Overview of signal, control and validation regions in the disappearing tracks search

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Weekly analysis chat

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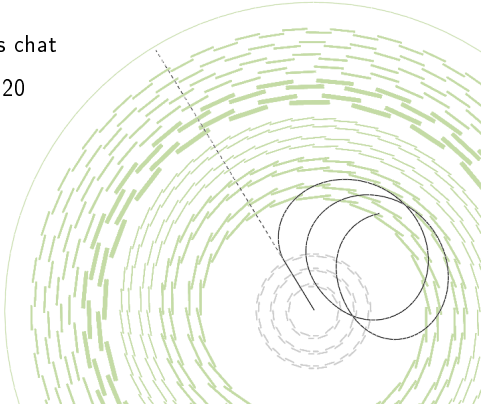


Signal regions

hadronic analysis:

hard E_T^{miss}	$n_{\text{b-tags}}$	n_{jets}	n_{short}	n_{long}	de/dx	SR
hadronic channel (n_μ=0, n_e=0)						
150-300	0	1-3	0	1	2.0-4.0	1
					>4.0	2
			1	0	2.0-4.0	3
					>4.0	4
		≥4	0	1	2.0-4.0	5
					>4.0	6
			1	0	2.0-4.0	7
					>4.0	8
	≥1	1-3	0	1	2.0-4.0	9
					>4.0	10
			1	0	2.0-4.0	11
					>4.0	12
		≥4	0	1	2.0-4.0	13
					>4.0	14
			1	0	2.0-4.0	15
					>4.0	16
>300	any	1-3	0	1	2.0-4.0	17
					>4.0	18
			1	0	2.0-4.0	19
					>4.0	20
		≥4	0	1	2.0-4.0	21
					>4.0	22
			1	0	2.0-4.0	23
					>4.0	24

leptonic analysis:

muon channel (n_μ=1, n_e=0)						
0-150	0	≥1	0	1	2.0-4.0	25
					>4.0	26
			1	0	2.0-4.0	27
					>4.0	28
	≥1		0	1	2.0-4.0	29
					>4.0	30
			1	0	2.0-4.0	31
					>4.0	32
>150	any		0	1	2.0-4.0	33
					>4.0	34
			1	0	2.0-4.0	35
					>4.0	36
electron channel (n_e=1)						
0-150	0	≥1	0	1	2.0-4.0	37
					>4.0	38
			1	0	2.0-4.0	39
					>4.0	40
	≥1		0	1	2.0-4.0	41
					>4.0	42
			1	0	2.0-4.0	43
					>4.0	44
>150	any		0	1	2.0-4.0	45
					>4.0	46
			1	0	2.0-4.0	47
					>4.0	48

$n_{DT} \geq 2$:

- DeDx>2 MeV/cm², MHT>150 GeV (hadronic)
- DeDx>2 MeV/cm², $n_e \geq 1$ (e+DT)
- DeDx>2 MeV/cm², $n_\mu \geq 1$ (μ+DT)

Overview of control regions

choose control and validation regions orthogonal to the signal regions:

fake control regions

fake rate measurement region:

- MHT<100 GeV
- $n_{lep} = 0$

fake control region:

- same as signal region, but:
- $d_{xy} > 0.02$ cm
- no cut on BDT score and relative isolation

prompt control regions

prompt U_{highlow} measurement region:

- $n_e \geq 1$
- $m_{inv}^{l,\text{track}} = (70, 110)$ GeV
- E_{calo} sideband, $E_{\text{calo}} = (17, 35)$ GeV

prompt control region:

- same as signal region, but:
- E_{calo} sideband $E_{\text{calo}} = (17, 35)$ GeV

validation regions

low lepton m_T region:

- $n_{\text{jets}} \geq 1$
- $n_e \geq 1$ or $n_\mu \geq 1$
- $m_T^{lep} < 90$ GeV

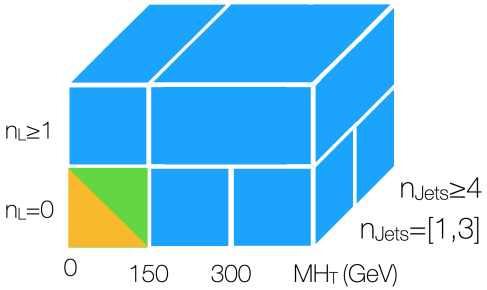
Z peak region:

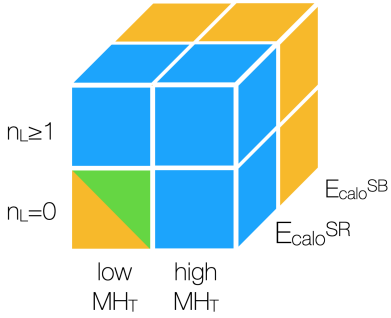
- $n_{\text{jets}} \geq 1$
- $n_e \geq 1$ or $n_\mu \geq 1$
- $m_{inv}^{l,\text{track}} = (65, 110)$ GeV
- $m_T^{lep} > 90$ GeV

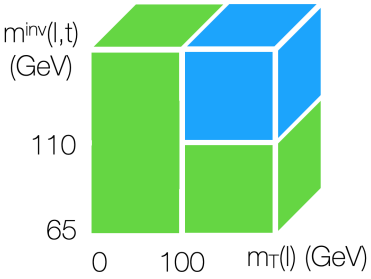
hadronic low-MHT region:

- MHT<50 GeV
- $n_{\text{lep}} = 0$
- $n_{\text{jets}} \geq 1$

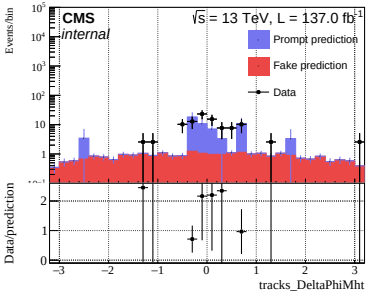
- signal regions
- control regions
- validation regions

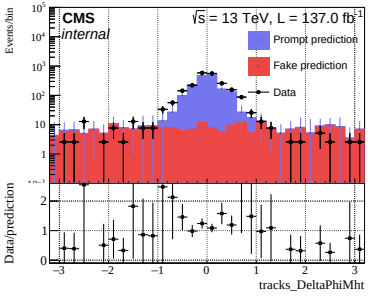






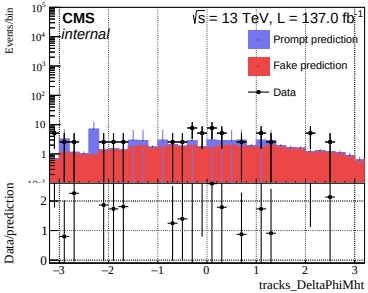
Purifying fake and prompt control regions

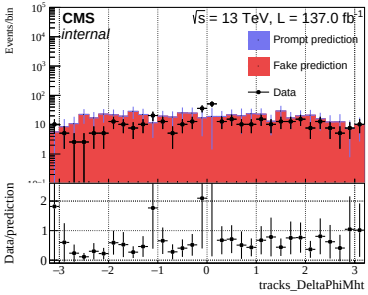




- $\Delta\Phi$(MHT, DT) distribution in the electron Z peak validation region
- top: short tracks, bottom: long tracks
- prompt: $|\Delta\Phi(\text{MHT, DT})| < 1$
- fake: $|\Delta\Phi(\text{MHT, DT})| > 1$
- $\rightarrow$ could be used to purify the control regions for the fake and prompt background estimation methods
  - reduce prompt contamination in fake CR
  - reduce fake contamination in prompt CR

Purifying fake and prompt control regions





- $\Delta\Phi$(MHT, DT) distribution
- top: short tracks, bottom: long tracks
- muon Z peak validation region, no distinguishing features