Role of Jet or Subjet Mass

Strassler 0806.2385

$N_c=3, N_f=2$, s-channel Z'

$m_{Z'}$ = 3 TeV, m_π = 50 – 200 GeV

$(m_\pi/\Lambda)_{hidden} = (m_\pi/\Lambda)_{SM}$

Model-Quasi-Independent Fact:

A jet, or its hardest sub-jet, is often a single boosted hidden hadron!

- Self-identifying
- Self-isolating
- Self-analyzing

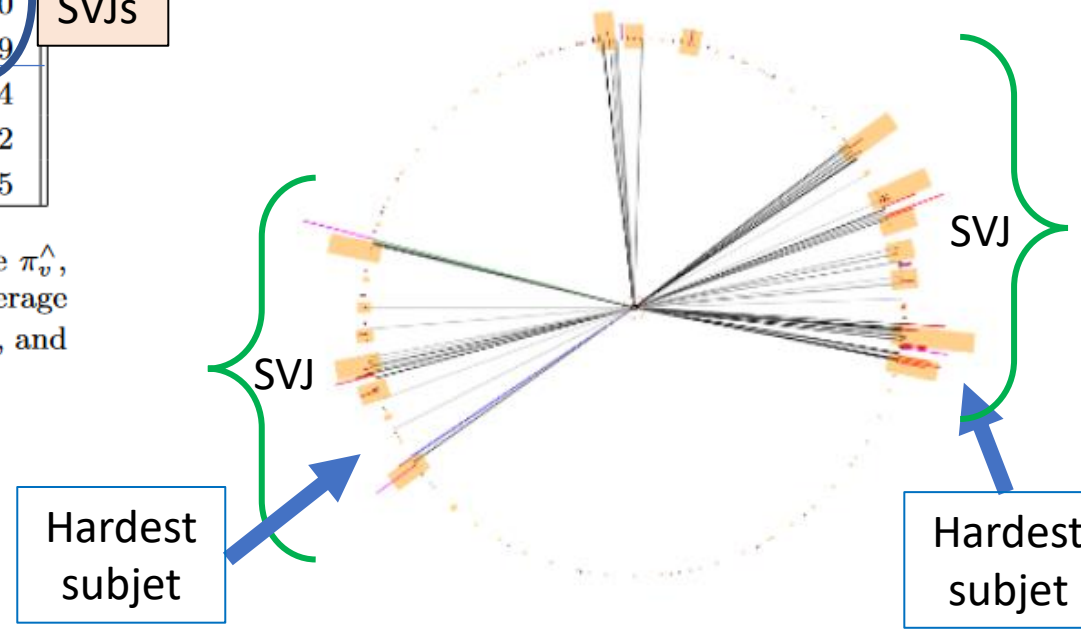
Therefore $m_{(sub)jet} \approx m_{hadron}$ in many SVJs!

Case	$\pi_v^\wedge$ stable?	m_{π_v} (GeV)	R	# π_v decays	$\hat{H}_T$ (GeV)	M_4 (GeV)	$\not{E}_T$ (GeV)
A1	Yes	50	368	4.0	667	590	318
A2	Yes	120	883	2.4	765	667	400
A3	Yes	200	1470	1.5	886	770	459
B1	No	50	368	10.3	1650	1427	214
B2	No	120	883	6.1	1835	1562	182
B3	No	200	1470	3.9	2248	1810	145

SVJs

TABLE I: The case studies, showing the stability of the $\pi_v^\wedge$, the mass of the v-pion, the ratio $R = \Lambda_v/\Lambda_{QCD}$, the average number of visible v-pion decays, and the average $\hat{H}_T$, M_4, and $\not{E}_T$.

Crude Event Display from Case A1



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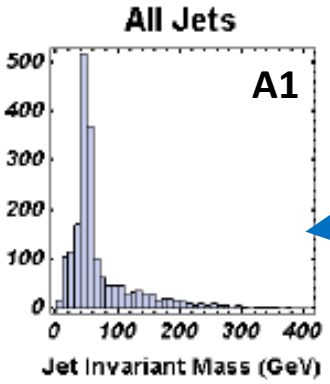
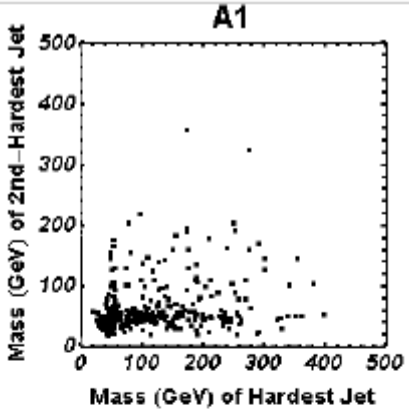
R=0.7 jets
Truth level
Signal only

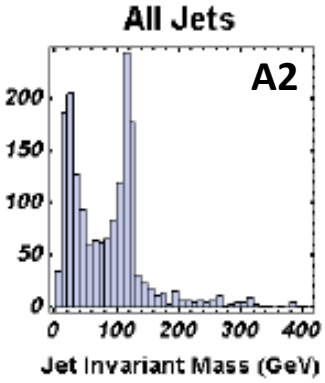
m_π = 50 GeV



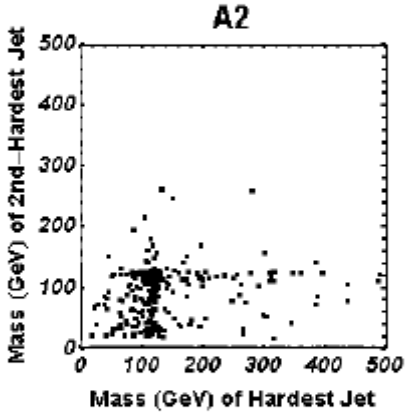
Mass of metastable hidden hadrons may show up in jet or subjet **mass spectrum**



m_π = 120 GeV

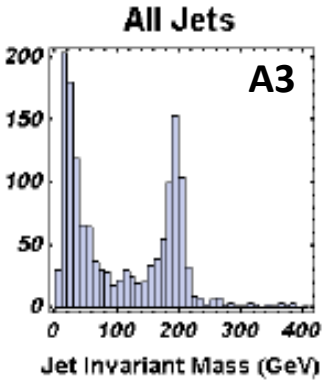


Both SVJs in an event may have jet/subjet **with the same mass**

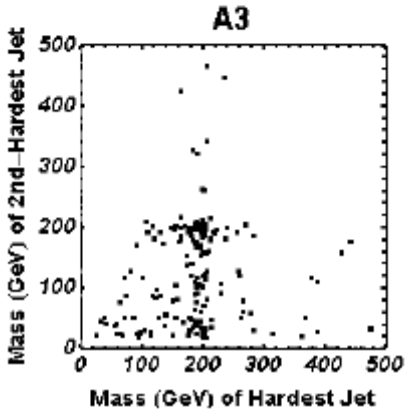


Would be convincing evidence of a signal after SVJs identified **(better than di-SVJ mass?)**

m_π = 200 GeV



Question: What is the best strategy using modern substructure methods?



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Dark Jets

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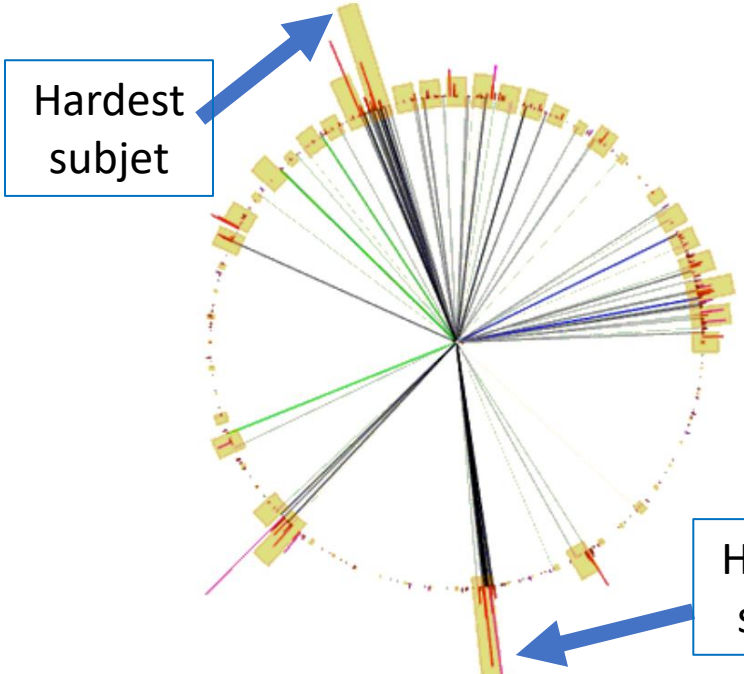

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Truth level
Signal only

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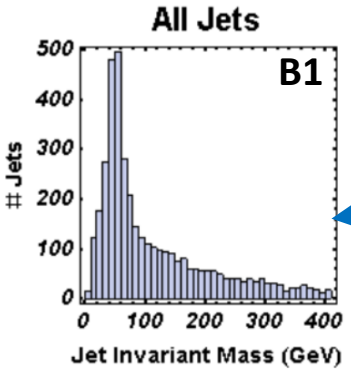

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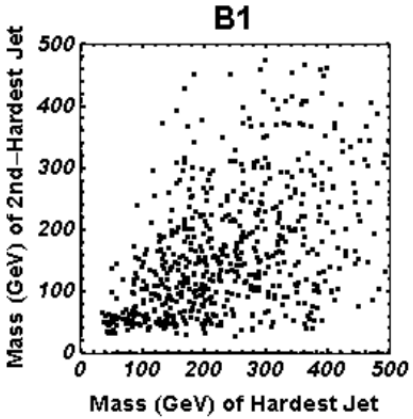
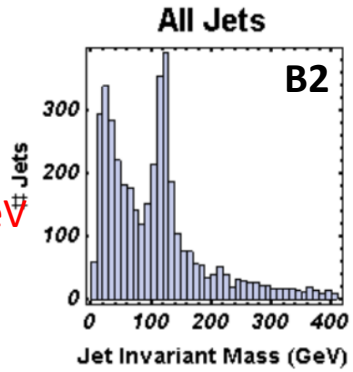


m_π = 120 GeV



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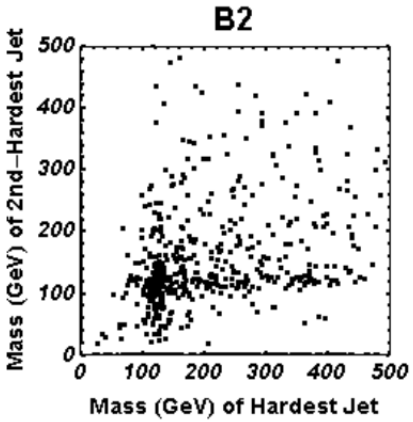

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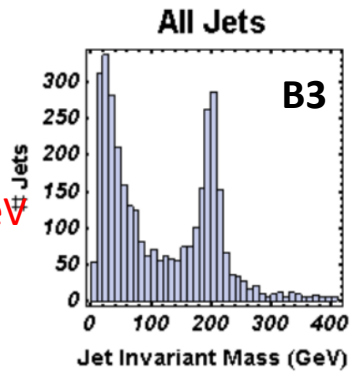
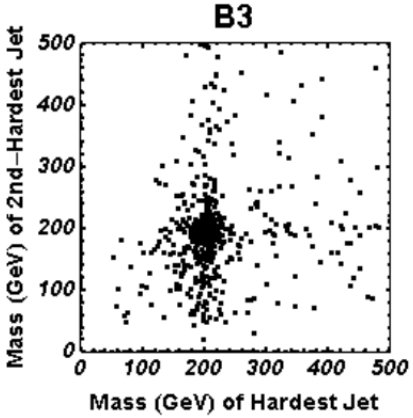
m_π = 200 GeV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