

Update on the Strange Behaviour of Vertex-Z with One Layer SVD

Amaresh Datta (amaresh@jinr.ru)

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Reminding of the Issue

MinBias events generated with $\sigma_z = 30$ cm

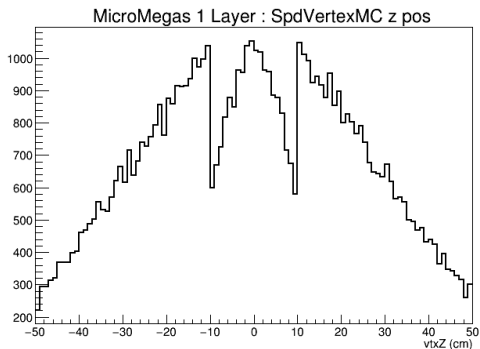


Figure 1: SpdVertexMC Z-position with MicroMegas 1 super layer

strange symmetric dips in reconstructed event vertex Z at ~ 10 cm for one layer of MicroMegas

Observations from Tests

- Multiple tests done and emails exchanged between myself, Igor Denisenko and Vladimir Andreev
- SpdVertexRC and KFParticle vertex do not show this pattern
- Igor found the problem is more fundamental : single muon origin z-pos shows same pattern - many tracks generated within -10 to 10 cm not converging
- Independent of SVD type (MAPS and MicroMegas)
- Specific problem for just one layer of SVD, tests suggest some bug in track fitting in -10 to 10 cm vertex-Z
- V. Andreev suggested temporary fix by increasing number of iterations in track fitting (`track_fitter`→`SetFitterMaxIterations(6)`)

Investigating the Root Cause

- Found in `SpdTrackFitterGF.cxx` : `BuildTracks()` initializes starting vertex position two different ways based on whether `DefineStartParameters()` returns `true` or `false`
- Inside `DefineStartParameters()`, an explicit condition checks if the initial guess is within 10 cm or not

```
if ((B-v).Mag() > 10) {  
    if (fVerboseLevel > 3) {  
        cout << "\nW- <SpdTrackFitter6F::DefineStartParameters> poor start vertex, "  
             << "|v(seed)-v(mc)| > 10 cm : " << ((B-v).Mag()) << " [cm], "  
             << "p = " << mon.Mag()*1e3 << " [MeV] "; // << endl;  
    }  
    return false;  
}
```

where B is the “nearest point to z-axis from the track” and v is (0,0,0)

- Only one layer of SVD messes up calculation inside `DefineStartParameters()` as it uses the vector from 1st hit (SVD) to 2nd hit (ST)
- **Conclusion** : This function to be removed and uniform initializations to be implemented in track reconstruction and committed to SpdRoot, meanwhile use more iterations in the reco script if you need 1 layer of SVD

Thank You