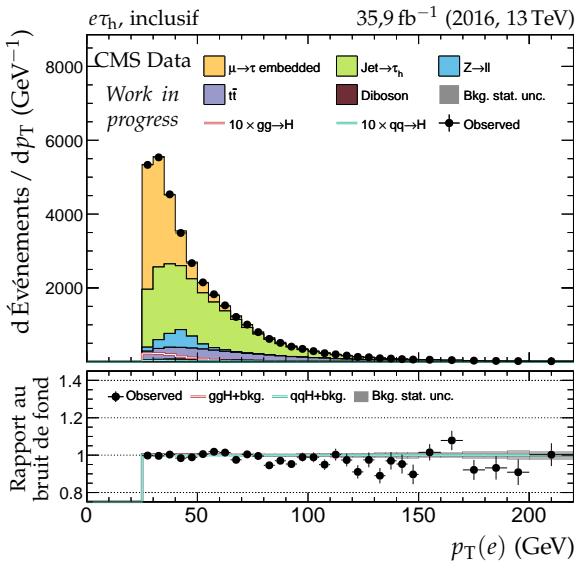


Figure X.13 – Canal $e\tau_h$, 2016 : cinématique des leptons (e, τ_h).

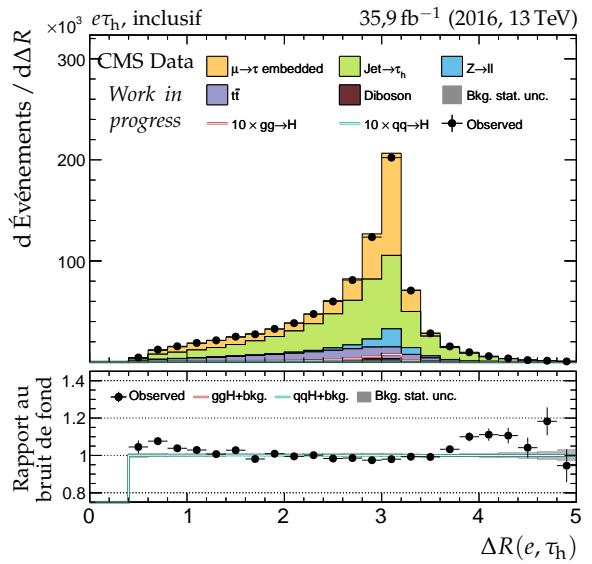
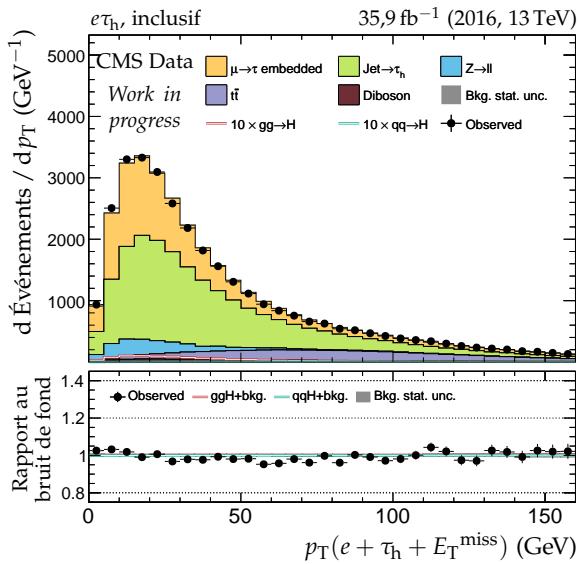
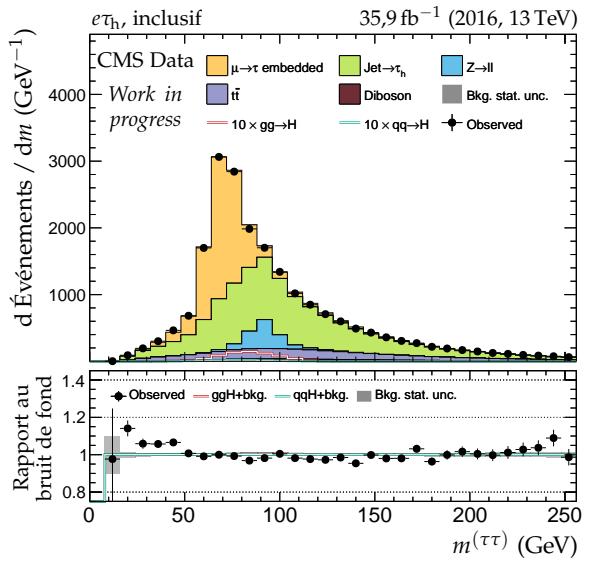
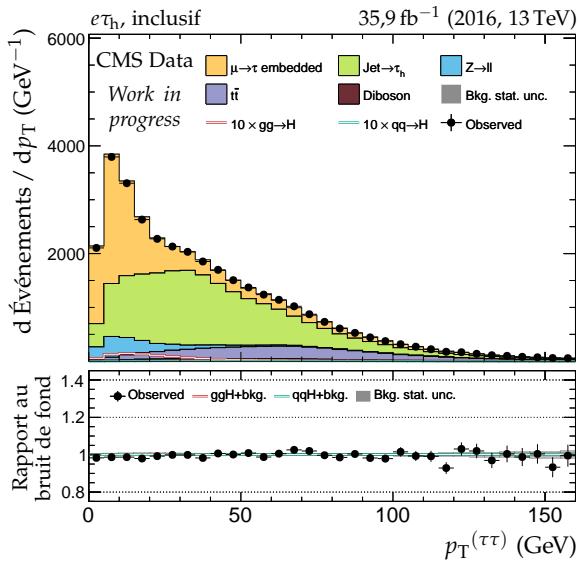
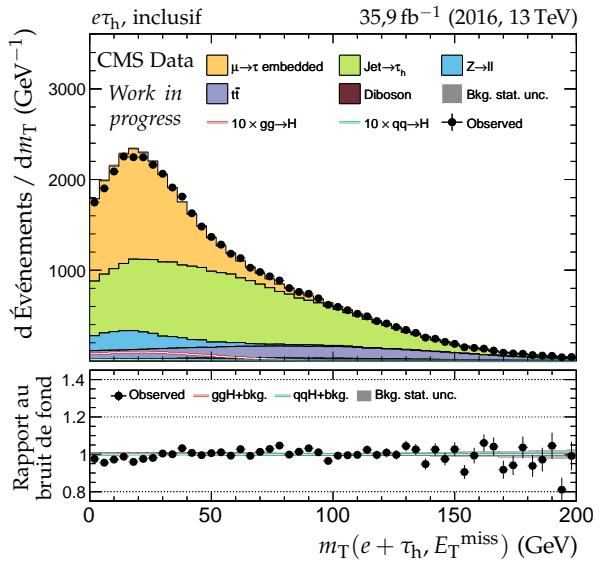
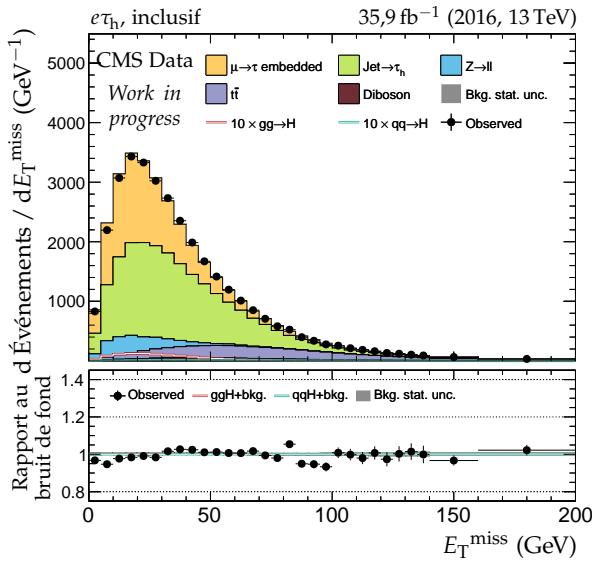


Figure X.14 – Canal $e\tau_h$, 2016 : dilepton et énergie transverse manquante.

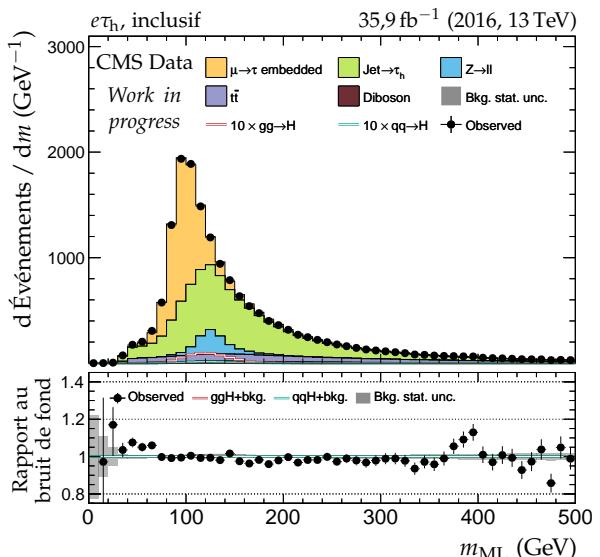
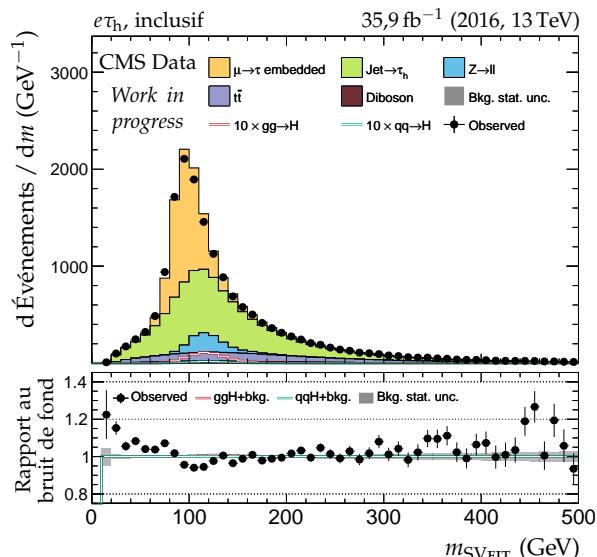
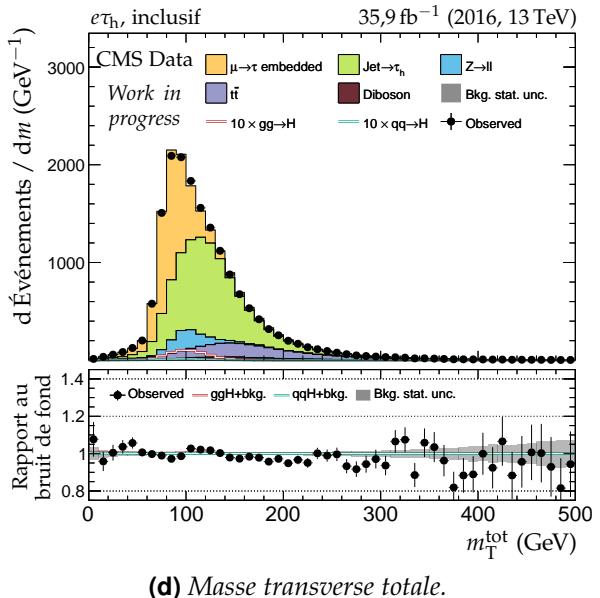
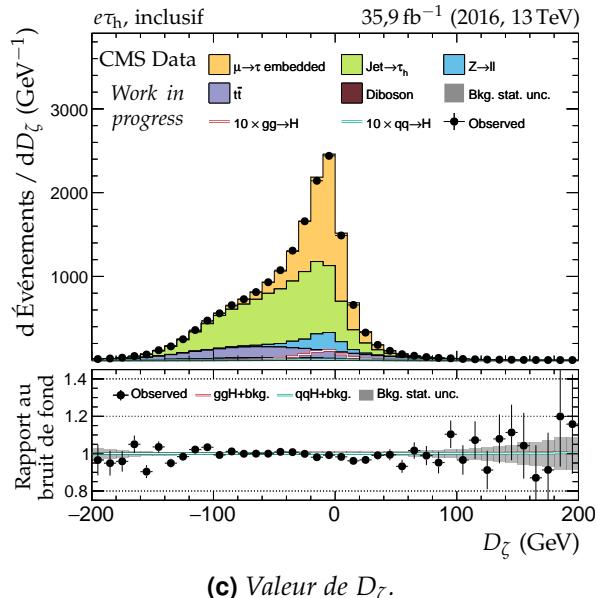
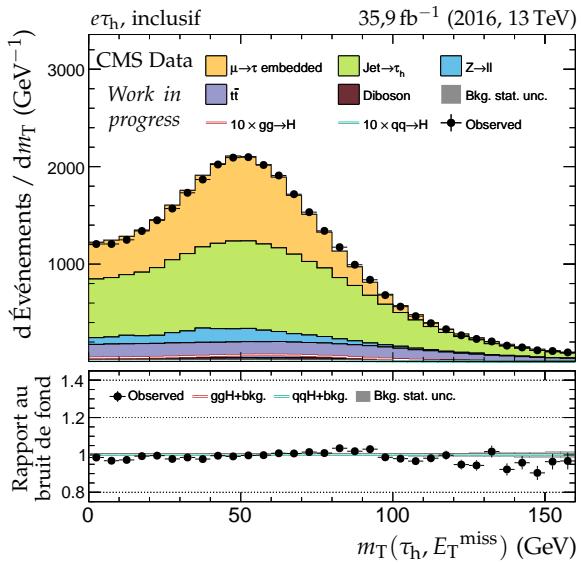
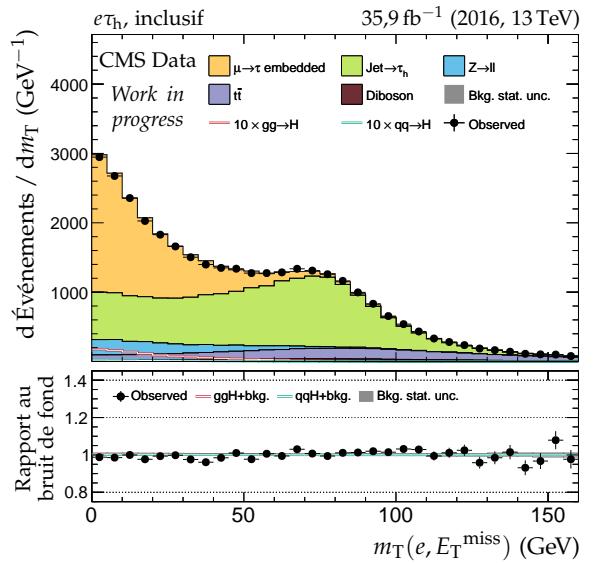


Figure X.15 – Canal $e\tau_h$, 2016 : masses transverses, D_ζ et masses.

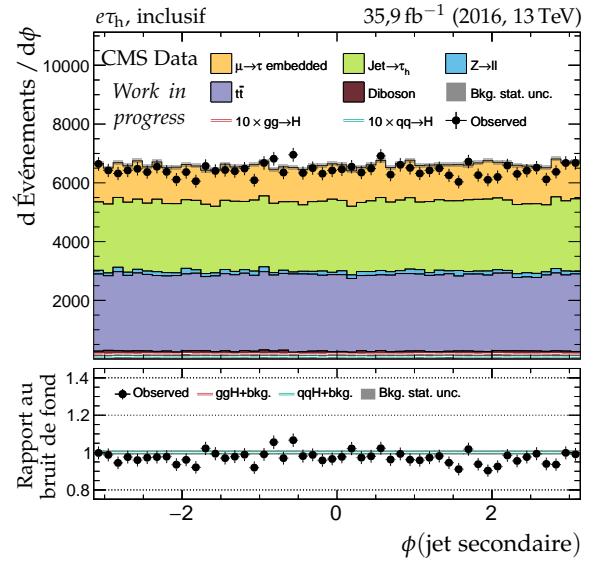
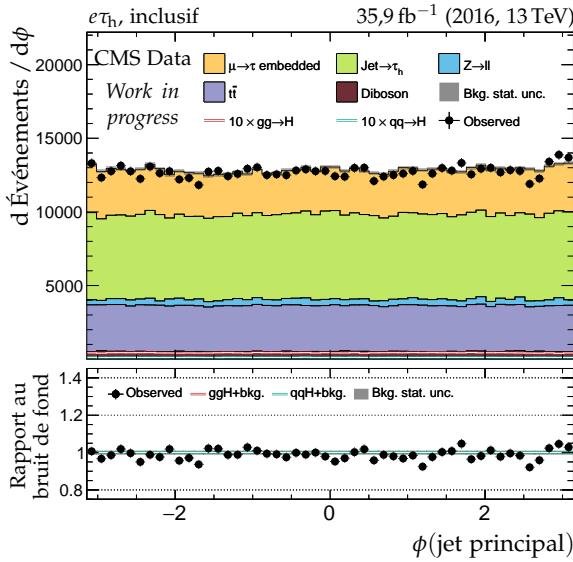
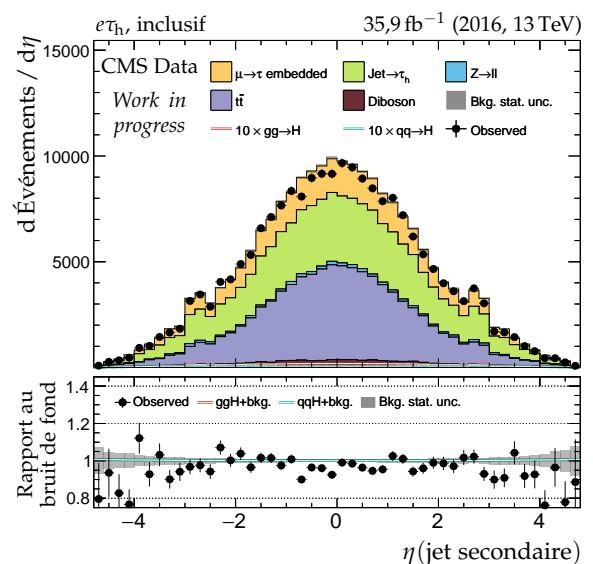
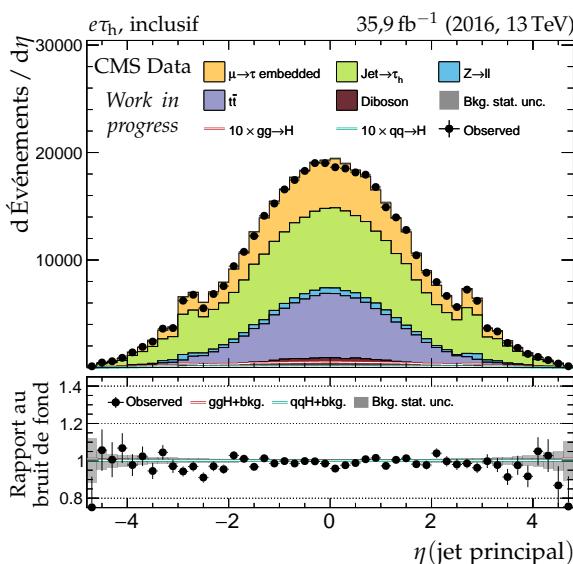
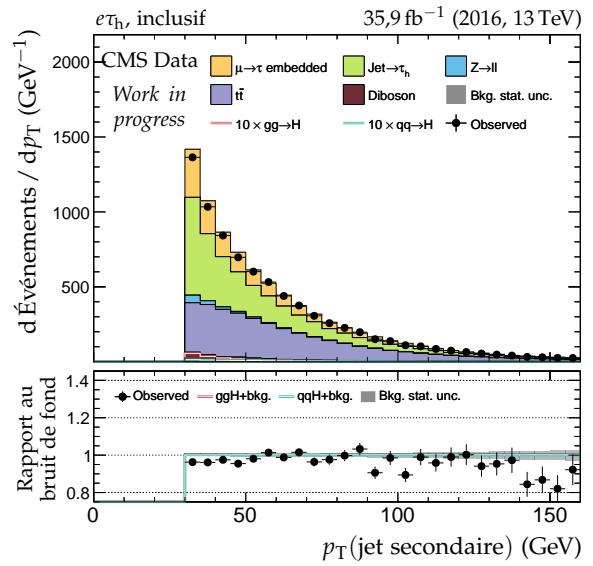
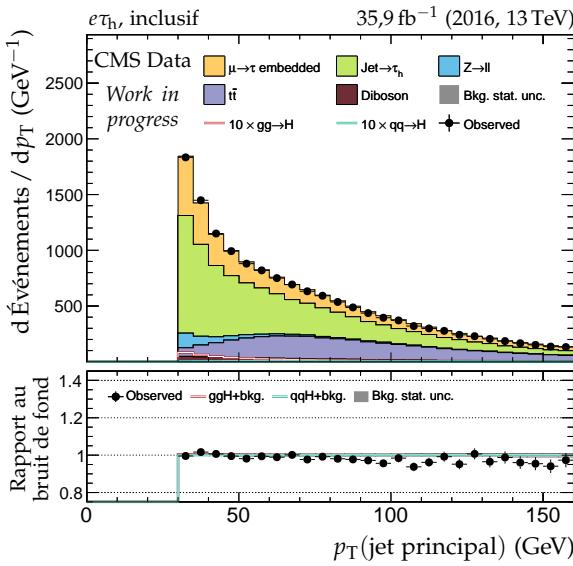


Figure X.16 – Canal $e\tau_h$, 2016 : cinématique des deux jets principaux.

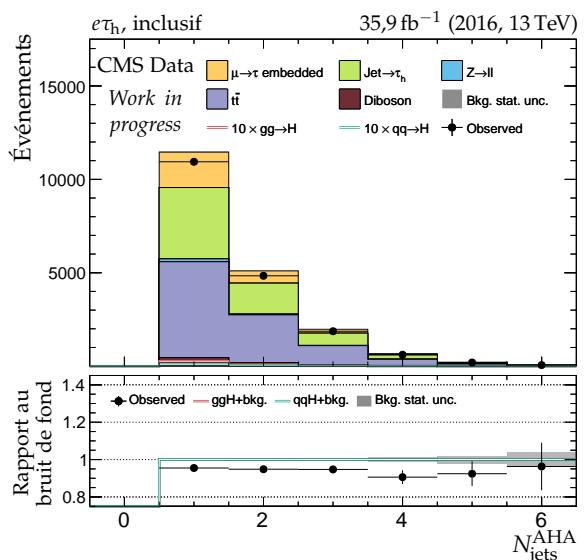
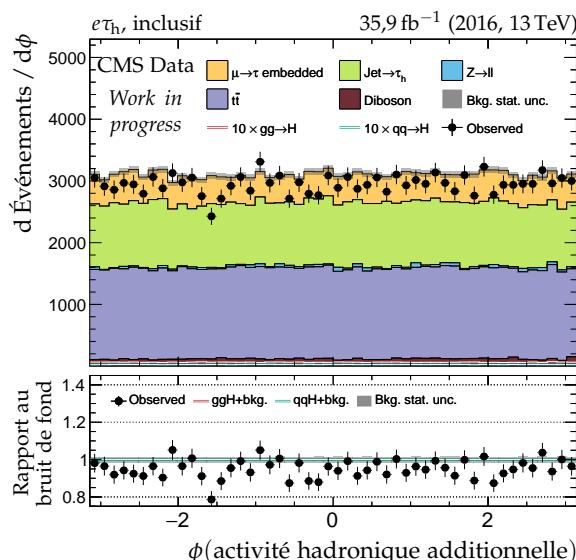
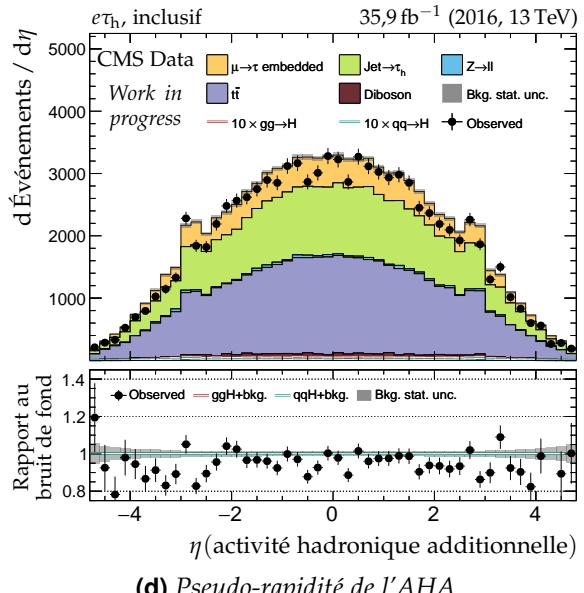
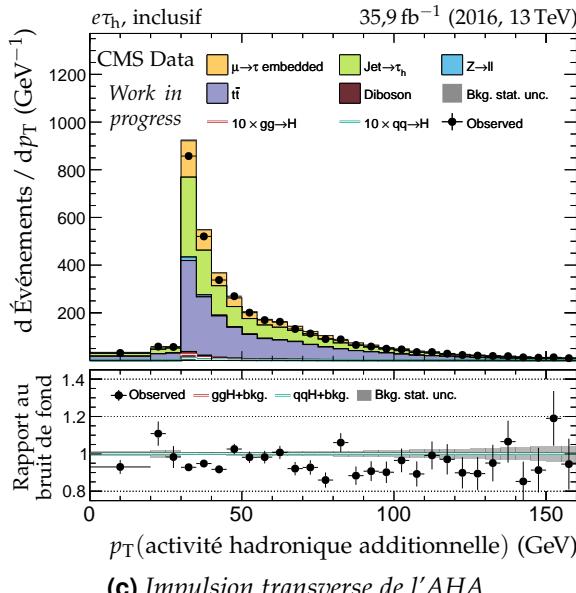
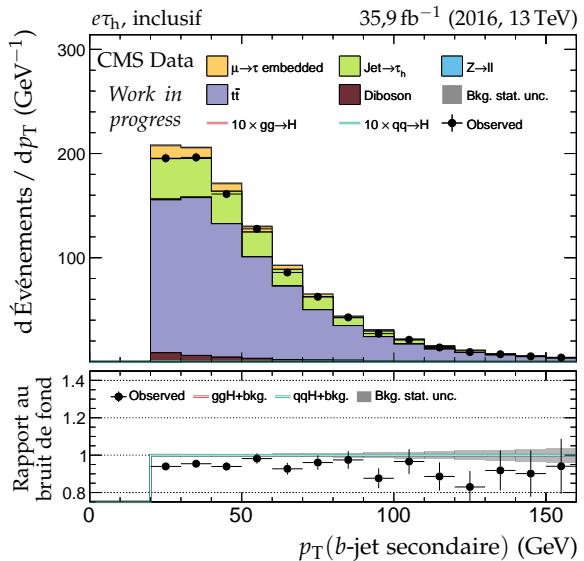
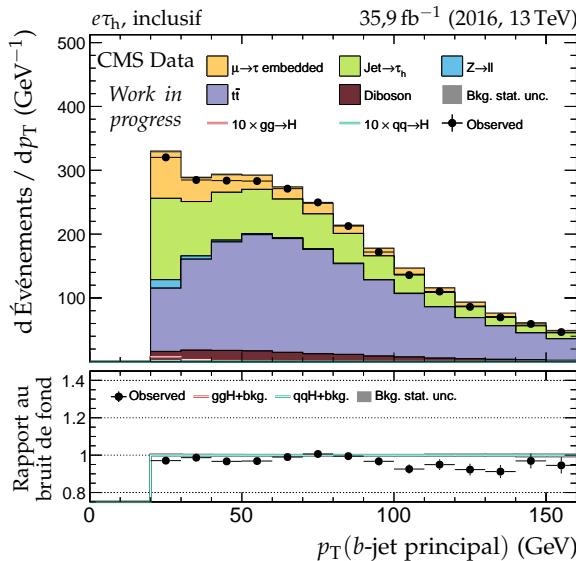


Figure X.17 – Canal $e\tau_h$, 2016 : b -jets et activité hadronique additionnelle.

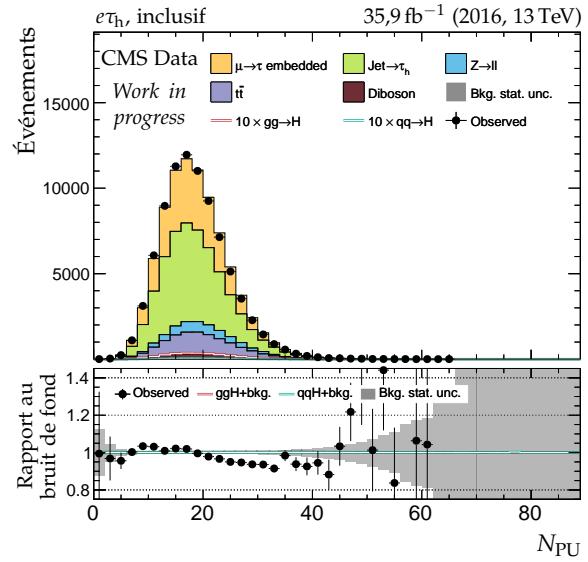
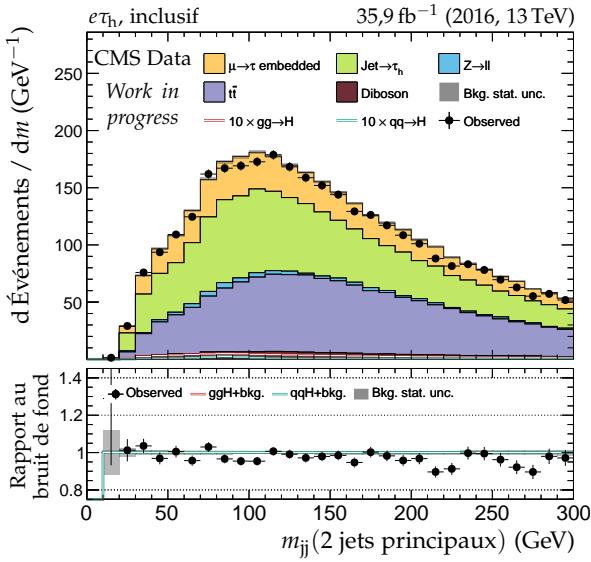
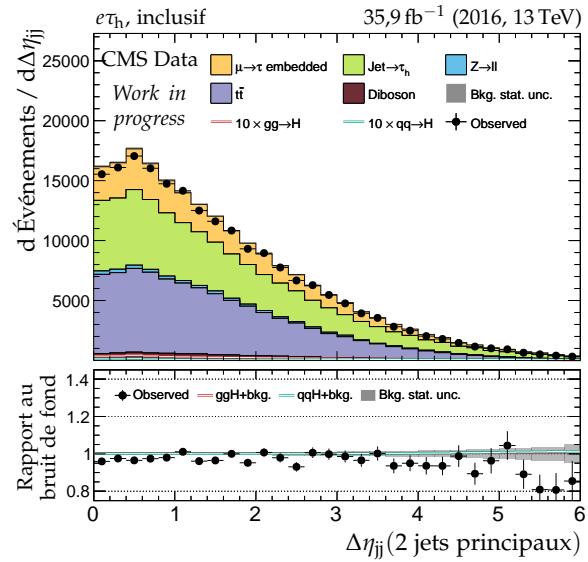
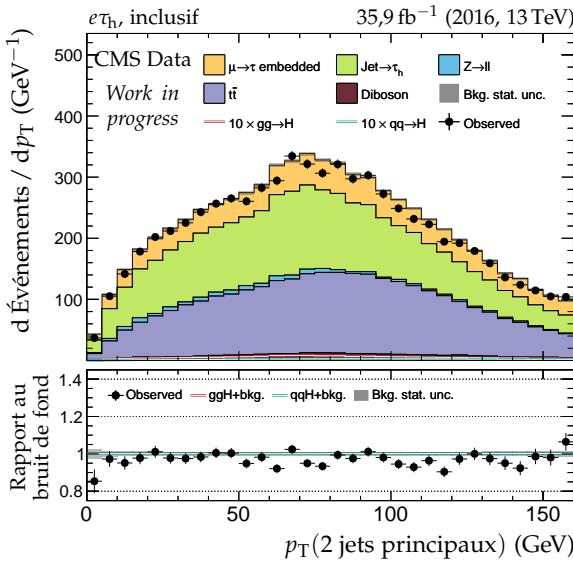
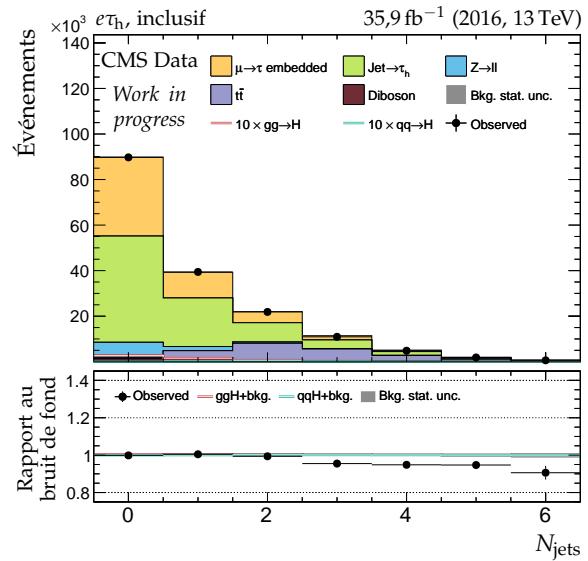
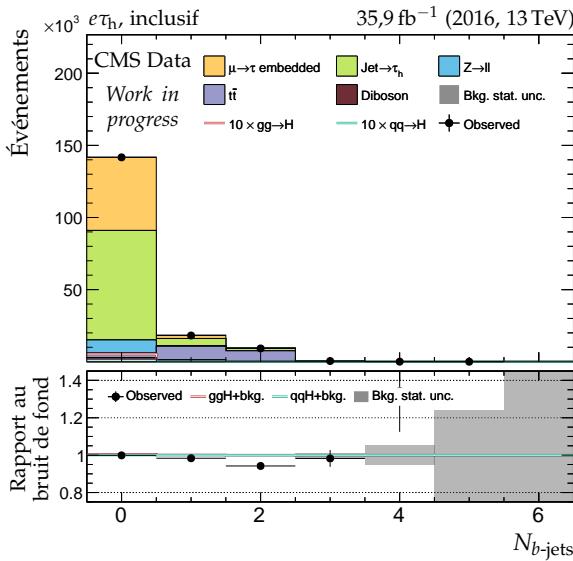


Figure X.18 – Canal $e\tau_h$, 2016 : nombre de jets, système des deux jets principaux et empilement.

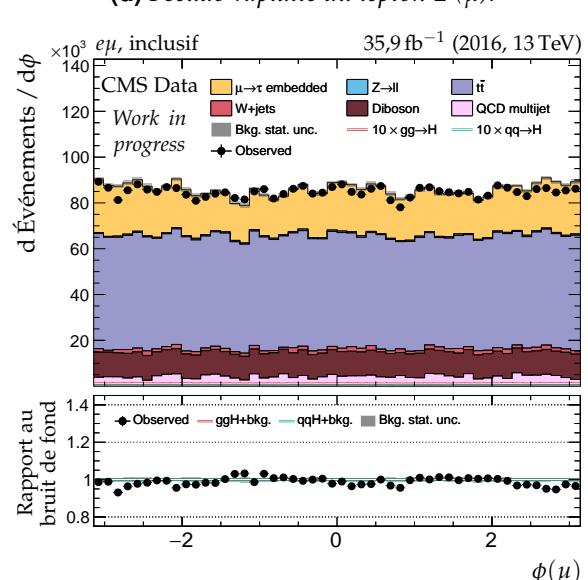
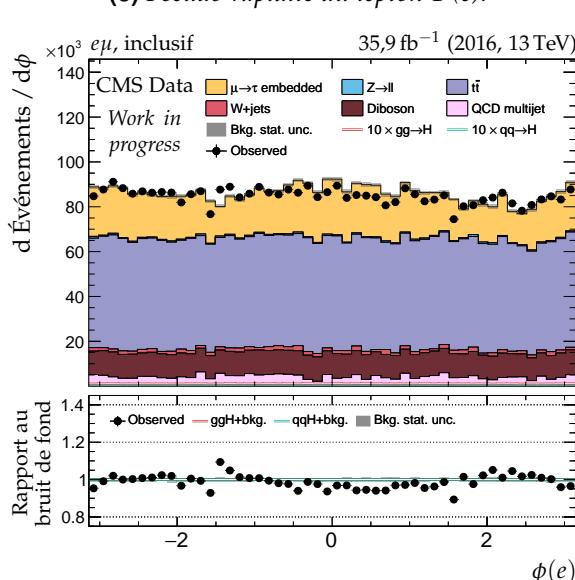
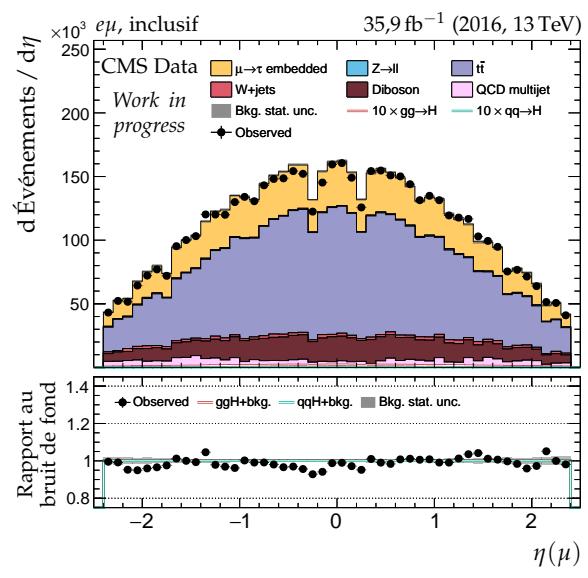
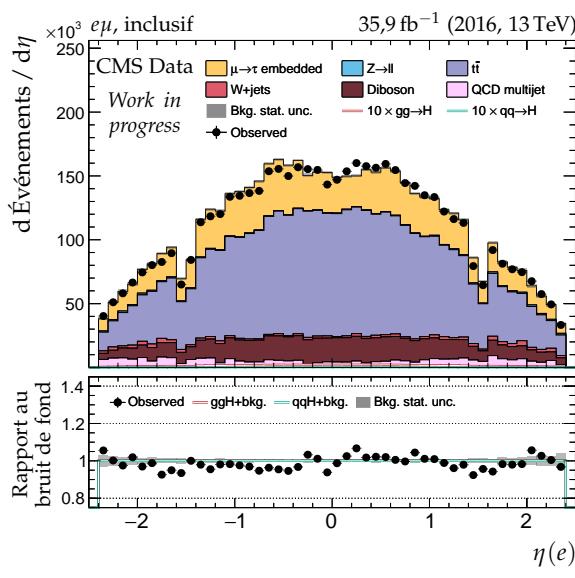
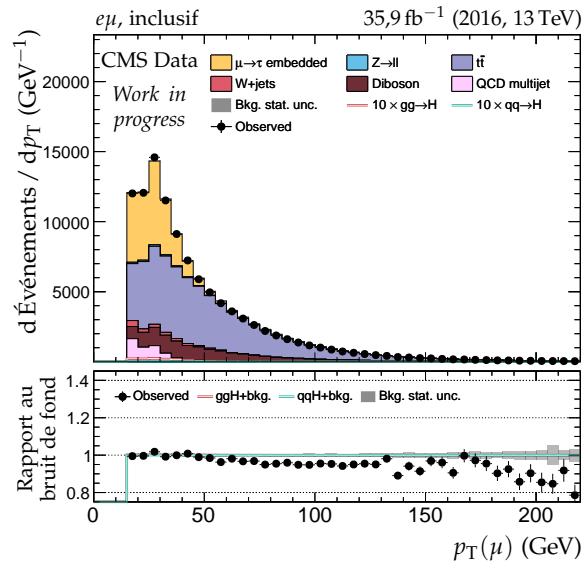
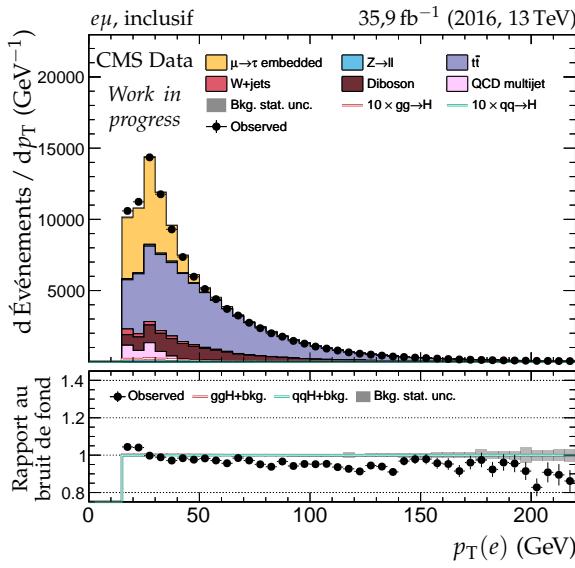


Figure X.19 – Canal $e\mu$, 2016 : cinématique des leptons (e, μ).

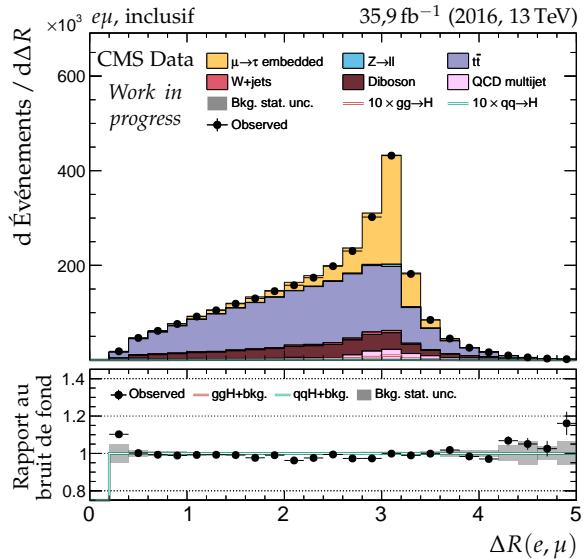
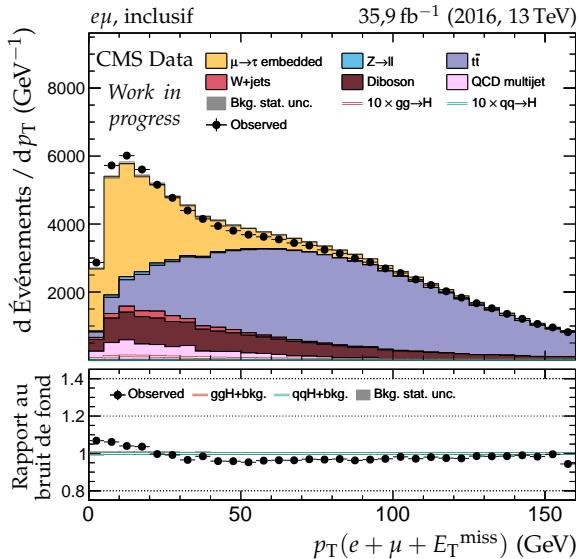
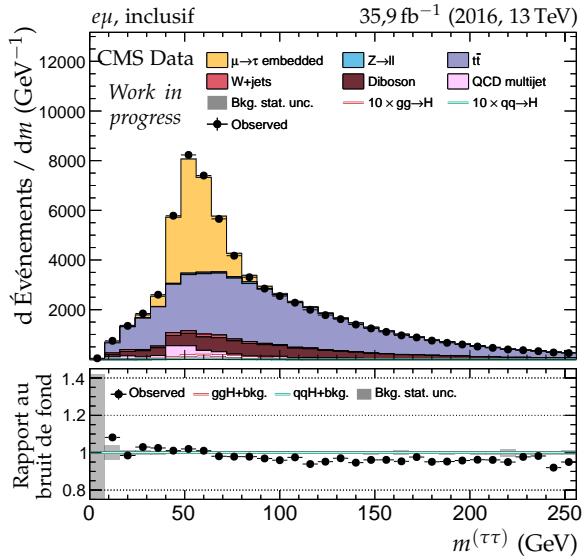
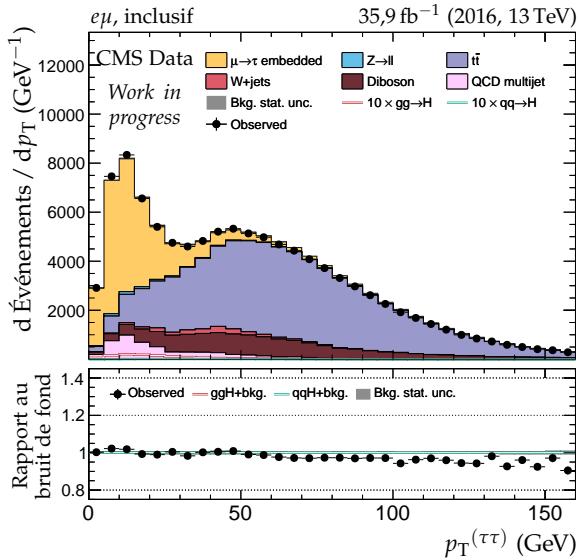
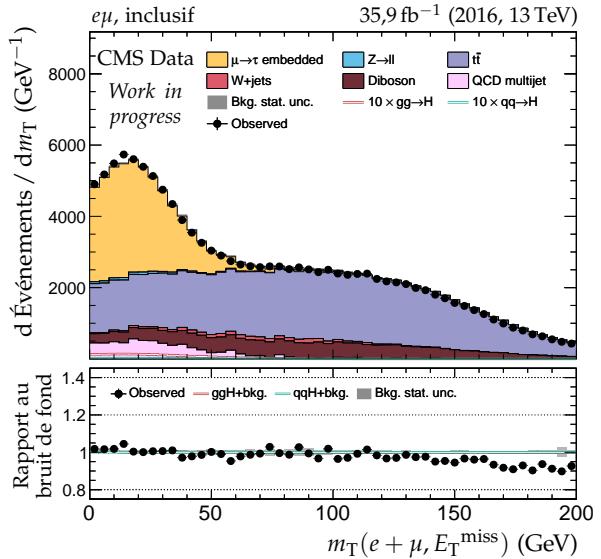
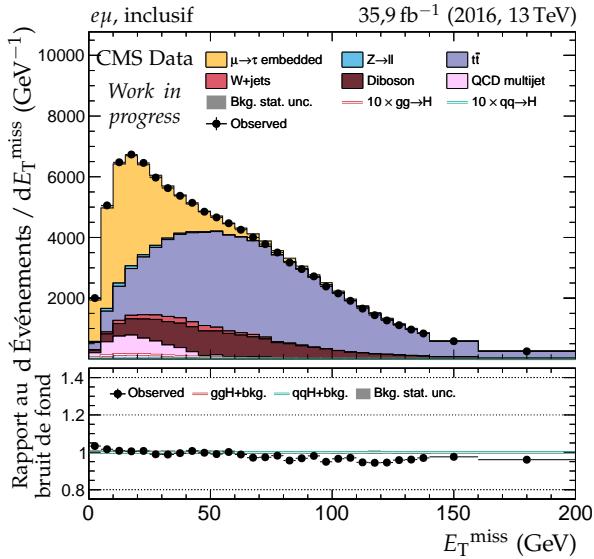


Figure X.20 – Canal $e\mu$, 2016 : dilepton et énergie transverse manquante.

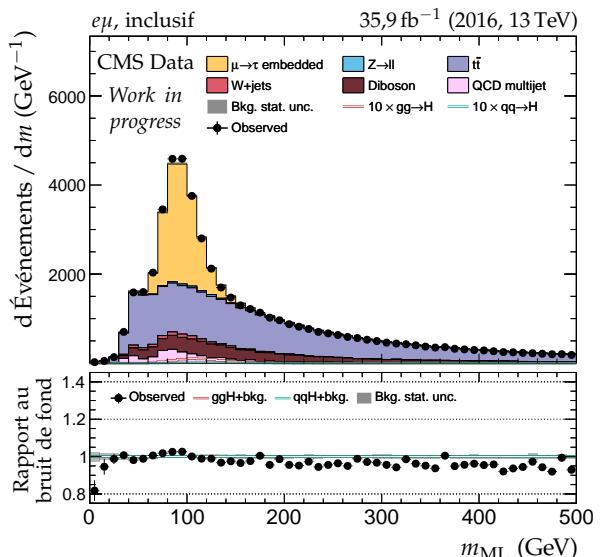
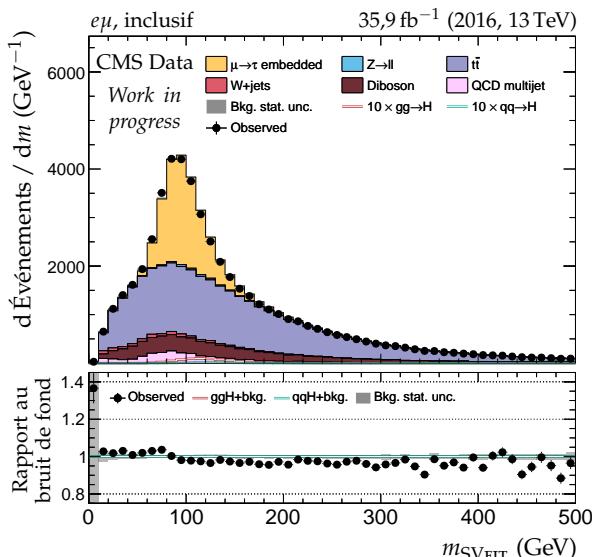
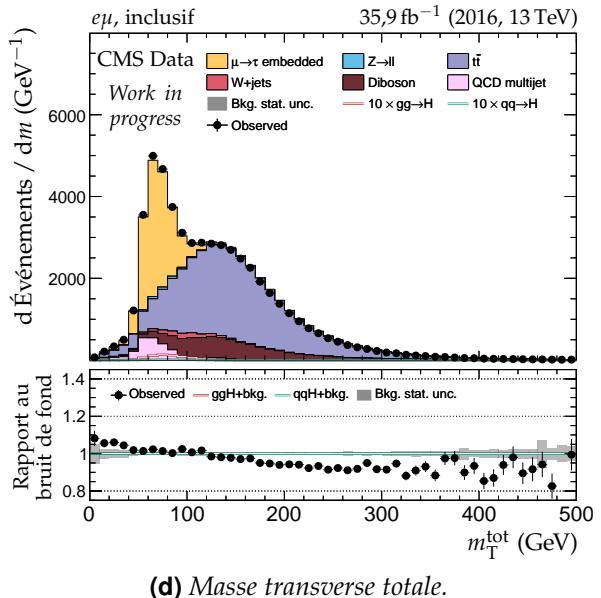
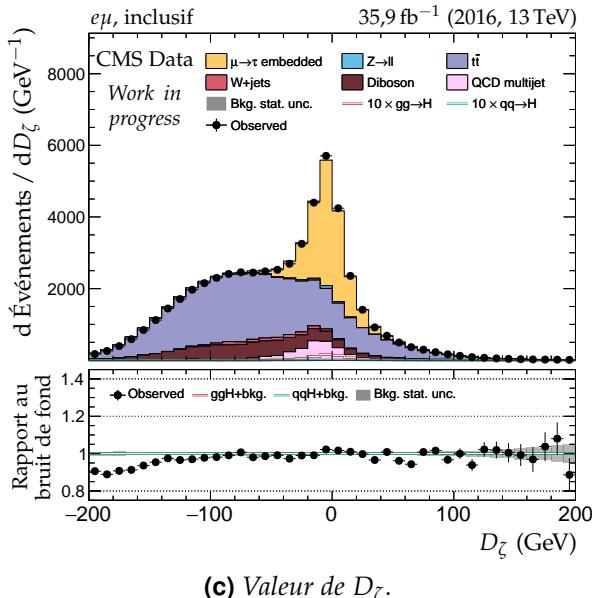
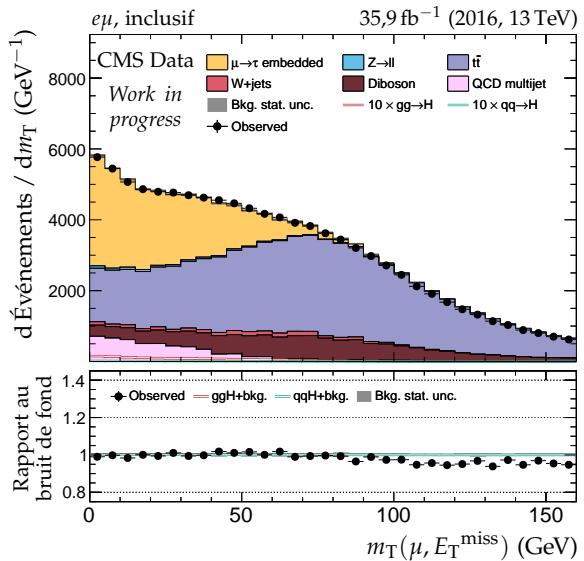
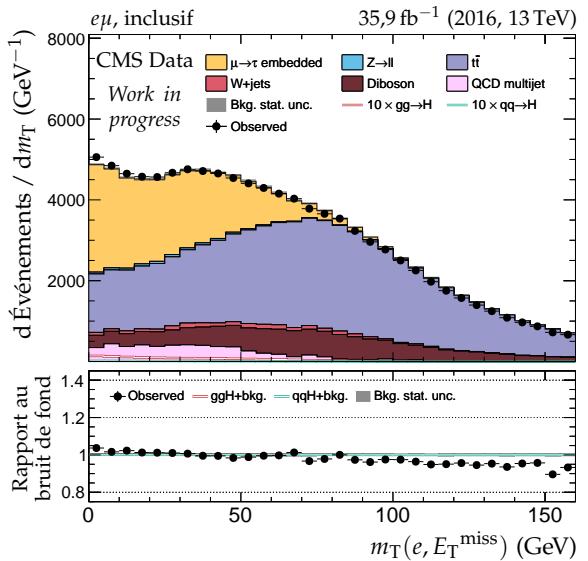


Figure X.21 – Canal $e\mu$, 2016 : masses transverses, D_ζ et masses.

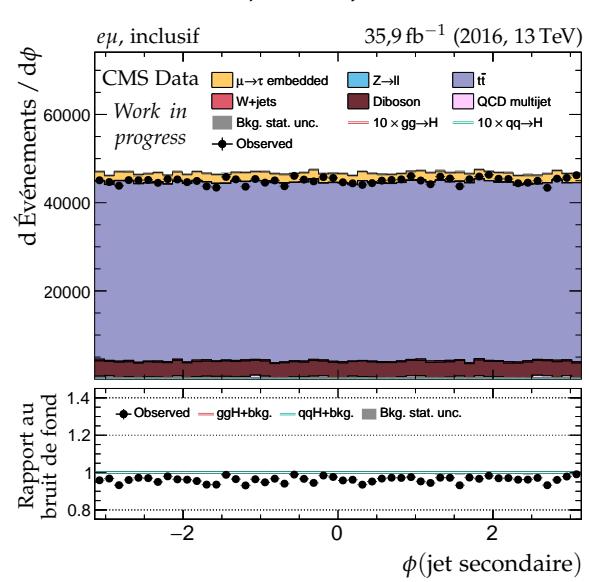
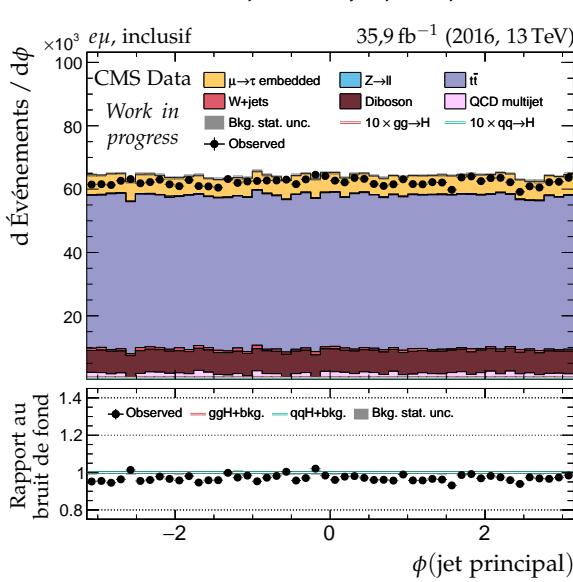
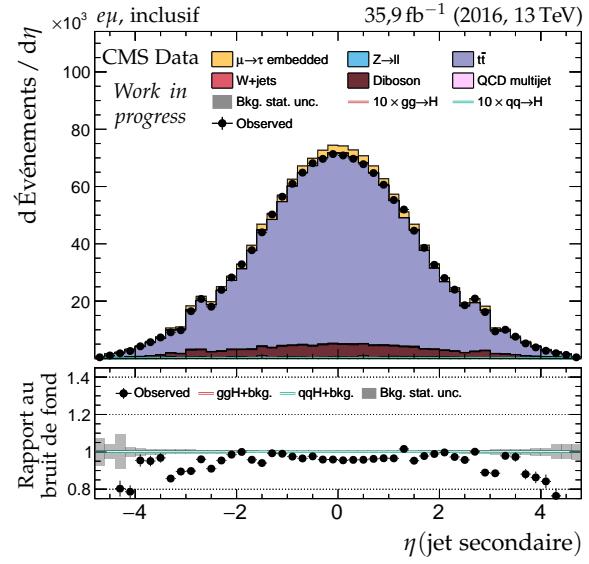
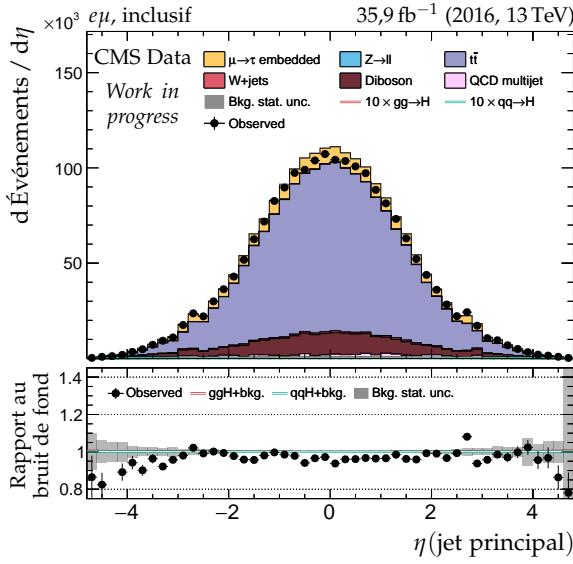
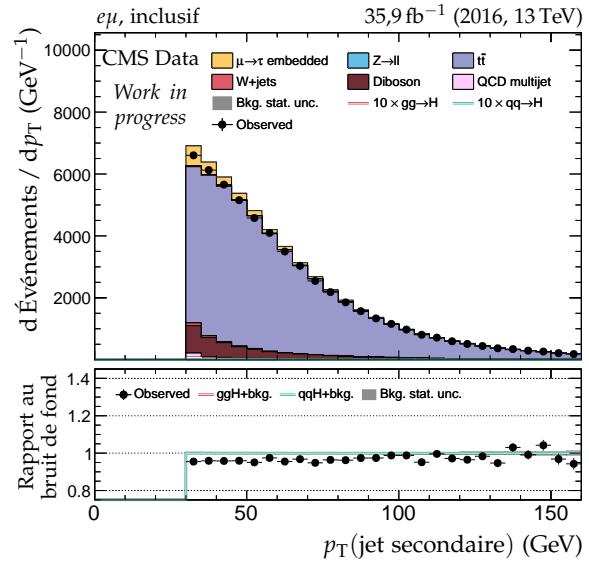
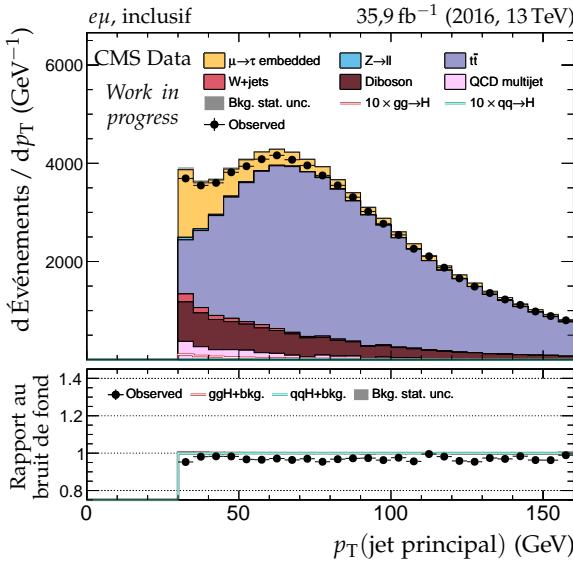


Figure X.22 – Canal $e\mu$, 2016 : cinématique des deux jets principaux.

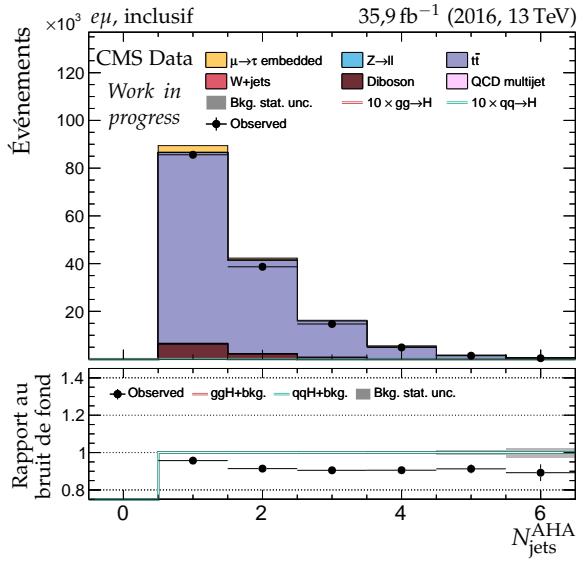
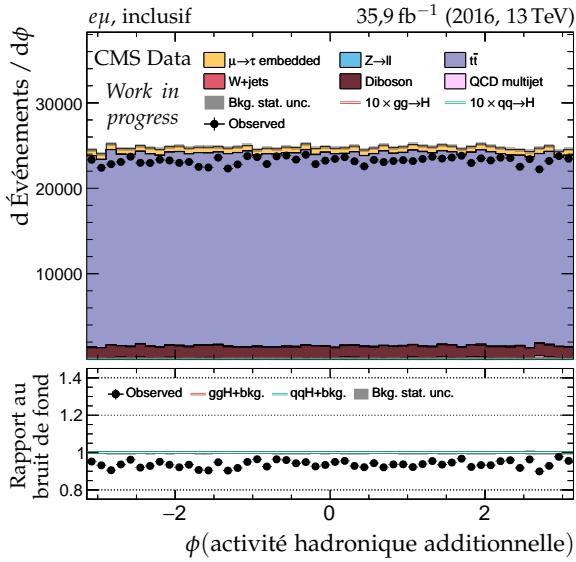
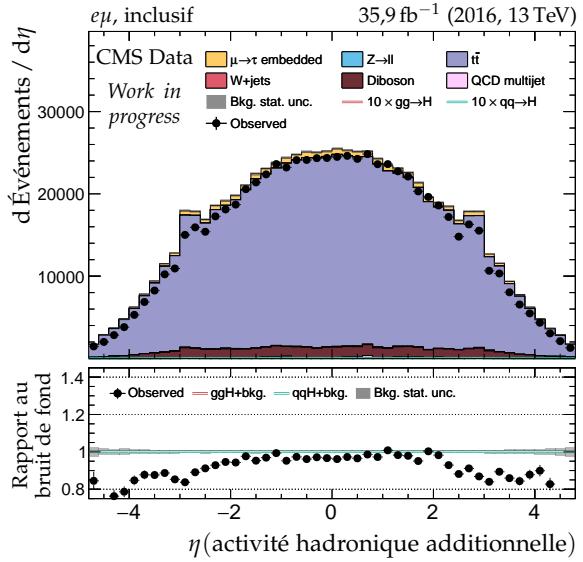
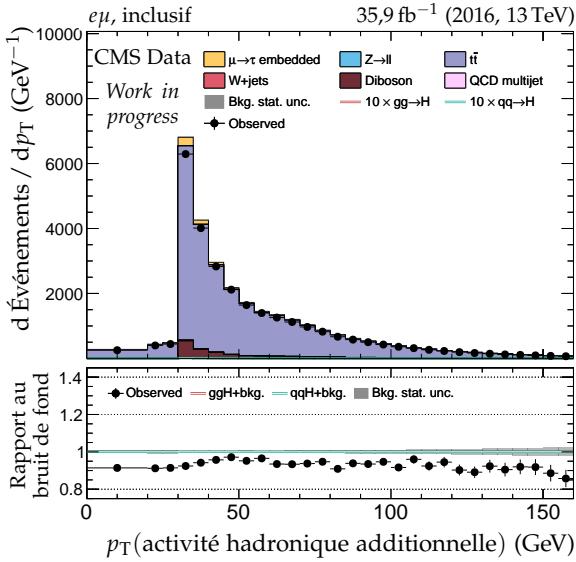
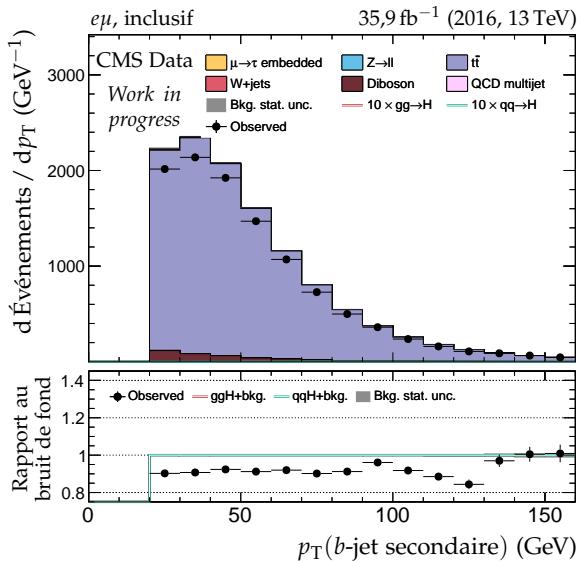
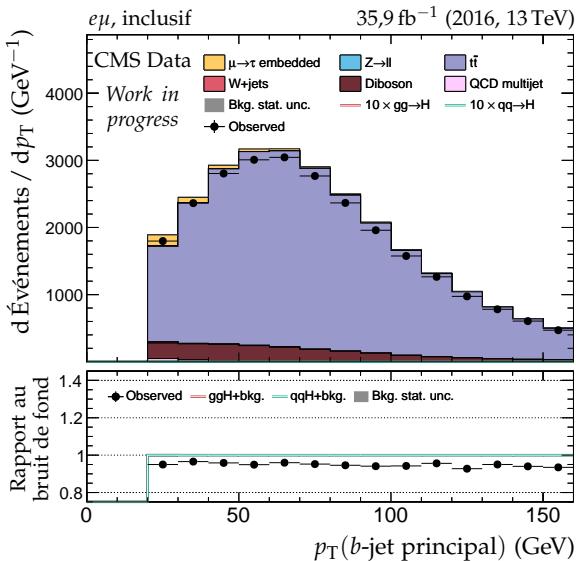


Figure X.23 – Canal $e\mu$, 2016 : b-jets et activité hadronique additionnelle.

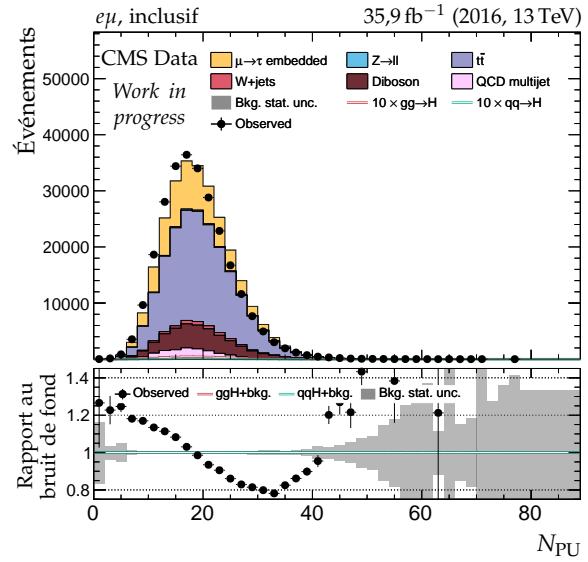
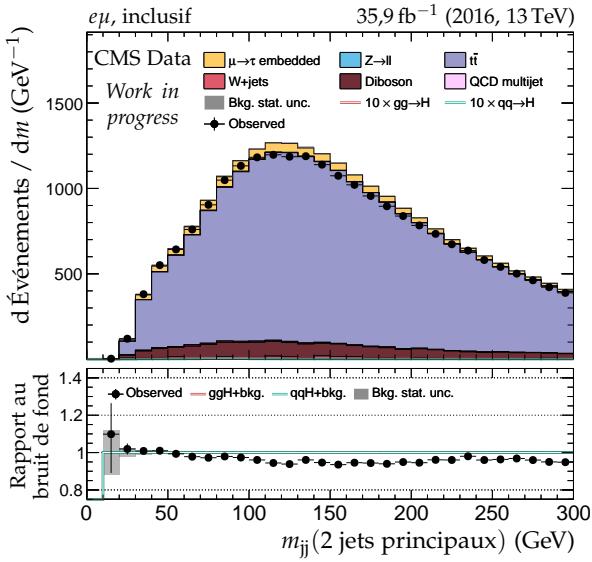
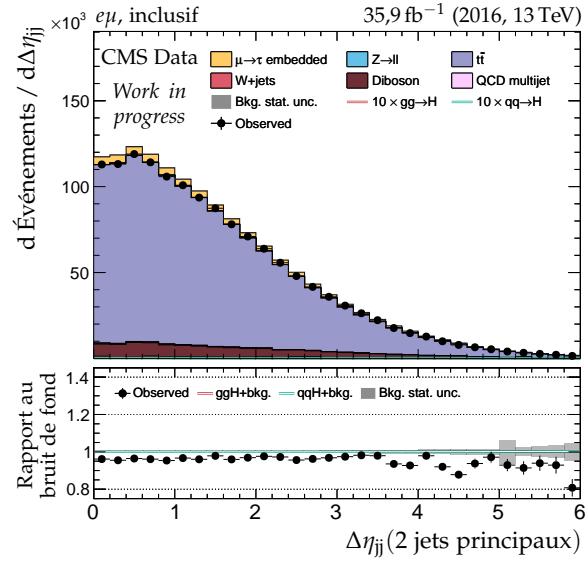
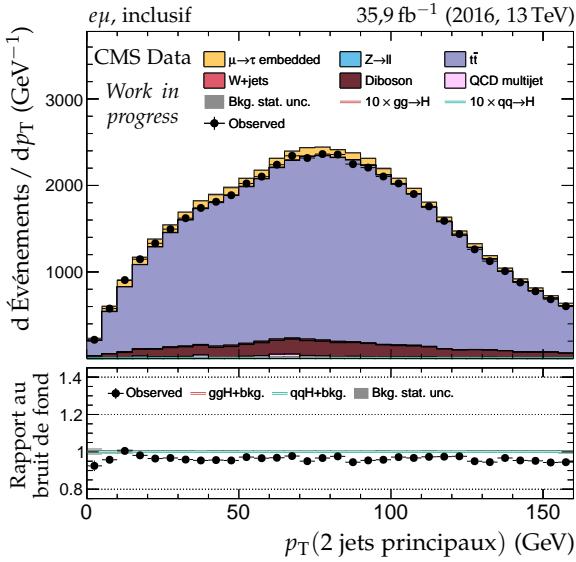
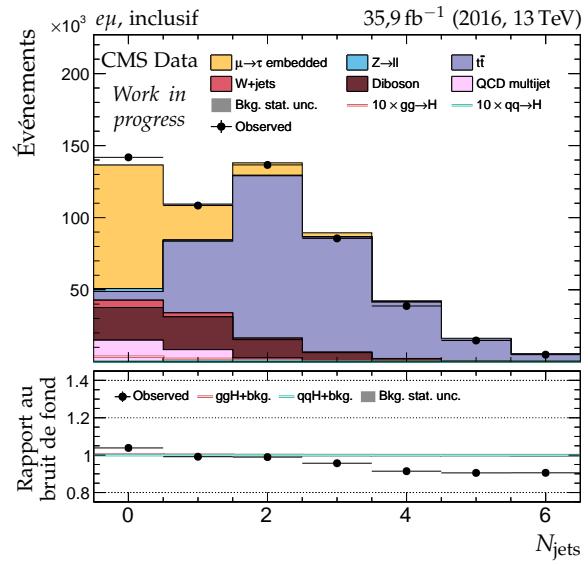
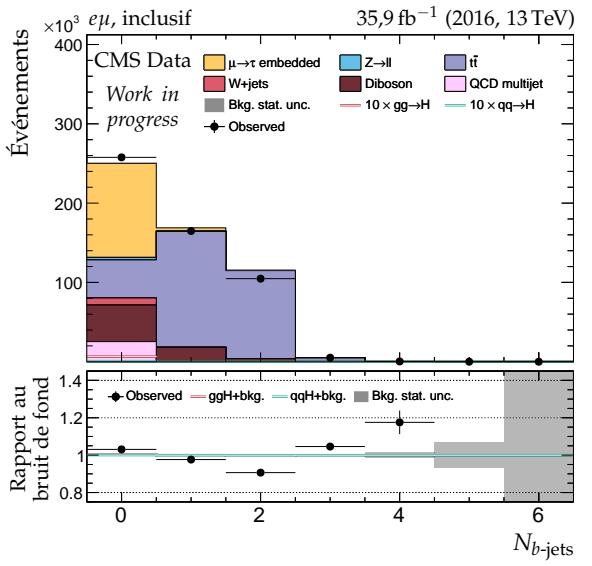
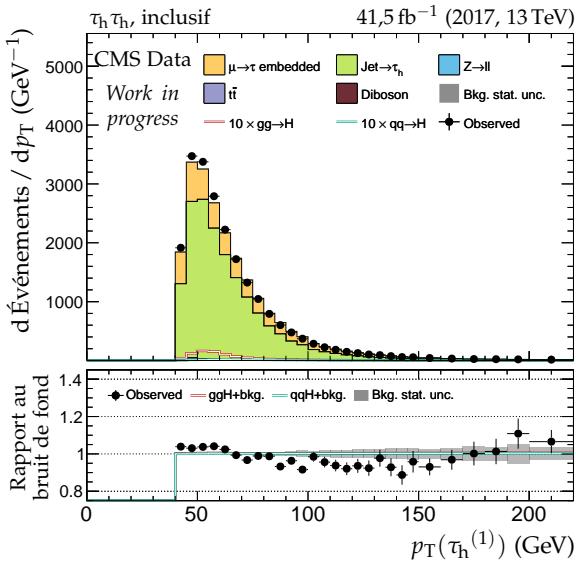
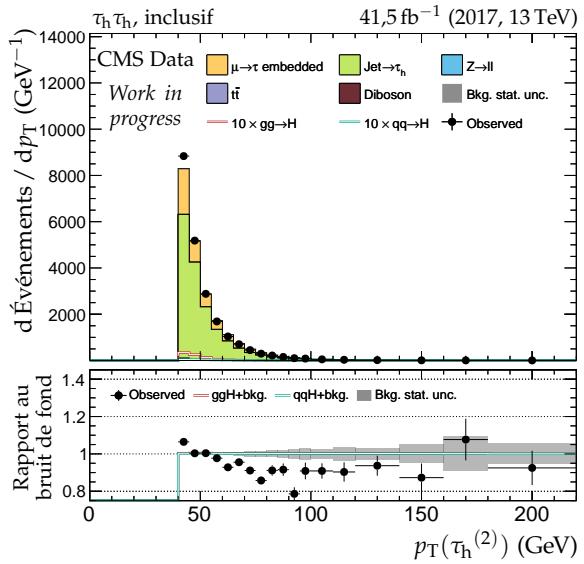


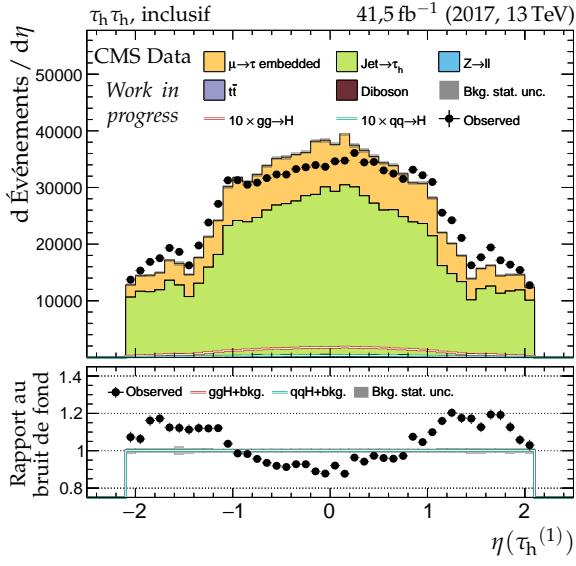
Figure X.24 – Canal $e\mu$, 2016 : nombre de jets, système des deux jets principaux et empilement.



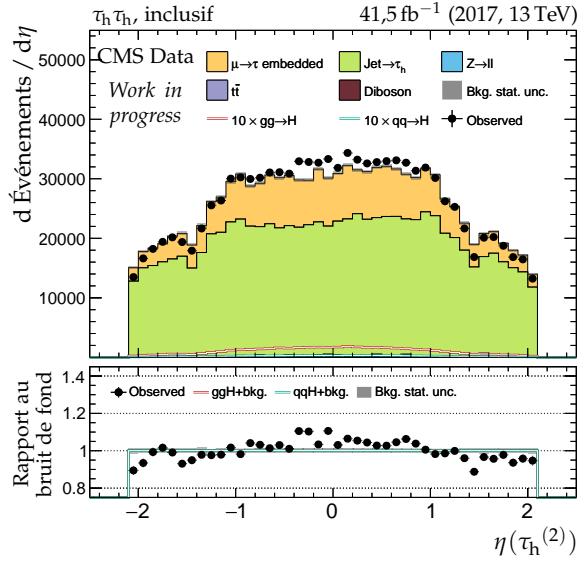
(a) Impulsion transverse du lepton 1 ($\tau_h^{(1)}$).



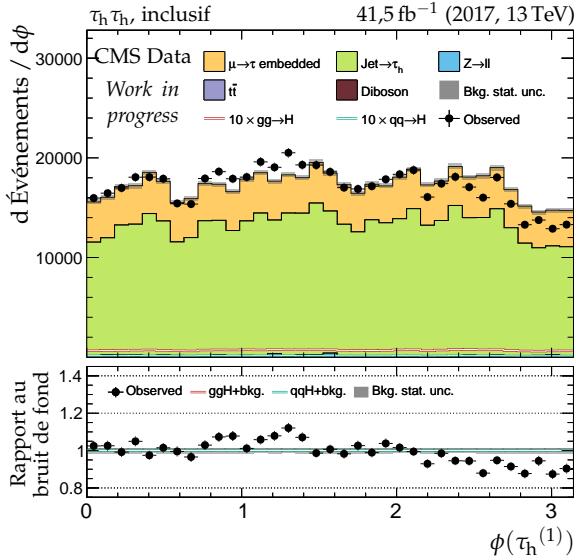
(b) Impulsion transverse du lepton 2 ($\tau_h^{(2)}$).



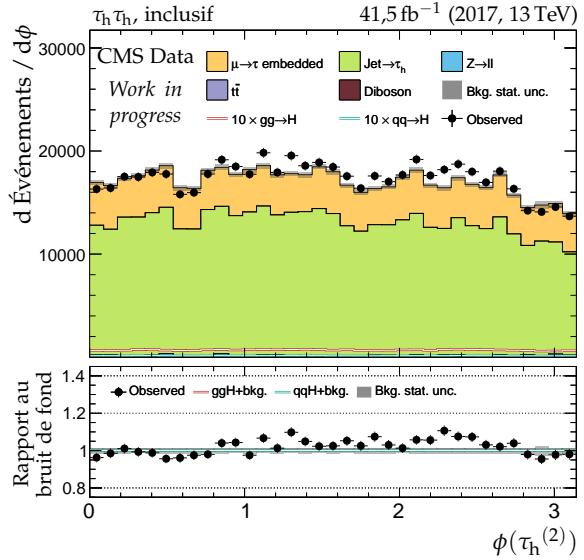
(c) Pseudo-rapidité du lepton 1 ($\tau_h^{(1)}$).



(d) Pseudo-rapidité du lepton 2 ($\tau_h^{(2)}$).

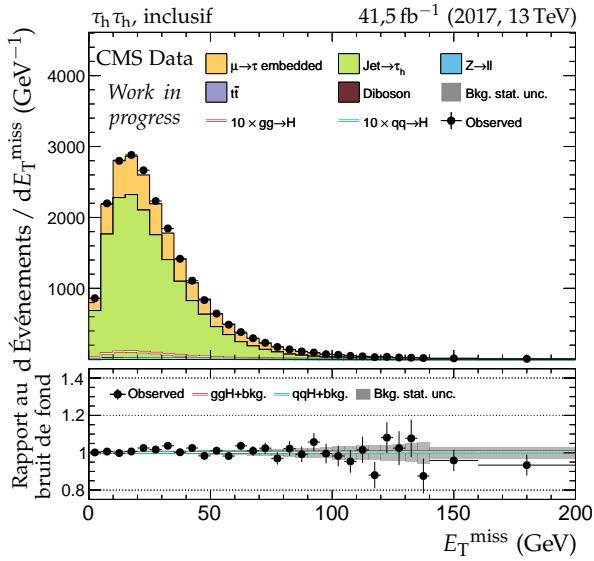


(e) Angle azimutal du lepton 1 ($\tau_h^{(1)}$).

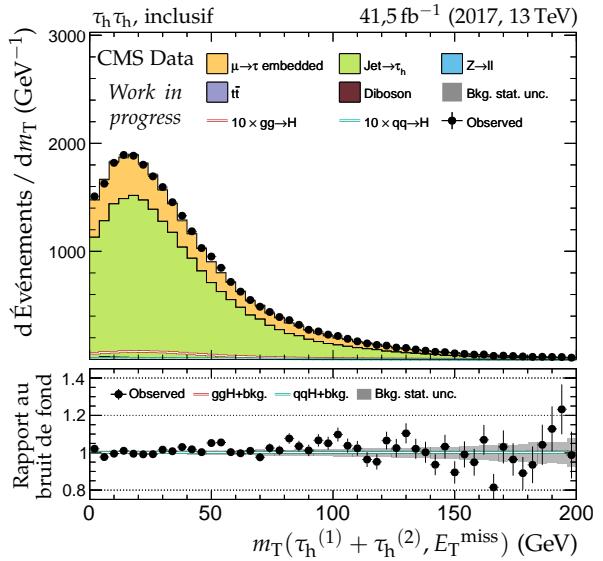


(f) Angle azimutal du lepton 2 ($\tau_h^{(2)}$).

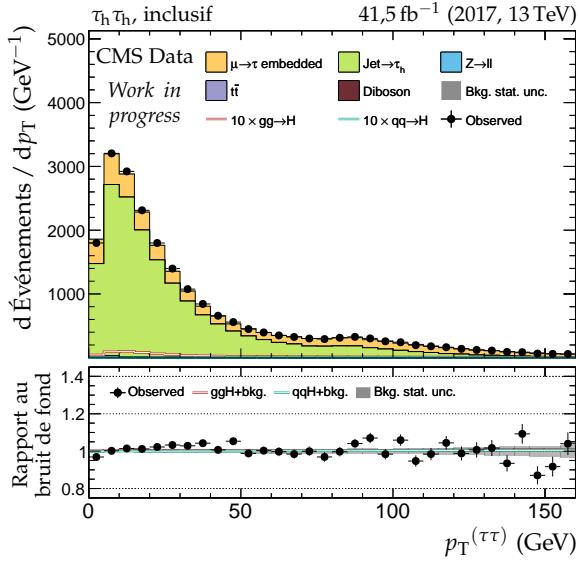
Figure X.25 – Canal $\tau_h \tau_h$, 2017 : cinématique des leptons ($\tau_h^{(1)}, \tau_h^{(2)}$).



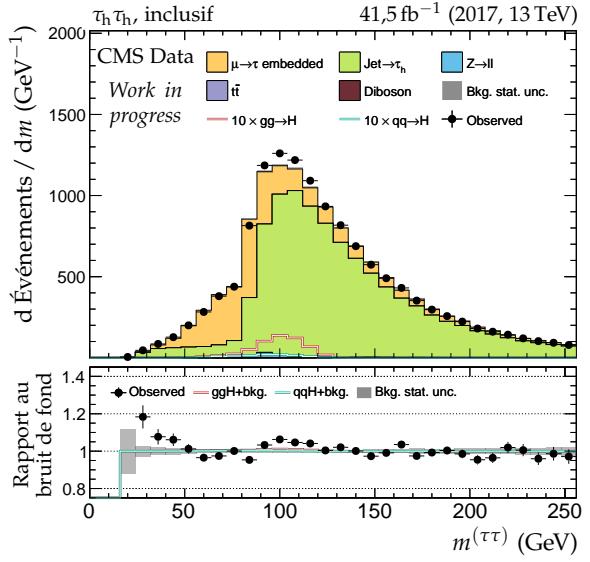
(a) Énergie transverse manquante.



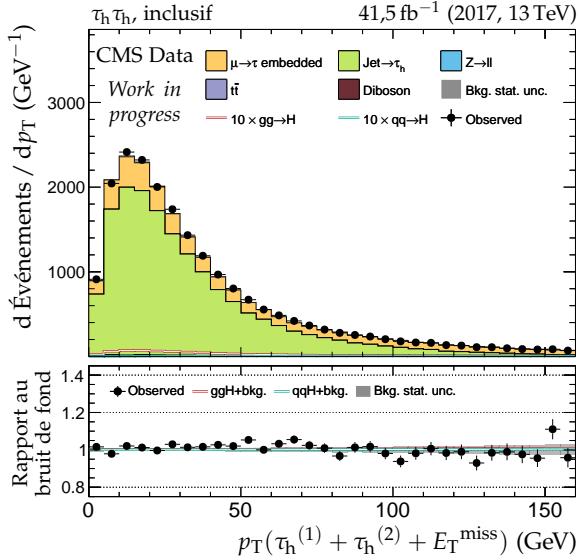
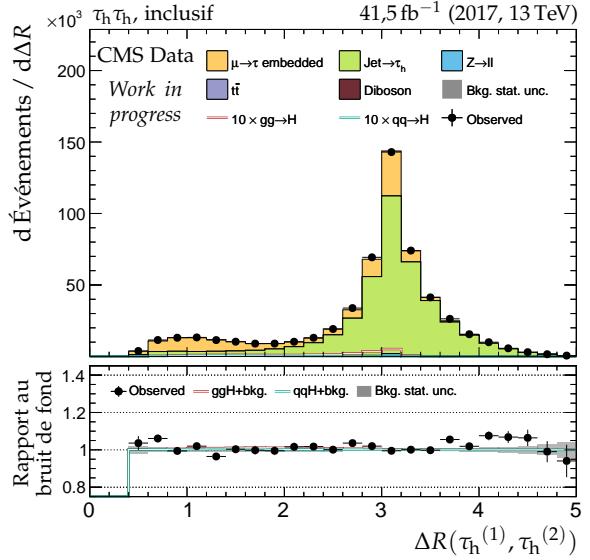
(b) Masse transverse du dilepton.

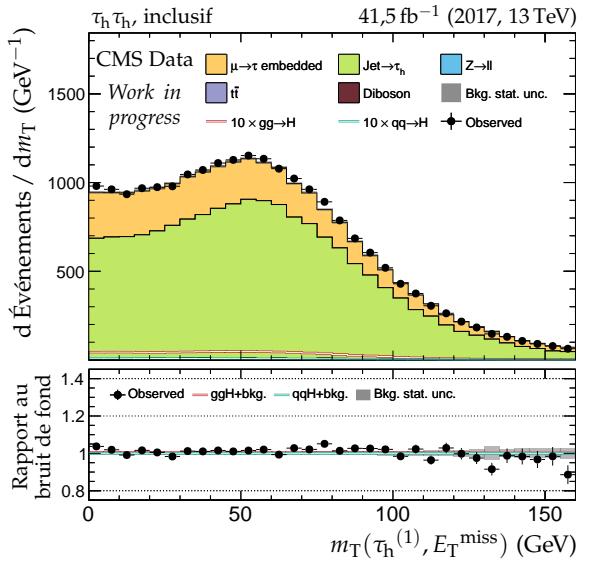
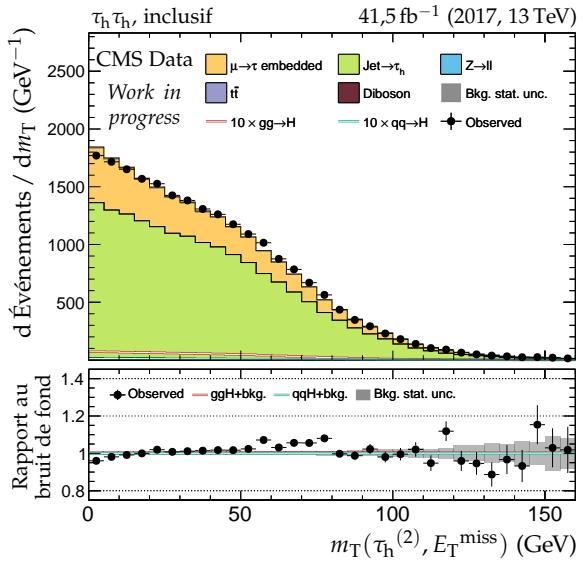
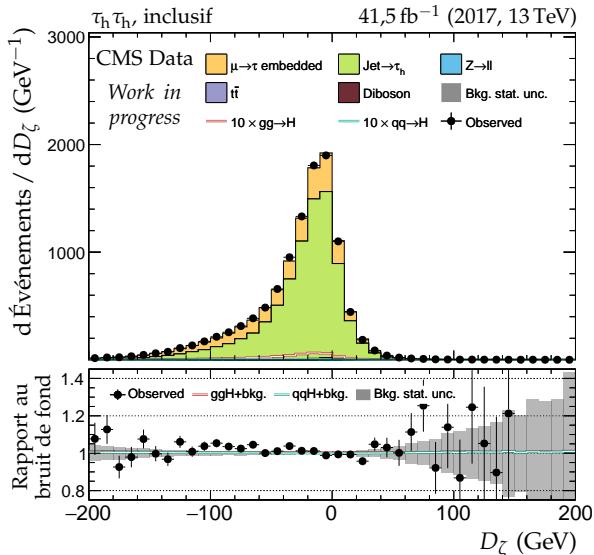
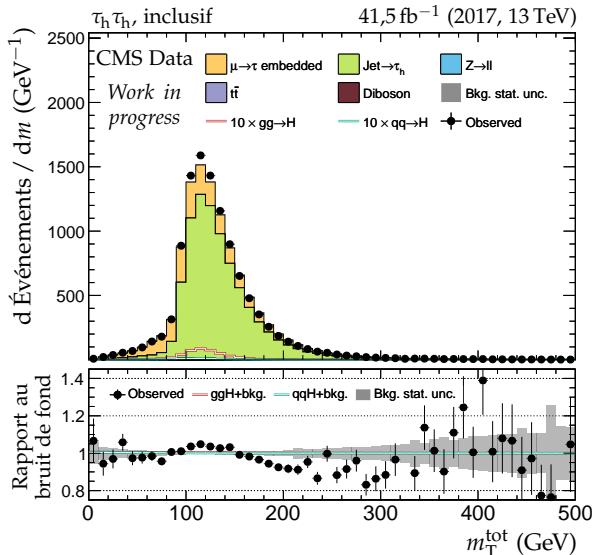


(c) Impulsion transverse du dilepton.



(d) Masse visible du dilepton.

(e) Impulsion transverse du système di- τ .(f) Distance ΔR entre les leptons ($\tau_h^{(1)}, \tau_h^{(2)}$).**Figure X.26 – Canal $\tau_h \tau_h$, 2017 : dilepton et énergie transverse manquante.**


 (a) Masse transverse du lepton 1 ($\tau_h^{(1)}$).

 (b) Masse transverse du lepton 2 ($\tau_h^{(2)}$).

 (c) Valeur de D_ζ .


(d) Masse transverse totale.

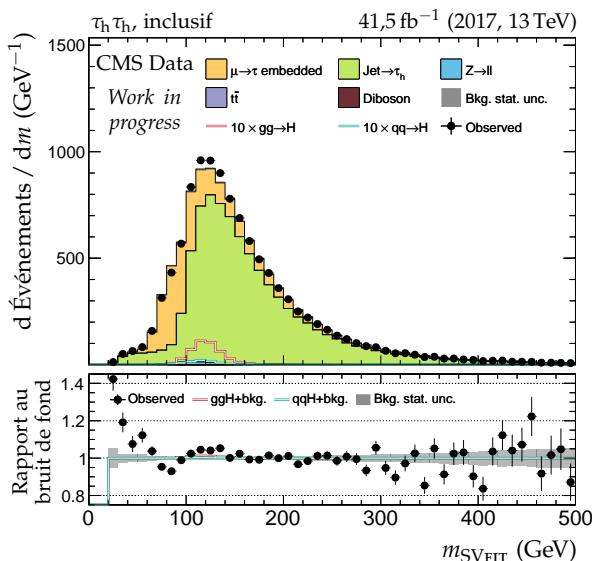
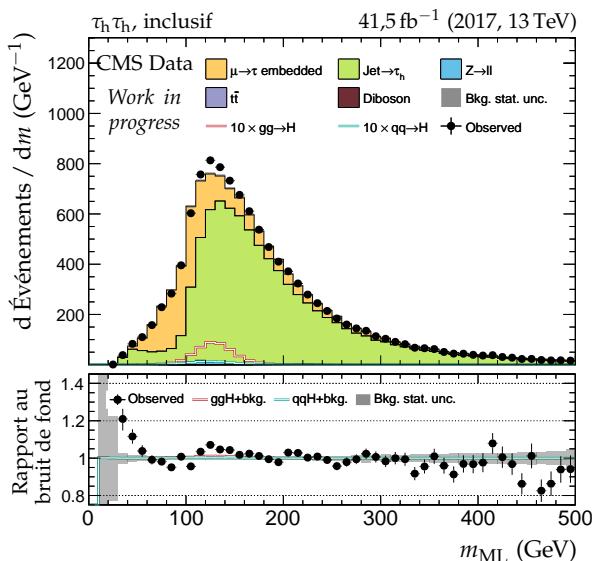
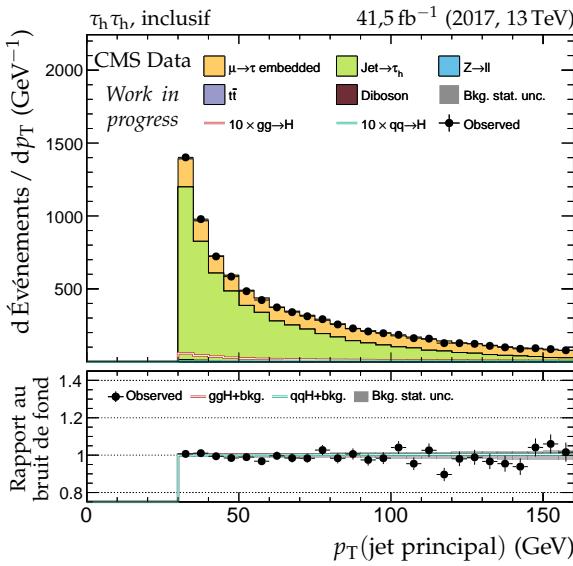
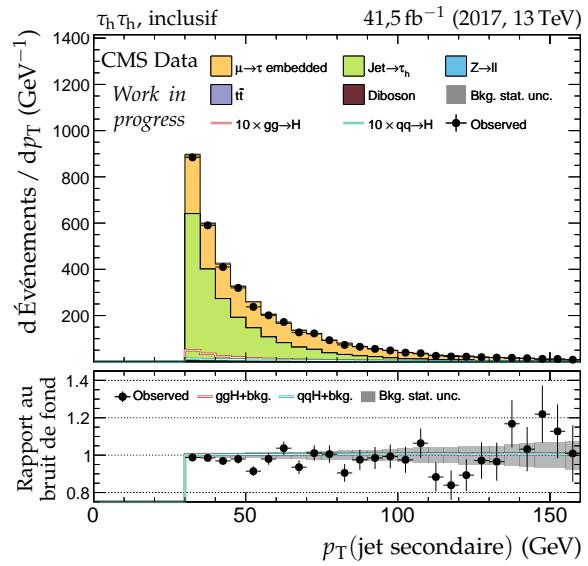

 (e) Masse du système di- τ d'après SVFIT.

 (f) Masse du système di- τ d'après le ML.

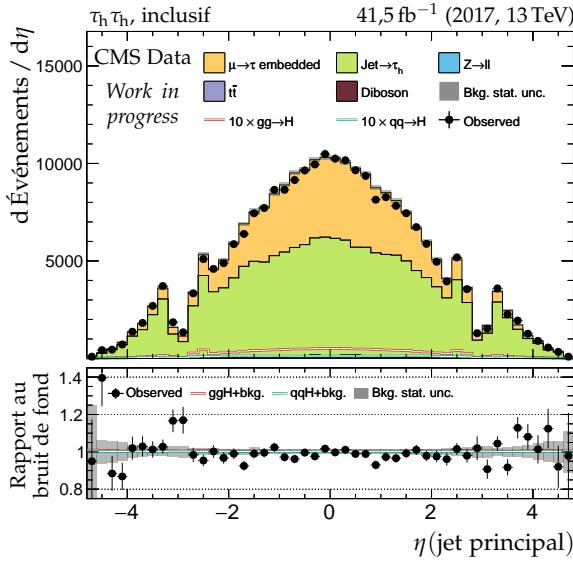
 Figure X.27 – Canal $\tau_h \tau_h$, 2017 : masses transverses, D_ζ et masses.



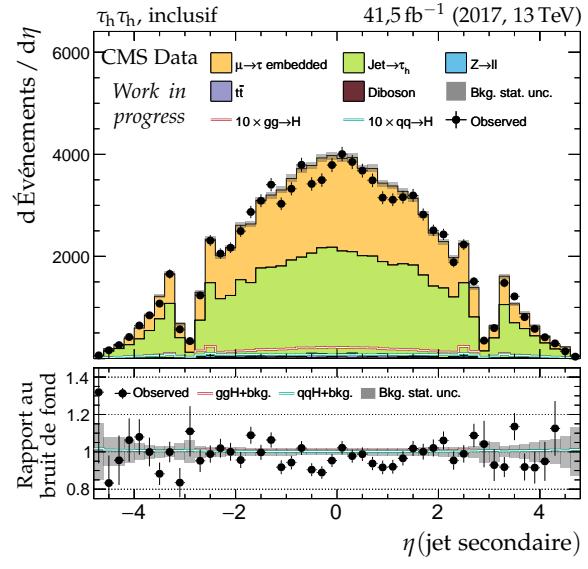
(a) Impulsion transverse du jet principal.



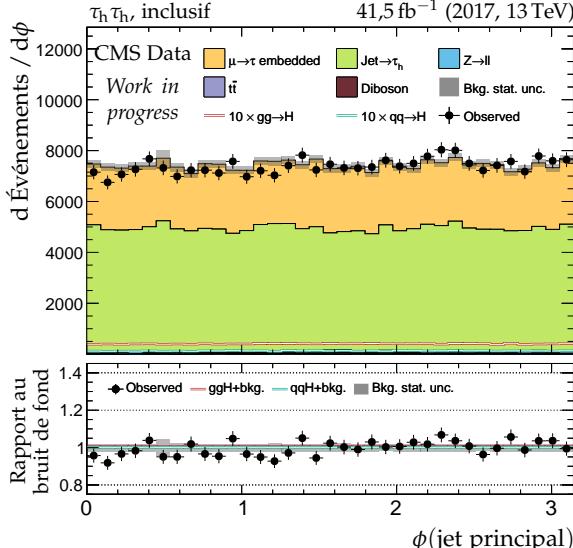
(b) Impulsion transverse du jet secondaire.



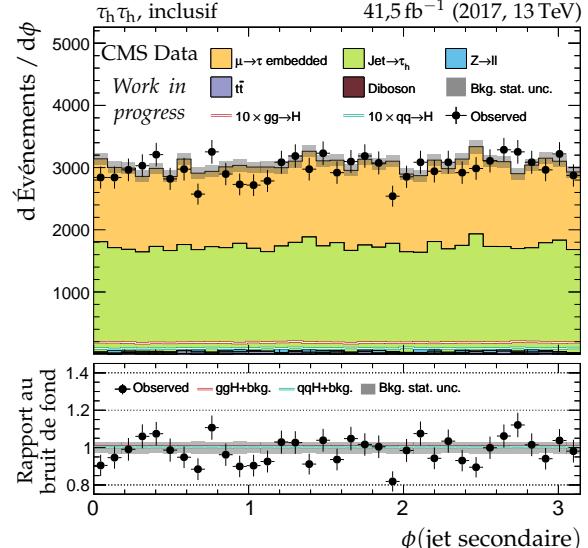
(c) Pseudo-rapidité du jet principal.



(d) Pseudo-rapidité du jet secondaire.

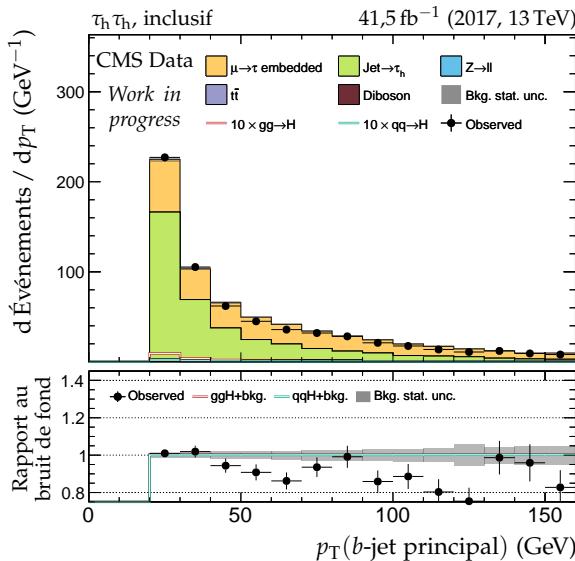


(e) Angle azimutal du jet principal.

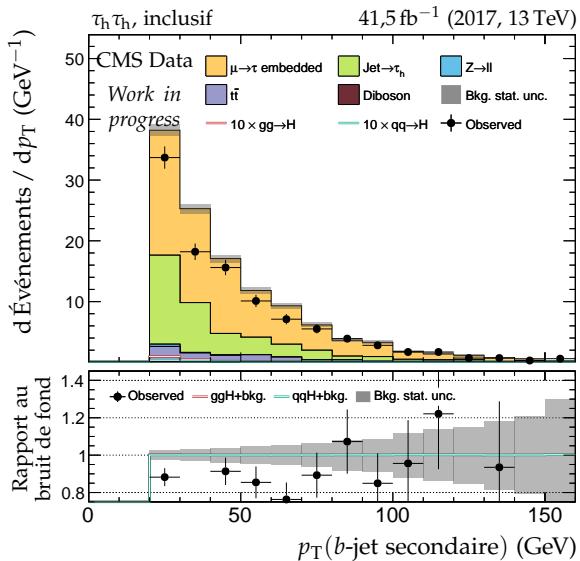


(f) Angle azimutal du jet secondaire.

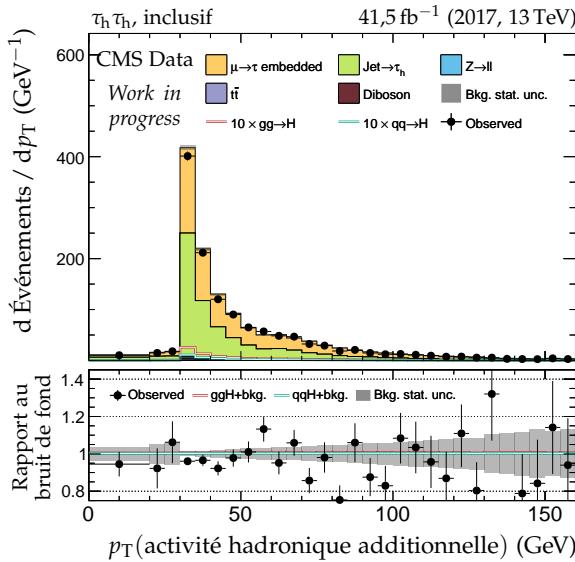
Figure X.28 – Canal $\tau_h \tau_h$, 2017 : cinématique des deux jets principaux.



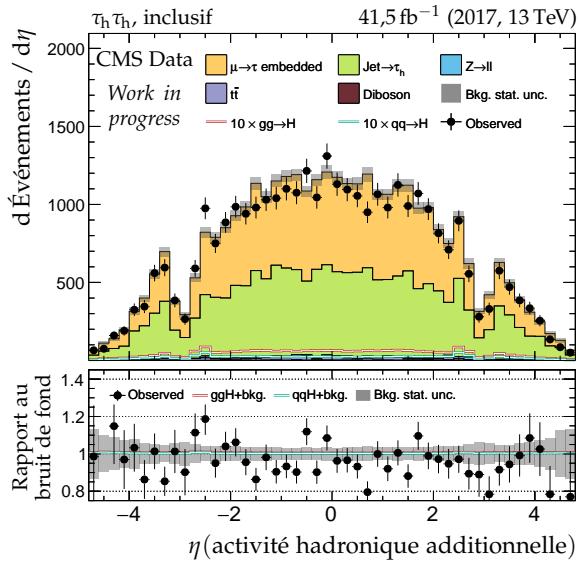
(a) Impulsion transverse du b-jet principal.



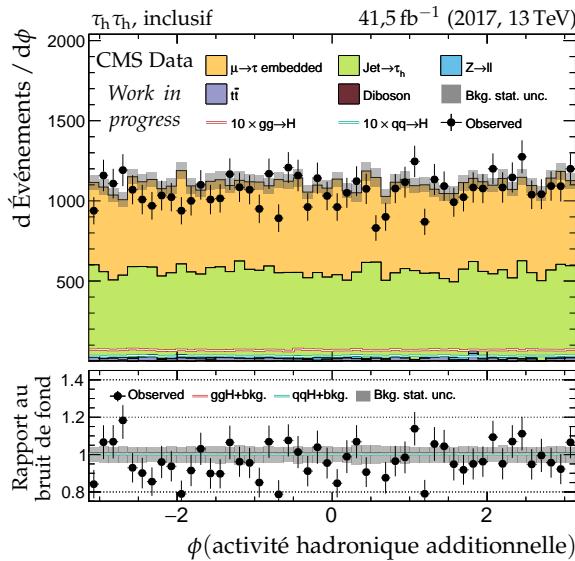
(b) Impulsion transverse du b-jet secondaire.



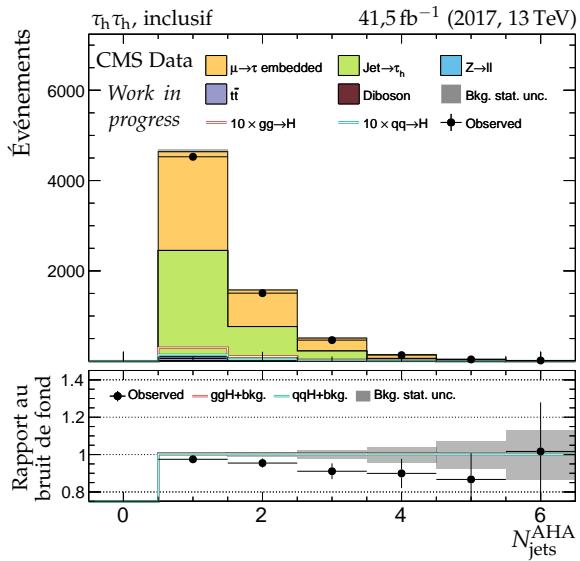
(c) Impulsion transverse de l'AHA.



(d) Pseudo-rapidité de l'AHA.



(e) Angle azimutal de l'AHA.



(f) Nombre de jets dans l'AHA.

Figure X.29 – Canal $\tau_h\tau_h$, 2017 : b-jets et activité hadronique additionnelle.

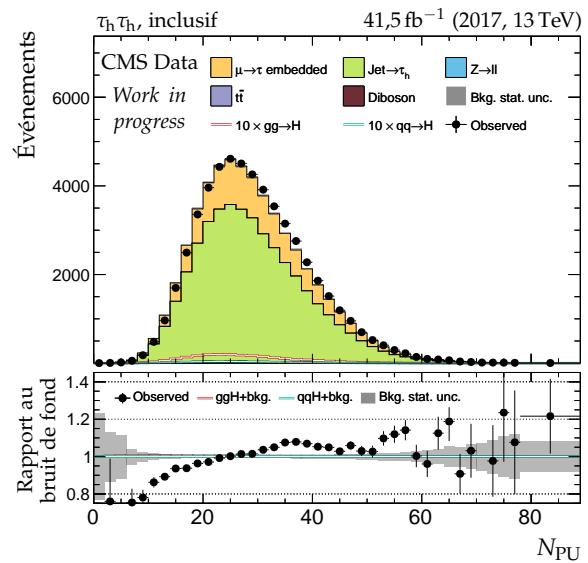
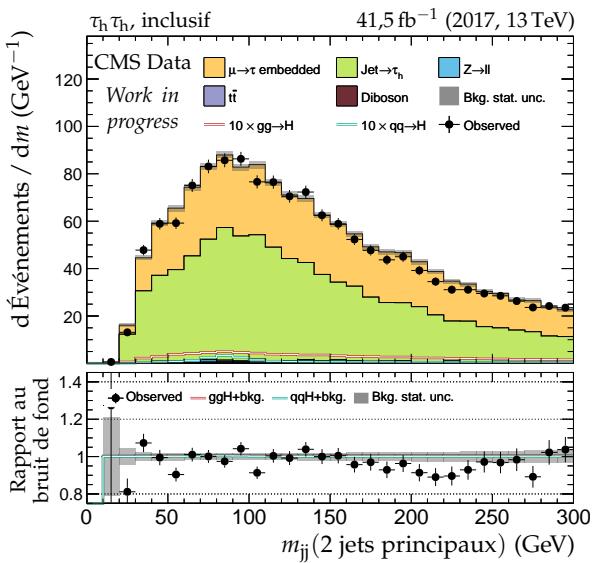
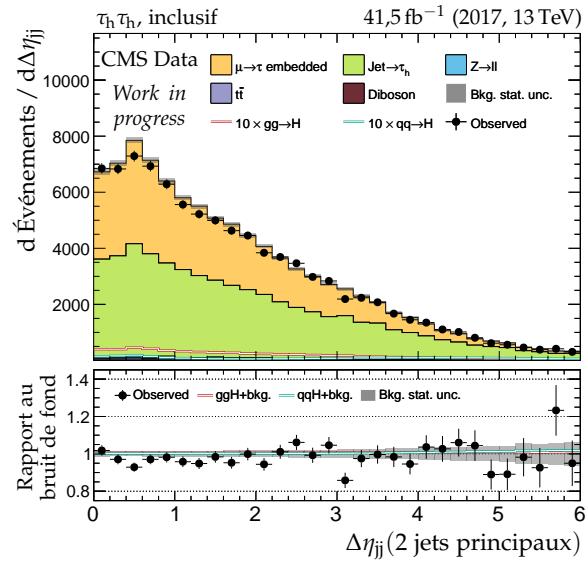
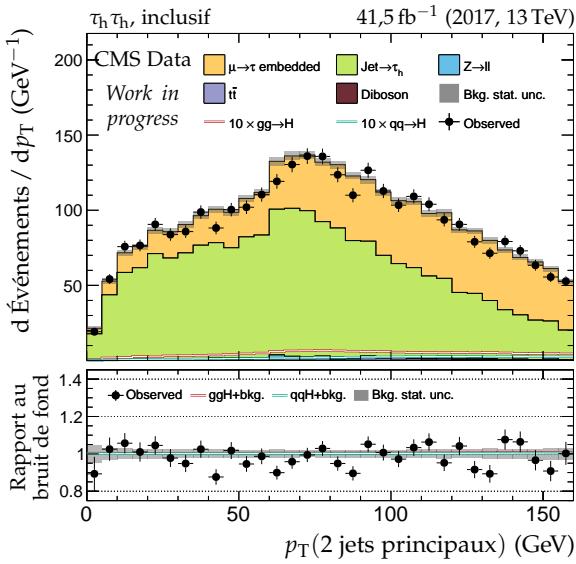
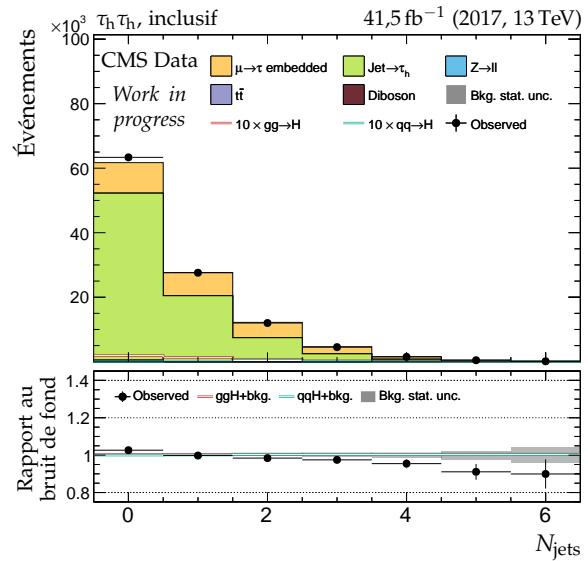
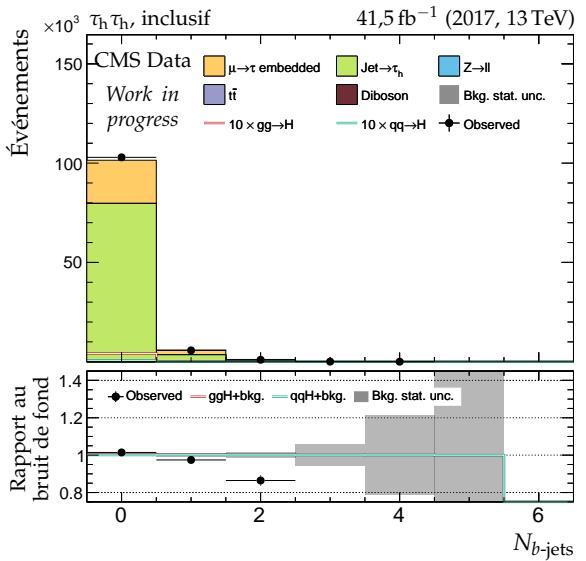
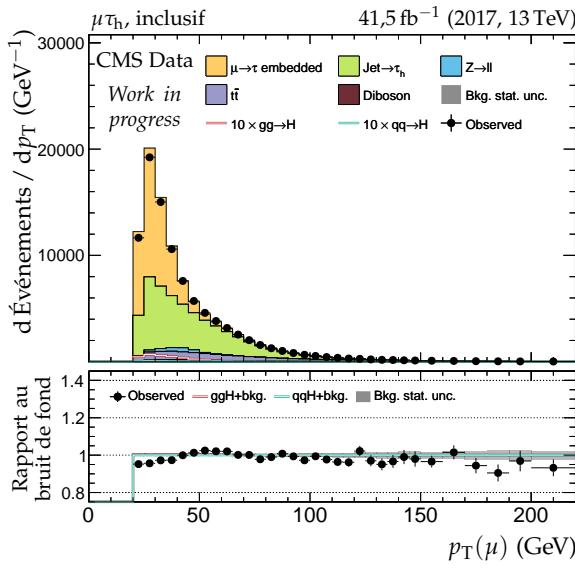
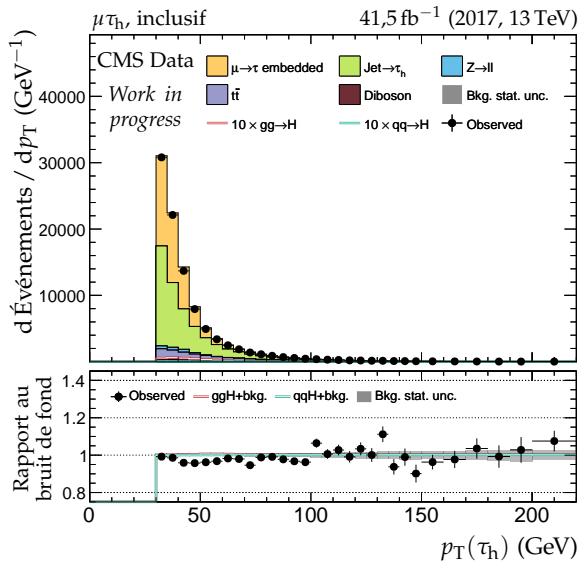


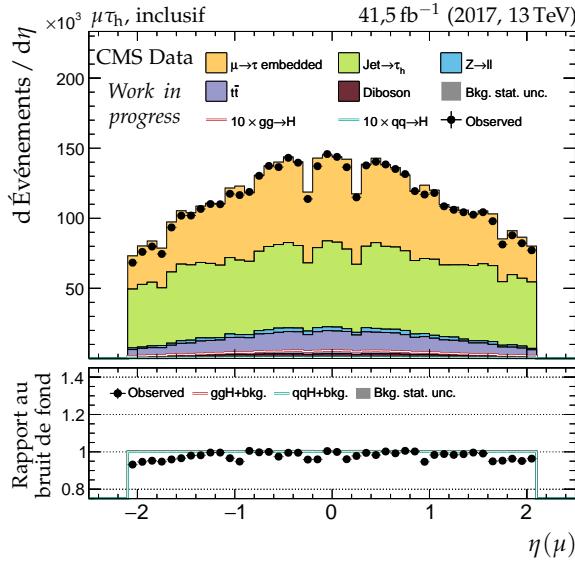
Figure X.30 – Canal $\tau_h \tau_h$, 2017 : nombre de jets, système des deux jets principaux et empilement.



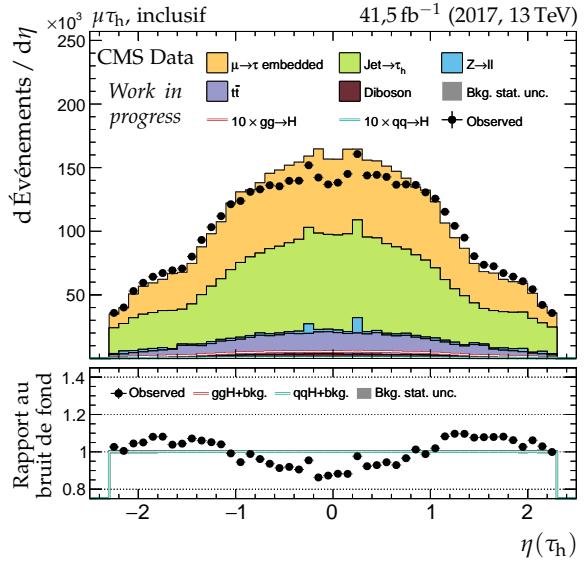
(a) Impulsion transverse du lepton 1 (μ).



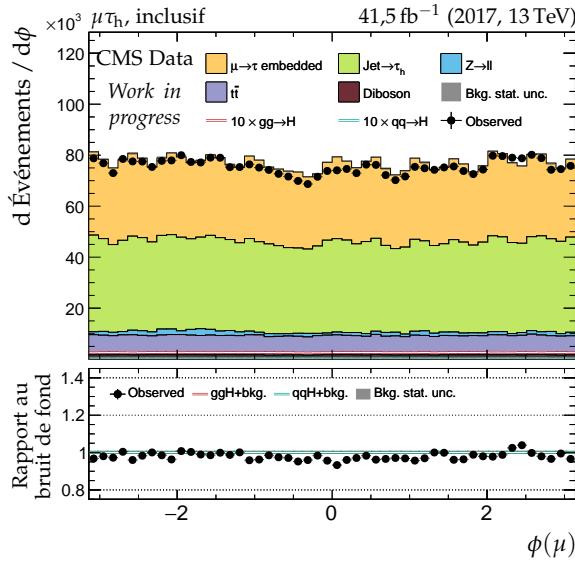
(b) Impulsion transverse du lepton 2 (τ_h).



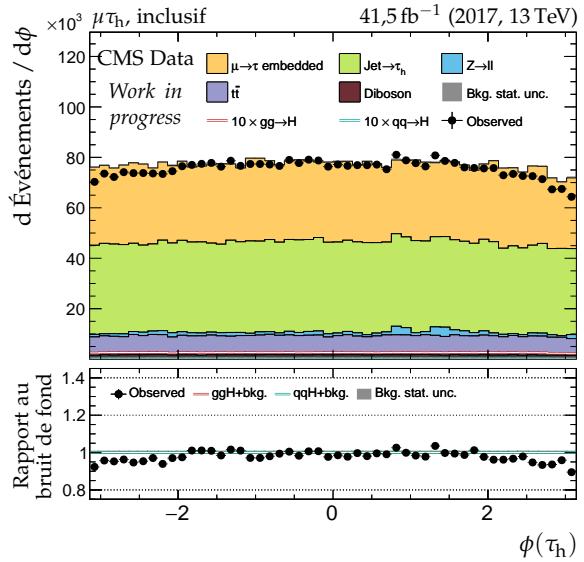
(c) Pseudo-rapidité du lepton 1 (μ).



(d) Pseudo-rapidité du lepton 2 (τ_h).

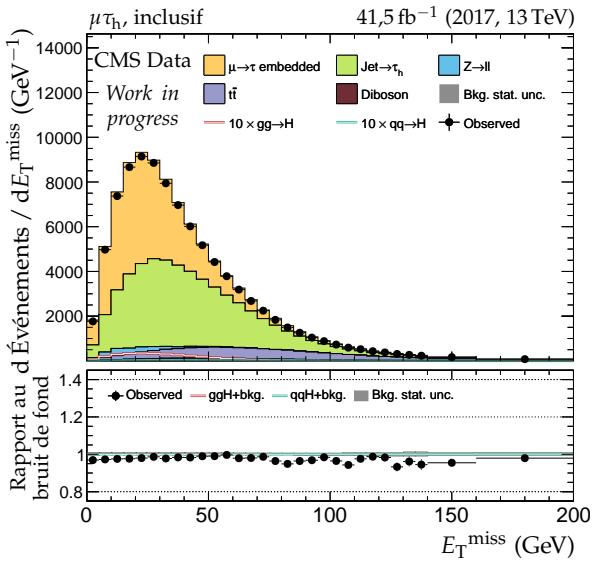


(e) Angle azimutal du lepton 1 (μ).

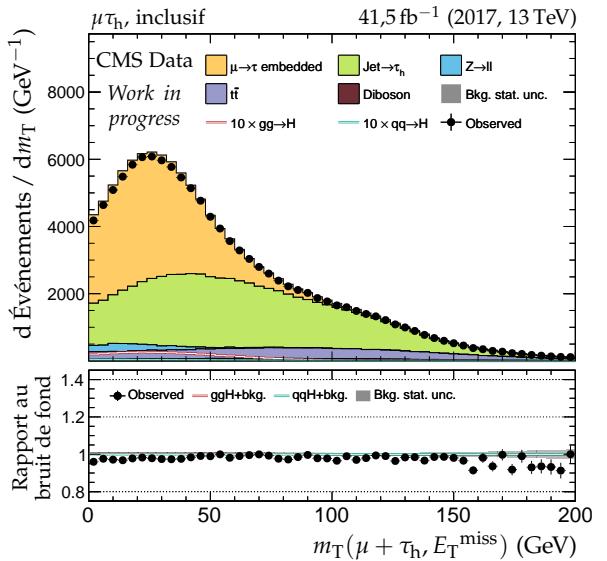


(f) Angle azimutal du lepton 2 (τ_h).

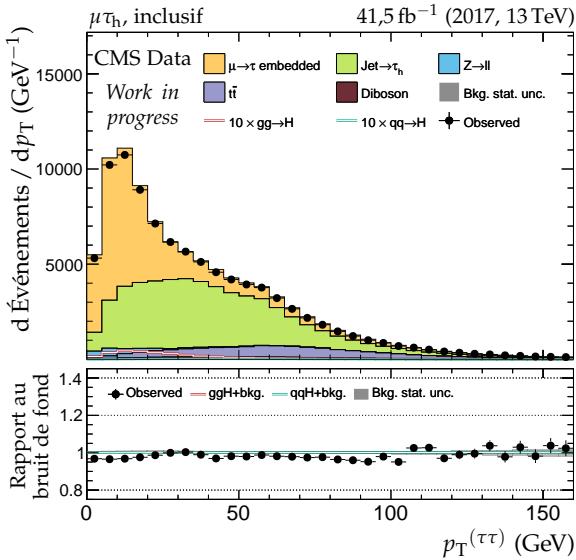
Figure X.31 – Canal $\mu\tau_h$, 2017 : cinématique des leptons (μ, τ_h).



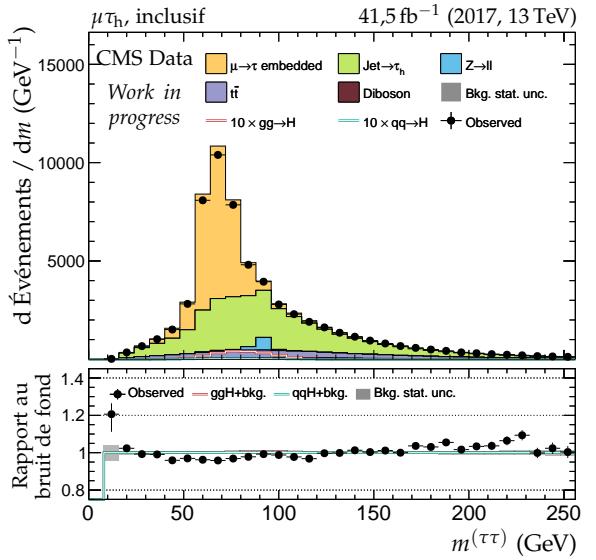
(a) Énergie transverse manquante.



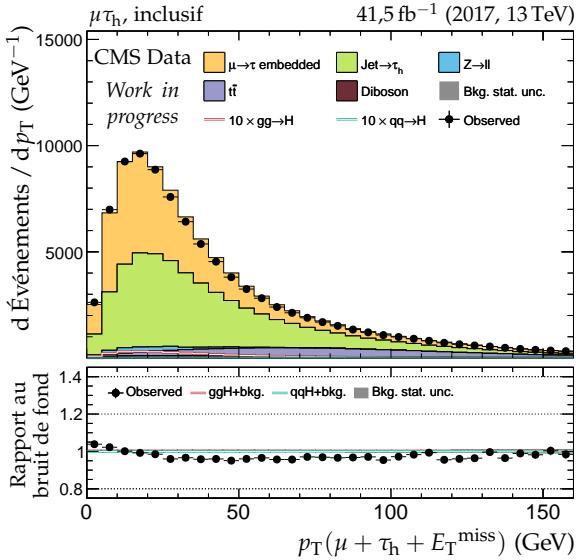
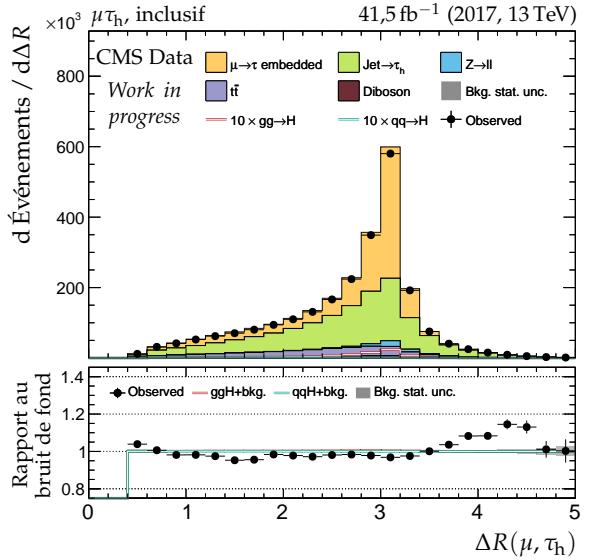
(b) Masse transverse du dilepton.

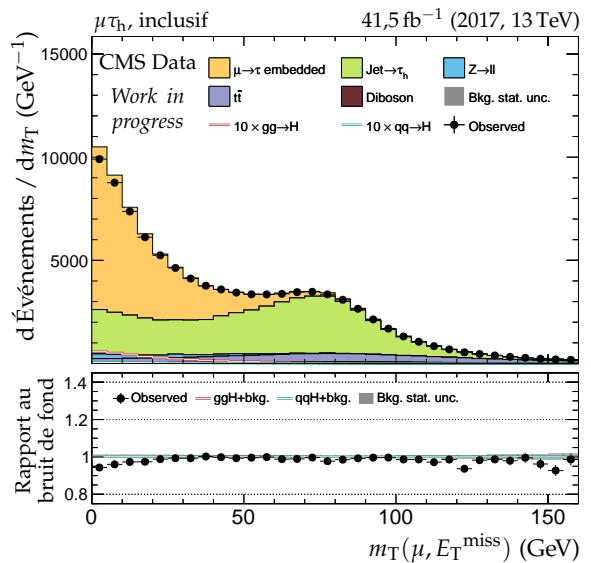


(c) Impulsion transverse du dilepton.

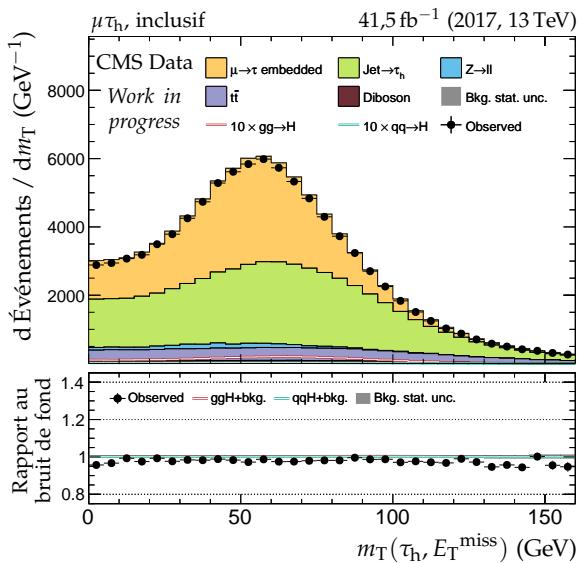


(d) Masse visible du dilepton.

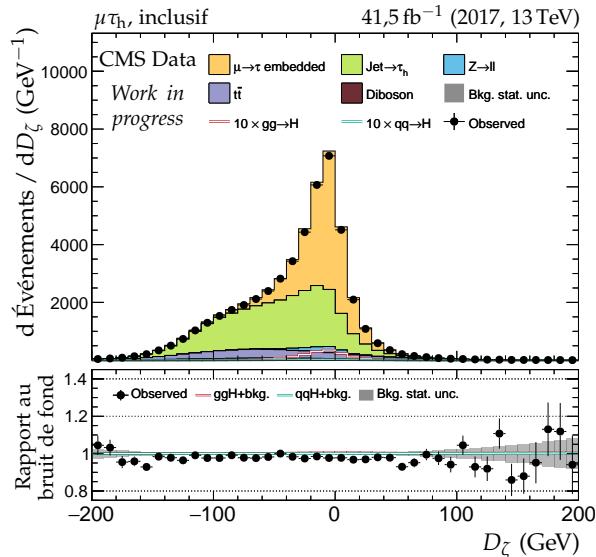
(e) Impulsion transverse du système di- τ .(f) Distance ΔR entre les leptons (μ, τ_h).**Figure X.32 – Canal $\mu\tau_h$, 2017 : dilepton et énergie transverse manquante.**



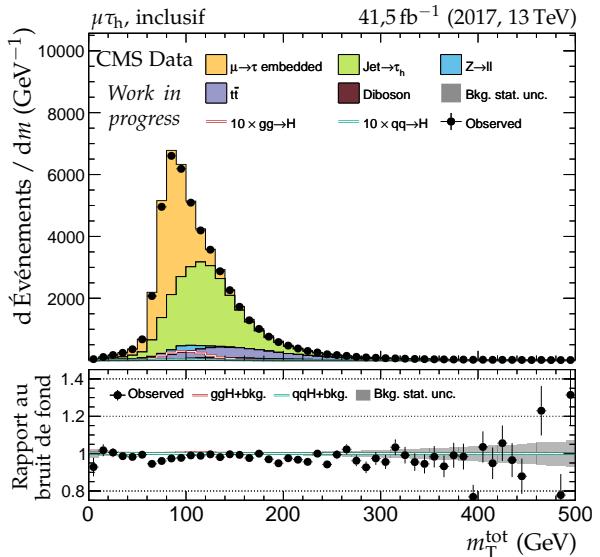
(a) Masse transverse du lepton 1 (μ).



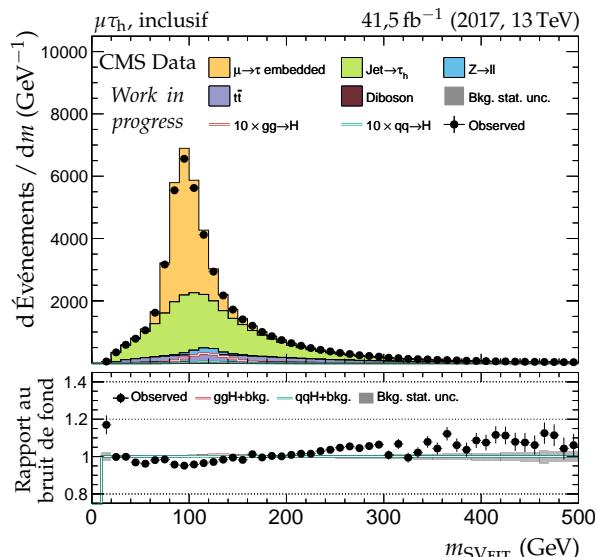
(b) Masse transverse du lepton 2 (τ_h).



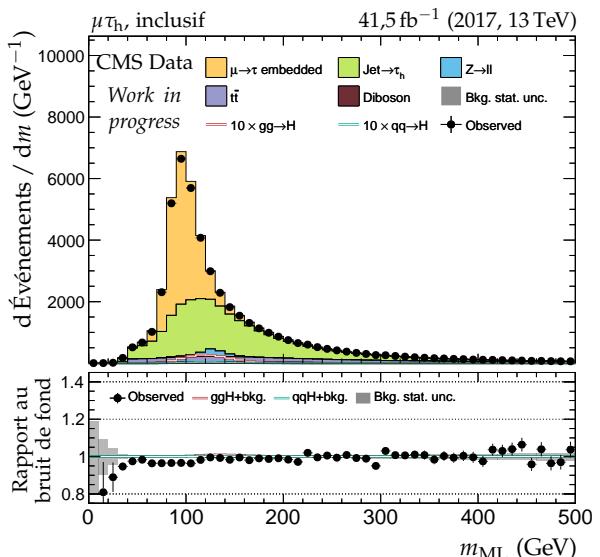
(c) Valeur de D_ζ .



(d) Masse transverse totale.



(e) Masse du système di- τ d'après SVFIT.



(f) Masse du système di- τ d'après le ML.

Figure X.33 – Canal $\mu\tau_h$, 2017 : masses transverses, D_ζ et masses.

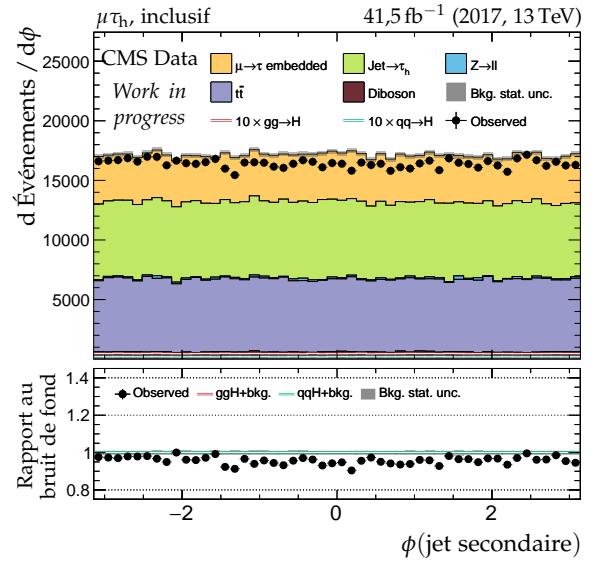
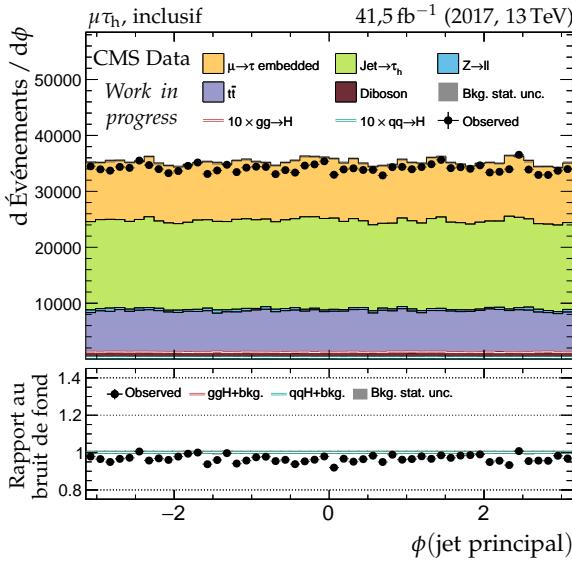
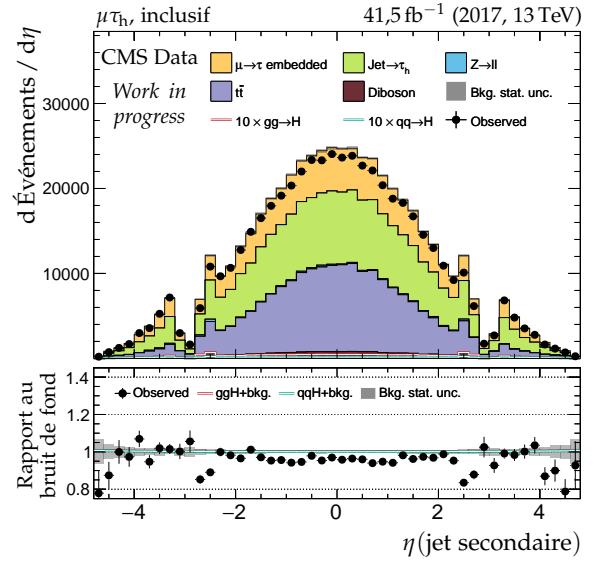
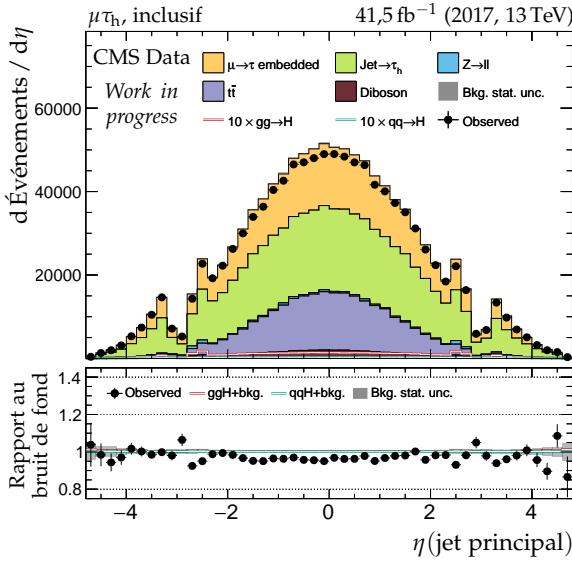
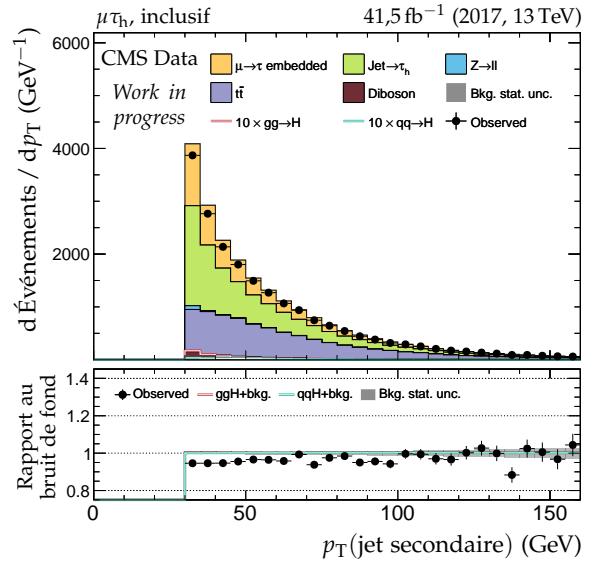
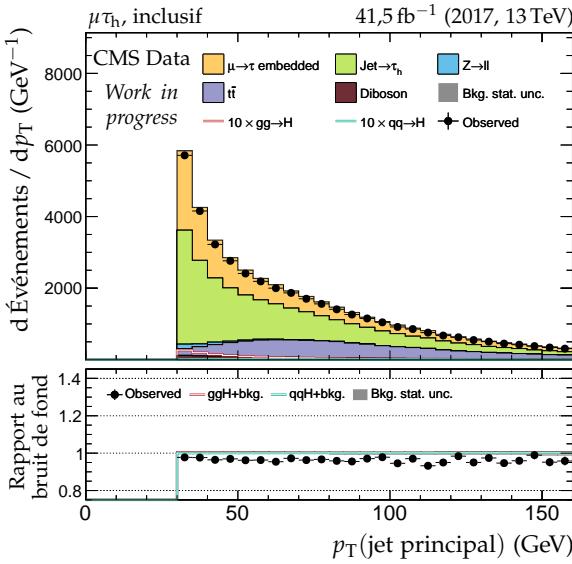
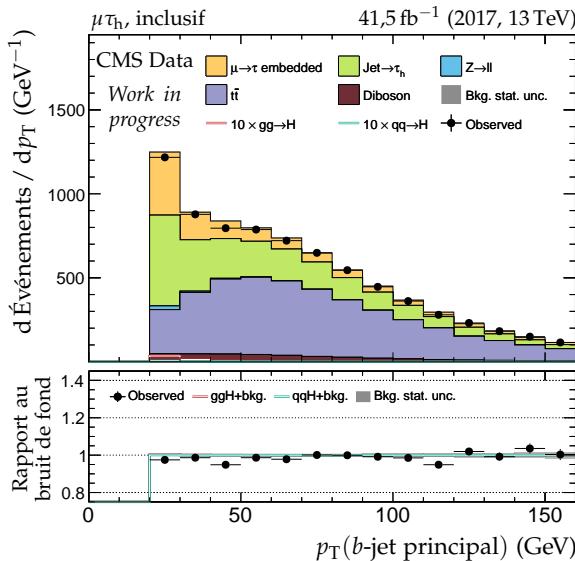
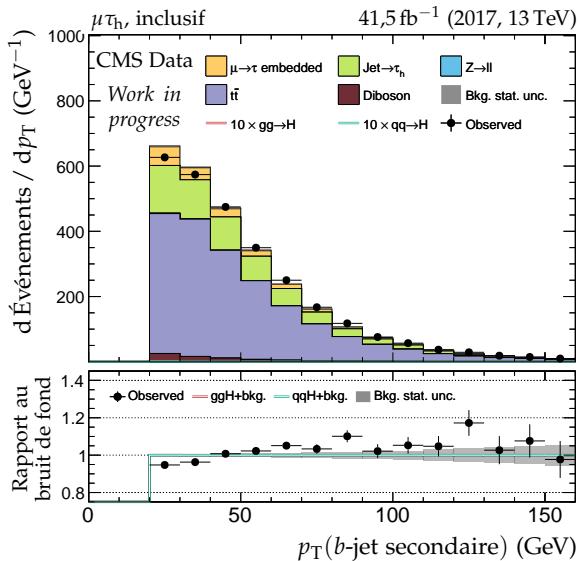


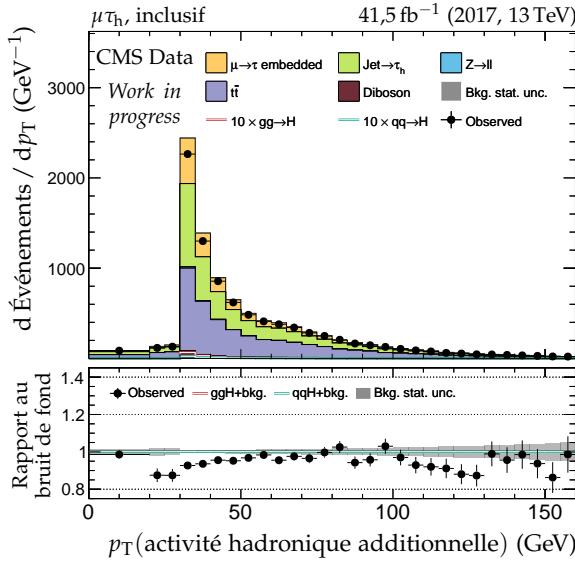
Figure X.34 – Canal $\mu\tau_h$, 2017 : cinématique des deux jets principaux.



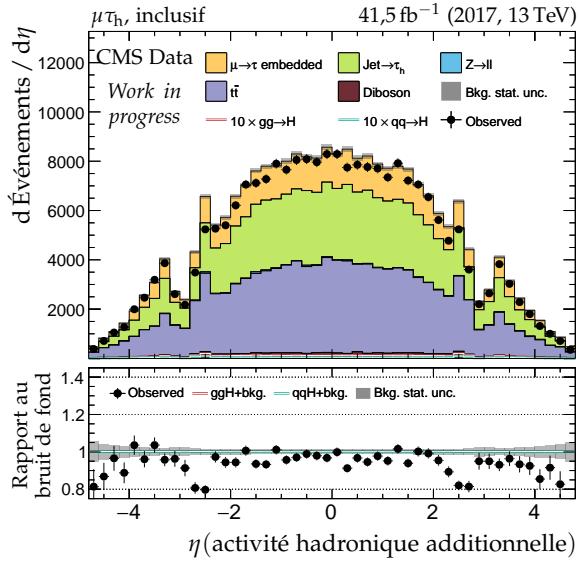
(a) Impulsion transverse du b-jet principal.



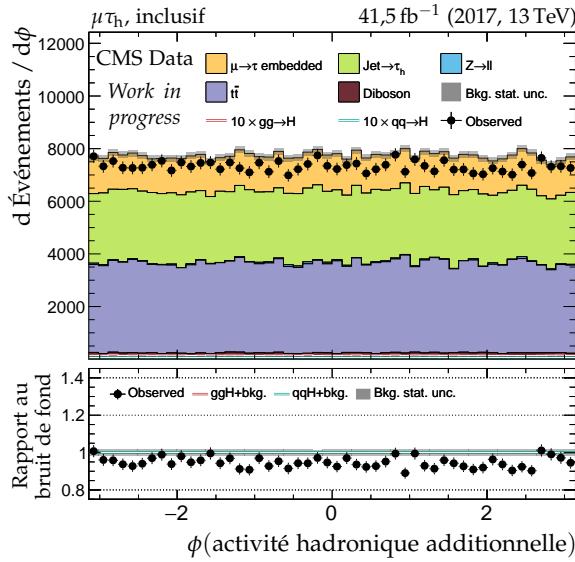
(b) Impulsion transverse du b-jet secondaire.



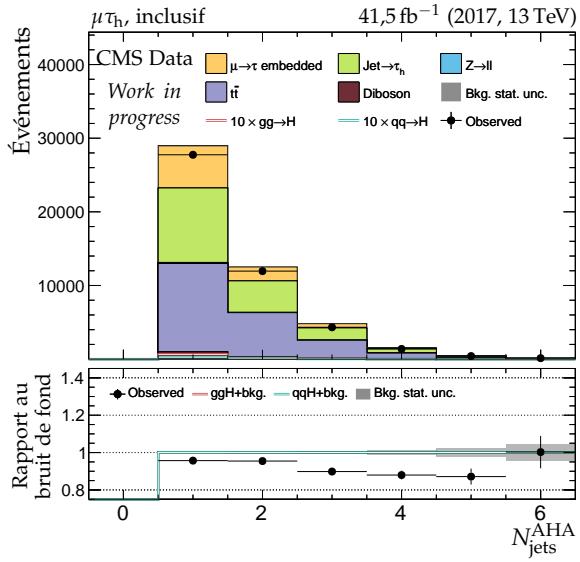
(c) Impulsion transverse de l'AHA.



(d) Pseudo-rapidité de l'AHA.



(e) Angle azimutal de l'AHA.



(f) Nombre de jets dans l'AHA.

Figure X.35 – Canal $\mu\tau_h$, 2017 : b-jets et activité hadronique additionnelle.

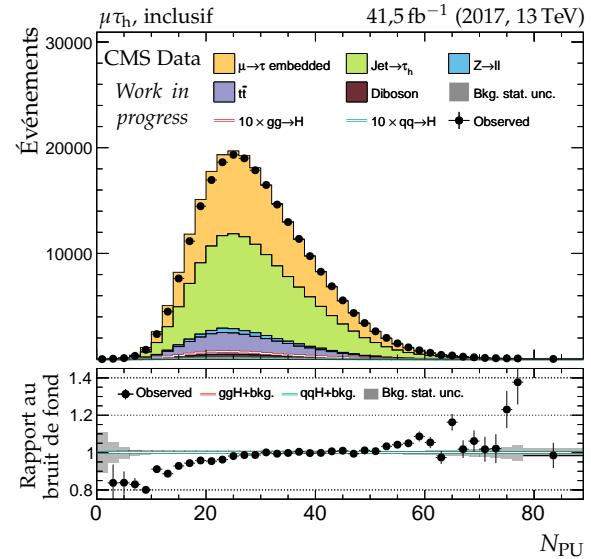
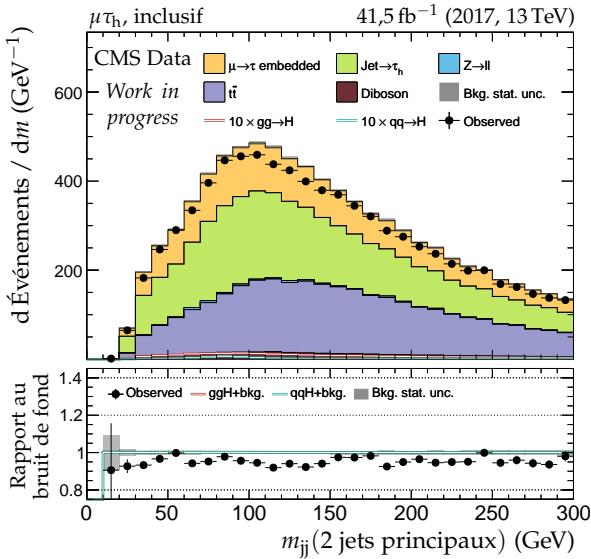
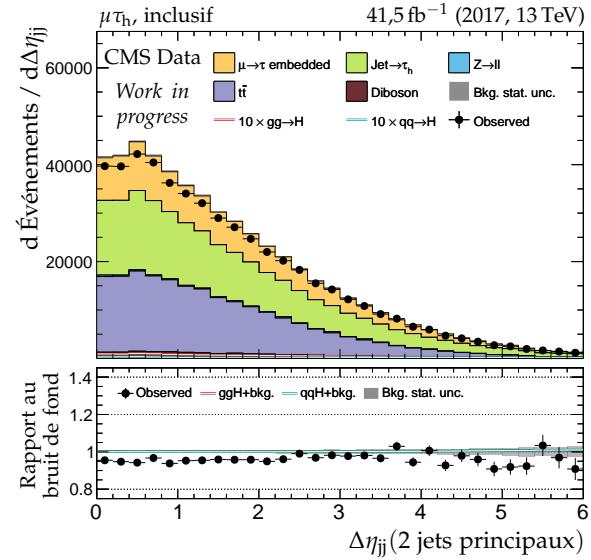
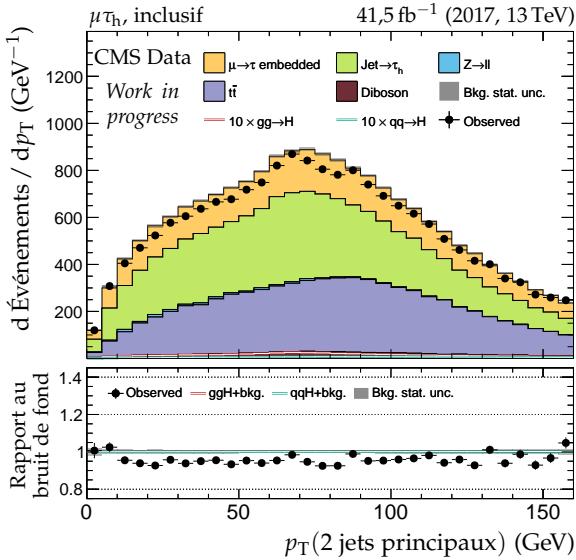
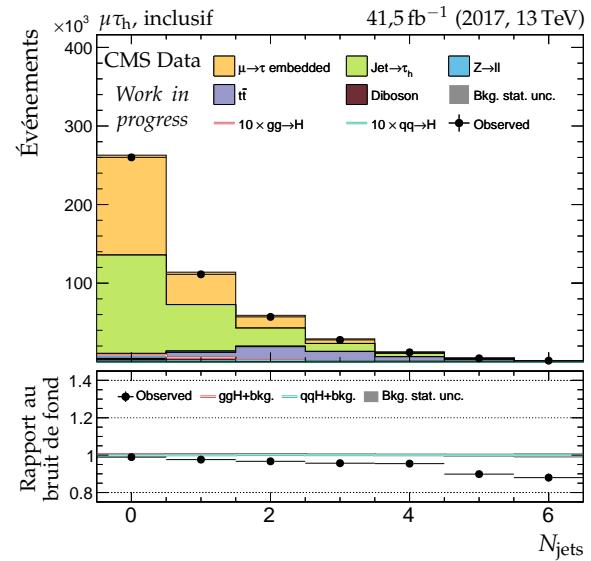
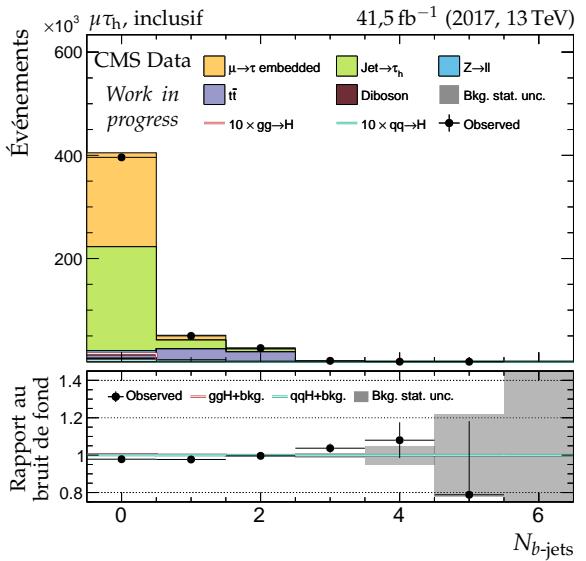


Figure X.36 – Canal $\mu\tau_h$, 2017 : nombre de jets, système des deux jets principaux et empilement.

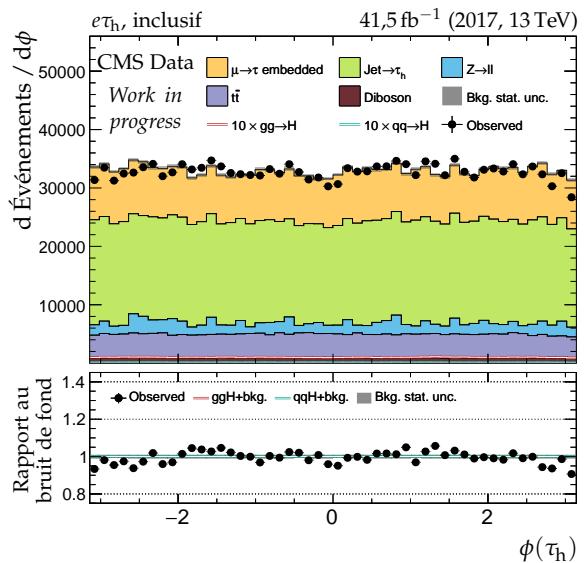
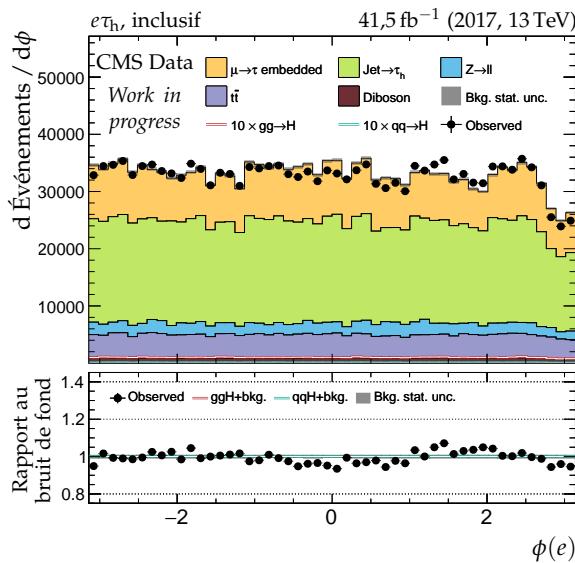
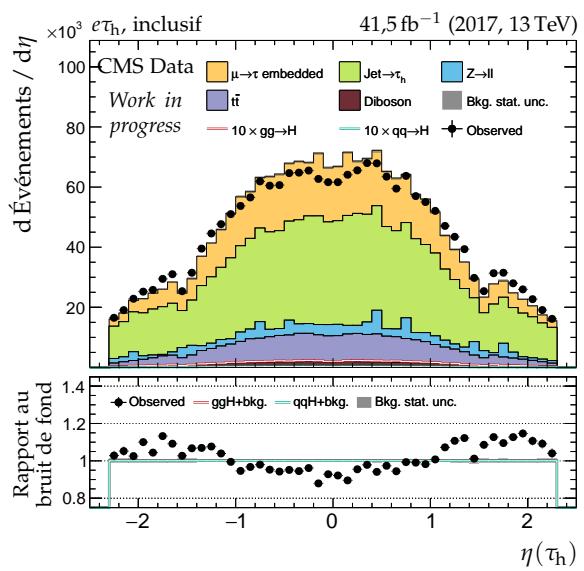
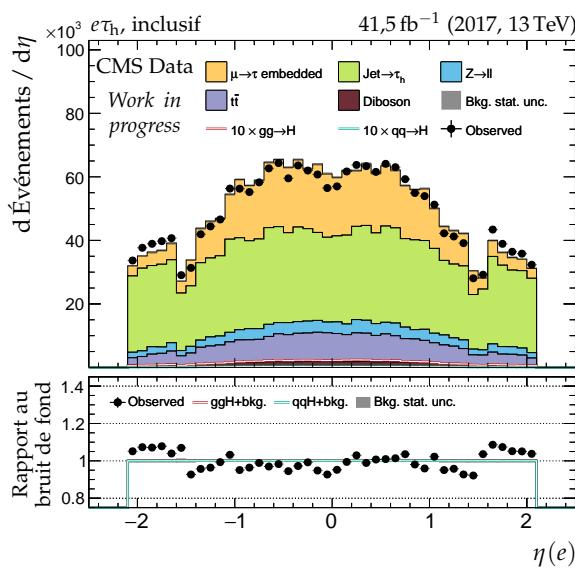
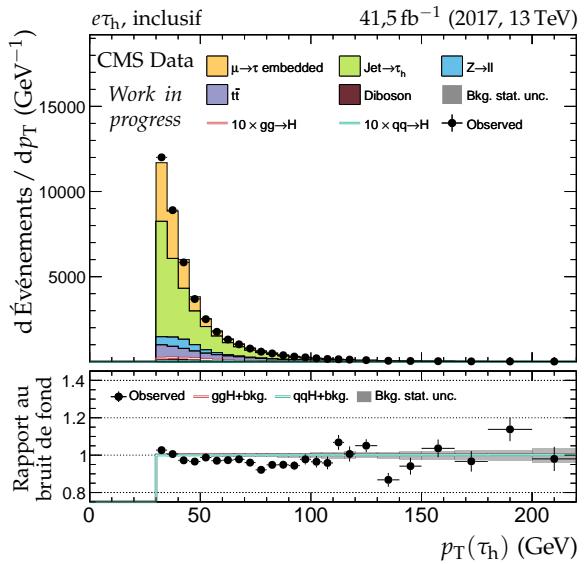
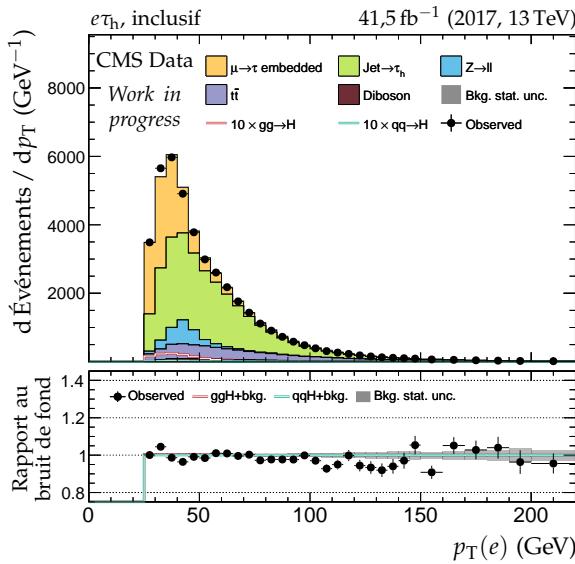


Figure X.37 – Canal $e\tau_h$, 2017 : cinématique des leptons (e, τ_h).

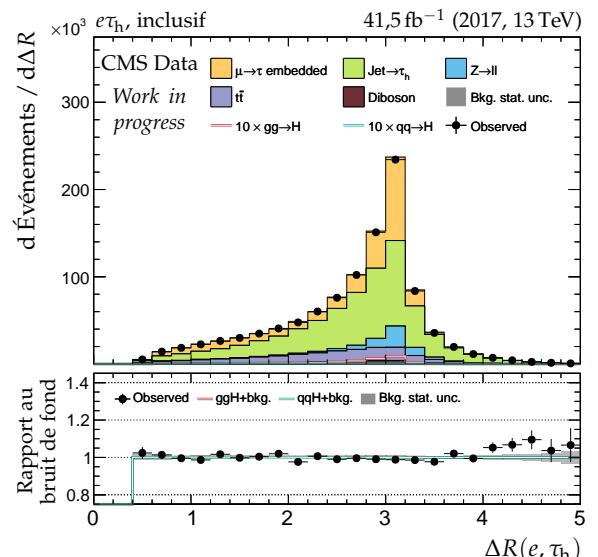
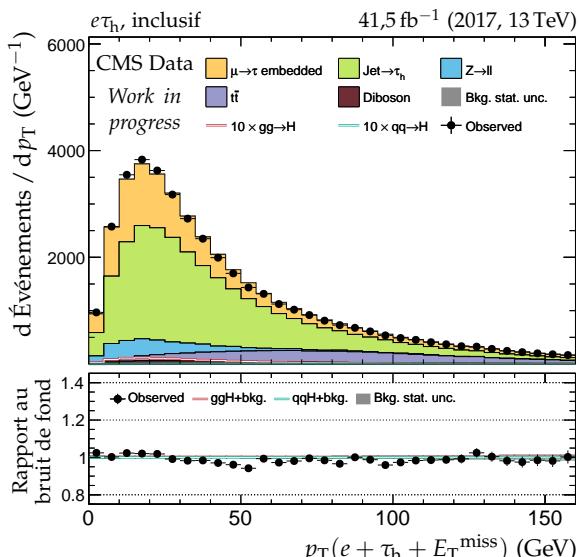
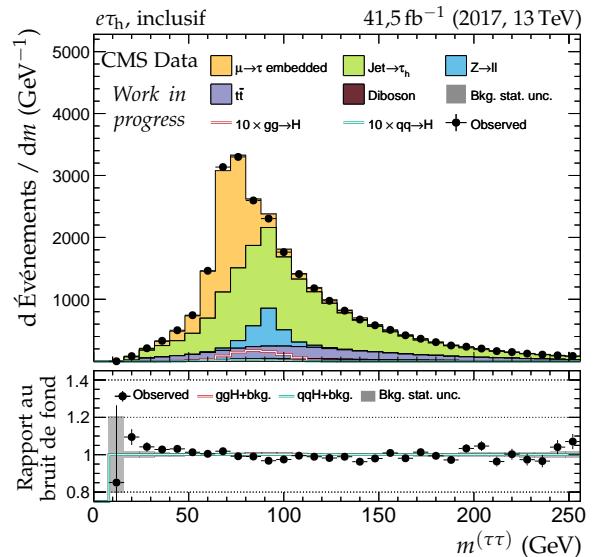
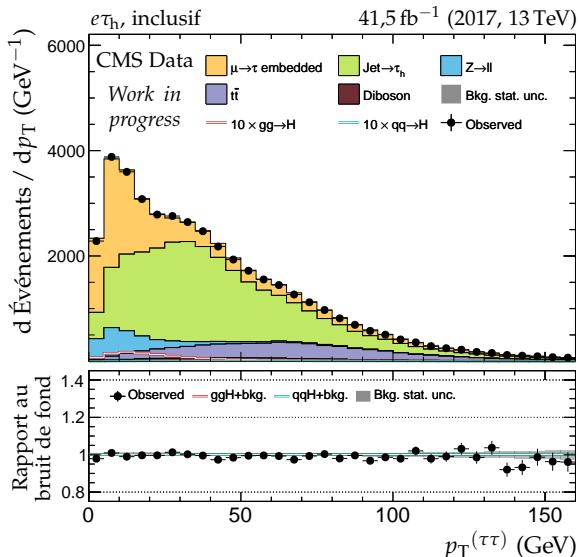
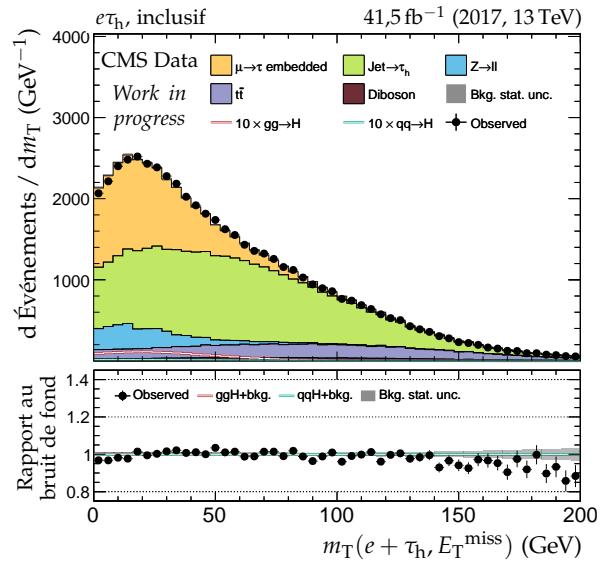
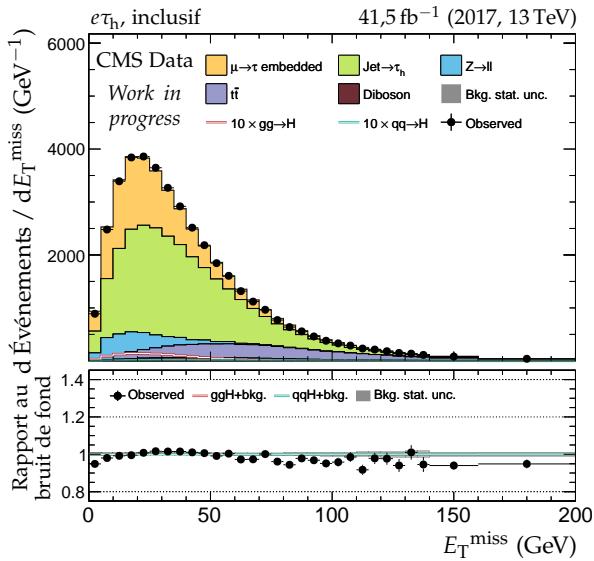


Figure X.38 – Canal $e\tau_h$, 2017 : dilepton et énergie transverse manquante.

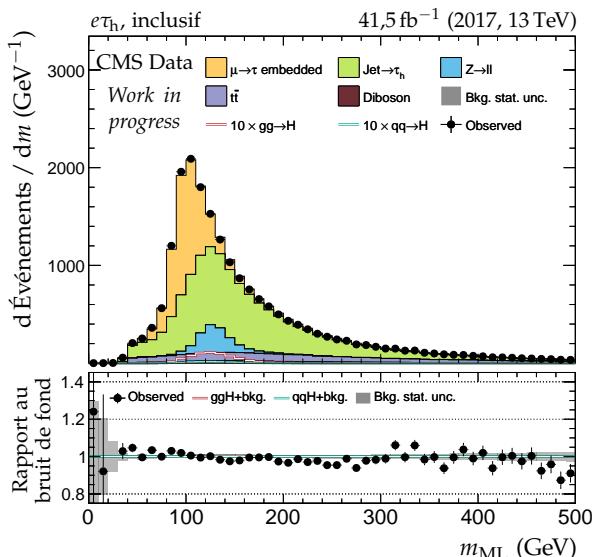
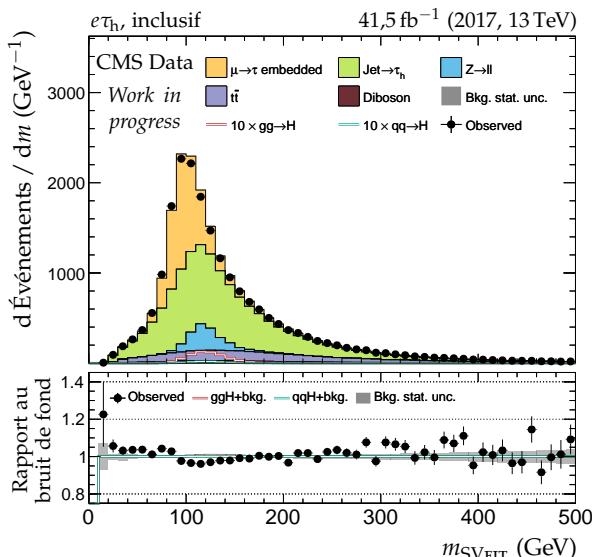
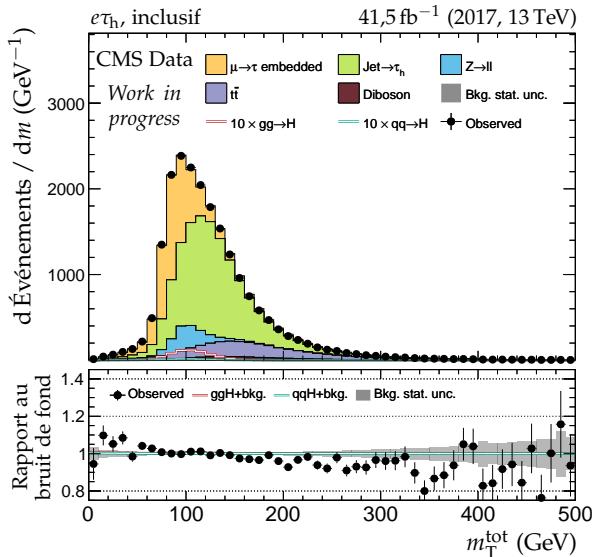
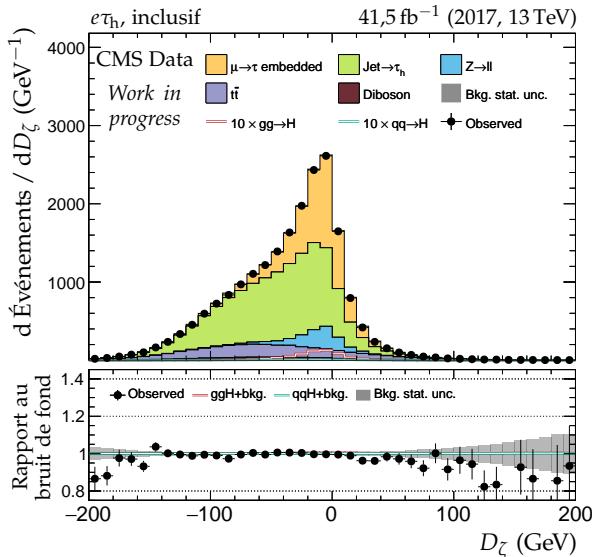
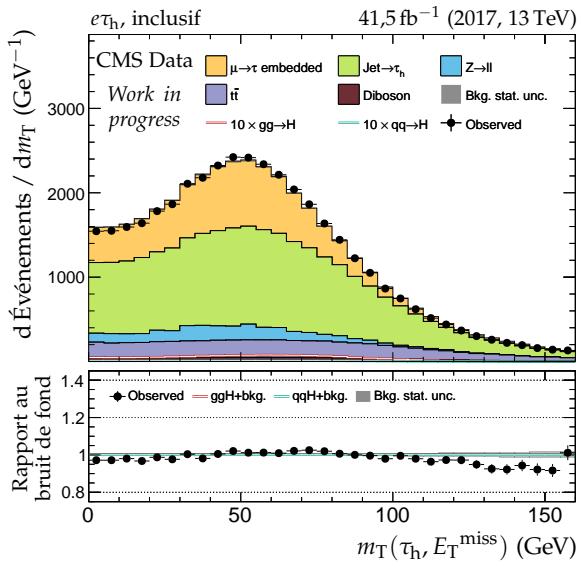
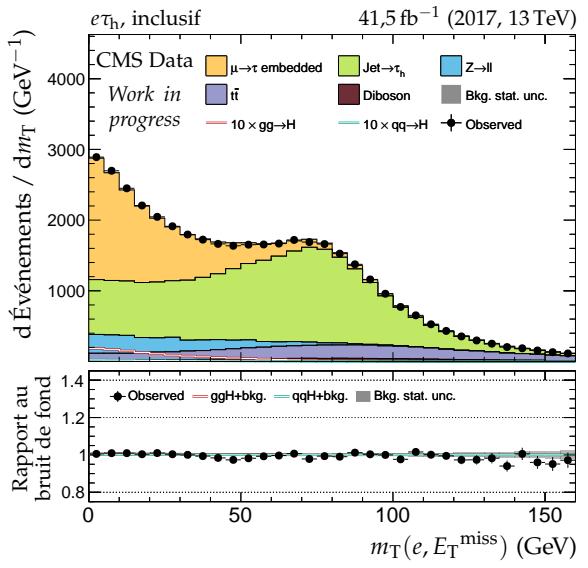


Figure X.39 – Canal $e\tau_h$, 2017 : masses transverses, D_ζ et masses.

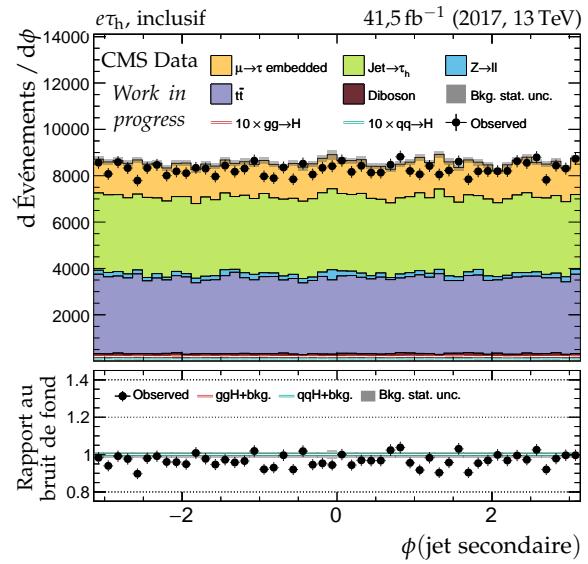
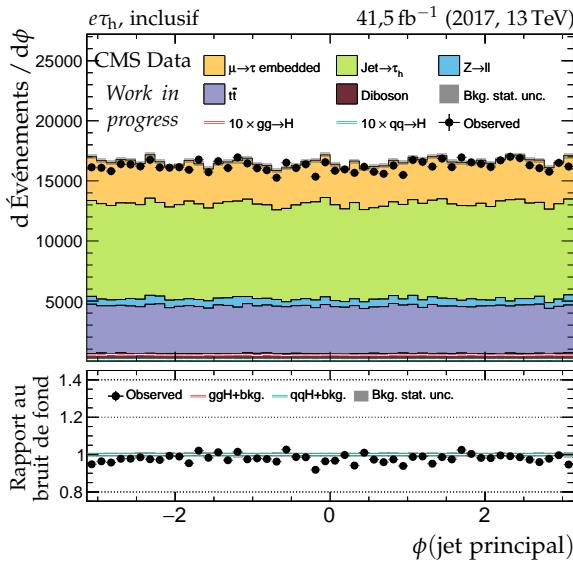
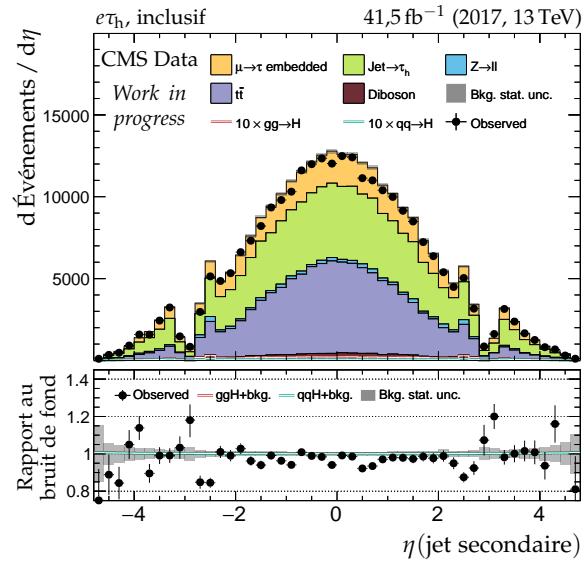
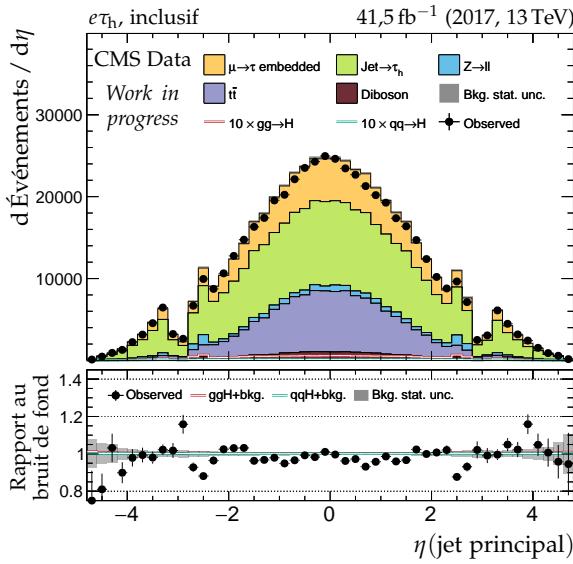
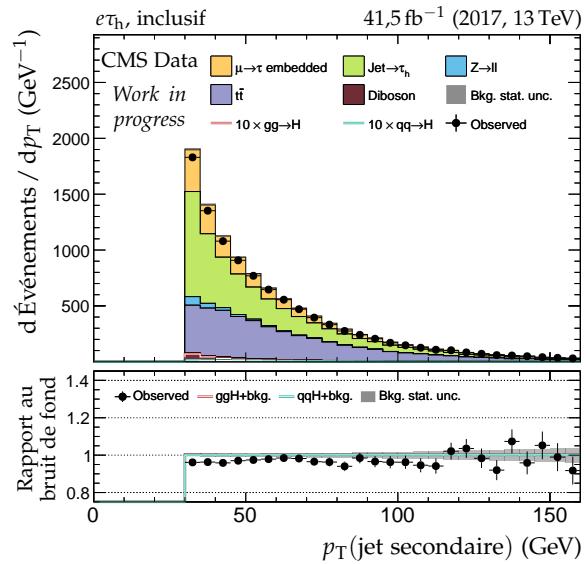
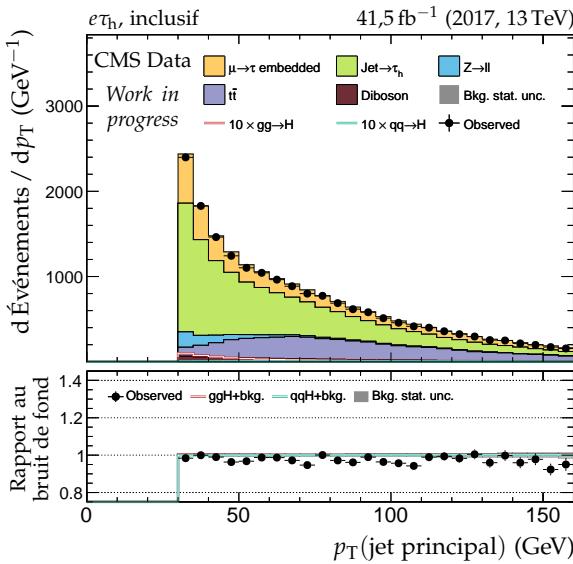
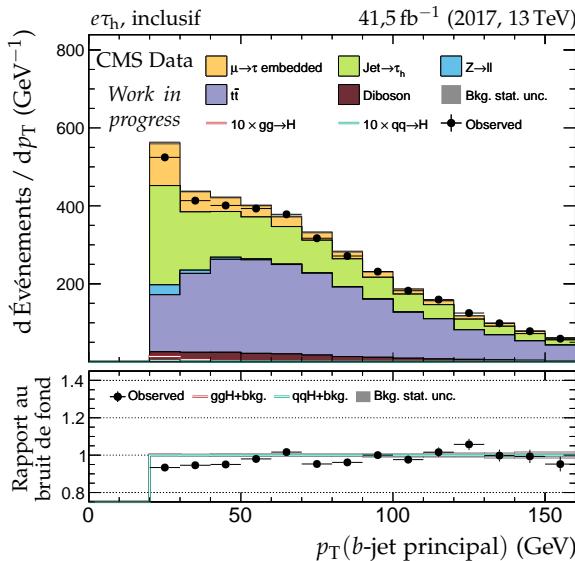
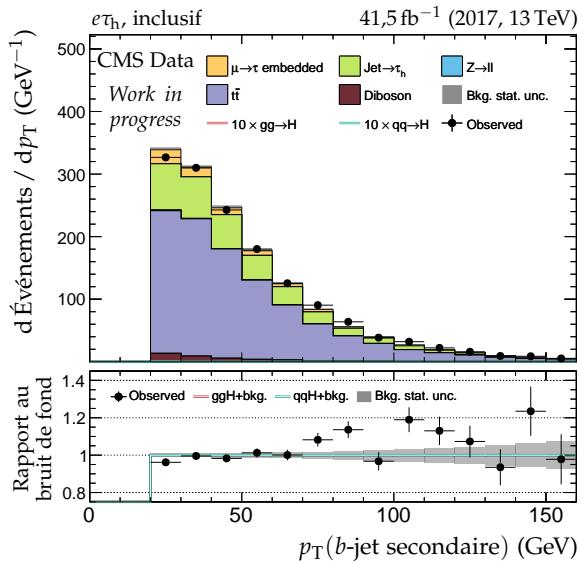


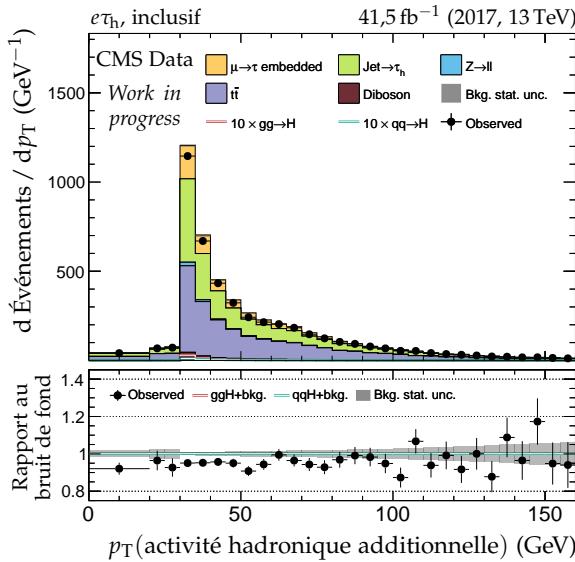
Figure X.40 – Canal $e\tau_h$, 2017 : cinématique des deux jets principaux.



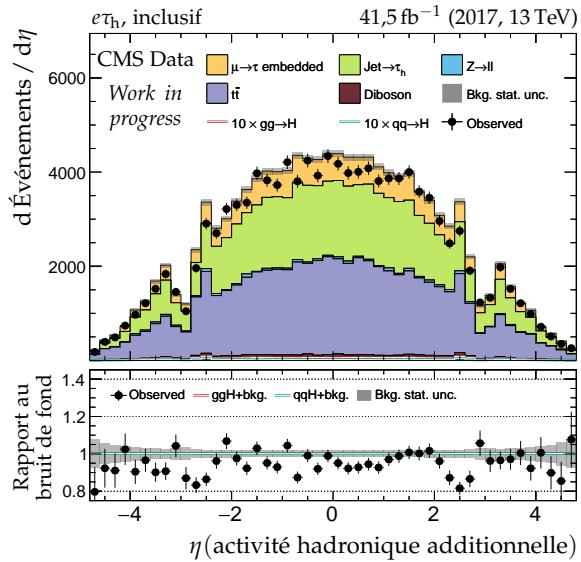
(a) Impulsion transverse du b-jet principal.



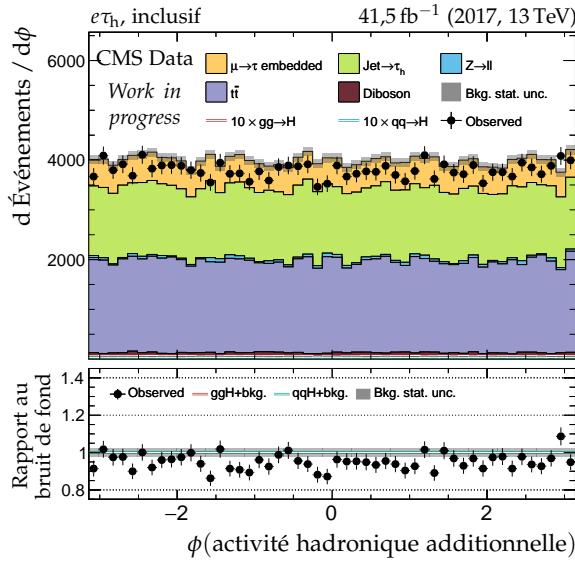
(b) Impulsion transverse du b-jet secondaire.



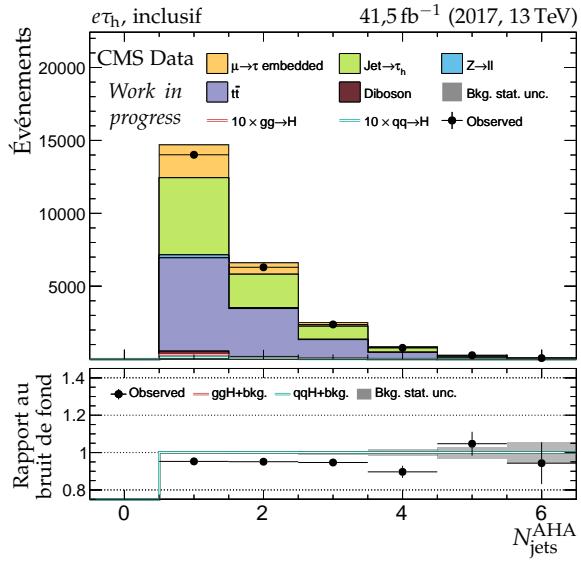
(c) Impulsion transverse de l'AHA.



(d) Pseudo-rapidité de l'AHA.

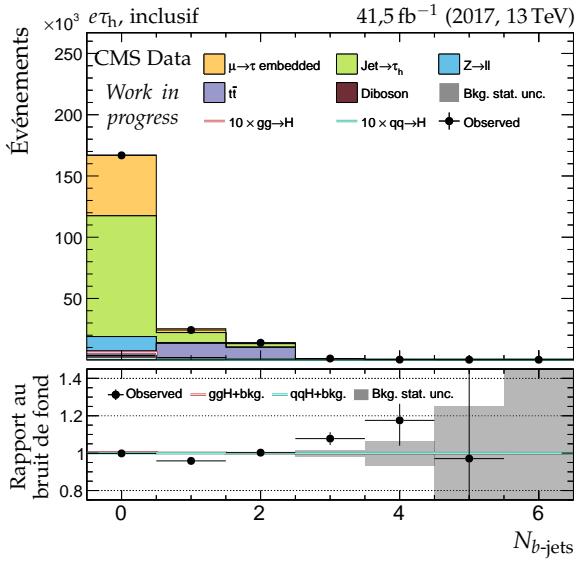
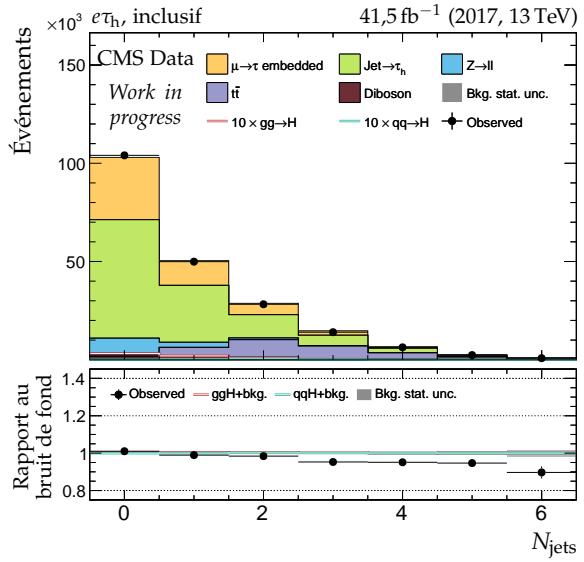


(e) Angle azimutal de l'AHA.

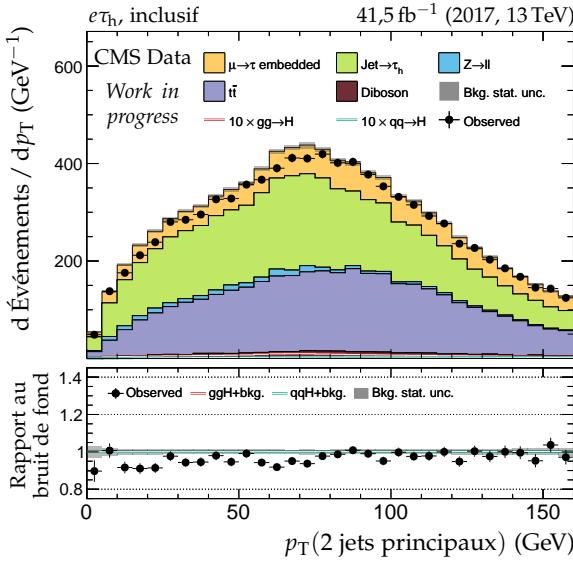


(f) Nombre de jets dans l'AHA.

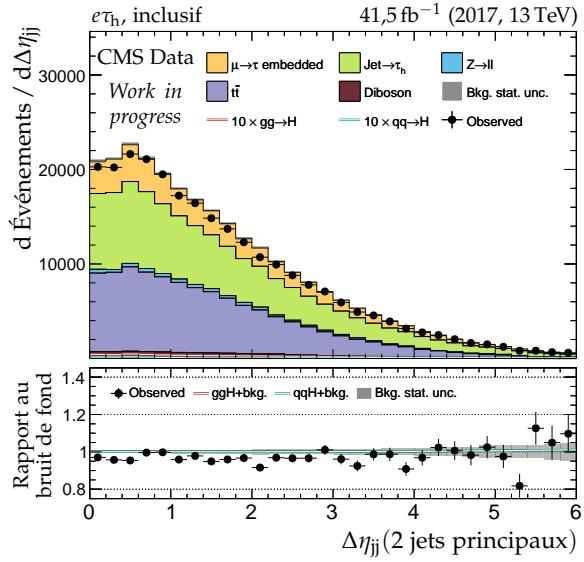
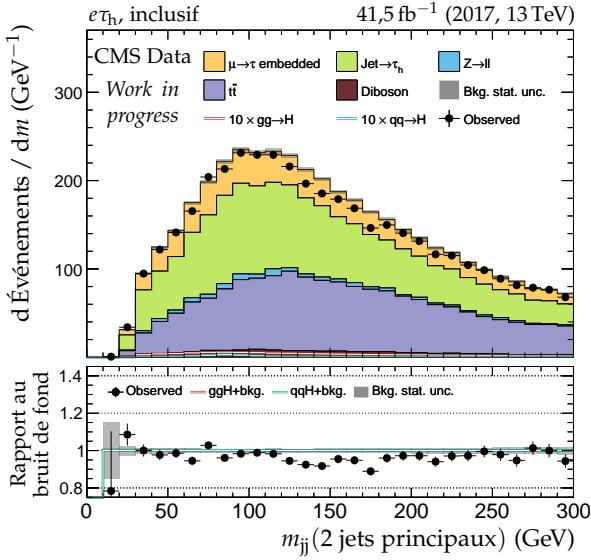
Figure X.41 – Canal $e\tau_h$, 2017 : b-jets et activité hadronique additionnelle.

(a) Nombre de b -jets.

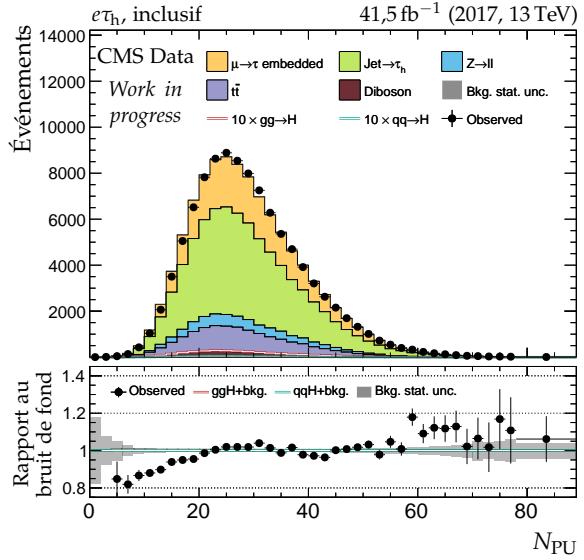
(b) Nombre de jets.



(c) Impulsion transverse du système des deux jets.

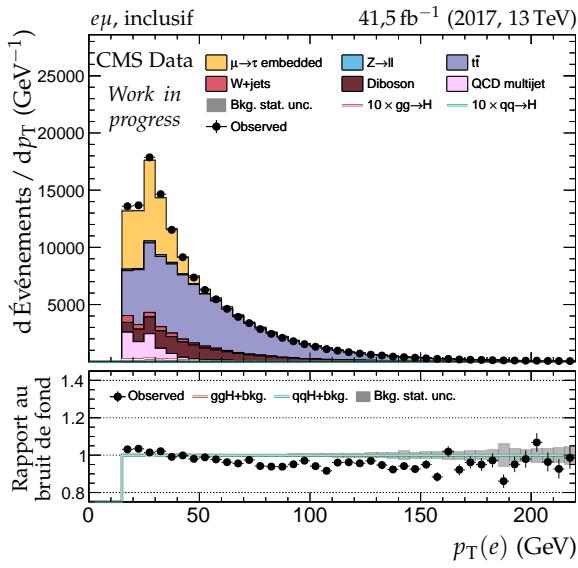
(d) Distance en η entre les deux jets.

(e) Masse invariante du système des deux jets.

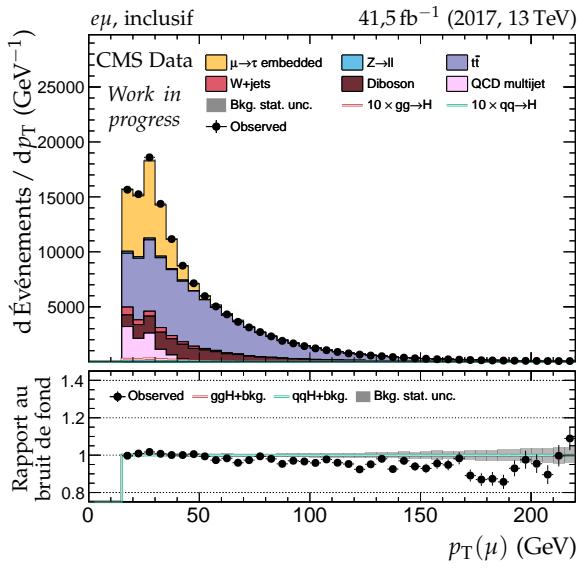


(f) Nombre de vertex d'empilement.

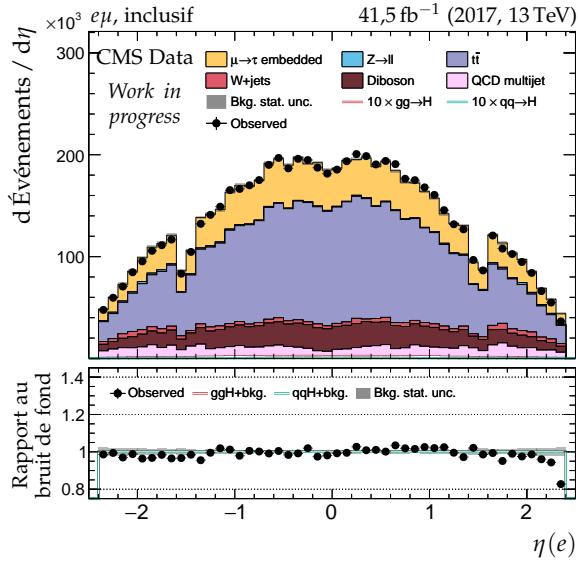
Figure X.42 – Canal $e\tau_h$, 2017 : nombre de jets, système des deux jets principaux et empilement.



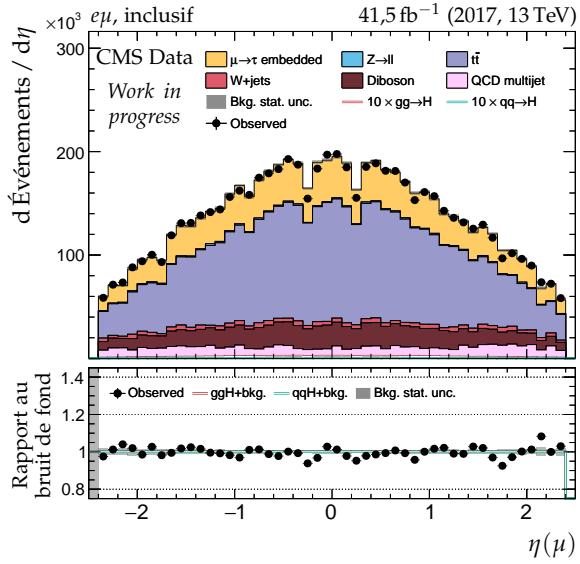
(a) Impulsion transverse du lepton 1 (e).



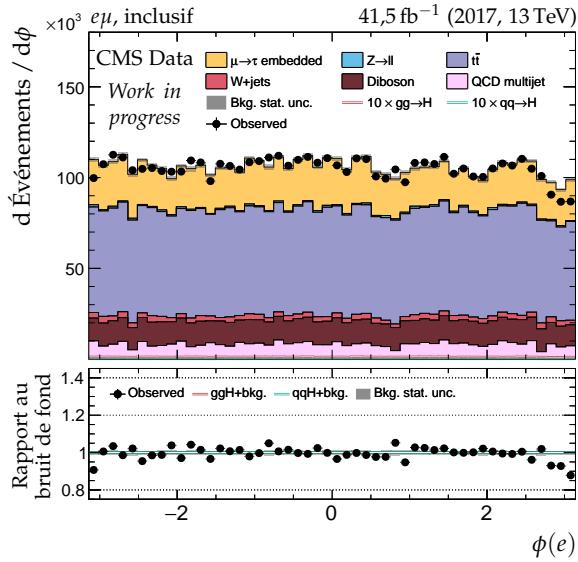
(b) Impulsion transverse du lepton 2 (μ).



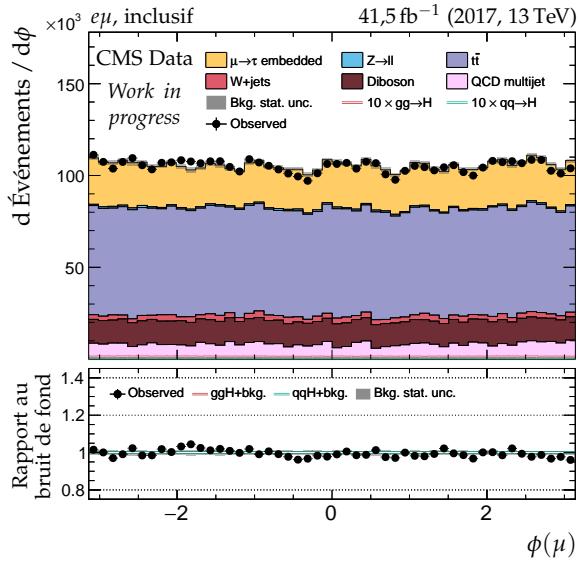
(c) Pseudo-rapidité du lepton 1 (e).



(d) Pseudo-rapidité du lepton 2 (μ).



(e) Angle azimutal du lepton 1 (e).



(f) Angle azimutal du lepton 2 (μ).

Figure X.43 – Canal $e\mu$, 2017 : cinématique des leptons (e, μ).

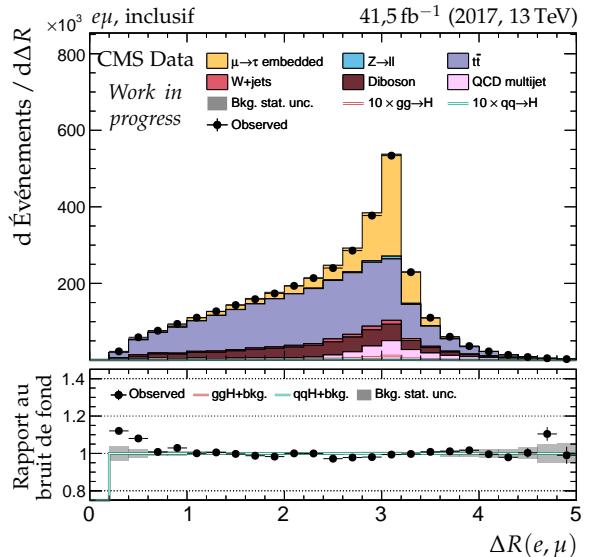
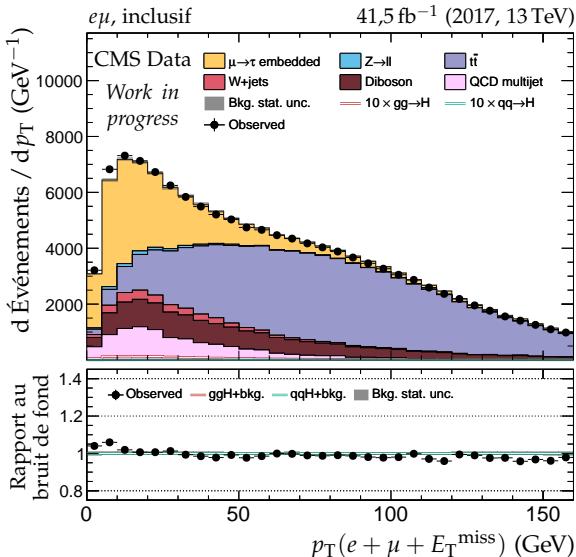
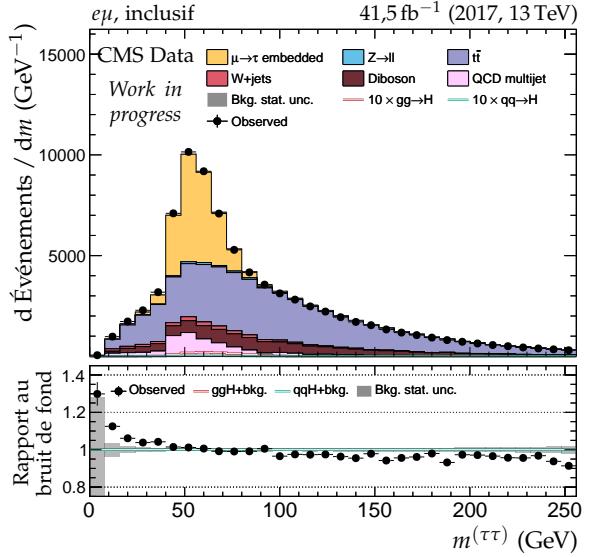
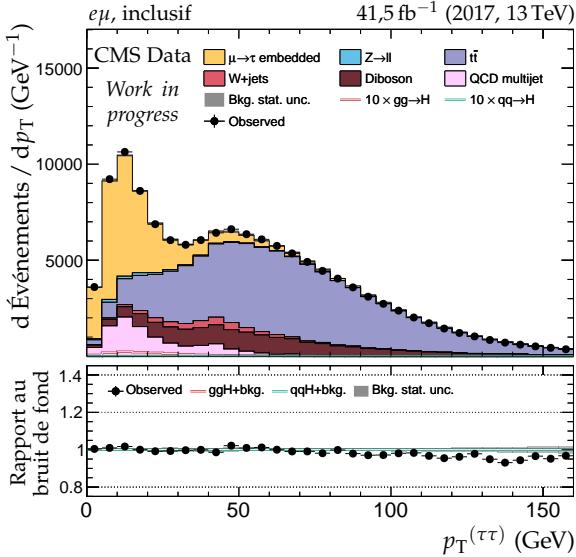
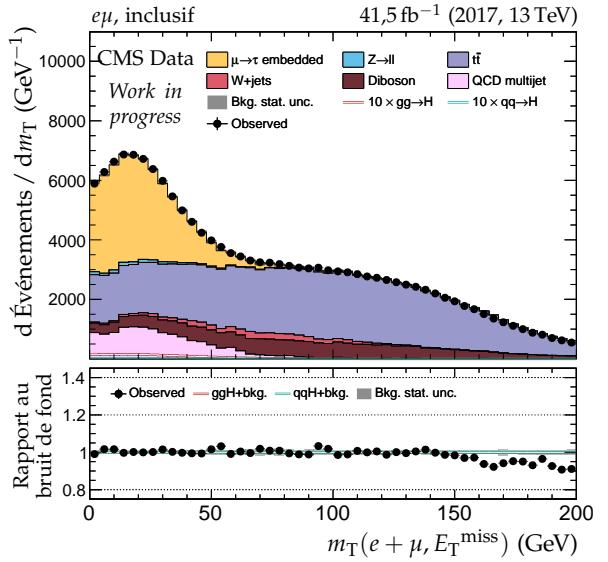
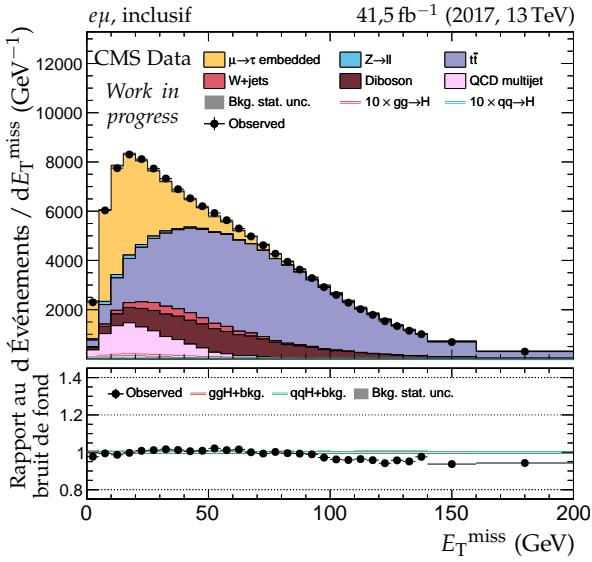


Figure X.44 – Canal $e\mu$, 2017 : dilepton et énergie transverse manquante.

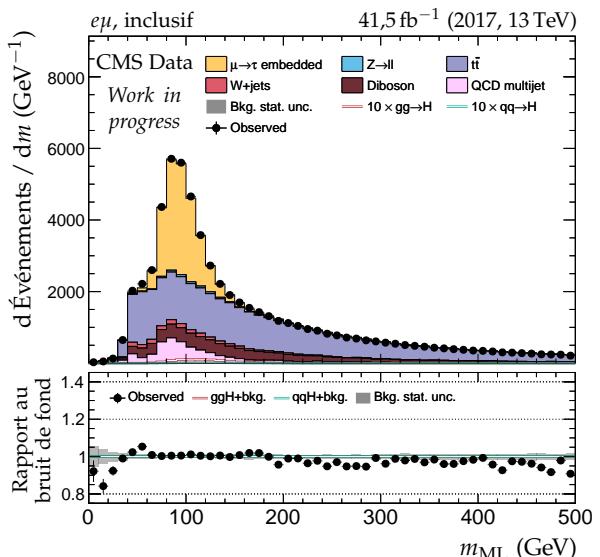
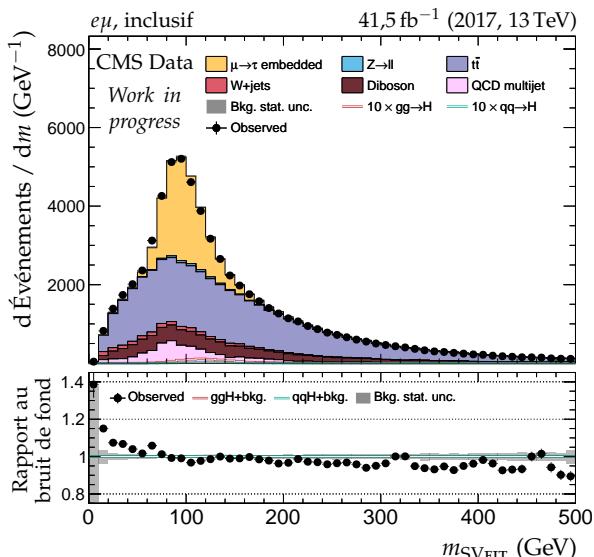
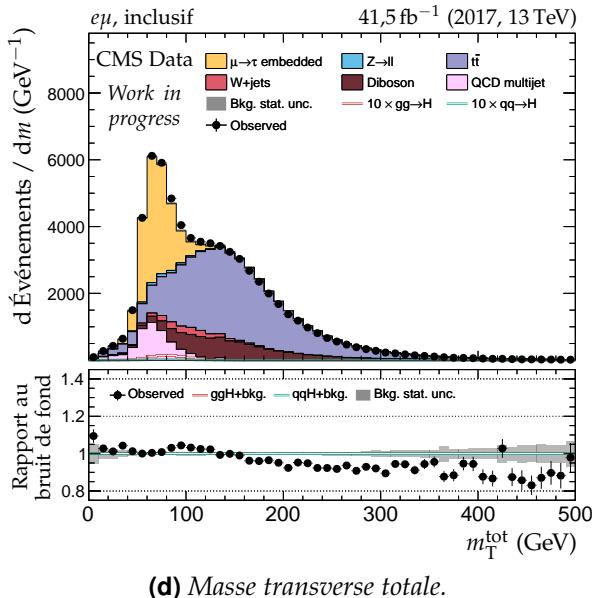
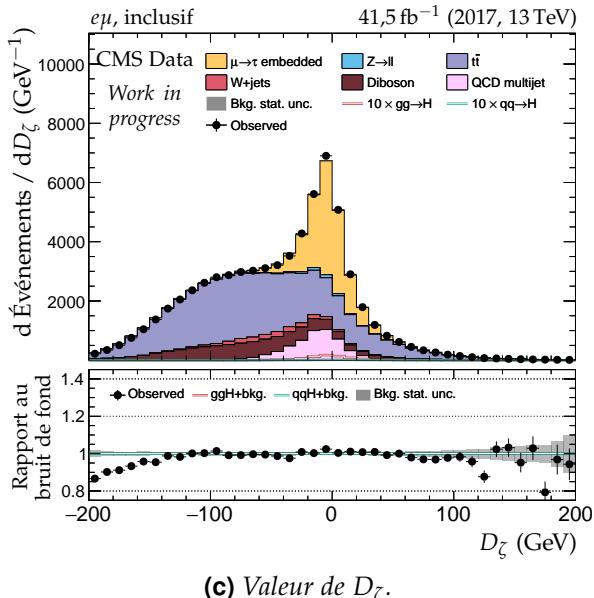
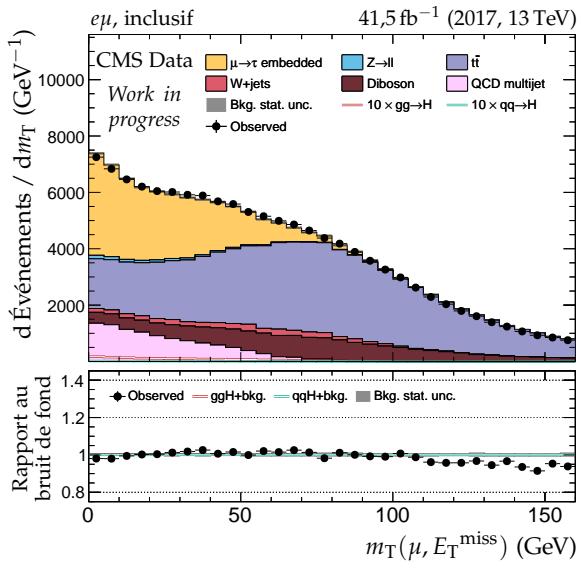
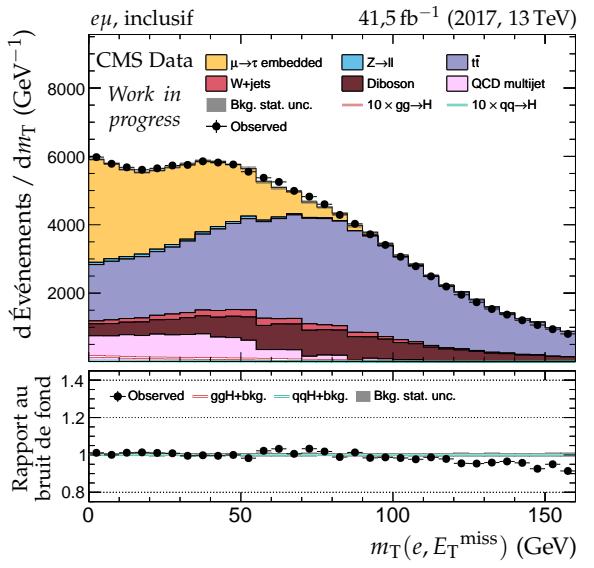


Figure X.45 – Canal $e\mu$, 2017 : masses transverses, D_ζ et masses.

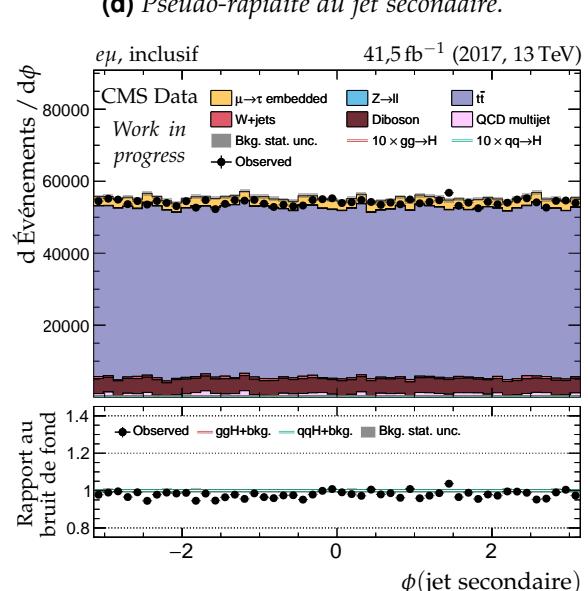
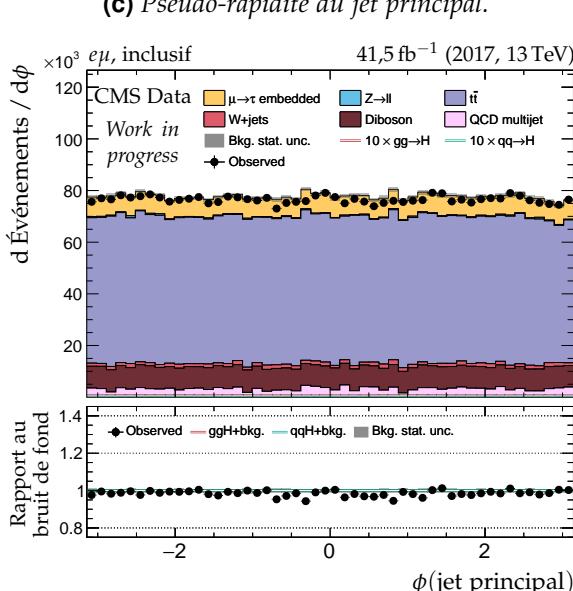
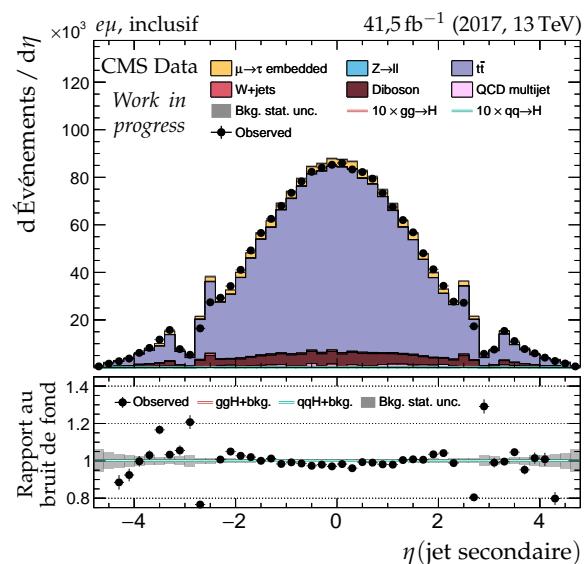
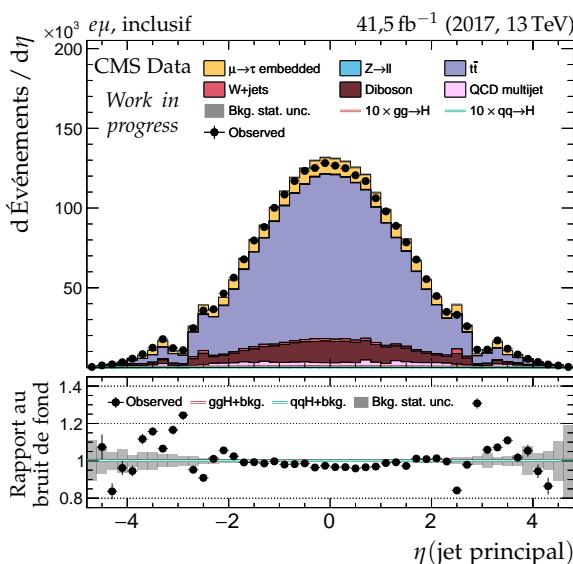
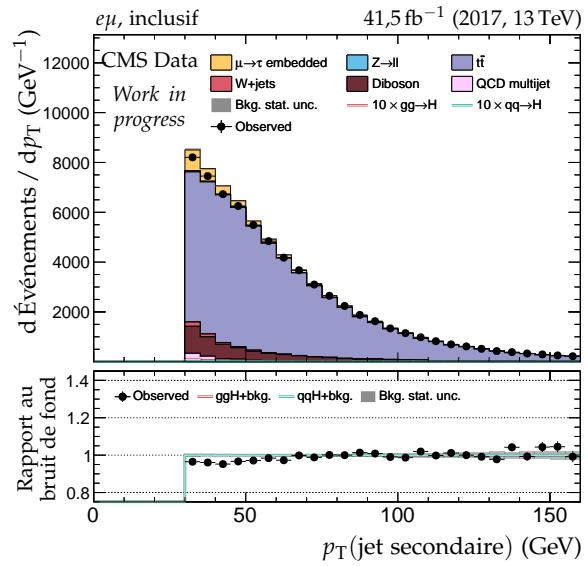
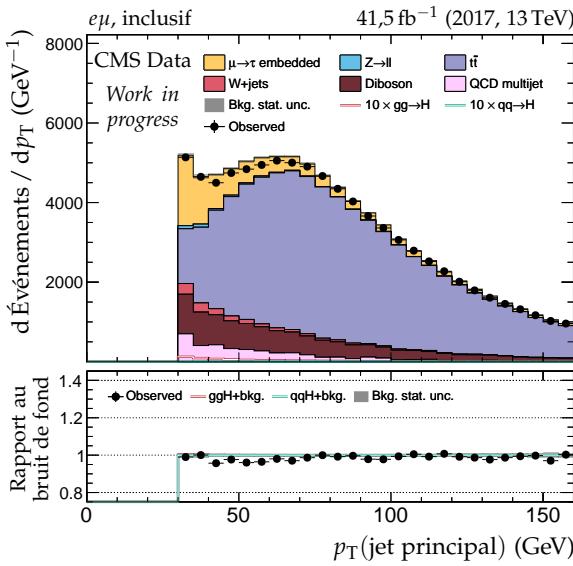


Figure X.46 – Canal $e\mu$, 2017 : cinématique des deux jets principaux.

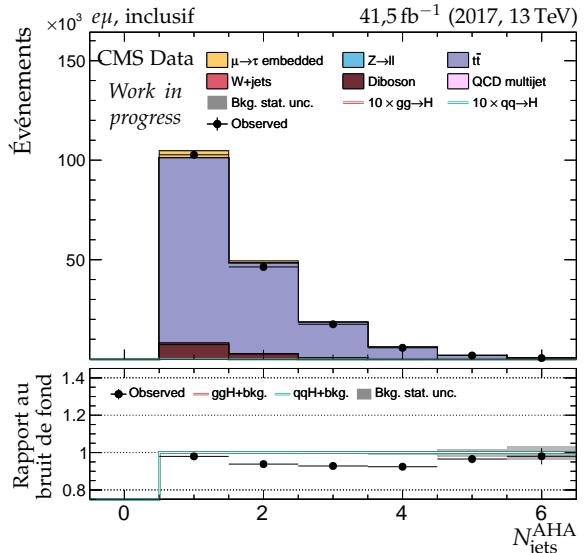
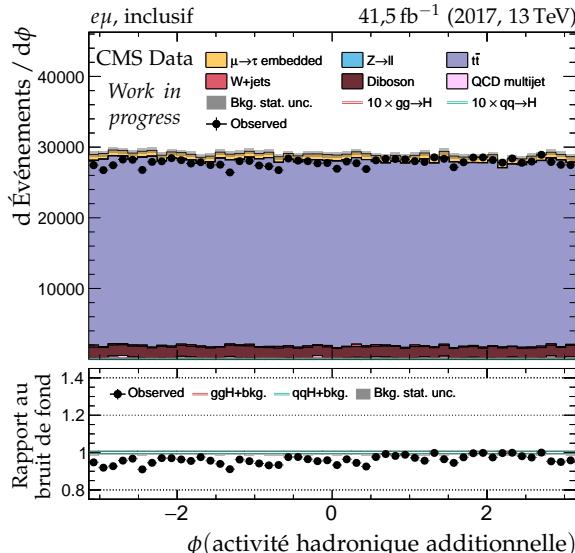
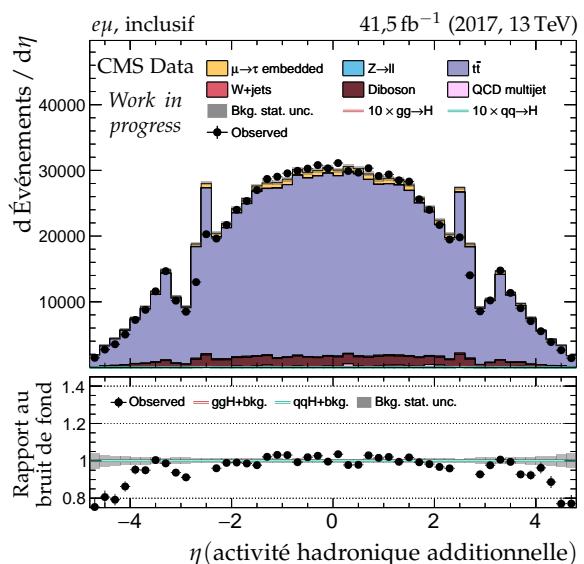
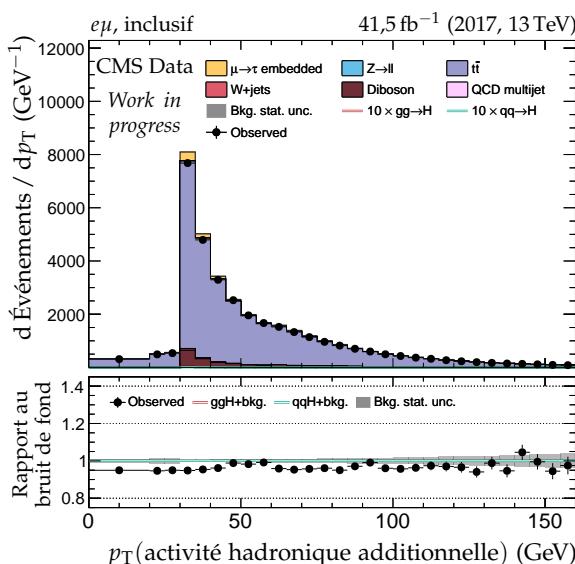
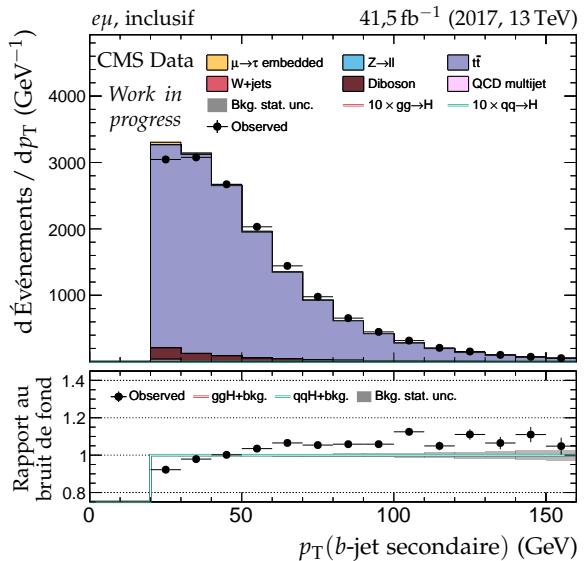
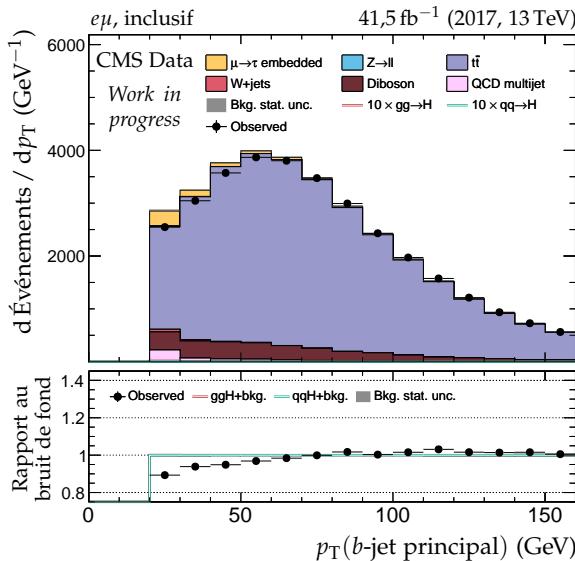


Figure X.47 – Canal $e\mu$, 2017 : b-jets et activité hadronique additionnelle.

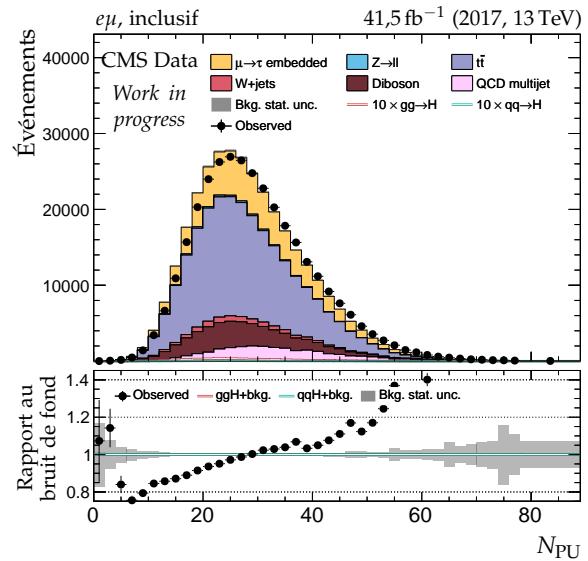
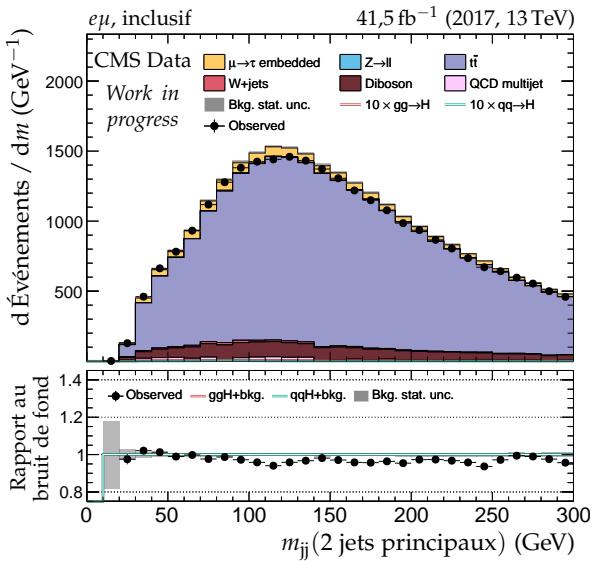
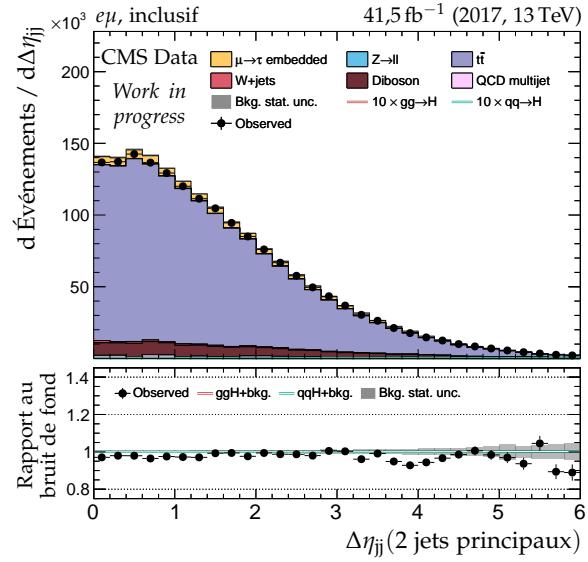
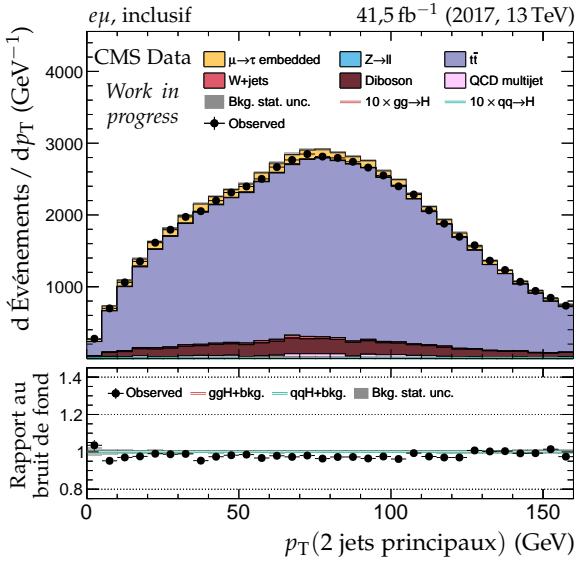
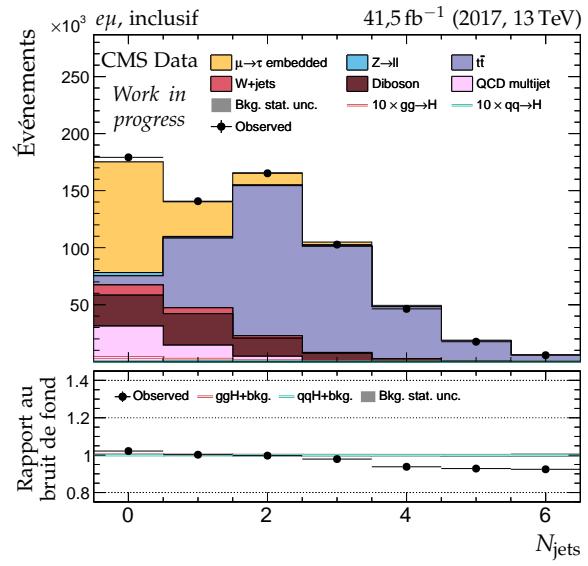
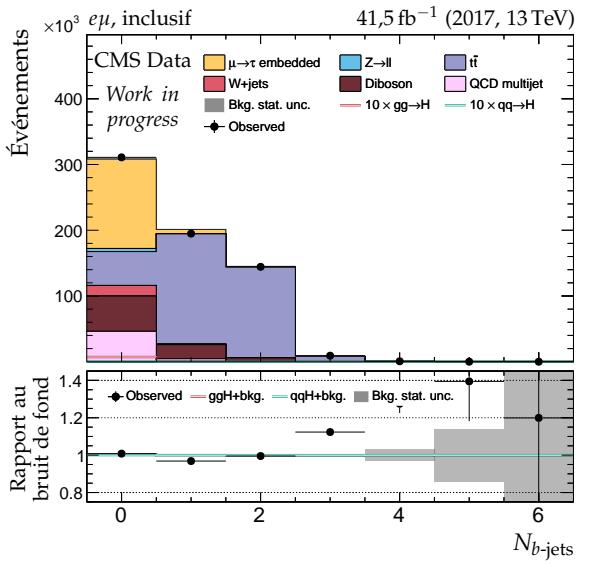
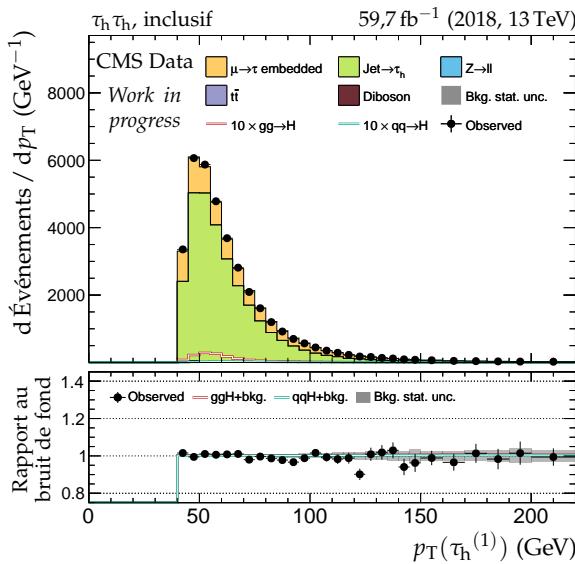
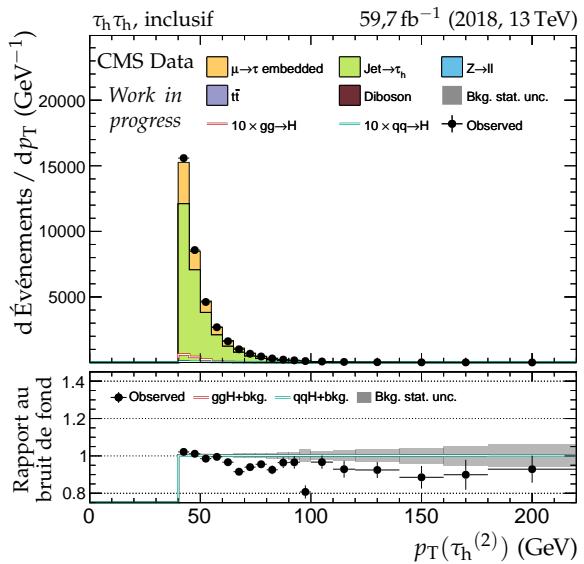


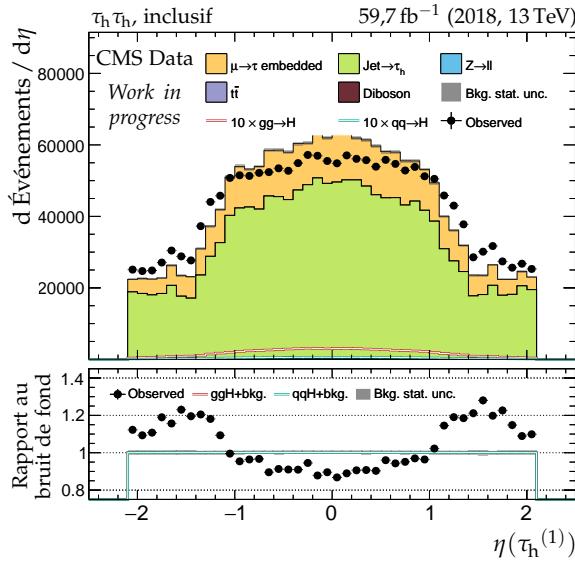
Figure X.48 – Canal $e\mu$, 2017 : nombre de jets, système des deux jets principaux et empilement.



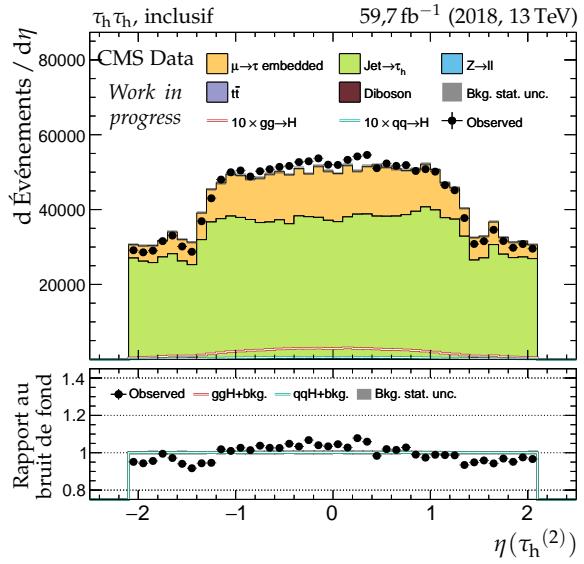
(a) Impulsion transverse du lepton 1 ($\tau_h^{(1)}$).



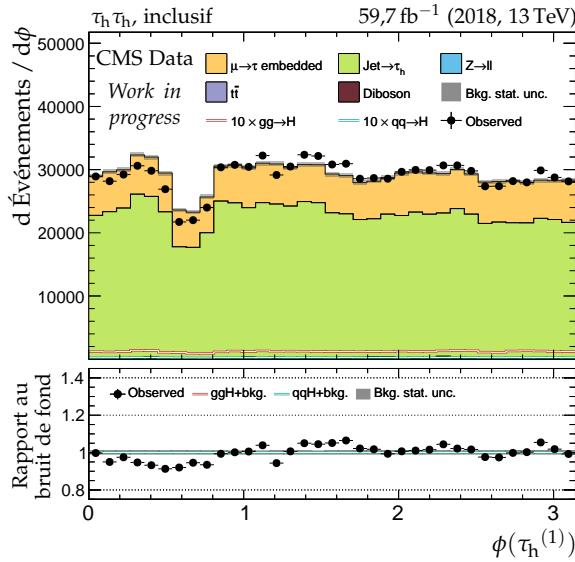
(b) Impulsion transverse du lepton 2 ($\tau_h^{(2)}$).



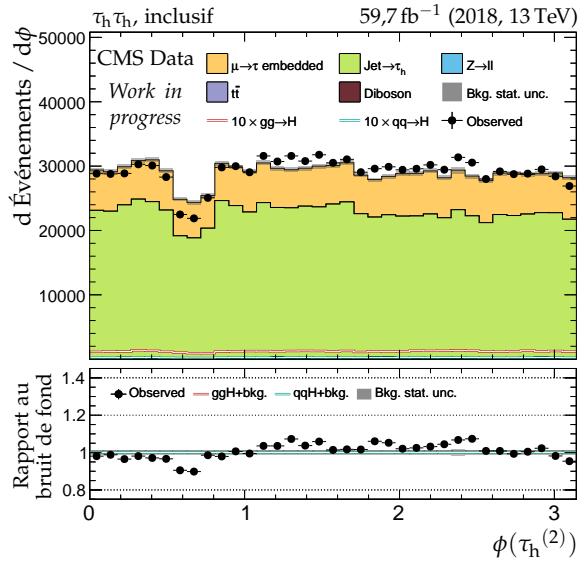
(c) Pseudo-rapidité du lepton 1 ($\tau_h^{(1)}$).



(d) Pseudo-rapidité du lepton 2 ($\tau_h^{(2)}$).

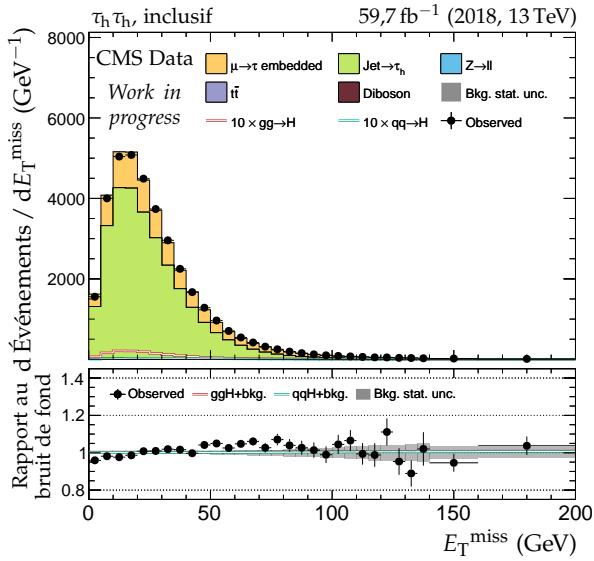


(e) Angle azimutal du lepton 1 ($\tau_h^{(1)}$).

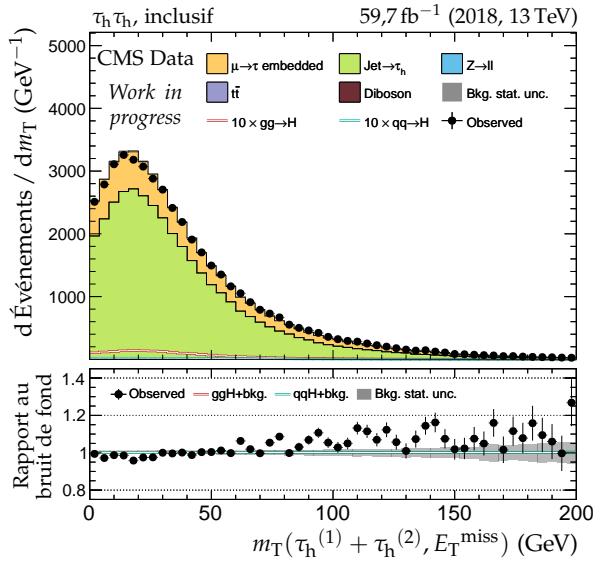


(f) Angle azimutal du lepton 2 ($\tau_h^{(2)}$).

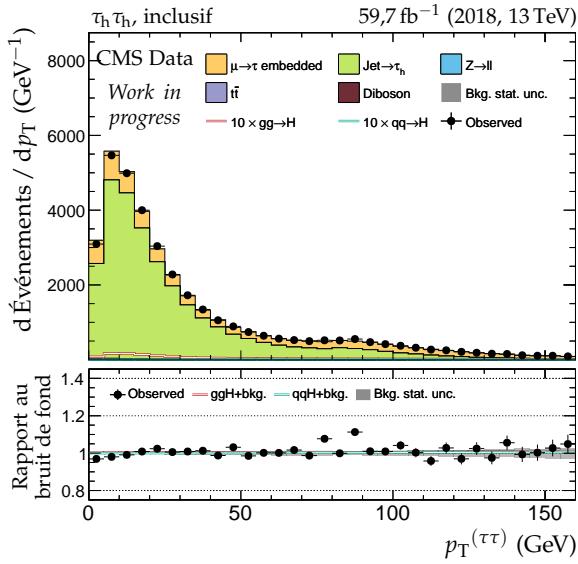
Figure X.49 – Canal $\tau_h\tau_h$, 2018 : cinématique des leptons ($\tau_h^{(1)}, \tau_h^{(2)}$).



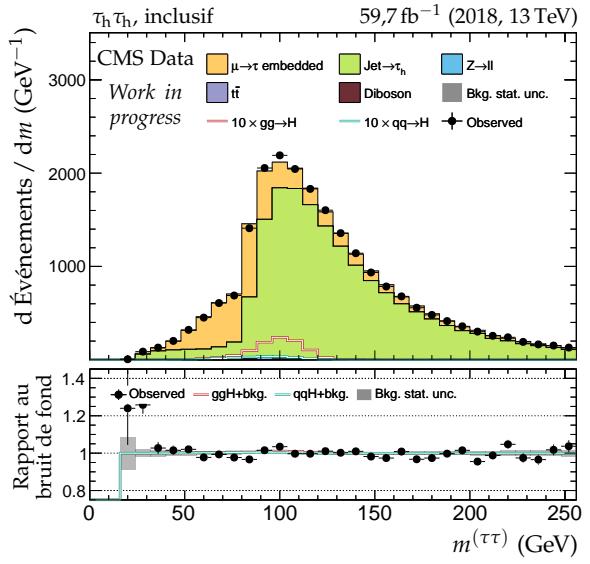
(a) Énergie transverse manquante.



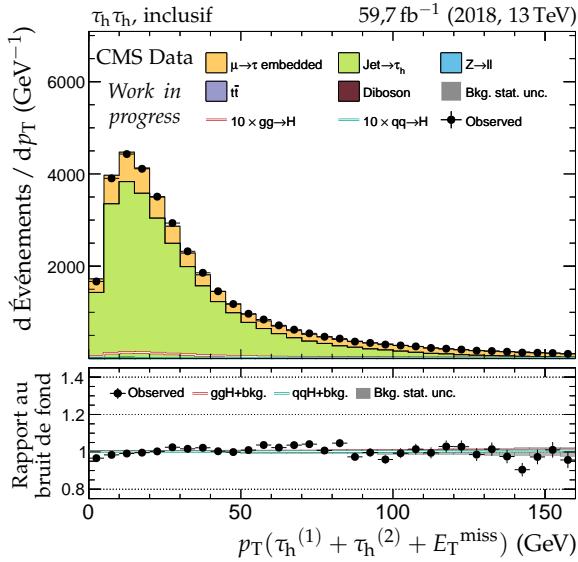
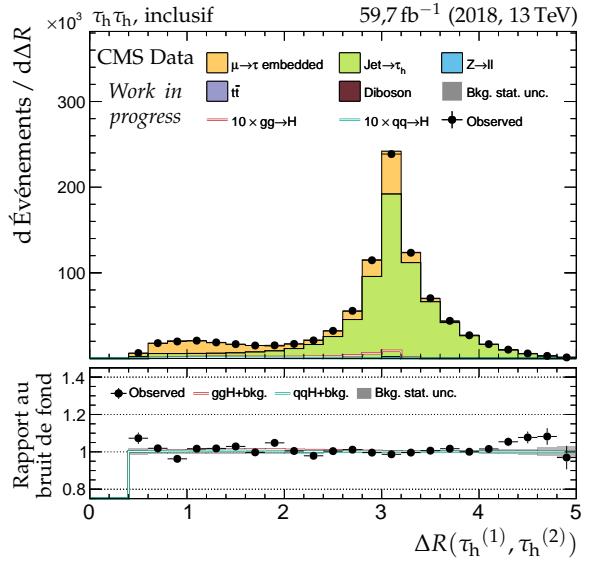
(b) Masse transverse du dilepton.

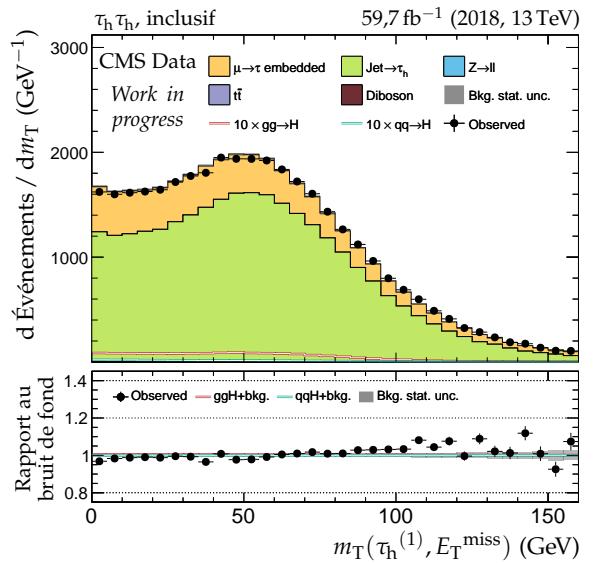


(c) Impulsion transverse du dilepton.

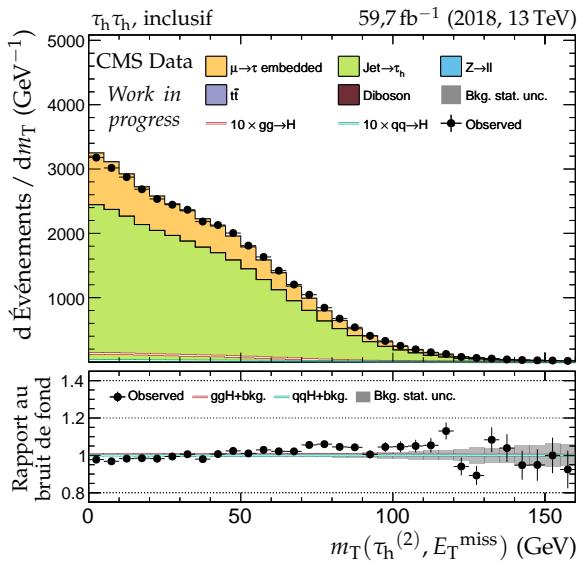


(d) Masse visible du dilepton.

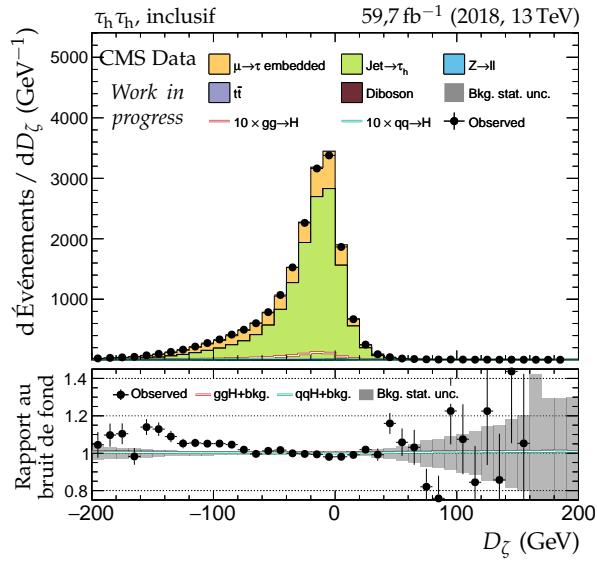
(e) Impulsion transverse du système di- τ .(f) Distance ΔR entre les leptons ($\tau_h^{(1)}, \tau_h^{(2)}$).**Figure X.50 – Canal $\tau_h \tau_h$, 2018 : dilepton et énergie transverse manquante.**



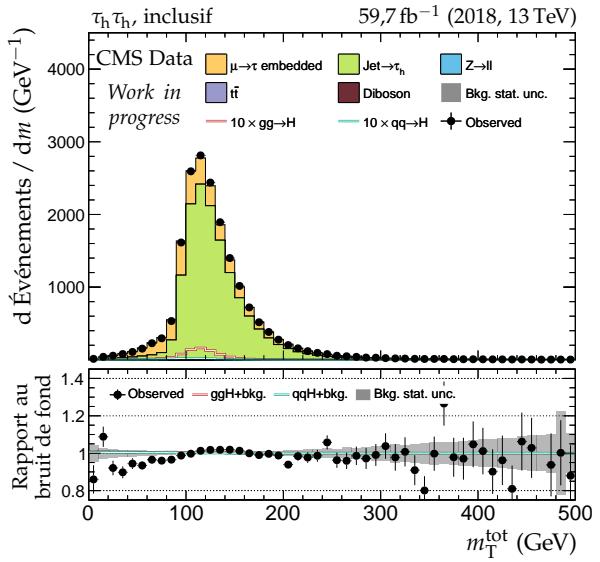
(a) Masse transverse du lepton 1 ($\tau_h^{(1)}$).



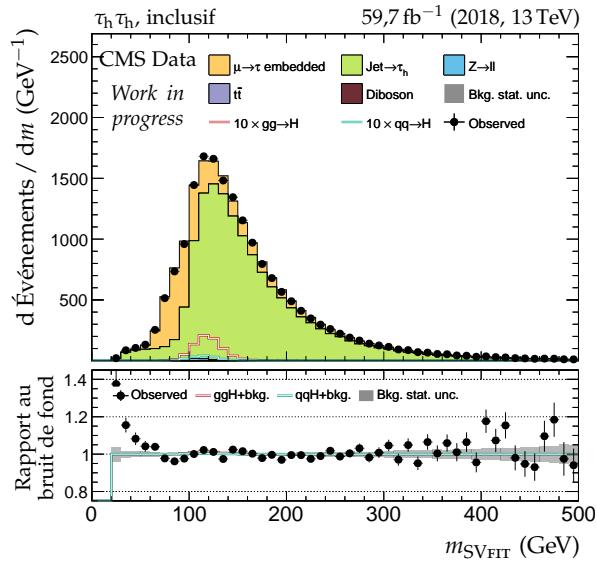
(b) Masse transverse du lepton 2 ($\tau_h^{(2)}$).



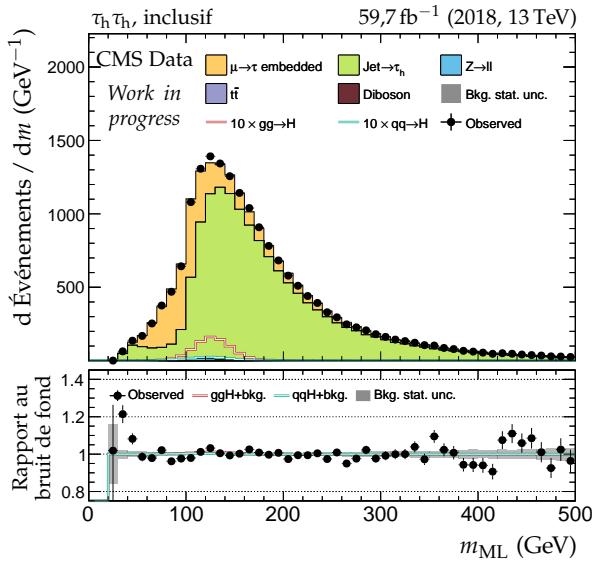
(c) Valeur de D_ζ .



(d) Masse transverse totale.

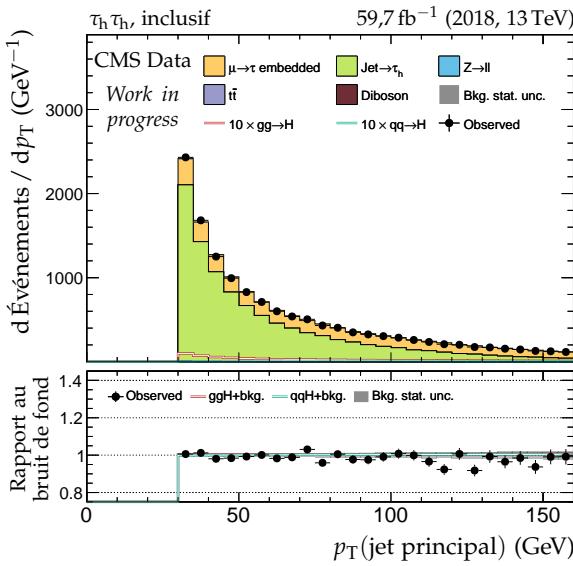


(e) Masse du système di- τ d'après SVFIT.

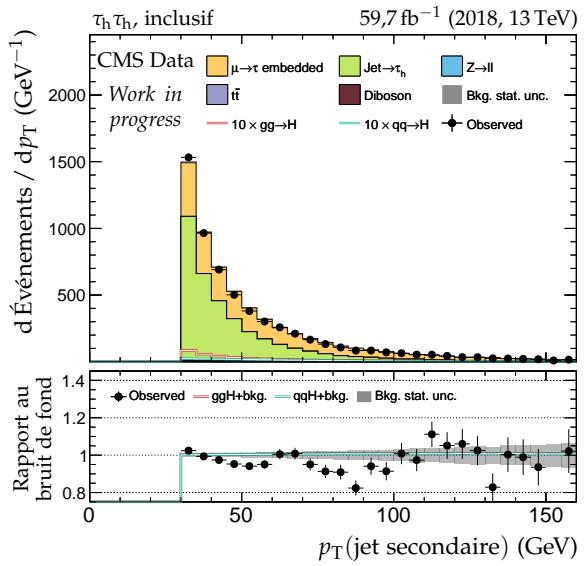


(f) Masse du système di- τ d'après le ML.

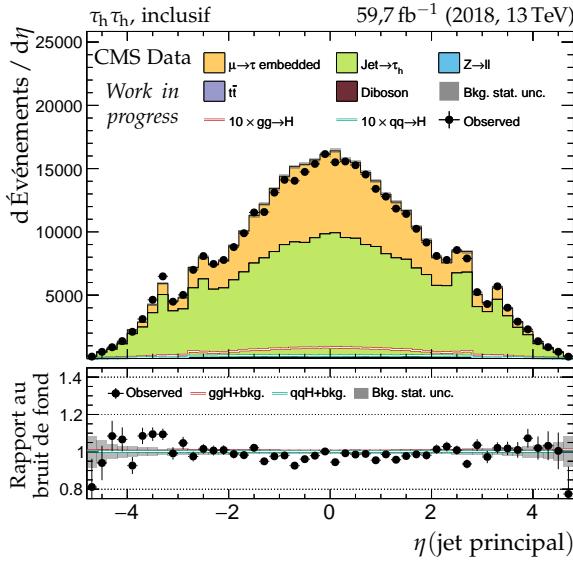
Figure X.51 – Canal $\tau_h \tau_h$, 2018 : masses transverses, D_ζ et masses.



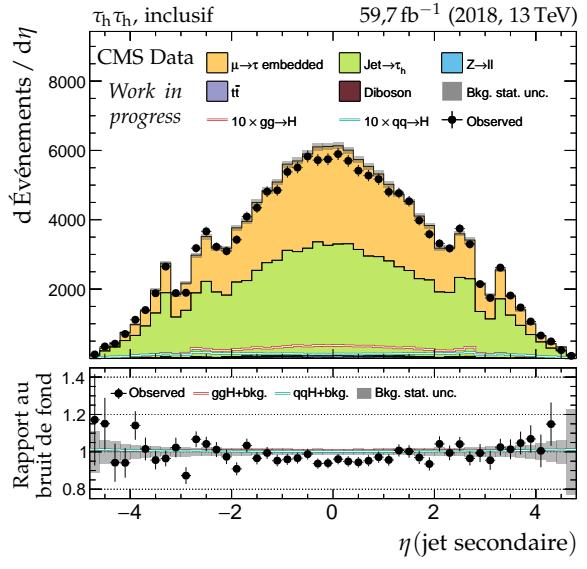
(a) Impulsion transverse du jet principal.



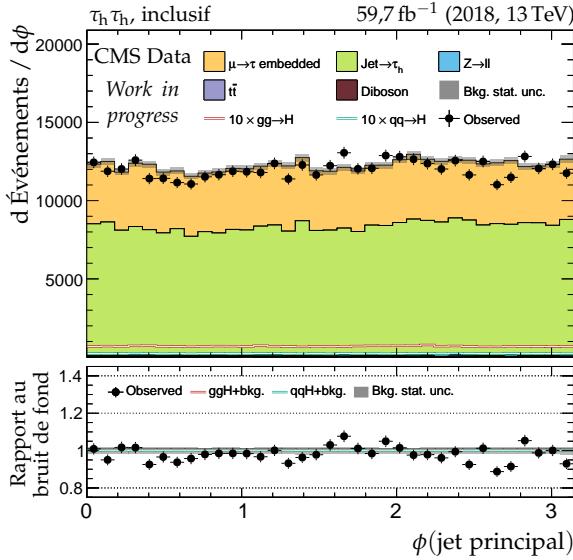
(b) Impulsion transverse du jet secondaire.



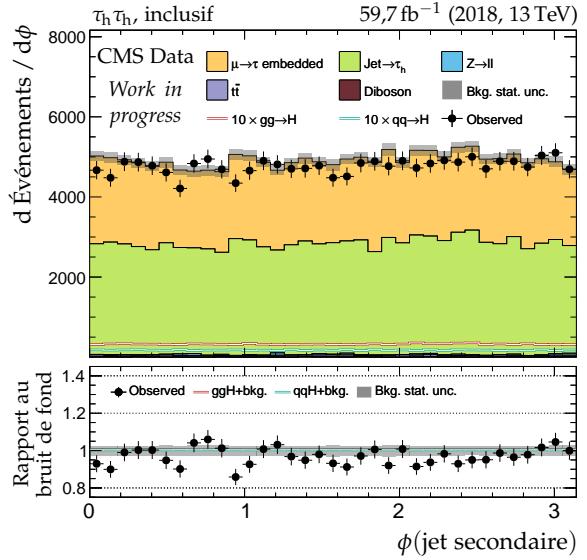
(c) Pseudo-rapidité du jet principal.



(d) Pseudo-rapidité du jet secondaire.



(e) Angle azimutal du jet principal.



(f) Angle azimutal du jet secondaire.

Figure X.52 – Canal $\tau_h \tau_h$, 2018 : cinématique des deux jets principaux.

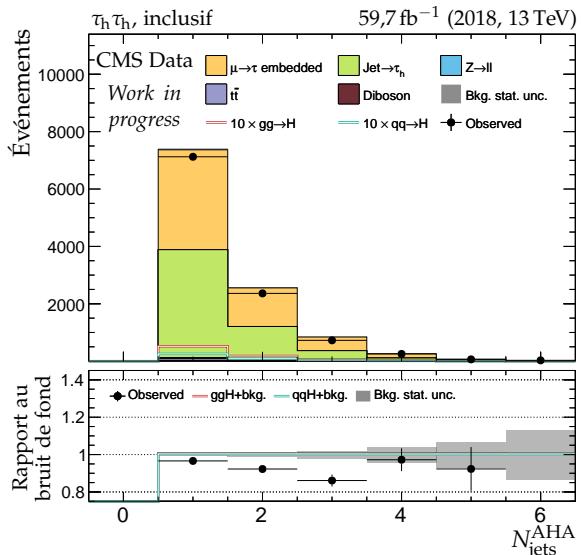
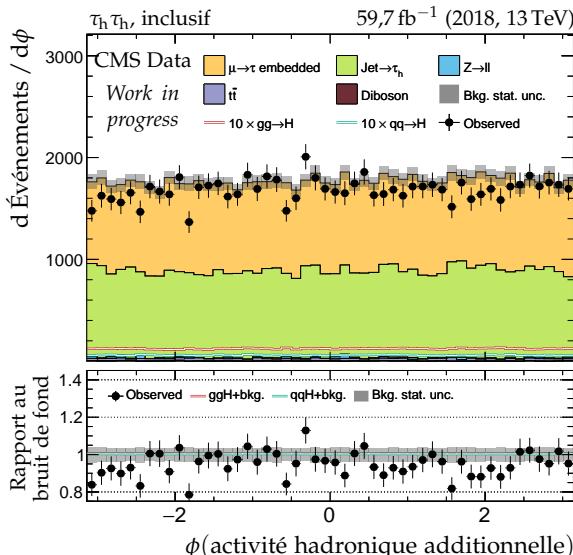
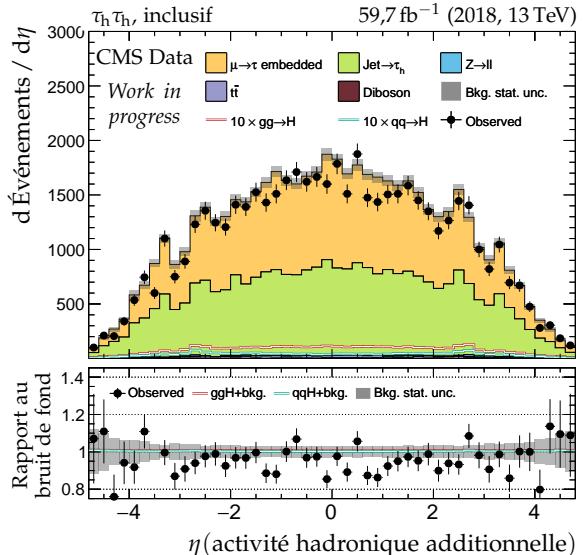
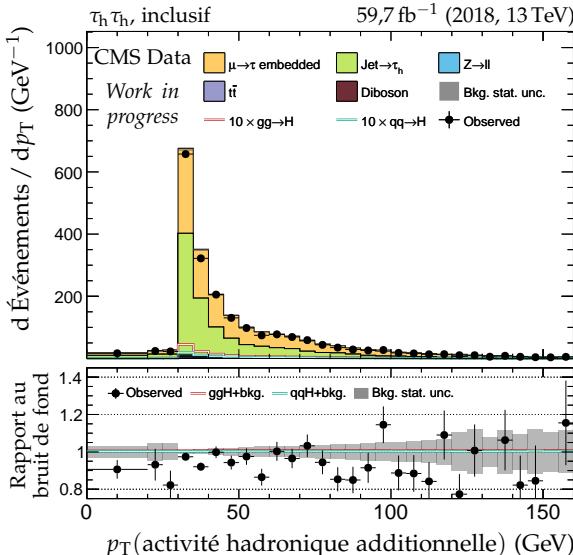
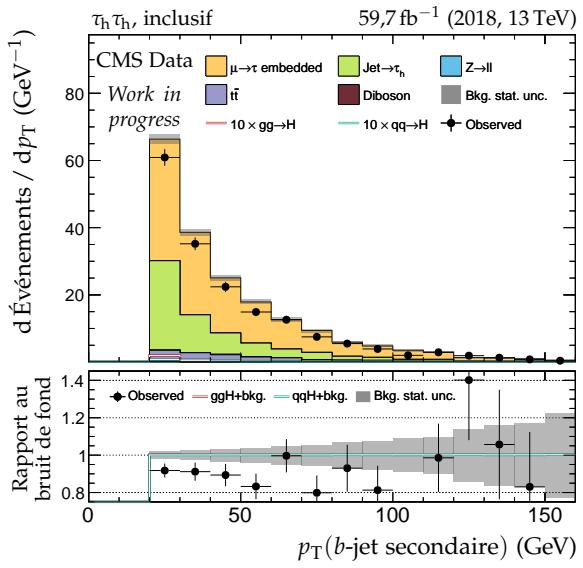
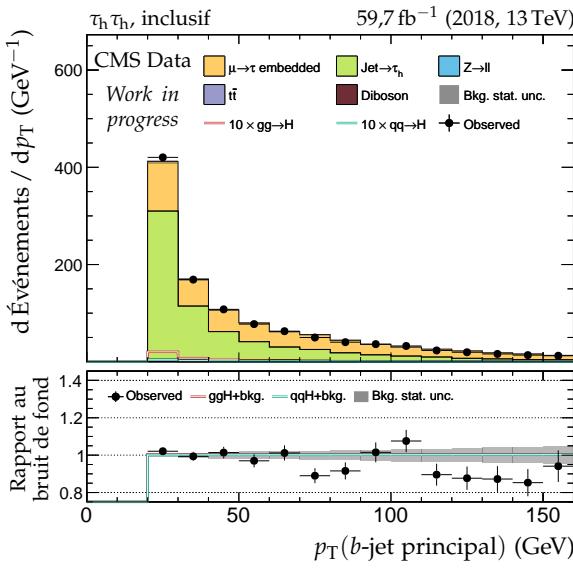


Figure X.53 – Canal $\tau_h\tau_h$, 2018 : b-jets et activité hadronique additionnelle.

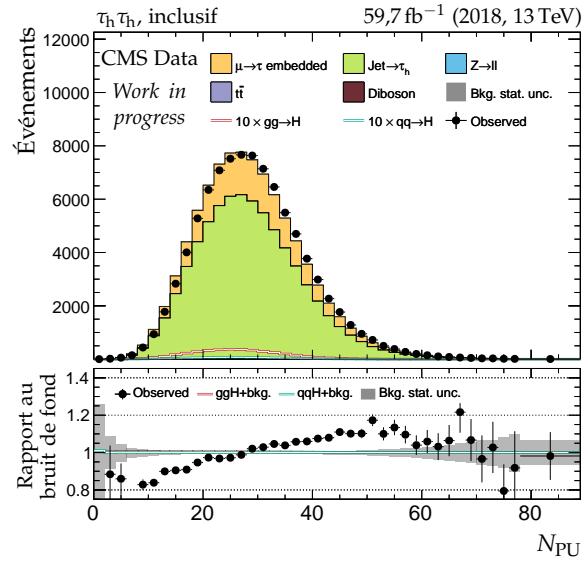
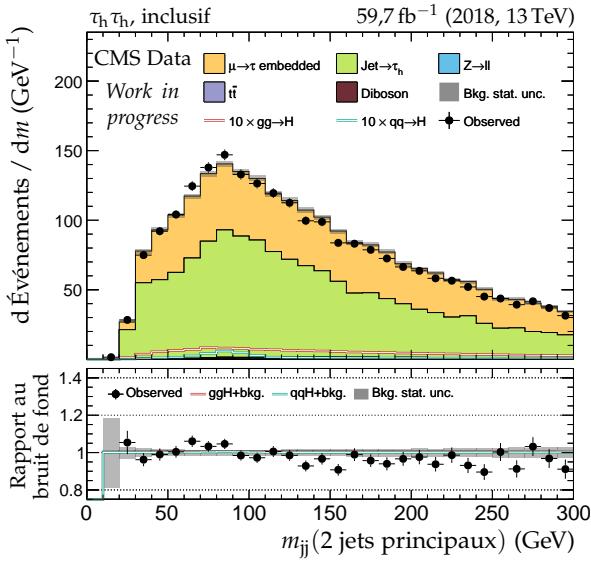
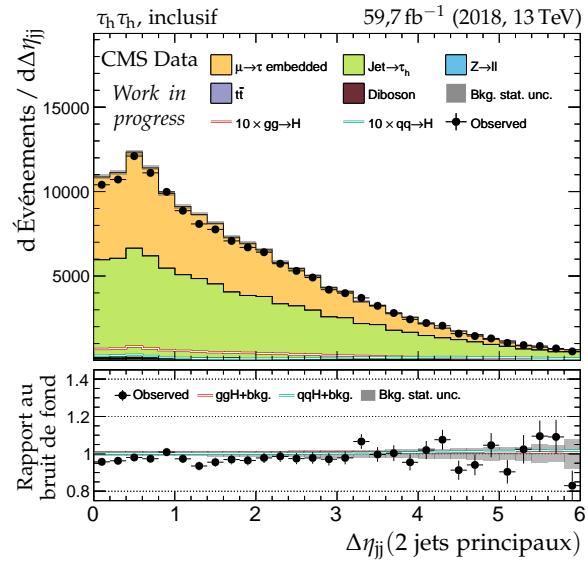
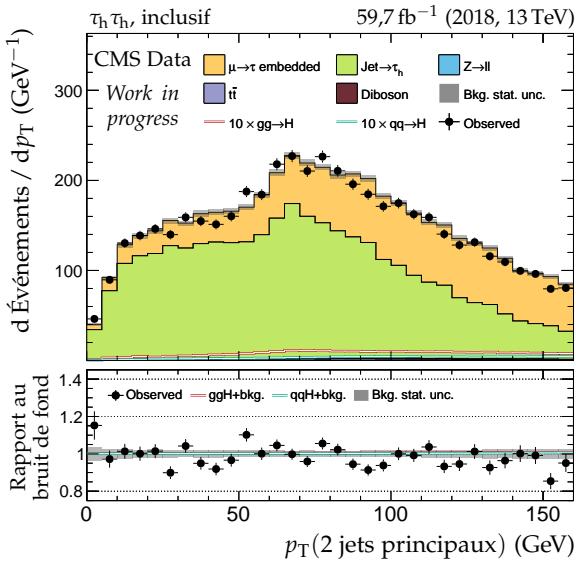
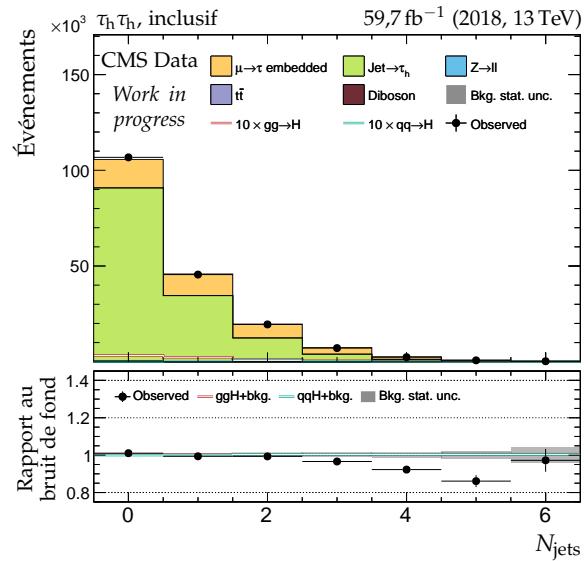
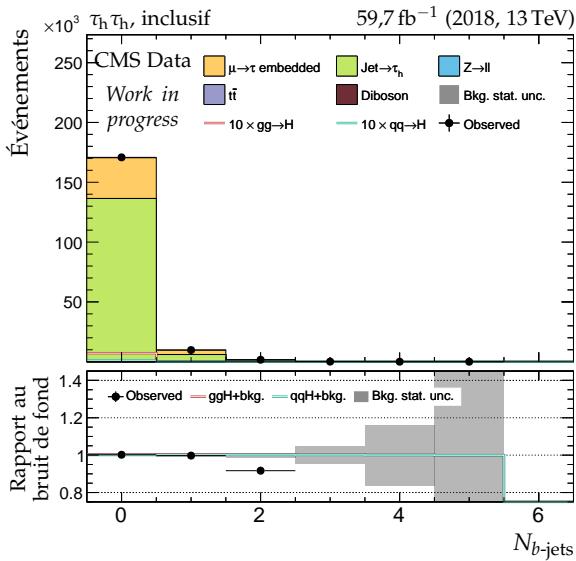


Figure X.54 – Canal $\tau_h \tau_h$, 2018 : nombre de jets, système des deux jets principaux et empilement.

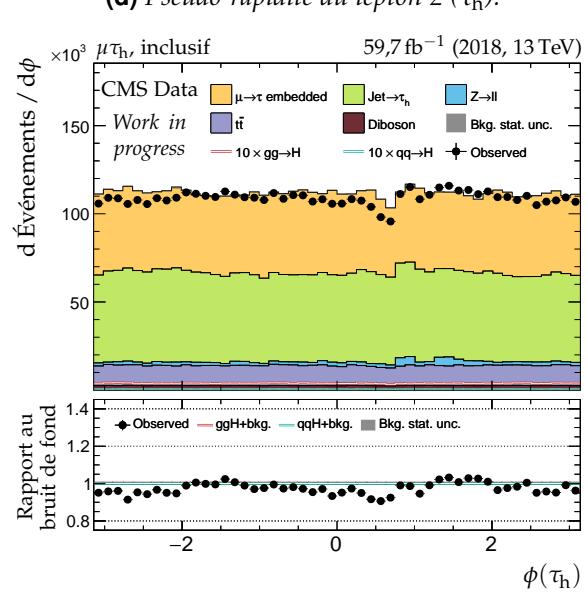
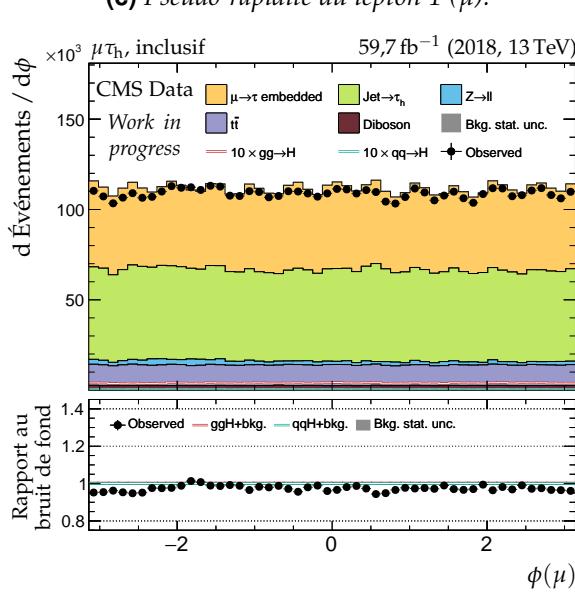
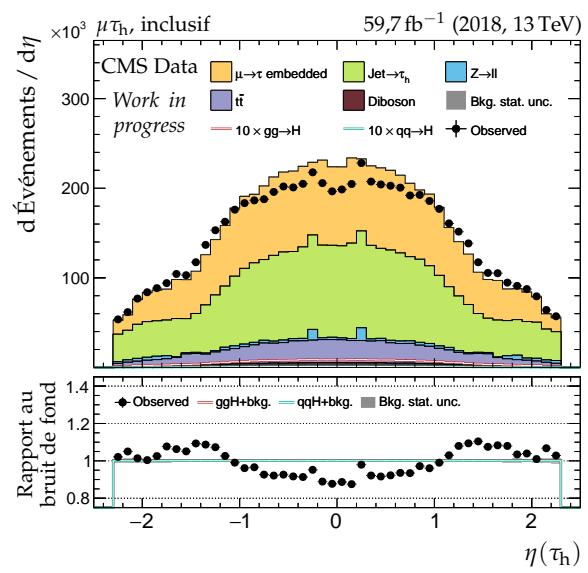
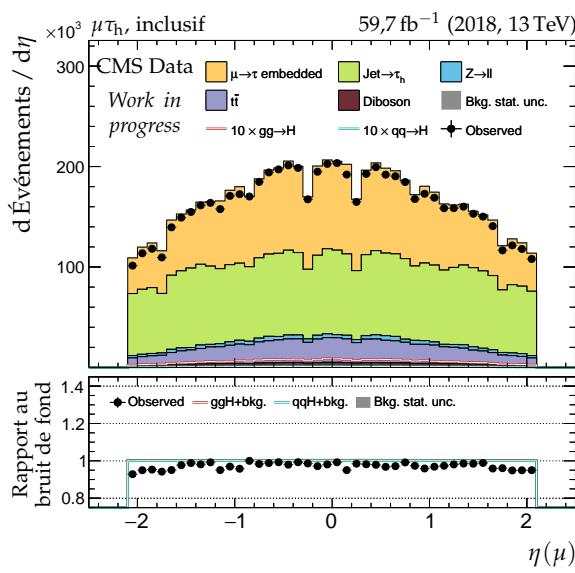
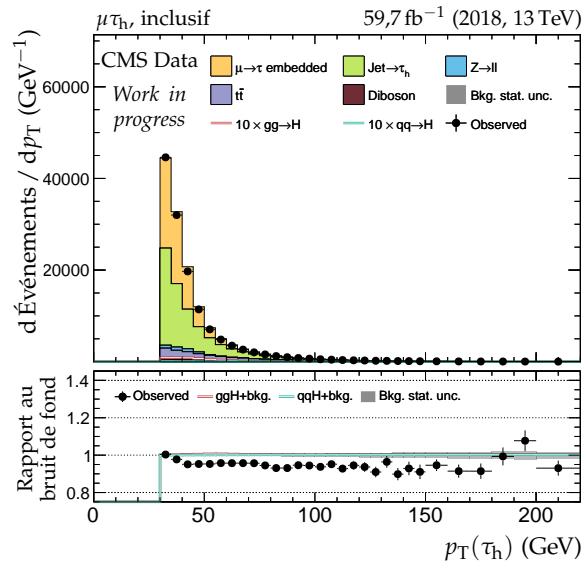
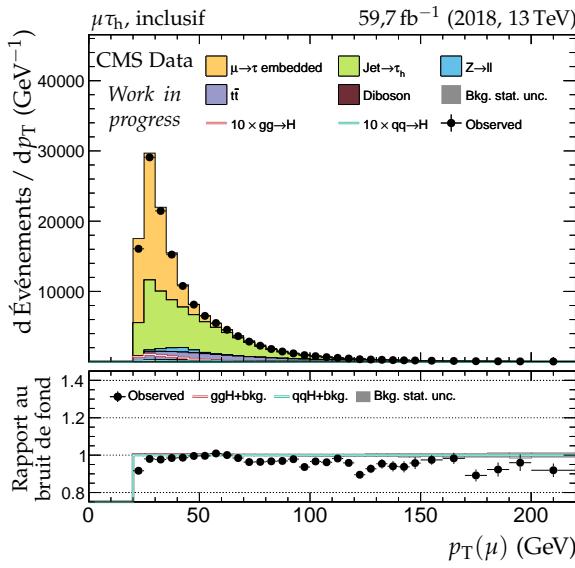
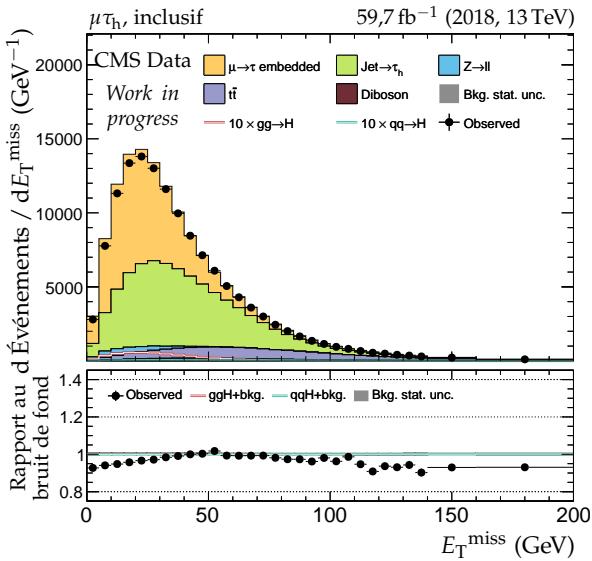
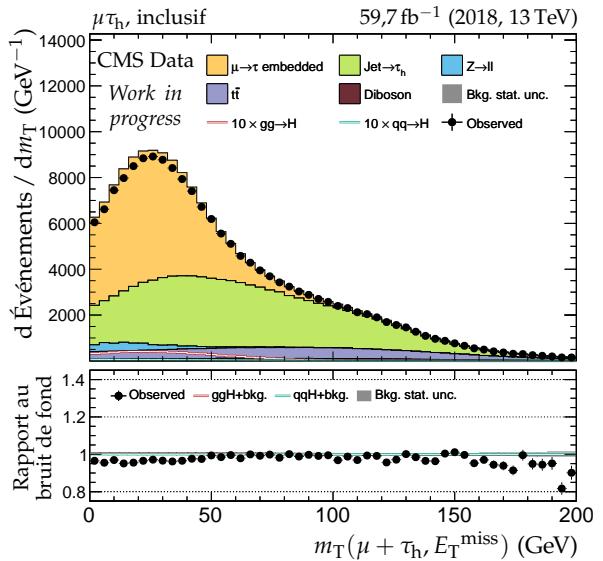


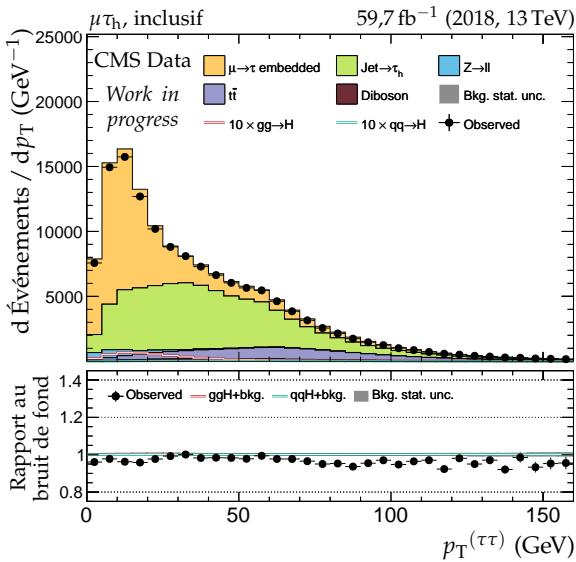
Figure X.55 – Canal $\mu\tau_h$, 2018 : cinématique des leptons (μ, τ_h).



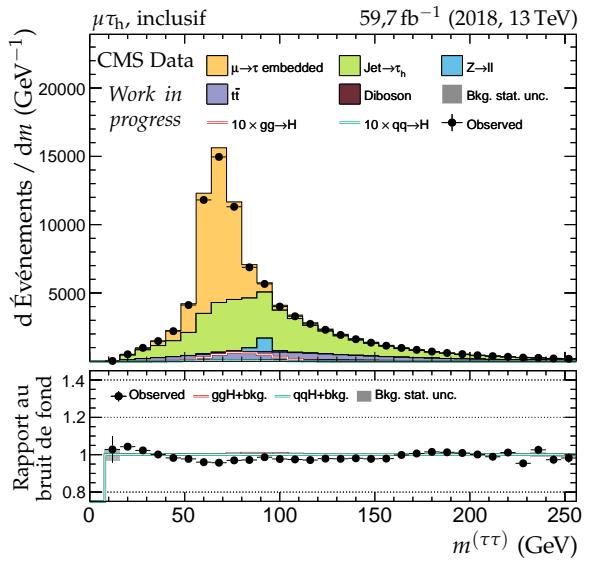
(a) Énergie transverse manquante.



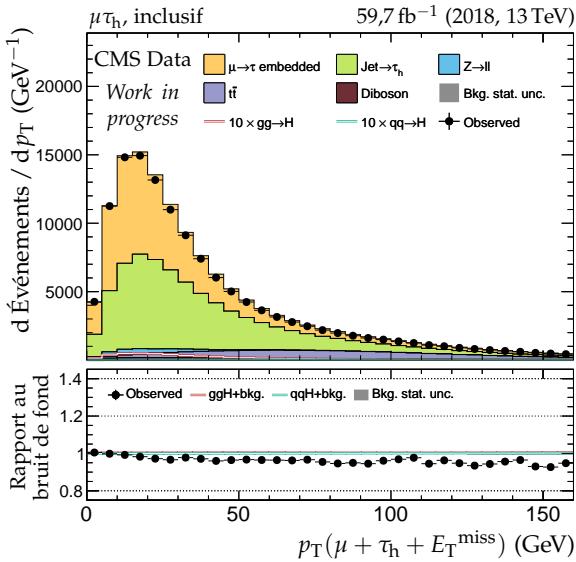
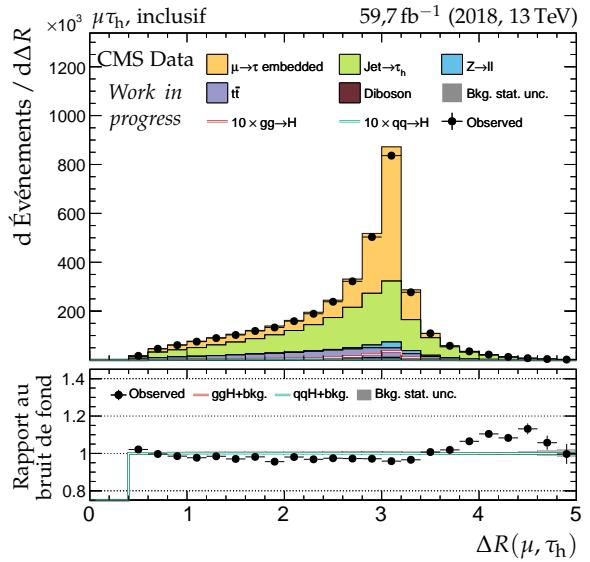
(b) Masse transverse du dilepton.

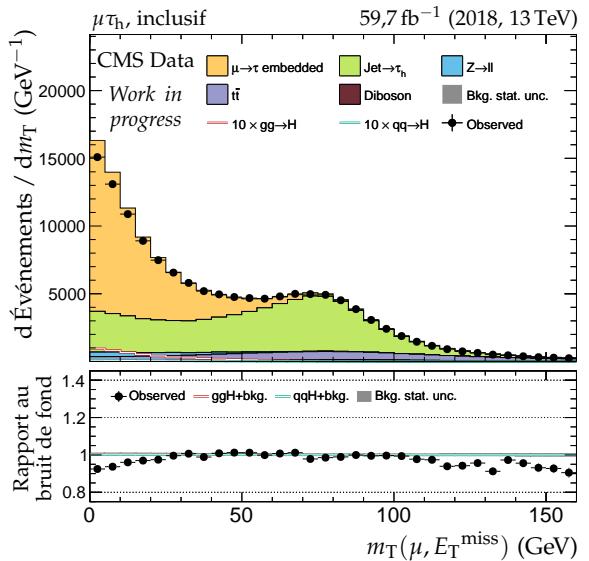


(c) Impulsion transverse du dilepton.

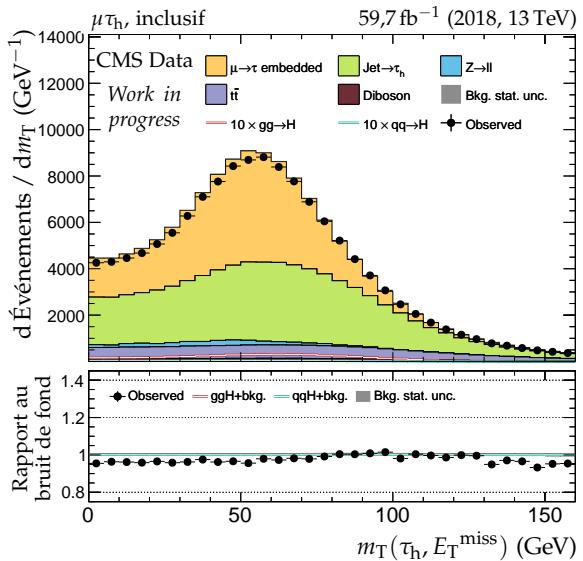


(d) Masse visible du dilepton.

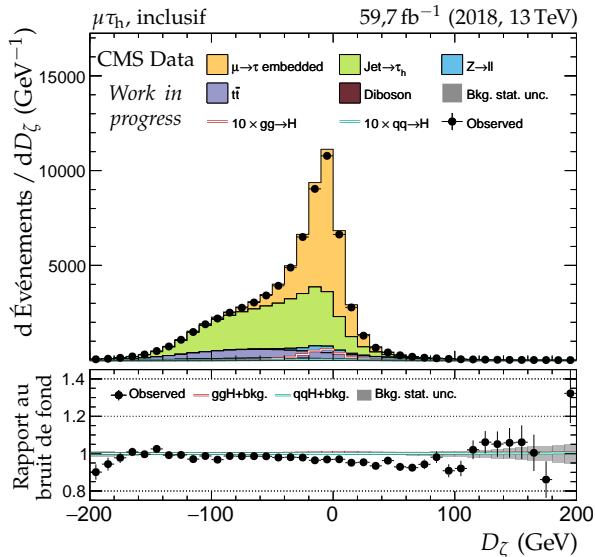
(e) Impulsion transverse du système di- τ .(f) Distance ΔR entre les leptons (μ, τ_h).**Figure X.56 – Canal $\mu\tau_h$, 2018 : dilepton et énergie transverse manquante.**



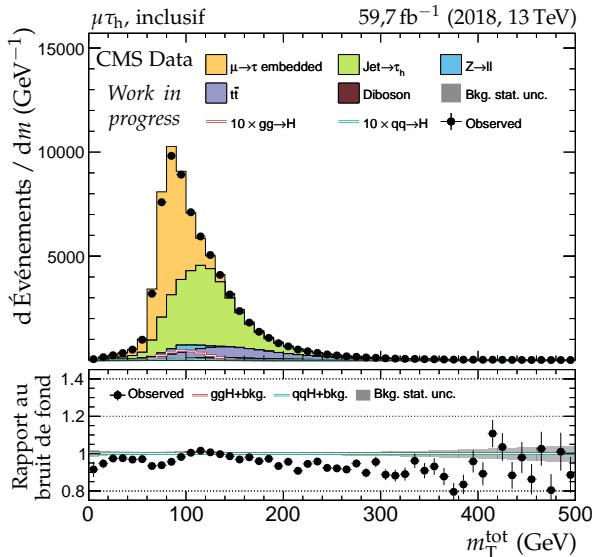
(a) Masse transverse du lepton 1 (μ).



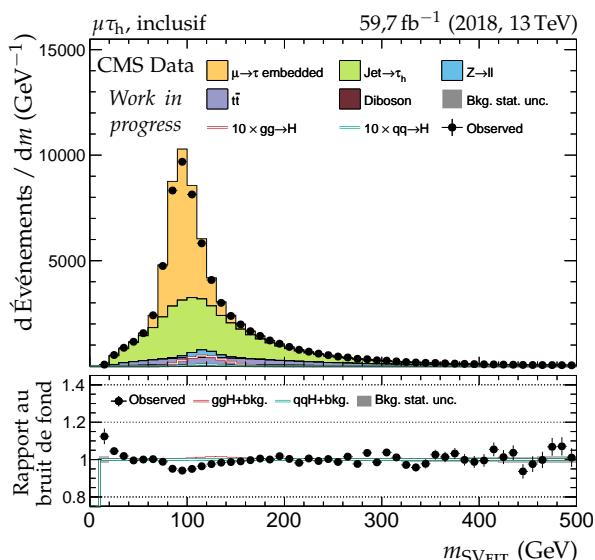
(b) Masse transverse du lepton 2 (τ_h).



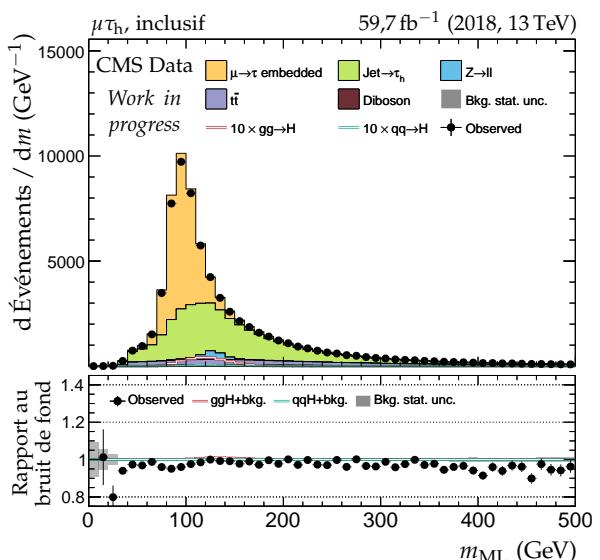
(c) Valeur de D_ζ .



(d) Masse transverse totale.

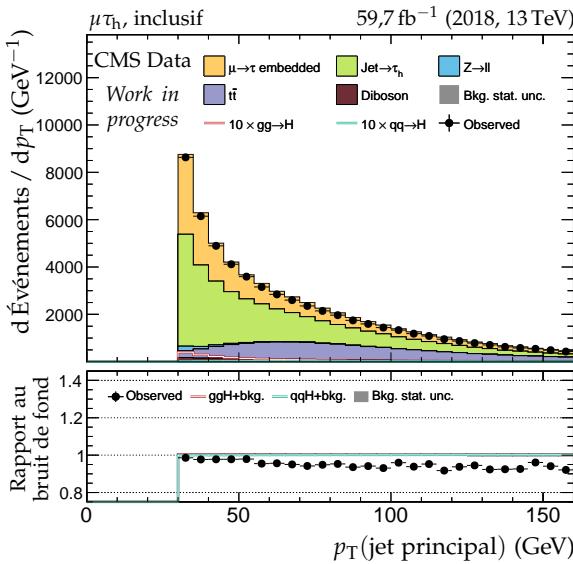


(e) Masse du système $d\tau$ d'après SVFIT.

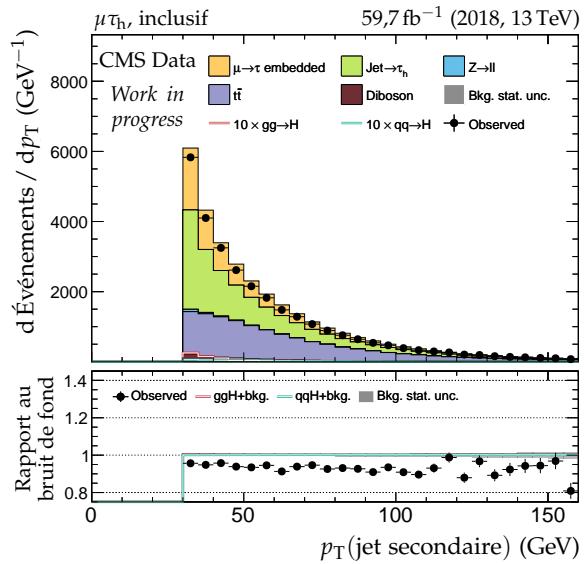


(f) Masse du système $d\tau$ d'après le ML.

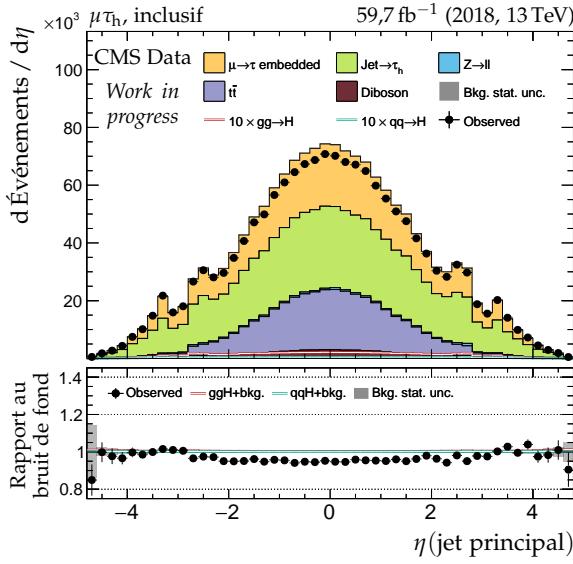
Figure X.57 – Canal $\mu\tau_h$, 2018 : masses transverses, D_ζ et masses.



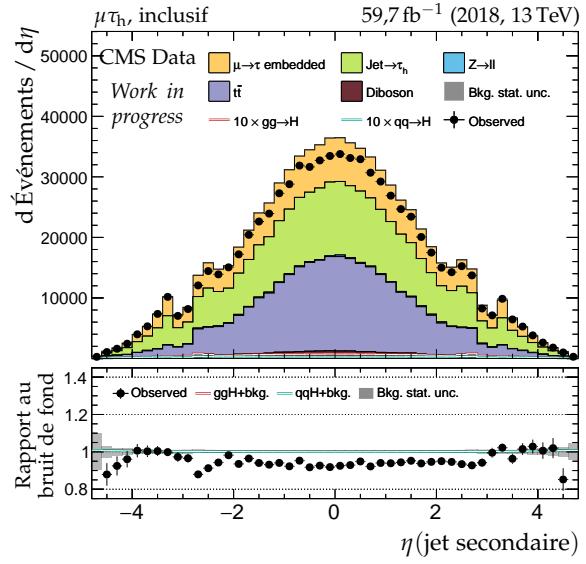
(a) Impulsion transverse du jet principal.



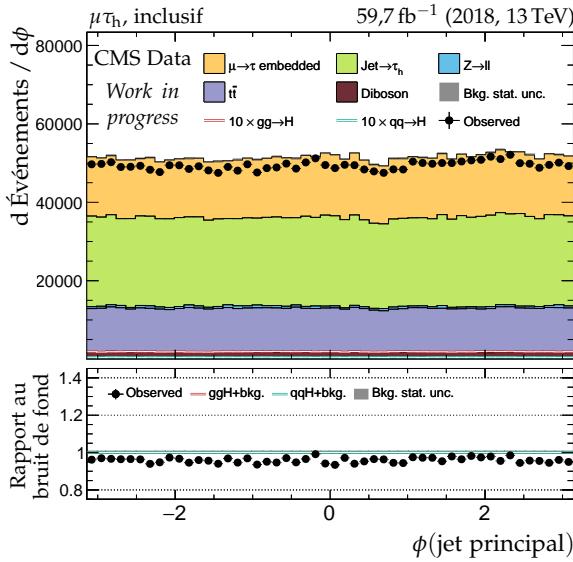
(b) Impulsion transverse du jet secondaire.



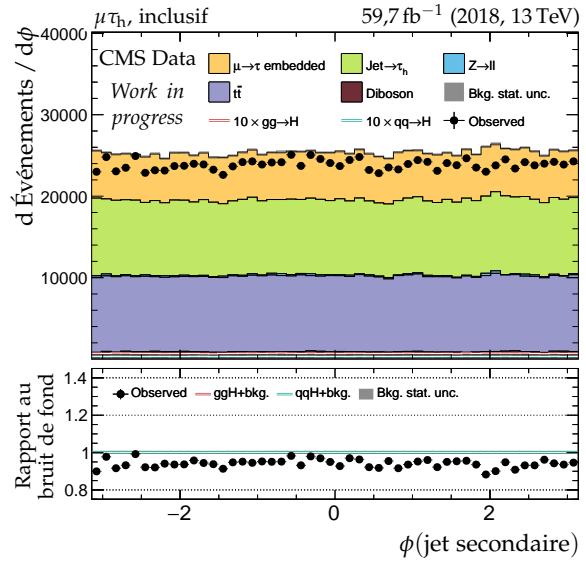
(c) Pseudo-rapidité du jet principal.



(d) Pseudo-rapidité du jet secondaire.

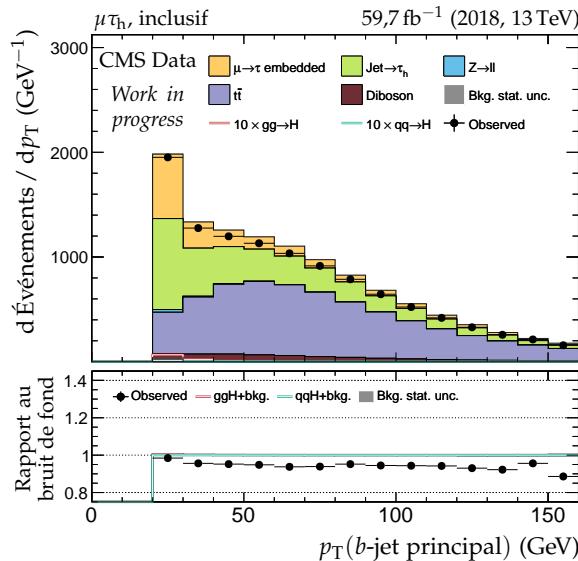


(e) Angle azimutal du jet principal.

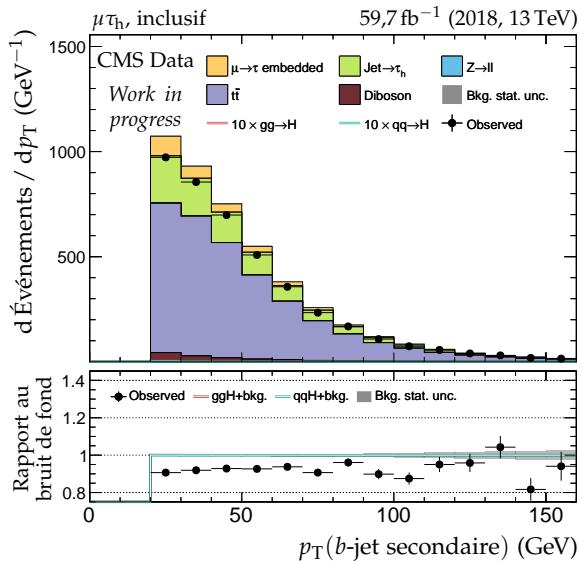


(f) Angle azimutal du jet secondaire.

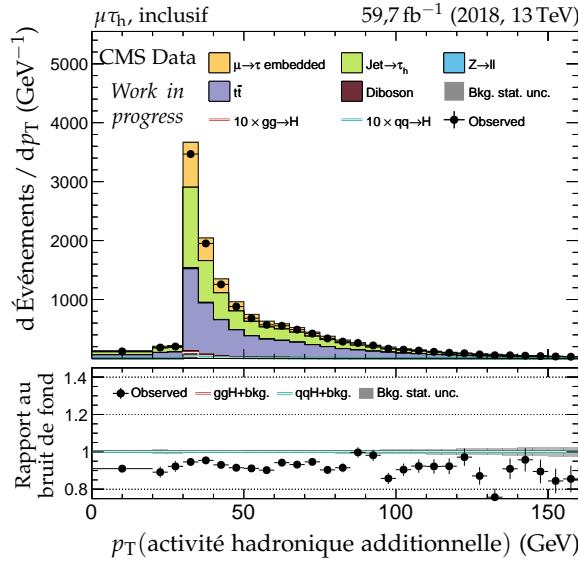
Figure X.58 – Canal $\mu\tau_h$, 2018 : cinématique des deux jets principaux.



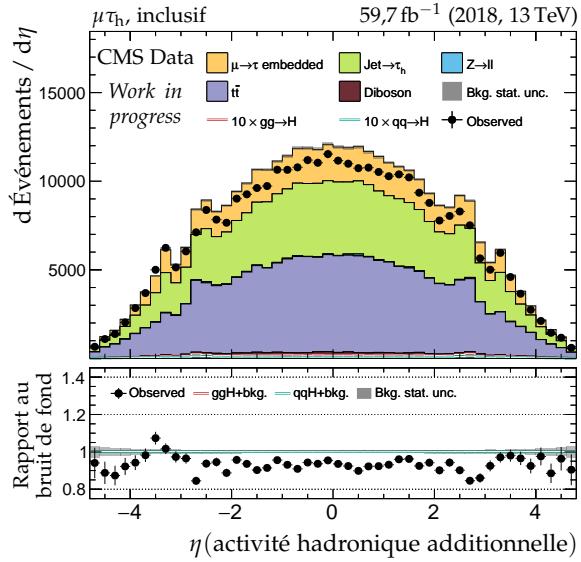
(a) Impulsion transverse du b-jet principal.



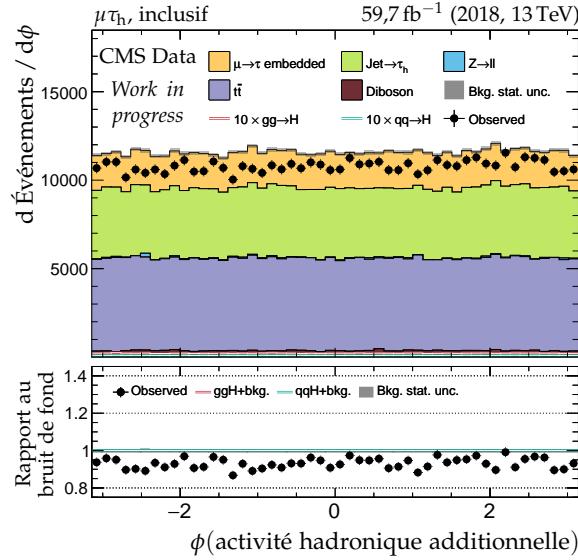
(b) Impulsion transverse du b-jet secondaire.



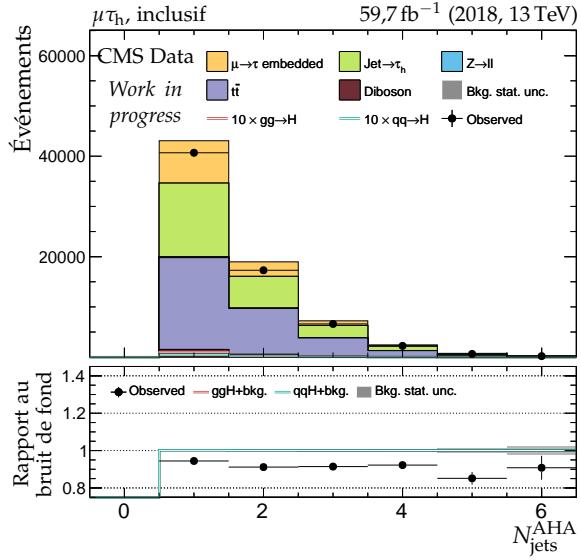
(c) Impulsion transverse de l'AHA.



(d) Pseudo-rapidité de l'AHA.

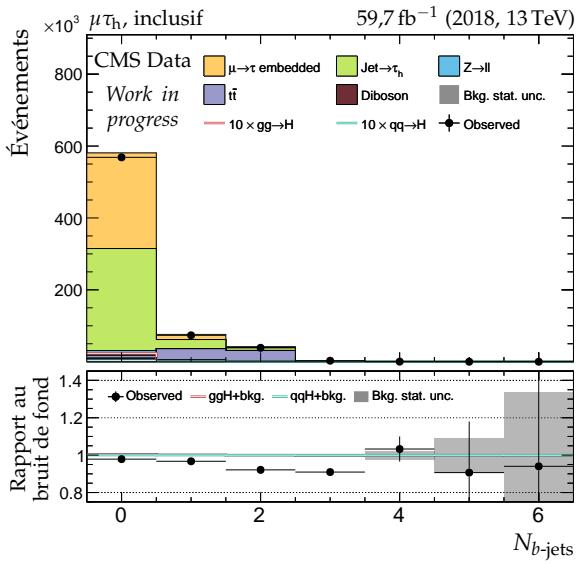
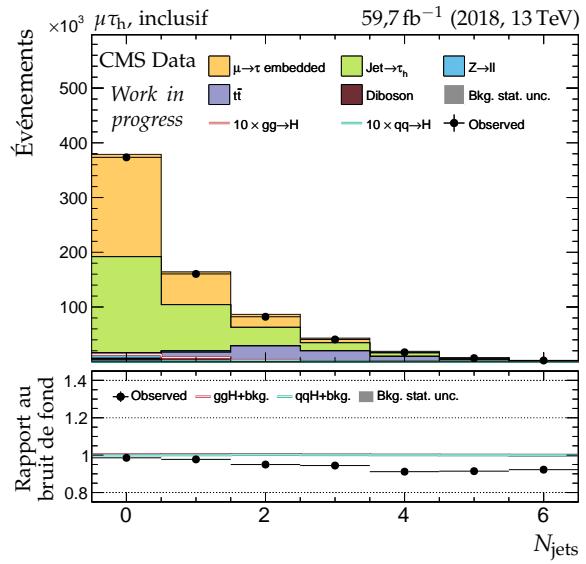


(e) Angle azimutal de l'AHA.

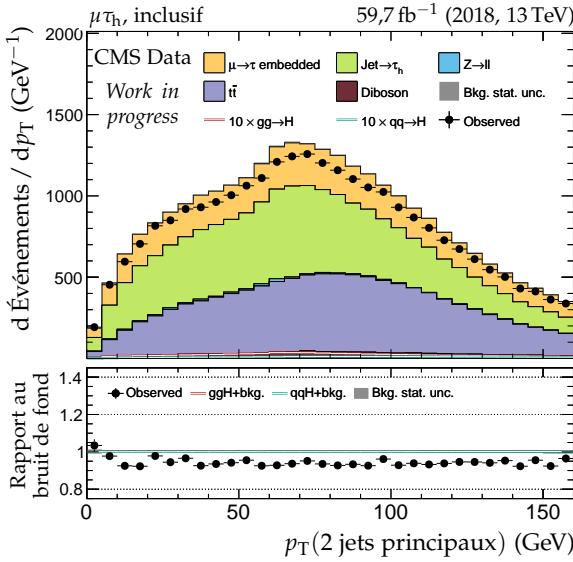


(f) Nombre de jets dans l'AHA.

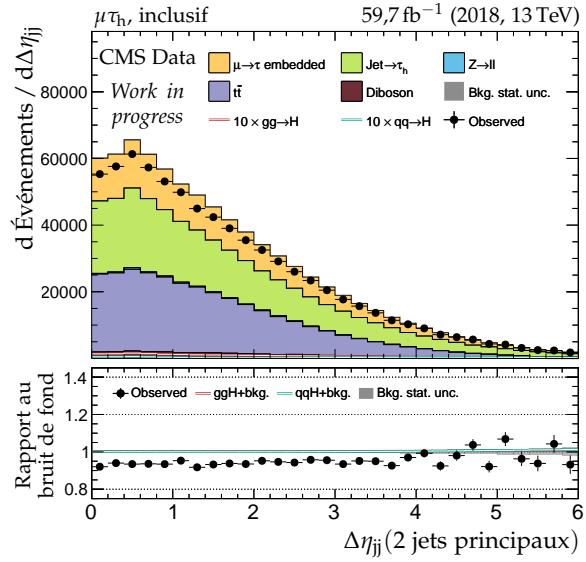
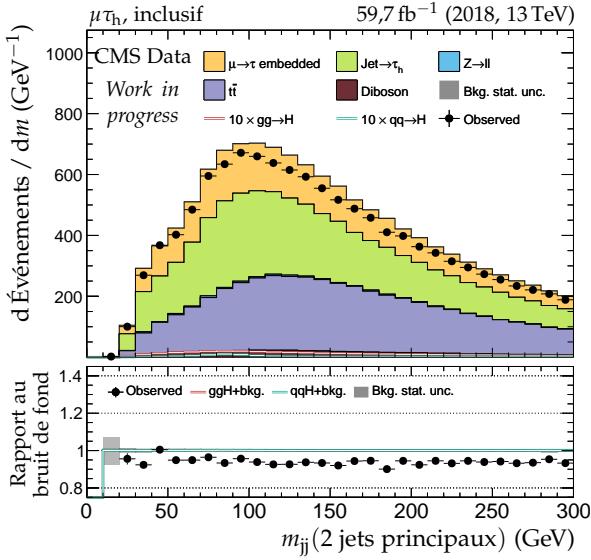
Figure X.59 – Canal $\mu\tau_h$, 2018 : b-jets et activité hadronique additionnelle.

(a) Nombre de b -jets.

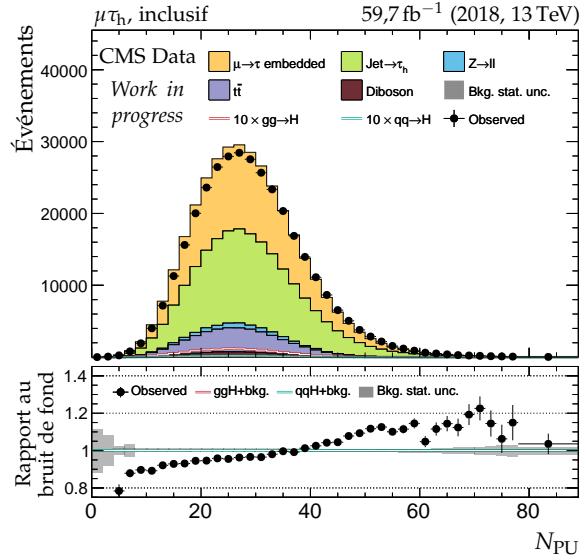
(b) Nombre de jets.



(c) Impulsion transverse du système des deux jets.

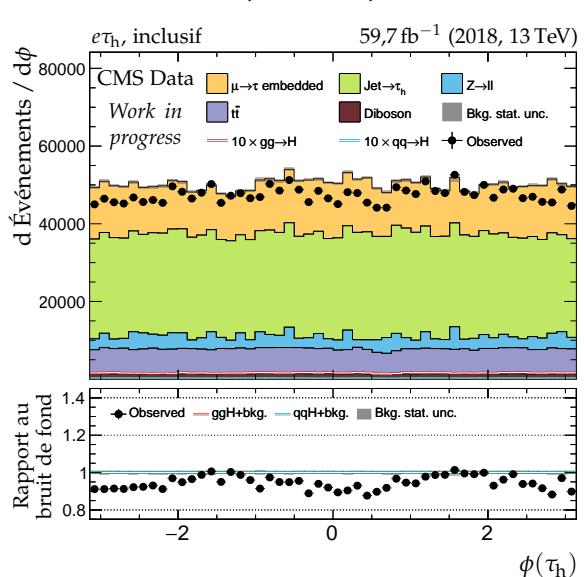
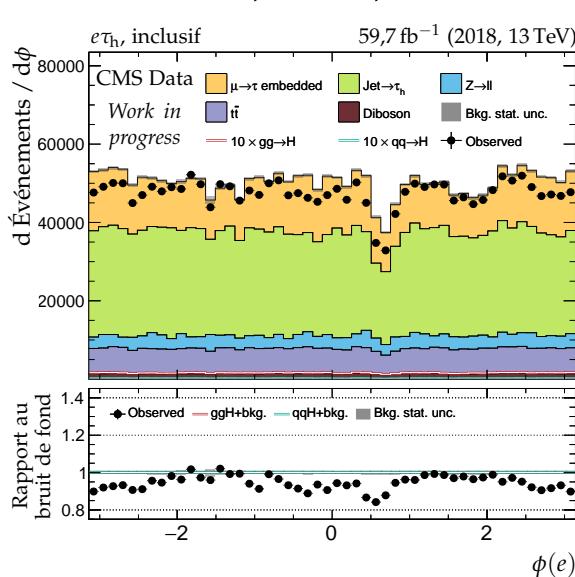
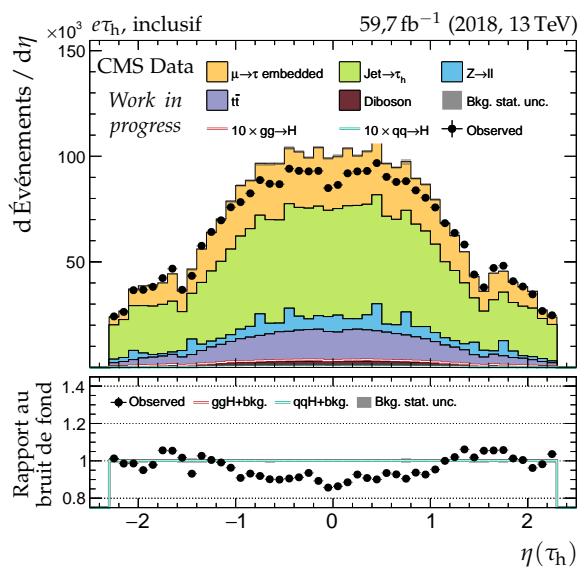
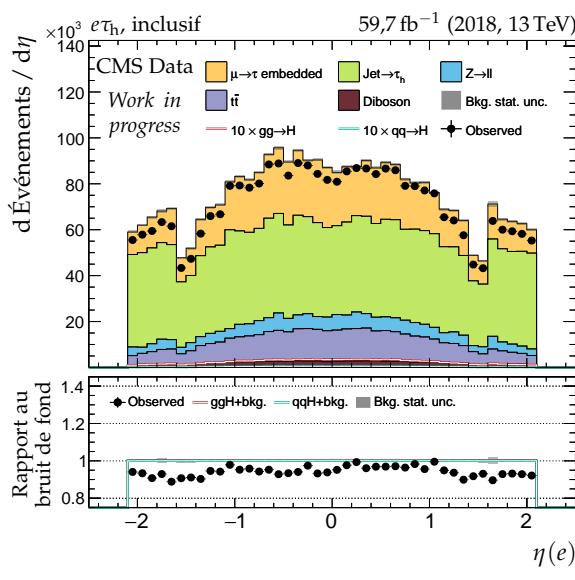
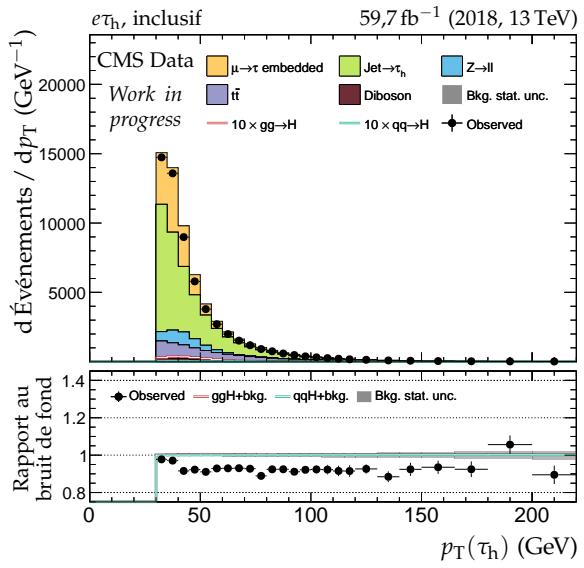
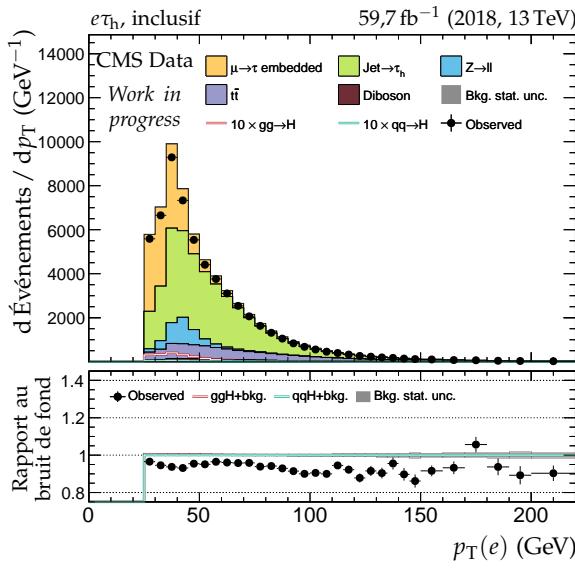
(d) Distance en η entre les deux jets.

(e) Masse invariante du système des deux jets.



(f) Nombre de vertex d'empilement.

Figure X.60 – Canal $\mu\tau_h$, 2018 : nombre de jets, système des deux jets principaux et empilement.

**Figure X.61 – Canal $e\tau_h$, 2018 : cinématique des leptons (e, τ_h).**

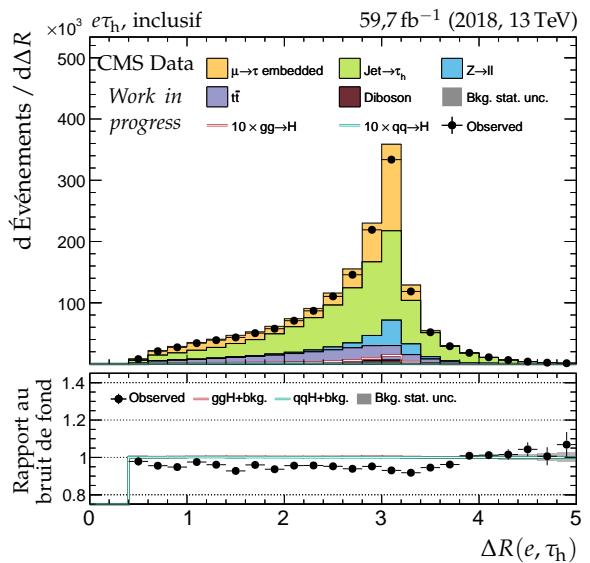
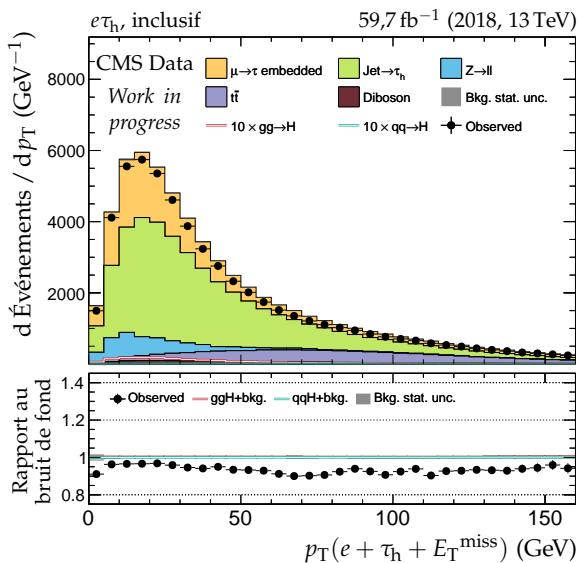
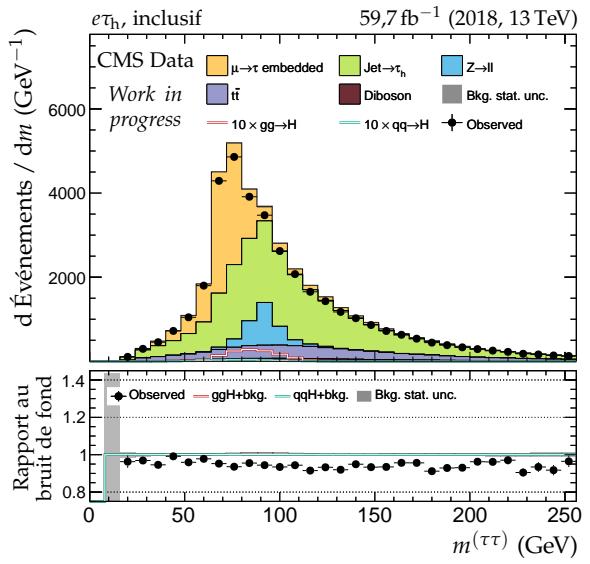
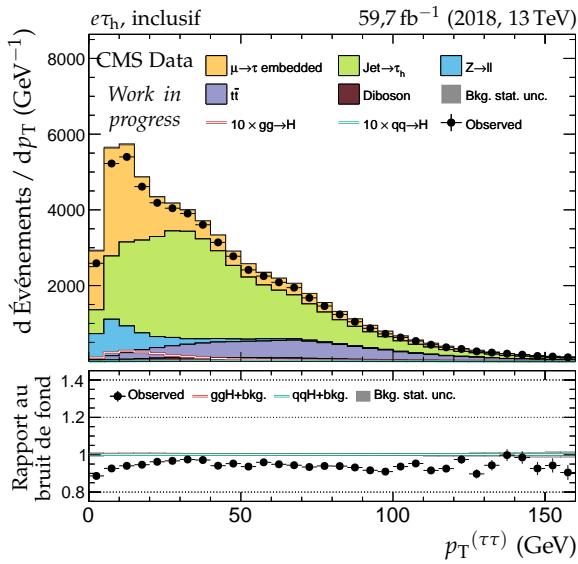
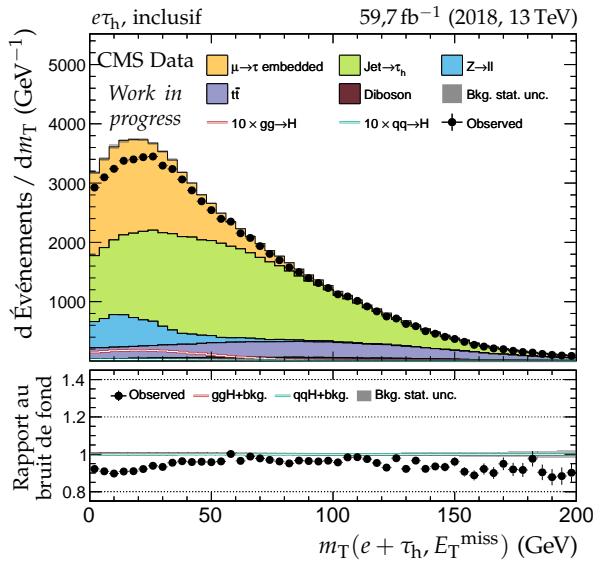
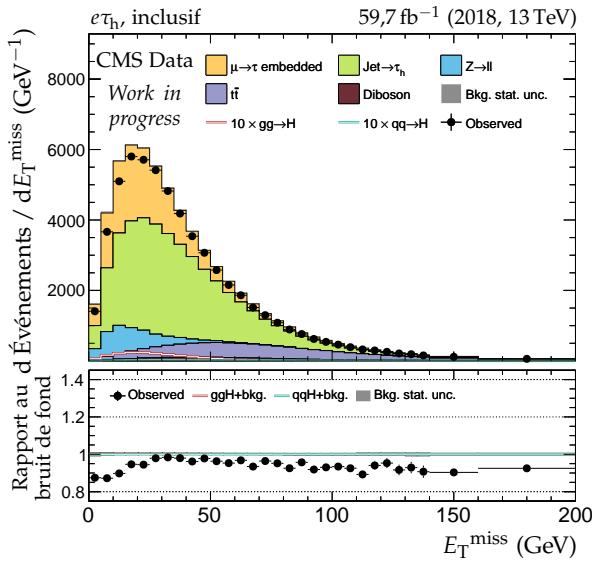
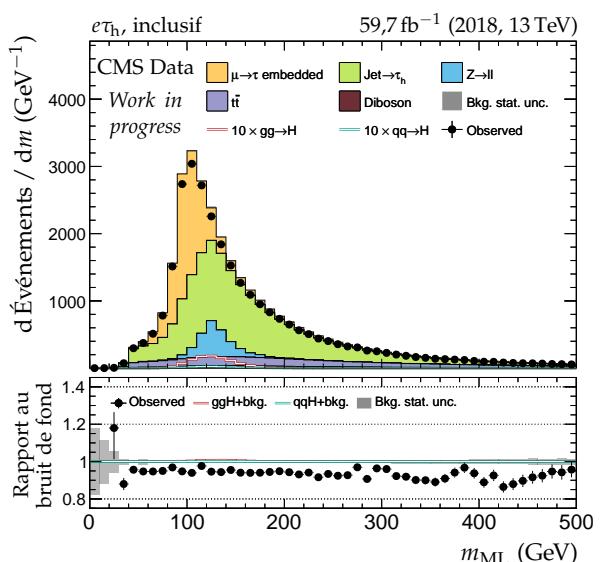
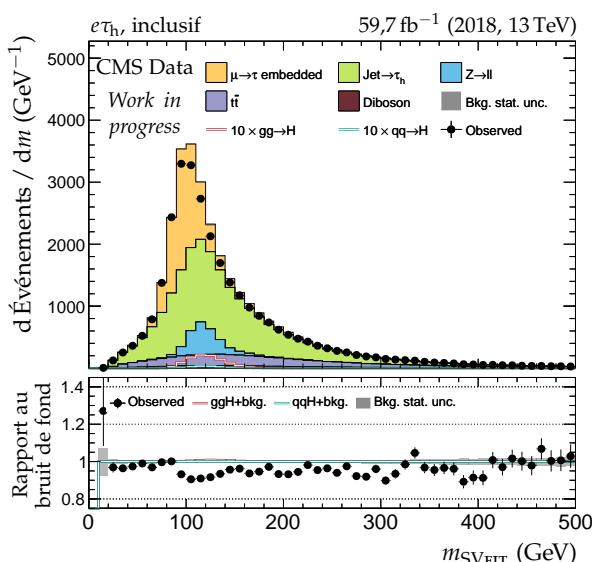
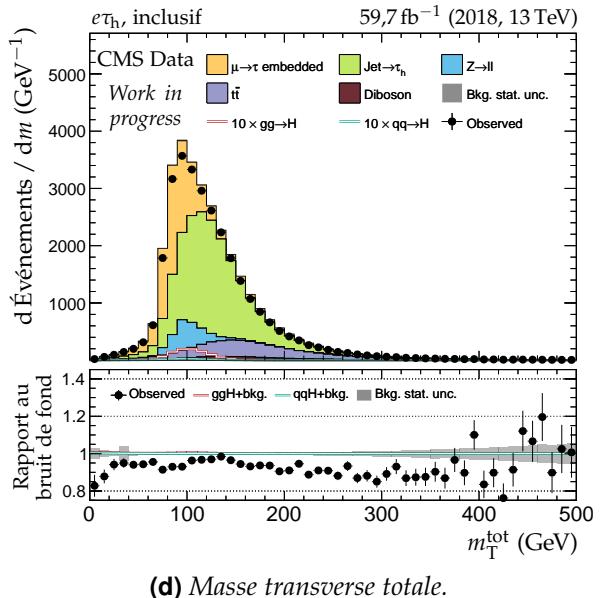
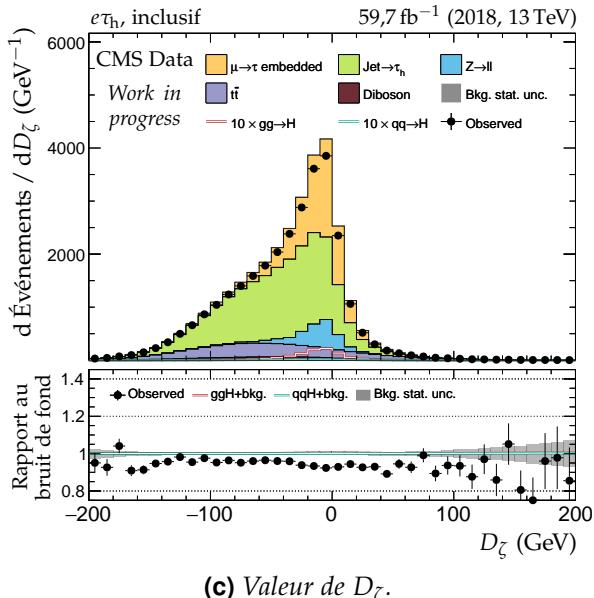
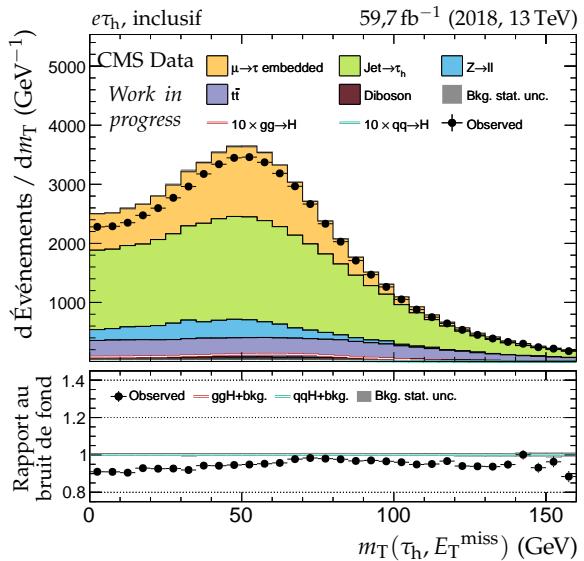
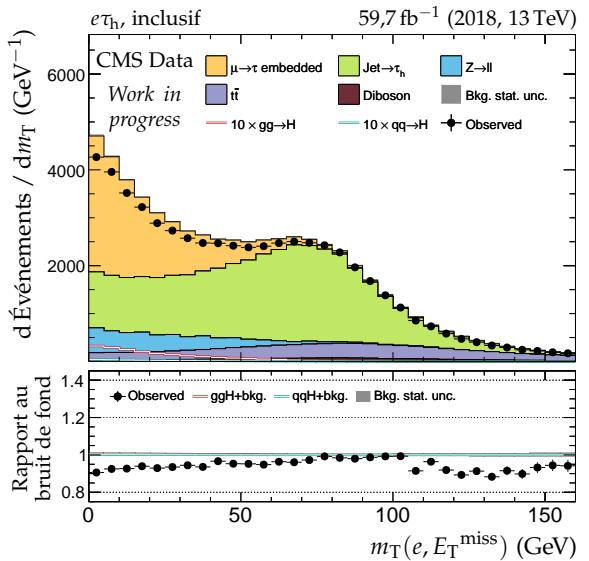


Figure X.62 – Canal $e\tau_h$, 2018 : dilepton et énergie transverse manquante.

**Figure X.63 – Canal $e\tau_h$, 2018 : masses transverses, D_ζ et masses.**

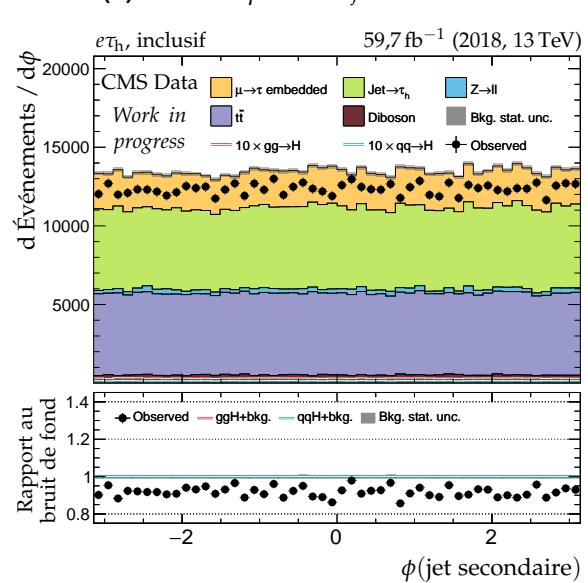
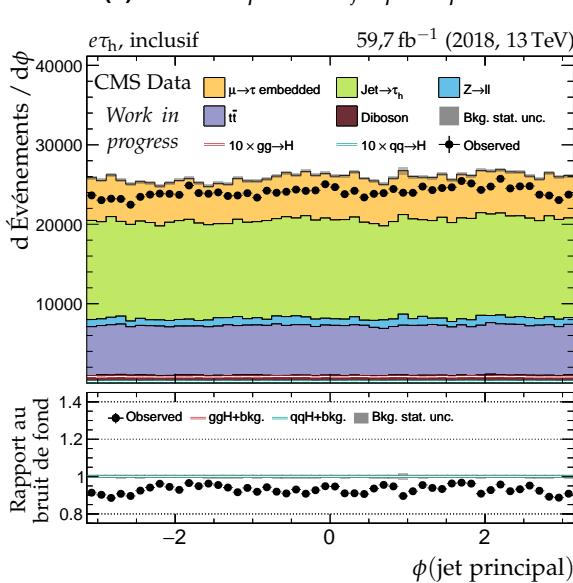
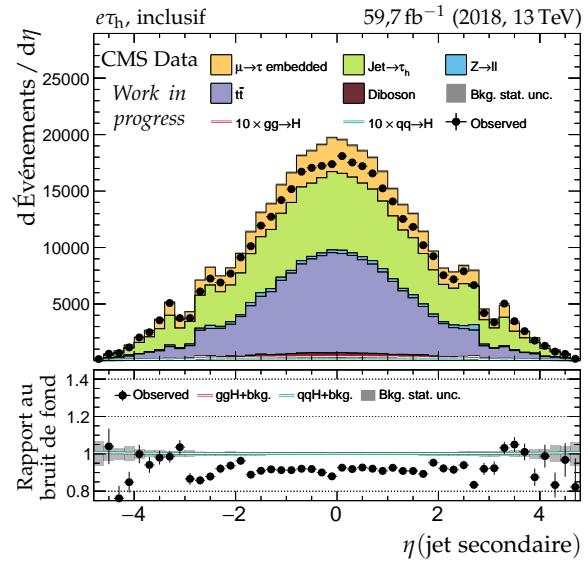
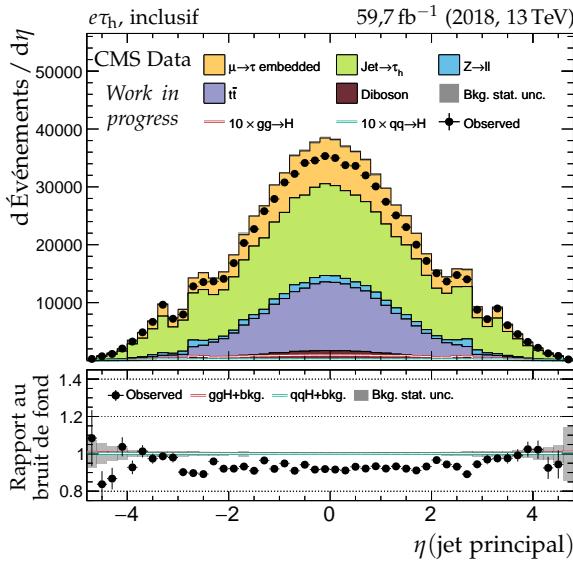
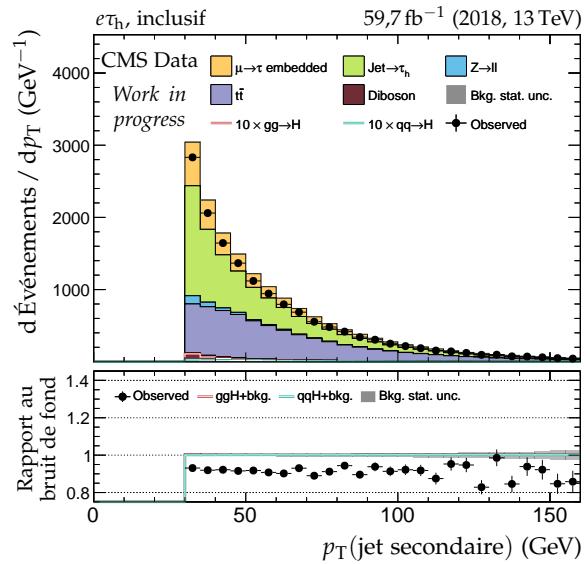
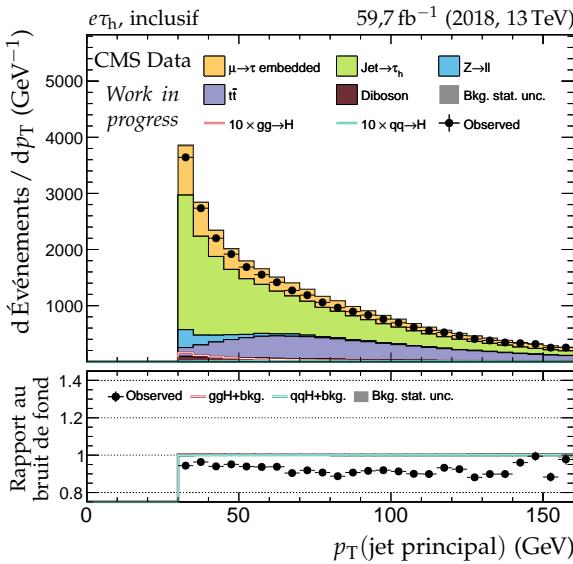


Figure X.64 – Canal $e\tau_h$, 2018 : cinématique des deux jets principaux.

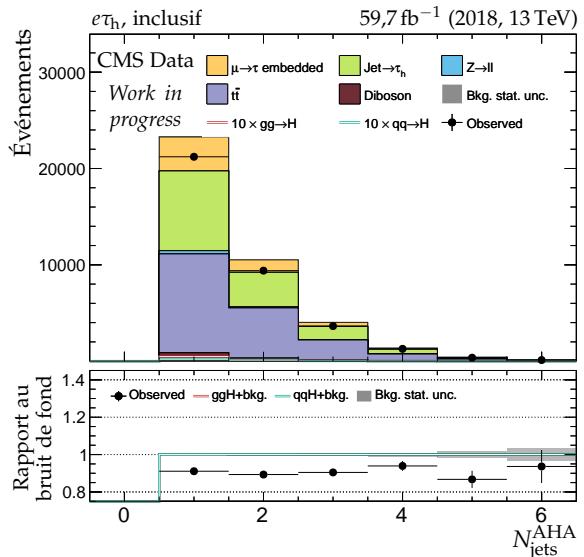
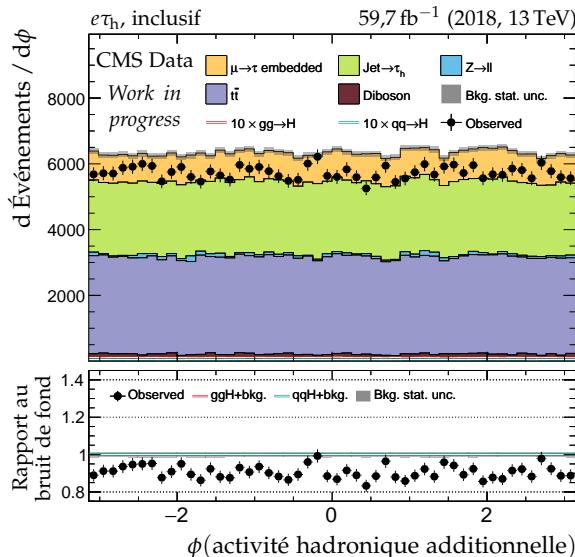
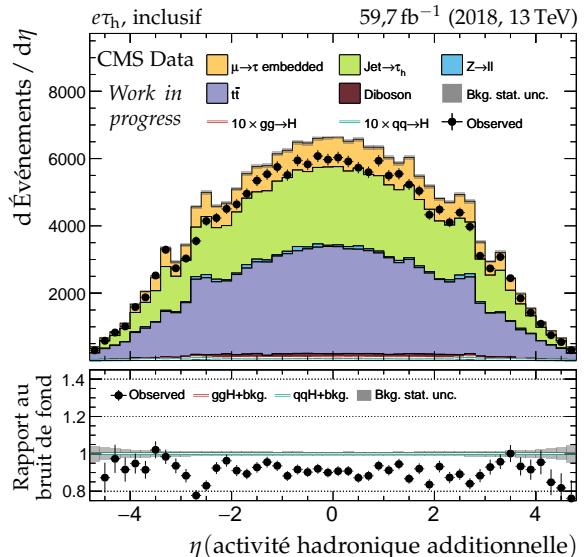
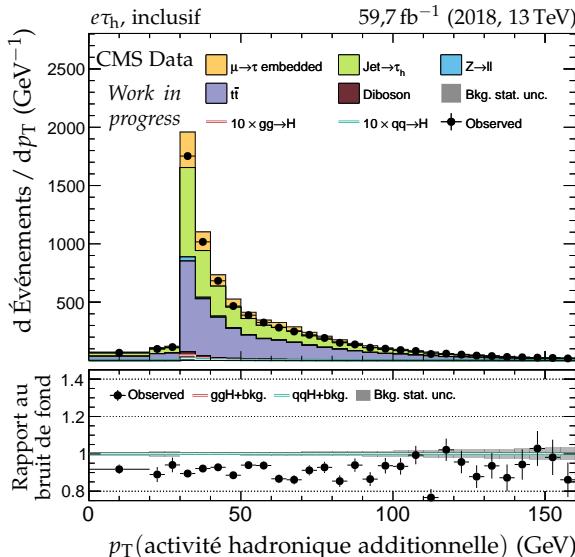
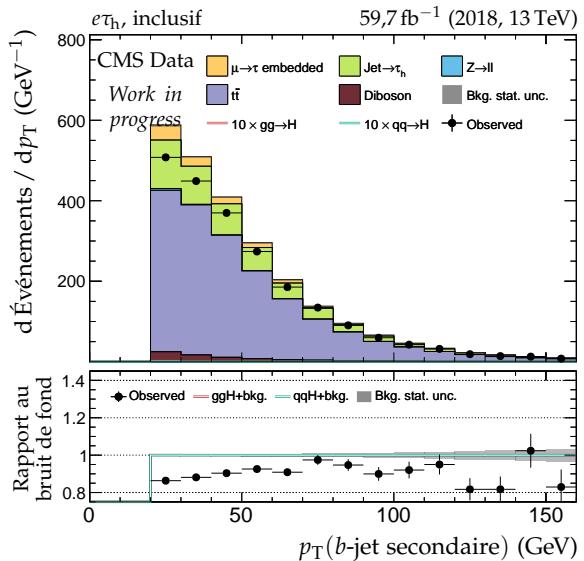
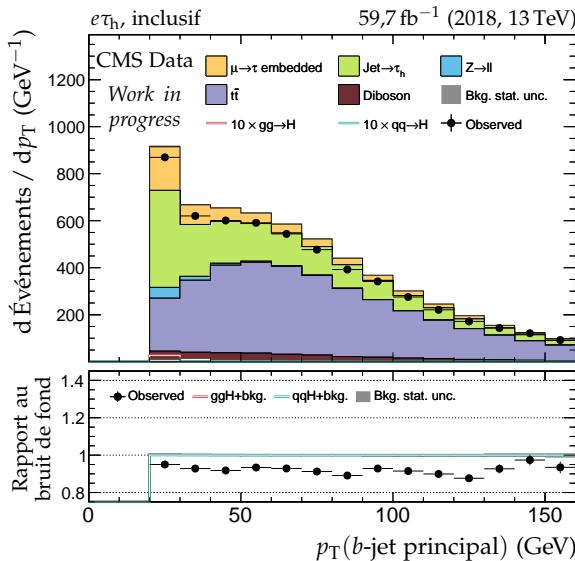


Figure X.65 – Canal $e\tau_h$, 2018 : b-jets et activité hadronique additionnelle.

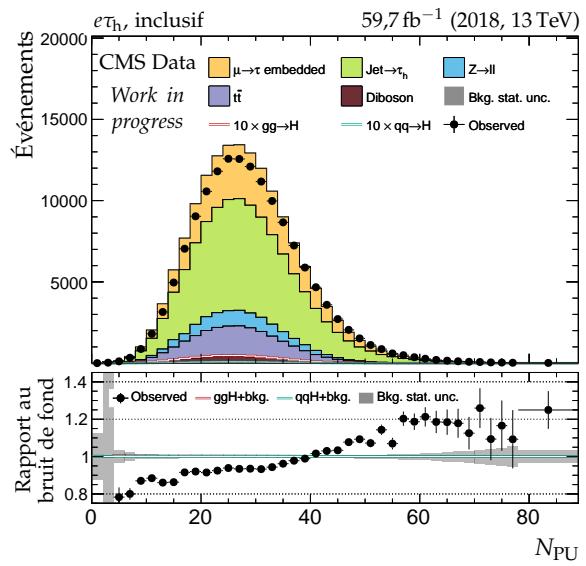
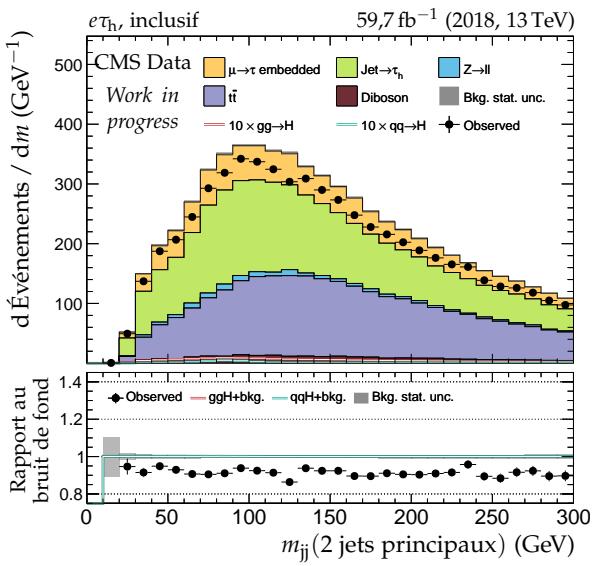
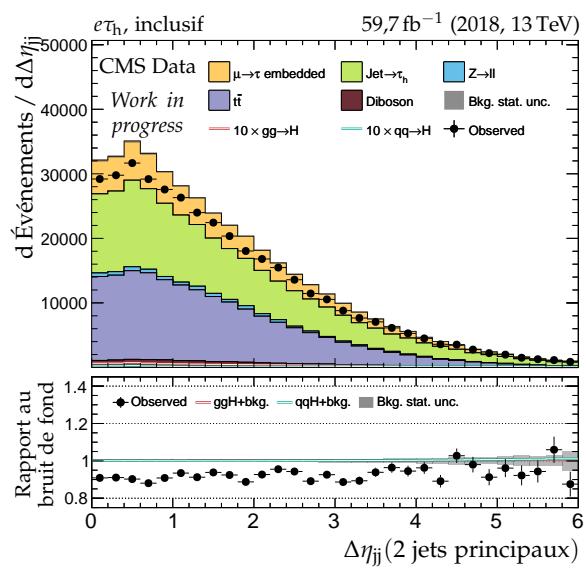
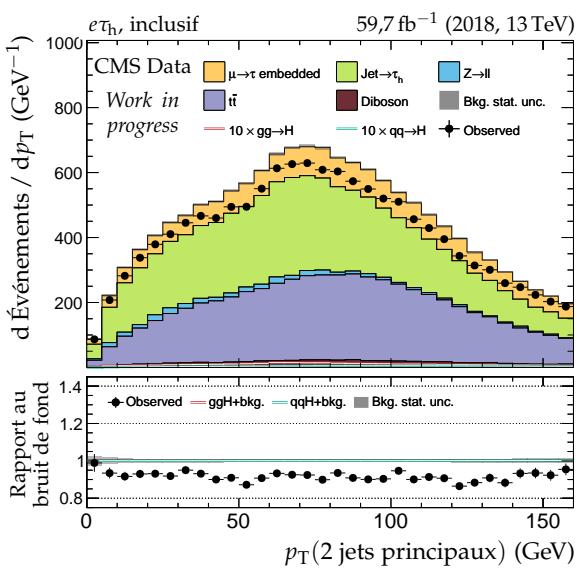
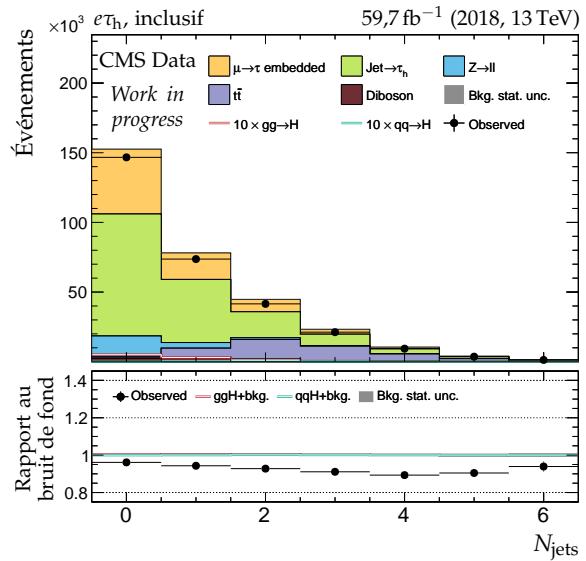
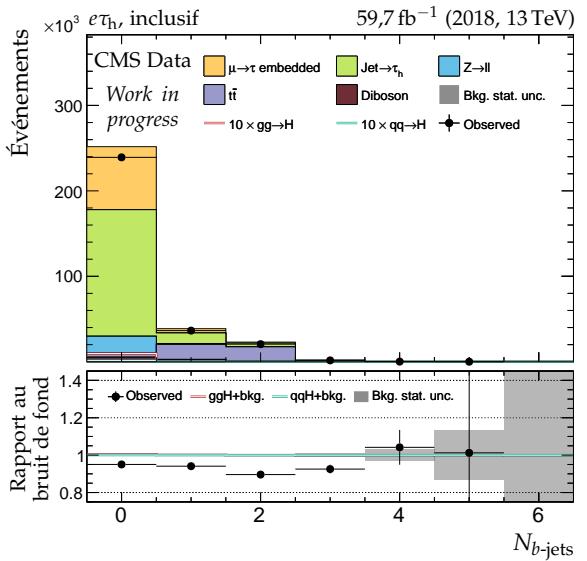
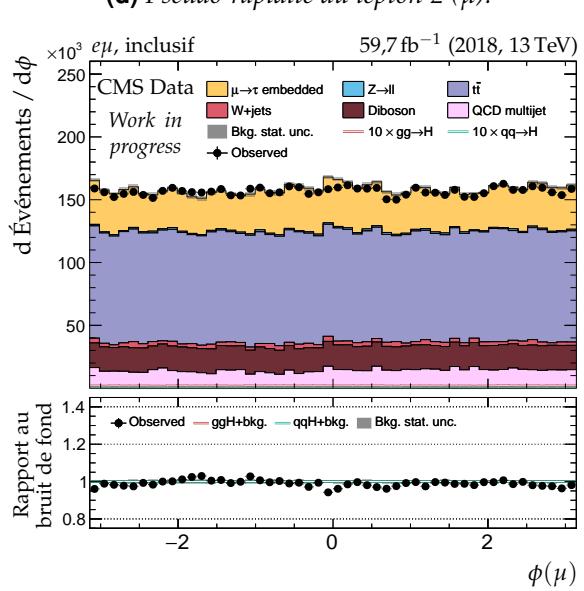
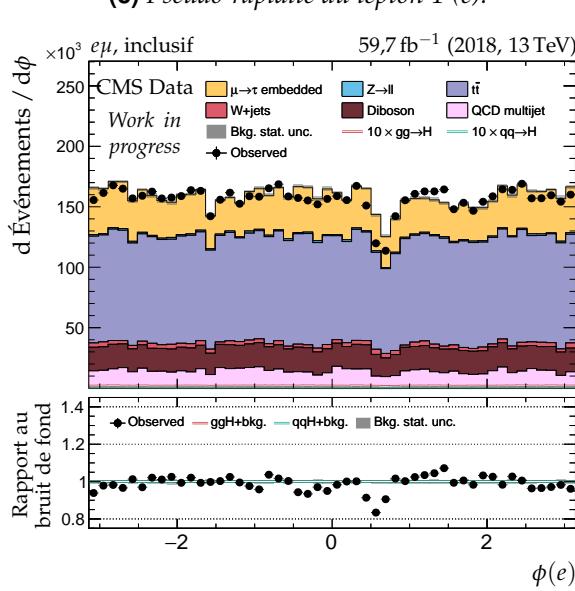
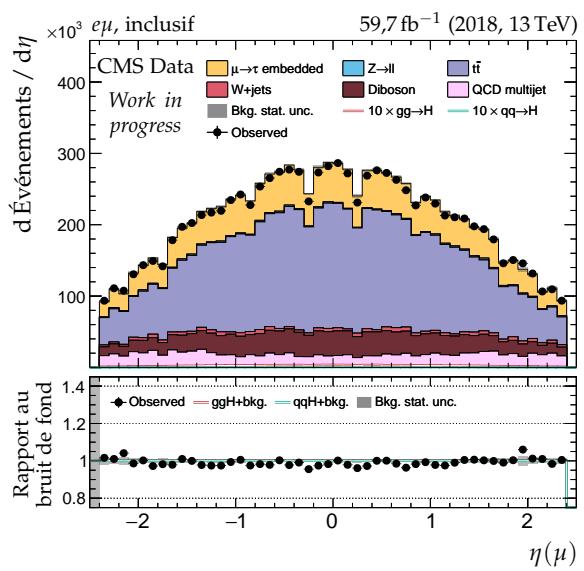
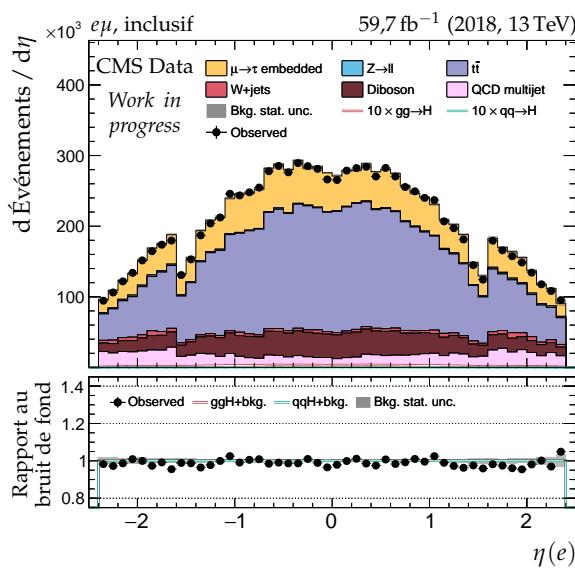
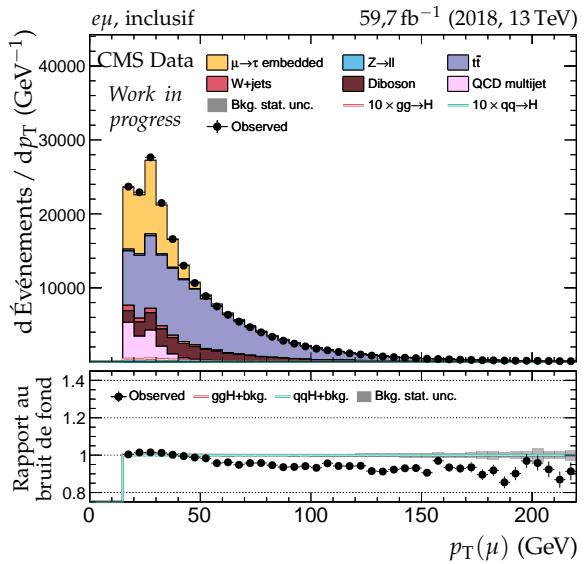
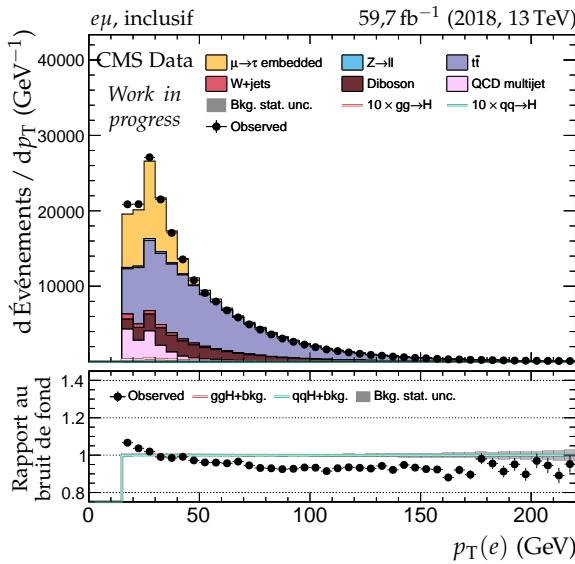


Figure X.66 – Canal $e\tau_h$, 2018 : nombre de jets, système des deux jets principaux et empilement.

**Figure X.67 – Canal $e\mu$, 2018 : cinématique des leptons (e, μ).**

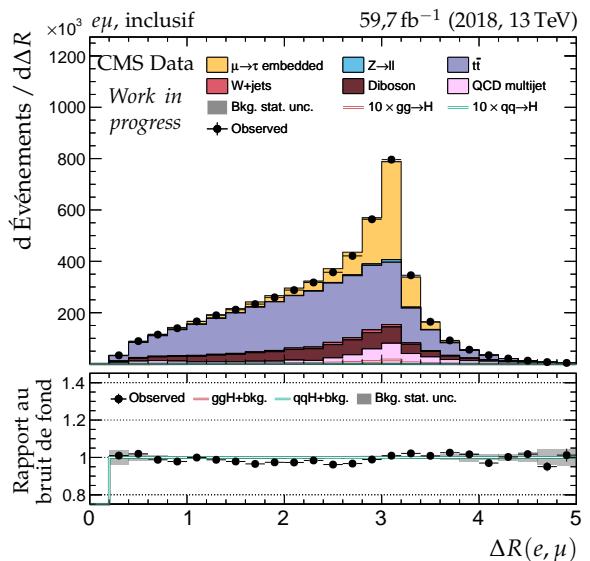
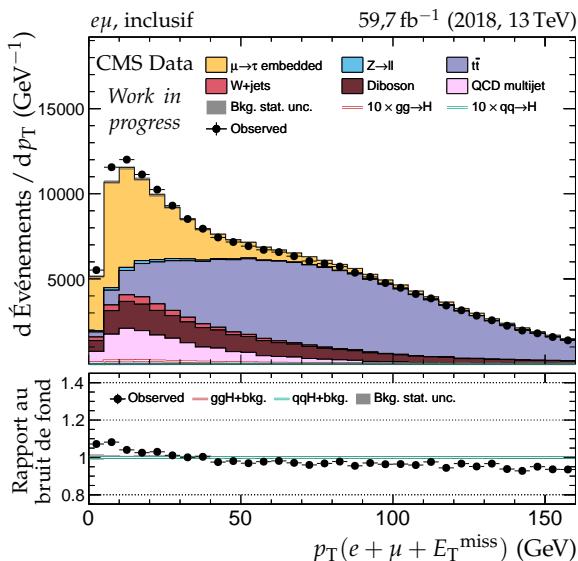
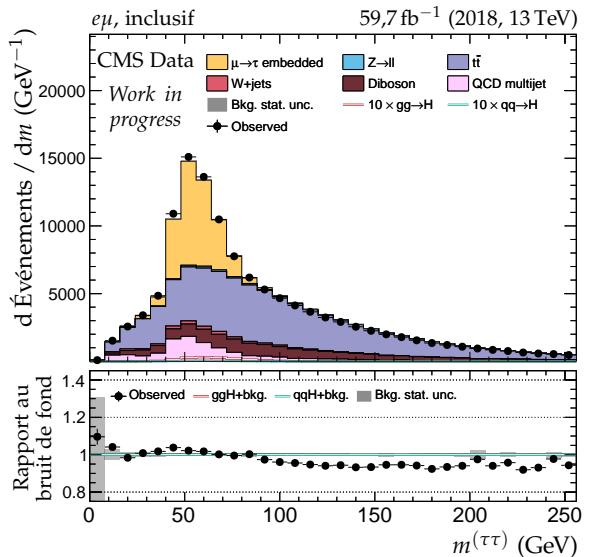
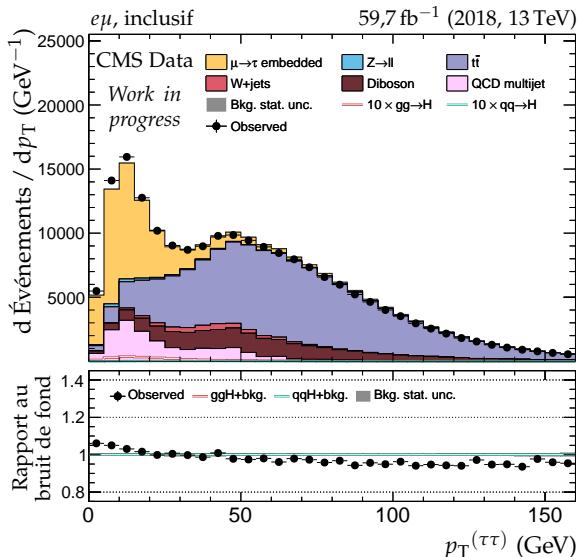
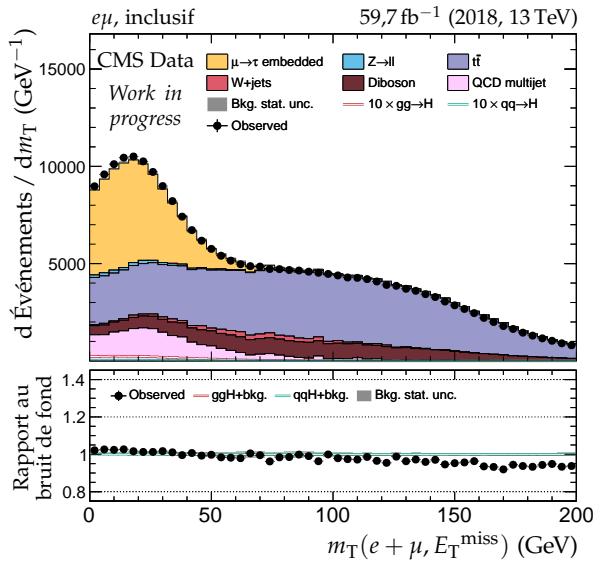
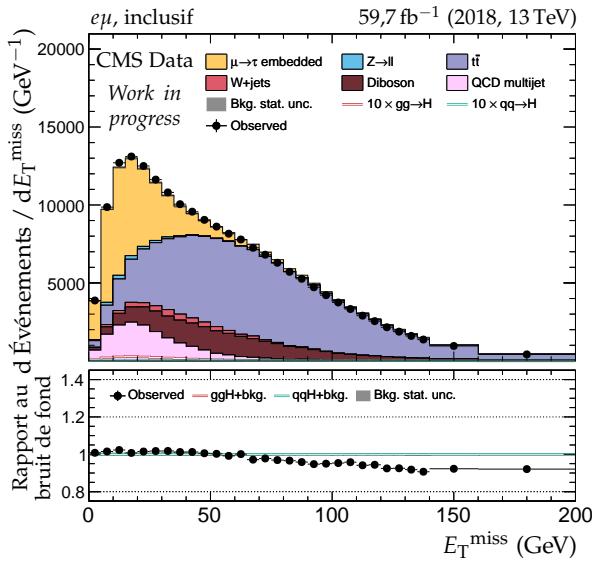


Figure X.68 – Canal $e\mu$, 2018 : dilepton et énergie transverse manquante.

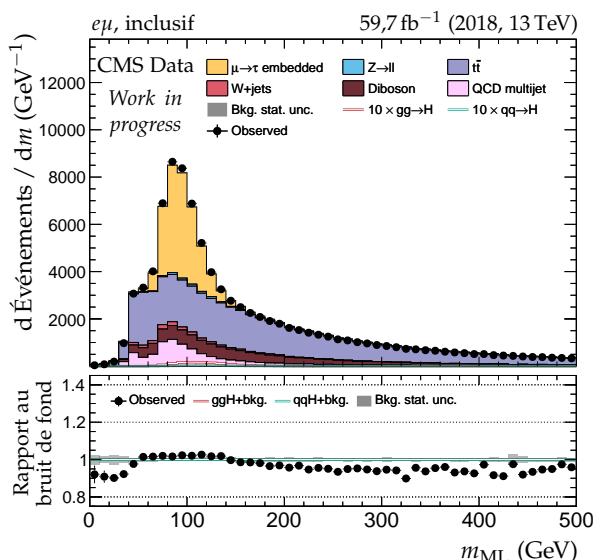
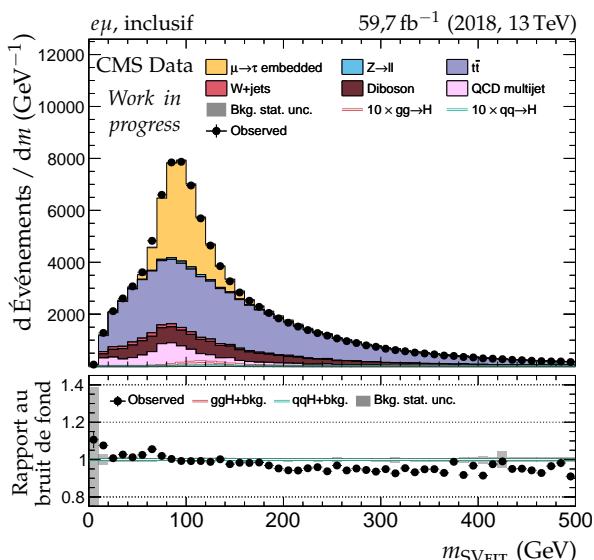
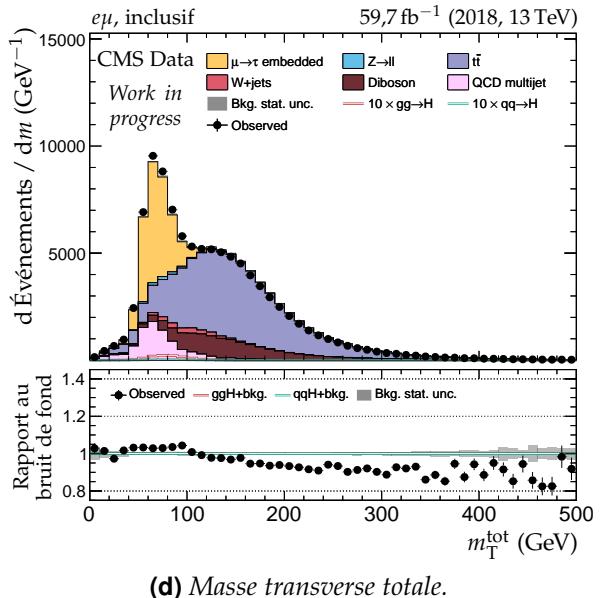
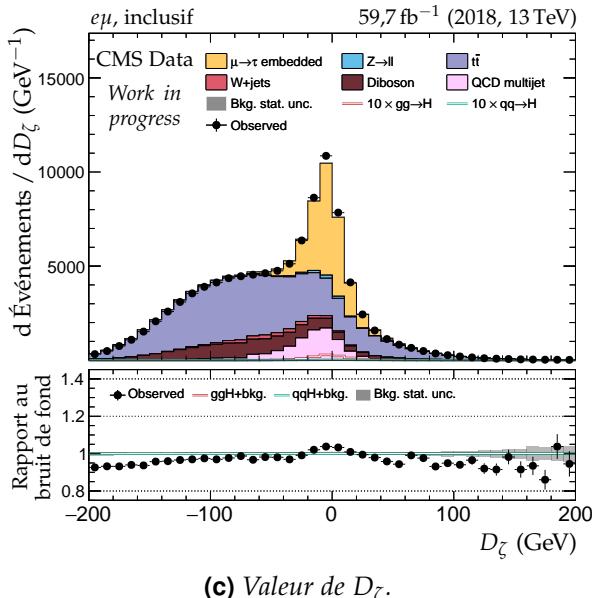
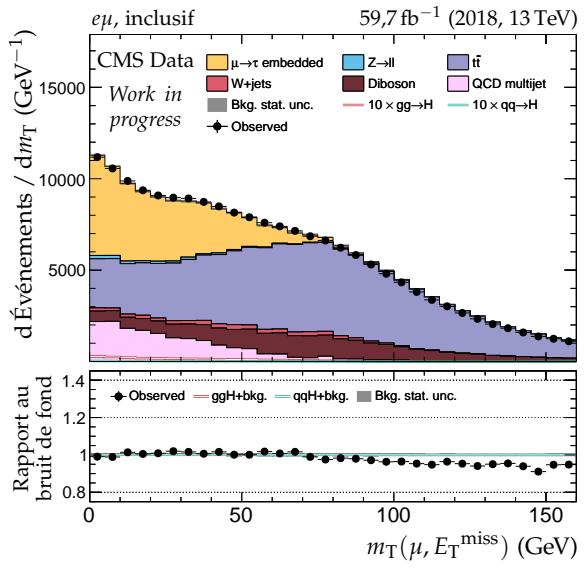
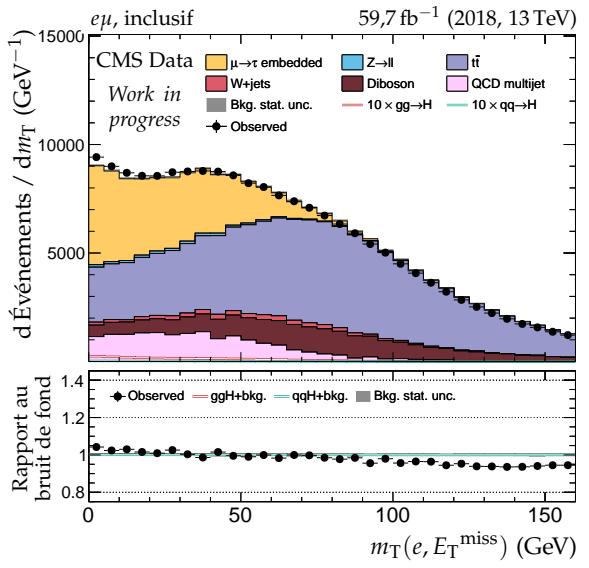


Figure X.69 – Canal $e\mu$, 2018 : masses transverses, D_ζ et masses.

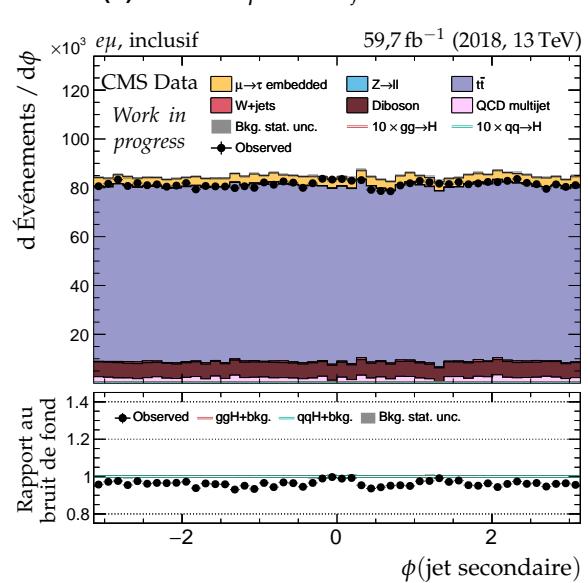
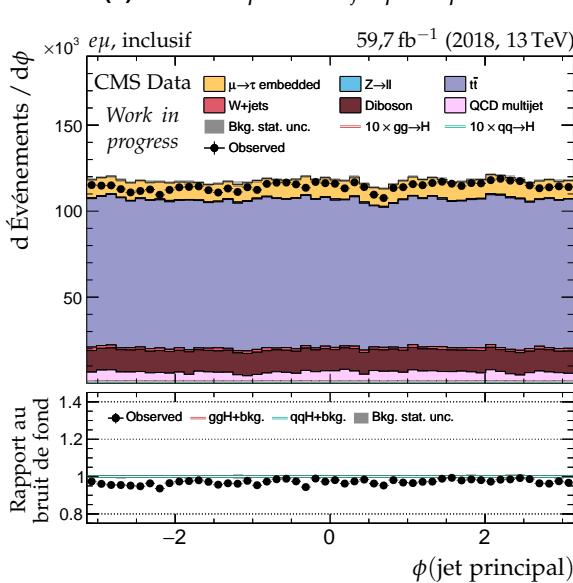
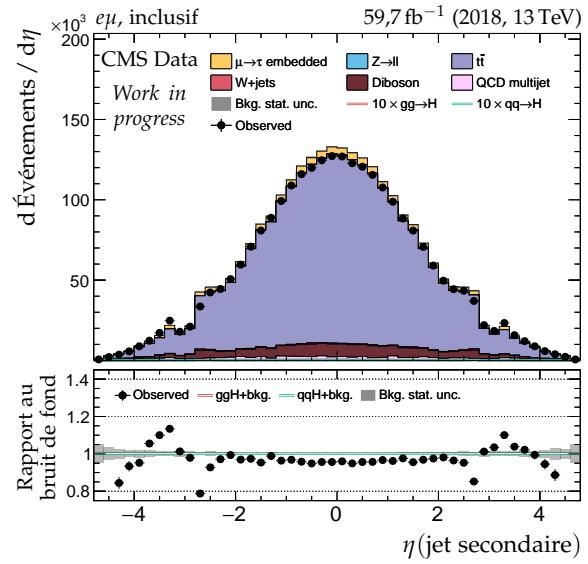
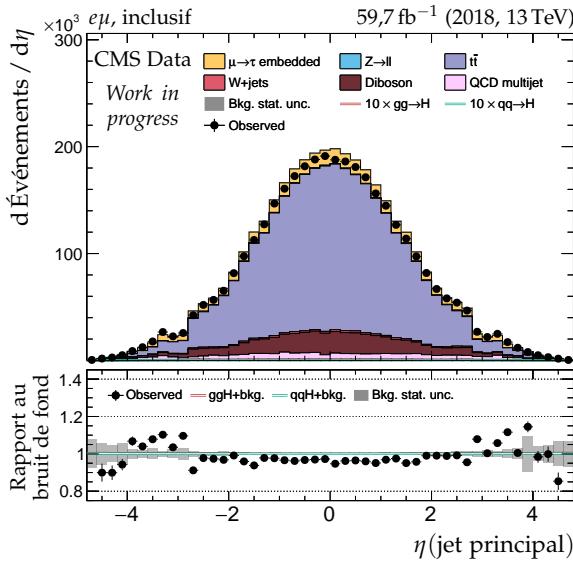
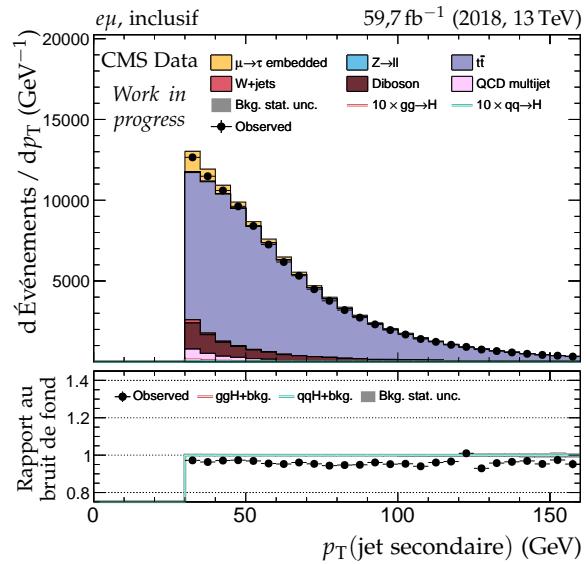
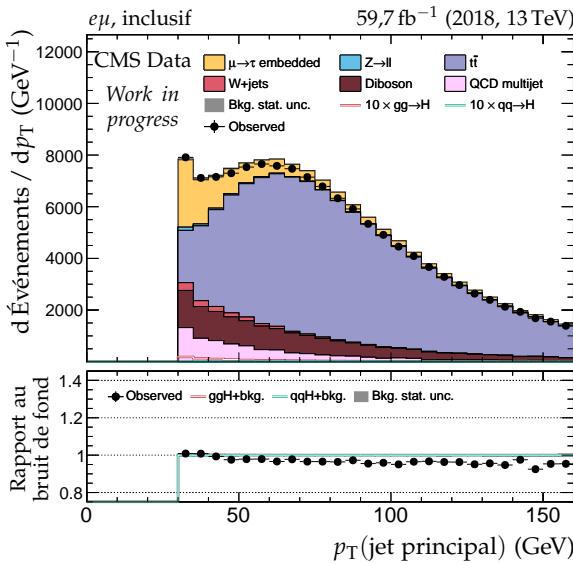


Figure X.70 – Canal $e\mu$, 2018 : cinématique des deux jets principaux.

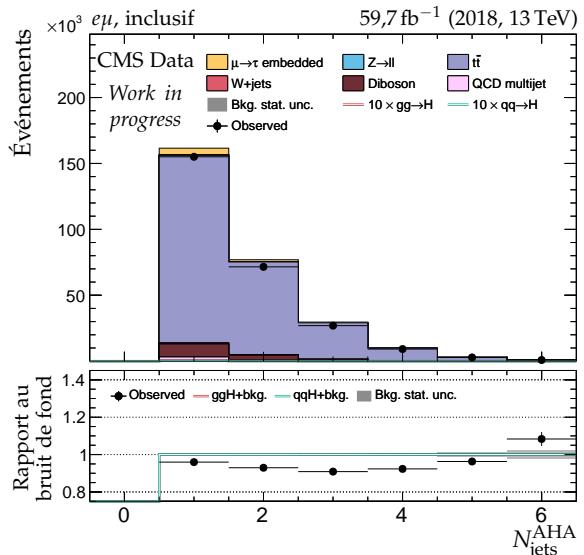
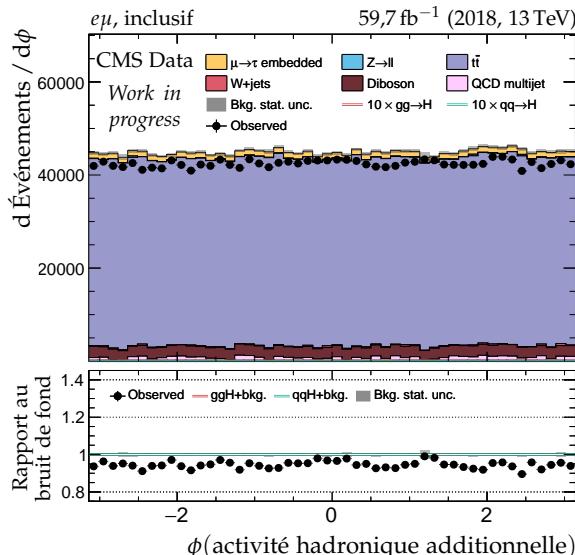
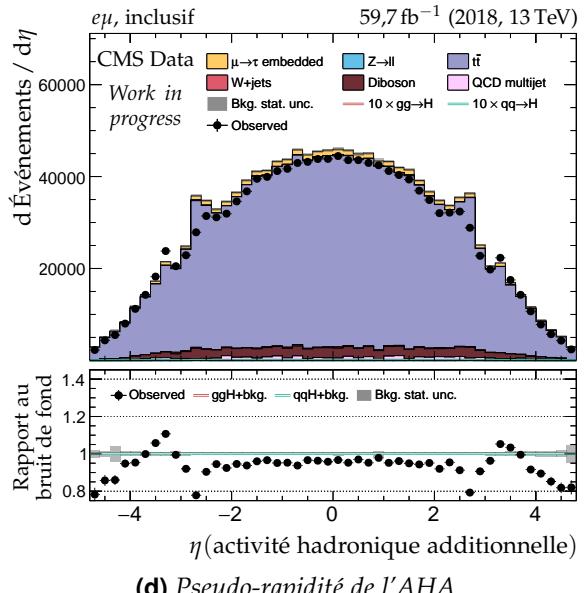
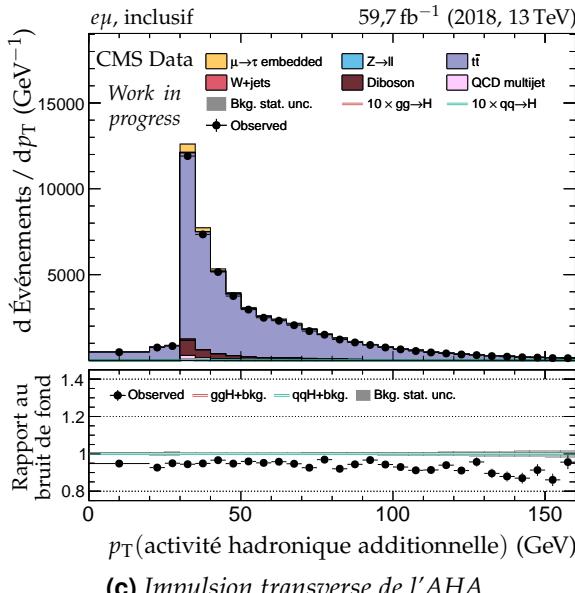
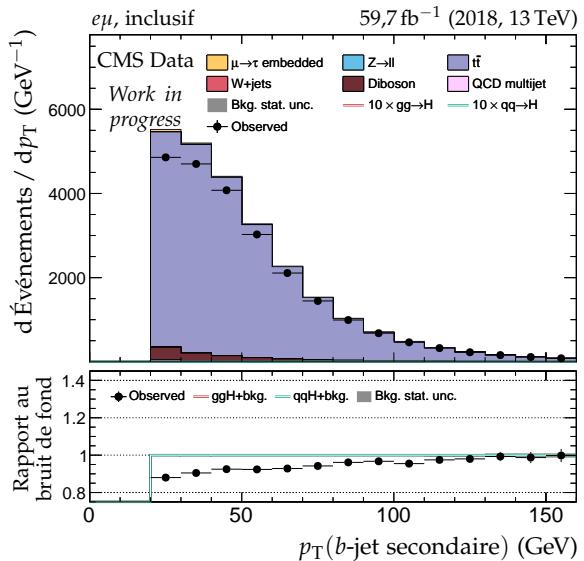
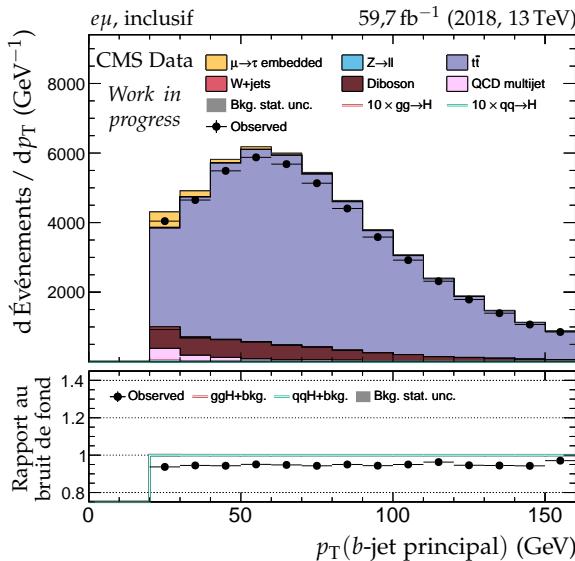
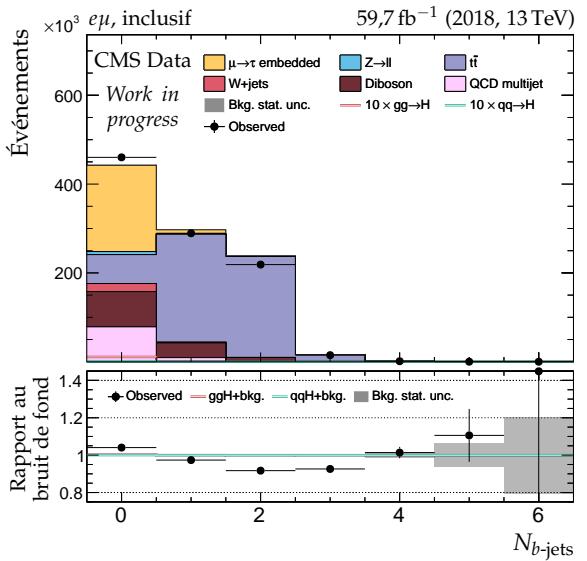
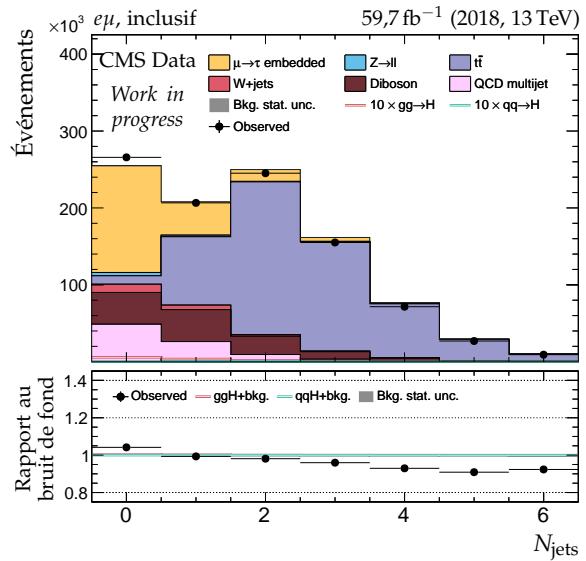
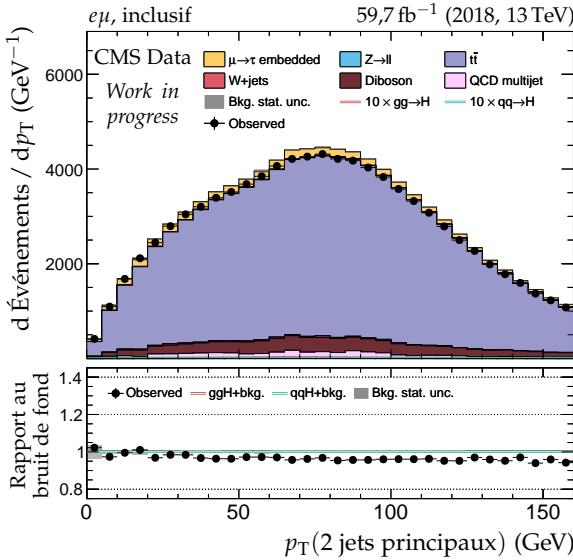


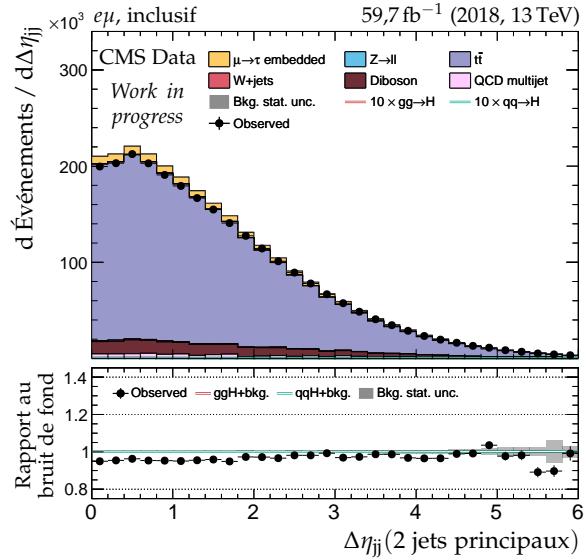
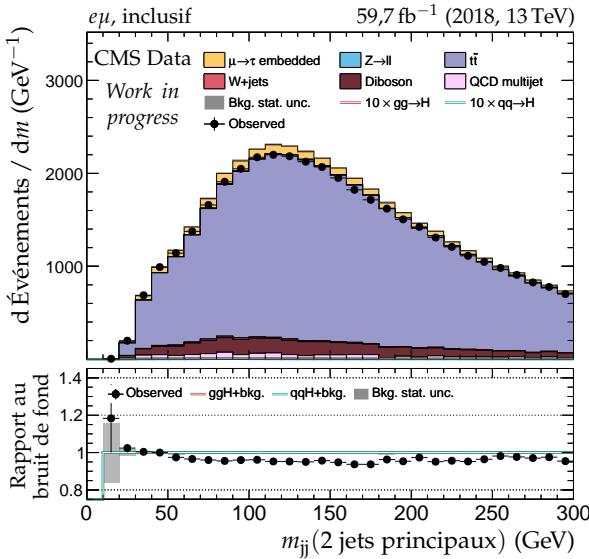
Figure X.71 – Canal $e\mu$, 2018 : b-jets et activité hadronique additionnelle.

(a) Nombre de b -jets.

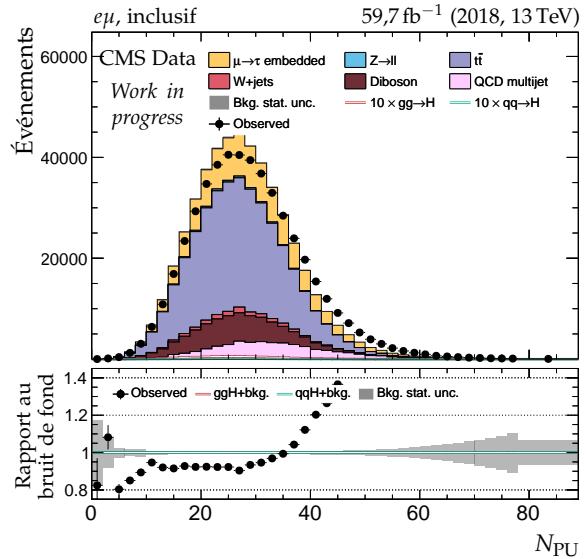
(b) Nombre de jets.



(c) Impulsion transverse du système des deux jets.

(d) Distance en η entre les deux jets.

(e) Masse invariante du système des deux jets.



(f) Nombre de vertex d'empilement.

Figure X.72 – Canal $e\mu$, 2018 : nombre de jets, système des deux jets principaux et empilement.

