Primary vertex fitting
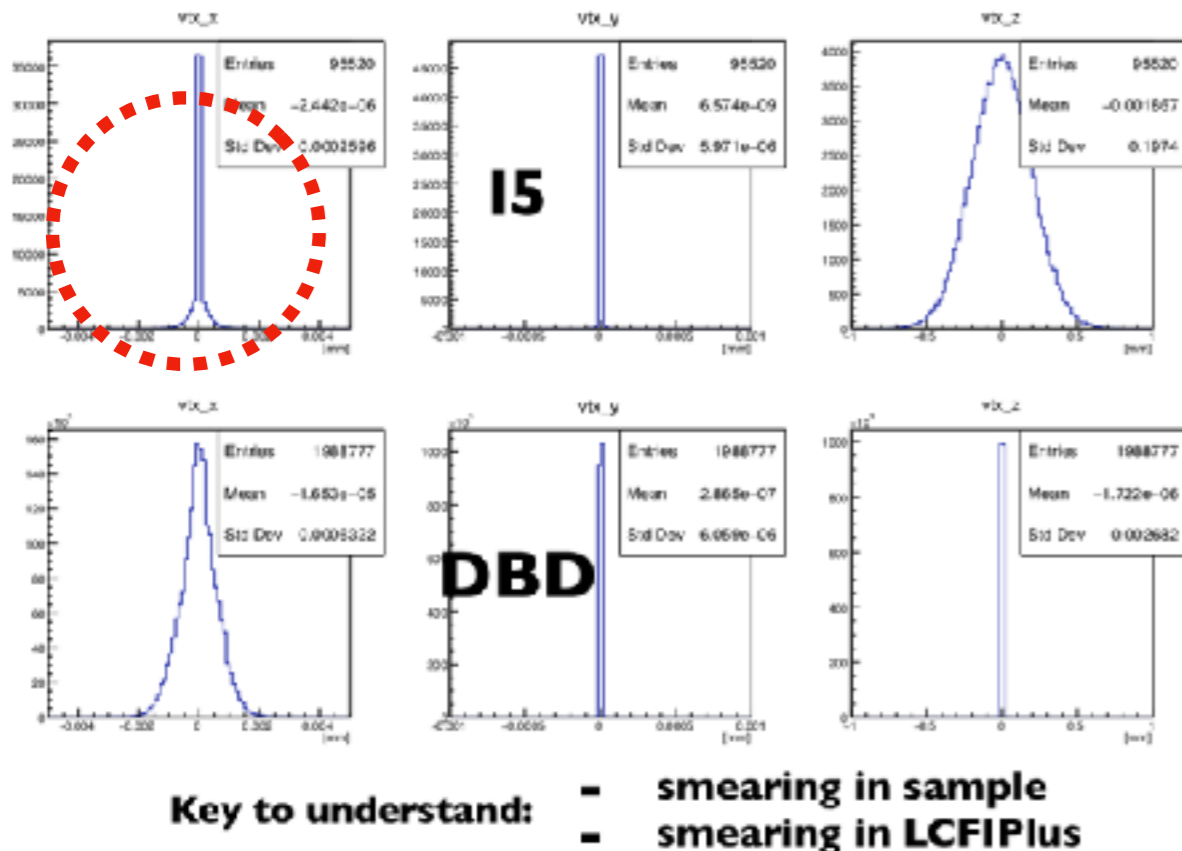
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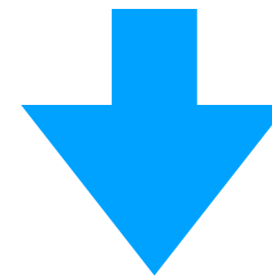
Issue?

The last general meeting

Primary vertex : position (I5 and DBD)

I5

DBD

Key to understand:
- smearing in sample
- smearing in LCFIPlus
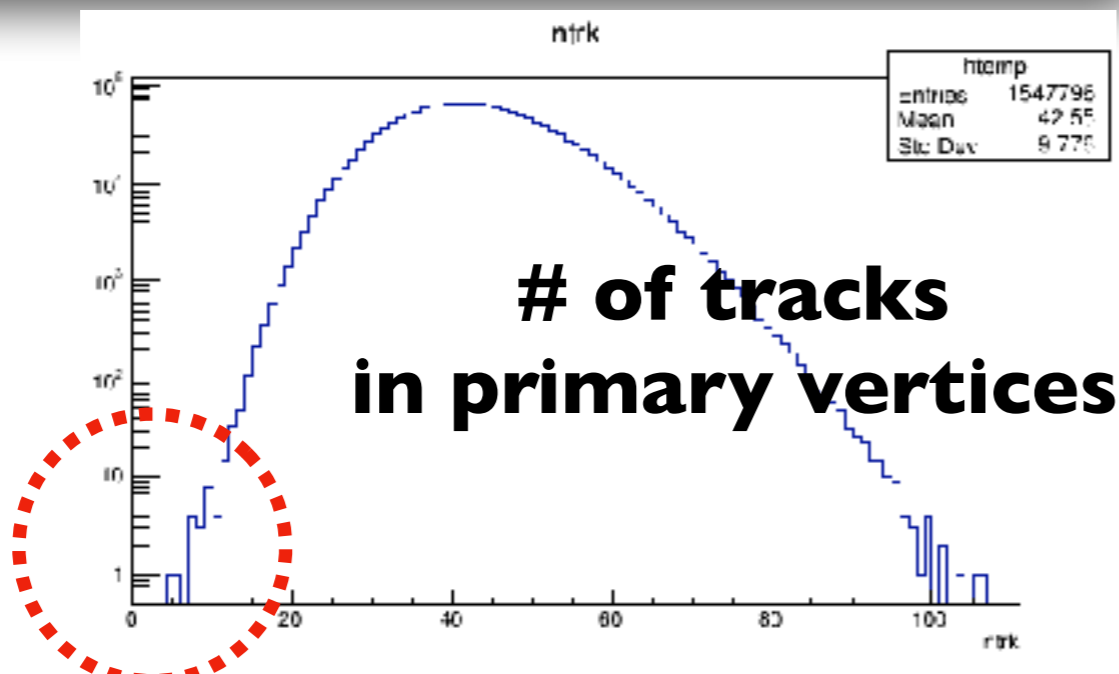
10

# of tracks
in primary vertices

It was pointed out that
- **the peak looks delta function**
- **it may indicate fitting failure e.g. take a default value or so.**

No error found in the run log
In fact, there is a treatment so that if the vertex fitting fails, return a vertex that is assigned to (0,0,0) but without any associated tracks.
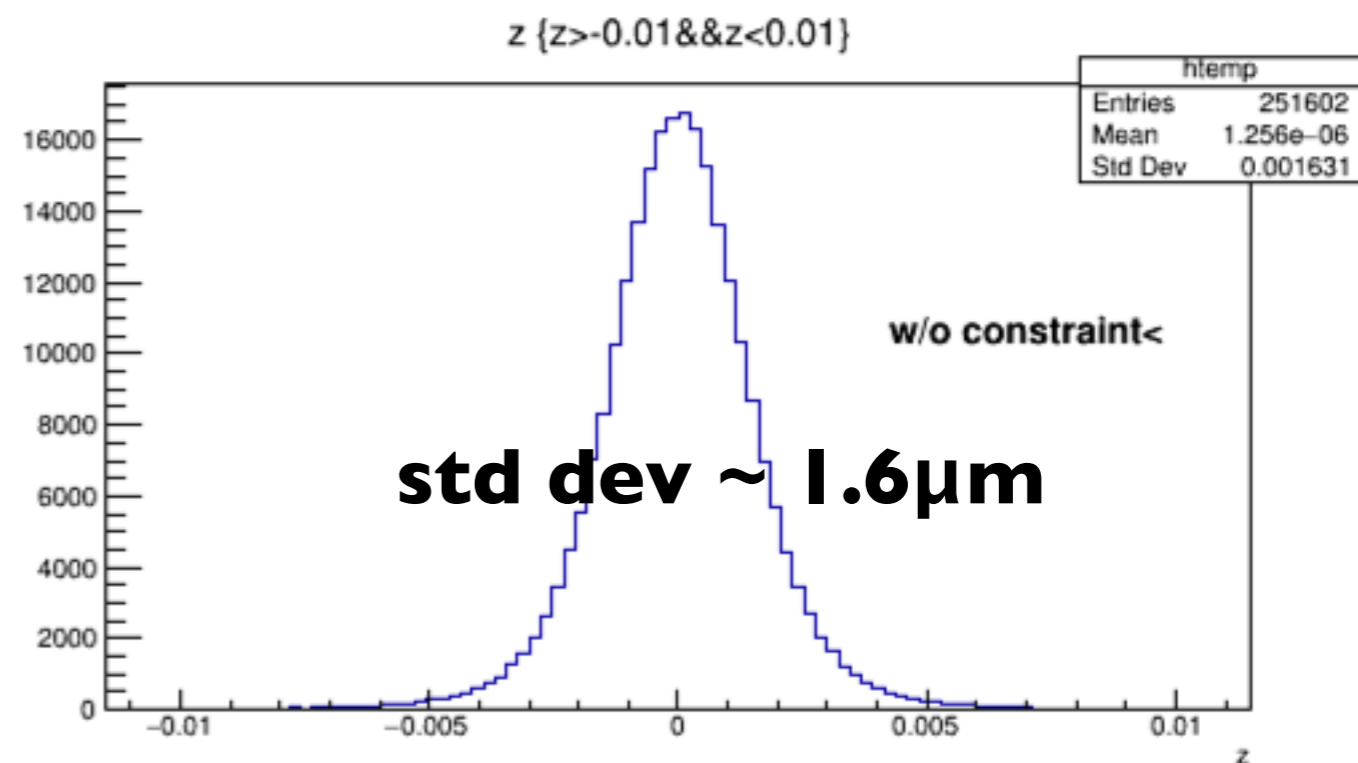**Left plot tells us that this is not the case.**

Issue?

A theory was as follows:
- **the delta function is caused by a very good vertex resolution compared to the constraint width.**
- **If this theory is correct, turning off the constraint doesn't change much.**
- **The answer is ...**
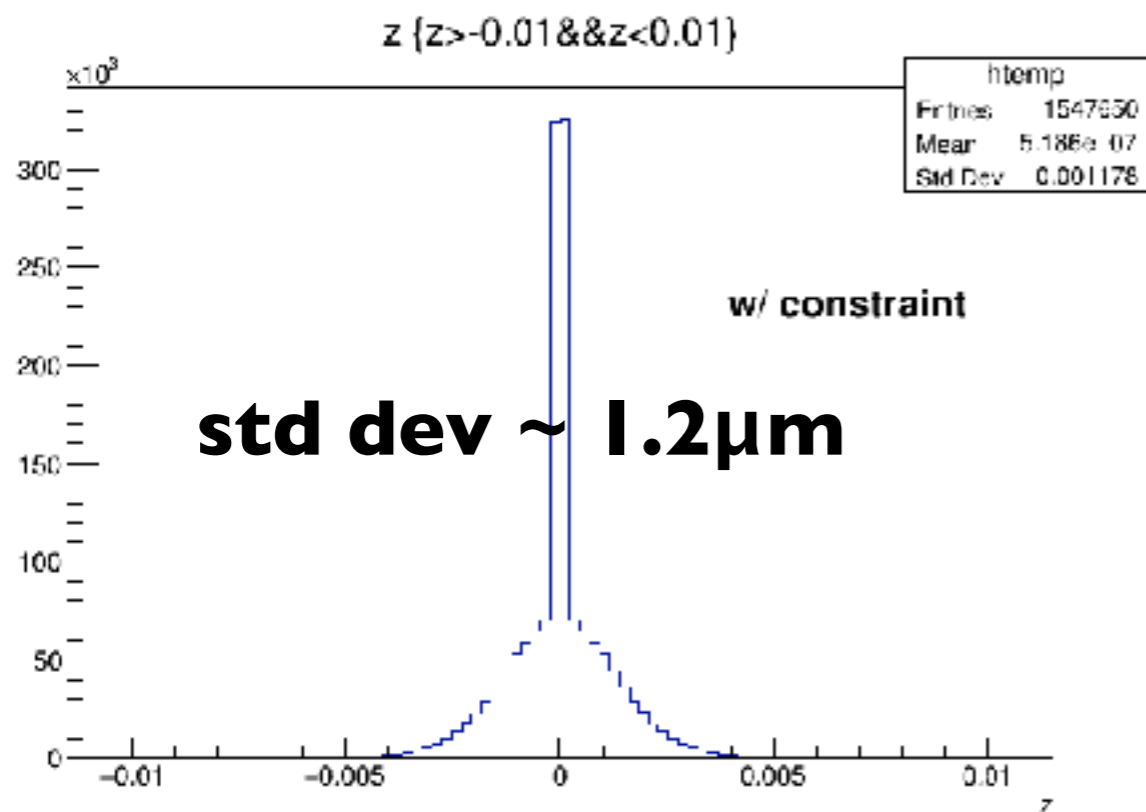
with constraint

without constraint

Digging the codes

I have got a suspicious part last night and this is not yet well discussed within the developer's group.

The following code is related to fitting a point with Minuit2.

```
1306    ROOT::Minuit2::VariableMetricMinimizer minlow;
1307    // parameters
1308    ROOT::Minuit2::MnUserParameters param;
1309    param.Add("x",initial.x(),1e-4);
1310    param.Add("y",initial.y(),1e-4);
1311    param.Add("z",initial.z(),1e-4);
1312    ROOT::Minuit2::FCNAdapter<ROOT::Math::IMultiGenFunction> func(f, 1. ); // errordef = 1 in chi2 minimization
1313
1314    int maxfcn = 10000; // max function calls
1315    double tol = 0.01; // tolerance
1316    ROOT::Minuit2::FunctionMinimum m = minlow.Minimize(func, param, ROOT::Minuit2::MnStrategy(1), maxfcn,tol);
1317
```

https://github.com/ryonamin/LCFIPlus/blob/master/src/geometry.cc#L1309-L1311

When running minimization, we specify initial point and "error".
So far I'm not confident what the error means.
My worry is that this initial point might work as an additional fitting point.
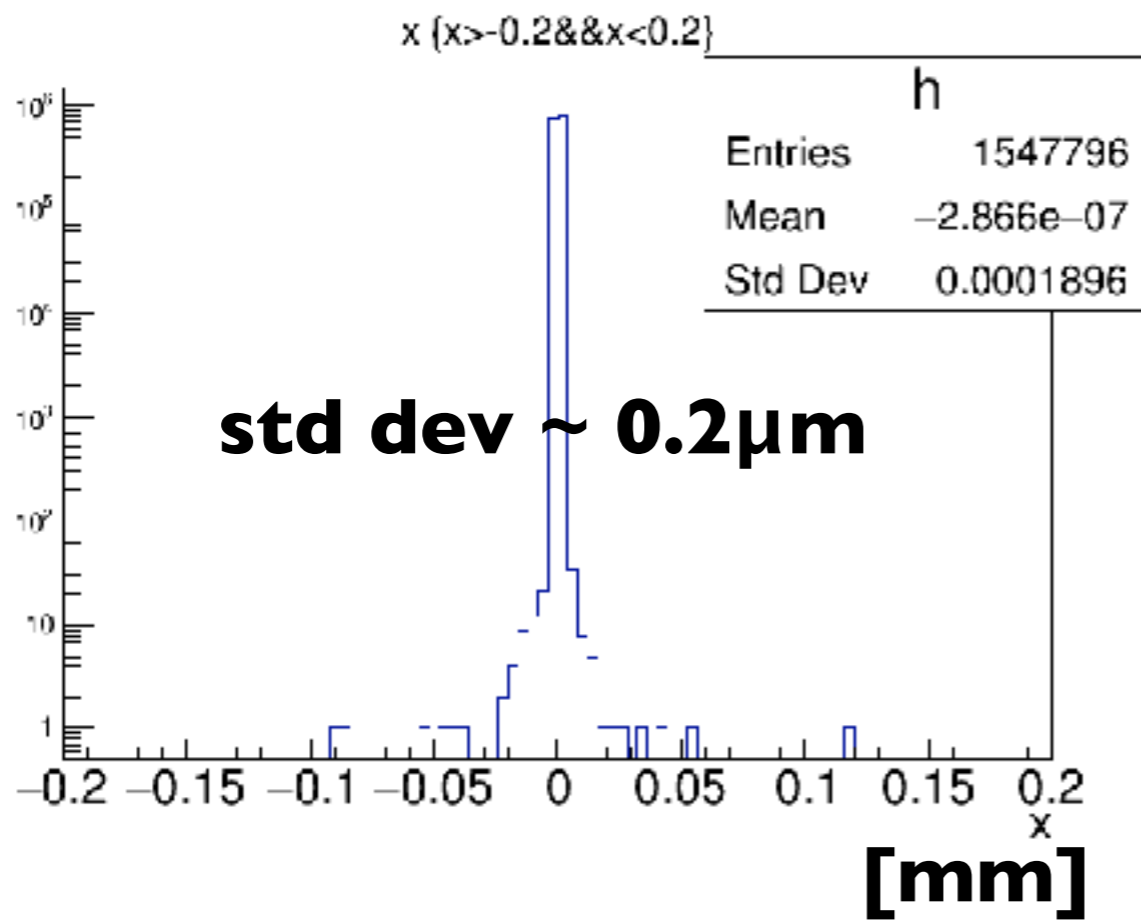I made a quick test with these values being 100 and see what happens.

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Primary vertex x position

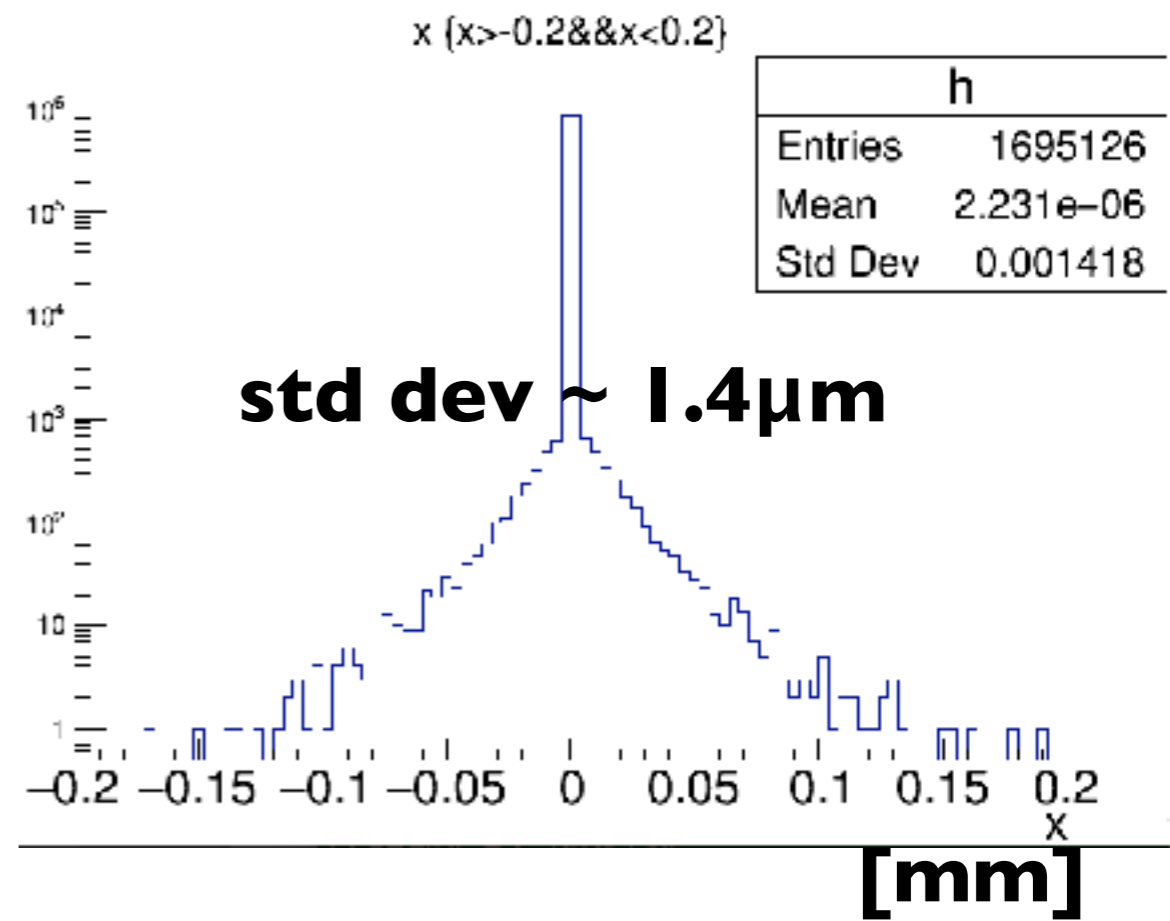## DBD sample with recent vertexing (True value is 0)
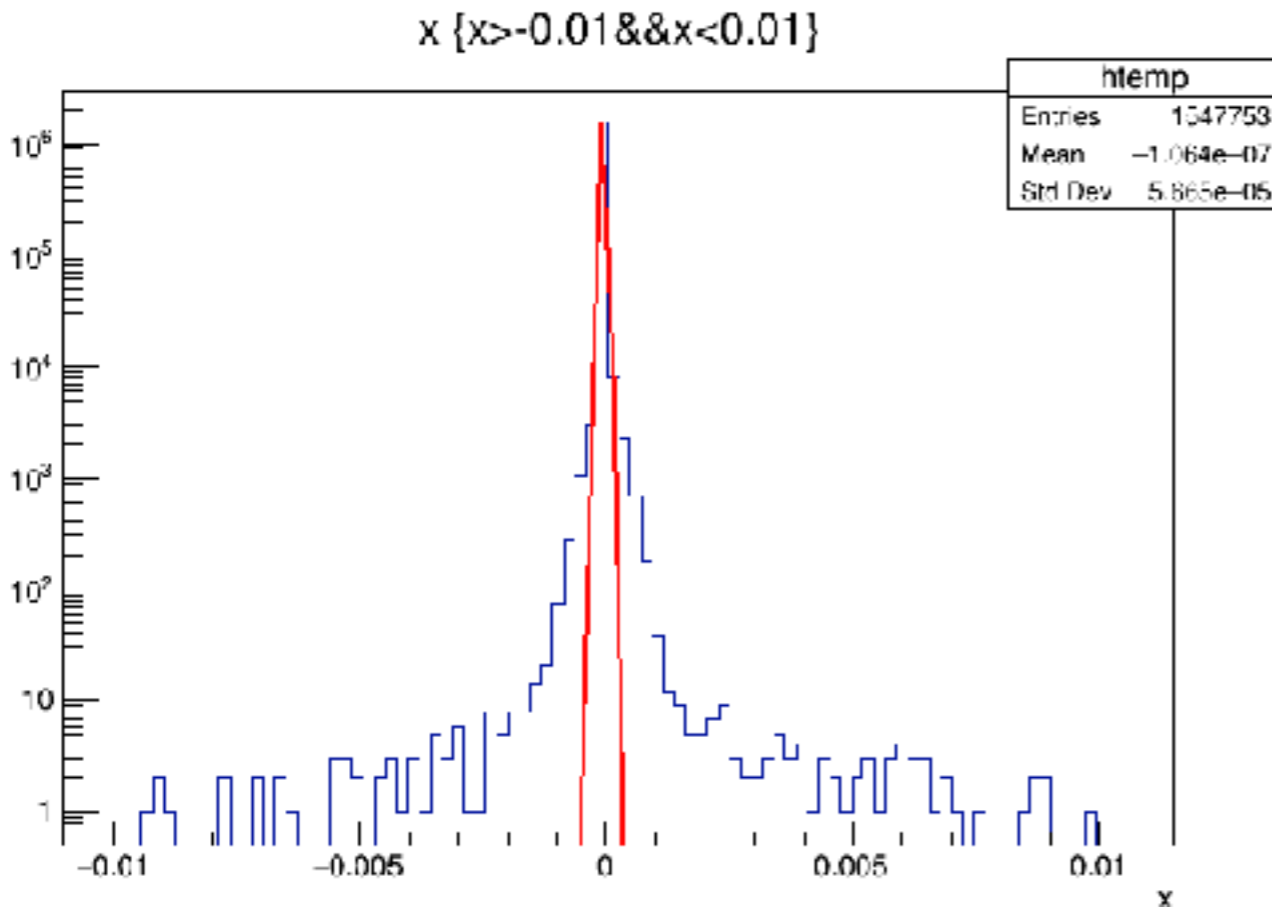
with constraint
at 0 with
σ=639nm

std dev ~ 0.2µm

current

std dev ~ 1.4µm

test

Zoom-up to centre

Fit σ~66nm
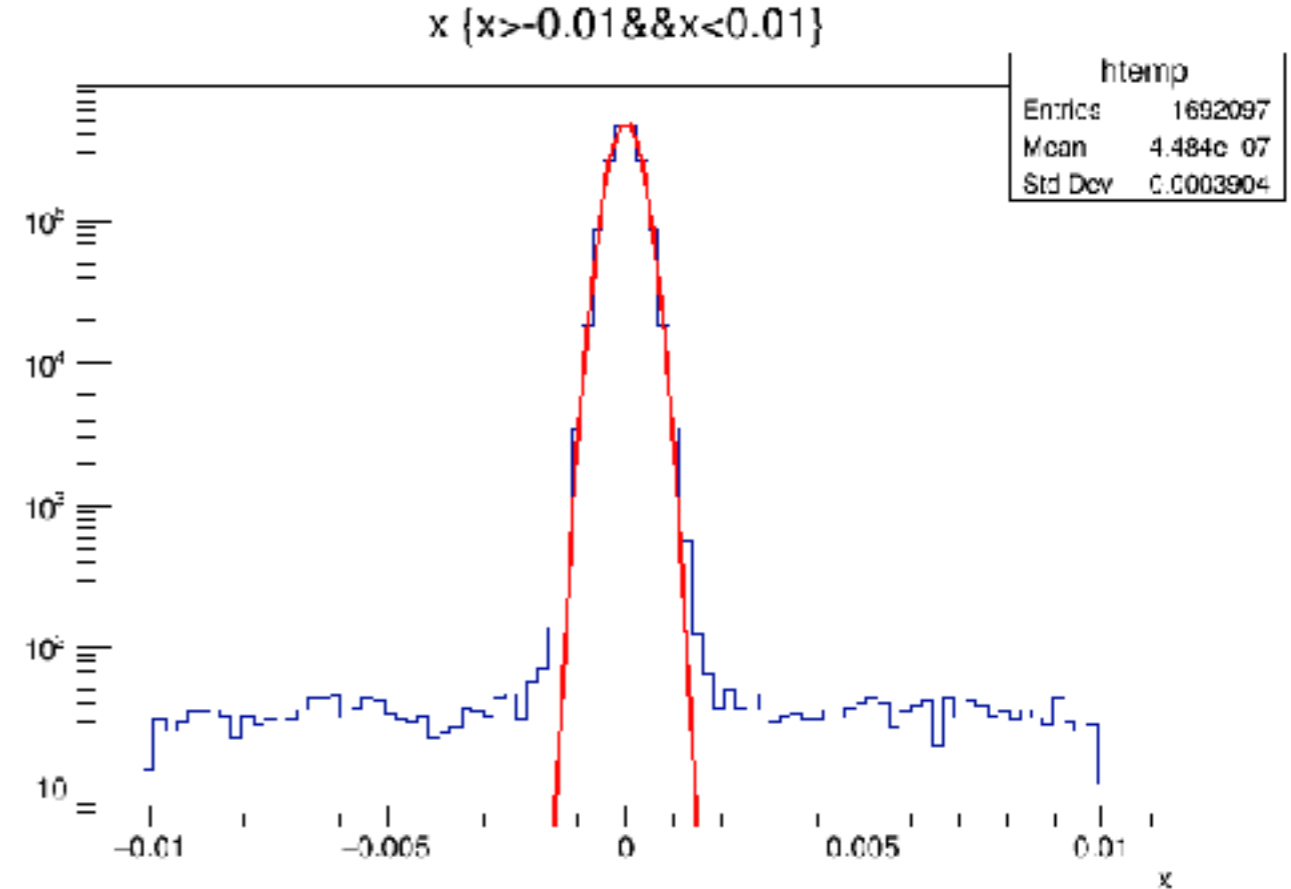
current

Fit σ~300nm

test

Primary vertex y position

DBD sample with recent vertexing (True value is 0)

with constraint
at 0 with
σ=5.7nm

y {y>-0.002&&y<0.002}

h	
Entries	1547796
Mean	3.705e−10
Std Dev	4.193e−07

std dev ~ 0.4 nm

y
[mm]

y {y>-0.002&&y<0.002}

h	
Entries	1695126
Mean	5.907e−10
Std Dev	4.829e−06

std dev ~ 5 nm

z
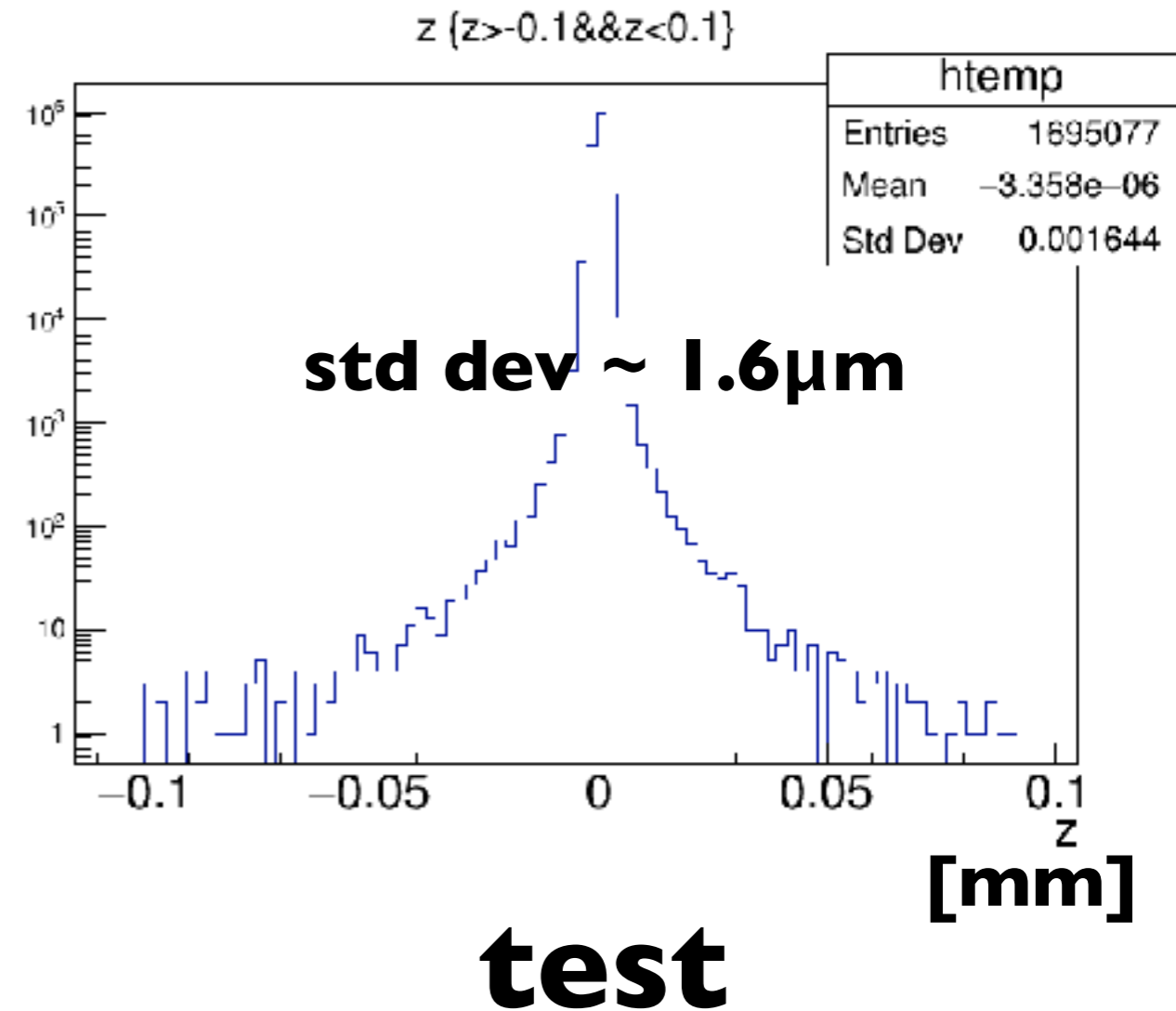**[mm]**
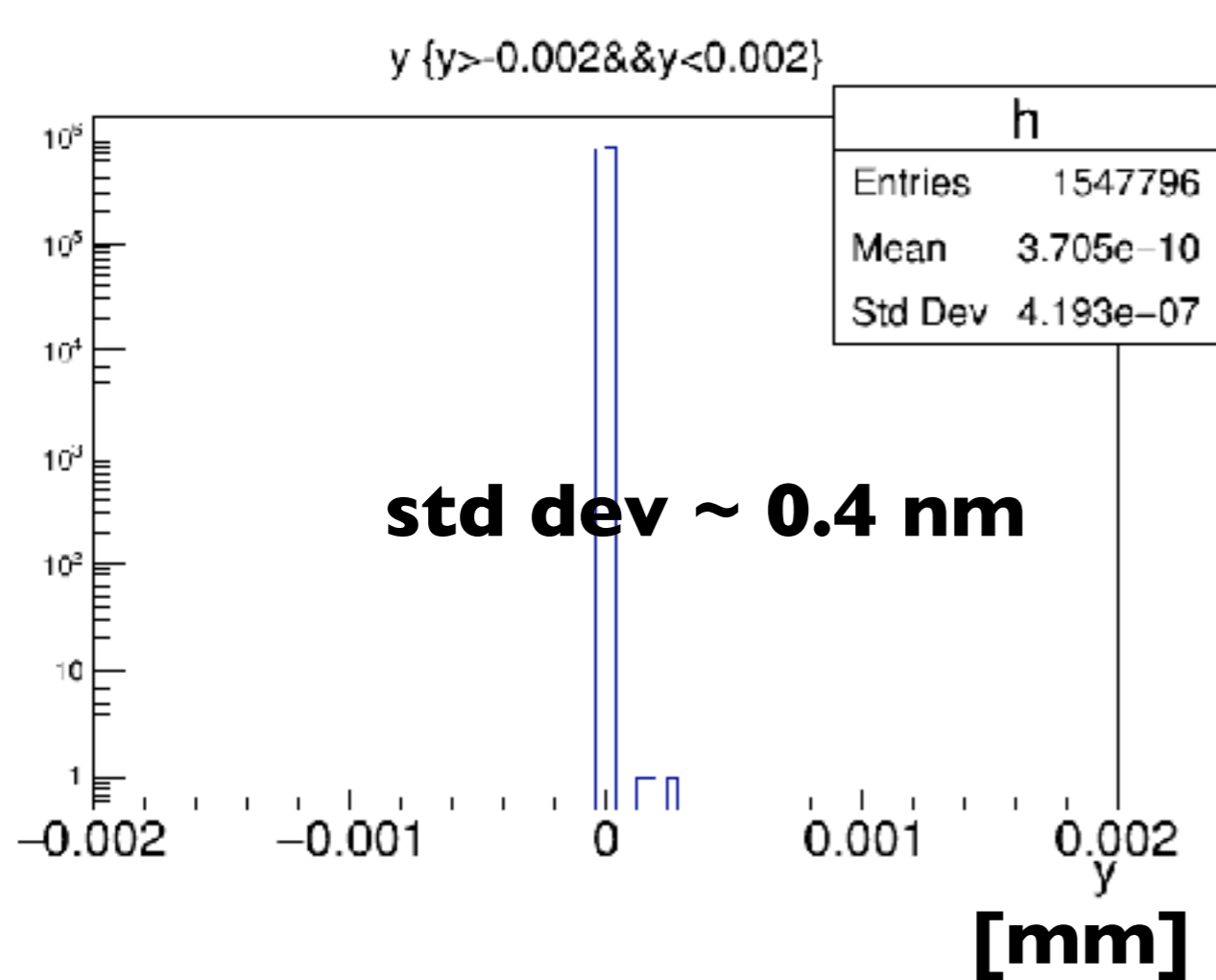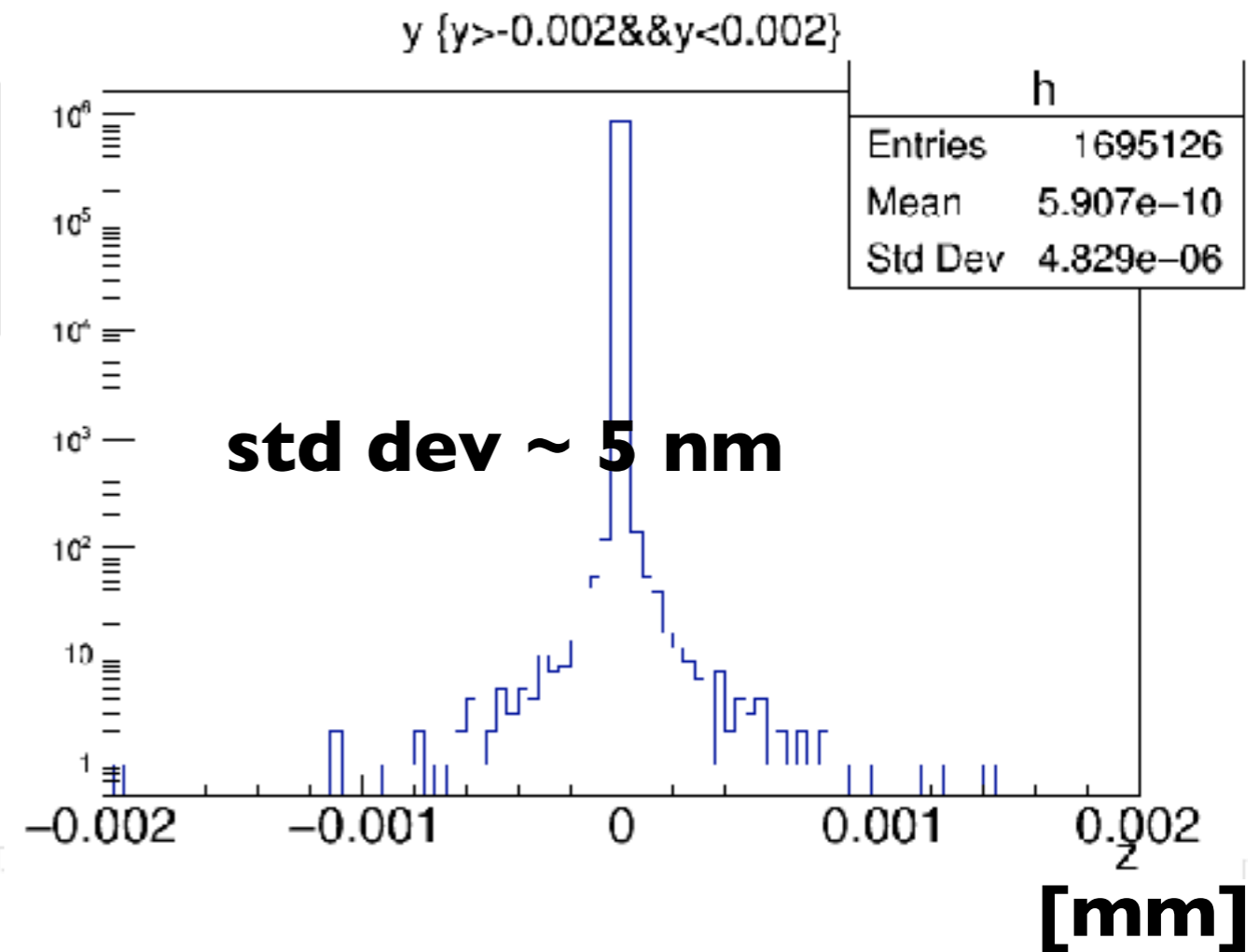
current   test

Primary vertex z position

DBD sample with recent vertexing (True value is 0)
with constraint
at 0 with
σ=91.3μm

std dev ~ 1.2μm

std dev ~ 1.6μm

current

test

Revisit p.3

z {z>-0.01&&z<0.01}

w/ constraint

std dev ~ 1.2μm

with constraint

z {z>-0.01&&z<0.01}

w/o constraint<

std dev ~ 1.6μm

without constraint

z {z>-0.01&&z<0.01}

test

std dev ~ 1.4μm