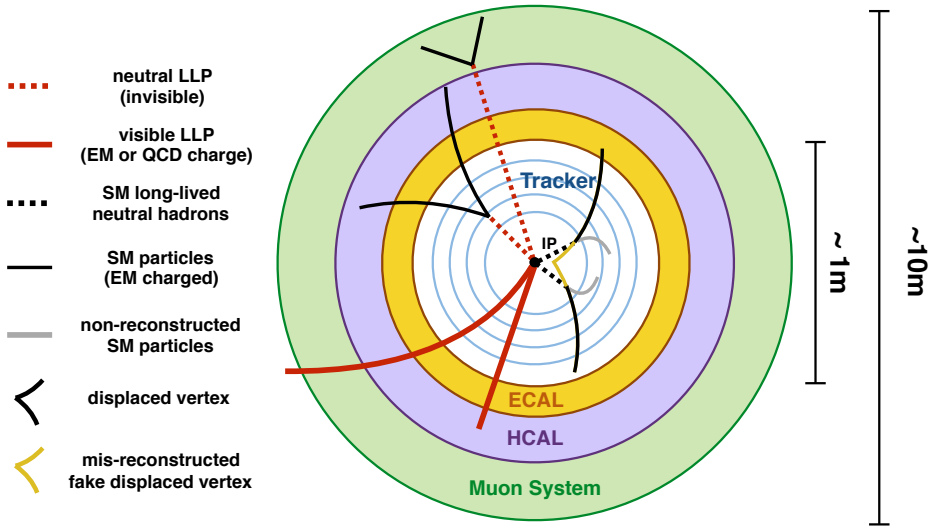
Search for long lived particles

$H \to \pi_v \pi_v \to b\bar{b}b\bar{b}$

First touchbase



HIG–EXO Meeting, 09 april 2018

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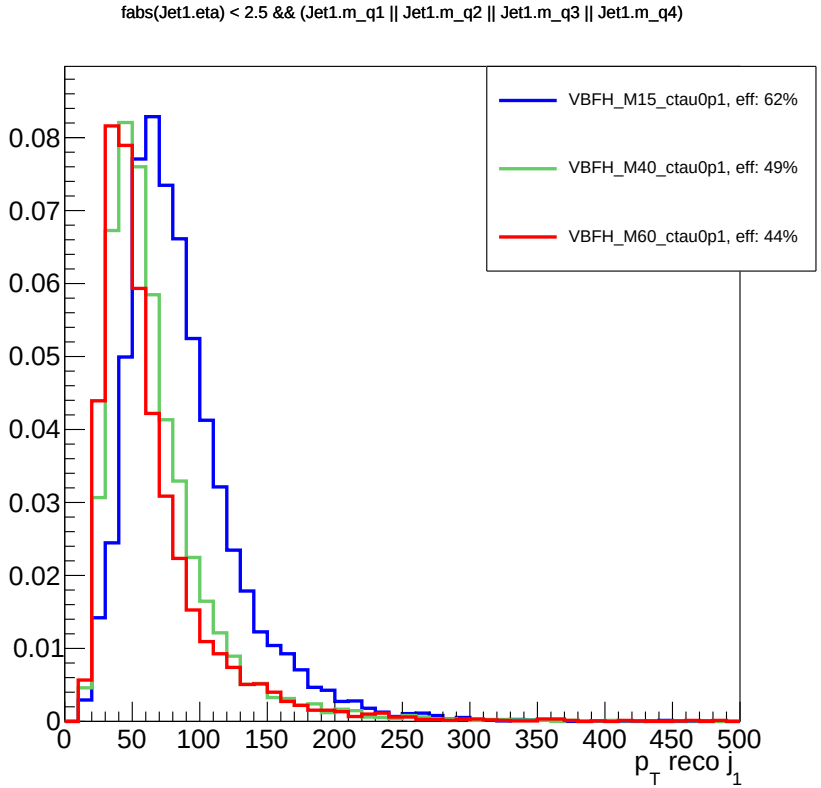
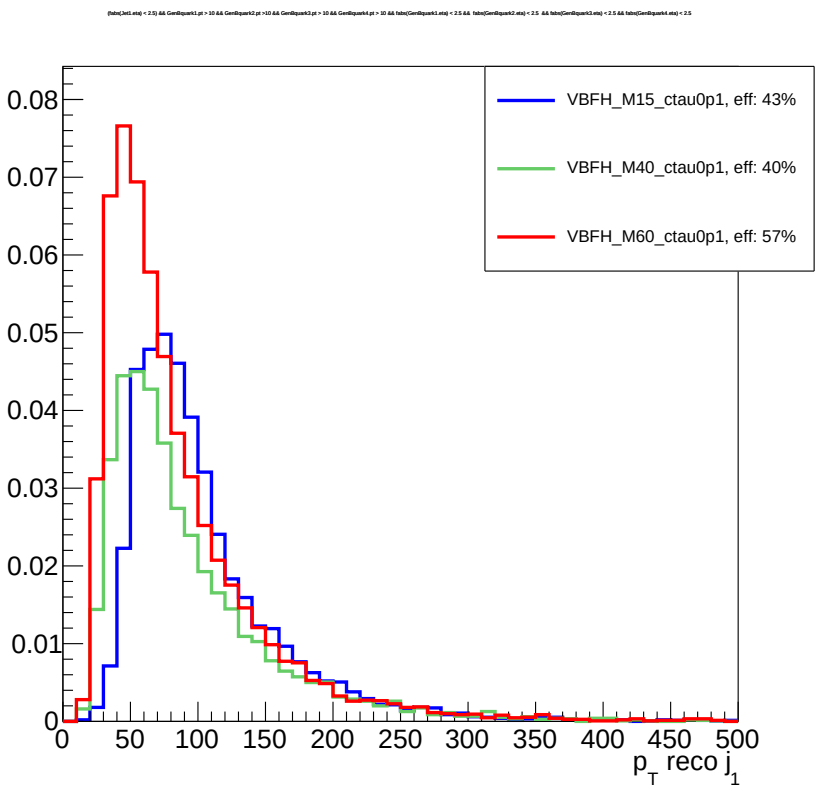
Question 1: why trigger efficiency larger for lighter m_π?

Investigation on trigger efficiency I

VBF samples, $m_\pi = 15, 40, 60$ GeV, $c\tau = 0.1$ mm

- Reco AK4 jets, $p_T > 15$ GeV, $|\eta| < 2.5$
- Events normalized to number of gen events
- Left: leading jet p_T, matched to at least 1 gen b quark, legend: efficiency
- Right: leading jet p_T, basecut applied but no matching, legend: efficiency

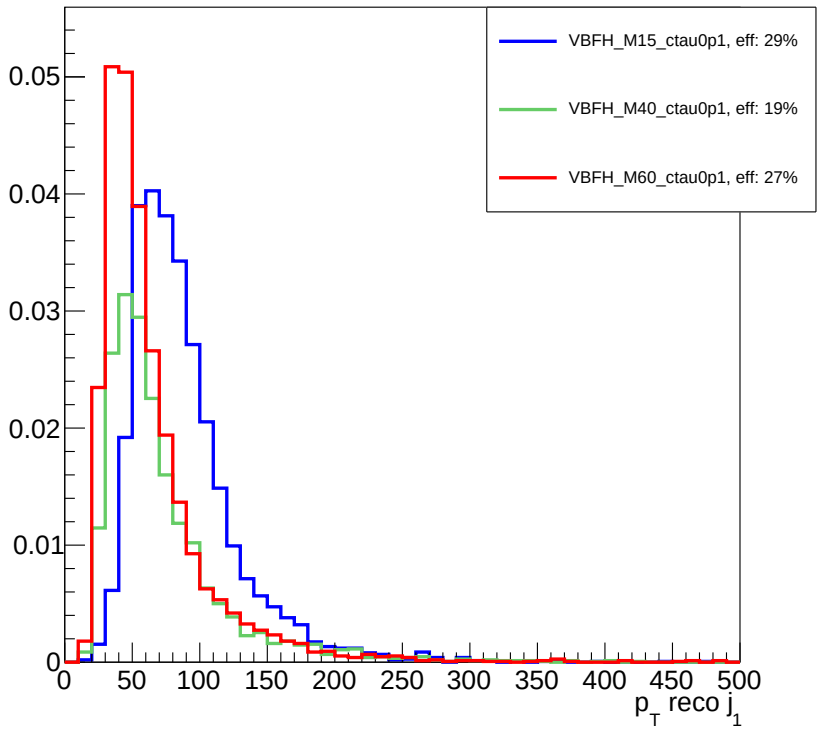


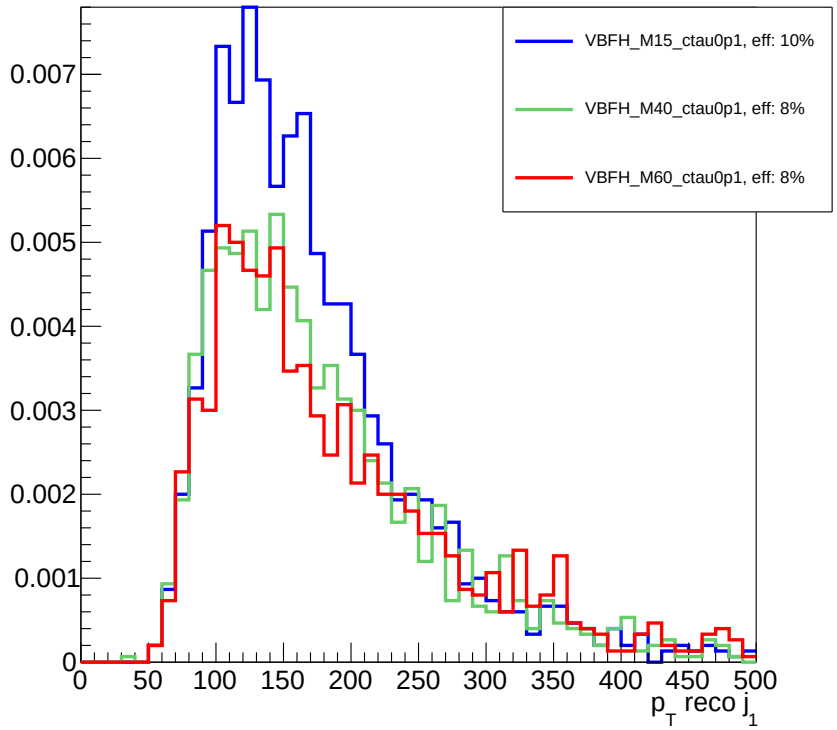


Investigation on trigger efficiency II

VBF samples, $m_\pi = 15, 40, 60$ GeV, $c\tau = 0.1$ mm

- Left: leading jet p_T, matched to at least 1 gen b quark and basecut applied
- Right: leading jet p_T, VBF triggers applied only





Answer to question 1

- At smaller m_π, the leading jet has harder p_T spectrum (due to the boost)
- To do: check if the leading jet is actually reconstructing the full π and not the single b-quark

Question 2: drop on efficiency fiducial cut at intermediate mass of π?

Investigation on 2D fiducial efficiency

VBF samples, $m_\pi = 15, 40, 60$ GeV

- Left: applying η cut one by one on each b quark
- Right: applying p_T cut one by one on each b quark, and final effect

	M 15	m40	m60		M 15	m40	m60
Eta 1	87	87	87	Pt 1	86	86	***94***
Eta 2	87	87	87	Pt 2	86	86	***94***
Eta 3	87	88	87	Pt 3	87	87	***94***
Eta 4	87	88	88	Pt 4	87	86	***94***
Eta 12	***84***	79	77	Pt 12	74	73	***88***
Eta 13	77	79	***80***	Pt 13	74	75	***88***
Eta 14	77	79	***80***	Pt 14	74	74	***88***
Eta 23	77	79	***80***	Pt 23	74	75	***88***
Eta 24	77	79	***80***	Pt 24	74	74	***88***
Eta 34	***84***	80	78	Pt 34	75	73	***88***
Eta 123	***75***	73	73	Pt 123	64	63	***82***
Eta 124	***74***	73	73	Pt 124	63	62	***82***
Eta 134	***75***	73	73	Pt 134	64	63	***82***
Eta 234	***75***	73	73	Pt 234	64	63	***82***
Eta 1234	***72***	68	69	Pt 1234	54	53	77
				All	43	40	57

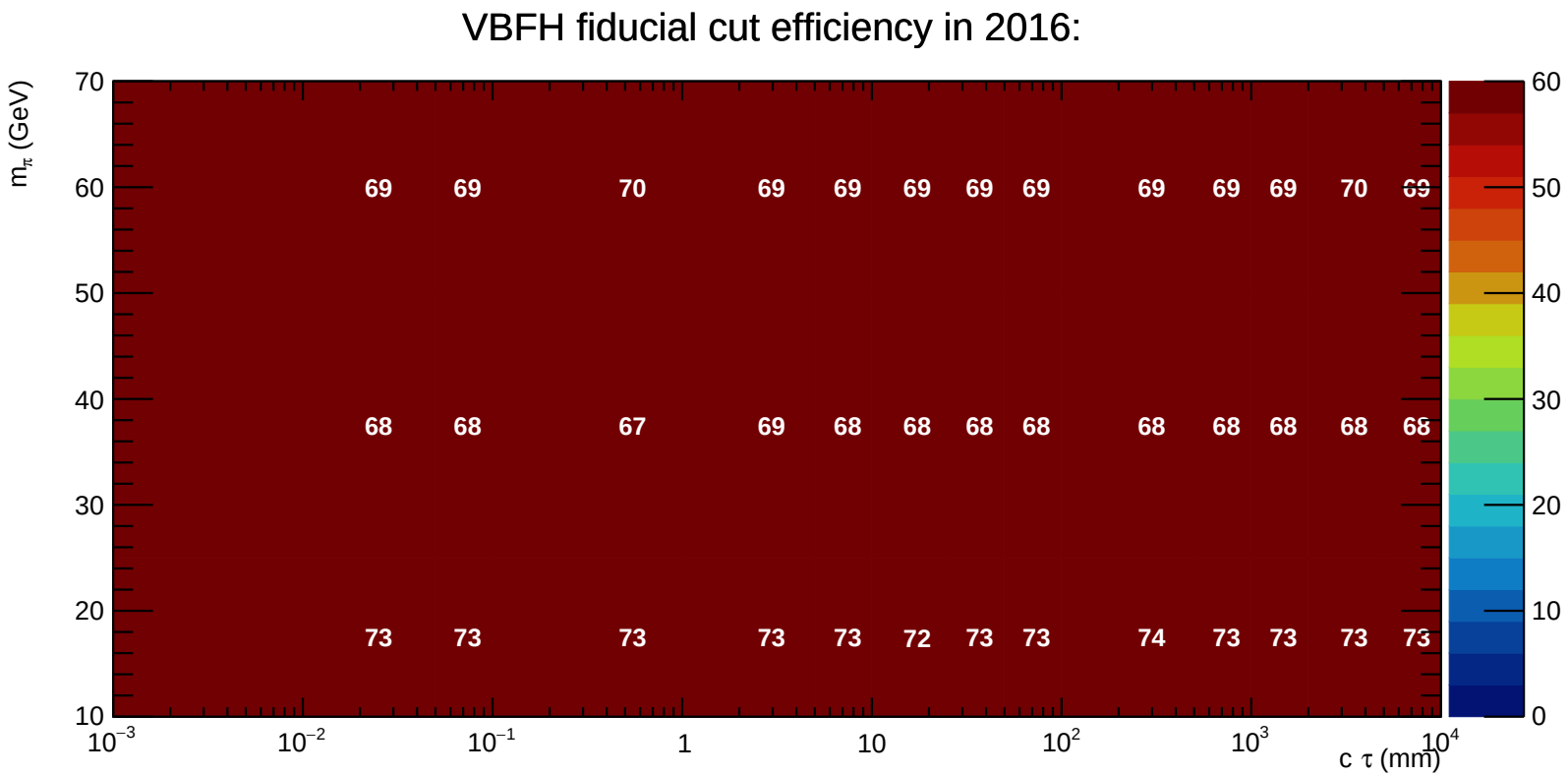
Answer to question 2

- A tradeoff between the effect of η cut (higher efficiency at $m_\pi = 15$ GeV) and of the p_T cut (higher efficiency at $m_\pi = 60$ GeV)

Additional plot

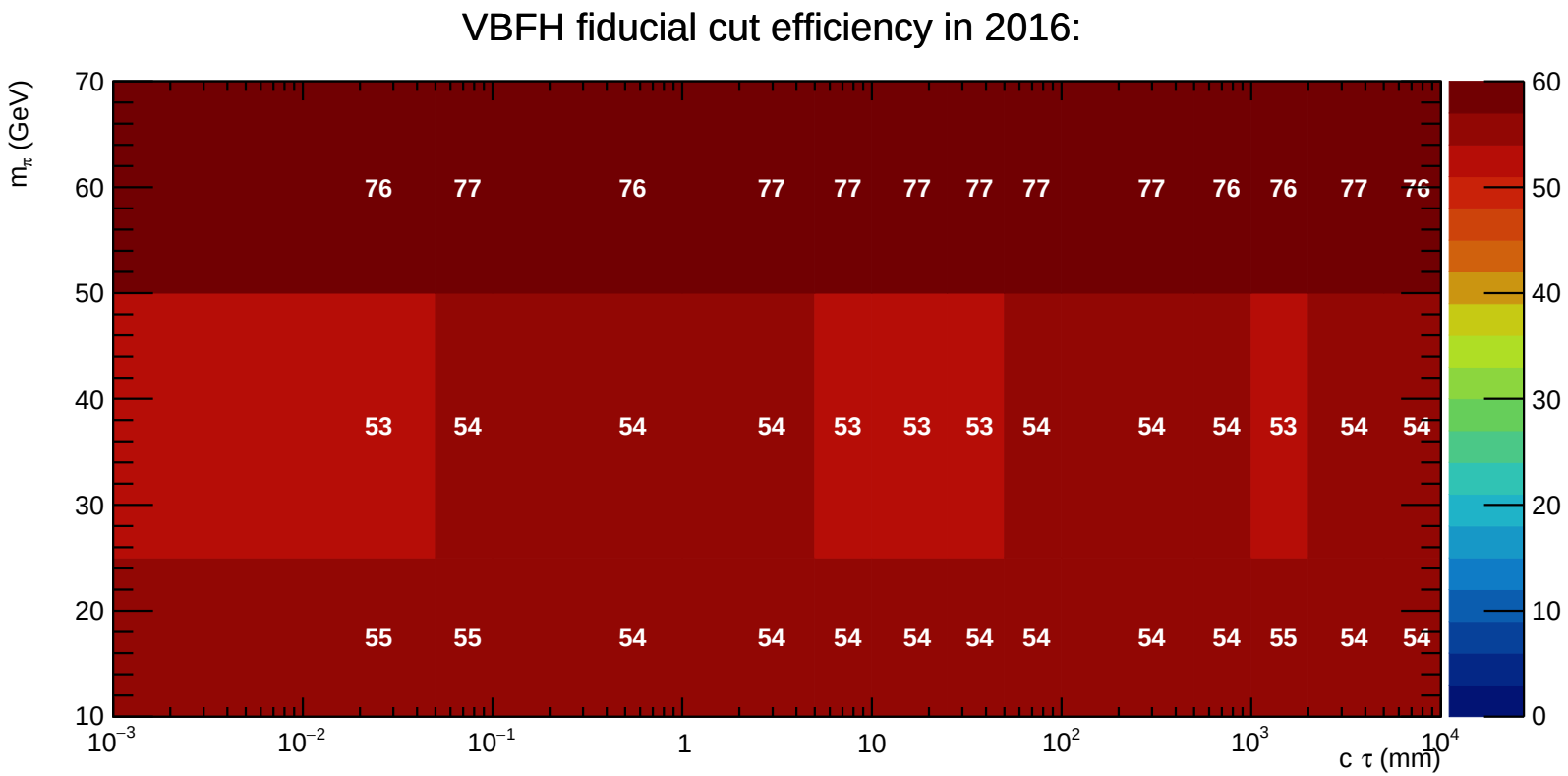
Investigation on 2D fiducial efficiency maps: cut b-quarks

VBF samples, $m_\pi = 15, 40, 60$ GeV



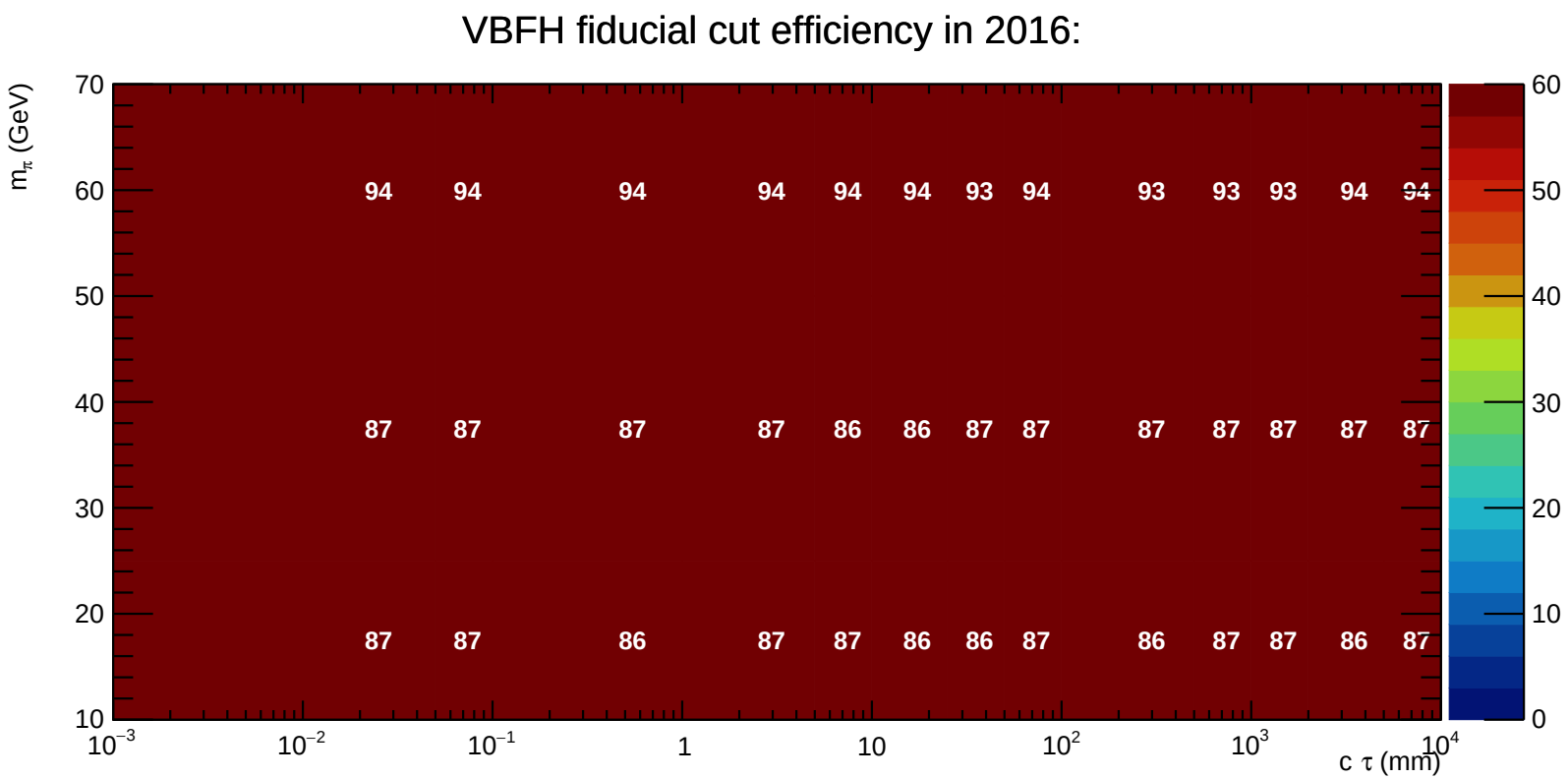
Investigation on 2D fiducial efficiency maps: cut b-quarks

VBF samples, $m_\pi = 15, 40, 60$ GeV



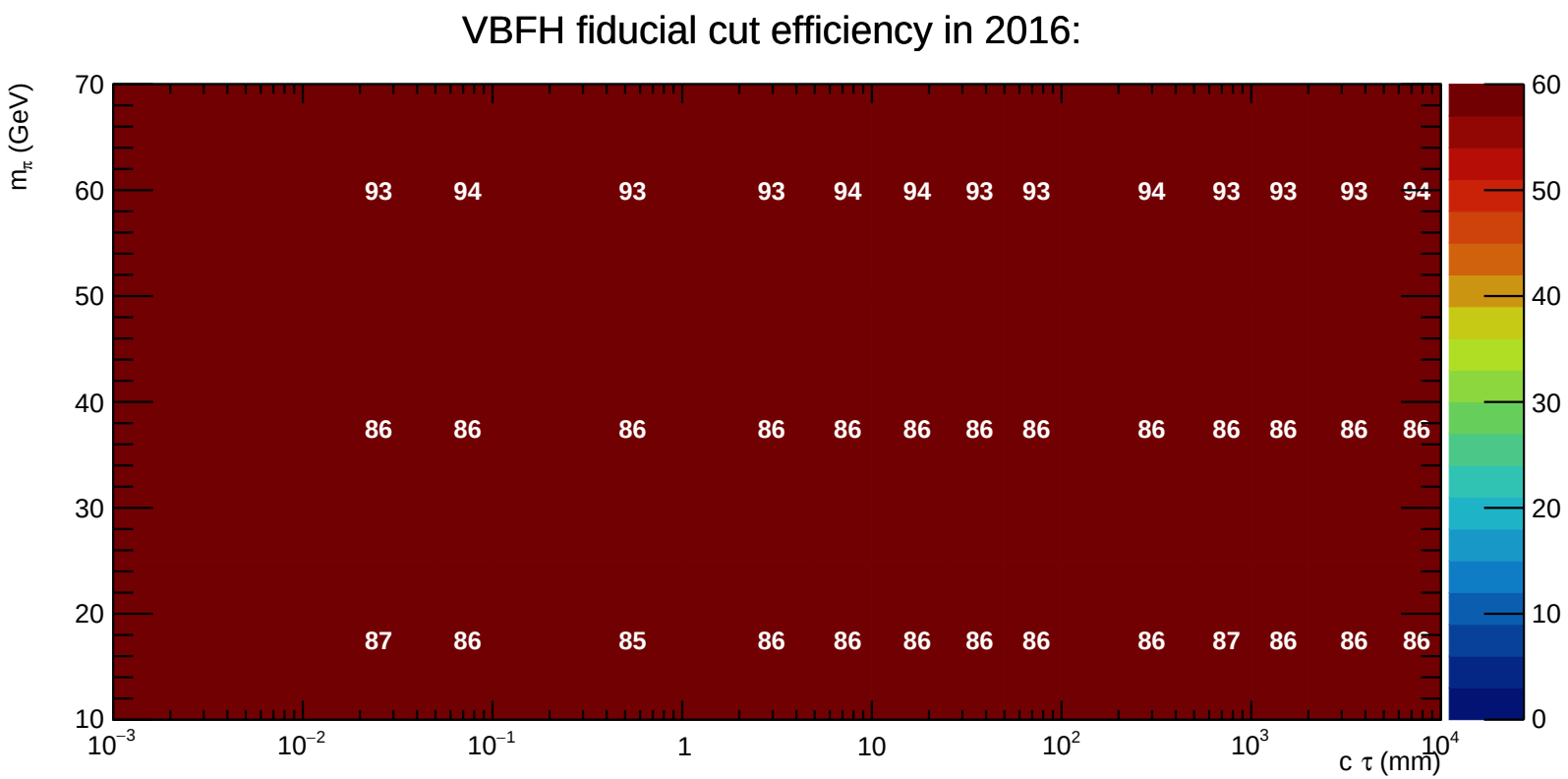
Investigation on 2D fiducial efficiency maps: cut $p_T(b_1)$

VBF samples, $m_\pi = 15, 40, 60$ GeV



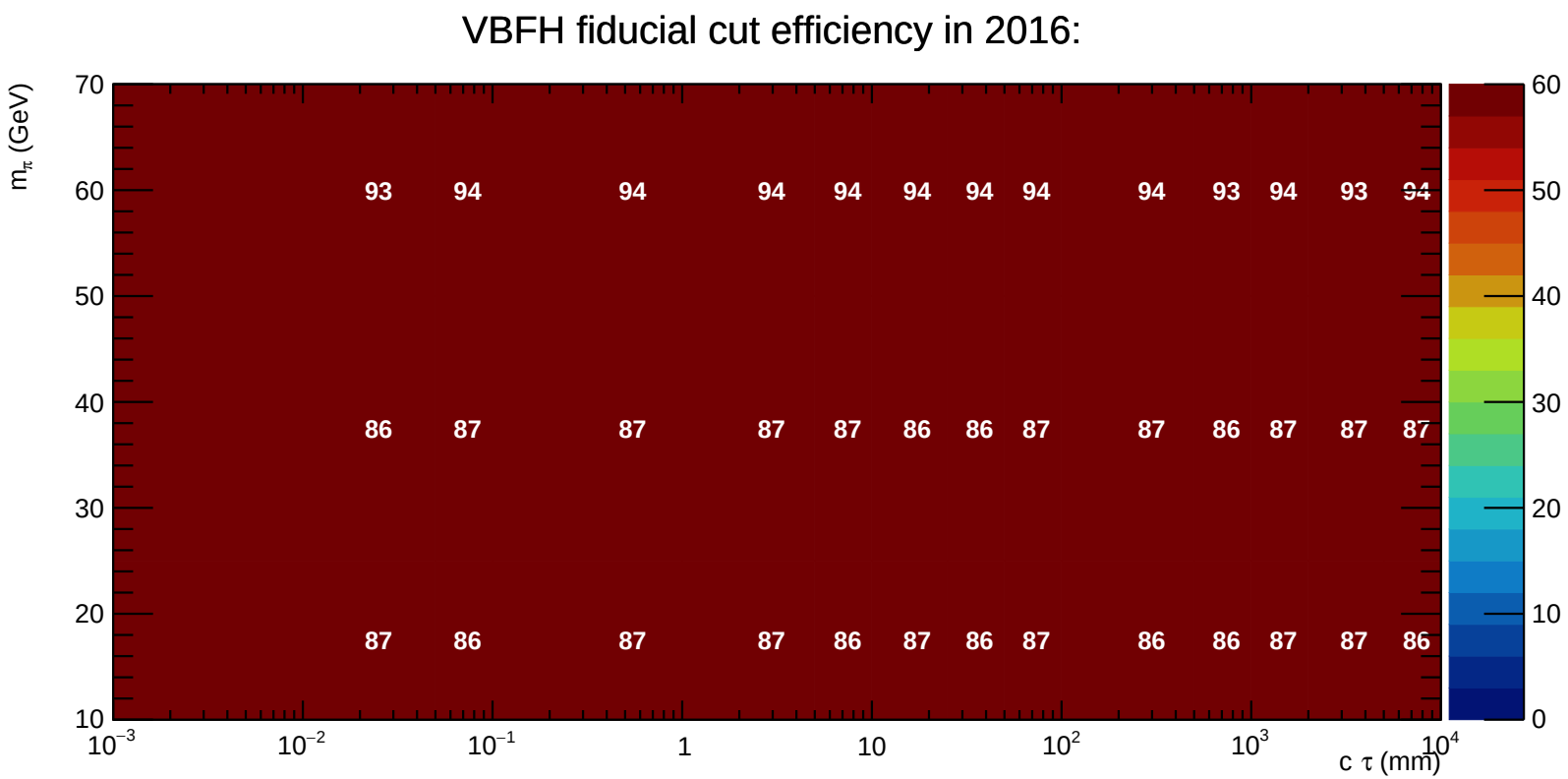
Investigation on 2D fiducial efficiency maps: cut $p_T(b_2)$

VBF samples, $m_\pi = 15, 40, 60$ GeV



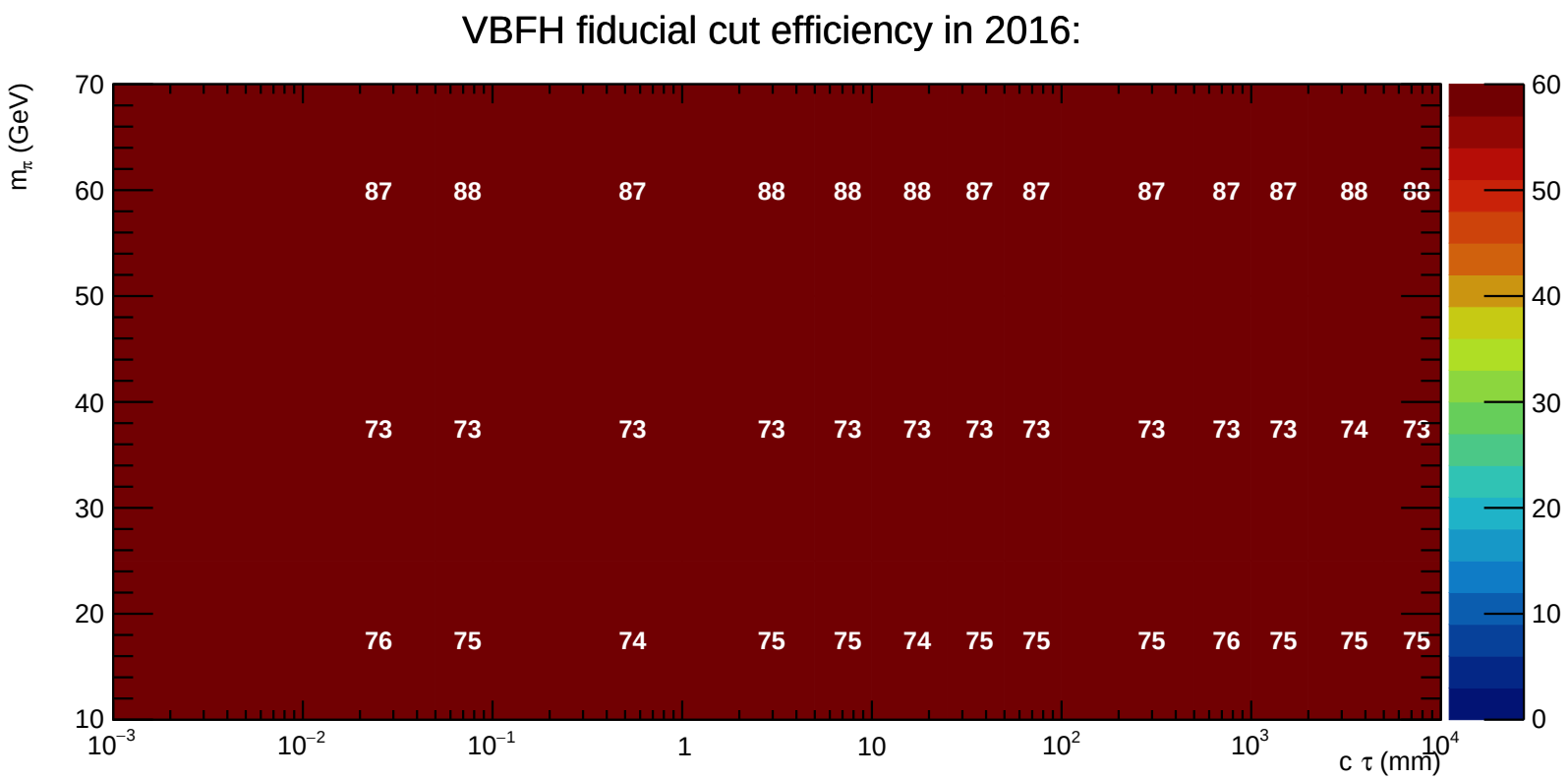
Investigation on 2D fiducial efficiency maps: cut $p_T(b_4)$

VBF samples, $m_\pi = 15, 40, 60$ GeV



Investigation on 2D fiducial efficiency maps: cut $p_T(b_1, b_2)$

VBF samples, $m_\pi = 15, 40, 60$ GeV



Investigation on 2D fiducial efficiency maps: cut $p_T(b_1, b_4)$

VBF samples, $m_\pi = 15, 40, 60$ GeV