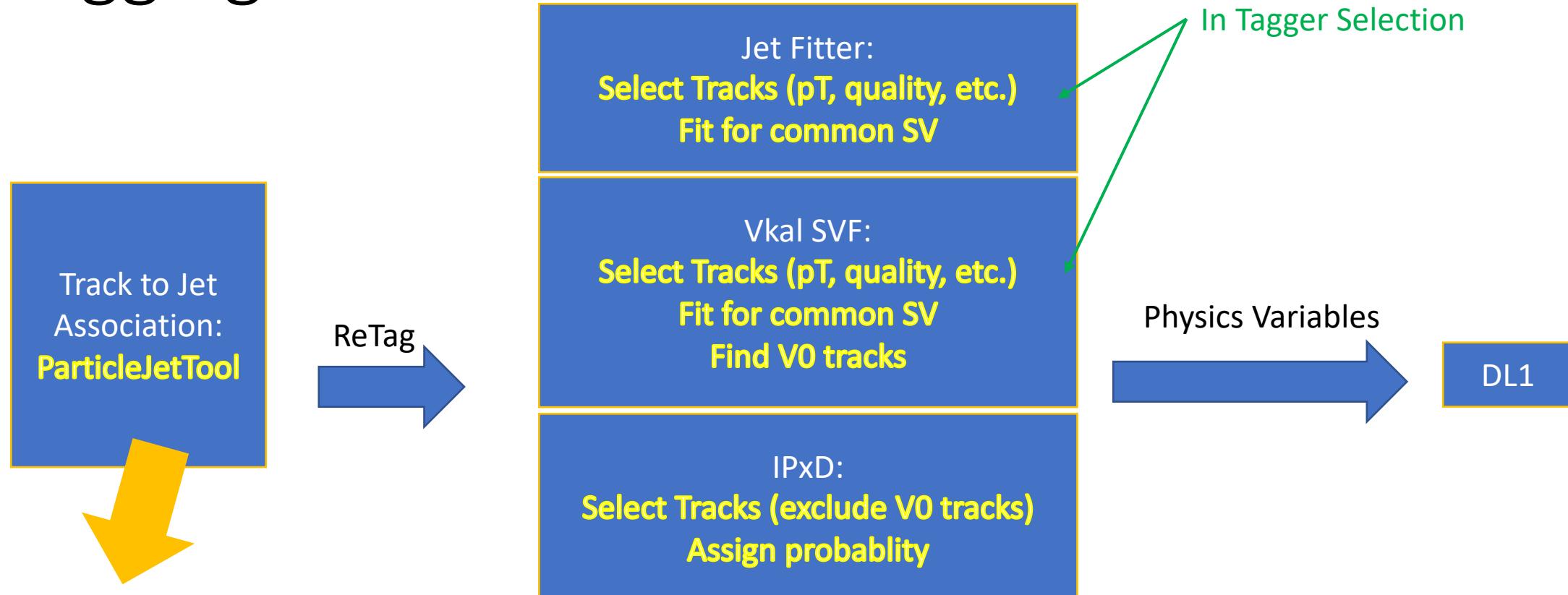


Summary and Plans

- For SV and JF, physics variables like energy fraction and decay lengths are used as input for higher level taggers.
- The calculation largely depends on raw input tracks.
 - Applying cuts on individual taggers improve vertexing performance
 - Applying cuts prior to lower level taggers can improve performances of these variables.
- Two example plots are shown in the slides.
- Plan:
 - waiting for the grid to return 8M inclusive samples and overlay samples
 - https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/HIJetMCSamples#Pythia8_dijets_8M_per_sample_in, will plot the same thing.
 - Make IPxD templates using these samples.
 - <https://gitlab.cern.ch/fdibello/IPtagTuning>

B-Tagging Workflow



-track pass TrkSelectionTool

-associate each track to closest jet

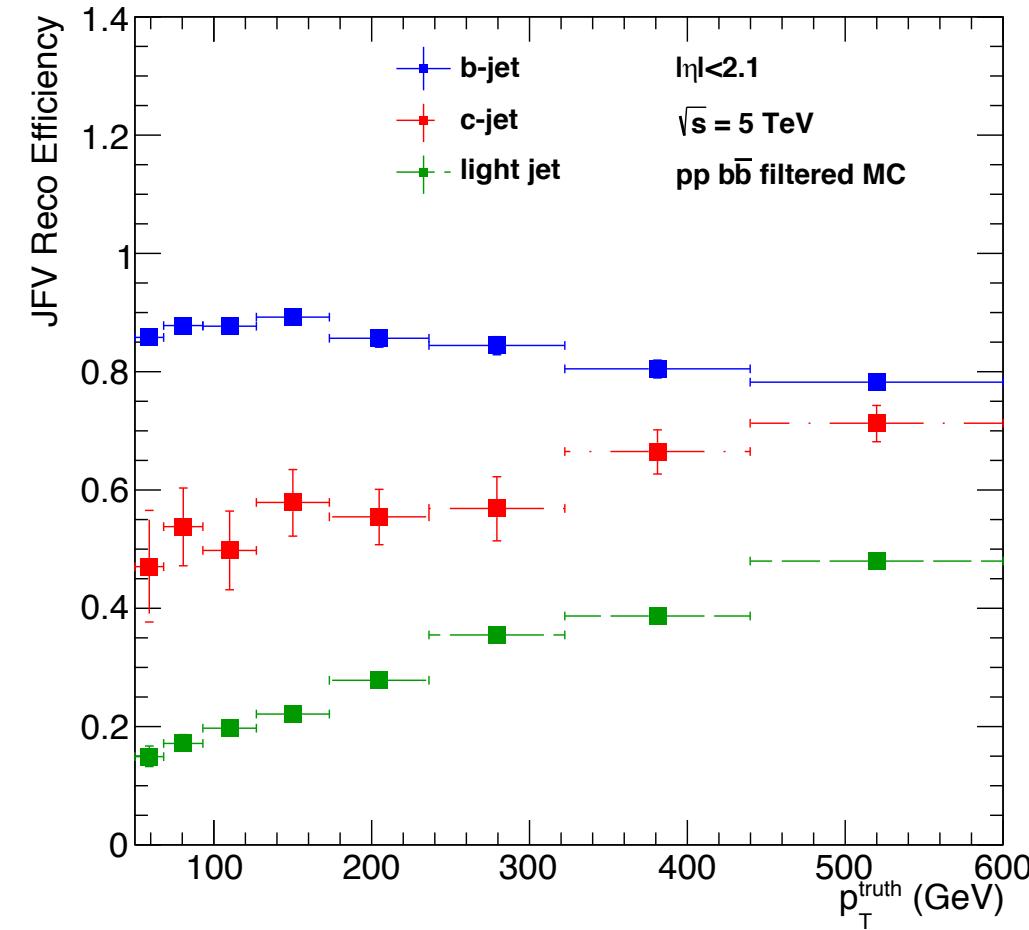
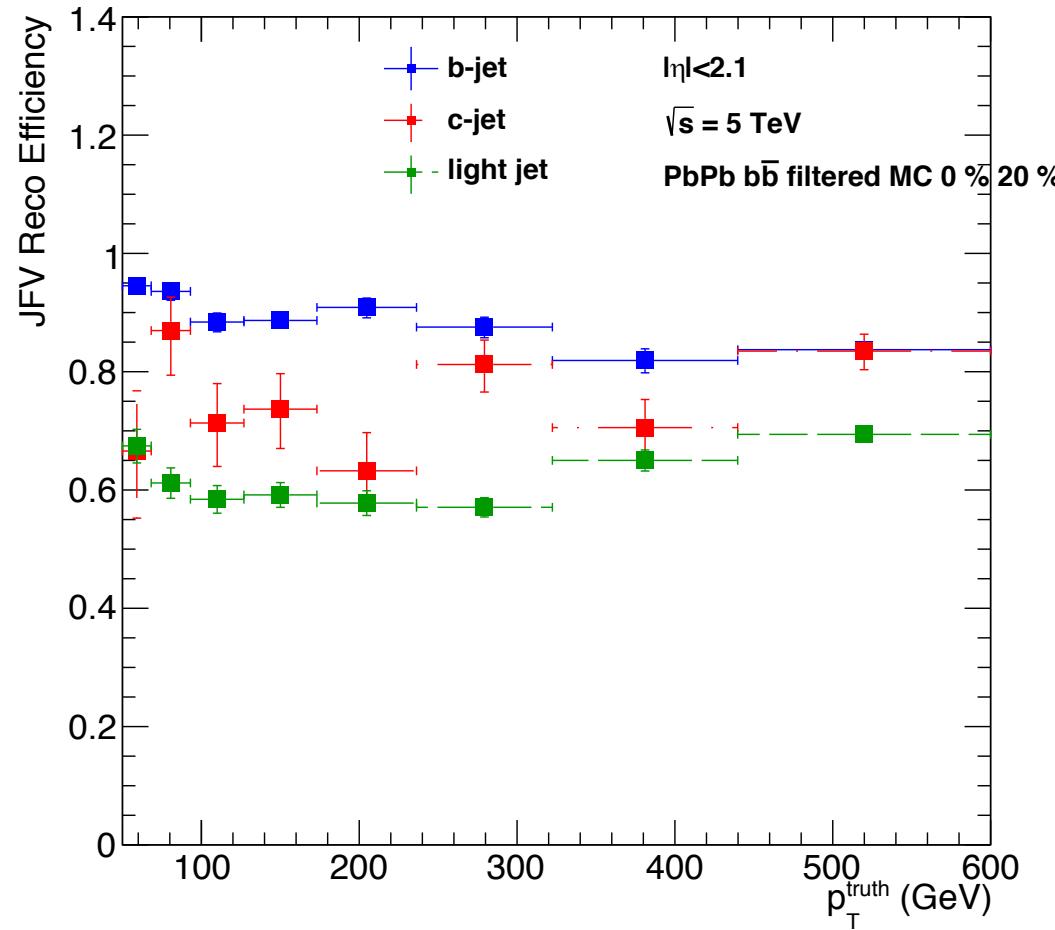
-if $dR <$ threshold, track is associated

Shrinking Cone: higher jet pT, smaller the threshold dR

Fixed Cone: threshold $dR = 0.4$ for all jet pR

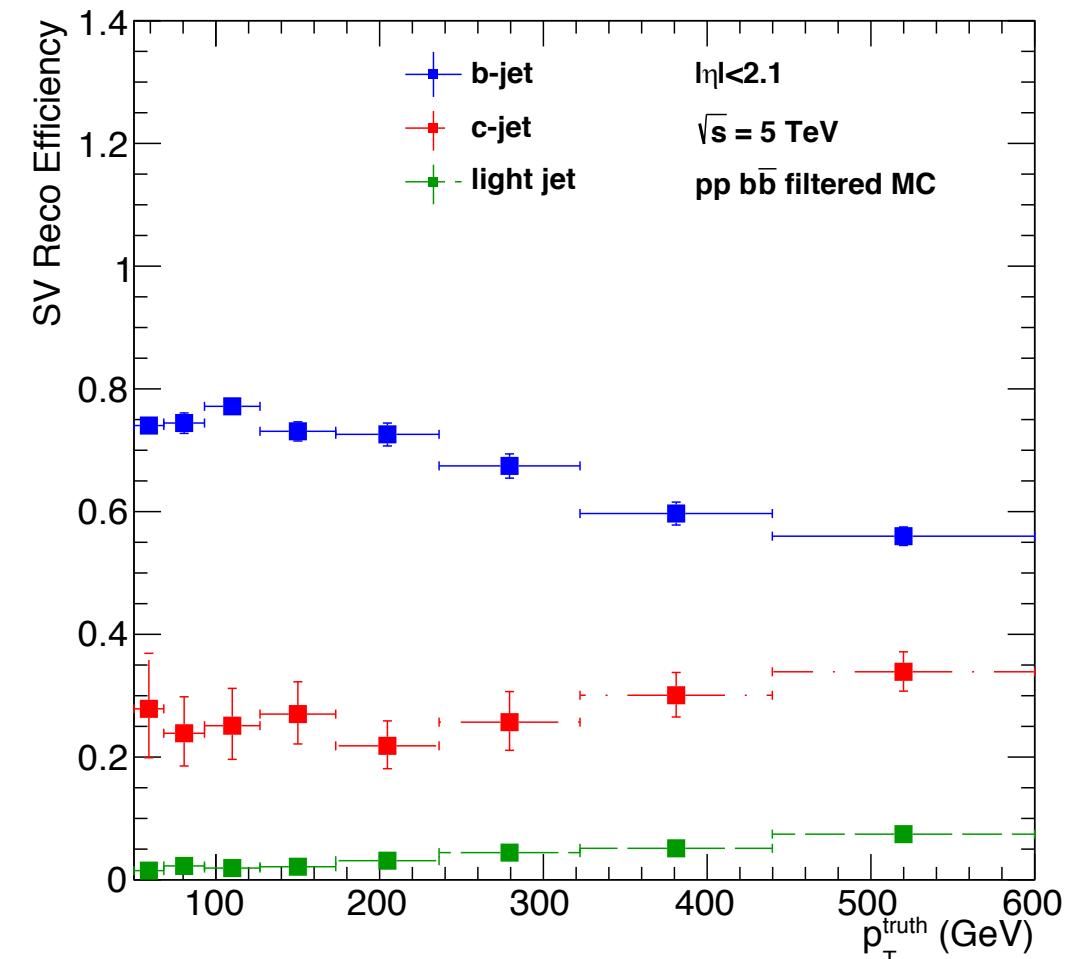
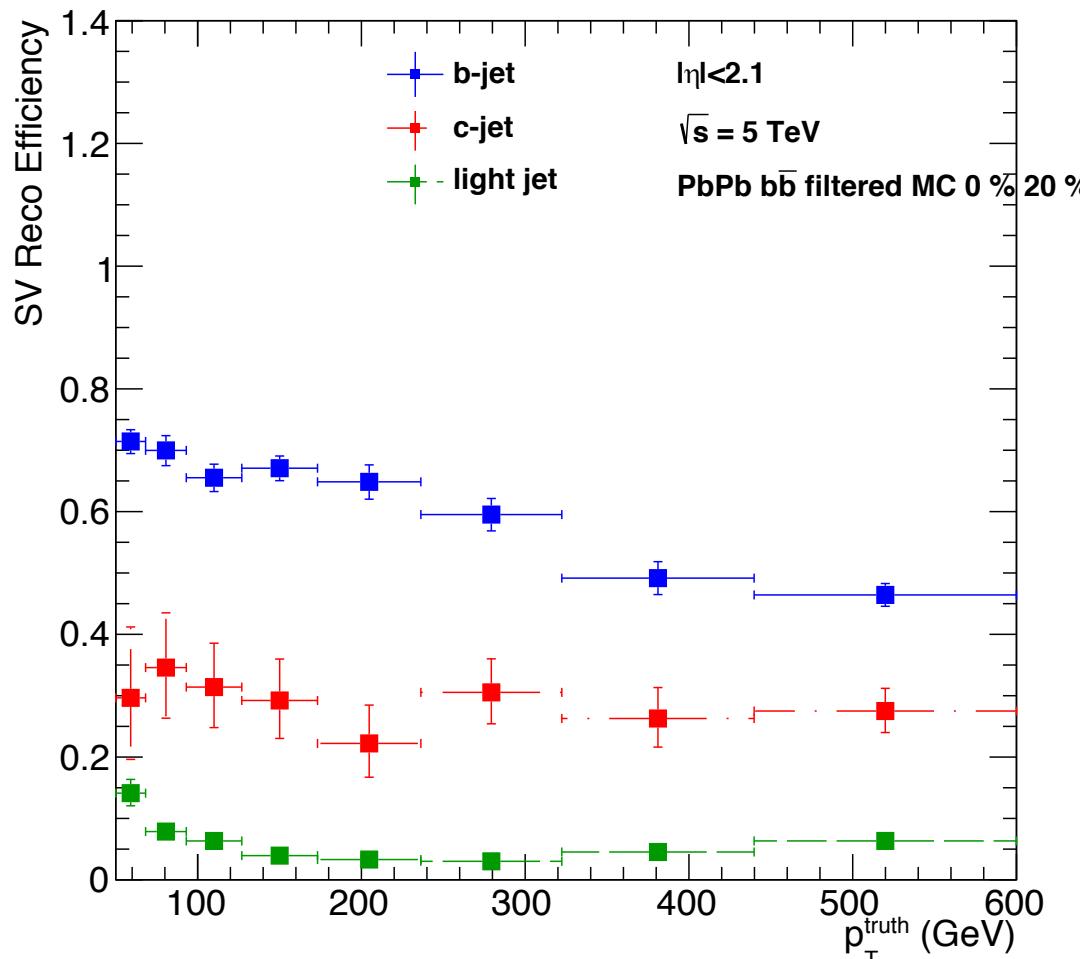
Pre-Tagging
Selection

Secondary Vertexing at Default Setup for JetFitter



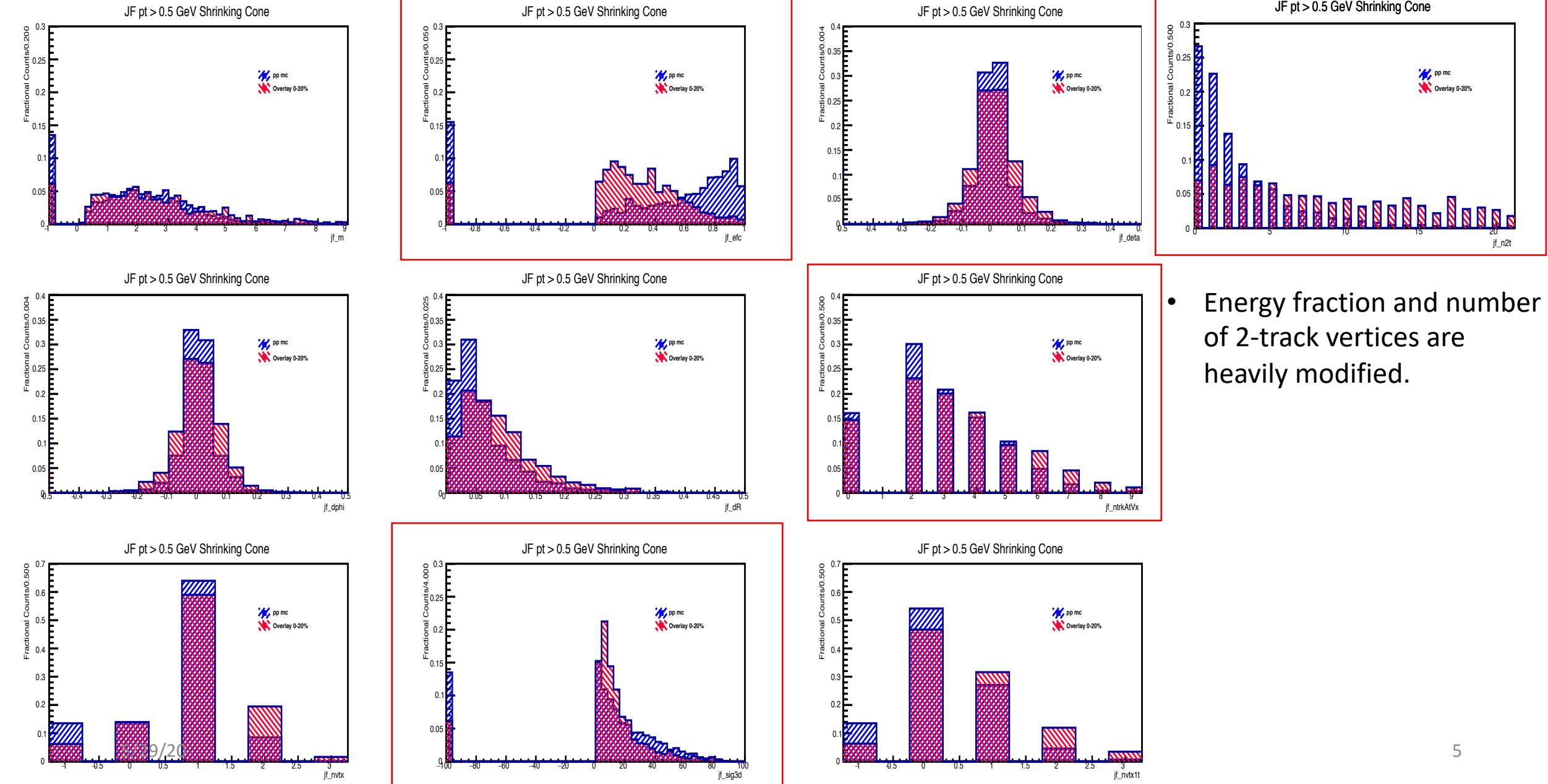
In comparing to pp, central PbPb MC has similar b-tagging efficiency but very high fake rate from both c-jet and light jet.

Secondary Vertexing at Default Setup for SVF (VKal)

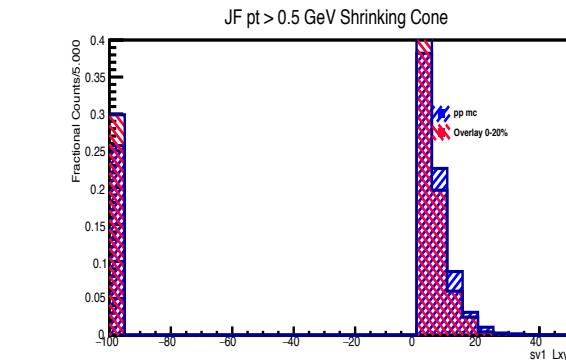
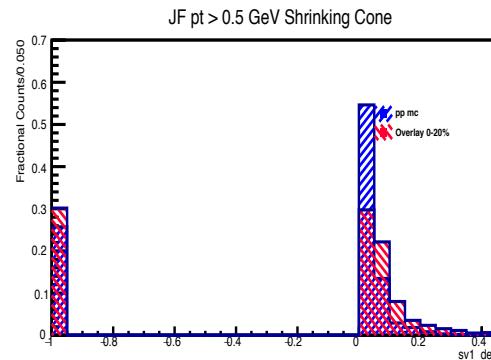
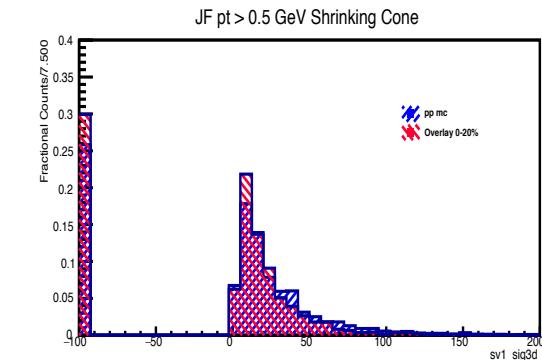
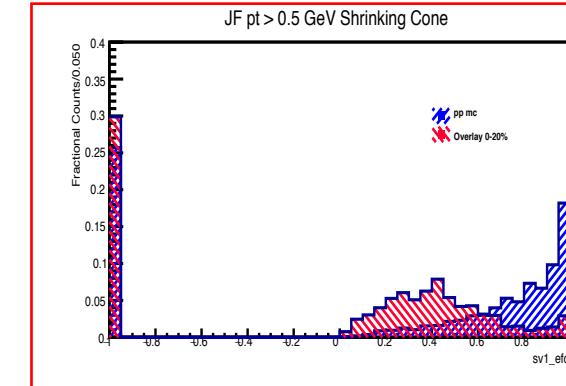
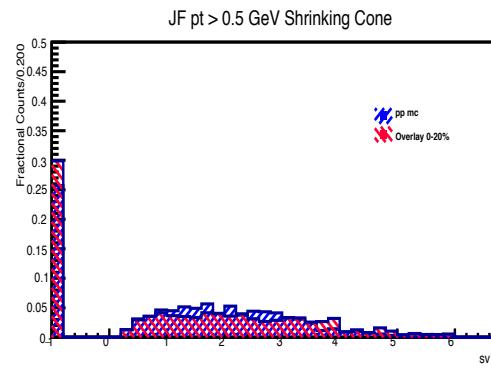
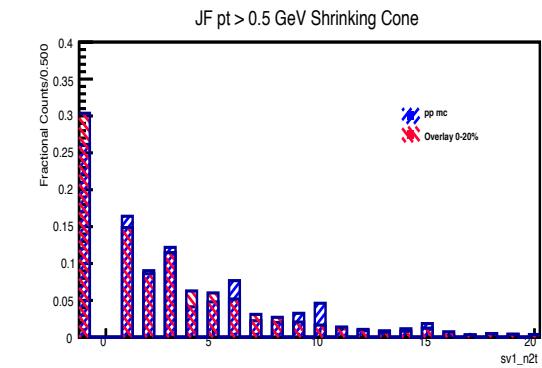
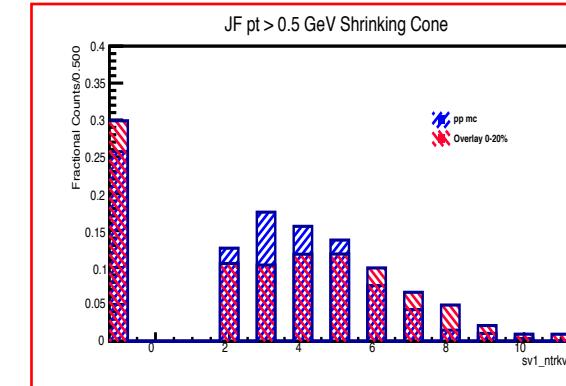
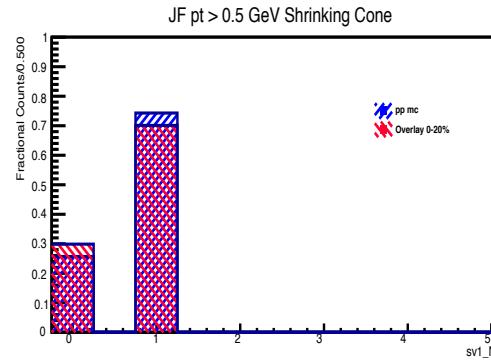
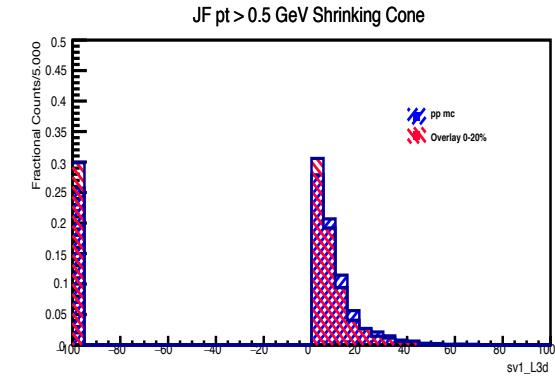


In comparison to pp, central PbPb MC has lower tagging efficiency, especially in high jet p_T region, the efficiency drops to below 50%.

JF Variables at Default Setup

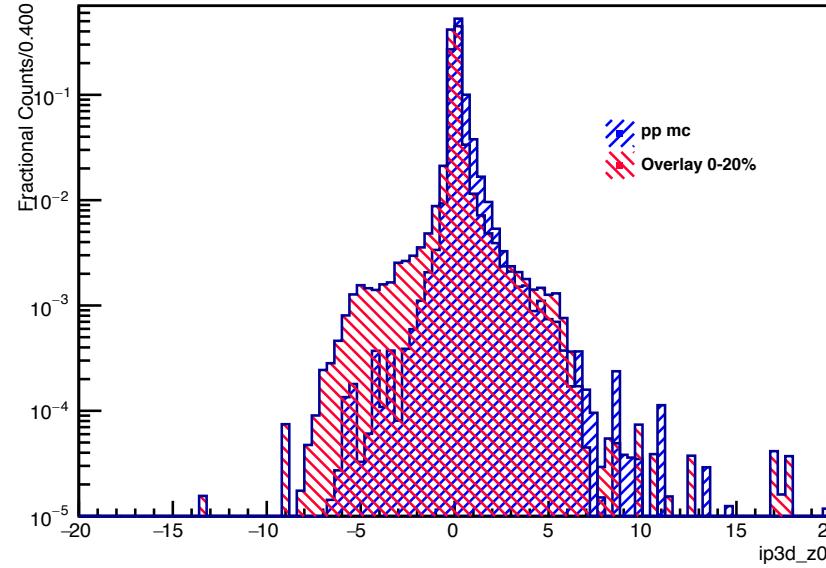


SV Variables at Default Setup

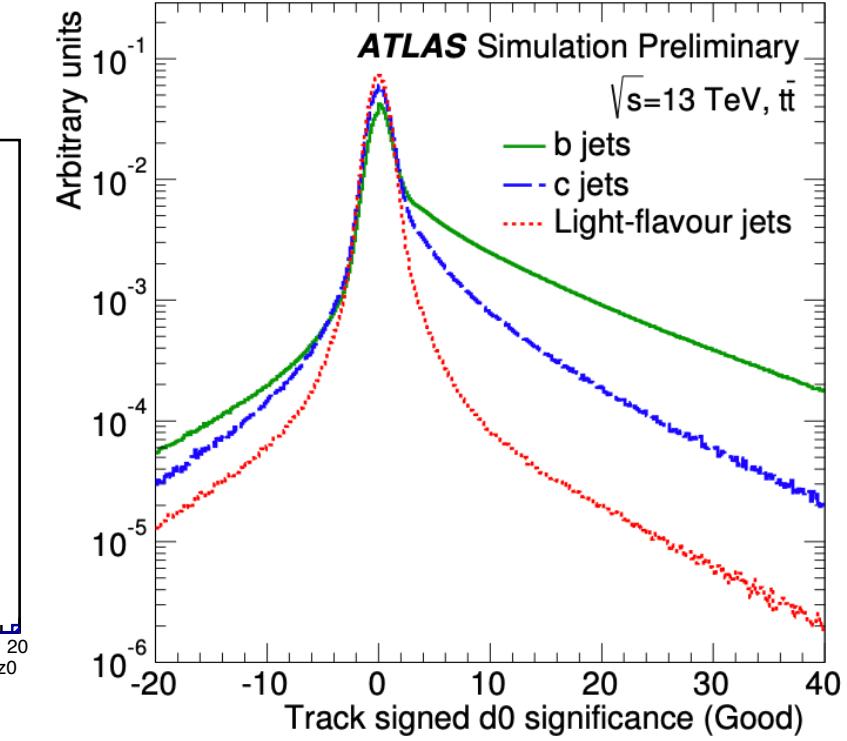
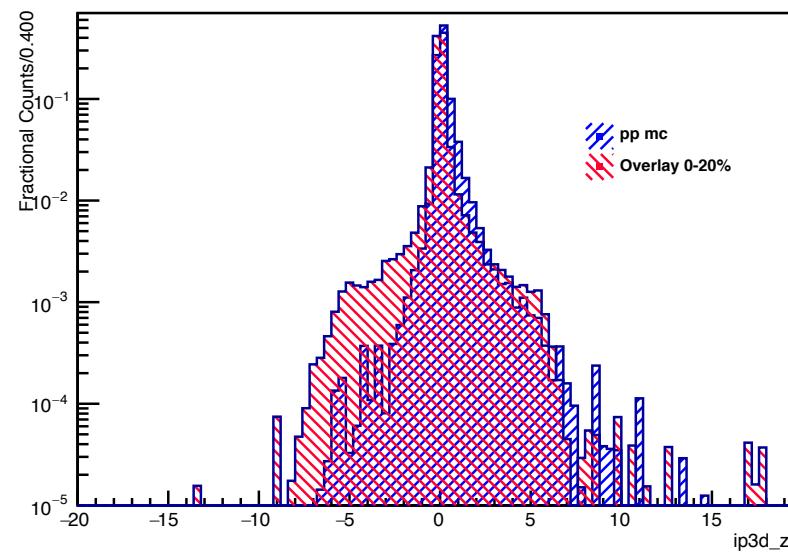


IPxD Variables

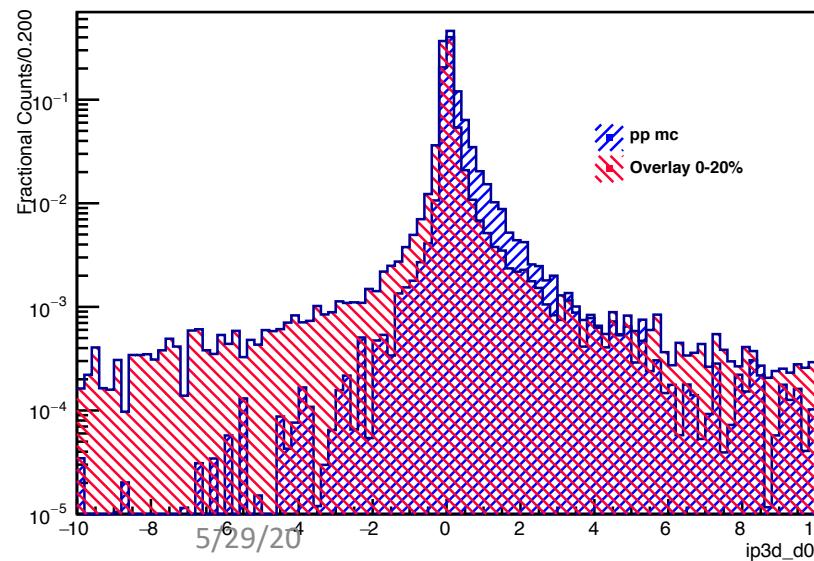
Default Cuts Shrinking Cone



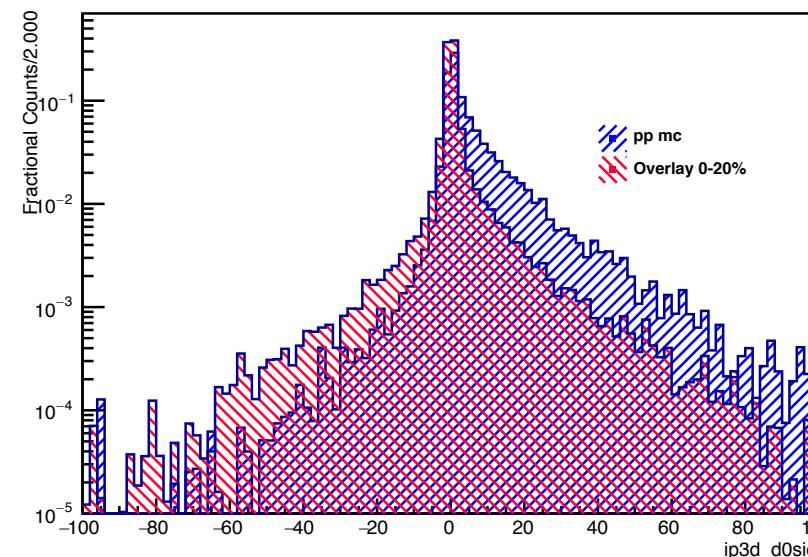
Default Cuts Shrinking Cone



Default Cuts Shrinking Cone



Default Cuts Shrinking Cone



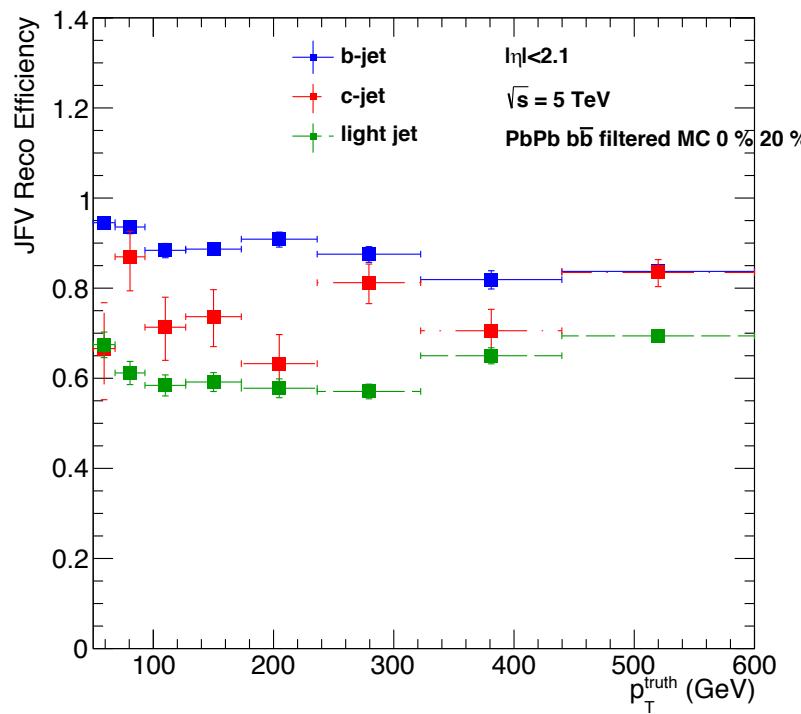
- Overlay samples have almost symmetric distribution of d0 and z0.

Motivation for Cuts made

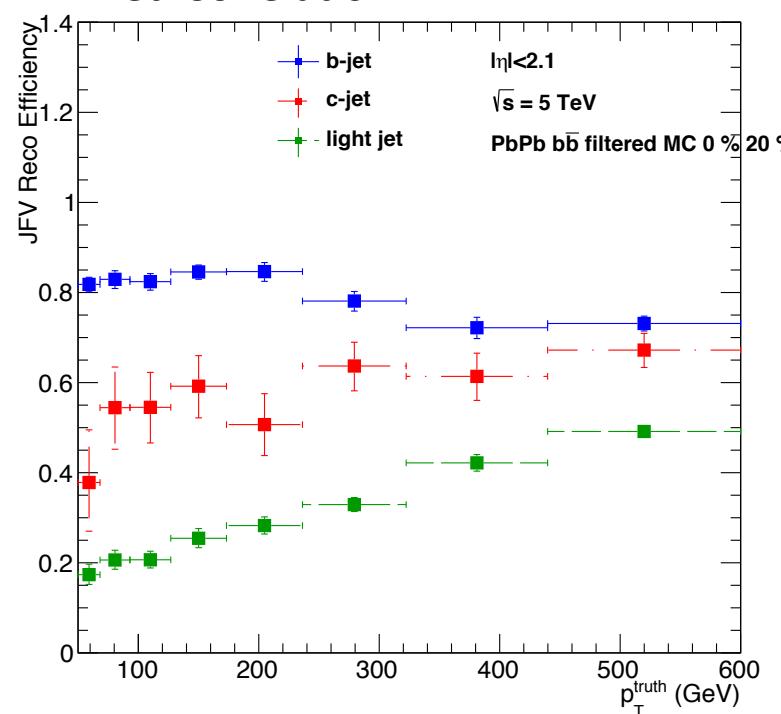
Item	Default	Change	Which Tool	Reason
Track Association	Shrinking Cone	Fixed R = 0.4	ParticleJetTools	Unknown PbPb track distribution vs jet pT SVF has efficiency drop in high pT due to track loss
Min pT Cut	0.5 GeV	1.5 GeV	JetFitter	Central Events have high fake rate possibly due to UE tracks contribution
Min pT Cut	0.7 GeV	1.5 GeV	VKal	Same as above
Min pT Cut	No Cut	1.5 GeV	ParticleJetTools	Physics variables like efc are still affected by UE tracks if only modifies in tagger algo
Anti Pile Up Tool	On	Off	Vkal + JetFitter	Irrelevant in single PV events

Secondary Vertexing Efficiency with JetFitter

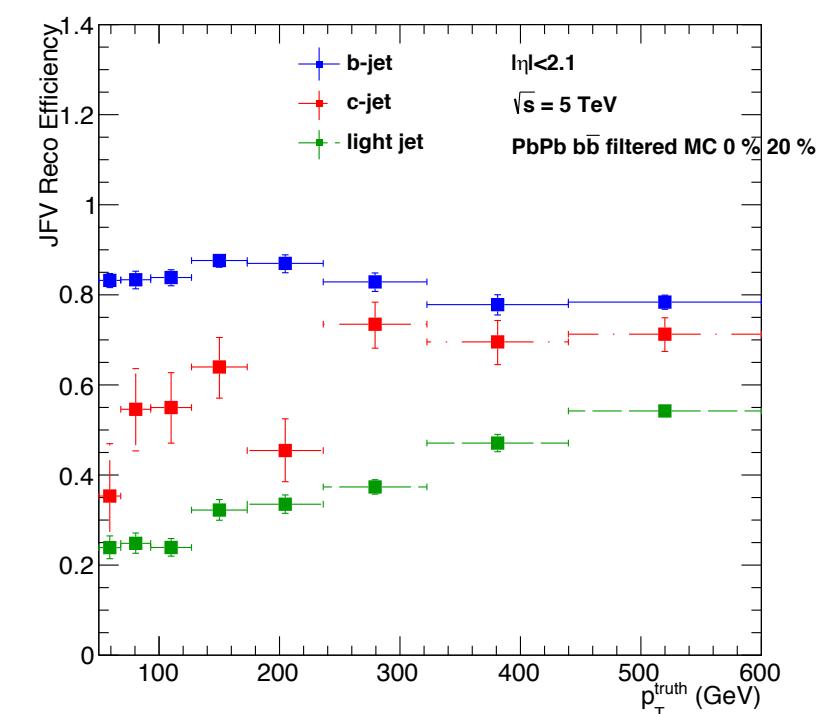
Default JF Setup
No Selection on Input Tracks
Shrinking Cone



Default JF Setup (anti PU off)
Loose Selection on Input Tracks
Min pT = 1.5 GeV
Fixed Cone at 0.4



Modified JF Setup (anti PU off)
First Fitting min Track pT: 1.5 GeV
Second Fitting min Track pT: 1.75 GeV
No Selection on Input Tracks
Fixed Cone at 0.4

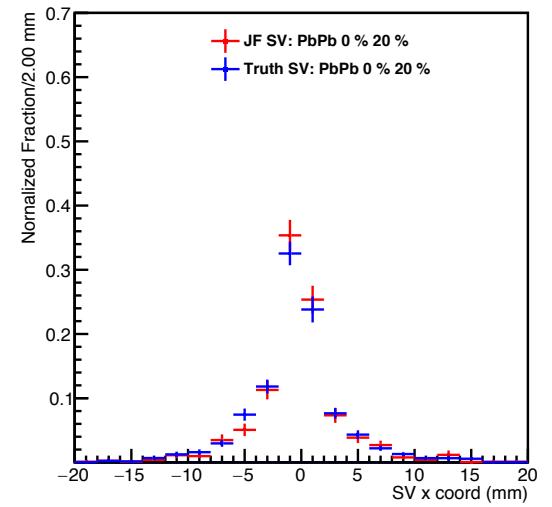


The vertexing efficiency for secondary vertex is similar when using the same value of minimum pT, either by selecting tracks before vertexing or changing pT selection in JF algorithm.

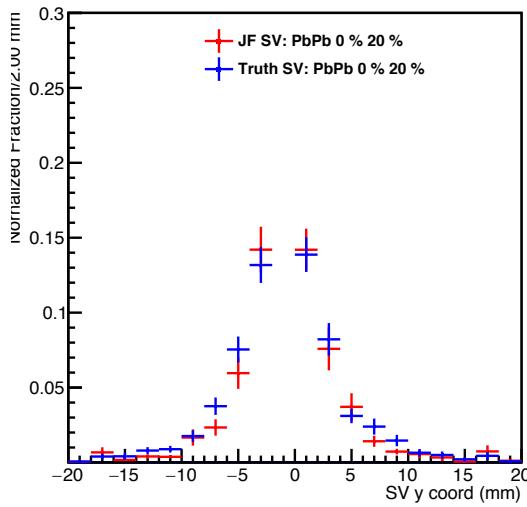
Secondary Vertexing Resolution with JetFitter

Default JF Setup; No Selection on Input Tracks; Shrinking Cone

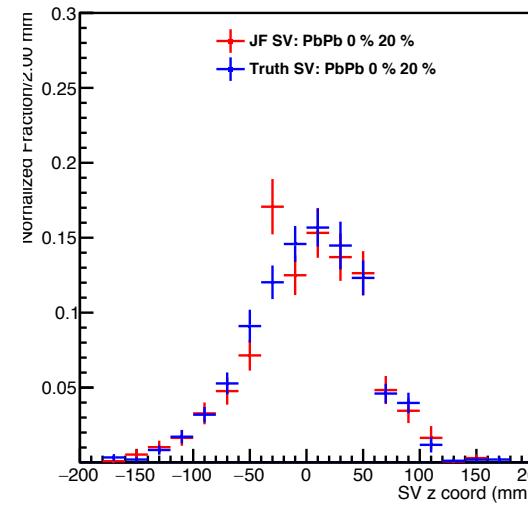
x Coordinate of JF Secondary Vertex



y Coordinate of JF Secondary Vertex

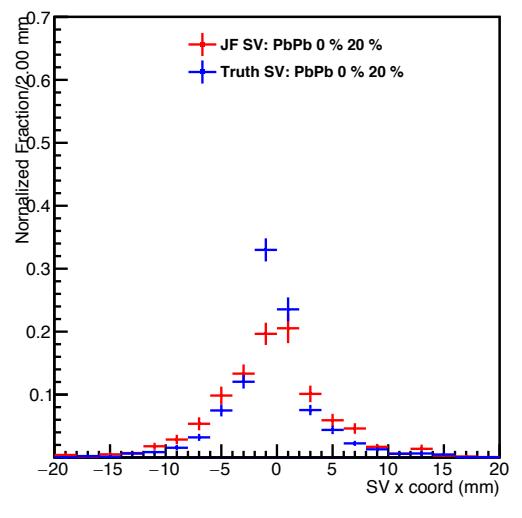


z Coordinate of JF Secondary Vertex

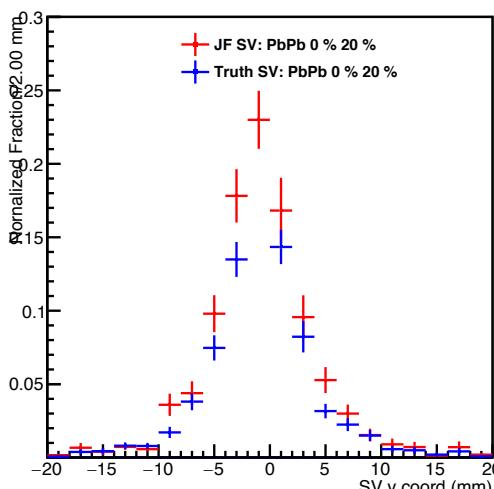


Default JF Setup (anti PU off); Loose Selection on Input Tracks; Min pT = 1.5 GeV; Fixed Cone at 0.4

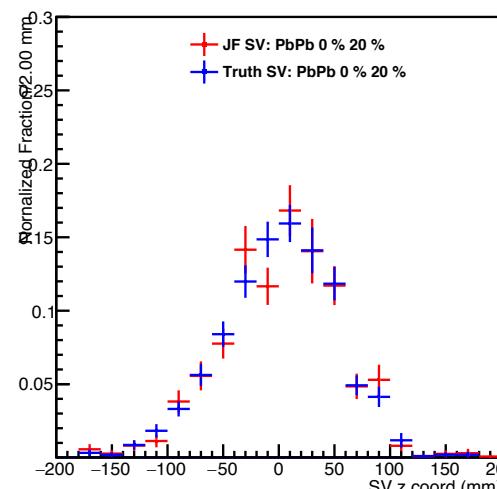
x Coordinate of JF Secondary Vertex



y Coordinate of JF Secondary Vertex



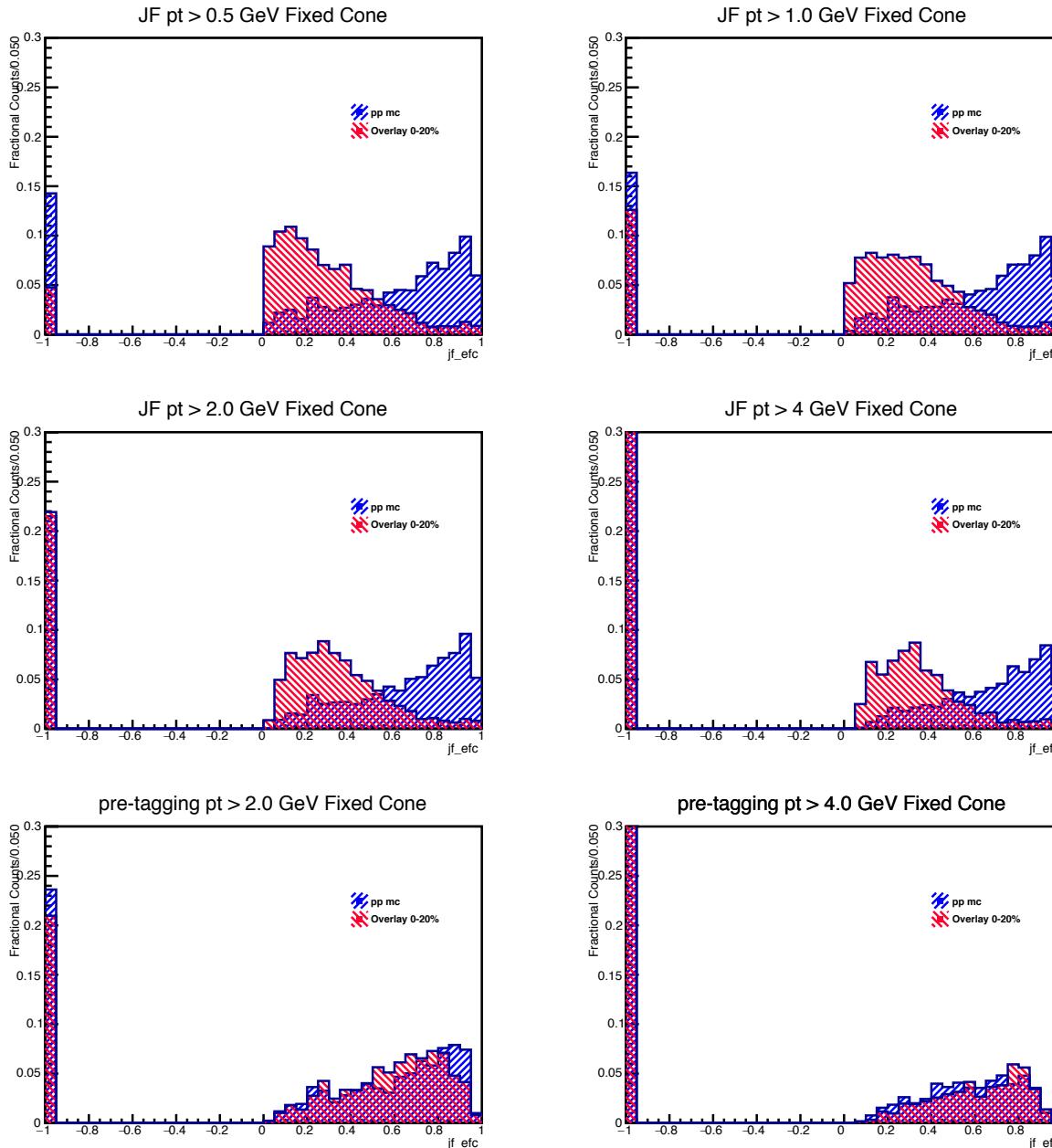
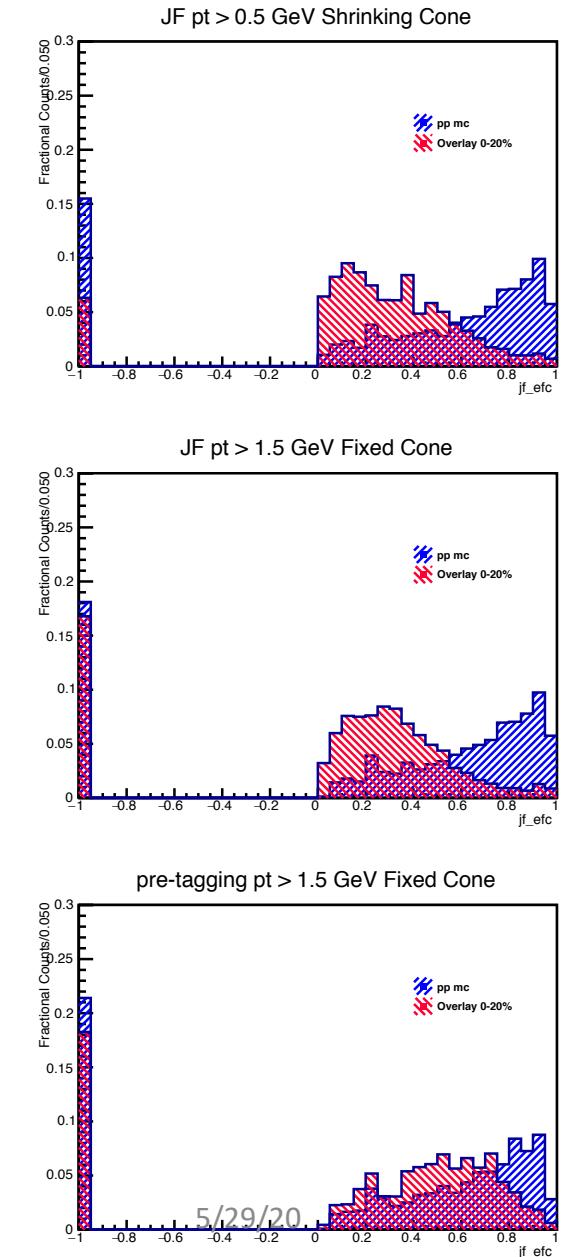
z Coordinate of JF Secondary Vertex



No big change in secondary vertex resolution, reconstructed SV coordinates have similar distribution with truth SV.

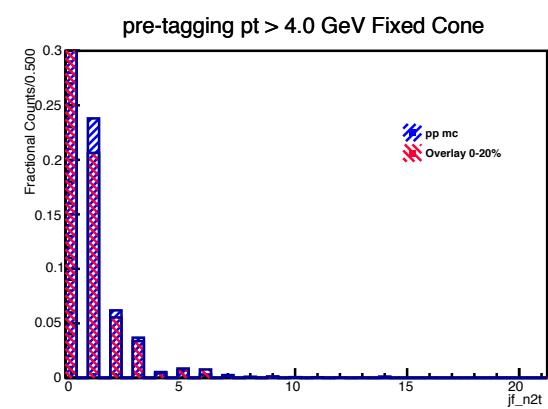
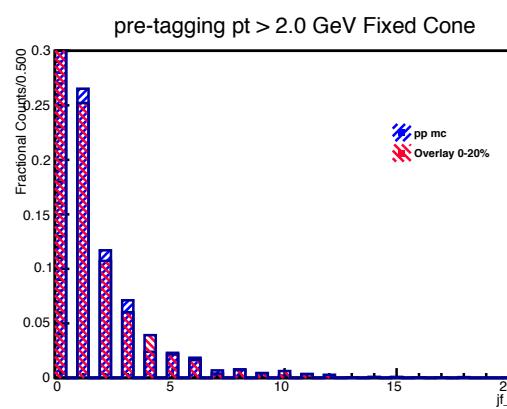
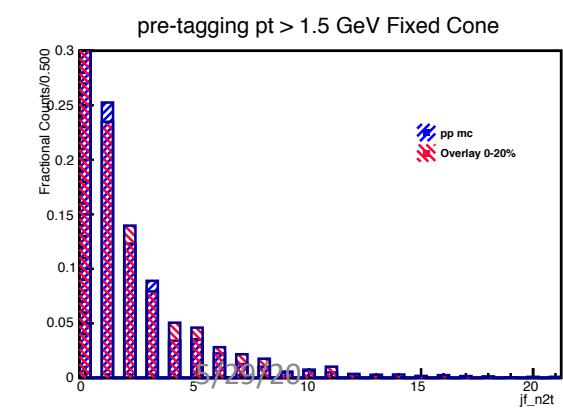
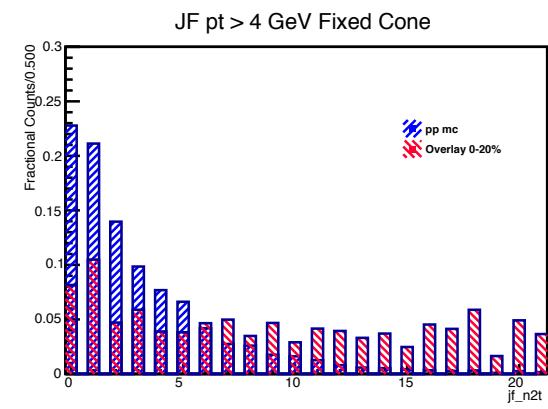
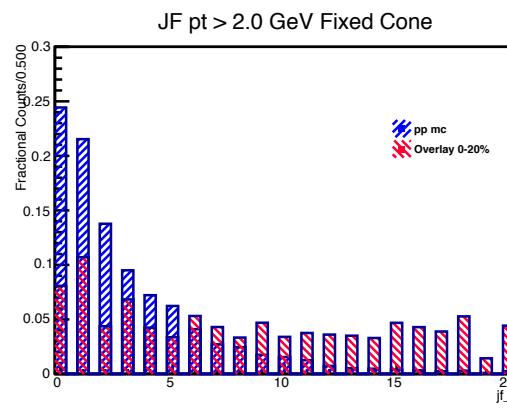
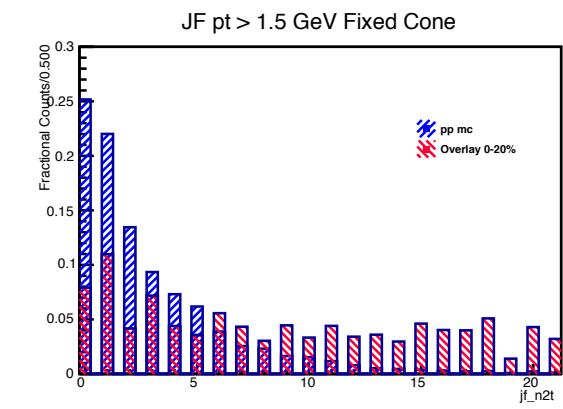
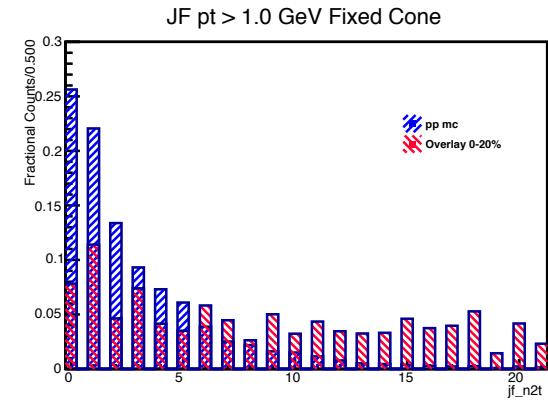
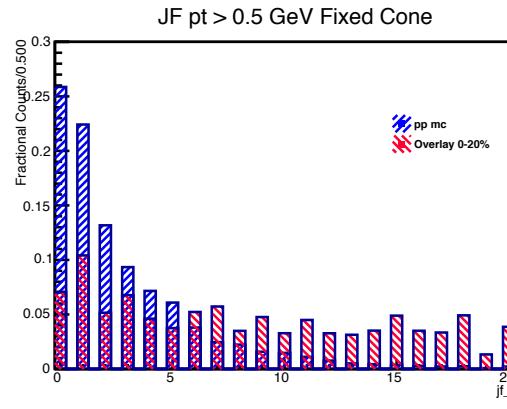
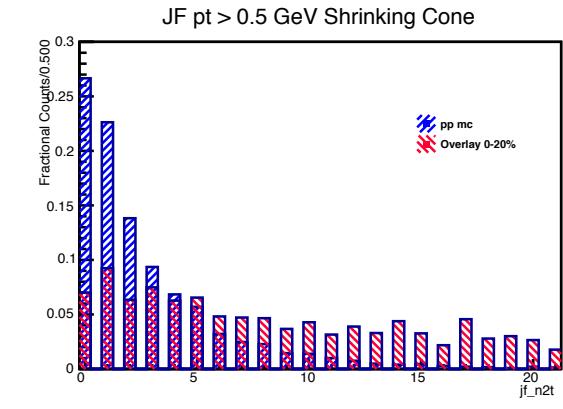
Similarly for modifying JF algorithm to select SV candidate tracks at 1.5 GeV (back up)

JF Energy Fraction



- Cuts applied at only JetFitter is not helping much.
- (first 6 graphs)
- Cutting at 1.5 GeV for pT before going into individual taggers helps.
- (last 3 graphs)

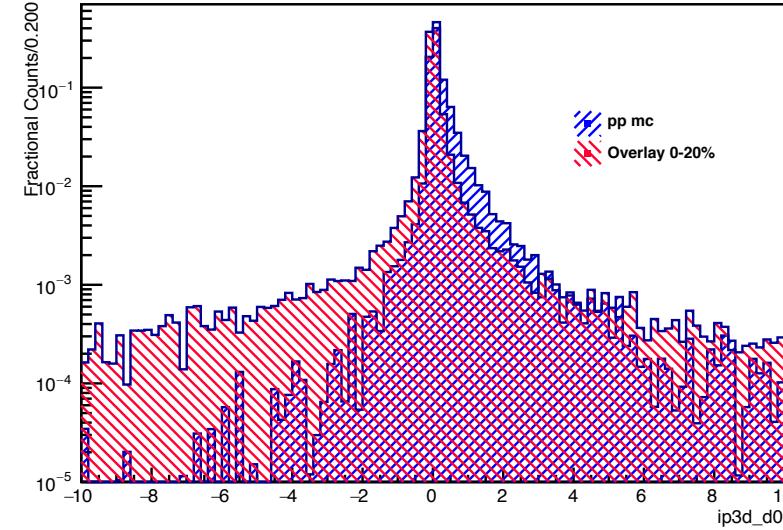
JF Number of 2-Track Vertices



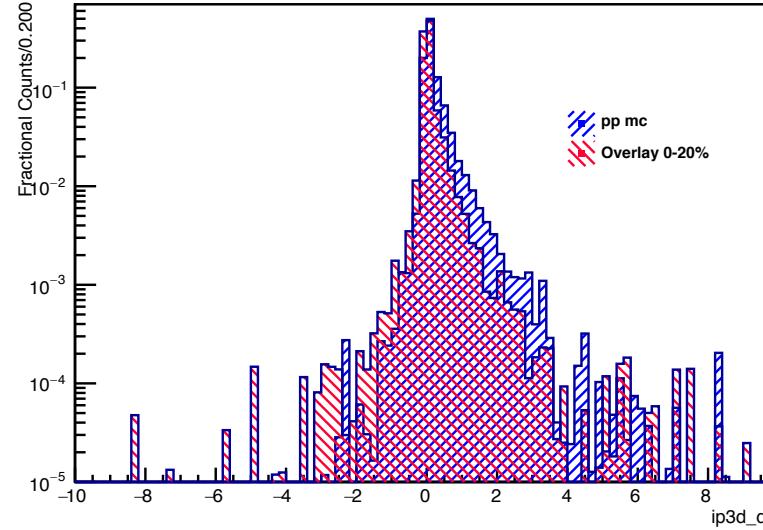
- Cuts applied at only JetFitter is not helping much.
- (first 6 graphs)
- Cutting at 1.5 GeV for pT before going into individual taggers helps.
- (last 3 graphs)
- Similar to energy fraction

IPxD Variables improvements over pT cuts

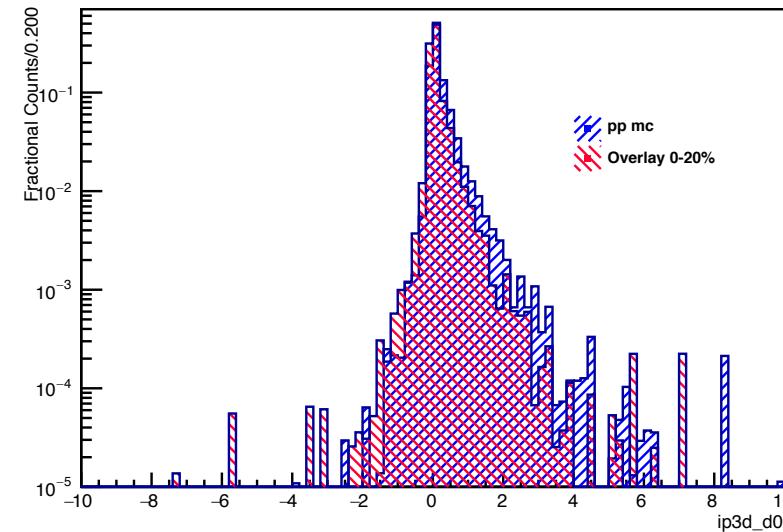
Default Cuts Shrinking Cone



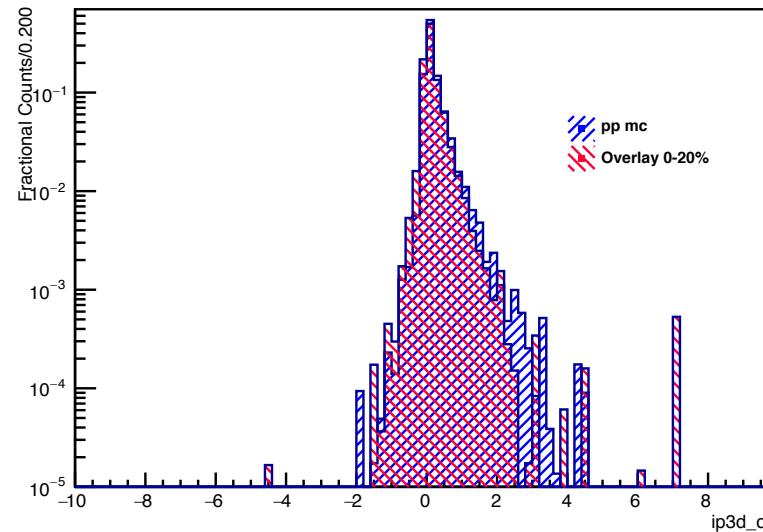
Pre-tagging min pT 1.5 GeV FC4



Pre-tagging min pT 2 GeV FC4



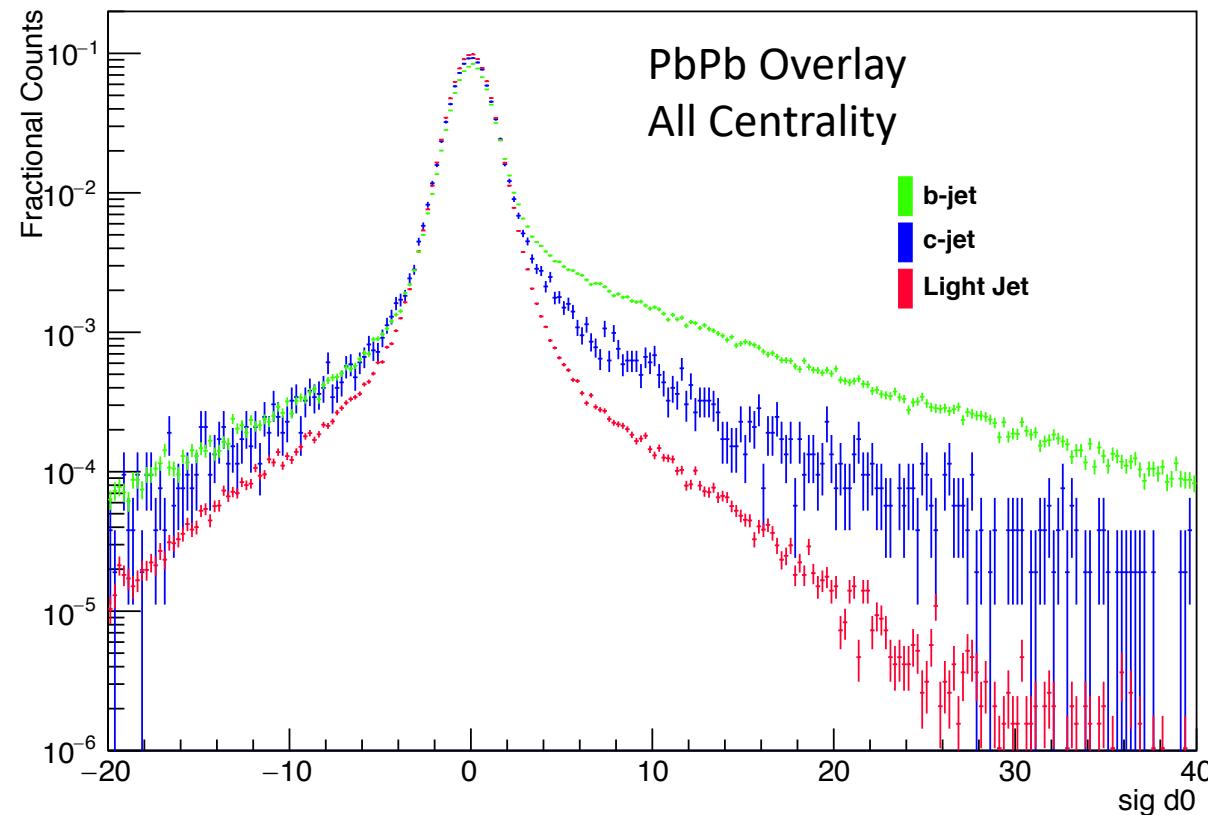
Pre-tagging min pT 4 GeV FC4



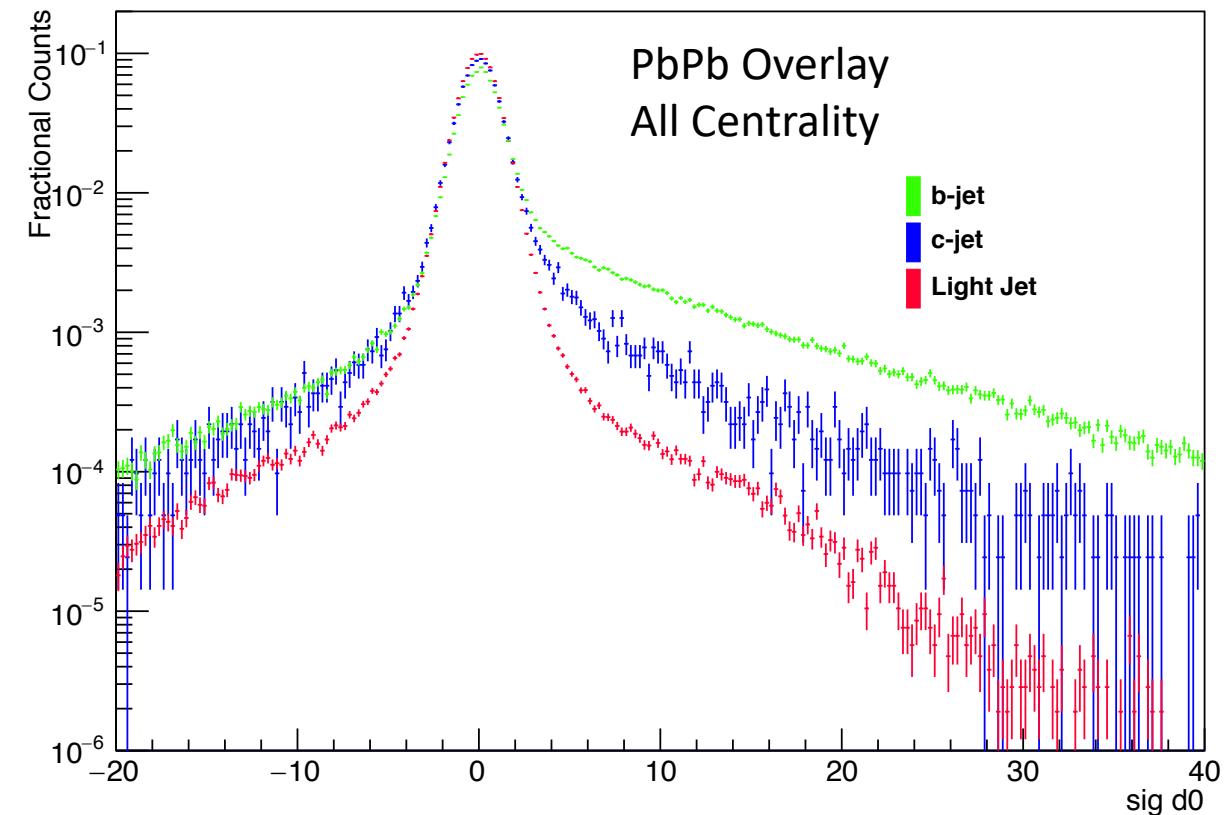
- d0 significance distributions assimilate at pT cut ≈ 2 GeV.
- Similarly for z0 and z0sig.

Templates Making with Overlay Sample for Quality Good

Default Setup



Fixed Cone + $pT \geq 1.5 \text{ GeV}$



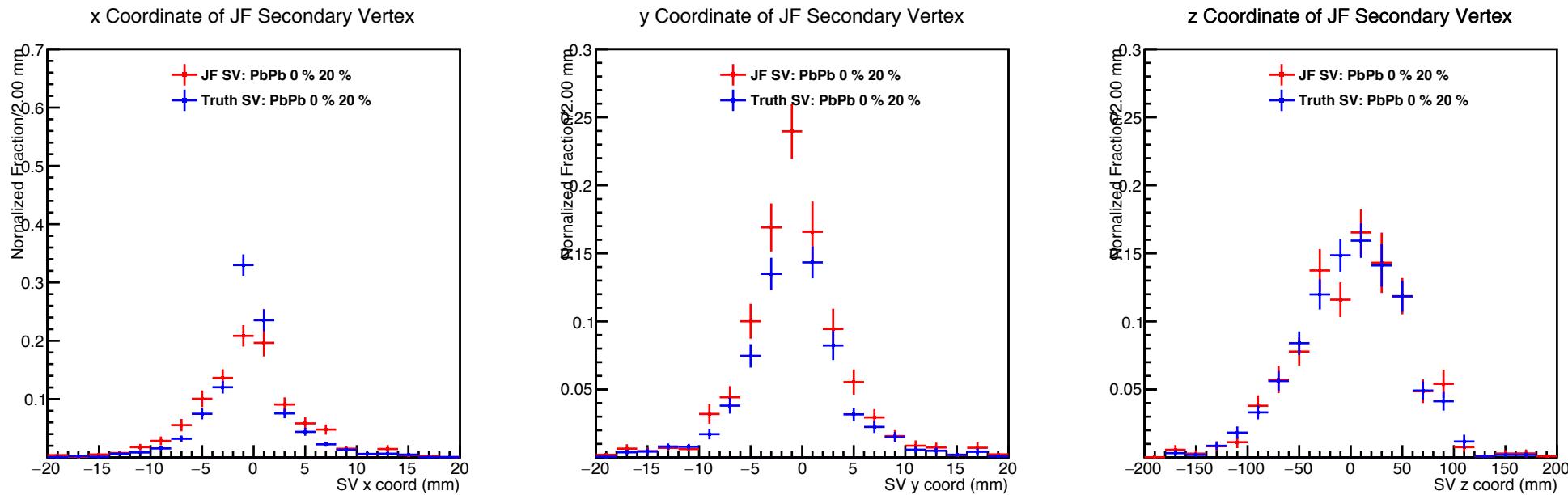
With pT cut combined with changing to fixed cone, the difference between jets are wider spreadout, which should help classification.

Summary and Plan

- Experimented cuts, especially with min pT requirement helps reduce fake and improve physics variables.
- Cuts should be applied at track association stage to improve physics variables like energy fraction.
- Applying these cuts do not affect SV resolution in JetFitter
 - Plan: compare for VKal tool.
- Tagger specific cuts, like track quality, shared hits, can be further experimented.
 - Plan: shared hits in VKal
- Plan: for IPxD, make plots for llr's change to different cuts.

Back-up

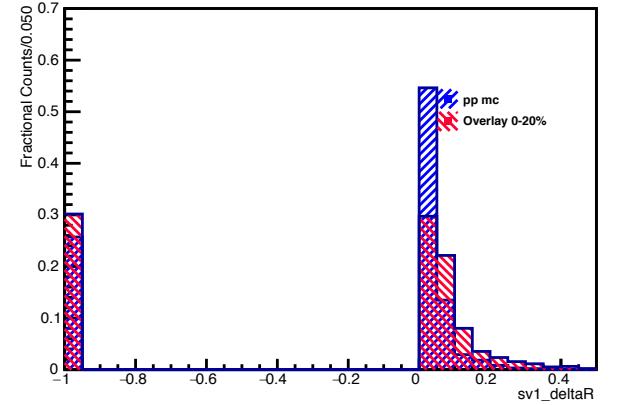
JF pre-tagging selection, $pT \geq 1.5$ GeV



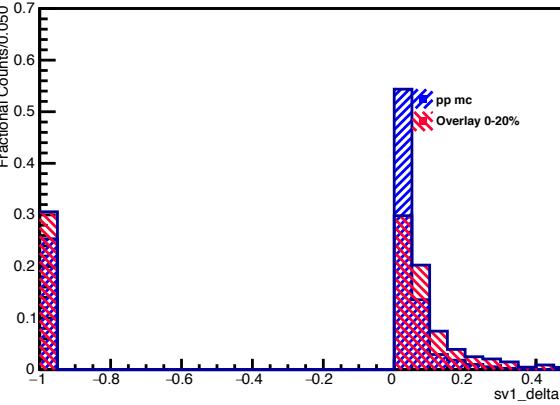
Modified JF Setup (anti PU off)
First Fitting min Track pT : 1.5 GeV
Second Fitting min Track pT : 1.75 GeV
No Selection on Input Tracks
Fixed Cone at 0.4

Jet Fitter

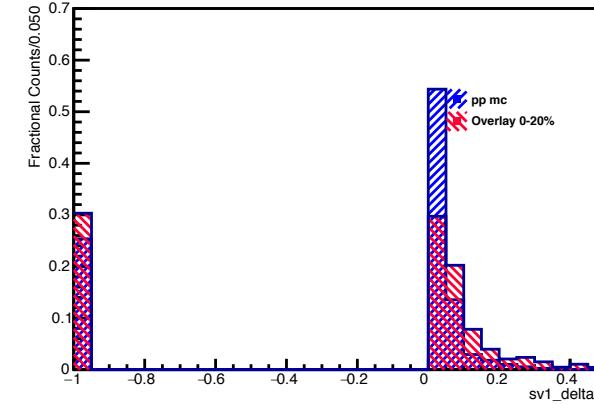
JF pt > 0.5 GeV Shrinking Cone



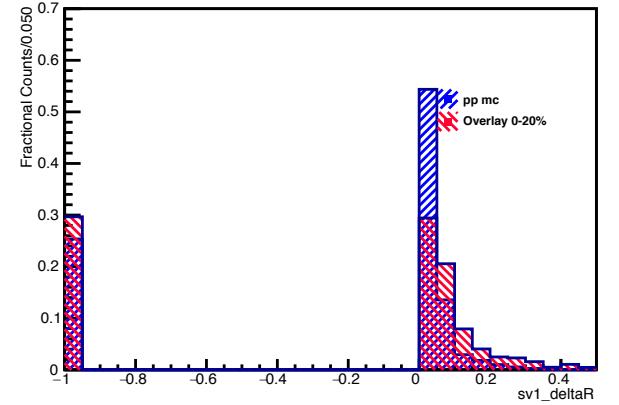
JF pt > 0.5 GeV Fixed Cone



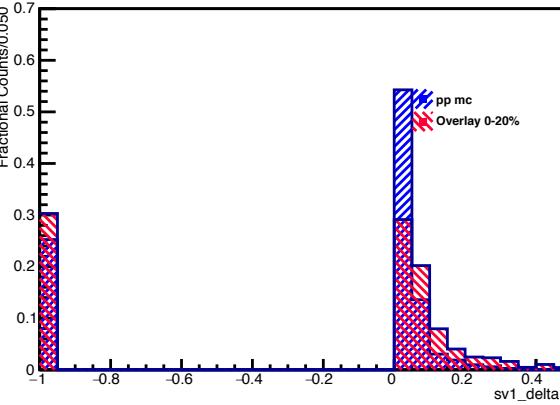
JF pt > 1.0 GeV Fixed Cone



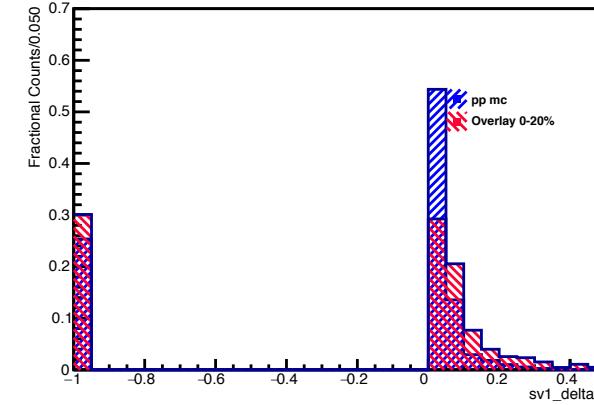
JF pt > 1.5 GeV Fixed Cone



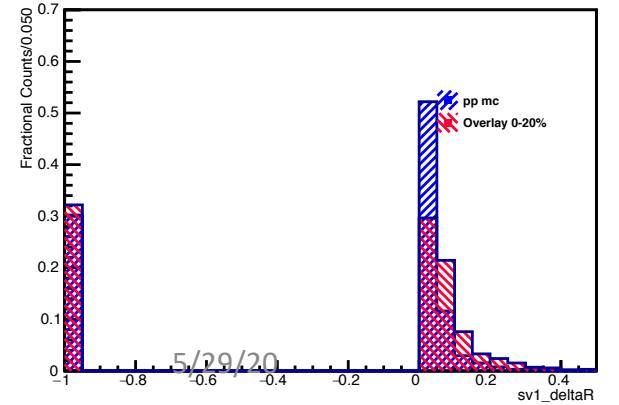
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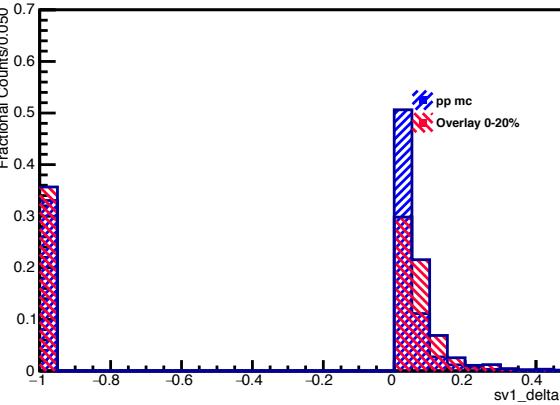
JF pt > 4 GeV Fixed Cone



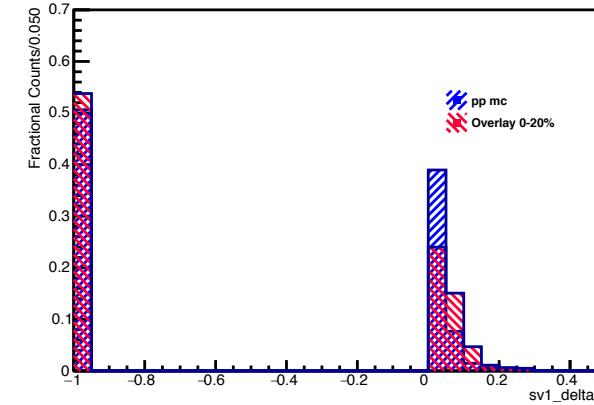
pre-tagging pt > 1.5 GeV Fixed Cone



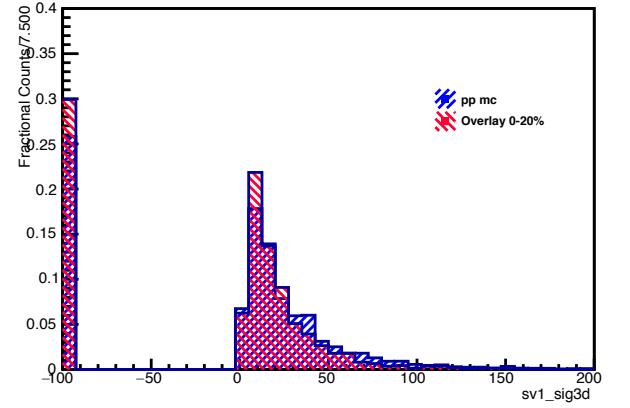
pre-tagging pt > 2.0 GeV Fixed Cone



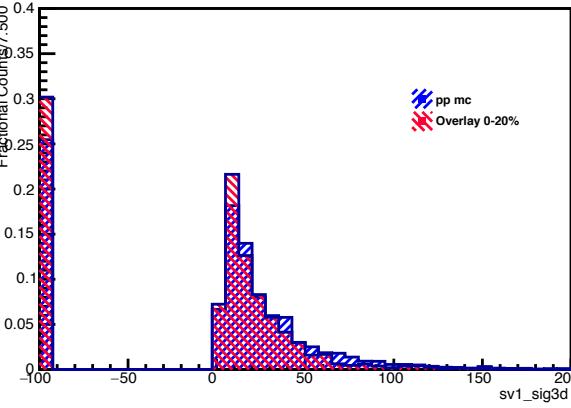
pre-tagging pt > 4.0 GeV Fixed Cone



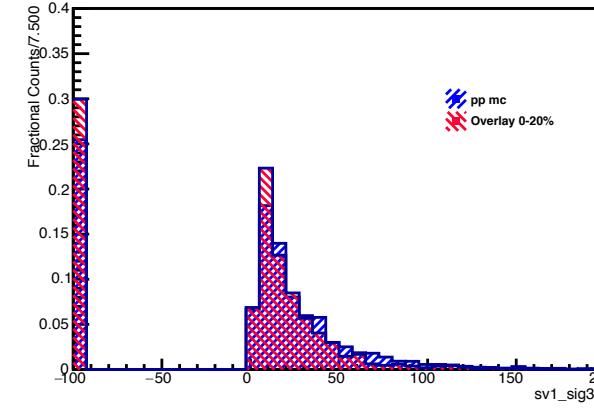
JF pt > 0.5 GeV Shrinking Cone



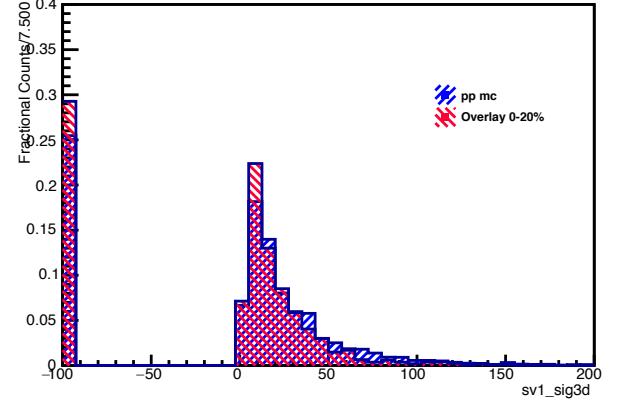
JF pt > 0.5 GeV Fixed Cone



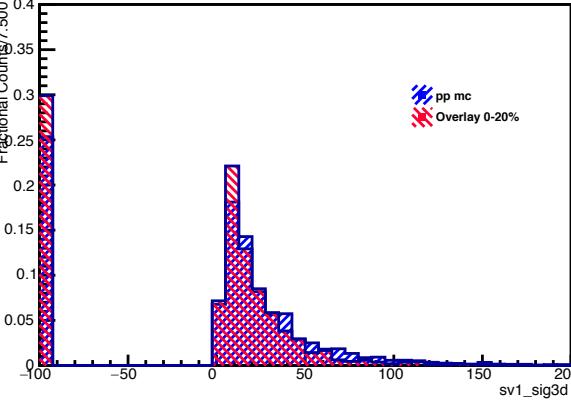
JF pt > 1.0 GeV Fixed Cone



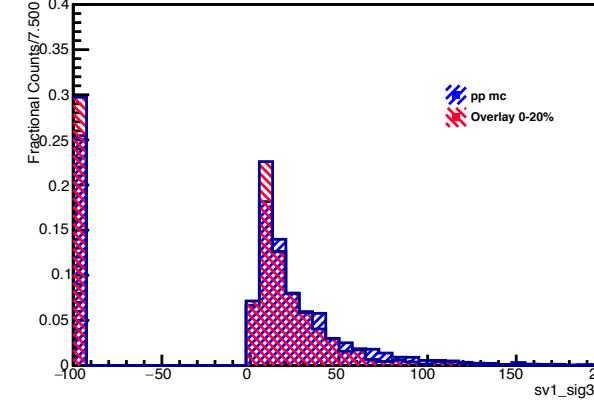
JF pt > 1.5 GeV Fixed Cone



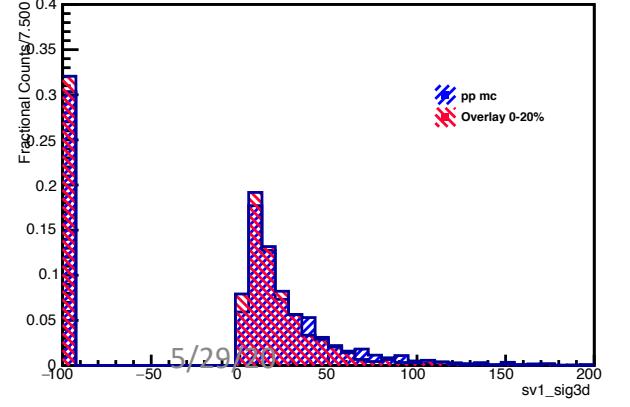
JF pt > 2.0 GeV Fixed Cone



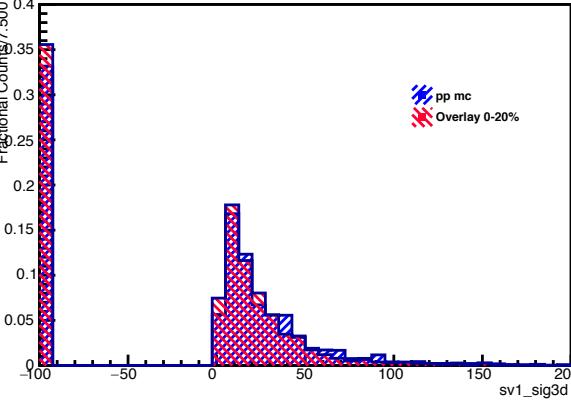
JF pt > 4 GeV Fixed Cone



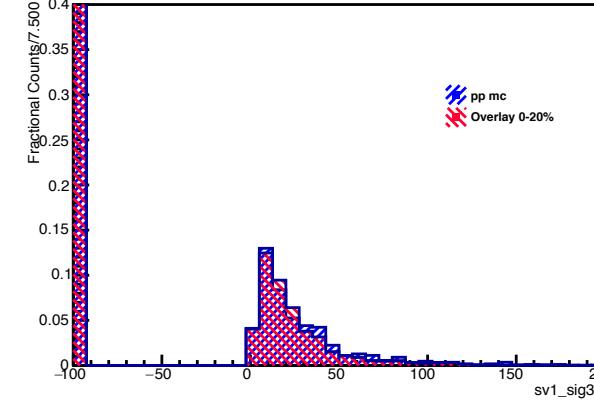
pre-tagging pt > 1.5 GeV Fixed Cone



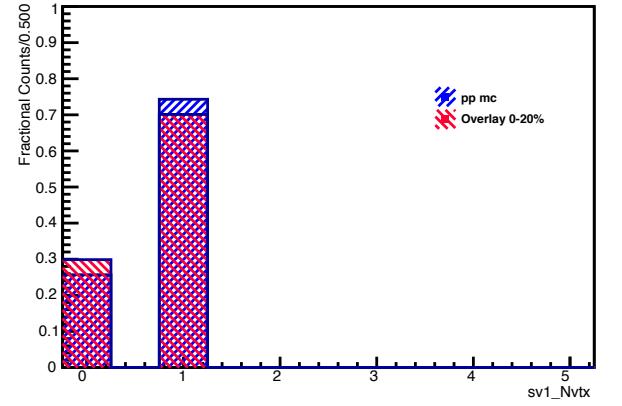
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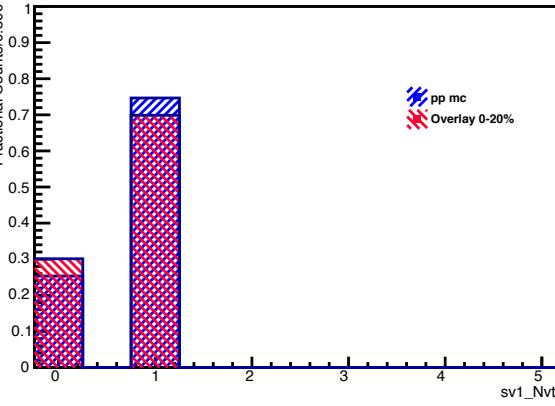
pre-tagging pt > 4.0 GeV Fixed Cone



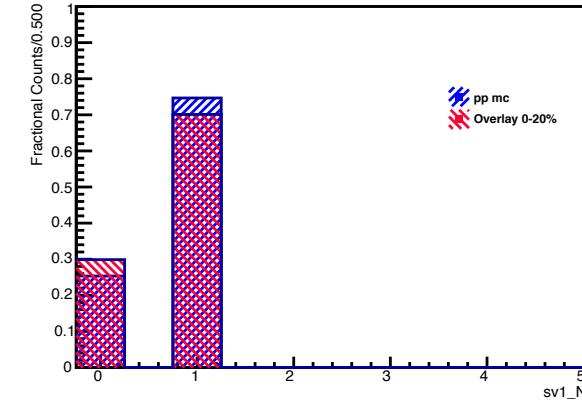
JF pt > 0.5 GeV Shrinking Cone



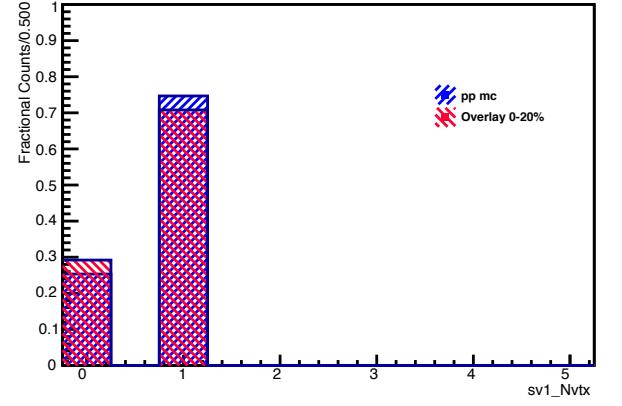
JF pt > 0.5 GeV Fixed Cone



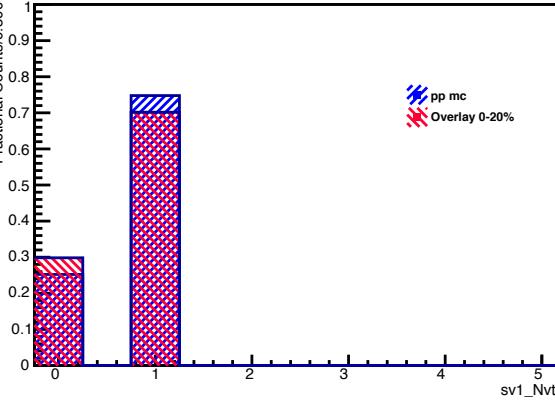
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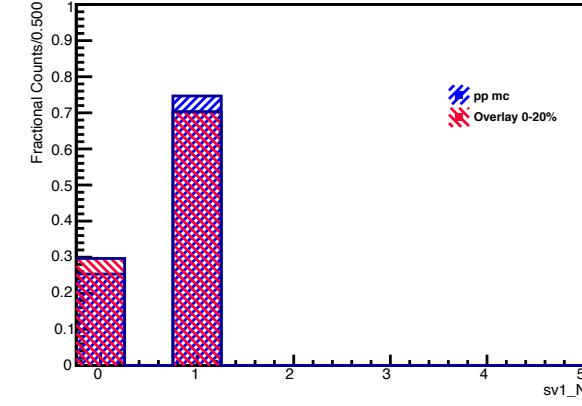
JF pt > 1.5 GeV Fixed Cone



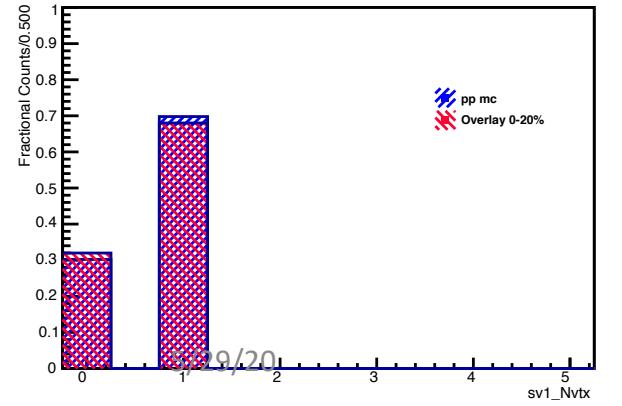
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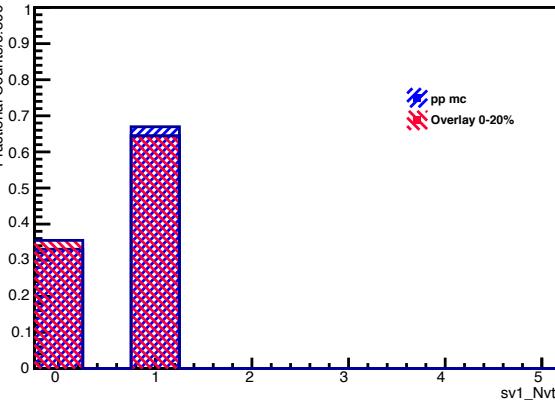
JF pt > 4 GeV Fixed Cone



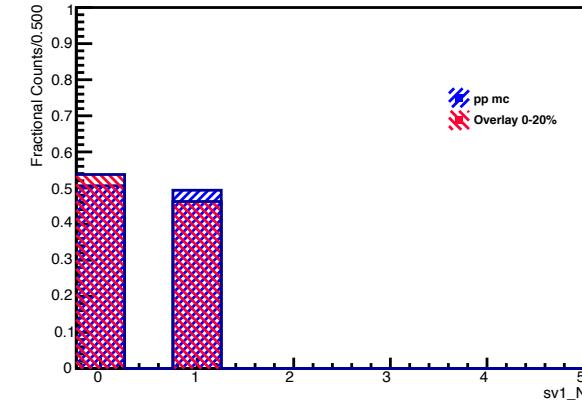
pre-tagging pt > 1.5 GeV Fixed Cone



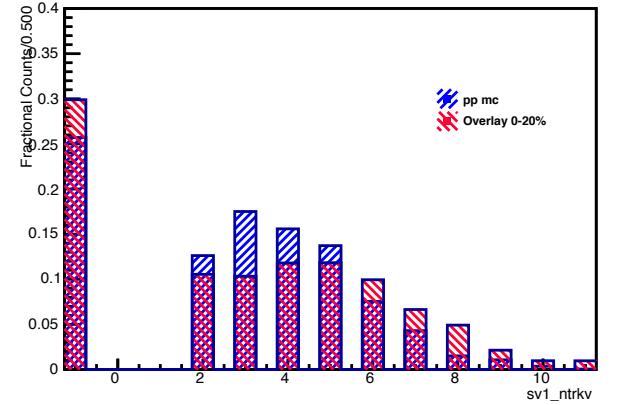
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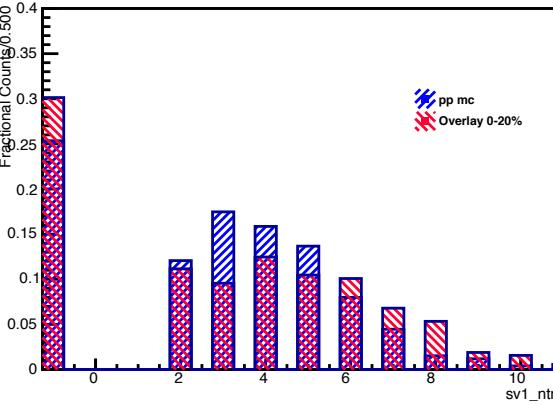
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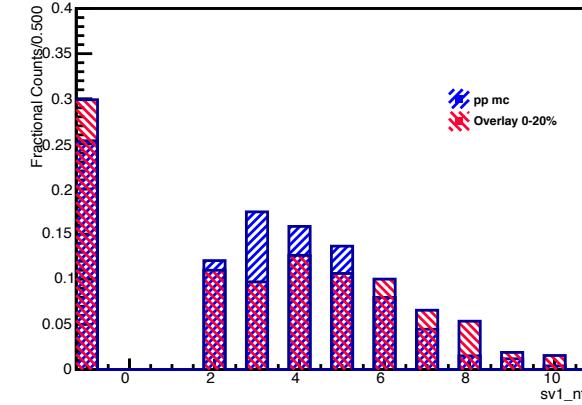
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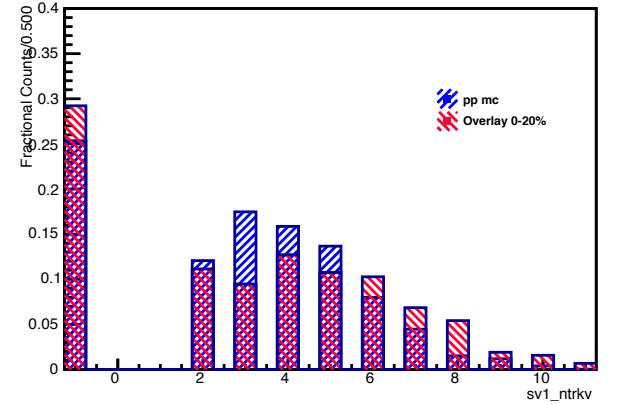
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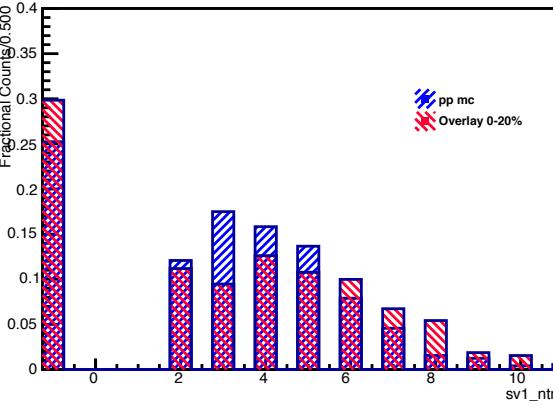
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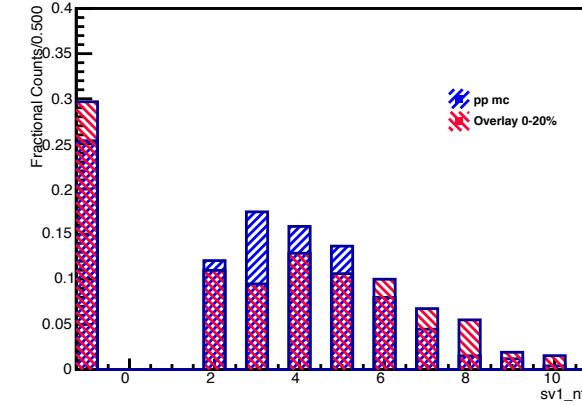
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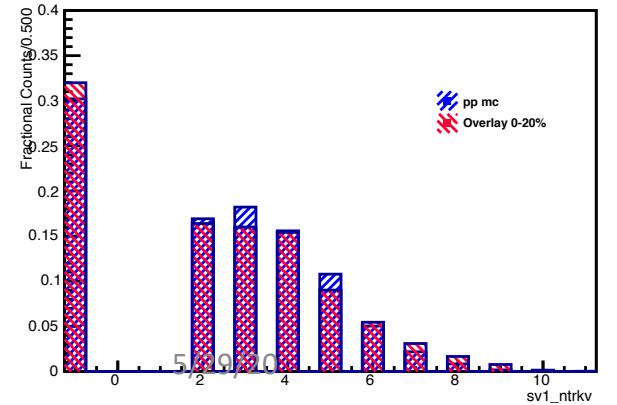
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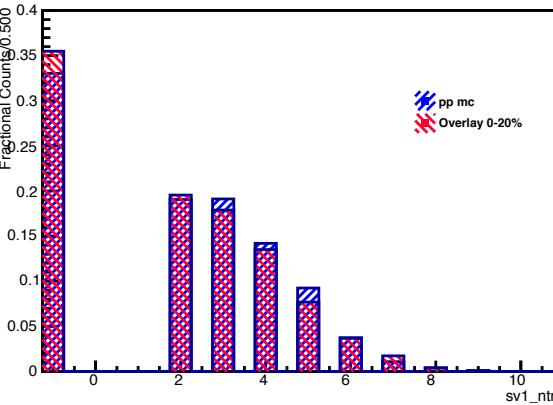
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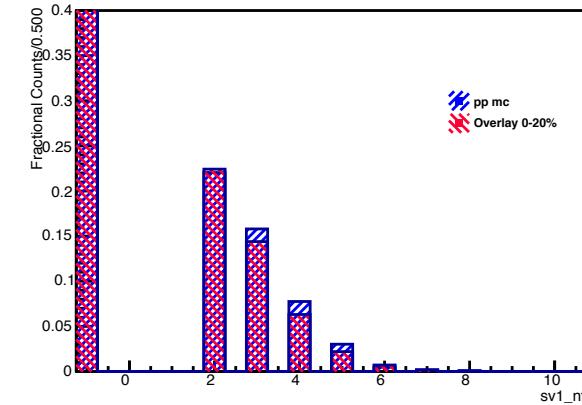
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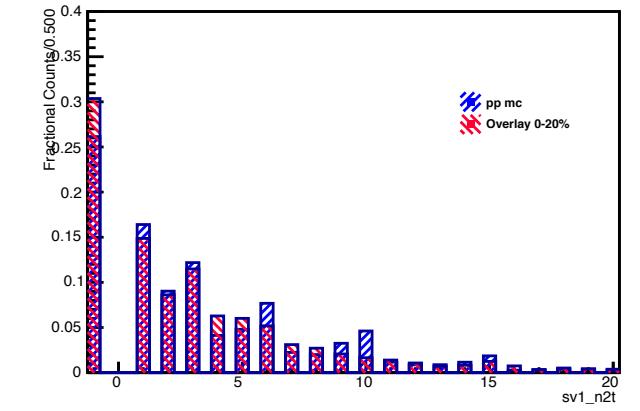
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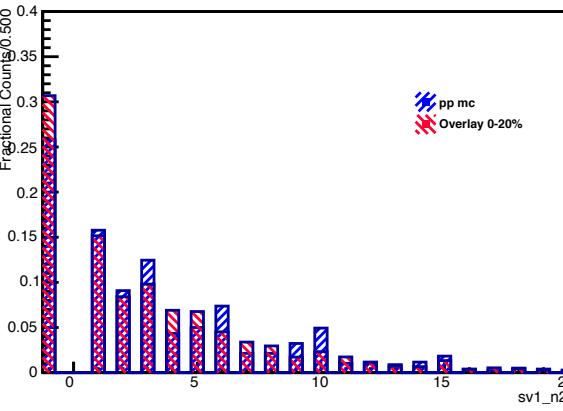
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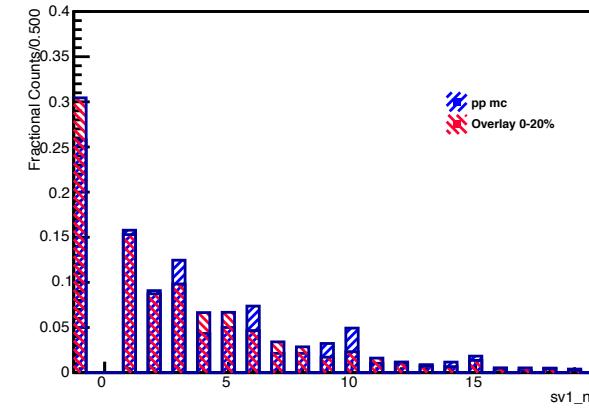
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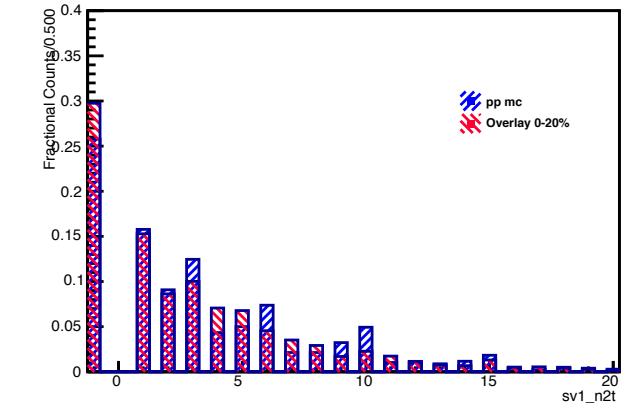
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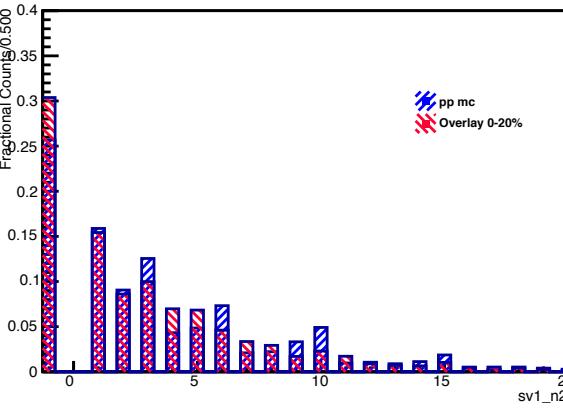
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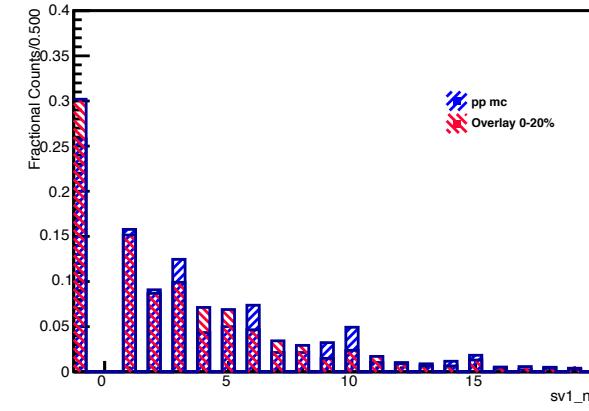
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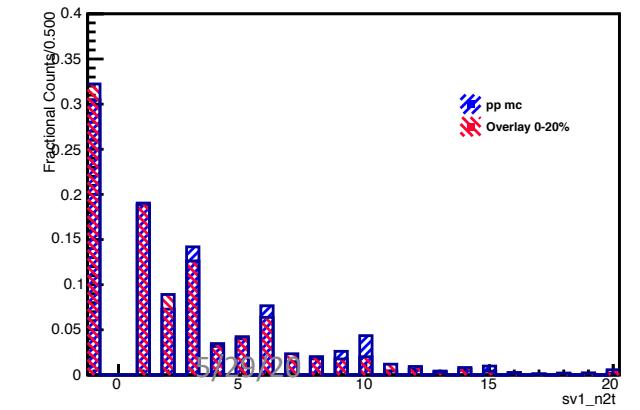
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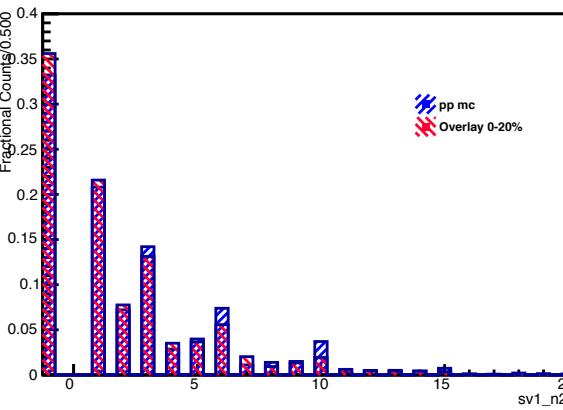
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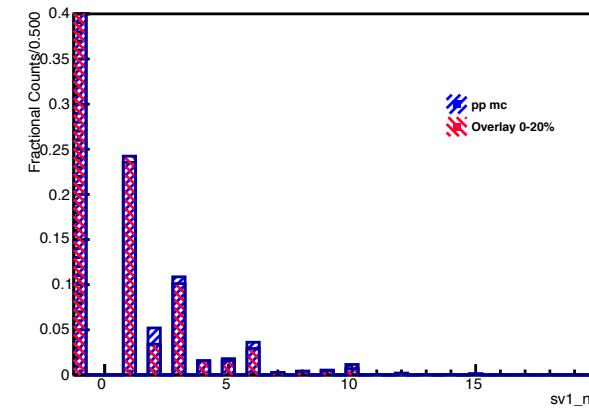
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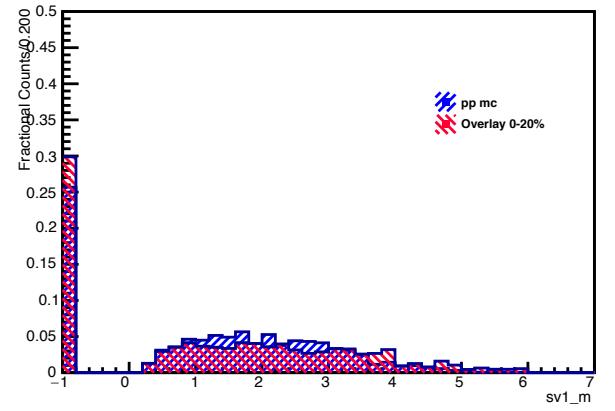
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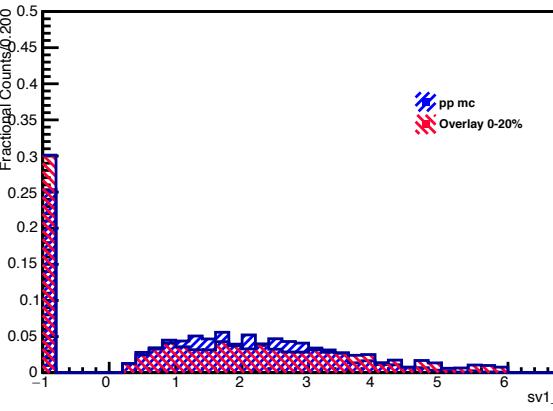
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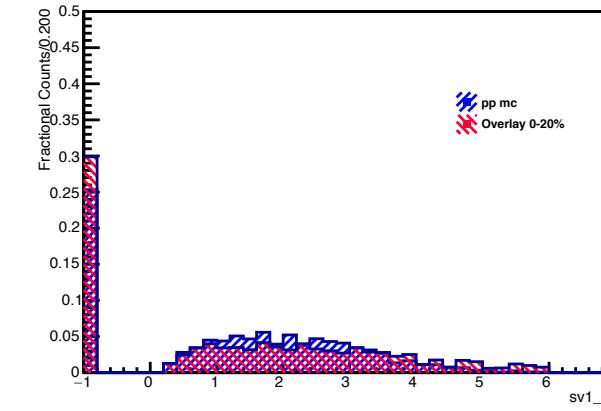
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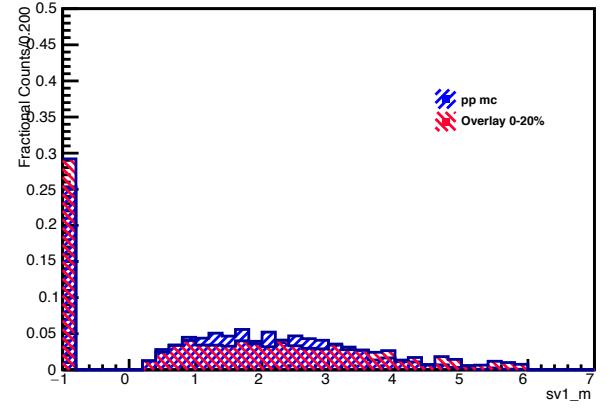
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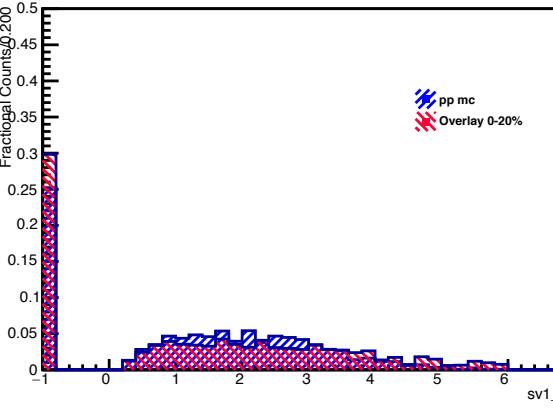
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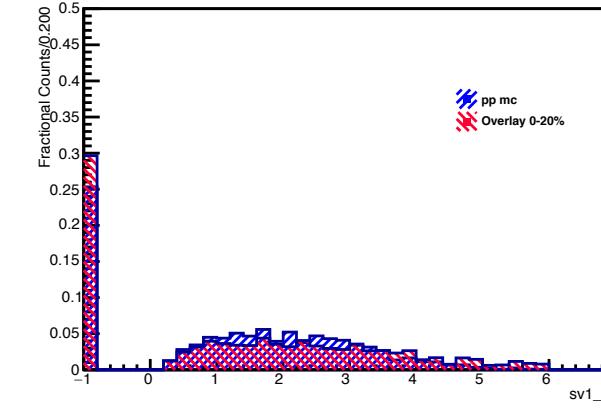
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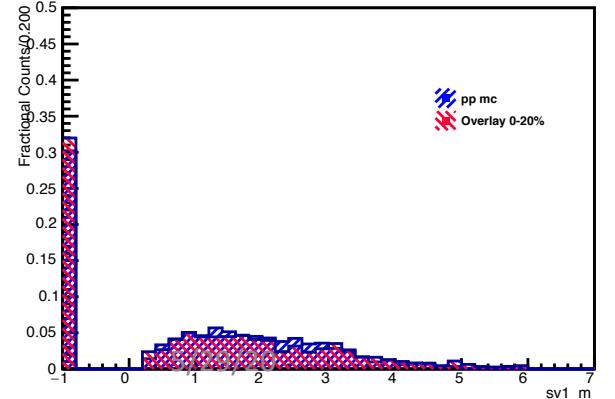
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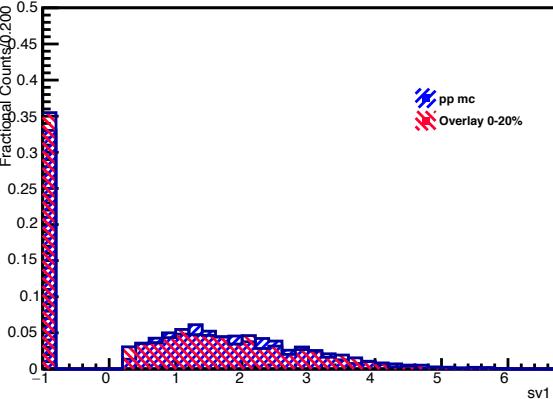
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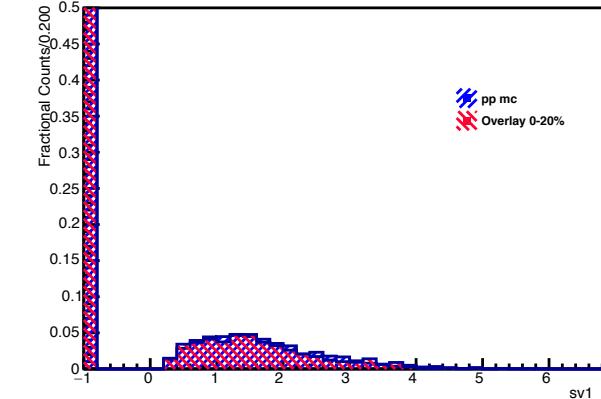
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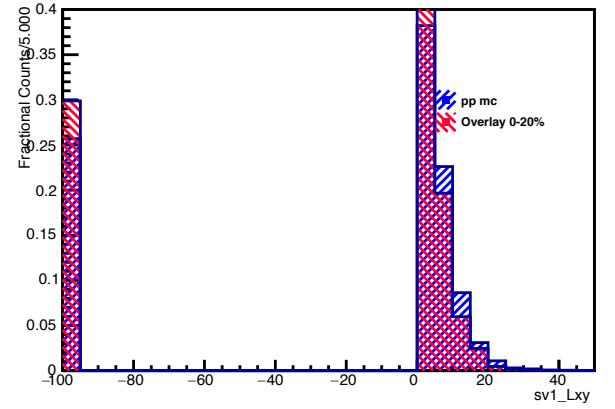
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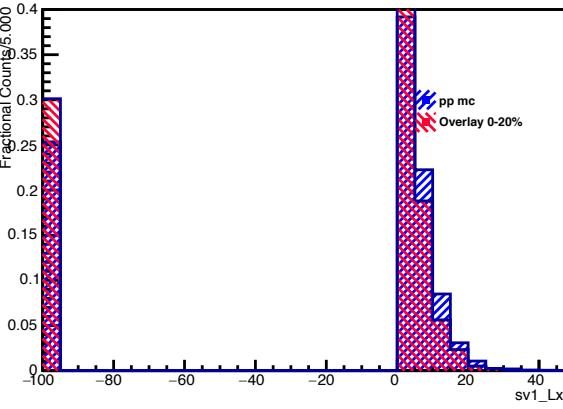
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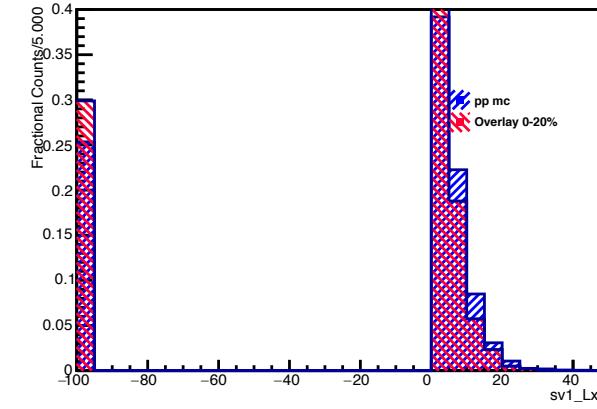
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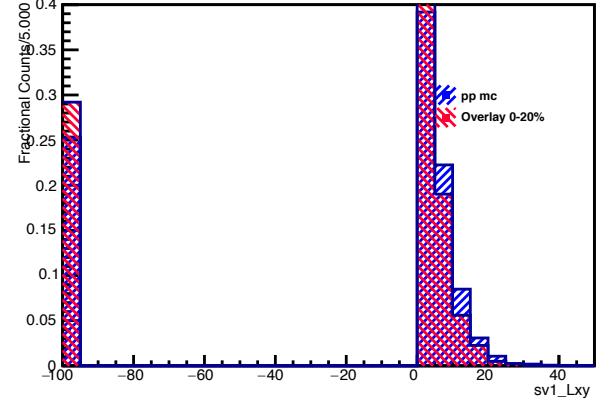
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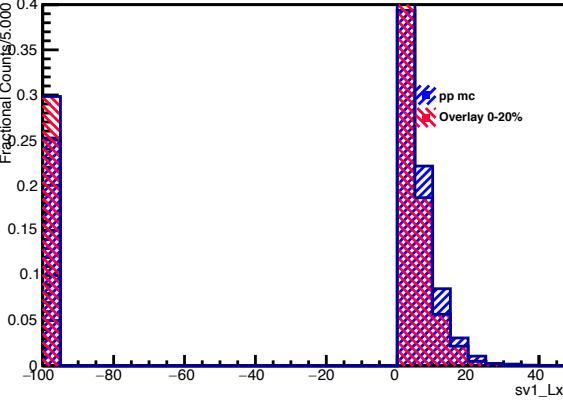
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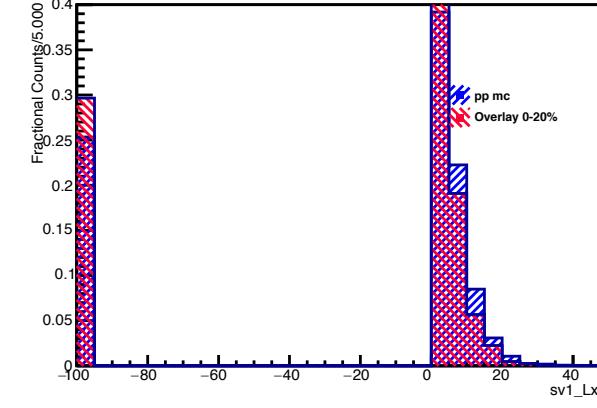
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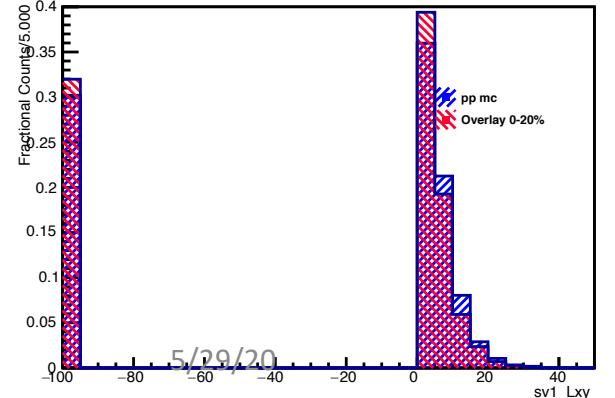
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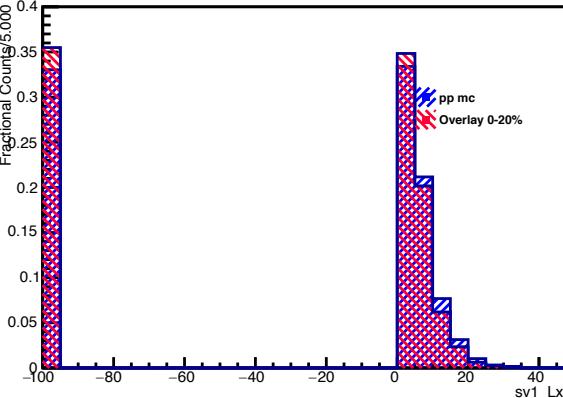
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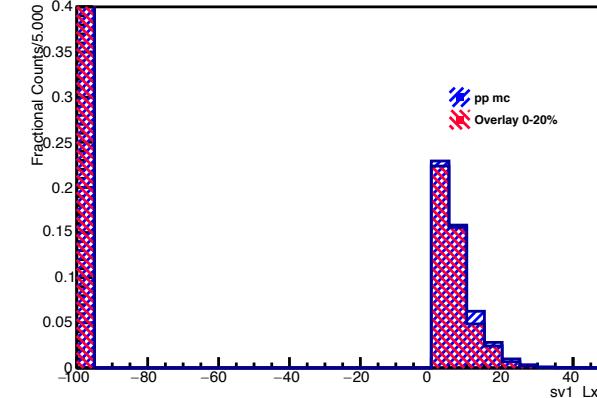
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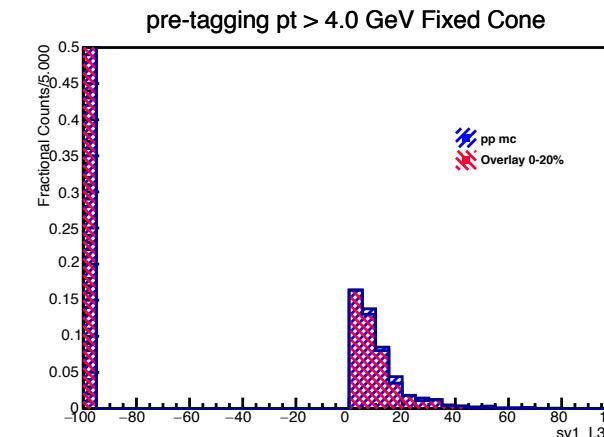
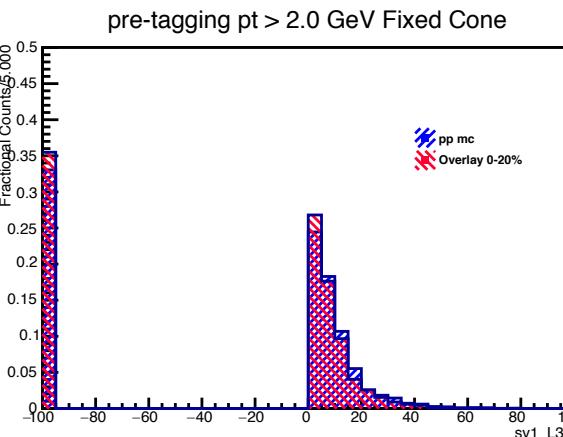
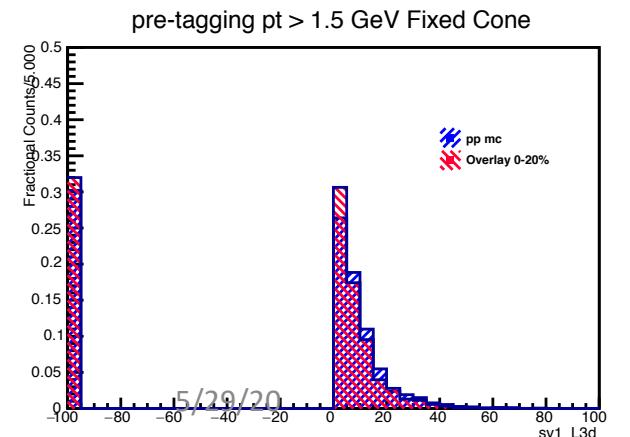
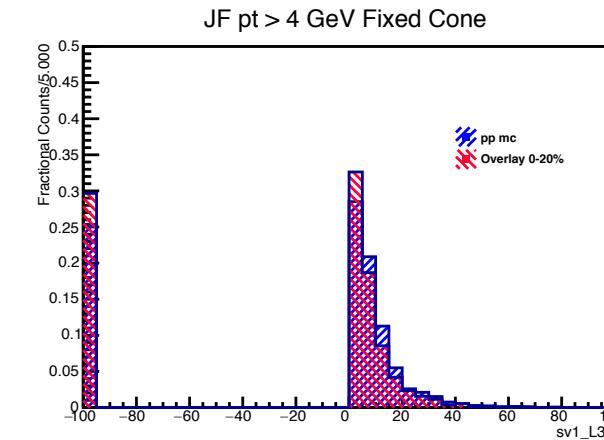
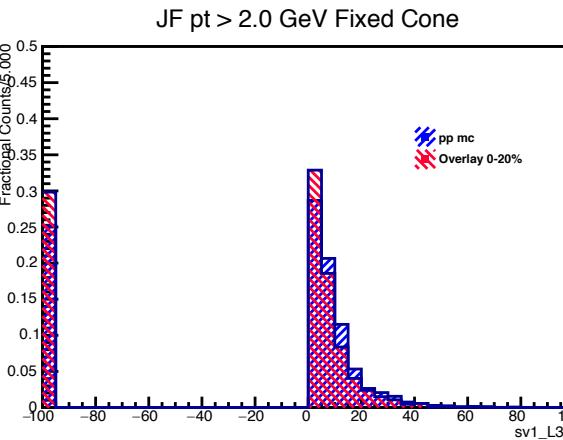
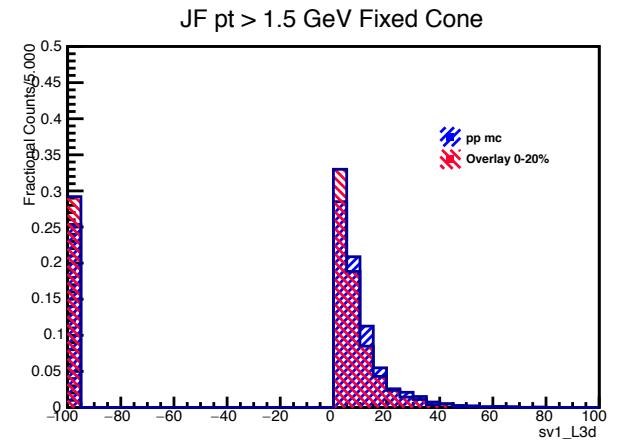
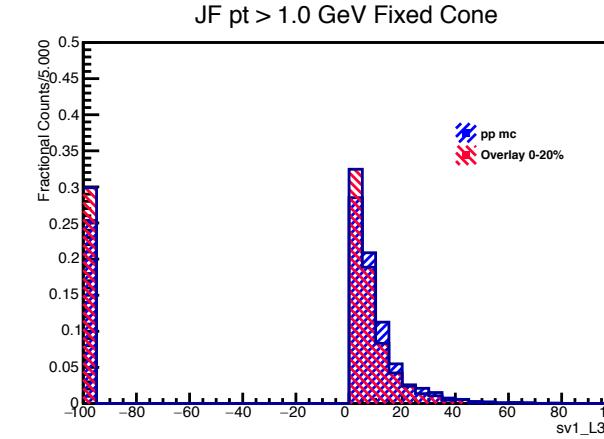
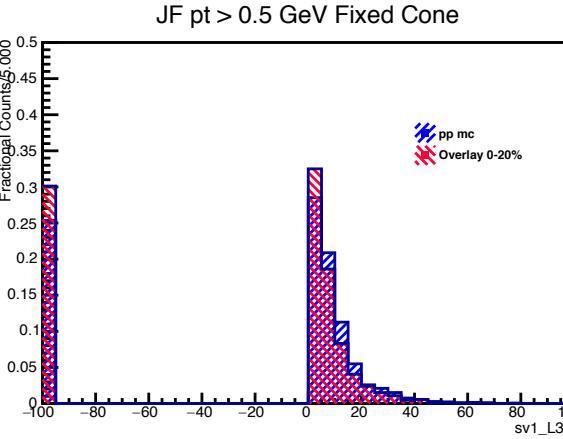
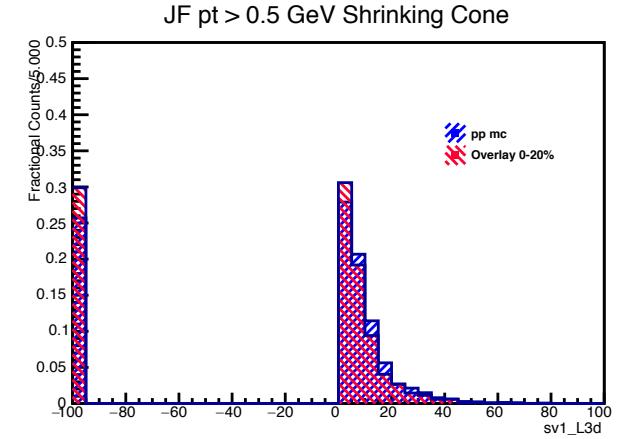


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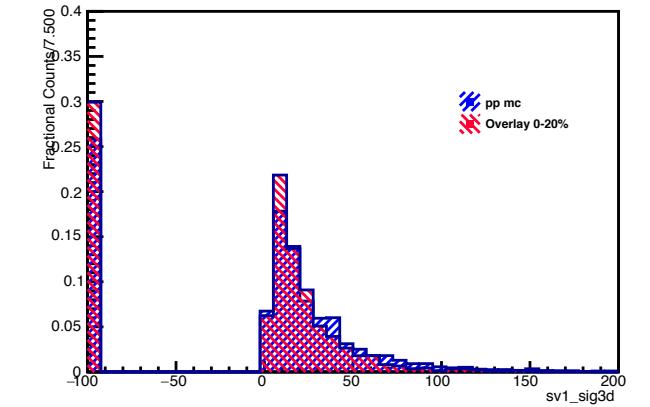
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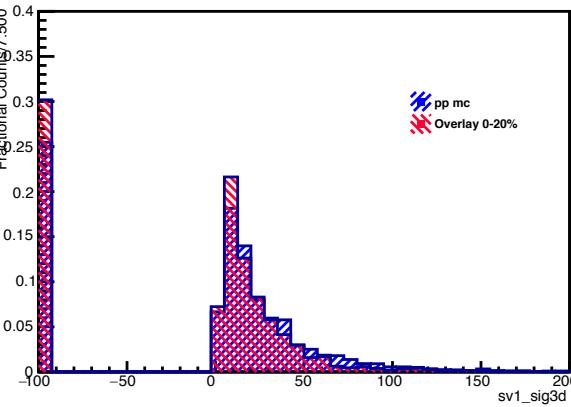


Secondary Vertex

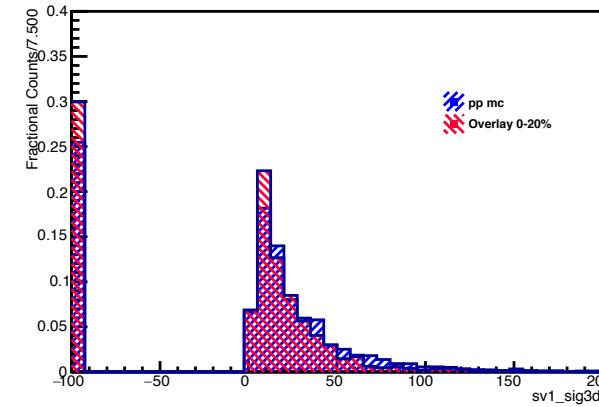
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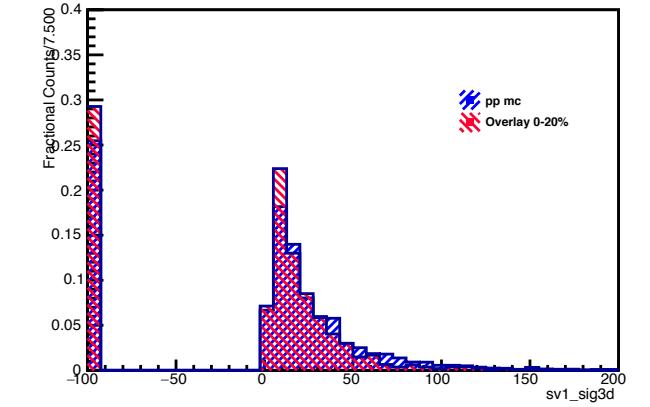
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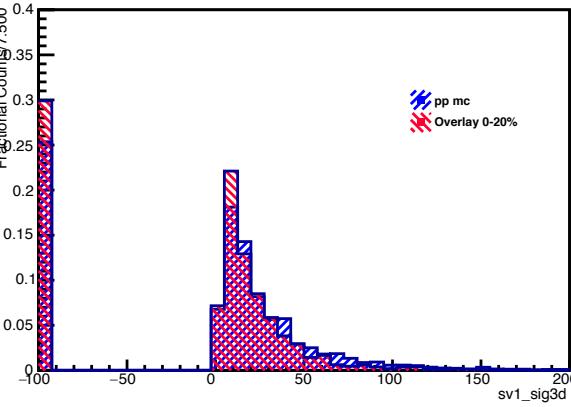
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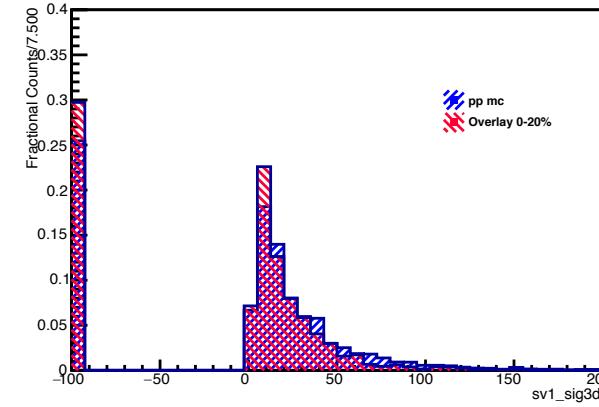
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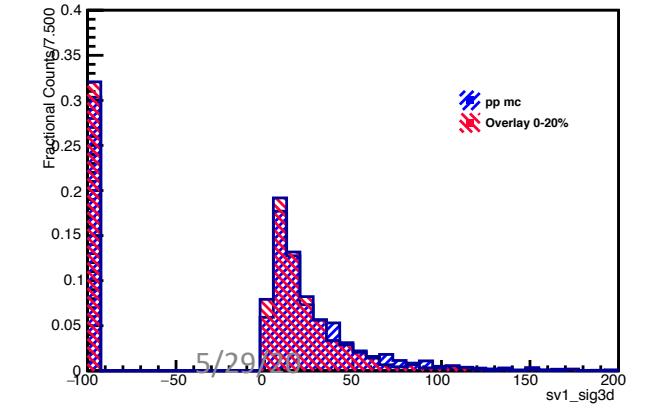
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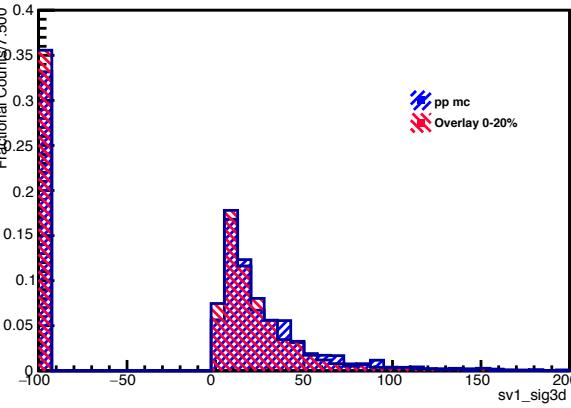
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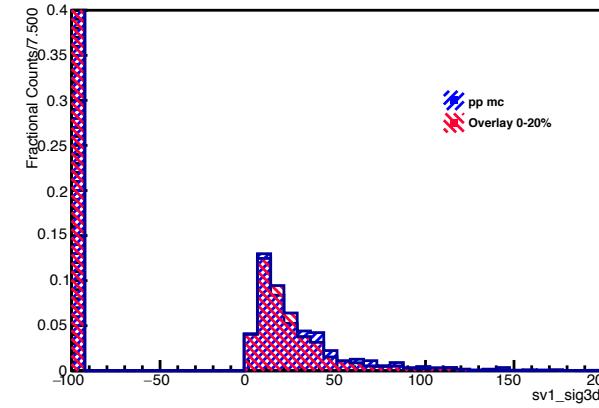
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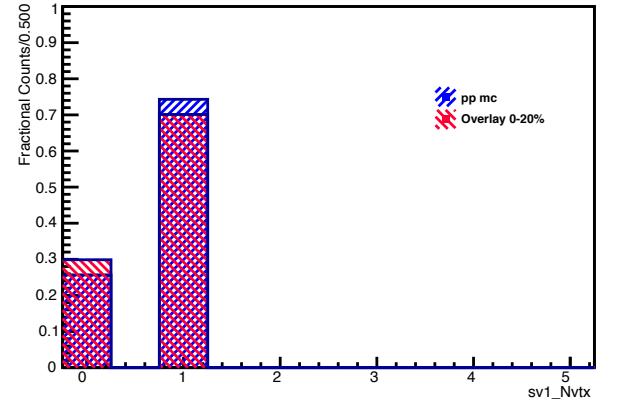
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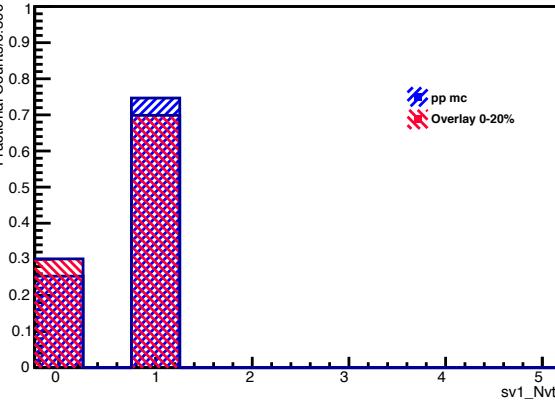
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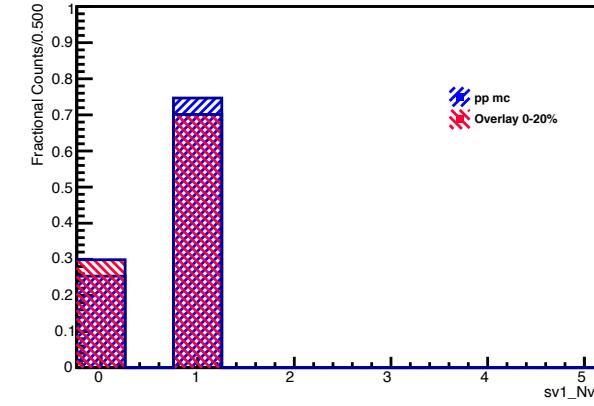
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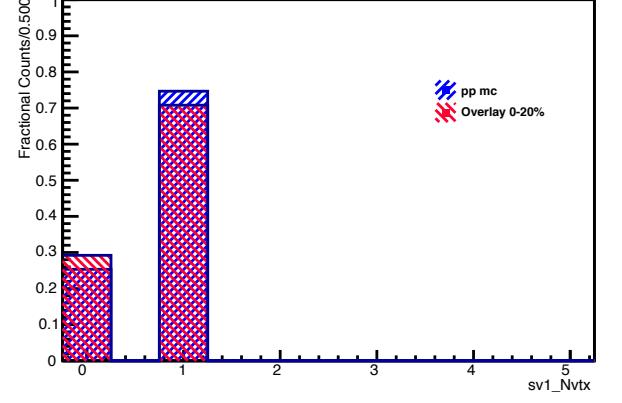
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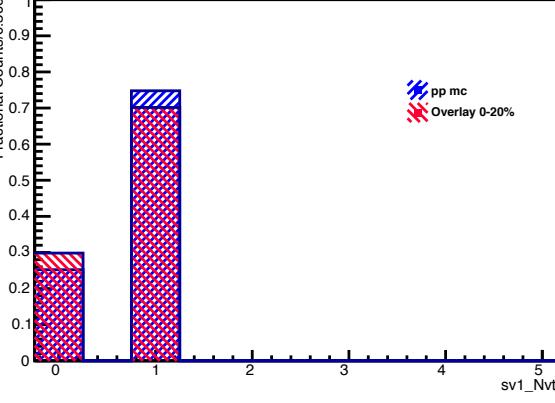
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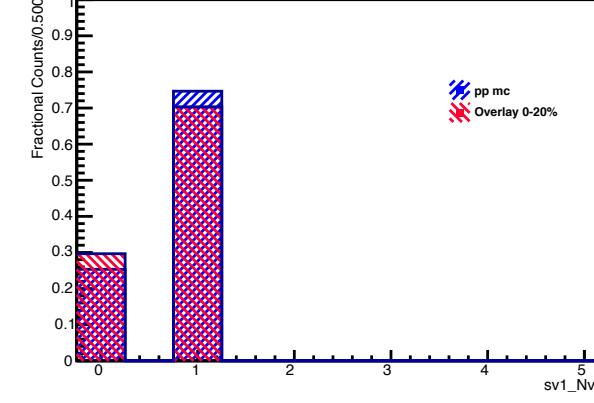
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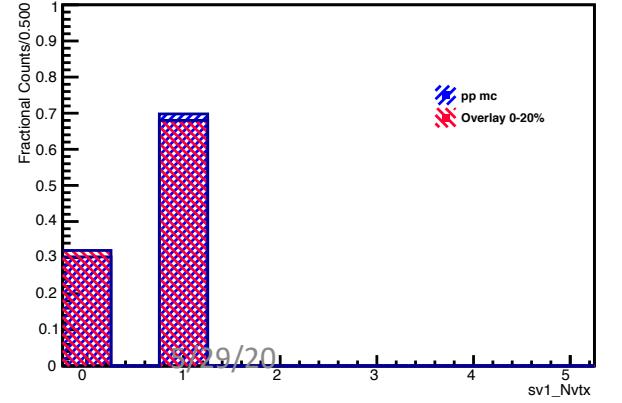
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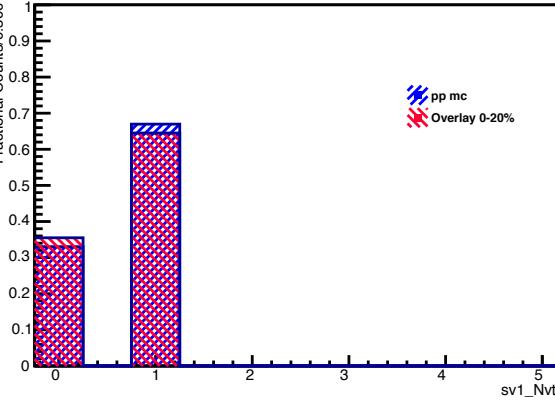
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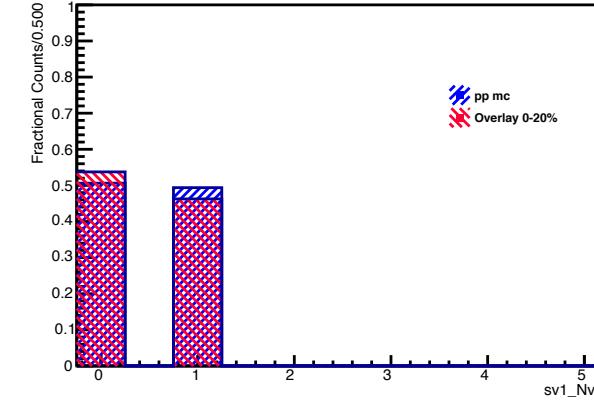
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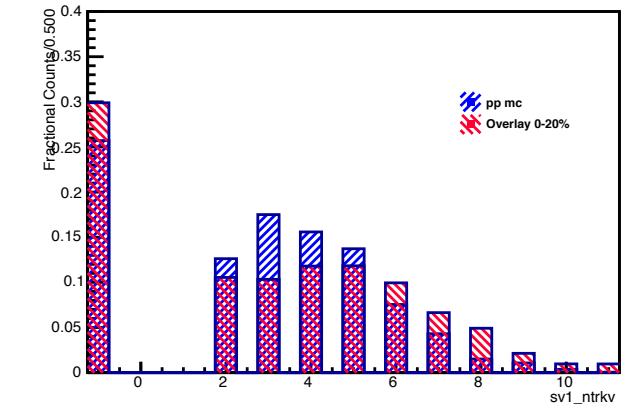
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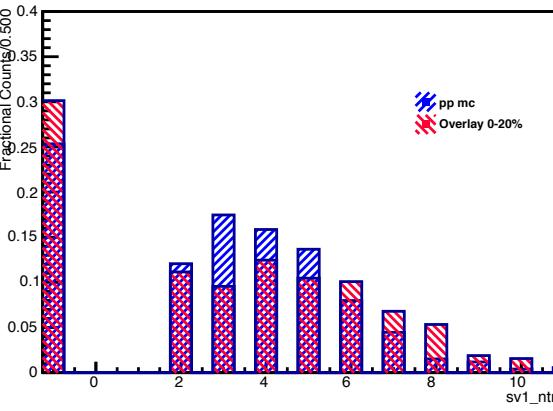
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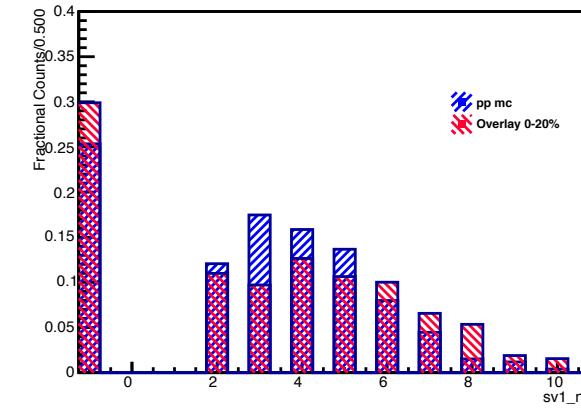
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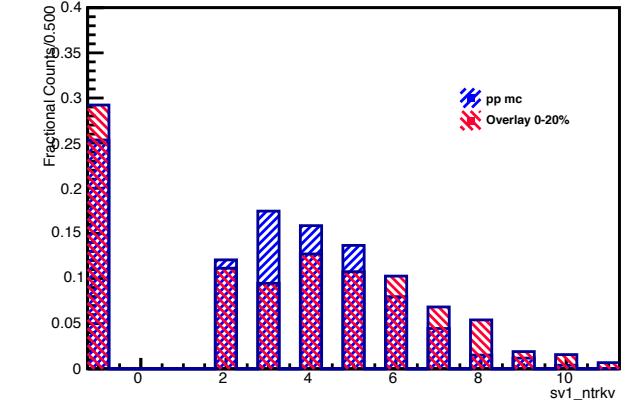
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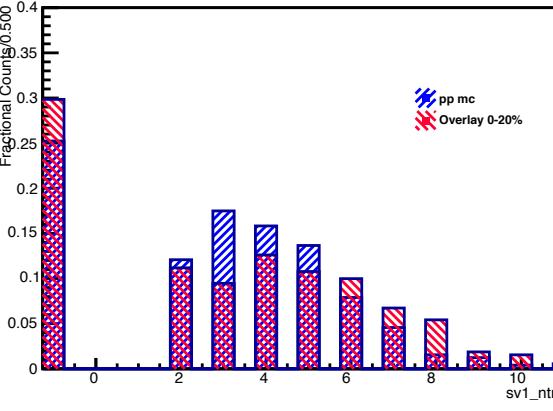
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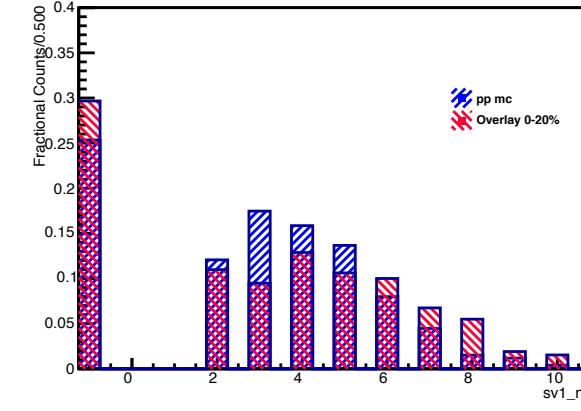
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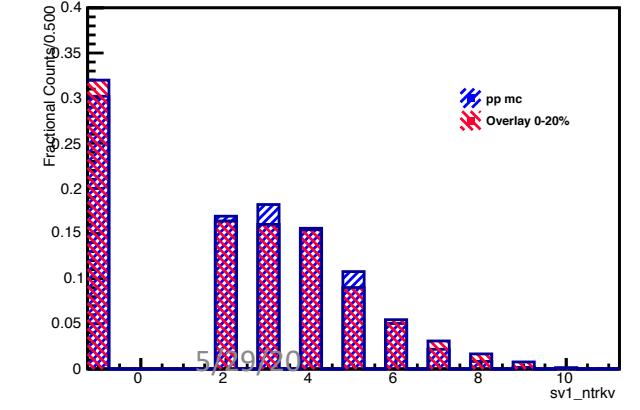
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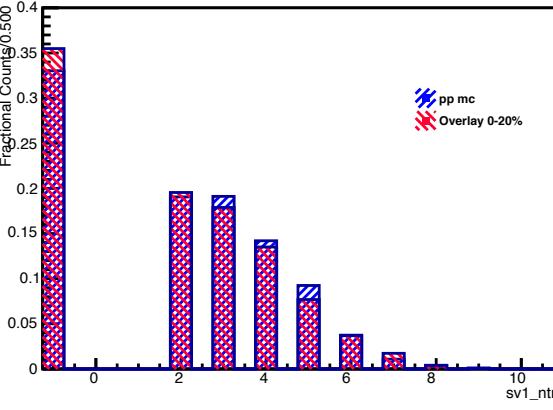
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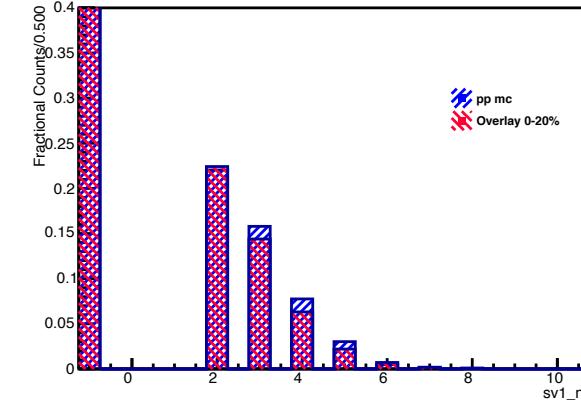
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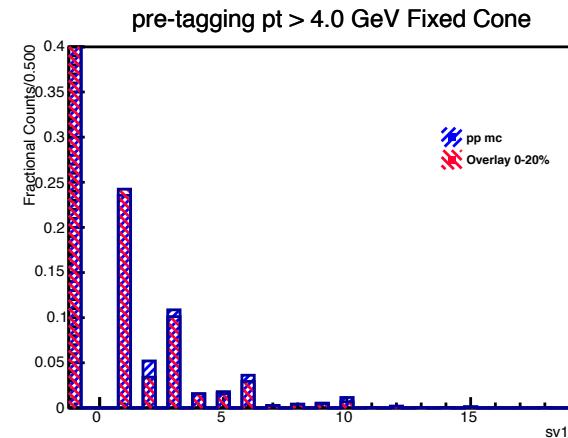
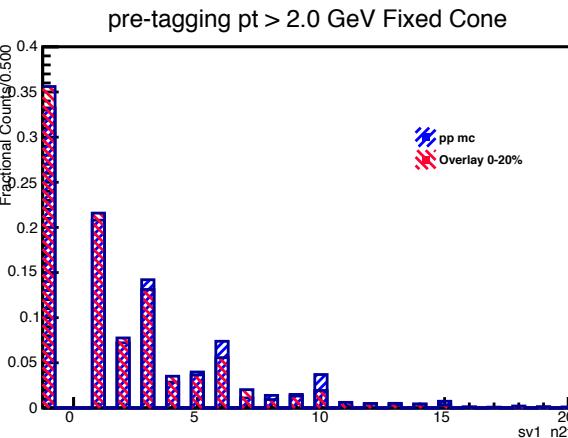
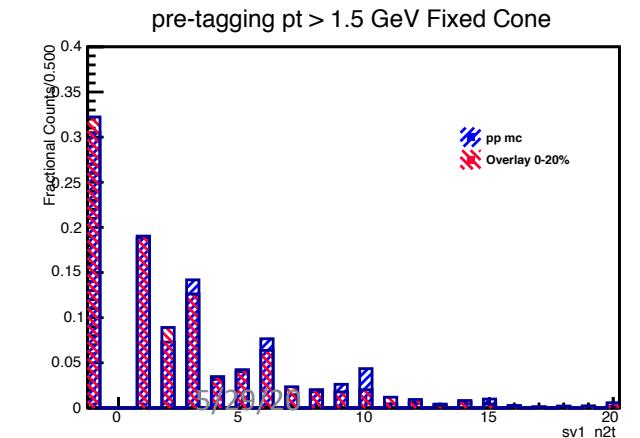
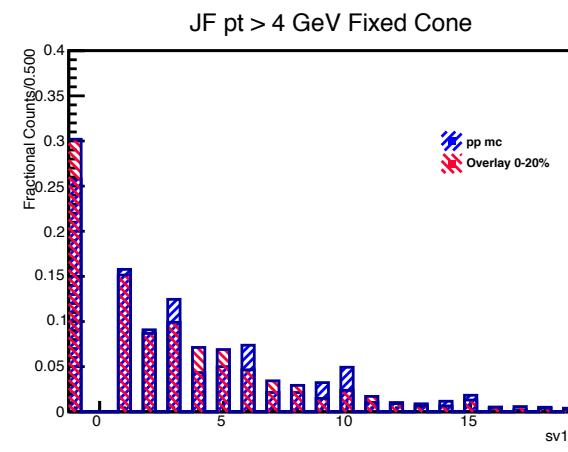
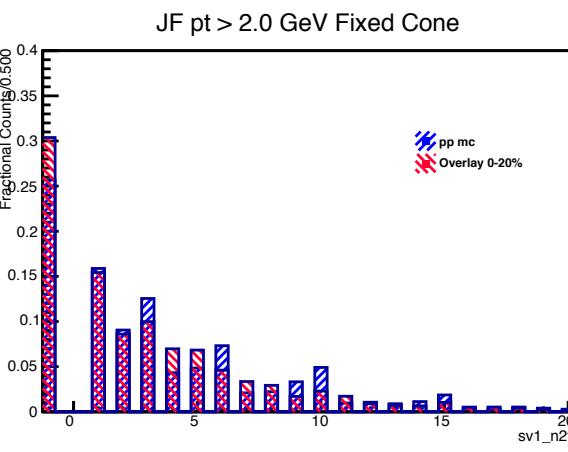
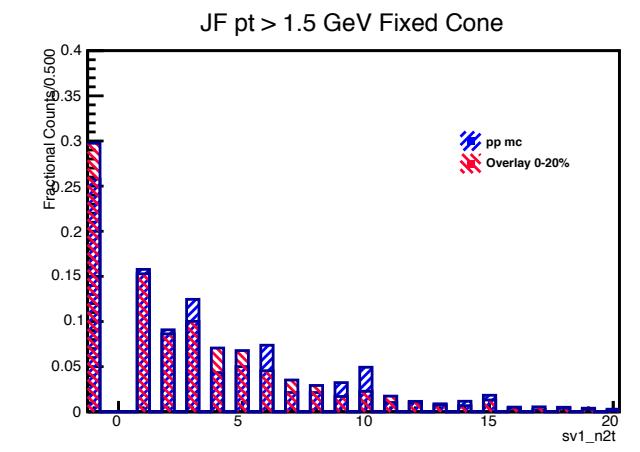
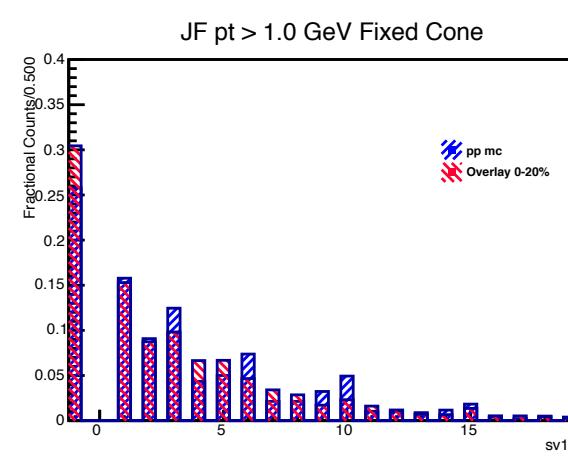
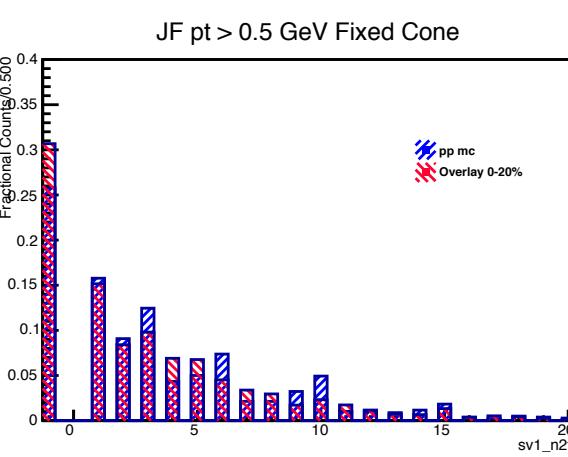
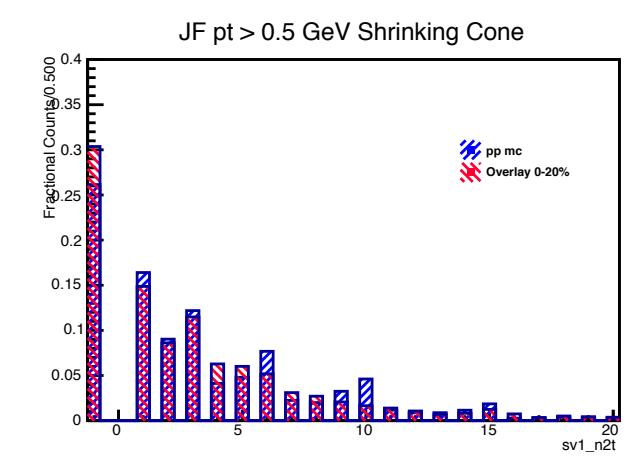


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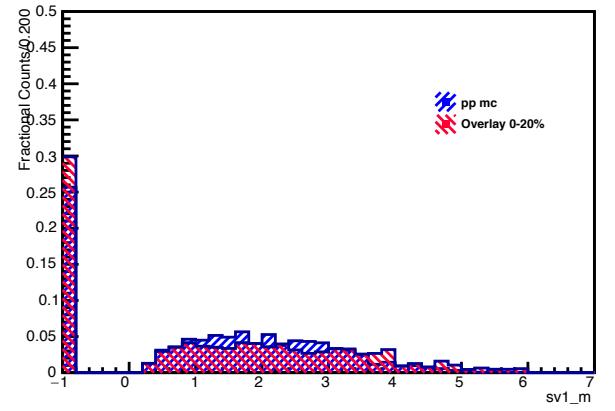


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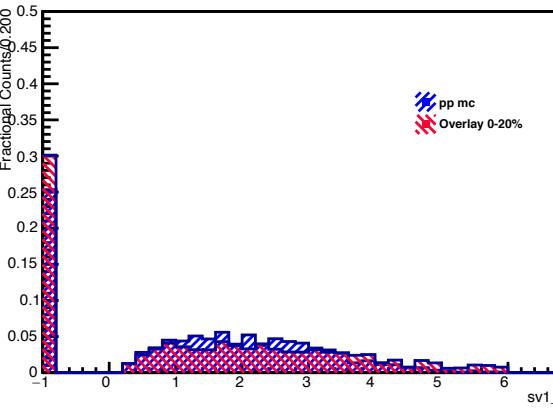




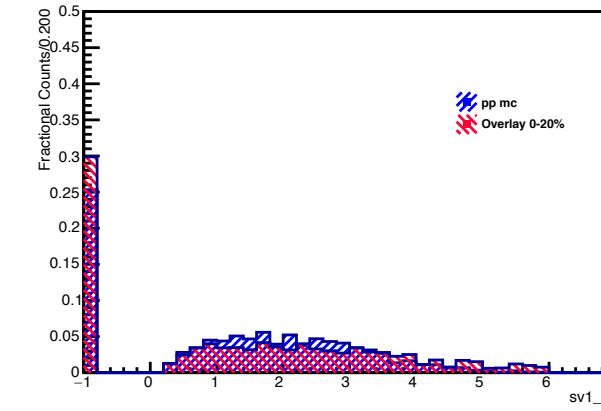
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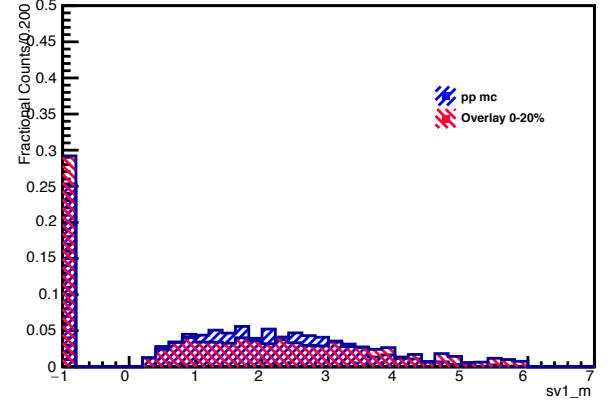
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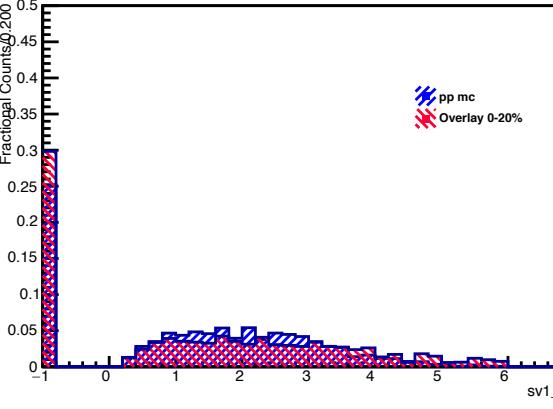
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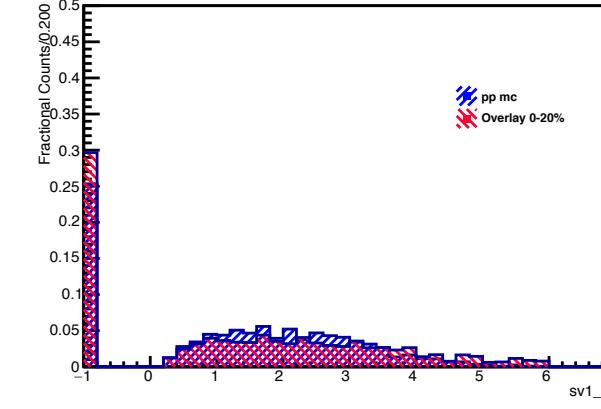
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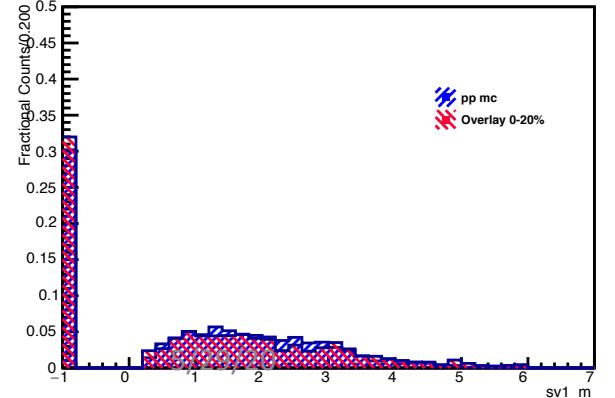
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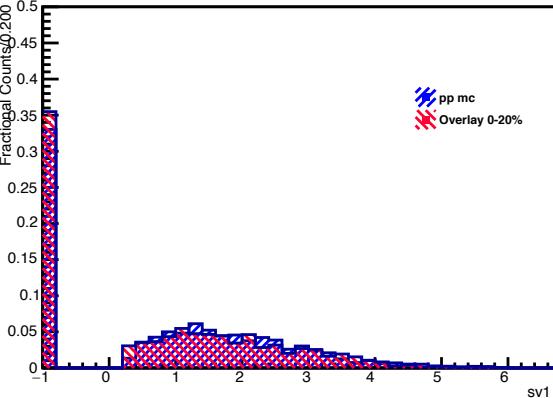
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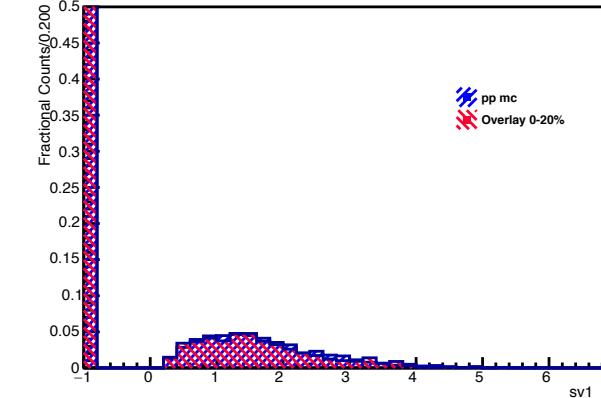
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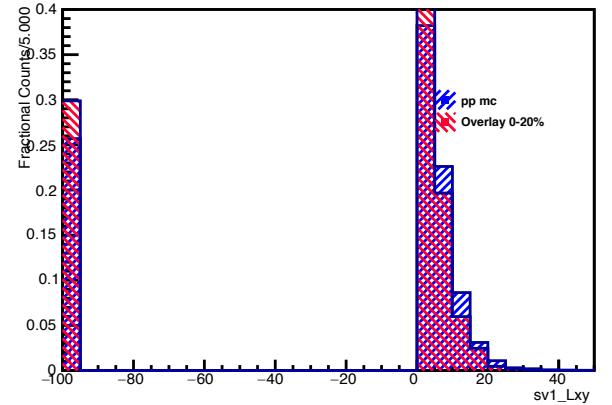
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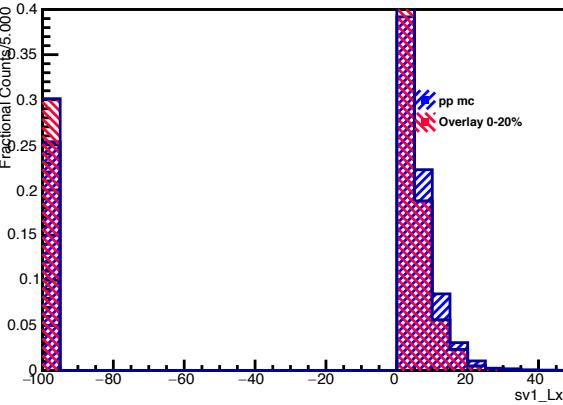
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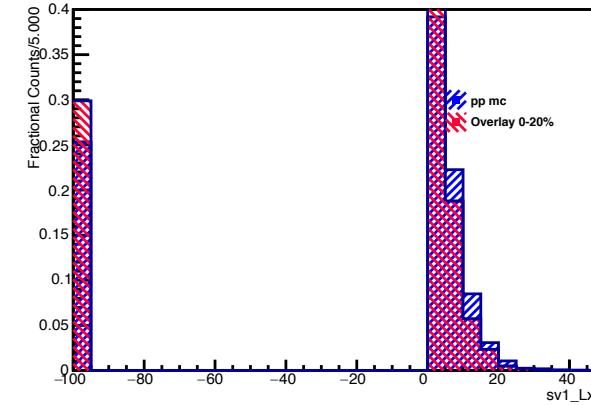
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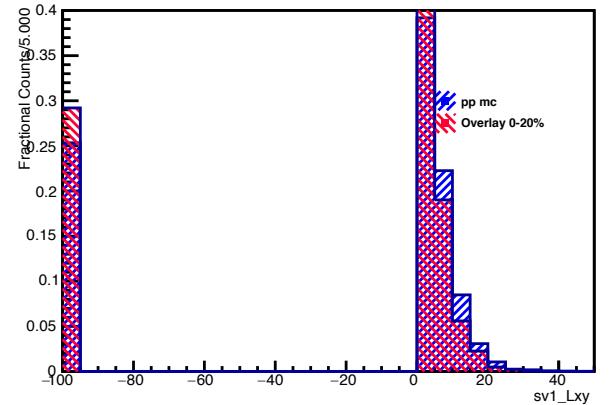
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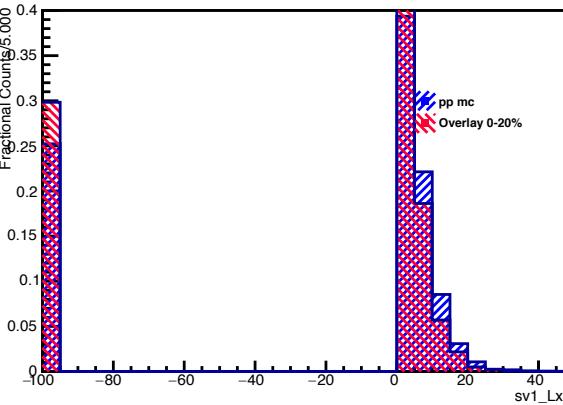
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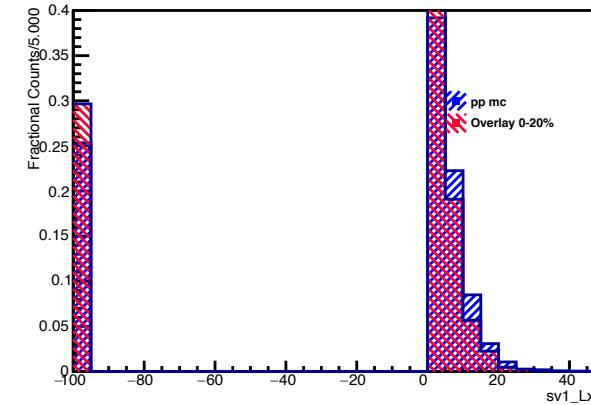
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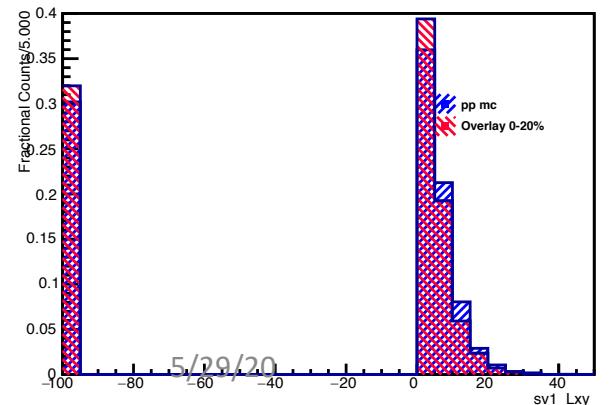
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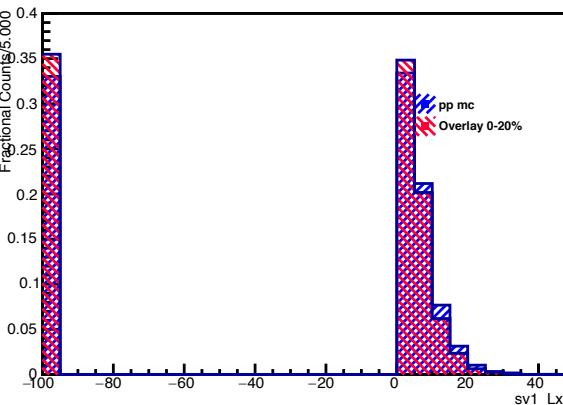
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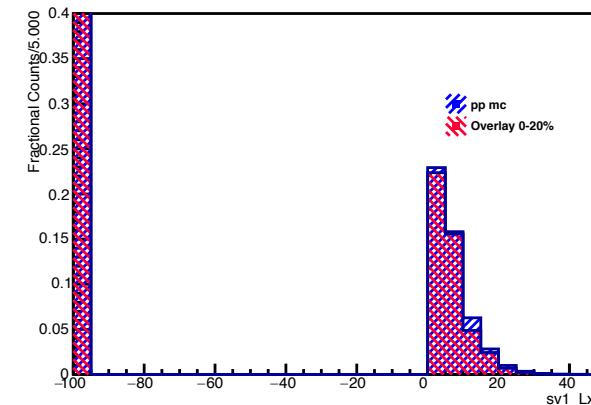
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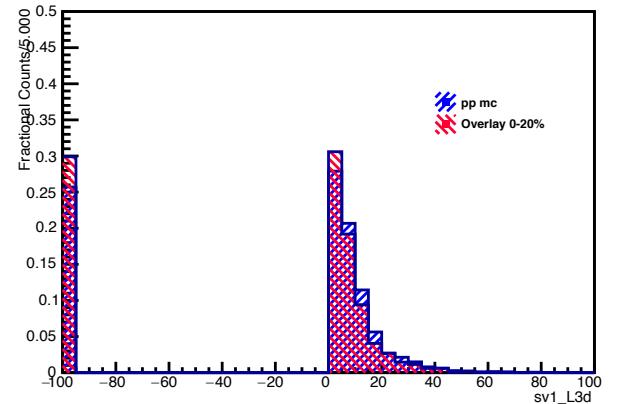
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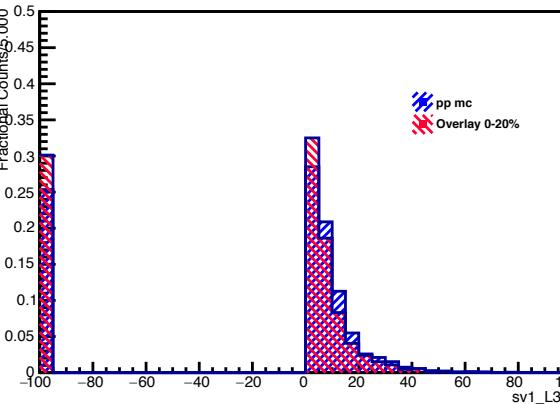
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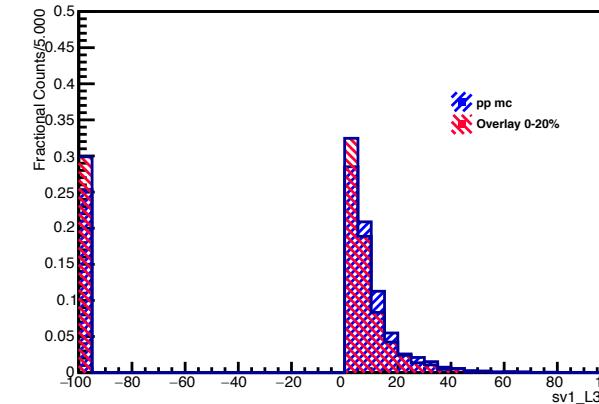
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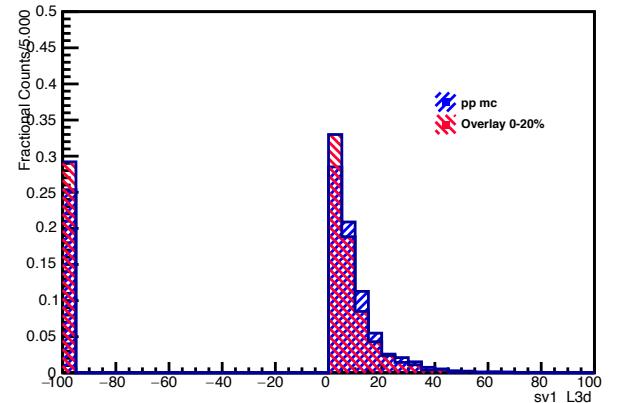
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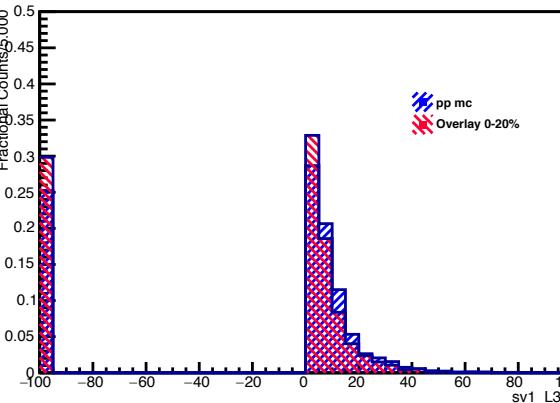
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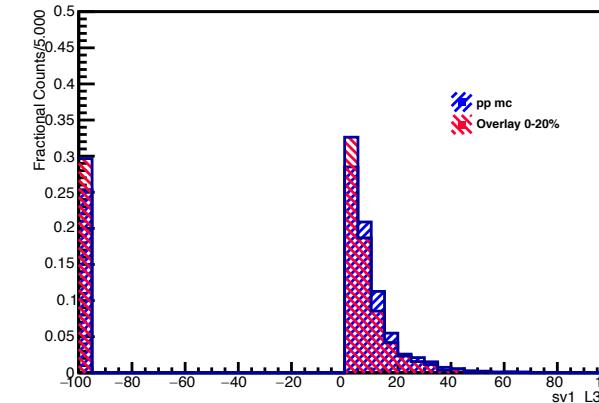
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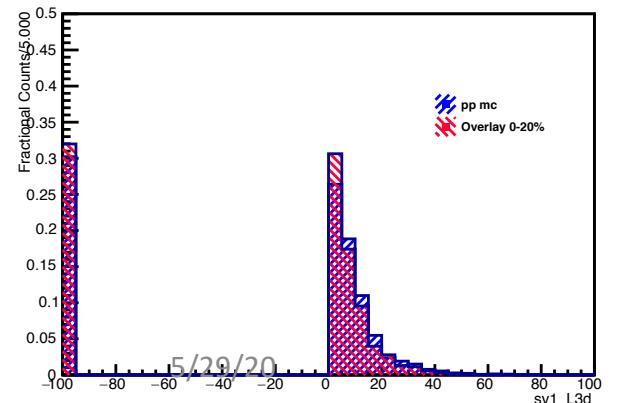
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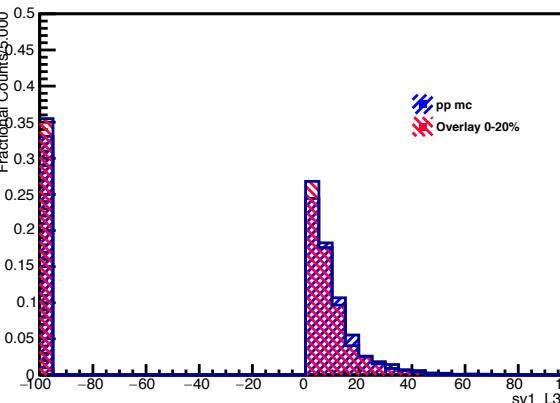
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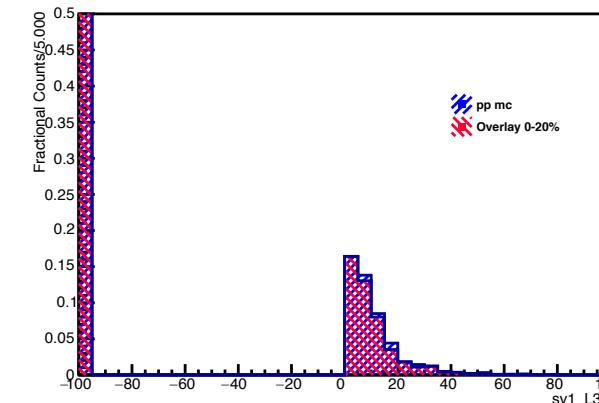
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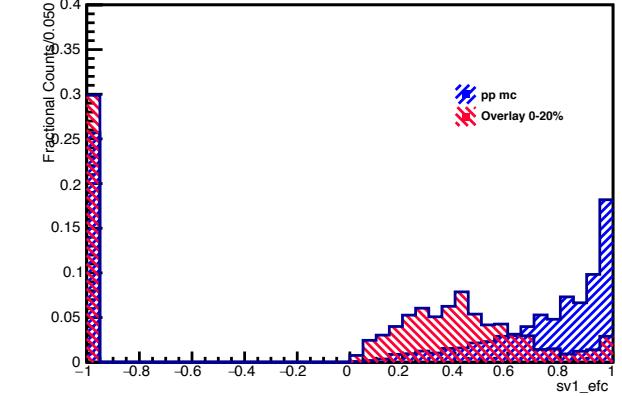
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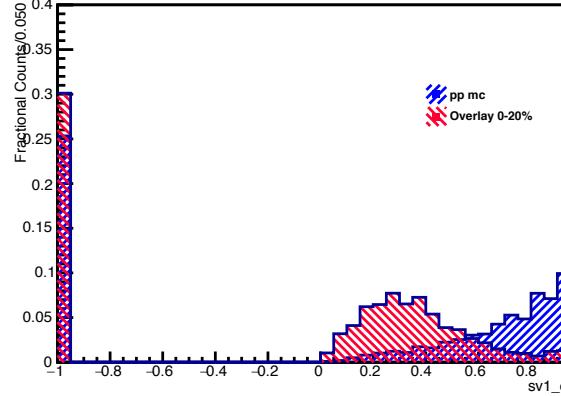
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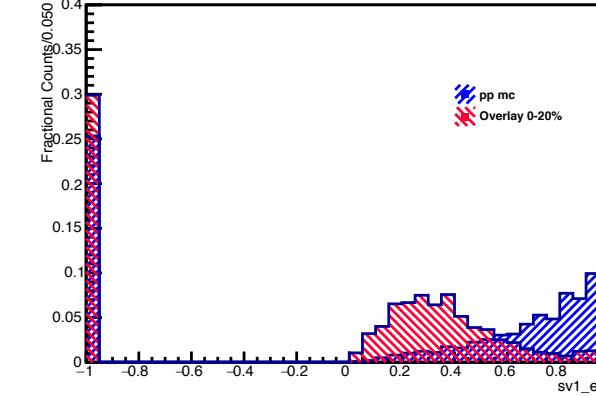
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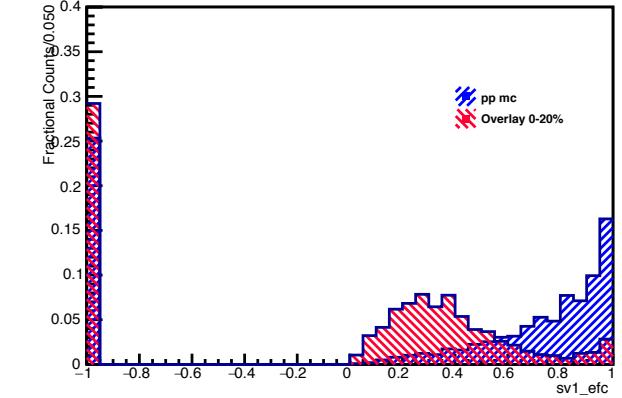
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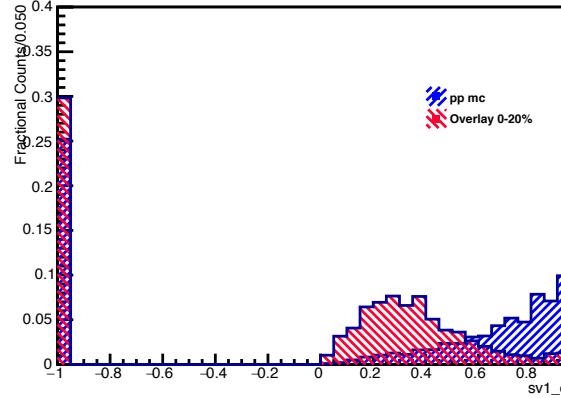
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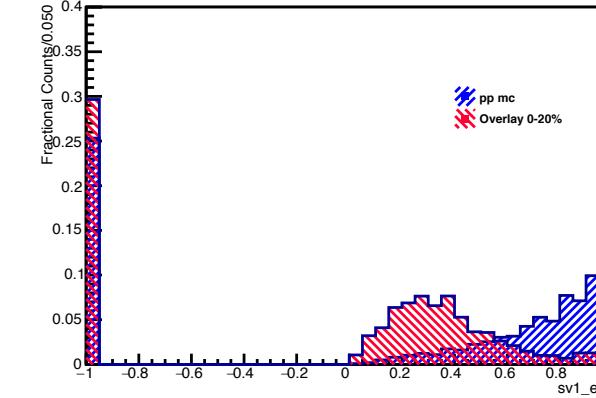
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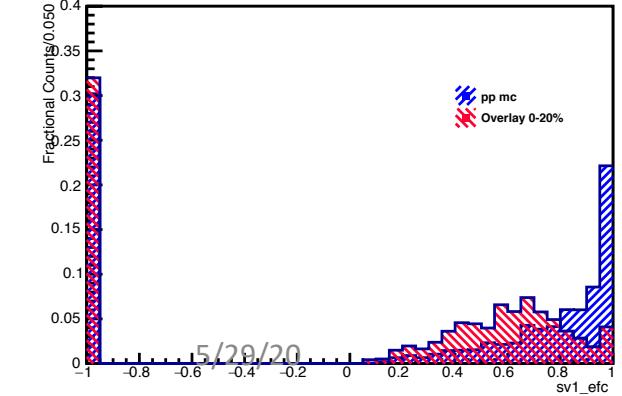
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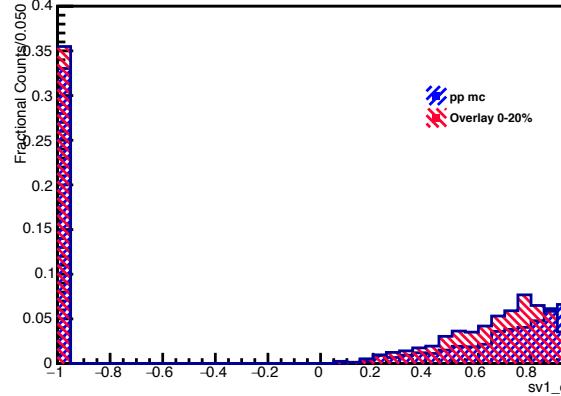
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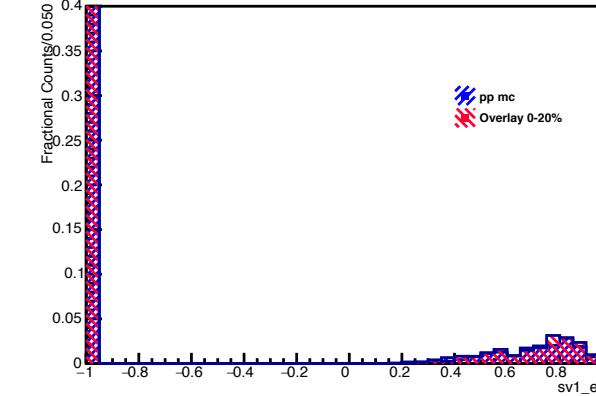
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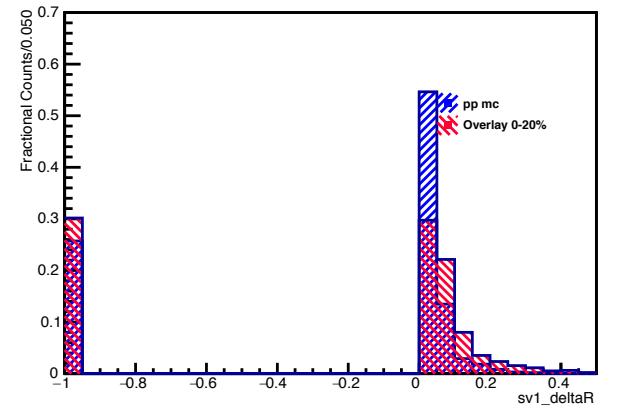
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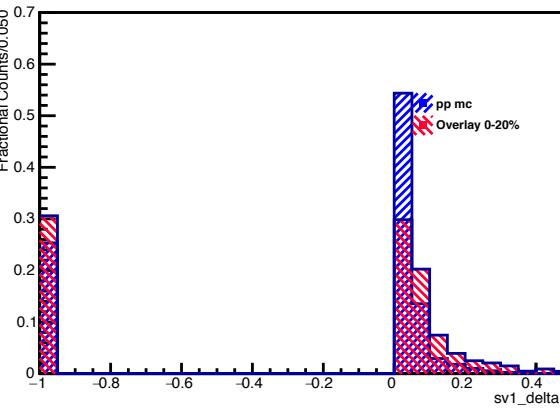
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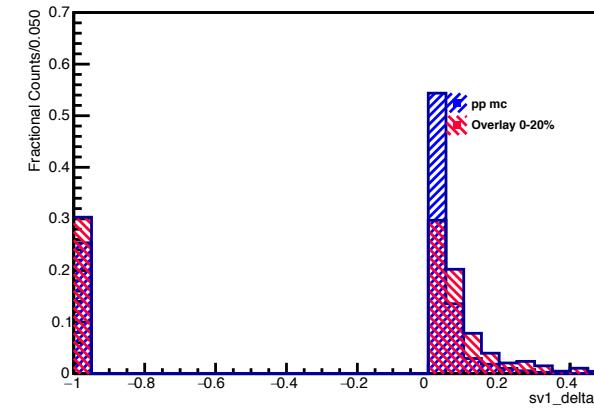
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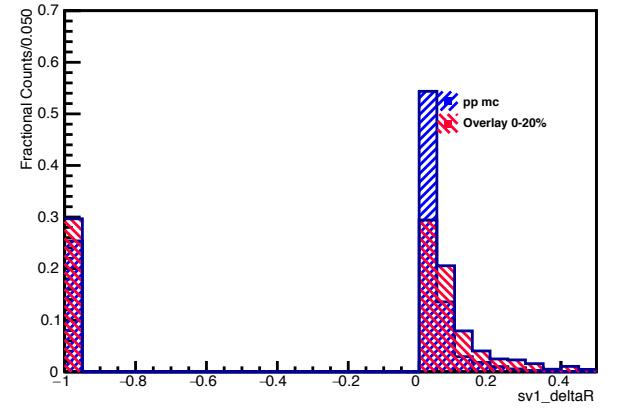
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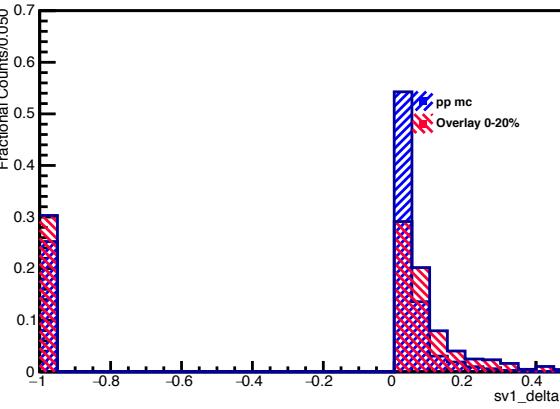
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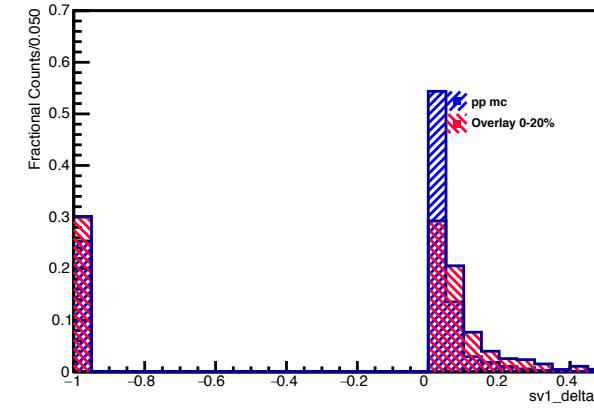
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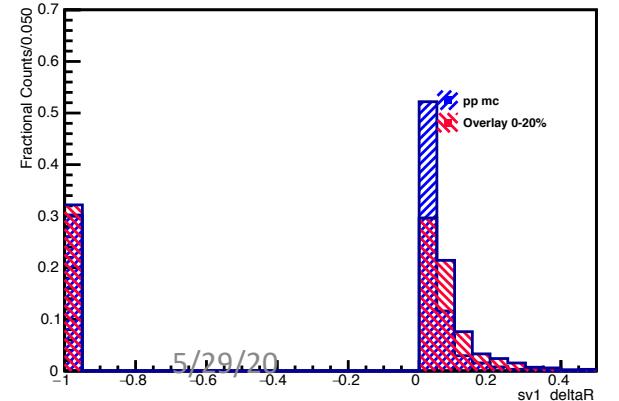
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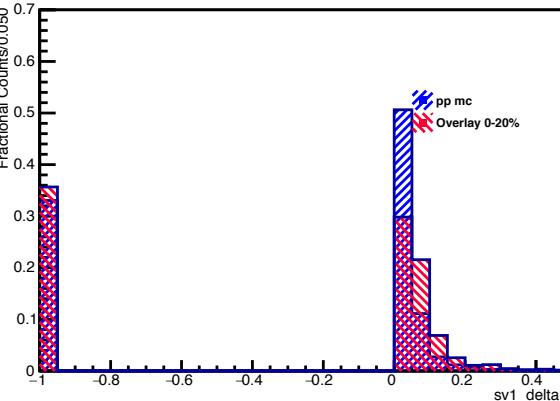
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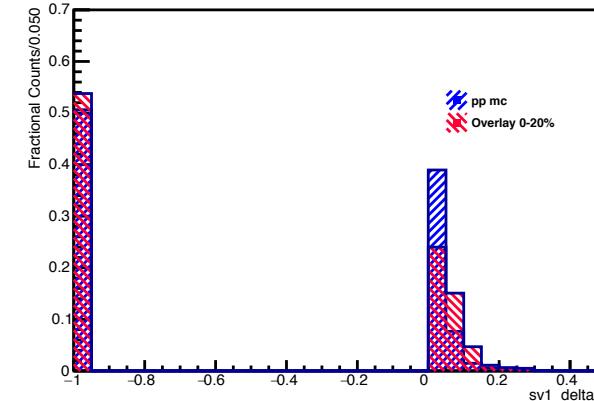
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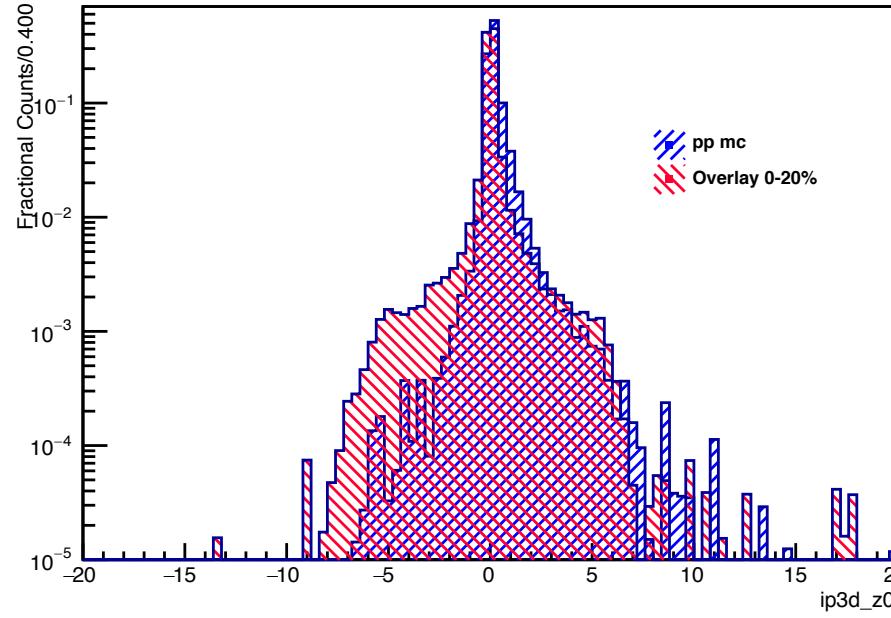


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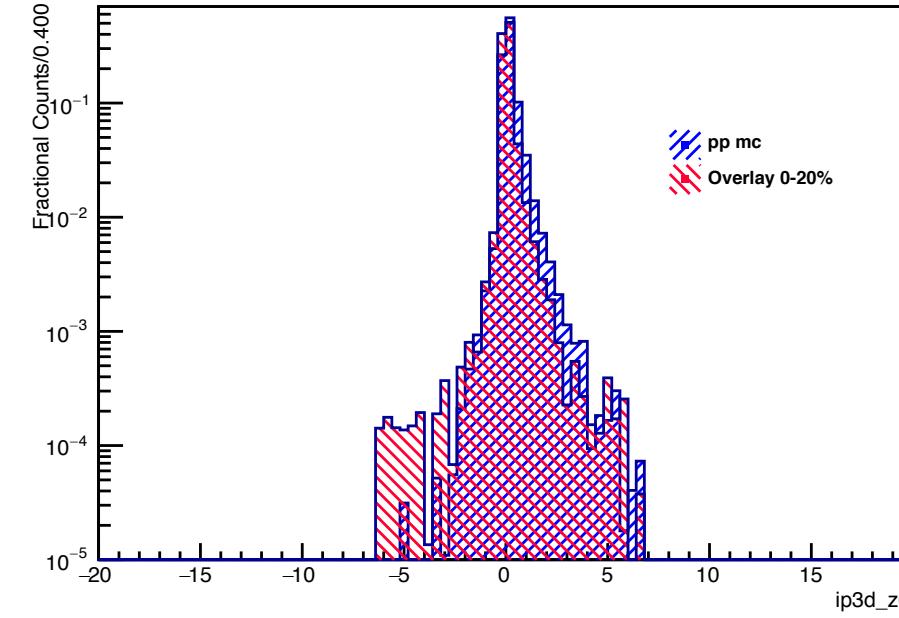


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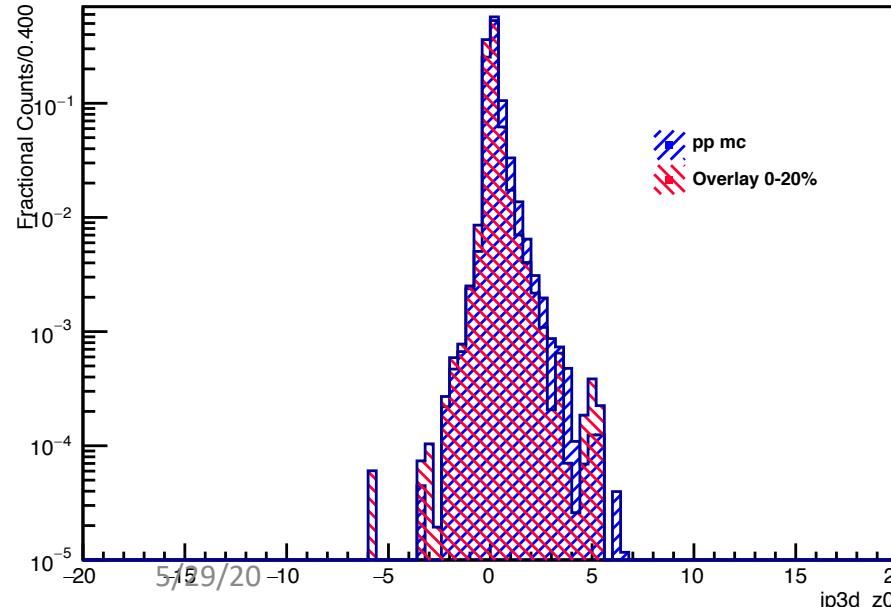
Default Cuts Shrinking Cone



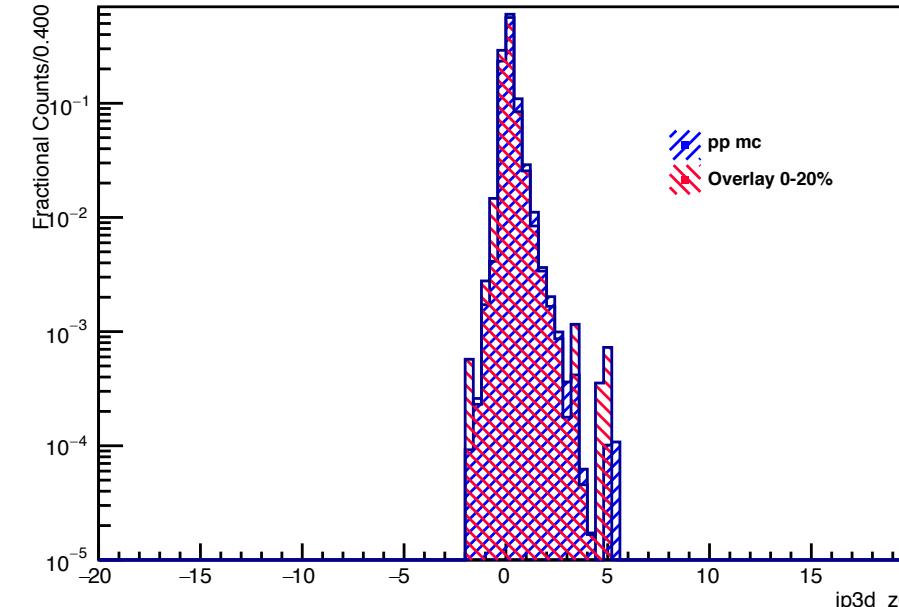
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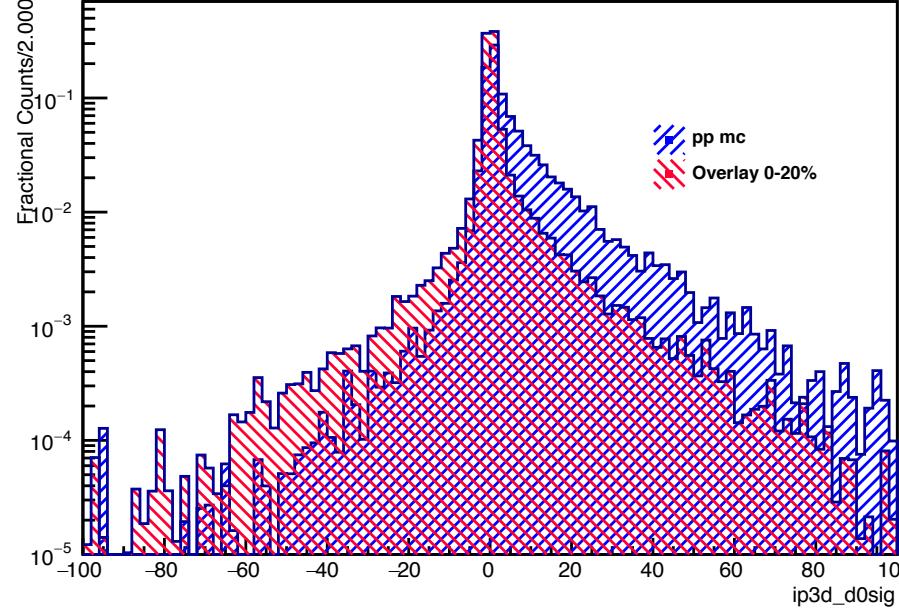
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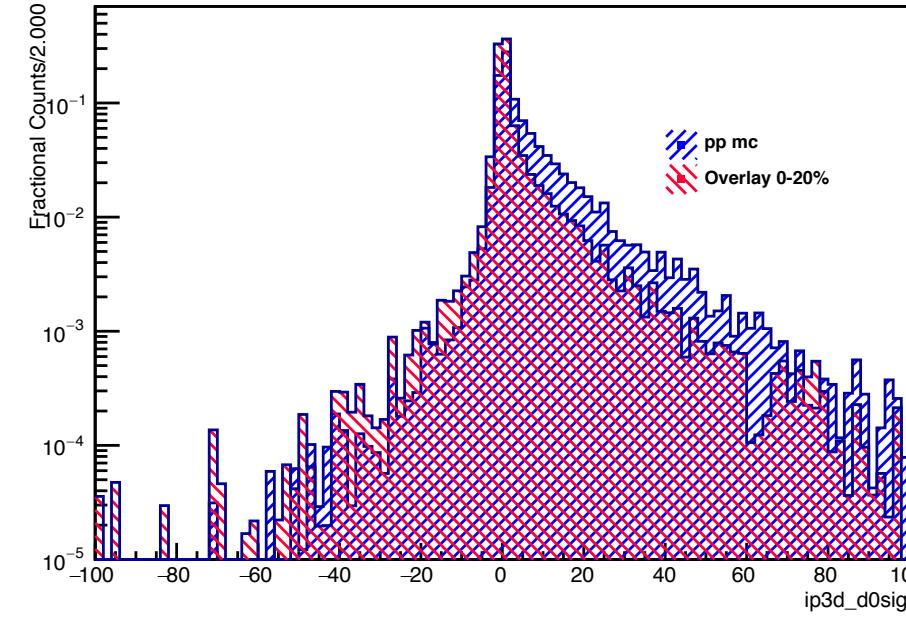
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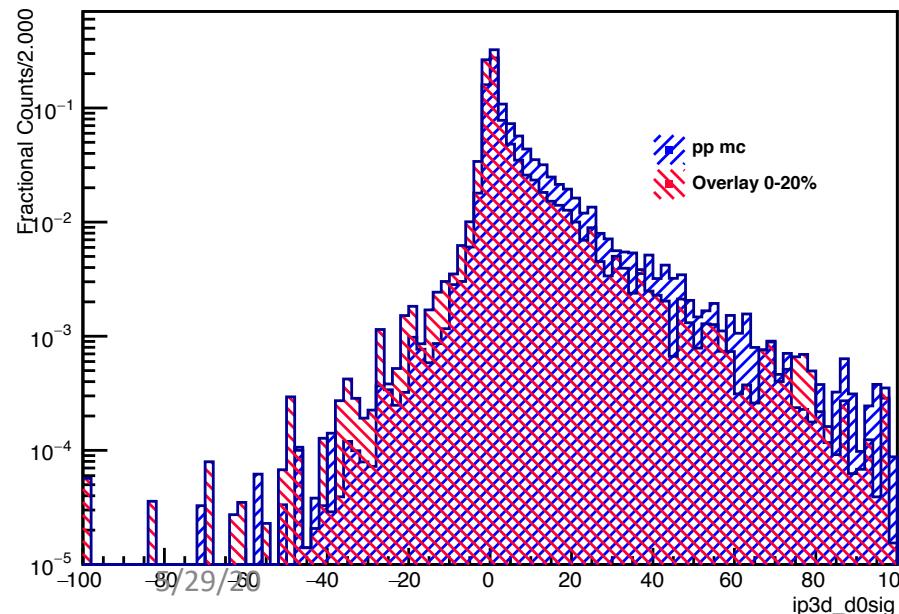
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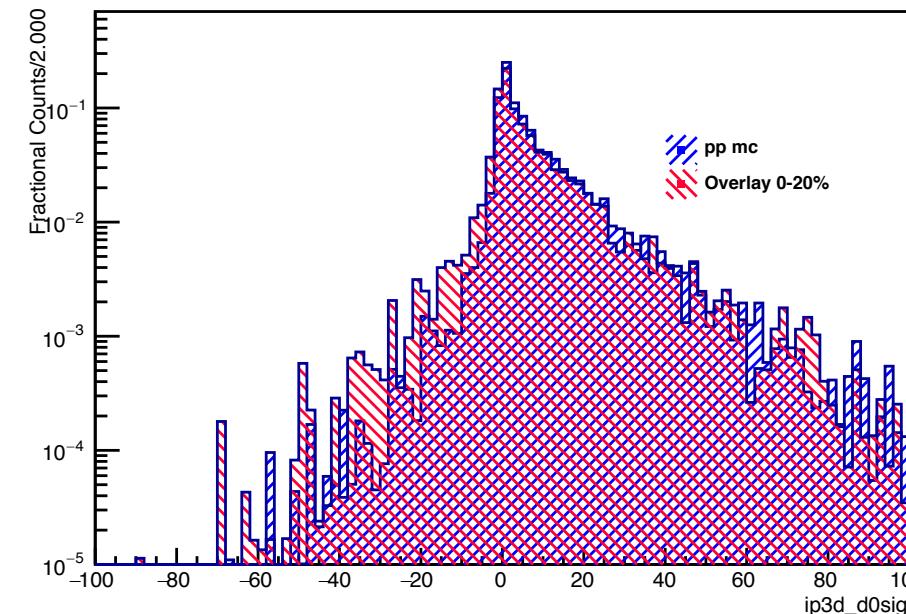
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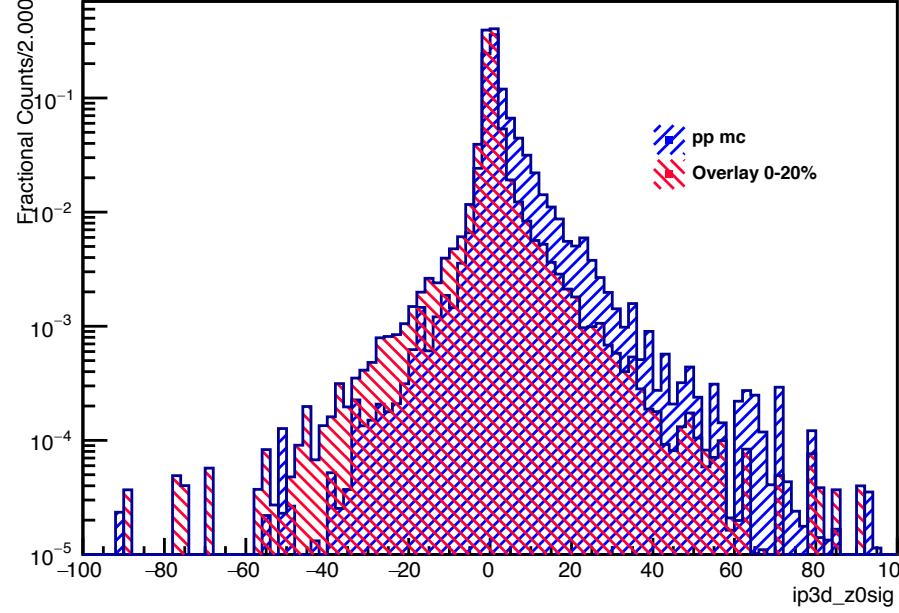


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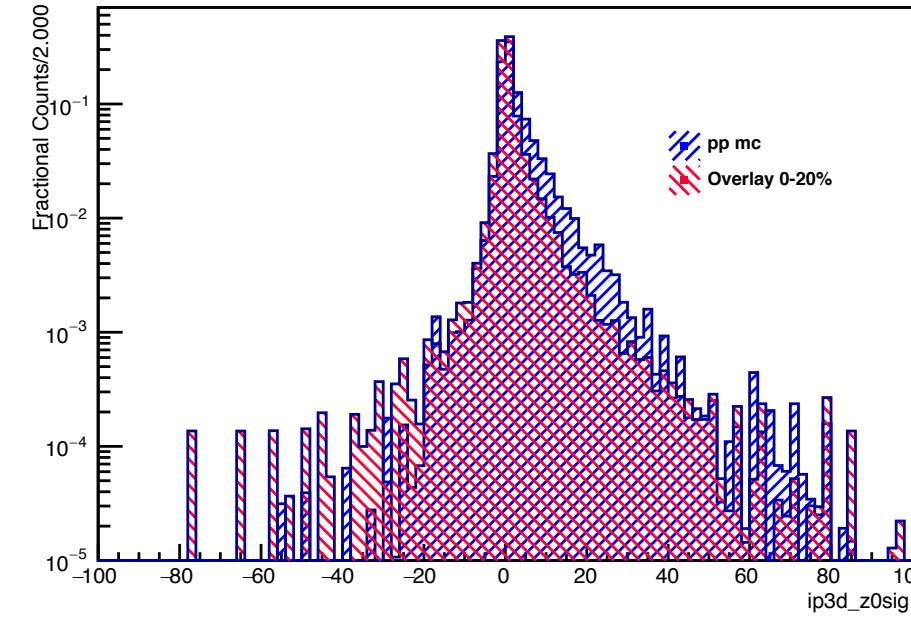


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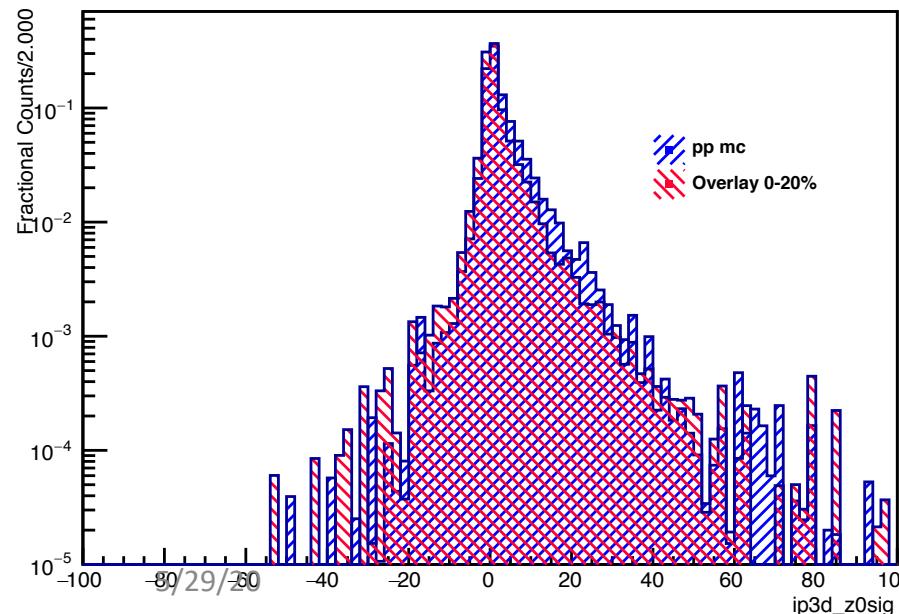
Default Cuts Shrinking Cone



Pre-tagging min pT 1.5 GeV FC4



Pre-tagging min pT 2 GeV FC4



Pre-tagging min pT 4 GeV FC4

