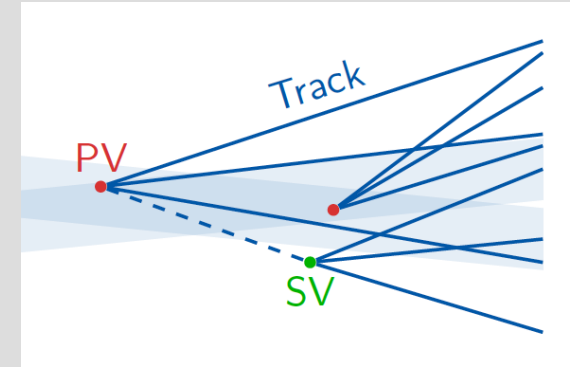
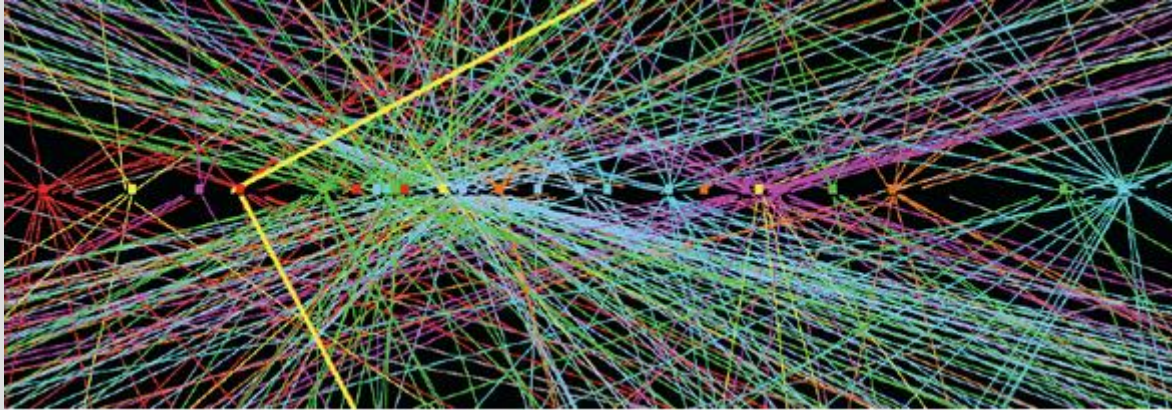


TrackOpt project status update

V. Kostyukhin
Siegen university

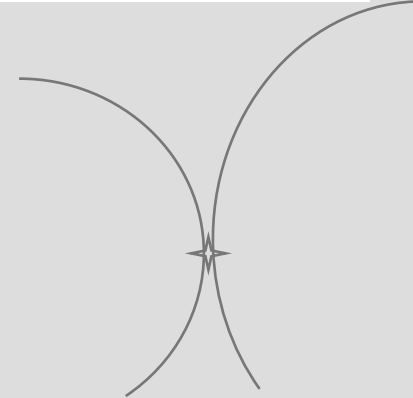
Primary Vertices(PV) – all beam-beam interaction points. 1D problem, doesn't require a curved particle trajectory calculation.



Secondary Vertices(SV) – interaction/decay points in 3D detector volume away from the beam line.

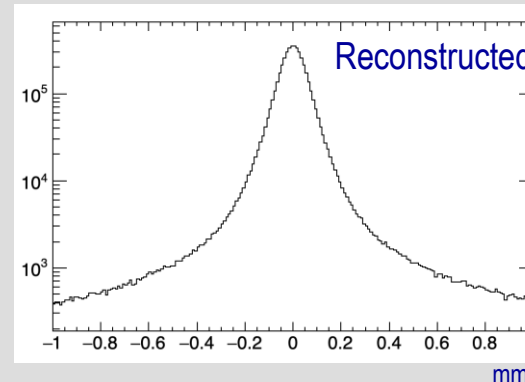
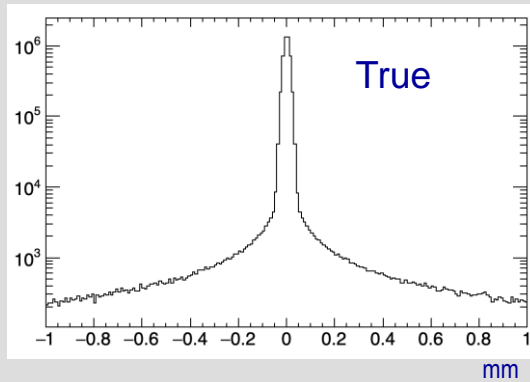
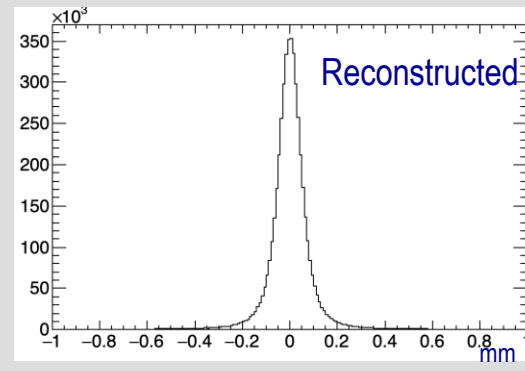
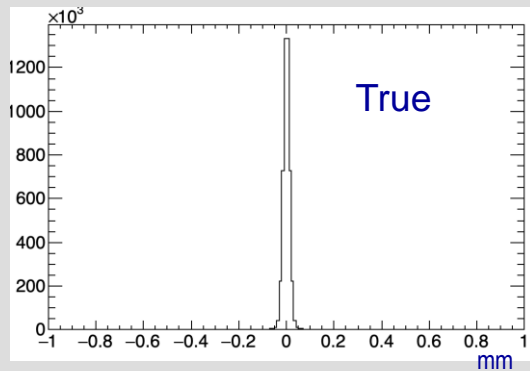
Can be detected by finding a crossing point (in fact a point of the closest approach due to resolution errors) of the curved particle trajectories in 3D space.

In general case the curved trajectory may be very complex due to non-uniform magnetic field.

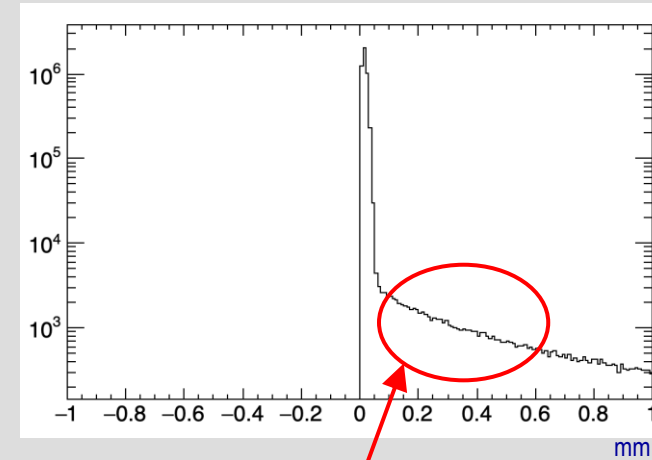


Important particle physics detector parameter - how far from the beamline secondary vertices should be to be detected? Crucial for short-living particle investigation.

Track impact parameters wrt the beamline



True R of vertices

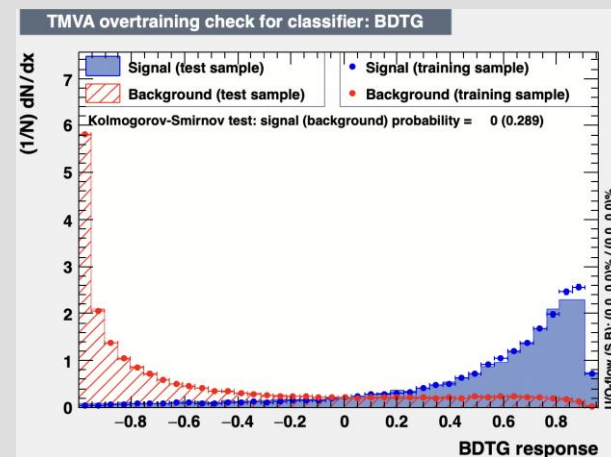
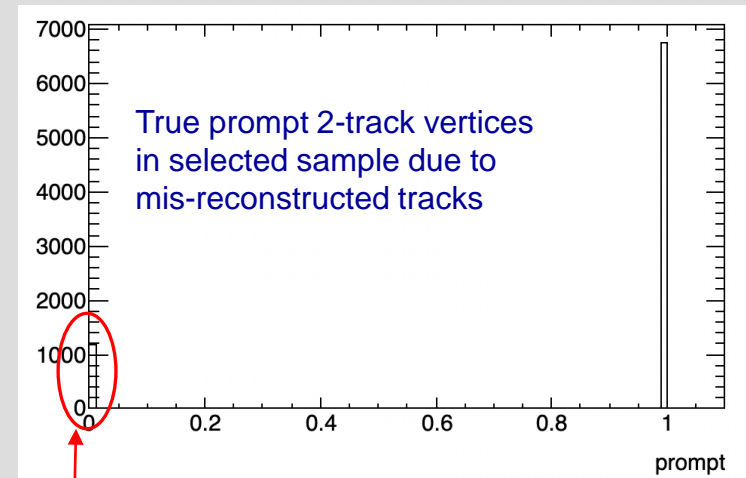
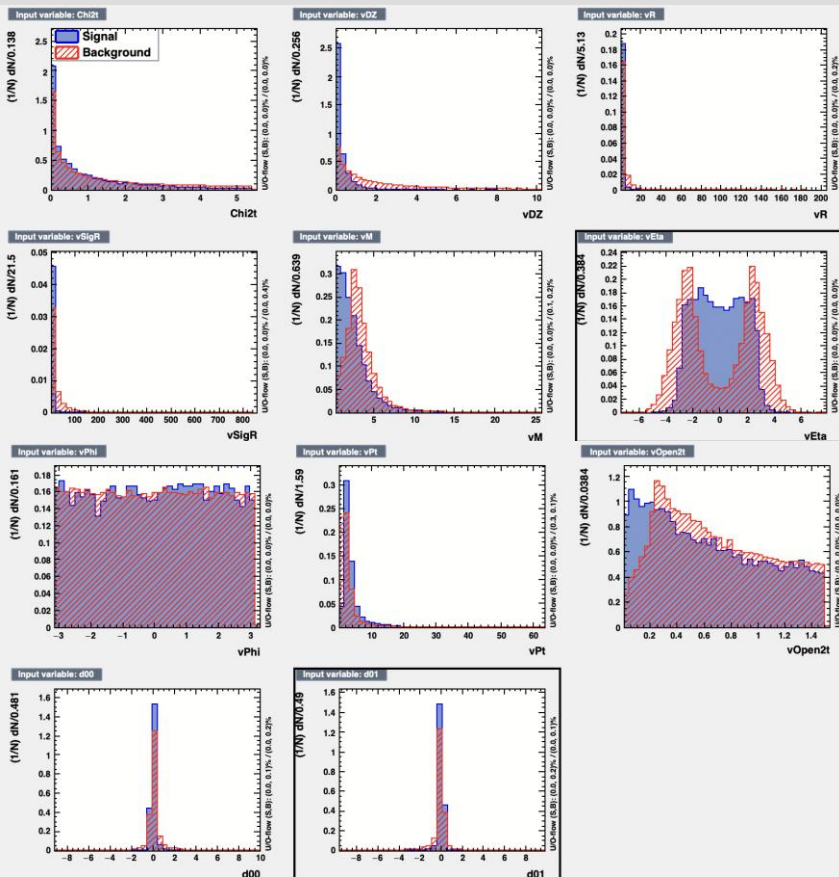


Problematic region for PV/SV reconstruction due to resolution (~equivalent to image blurring?). Hoped to resolve using ML.

For development use a limited SV-only setup - at least 1 track $>3\sigma$ from beamline

BDT for SV

Use a limited SV-only setup - at least 1 track $>3\sigma$ from beamline



Vertex from cluster Chi2=3113.61 R=0.998245 tracks=163,463,624,
Vertex from cluster Chi2=3324.29 R=0.566955
tracks=312,535,547,557,639,650,659,668,669,
Vertex from cluster Chi2=7247.38 R=8.17488 tracks=235,278,578,657,
Vertex from cluster Chi2=1296.45 R=6.07633 tracks=337,366,655,
Vertex from cluster Chi2=9468.76 R=4.36505 tracks=148,556,613,
Vertex from cluster Chi2=6614.18 R=4.43155 tracks=30,294,569,854,
Vertex from cluster Chi2=2702.48 R=4.7346 tracks=43,58,517,857,
Vertex from cluster Chi2=4348.98 R=6.51246 tracks=194,559,630,
Vertex from cluster Chi2=1576.28 R=26.8822 tracks=431,435,445,
Vertex from cluster Chi2=5736.98 R=2.69858 tracks=44,668,677,682,
Vertex from cluster Chi2=2977.08 R=0.671259 tracks=10,49,176,187,464,
Vertex from cluster Chi2=1261.69 R=9.17873 tracks=119,124,567,
Vertex from cluster Chi2=5459.14 R=0.549126 tracks=255,294,450,459,559,
Vertex from cluster Chi2=4829.65 R=2.40515 tracks=226,242,246,269,639,
Vertex from cluster Chi2=7465.72 R=1.26507 tracks=93,369,459,464,566,
Vertex from cluster Chi2=1370.08 R=6.59385 tracks=32,60,115,
Vertex from cluster Chi2=8471.36 R=0.580616 tracks=156,347,510,
Vertex from cluster Chi2=1367.7 R=4.25464 tracks=287,565,592,
Vertex from cluster Chi2=8465.35 R=7.97281 tracks=430,723,746,
Vertex from cluster Chi2=3773.78 R=0.778705 tracks=95,232,338,342,351,742,
Vertex from cluster Chi2=6285.52 R=6.61681 tracks=66,70,76,81,89,707,
Vertex from cluster Chi2=6730.46 R=1.27255 tracks=394,464,652,
Vertex from cluster Chi2=1091.78 R=5.64334 tracks=115,148,403,
Vertex from cluster Chi2=3701.53 R=7.45977 tracks=155,165,169,
Vertex from cluster Chi2=4597.44 R=10.311 tracks=115,135,443,
Vertex from cluster Chi2=1056.46 R=0.746708 tracks=374,466,760,
Vertex from cluster Chi2=3385.52 R=2.33193 tracks=12,126,629,708,859,
Vertex from cluster Chi2=4140.94 R=1.30156 tracks=45,190,283,306,613,
Vertex from cluster Chi2=6745.46 R=1.64951 tracks=229,654,656,
Vertex from cluster Chi2=3180.56 R=6.92057 tracks=564,590,598,
Vertex from cluster Chi2=1120.73 R=1.96858 tracks=207,708,730,
Vertex from cluster Chi2=3045.71 R=0.121116 tracks=242,270,287,509,527,609,674,
Vertex from cluster Chi2=1056.41 R=1.78759 tracks=25,447,467,
Vertex from cluster Chi2=5555.78 R=1.28278 tracks=254,430,731,
Vertex from cluster Chi2=6608.41 R=11.0387 tracks=392,583,589,612,
Vertex from cluster Chi2=1783.68 R=5.20877 tracks=251,254,722,
Vertex from cluster Chi2=4654.63 R=1.41019 tracks=10,294,606,609,
Vertex from cluster Chi2=2175.43 R=3.43941 tracks=23,402,411,
Vertex from cluster Chi2=2427.65 R=1.65088 tracks=343,390,537,612,744,
Vertex from cluster Chi2=1795.39 R=0.727084 tracks=20,86,252,462,546,
Vertex from cluster Chi2=2986.34 R=0.656091 tracks=208,291,299,340,
Vertex from cluster Chi2=1533.42 R=0.256599 tracks=158,266,290,324,
Vertex from cluster Chi2=6662.42 R=2.37594 tracks=4,544,591,
Vertex from cluster Chi2=3960.42 R=94.1604 tracks=25,581,789,799,
Vertex from cluster Chi2=7129.94 R=1.17776 tracks=121,192,200,208,215,216,217,243,
Vertex from cluster Chi2=2843.02 R=2.63132 tracks=81,313,363,389,405,406,
Vertex from cluster Chi2=1756.16 R=2.76816 tracks=188,361,702,

Using BDT weights - number of non-compact clusters is significantly reduced

Vertex from cluster Chi2=2510.17 R=4.33339 tracks=232,338,342,351,
Vertex from cluster Chi2=3438.78 R=10.7008 tracks=64,66,70,76,81,89,
Vertex from cluster Chi2=1180.91 R=7.29418 tracks=400,401,402,411,413,,

Needs a metric for performance estimation