

Status of the tracker alignment

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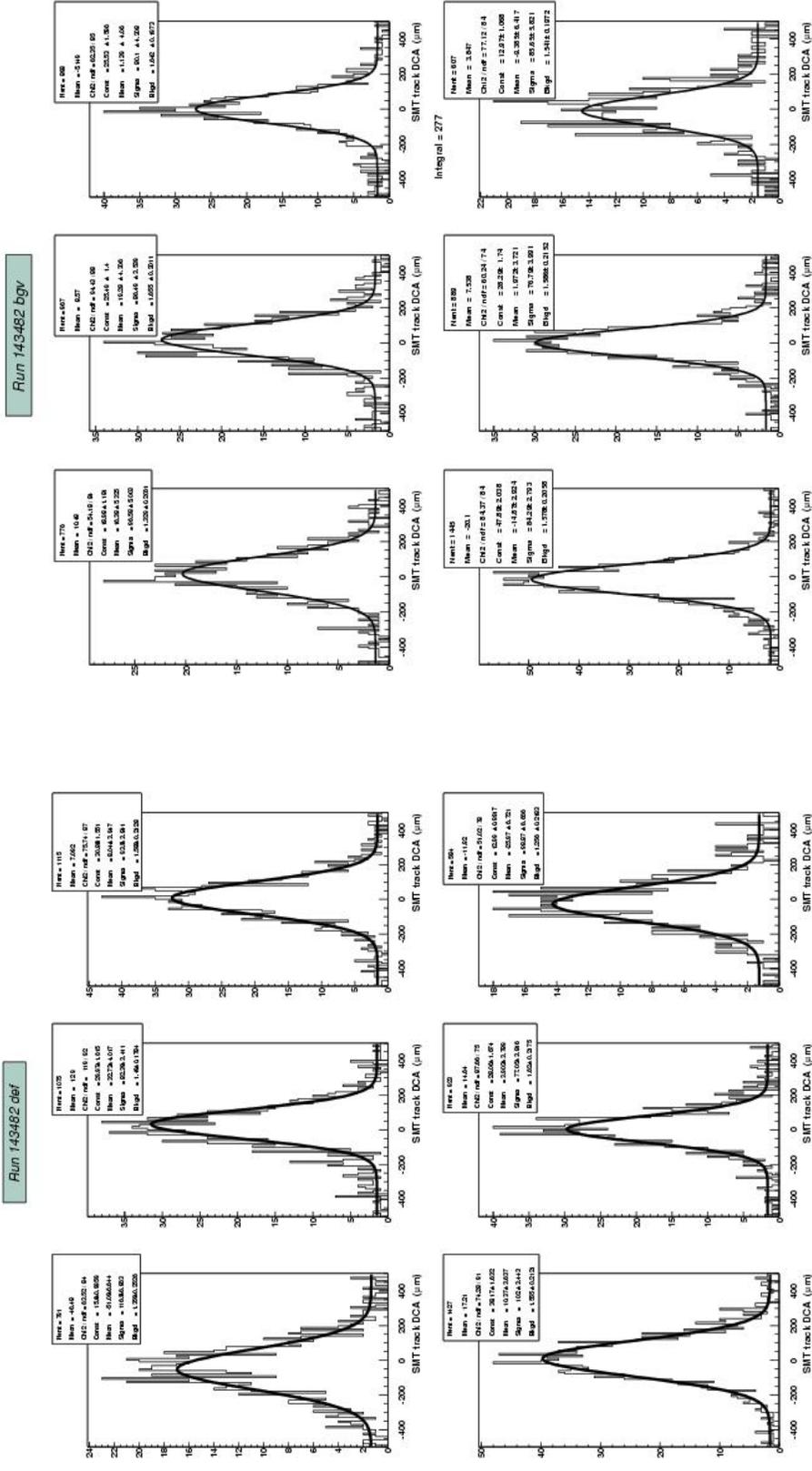
- Introduction
- CFT
- SMT
- SMT vs CFT
- Summary

Introduction

- Following results are obtained with the default DØ tracking code, `gtr`
- Typical track quality cuts include
 - $p_T > 1$ or 3 GeV, $\chi^2 < 50$, DCA (variable)
- When studying SMT vs CFT alignment require in addition
 - $\tan(\lambda) < 0.2$, $\Delta p_T(\text{CFT} - \text{SMT})/p_T < 0.3$ (momentum matching)
- SMT vs CFT track matching is considered at first CFT axial layer
 - SMT tracks are extrapolated to a cylinder with $r = 20$ cm
- For SMT alignment studies see talk by Guennadi Borissov

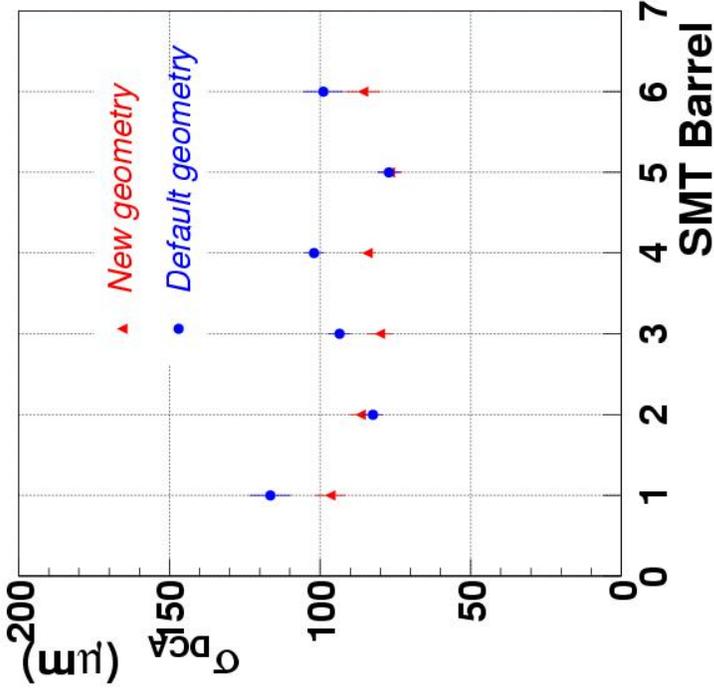
SMT alignment (1)

- DCA as measured with 6 SMT barrels, before alignment
- Same after alignment (Guennadi B.)
- SMT stand-alone tracking

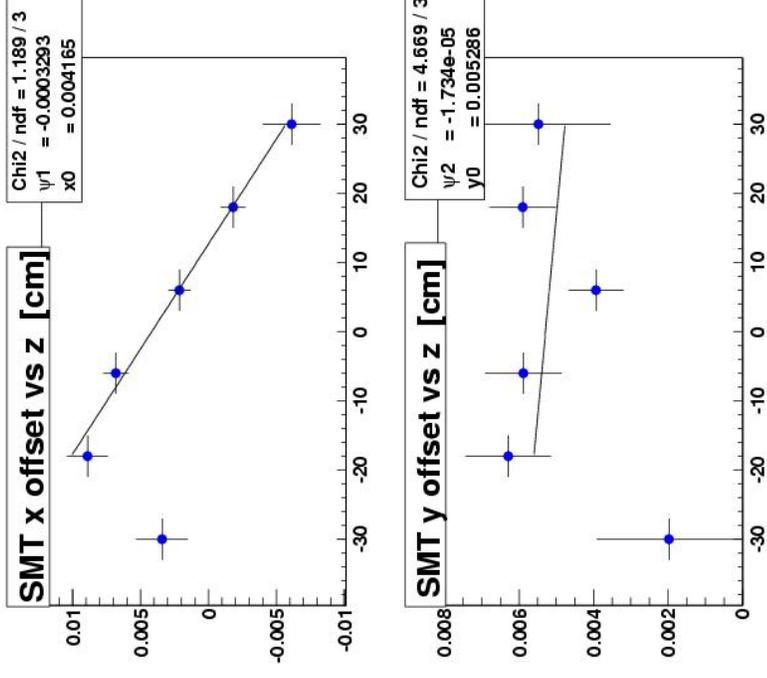


SMT alignment (2)

- Summary plot
 - Overall rotation of $-125 \mu\text{rad}$
 - Not centered: $(x, y) = (42, 53) \mu\text{m}$
 - Tilted: $\psi_1 = -330 \mu\text{rad}$
- SMT position relative to CFT
 - (supporting plots to follow)



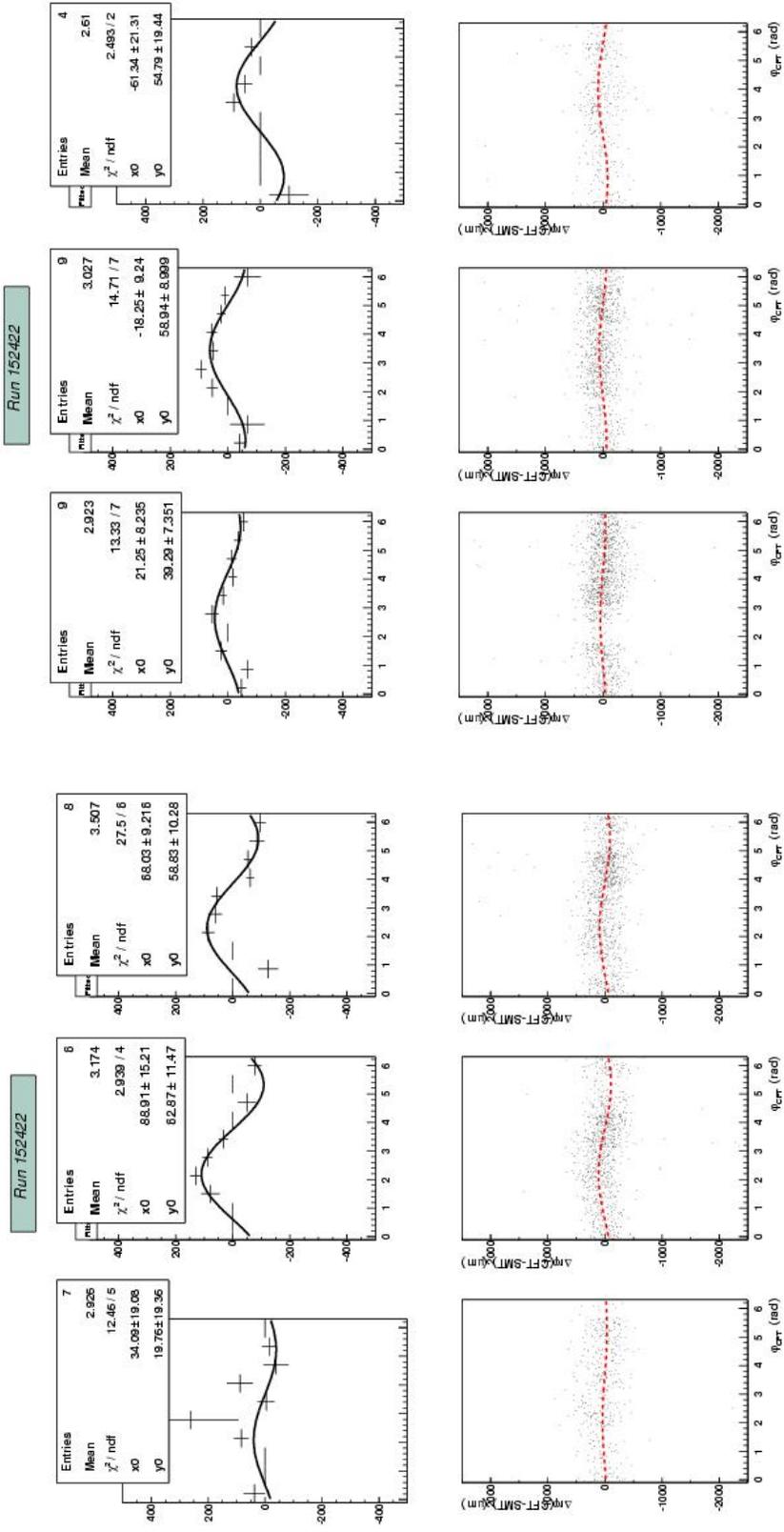
- Observe clear improvement



SMT vs CFT (1)

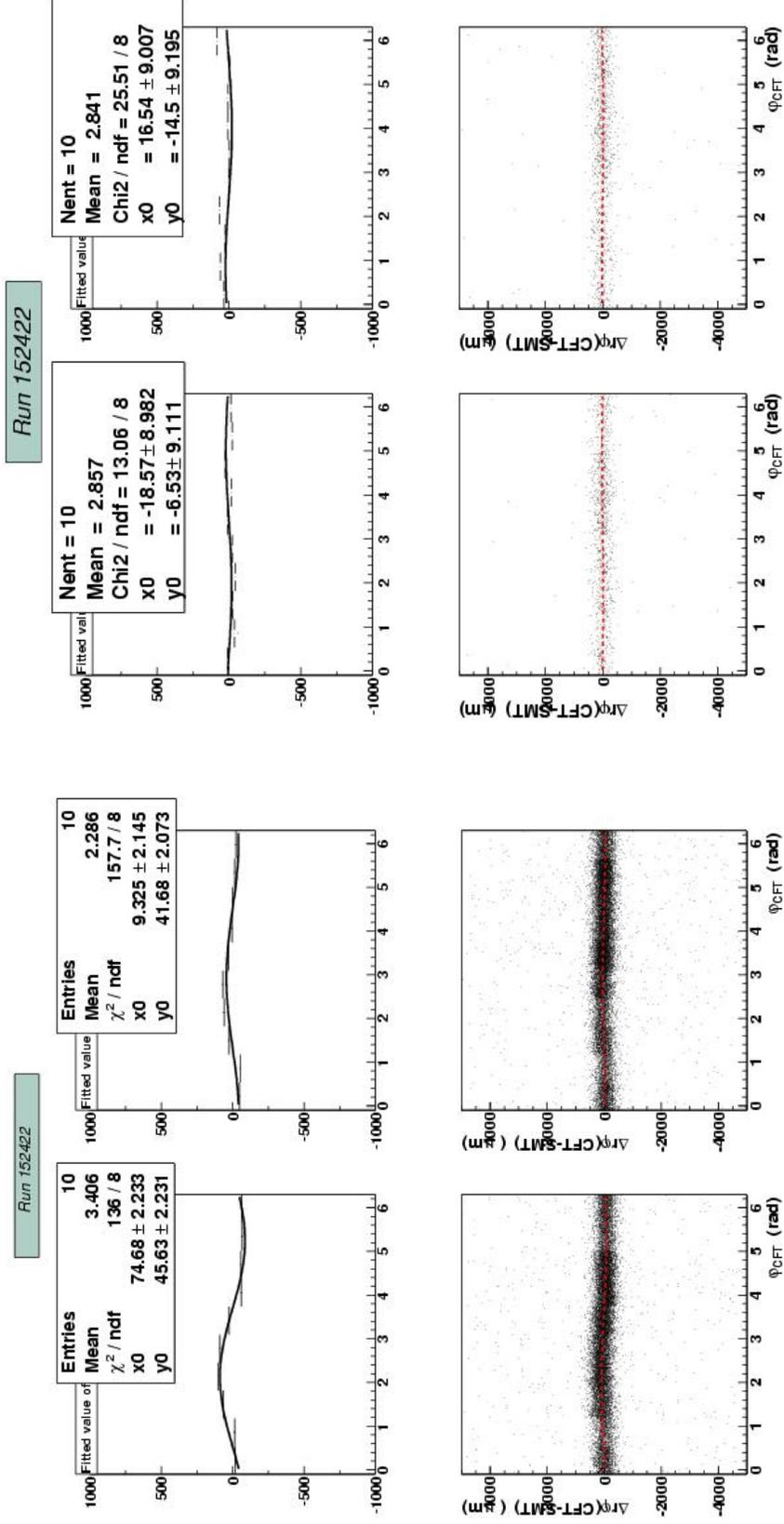
$\Delta r\phi(\text{CFT} - \text{SMT})$ vs ϕ measurements (at $r = 20$ cm)

- North SMT barrels
- South SMT barrels



SMT vs CFT (2)

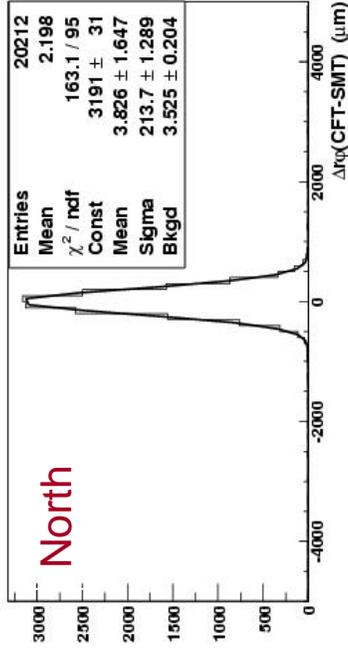
- Before alignment
 - All SMT barrels
- Apply (x, y, ψ_1) transform to SMT geometry (Brian D.)
- Need larger statistics to measure tilt



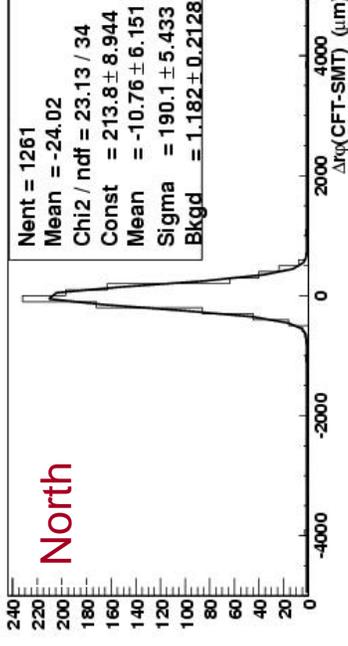
SMT vs CFT (3)

- Only overall $\phi = -125$ μrad rotation to SMT applied
 - Slight improvement also in track matching
- After (x, y, ψ_1) transform

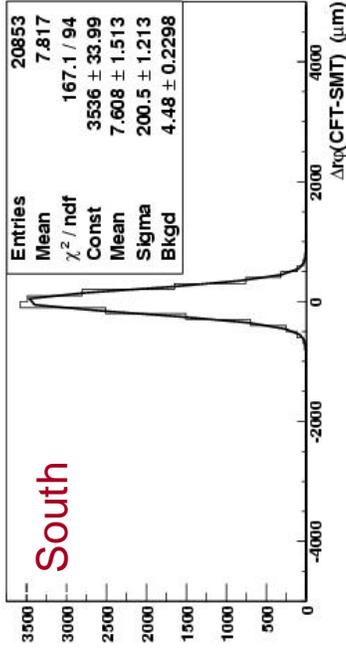
Run 152422



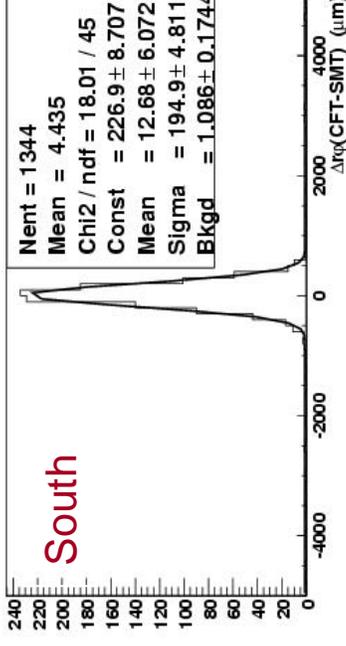
Run 152422



Run 152422



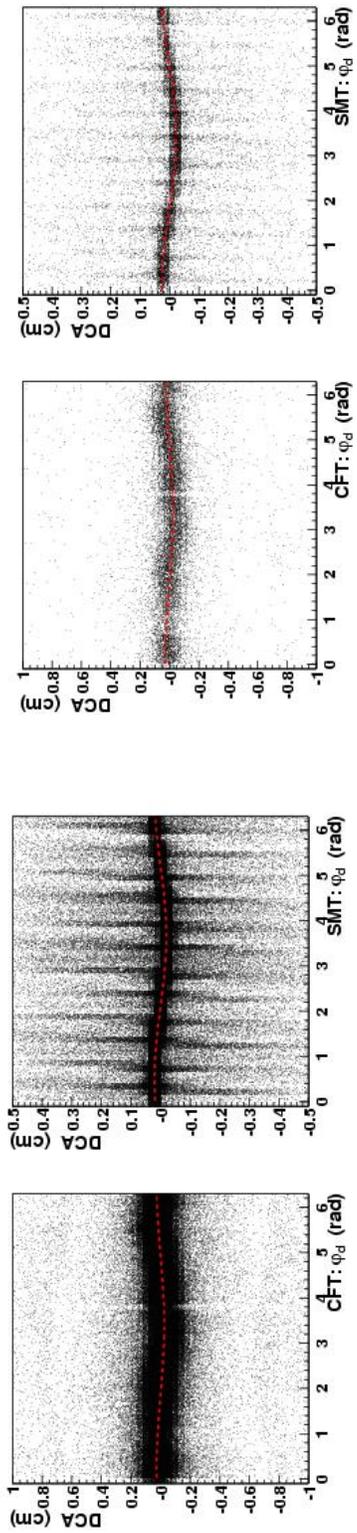
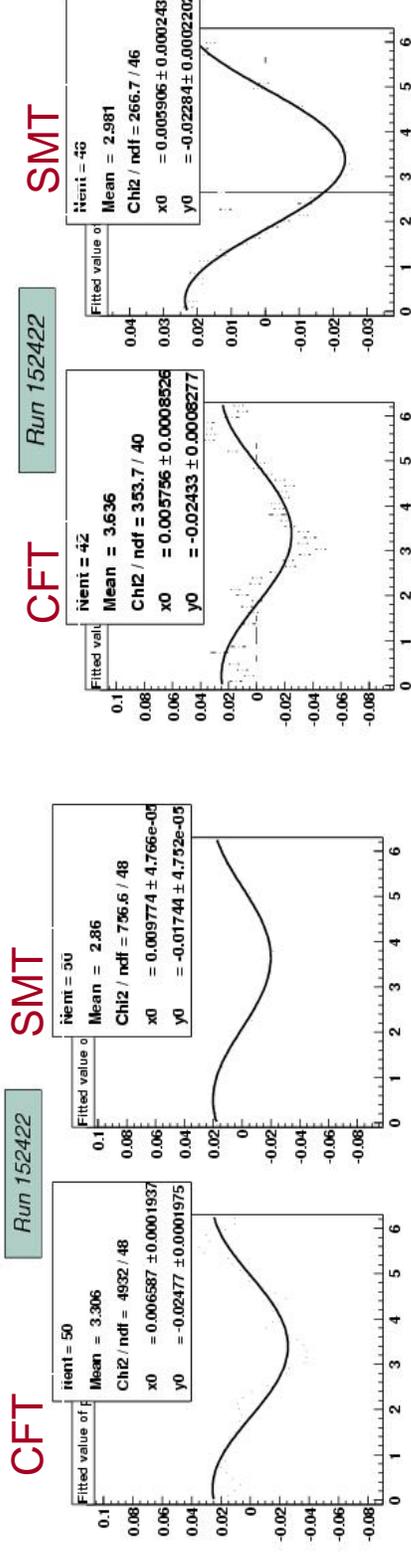
Run 152422



DCA vs φ measurements

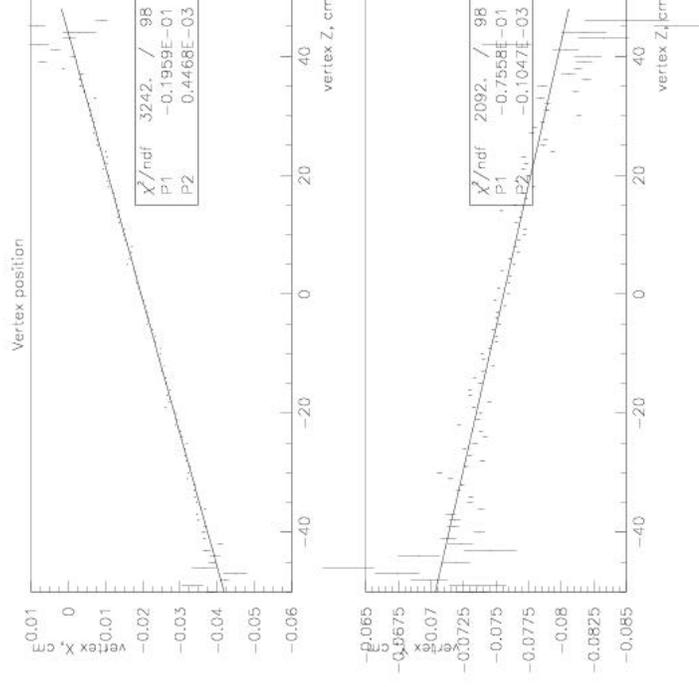
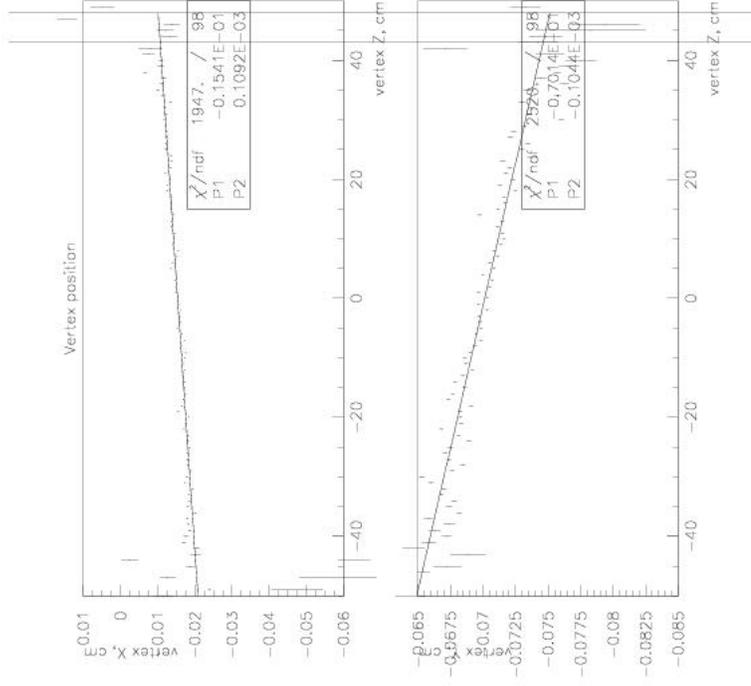
- Can independently verify position
 - After (x, y, ψ_1) transform
 - Both detectors measure similar beam offset values

Before SMT move



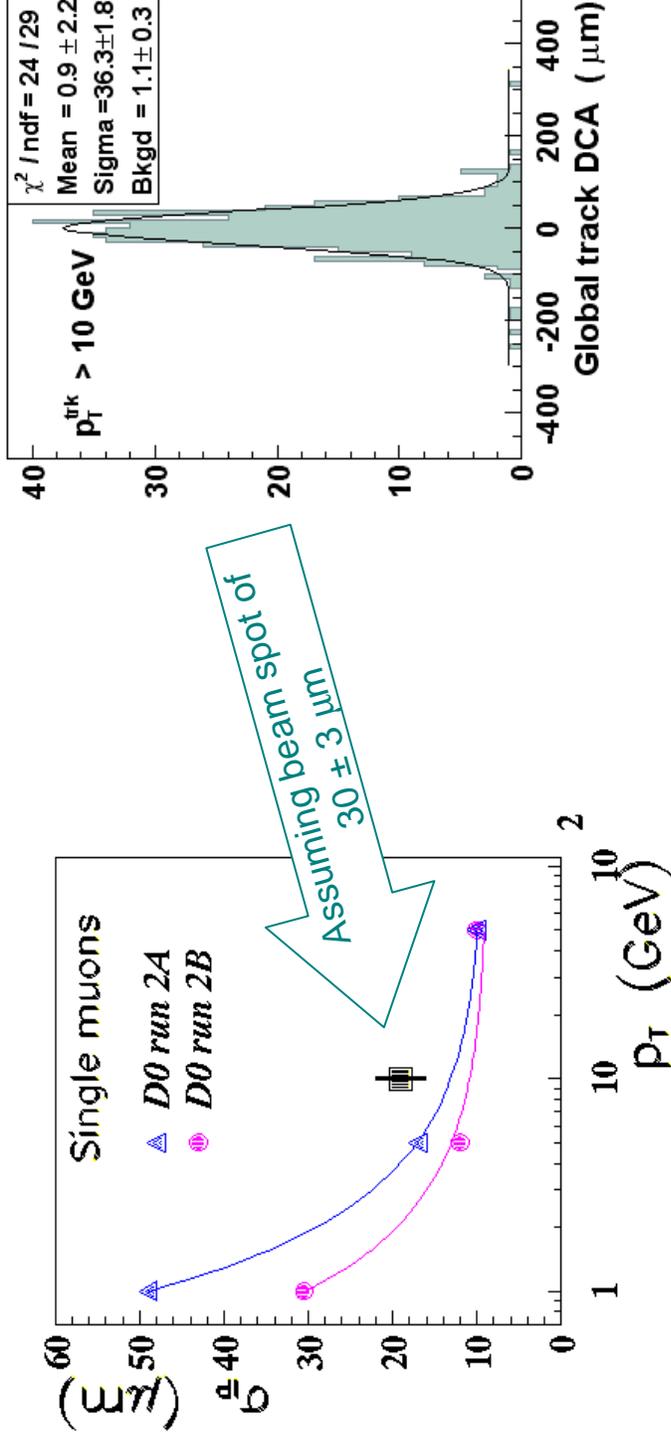
Beam tilt measurements

- Before alignment
 - Effective beam tilt in (x, z) plane has increased by factor of 3
- After (x, y, ψ_1) transform
 - Effective beam tilt in (x, z) plane has increased by factor of 3



Impact parameter resolution

- Run 2 simulations (Flora & Sasha K.)
- Measured IP resolution after 1st pass in SMT alignment

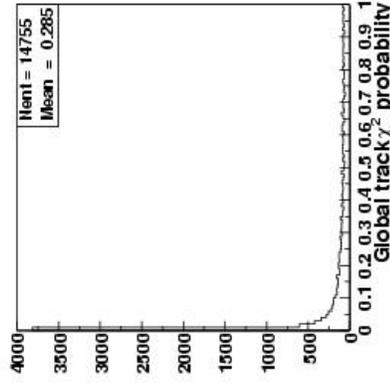
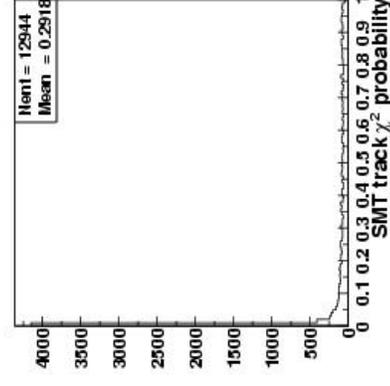
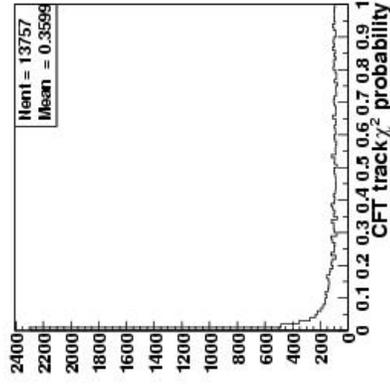


- Current performance is approaching Run 2A design figure
- Corresponding geometry is default for p11
 - More checks are needed before we release new one with (x, y, ψ_1) offset

Track χ^2 probability

- In p11 by default
 - Scale up the cluster errors in SMT by a factor of 1.6/1.4 for n-/p-side
 - Increase CFT cluster errors by (adding in quadrature) 70/80 μm axials/stereos

Run 152422

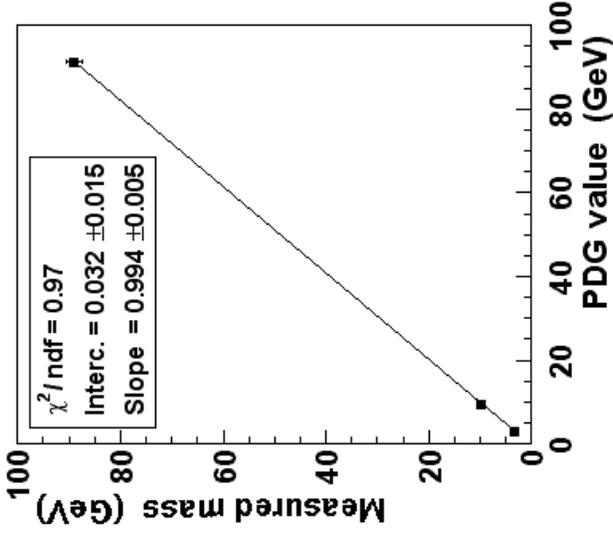
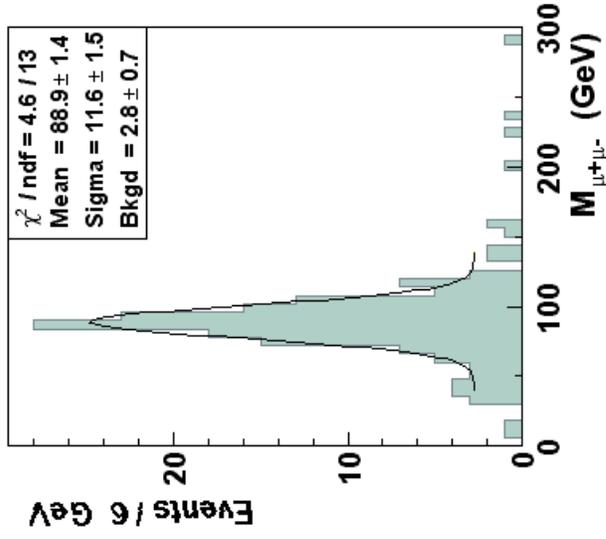


These large factors can be

- due to underestimated cluster errors
- and certainly due to misalignment

Momentum scale (with p10)

- $Z \rightarrow \mu\mu$ decays
- Momentum scale linearity from J/ψ , Υ and Z to $\mu\mu$ decays



- Measured width is ~30% worse than expected
 - Global tracks have mostly only CFT axial hits
- No “gross” problems seen

Summary

- We have much better tracker geometry in p11 as compared to p10 release
 - Few test with high statistics to be done before we make it default
- High priority now is the CFT alignment