Static Distortion Update

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Comparison between Direct Laser Data and Statics Distortion Model Calculation

- Apply the likelihood-fit method to direct-laser data to obtain both straight-line and Bézier fits.

- Apply the current calculated static-distortion map to the straight-line fit to obtain the distortion-shifted trajectory.
  - Straight-line fit as approximation of baseline.
  - The input static-distortion map: $CALIBRATIONROOT/distortion_maps/static_only_inverted_10-new.root

- Compare the distortion-shifted trajectory with the real data and the Bézier likelihood fit.

Polynomial Fit Method in 3D

- To better describe the Laser Track in the real data, we use Cubic Bézier (degree 3) Polynomial Curve in 3D to fit:

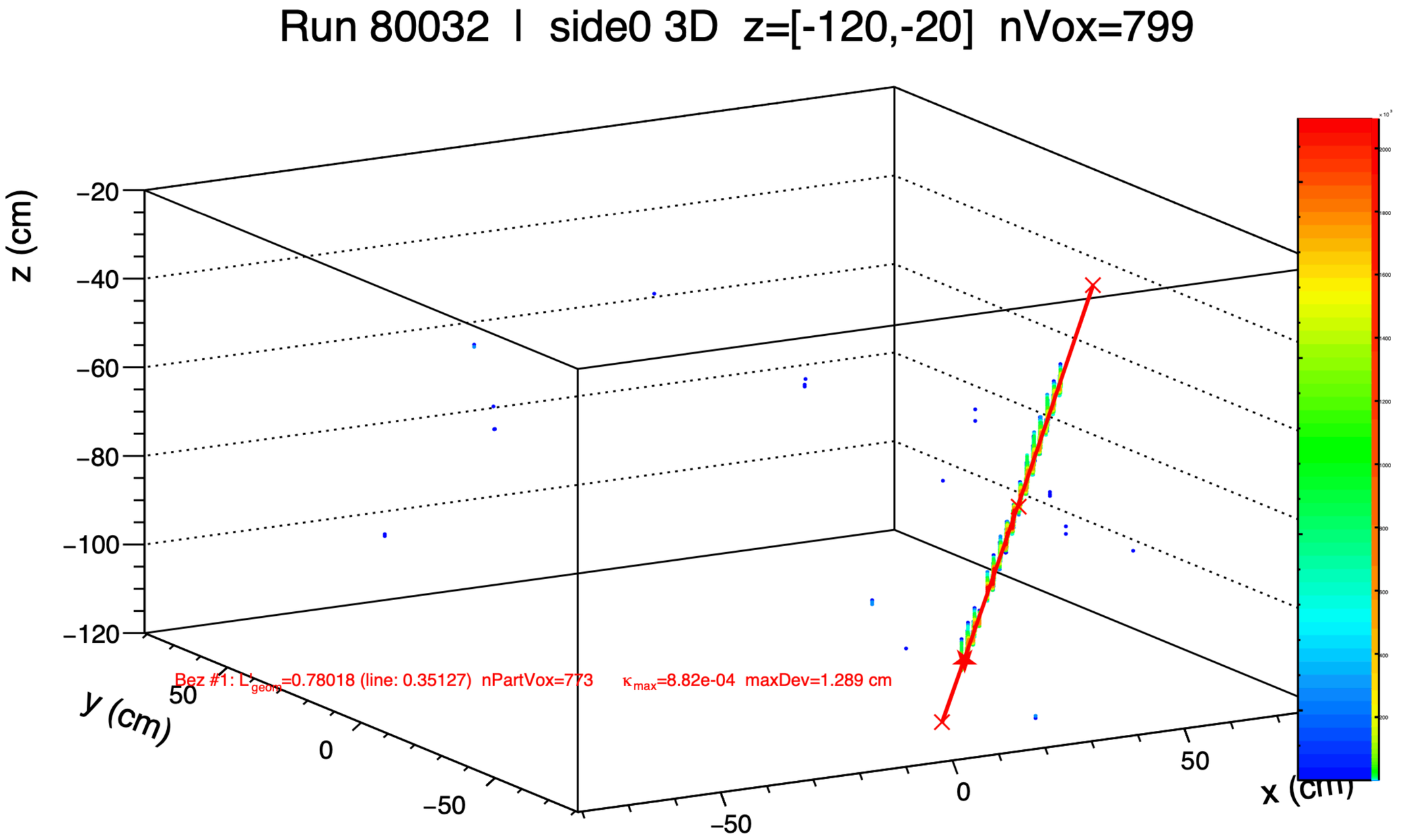
$$\mathbf{B}(t) = (1-t)^3\mathbf{P}_0 + 3(1-t)^2 t\,\mathbf{P}_1 + 3(1-t)t^2\,\mathbf{P}_2 + t^3\mathbf{P}_3$$

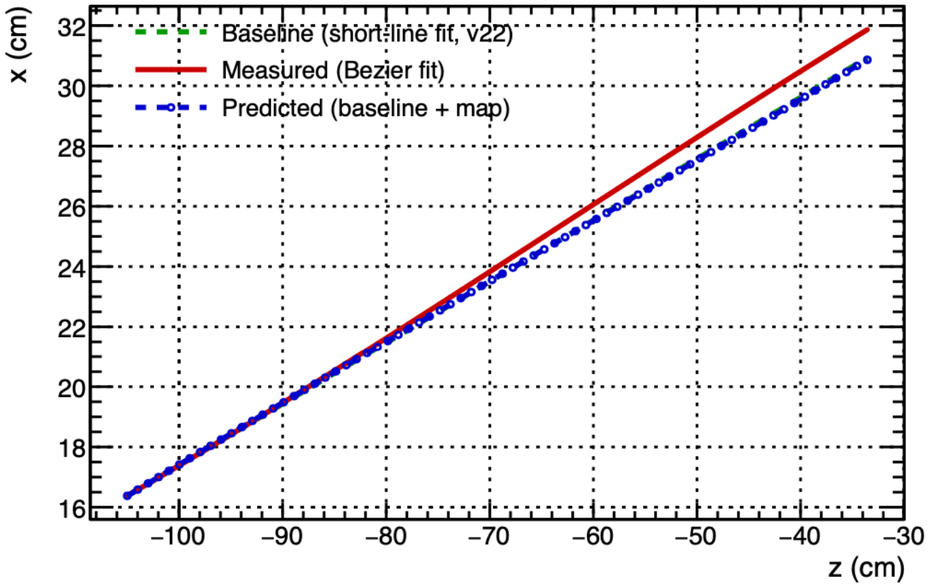
- We define parameter $t \in [0,1]$ and 4 control points. z is purely linear: $z(t) = z_{Min} + t\cdot(z_{Max} - z_{Min})$, 4 control points are evenly spaced in z.

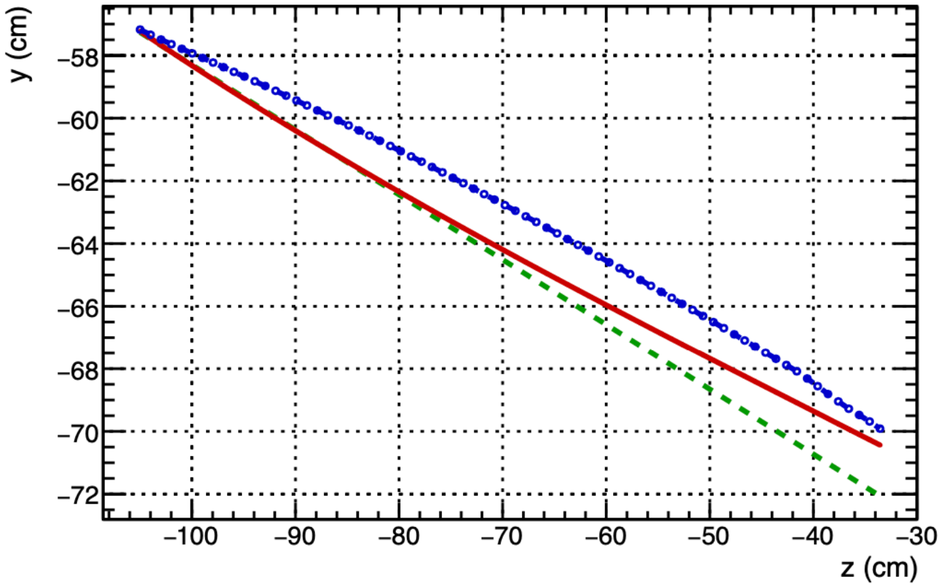
- The control points are parameterised as deviations from the original straight-line prediction:

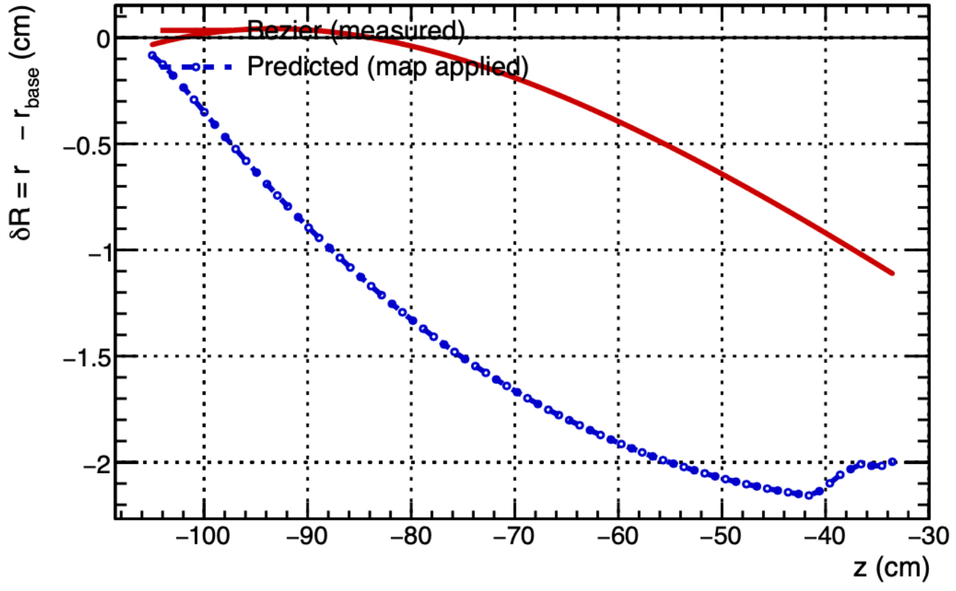
$$c_{x,i} = x_{\text{line}}(z_i) + \delta c_{x,i}, \quad c_{y,i} = y_{\text{line}}(z_i) + \delta c_{y,i}, \quad i = 0,1,2,3$$

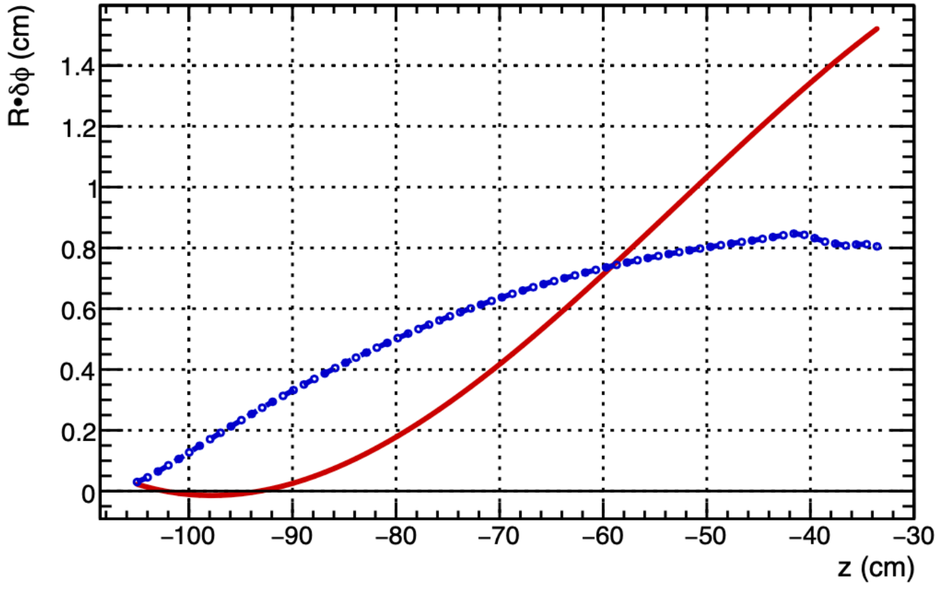
- The 8 free parameters fitted by Minuit: $\boldsymbol{\theta} = (\delta c_{x,0}, \delta c_{y,0}, \delta c_{x,1}, \delta c_{y,1}, \delta c_{x,2}, \delta c_{y,2}, \delta c_{x,3}, \delta c_{y,3})$

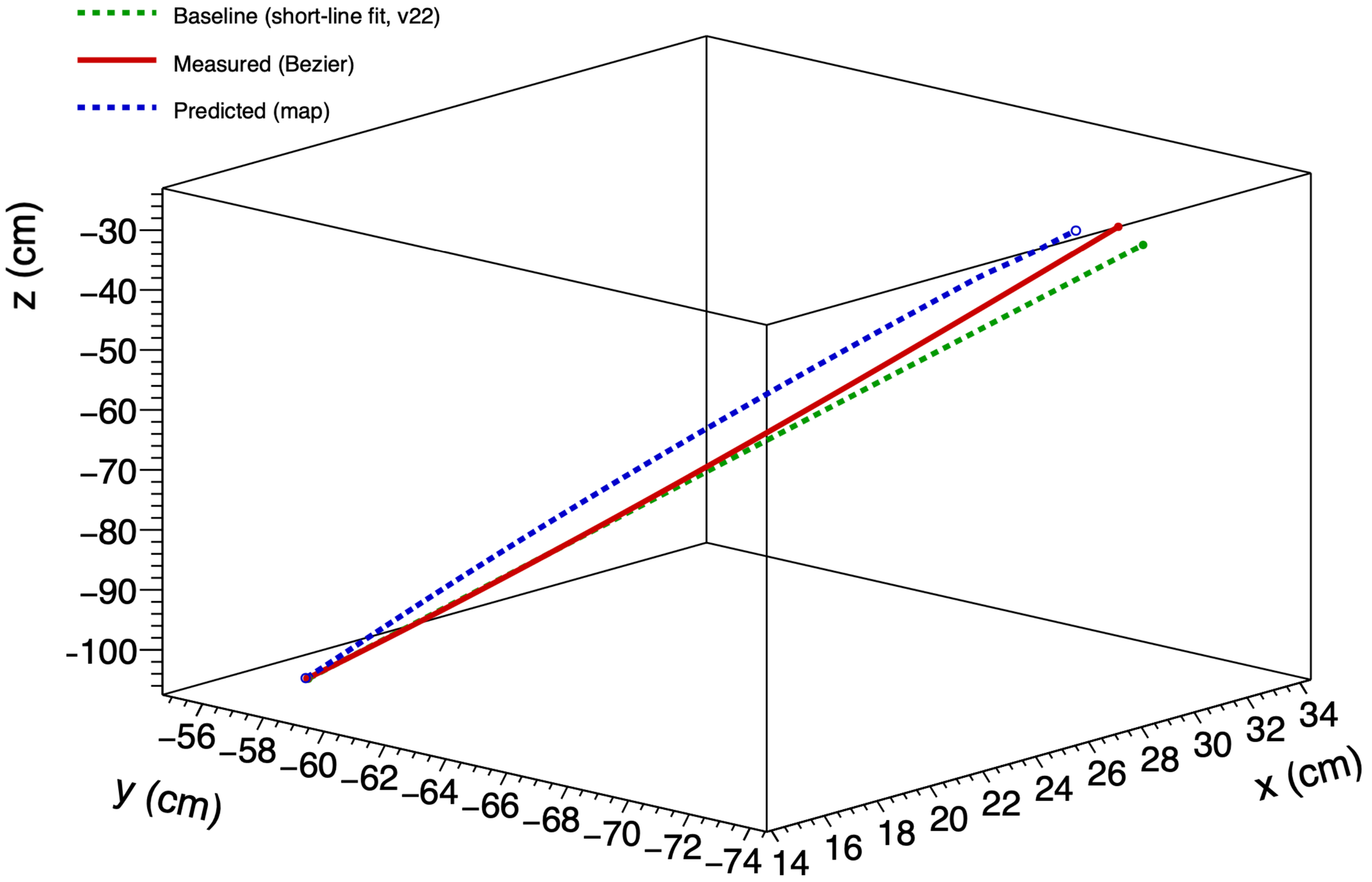

Run 80032 I side0 3D z=[-120,-20] nVox=799
z (cm)
−20
−40
−60
−80
−100
−120
y (cm)
50
0
−50
x (cm)
50
0
−50
Bez #1: L'geom=0.78018 (line: 0.35127) nPartVox=773
κmax=8.82e-04 maxDev=1.289 cm


Baseline (short-line fit, v22)
Measured (Bezier fit)
Predicted (baseline + map)
x (cm)
z (cm)


y (cm)
z (cm)

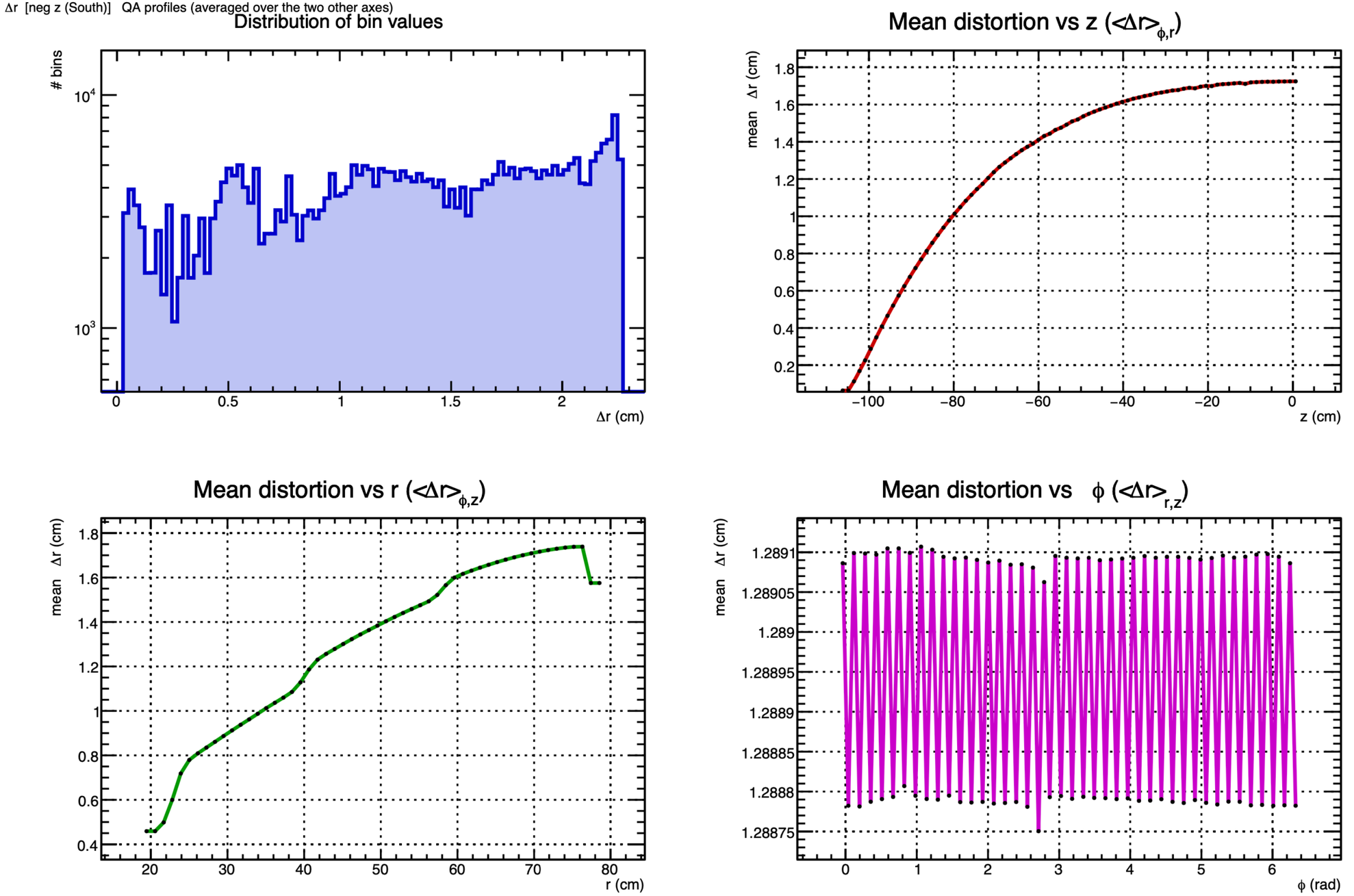

Bezier (measured)
Predicted (map applied)
δR = r − r_base (cm)
z (cm)


R•δϕ (cm)
z (cm)


Baseline (short-line fit, v22)
Measured (Bezier)
Predicted (map)
z (cm)
-30
-40
-50
-60
-70
-80
-90
-100
y (cm)
-56
-58
-60
-62
-64
-66
-68
-70
-72
-74
x (cm)
14
16
18
20
22
24
26
28
30
32
34

Back Up

Static Distortion Map: Δr drift from (r, ϕ, z) 1D projection



Static Distortion Map: rΔϕ drift from (r, ϕ, z) 1D projection