

Appendix A

Single Electron Trigger Scale Factors

The methodology and measurement of single electron trigger efficiencies and scale factors by means of the $W \rightarrow e\nu$ tag and probe method is described in details in Sect. 4.4. The results, the efficiencies and the scale factors in bins of $E_T \times |\eta|$, for the trigger EF_e15_medium¹ are summarised in Table A.1.

Table A.1 Single electron trigger efficiencies in % for data (ϵ_{data}) and Monte Carlo simulations (ϵ_{MC}) together with scale factors (SF) for trigger EF_e15_medium in bins of $E_T \times |\eta|$

		$ \eta \in (0.0, 0.8)$	$ \eta \in (0.8, 1.37)$	$ \eta \in (1.52, 2.47)$
$E_T \in (17, 20)$ GeV	ϵ_{data}	98.17 ± 0.21	96.72 ± 0.36	95.95 ± 0.32
	ϵ_{MC}	99.26 ± 0.18	99.45 ± 0.19	97.02 ± 0.33
	SF	0.9889 ± 0.0027	0.9725 ± 0.0040	0.9890 ± 0.0048
$E_T \in (20, 30)$ GeV	ϵ_{data}	99.16 ± 0.03	98.60 ± 0.05	97.51 ± 0.05
	ϵ_{MC}	99.79 ± 0.02	99.64 ± 0.04	98.31 ± 0.06
	SF	0.9937 ± 0.0004	0.9896 ± 0.0006	0.9918 ± 0.0008
$E_T > 30$ GeV	ϵ_{data}	99.37 ± 0.01	99.40 ± 0.02	97.49 ± 0.03
	ϵ_{MC}	99.71 ± 0.01	99.65 ± 0.02	98.54 ± 0.04
	SF	0.9965 ± 0.0002	0.9975 ± 0.0003	0.9894 ± 0.0004

The data sample corresponds to 2.1 fb^{-1} . The total uncertainty (statistical and systematic errors summed in quadrature) is quoted

¹ The trigger EF_e15_medium searches for an electron object with transverse energy larger than 15 GeV at the event filter (EF) level.

Appendix B

Electron Isolation Scale Factors

The methodology and measurement of electron isolation criteria efficiencies and scale factors by means of the $Z \rightarrow ee$ tag and probe method is described in details in Sect. 4.5. The results, the efficiencies and the scale factors in bins of $E_T \times \eta$, for the electron isolation cuts used in the $Z \rightarrow \tau\tau$ analysis ($p_{T\text{Cone40}}/E_T < 0.06$ and $E_{T\text{Cone40}}/E_T < 0.1$) are summarised in Tables B.1 and B.2.

Table B.1 First part ($E_T < 40$ GeV): electron isolation efficiencies in % for data (ϵ_{data}) and Monte Carlo simulations (ϵ_{MC}) together with scale factors (SF) for the considered isolation criteria ($p_{T\text{Cone40}}/E_T < 0.06$ and $E_{T\text{Cone40}}/E_T < 0.1$) in bins of $E_T \times \eta$

		$E_T \in (17, 30)$	$E_T \in (30, 40)$
$\eta \in (-2.47, -2.01)$	ϵ_{data}	68.8 ± 0.7	75.8 ± 0.5
	ϵ_{MC}	75.9 ± 0.5	82.6 ± 0.4
	SF	$0.907 \pm 0.011 \pm 0.008$	$0.917 \pm 0.007 \pm 0.007$
$\eta \in (-2.01, -1.52)$	ϵ_{data}	65.5 ± 0.7	73.7 ± 0.4
	ϵ_{MC}	70.4 ± 0.5	78.2 ± 0.3
	SF	$0.930 \pm 0.011 \pm 0.006$	$0.942 \pm 0.007 \pm 0.003$
$\eta \in (-1.37, -0.8)$	ϵ_{data}	64.8 ± 0.6	74.2 ± 0.3
	ϵ_{MC}	70.8 ± 0.5	80.9 ± 0.2
	SF	$0.915 \pm 0.010 \pm 0.010$	$0.918 \pm 0.005 \pm 0.004$
$\eta \in (-0.8, -0.1)$	ϵ_{data}	72.1 ± 0.4	82.5 ± 0.2
	ϵ_{MC}	77.4 ± 0.3	86.4 ± 0.2
	SF	$0.930 \pm 0.007 \pm 0.004$	$0.954 \pm 0.003 \pm 0.001$
$\eta \in (-0.1, 0.1)$	ϵ_{data}	73.3 ± 0.8	83.8 ± 0.5
	ϵ_{MC}	78.5 ± 0.6	86.6 ± 0.3
	SF	$0.934 \pm 0.013 \pm 0.008$	$0.968 \pm 0.007 \pm 0.002$
$\eta \in (0.1, 0.8)$	ϵ_{data}	72.1 ± 0.4	83.0 ± 0.2
	ϵ_{MC}	77.4 ± 0.3	86.6 ± 0.2
	SF	$0.932 \pm 0.007 \pm 0.006$	$0.958 \pm 0.003 \pm 0.002$
$\eta \in (0.8, 1.37)$	ϵ_{data}	64.2 ± 0.6	74.9 ± 0.3
	ϵ_{MC}	72.2 ± 0.5	81.3 ± 0.2
	SF	$0.889 \pm 0.010 \pm 0.011$	$0.921 \pm 0.005 \pm 0.002$
$\eta \in (1.52, 2.01)$	ϵ_{data}	66.8 ± 0.6	74.9 ± 0.4
	ϵ_{MC}	70.3 ± 0.5	78.3 ± 0.3
	SF	$0.950 \pm 0.012 \pm 0.008$	$0.956 \pm 0.007 \pm 0.005$
$\eta \in (2.01, 2.47)$	ϵ_{data}	69.1 ± 0.7	76.5 ± 0.5
	ϵ_{MC}	76.0 ± 0.5	82.8 ± 0.4
	SF	$0.909 \pm 0.011 \pm 0.015$	$0.924 \pm 0.007 \pm 0.002$

The data sample corresponds to 1.3 fb^{-1} . The statistical uncertainties are quoted for the efficiencies, while both statistical (first error) and systematic uncertainties (second error) are given for the scale factors

Table B.2 Second part ($E_T > 40$ GeV): electron isolation efficiencies in % for data (ϵ_{data}) and Monte Carlo simulations (ϵ_{MC}) together with scale factors (SF) for the considered isolation criteria ($p_{\text{T}}\text{Cone40}/E_T < 0.06$ and $E_{\text{T}}\text{Cone40}/E_T < 0.1$) in bins of $E_T \times \eta$

		$E_T \in (40, 50)$	$E_T > 50$
$\eta \in (-2.47, -2.01)$	ϵ_{data}	83.1 ± 0.4	87.5 ± 0.7
	ϵ_{MC}	88.2 ± 0.3	92.1 ± 0.5
	SF	$0.942 \pm 0.006 \pm 0.002$	$0.951 \pm 0.009 \pm 0.005$
$\eta \in (-1.52, -2.01)$	ϵ_{data}	83.9 ± 0.3	89.4 ± 0.5
	ϵ_{MC}	86.5 ± 0.3	91.3 ± 0.4
	SF	$0.970 \pm 0.005 \pm 0.001$	$0.979 \pm 0.007 \pm 0.004$
$\eta \in (-1.37, -0.8)$	ϵ_{data}	83.3 ± 0.2	89.7 ± 0.4
	ϵ_{MC}	89.0 ± 0.2	93.6 ± 0.2
	SF	$0.936 \pm 0.003 \pm 0.004$	$0.958 \pm 0.004 \pm 0.001$
$\eta \in (-0.8, -0.1)$	ϵ_{data}	89.5 ± 0.2	94.3 ± 0.2
	ϵ_{MC}	92.7 ± 0.1	95.9 ± 0.2
	SF	$0.966 \pm 0.002 \pm 0.001$	$0.984 \pm 0.003 \pm 0.002$
$\eta \in (-0.1, 0.1)$	ϵ_{data}	90.2 ± 0.3	94.4 ± 0.5
	ϵ_{MC}	93.1 ± 0.2	96.3 ± 0.3
	SF	$0.969 \pm 0.004 \pm 0.001$	$0.980 \pm 0.006 \pm 0.005$
$\eta \in (0.1, 0.8)$	ϵ_{data}	89.8 ± 0.2	94.2 ± 0.2
	ϵ_{MC}	92.7 ± 0.1	96.2 ± 0.1
	SF	$0.969 \pm 0.002 \pm 0.001$	$0.980 \pm 0.003 \pm 0.001$
$\eta \in (0.8, 1.37)$	ϵ_{data}	84.0 ± 0.3	90.5 ± 0.4
	ϵ_{MC}	88.8 ± 0.2	94.0 ± 0.2
	SF	$0.946 \pm 0.004 \pm 0.001$	$0.963 \pm 0.005 \pm 0.006$
$\eta \in (1.52, 2.01)$	ϵ_{data}	84.0 ± 0.3	90.5 ± 0.5
	ϵ_{MC}	86.8 ± 0.3	91.6 ± 0.4
	SF	$0.968 \pm 0.005 \pm 0.001$	$0.988 \pm 0.007 \pm 0.001$
$\eta \in (2.01, 2.47)$	ϵ_{data}	82.6 ± 0.4	88.5 ± 0.7
	ϵ_{MC}	88.7 ± 0.3	92.8 ± 0.5
	SF	$0.930 \pm 0.006 \pm 0.004$	$0.954 \pm 0.008 \pm 0.006$

The data sample corresponds to 1.3 fb^{-1} . The statistical uncertainties are quoted for the efficiencies, while both statistical (first error) and systematic uncertainties (second error) are given for the scale factors