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p̄anda

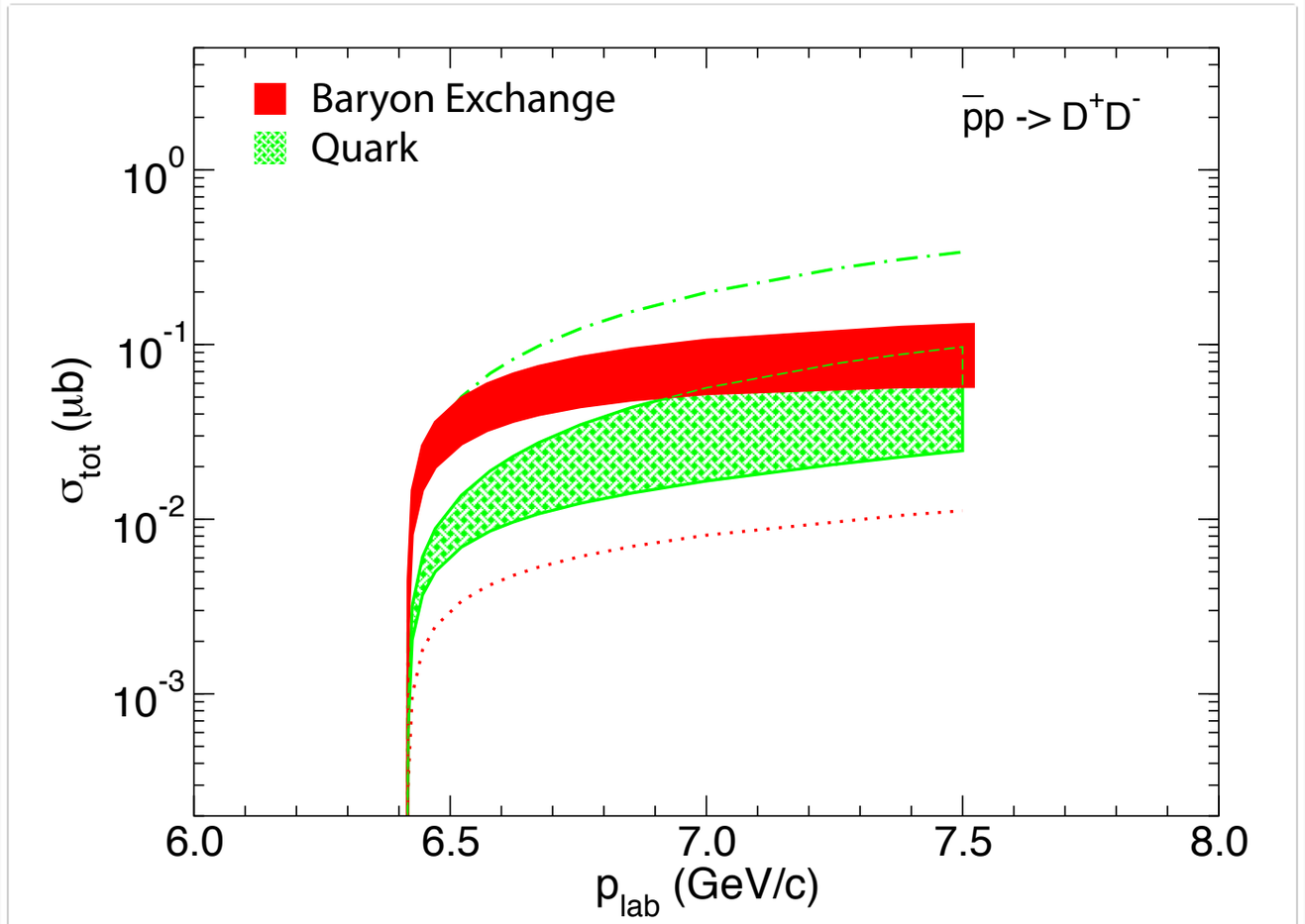
$p\bar{p} \rightarrow D^+ D^- \rightarrow K^- \pi^+ \pi^+ K^+ \pi^- \pi^-$

(Very) First Studies

11 June 2014 | Andreas Herten

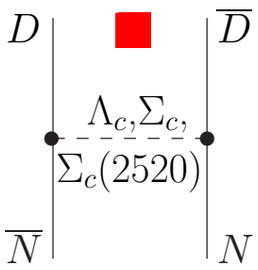
Mitglied der Helmholtz-Gemeinschaft

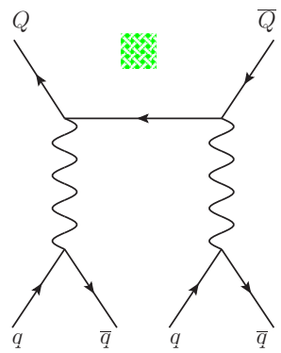
Motivation



J. Haidenbauer, G. Krein; Production of charmed pseudoscalar mesons in antiproton-proton annihilation; arXiv:1404.4174 [hep-ph] (04-2014)

Hadronic modes with a $\overline{K}$ or $\overline{K}K\overline{K}$				
Γ_{44}	$K^0_S\pi^+$		(1.45±0.04) %	S=1.3
Γ_{45}	$K^0_L\pi^+$		(1.46±0.05) %	
Γ_{46}	$K^-\pi^+\pi^+$	[b]	(9.22±0.21) %	S=1.1
Γ_{47}	$(K^-\pi^+)_{S-\text{wave}}\pi^+$		(7.54±0.26) %	
Γ_{48}	$\overline{K}^*_0(800)^0\pi^+$, $\overline{K}^*_0(800) \to K^-\pi^+$	[c]		
Γ_{49}	$\overline{K}^*_0(1430)^0\pi^+$, $\overline{K}^*_0(1430)^0 \to K^-\pi^+$	[c]		
Γ_{50}	$\overline{K}^*(892)^0\pi^+$, $\overline{K}^*(892)^0 \to K^-\pi^+$		(1.22±0.09) %	
Γ_{51}	$\overline{K}^*_2(1430)^0\pi^+$, $\overline{K}^*_2(1430)^0 \to K^-\pi^+$	[c]	(3.0 ±0.8) × 10^{-4}	
Γ_{52}	$\overline{K}^*(1680)^0\pi^+$, $\overline{K}^*(1680)^0 \to K^-\pi^+$	[c]	(1.6 ±0.6) × 10^{-3}	
Γ_{53}	$K^-\pi^+\pi^+$ nonresonant	[c]		
Γ_{54}	$K^0_S\pi^+\pi^0$	[b]	(6.8 ±0.5) %	S=1.9





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EvtGen

- EvtGen implements Dalitz decay for channel
- Based on CLEO-c data (2008),
  previously based on E691 data (1993)

```
EvtResonance2 DplusRes12(p4_p,moms3,moms1, 1.0, 0.0, 0.0503, 0.896, 1, true); // K*(892)
EvtResonance2 DplusRes22(p4_p,moms3,moms1, 3.0, 49.7-180.0, 0.164, 1.463, 0); // K*(1430)
EvtResonance2 DplusRes32(p4_p,moms3,moms1, 0.96, -29.9+180.0, 0.109, 1.4324, 2, true); // K*_2(1430)
EvtResonance2 DplusRes42(p4_p,moms3,moms1, 6.5, 29.0, 0.323, 1.717, 1, true); // K*(1680)
EvtResonance2 DplusRes52(p4_p,moms3,moms1, 5.01, -163.7+180.0, 0.470, 0.809, 0); // kappa(800)
```

PHYSICAL REVIEW D VOLUME 48, NUMBER 1 1 JULY 1993

Dalitz plot analysis of $D \to K\pi\pi$ decays

J. C. Anjos,[γ] J. A. Appel,[ζ] A. Bean,[α] S. B. Bracker,[λ] T. E. Browder,[α,(a)] L. M. Cremaldi,[η] G. M. Danner,[ι] J. Duboscq,[α,(b)] J. R. Elliott,[ϵ,(c)] C. O. Escobar,[κ] M. C. Gibney,[ϵ,(d)] A. S. Gordon,[ι,(e)] G. F. Hartner,[λ] P. E. Karchin,[μ] B. R. Kumar,[λ] M. J. Losty,[θ] G. J. Luste,[λ] P. M. Mantsch,[ζ] J. F. Martin,[λ] S. McHugh,[α] S. R. Menary,[λ,(f)] R. J. Morrison,[α] T. Nash,[ζ] P. Ong,[λ] J. Pinfold,[β] G. Punkar,[α,(g)] M. V. Purohit,[ι] J. R. Raab,[α,(h)] W. R. Ross,[μ] A. F. S. Santoro,[γ] A. L. Shoup,[δ,(i)] J. S. Sidhu,[β,(j)] K. Sliwa,[ξ,(k)] M. D. Sokoloff,[δ] M. H. G. Souza,[γ] M. E. Streetman,[ζ] A. B. Stundžia,[λ] W. D. Volkmuth,[ι] and M. S. Witherell[α]

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[β]*Carleton University, Ottawa, Ontario, Canada K1S 5B6*
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[δ]*University of Cincinnati, Cincinnati, Ohio 45221*
[ϵ]*University of Colorado, Boulder, Colorado 80309*
[ζ]*Fermi National Accelerator Laboratory, Batavia, Illinois 60510*
[η]*University of Mississippi, University, Mississippi 38677*
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(Received 2 December 1992)

Decays of the D^0 meson to $K^-\pi^+\pi^0$ and $\bar{K}^0\pi^+\pi^-$ and of the D^+ to $K^-\pi^+\pi^+$ have been analyzed for resonant substructure. We present results on the amplitudes and phases of each decay mode and compare the results with other measurements. We confirm the highly nonresonant nature of the D^+ to $K^-\pi^+\pi^+$ decays. There is general agreement with theoretical models for the branching ratios measured.

http://dx.doi.org/10.1103/PhysRevD.24.78

E691

CLNS 08/2018
CLEO 08-02

Dalitz plot analysis of the $D^+ \to K^-\pi^+\pi^+$ decay

(CLEO Collaboration)

Abstract

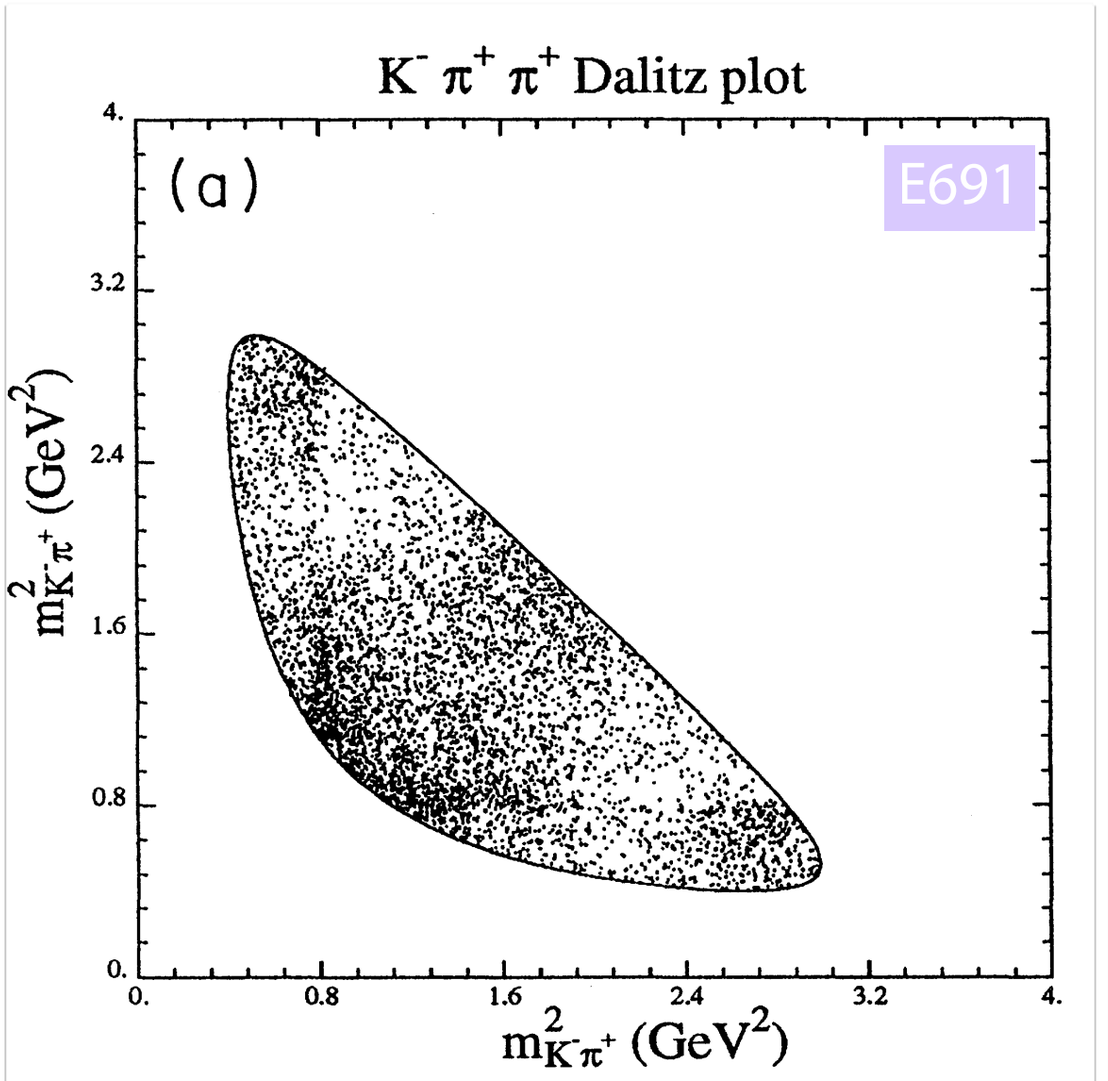
We perform a Dalitz plot analysis of $D^+ \to K^-\pi^+\pi^+$ decay with the CLEO-c data set of 572 pb^{-1} of e^+e^- collisions accumulated at the $\psi(3770)$. This corresponds to 1.6×10^6 D^+D^- pairs from which we select 140793 candidate events with a small background of 1.1%. We compare our results with previous measurements using the isobar model. We modify the isobar model with an improved description of some of the contributing resonances, and get better agreement with our data. We also consider a quasi-model-independent approach and measure the magnitude and phase of the contributing $K\pi$ S wave in the range of invariant masses from the threshold to the maximum in this decay. This gives an improved descriptions of our data over the isobar model. Finally we allow for an isospin-two $\pi^+\pi^+$ S wave contribution, and find that adding this to both the isobar model and the quasi-model-independent approach gives the best description of our data.

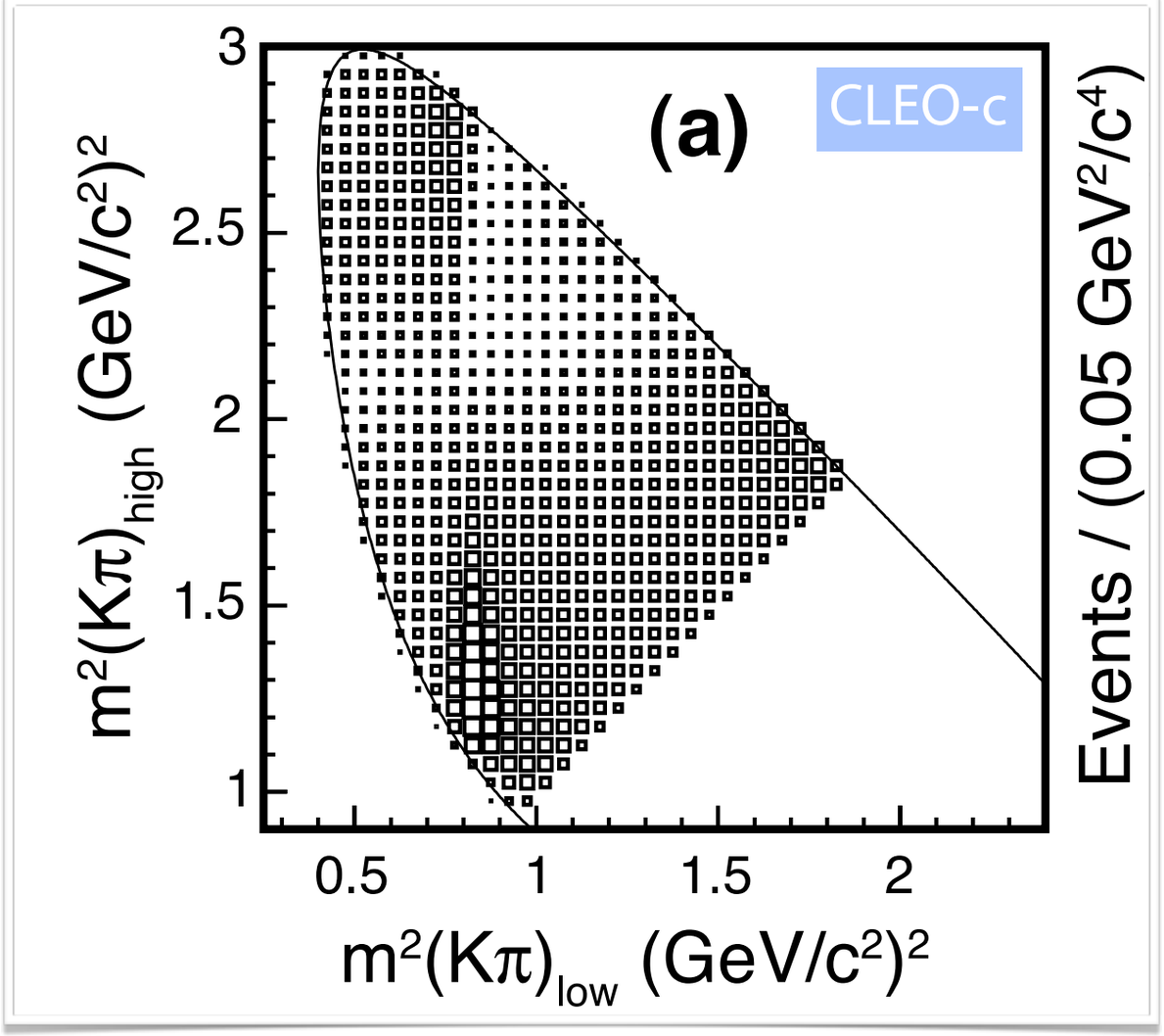
arXiv:0802.4214 [hep-ex]

CLEO-c

Mitglied der Helmholtz-Gemeinschaft

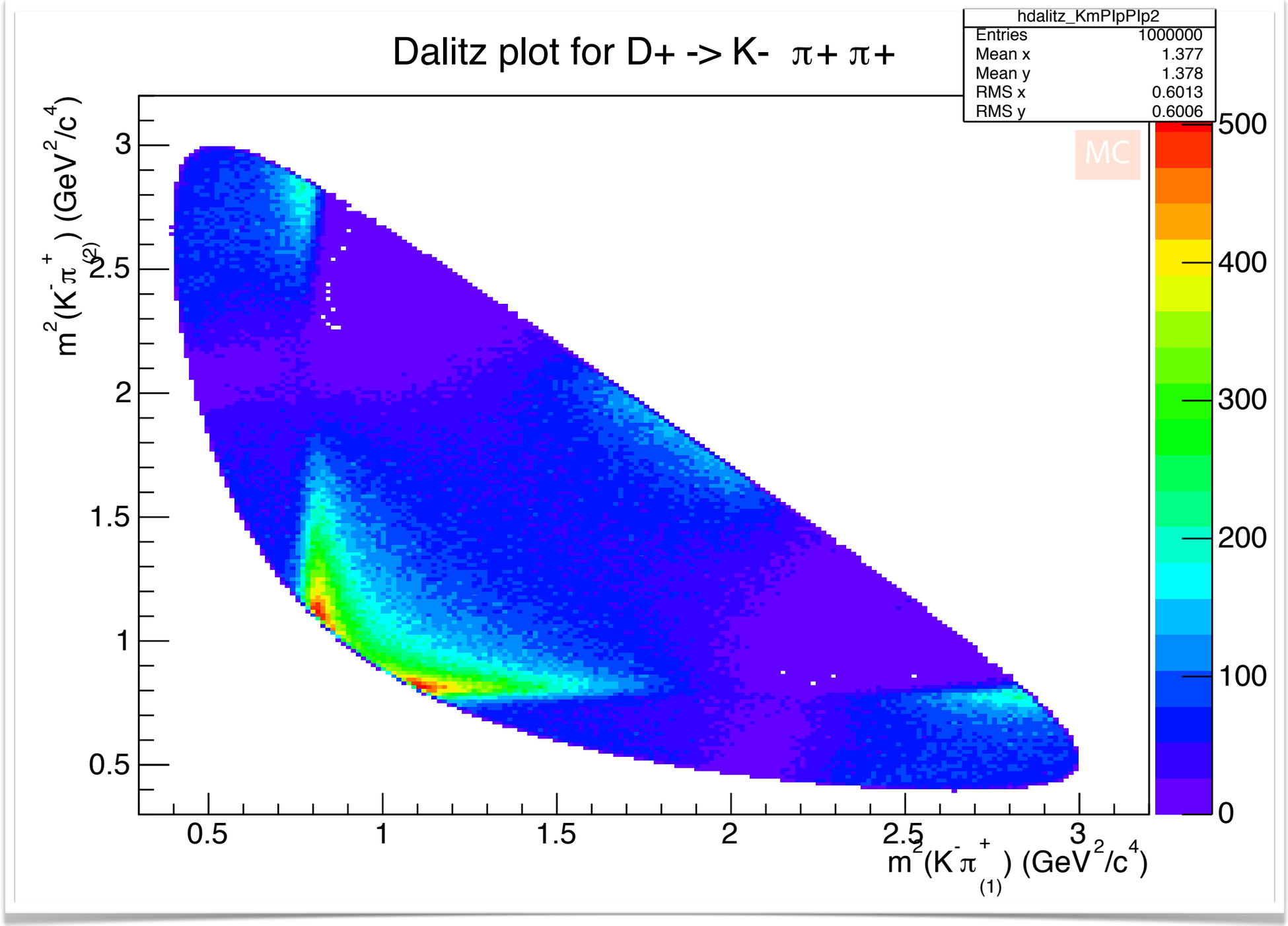
MC – Comparison





Mitglied der Helmholtz-Gemeinschaft

MC – Comparison



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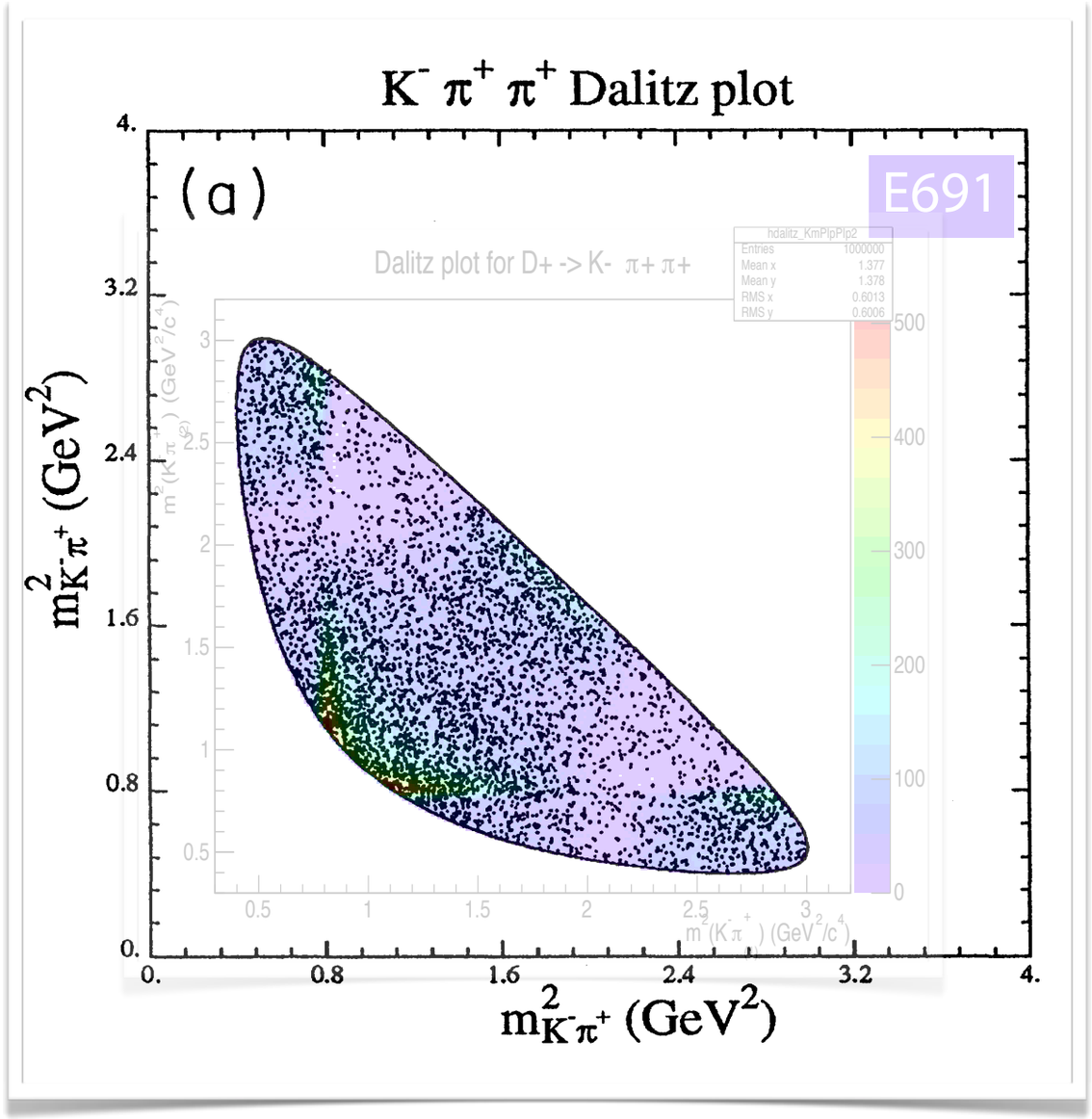
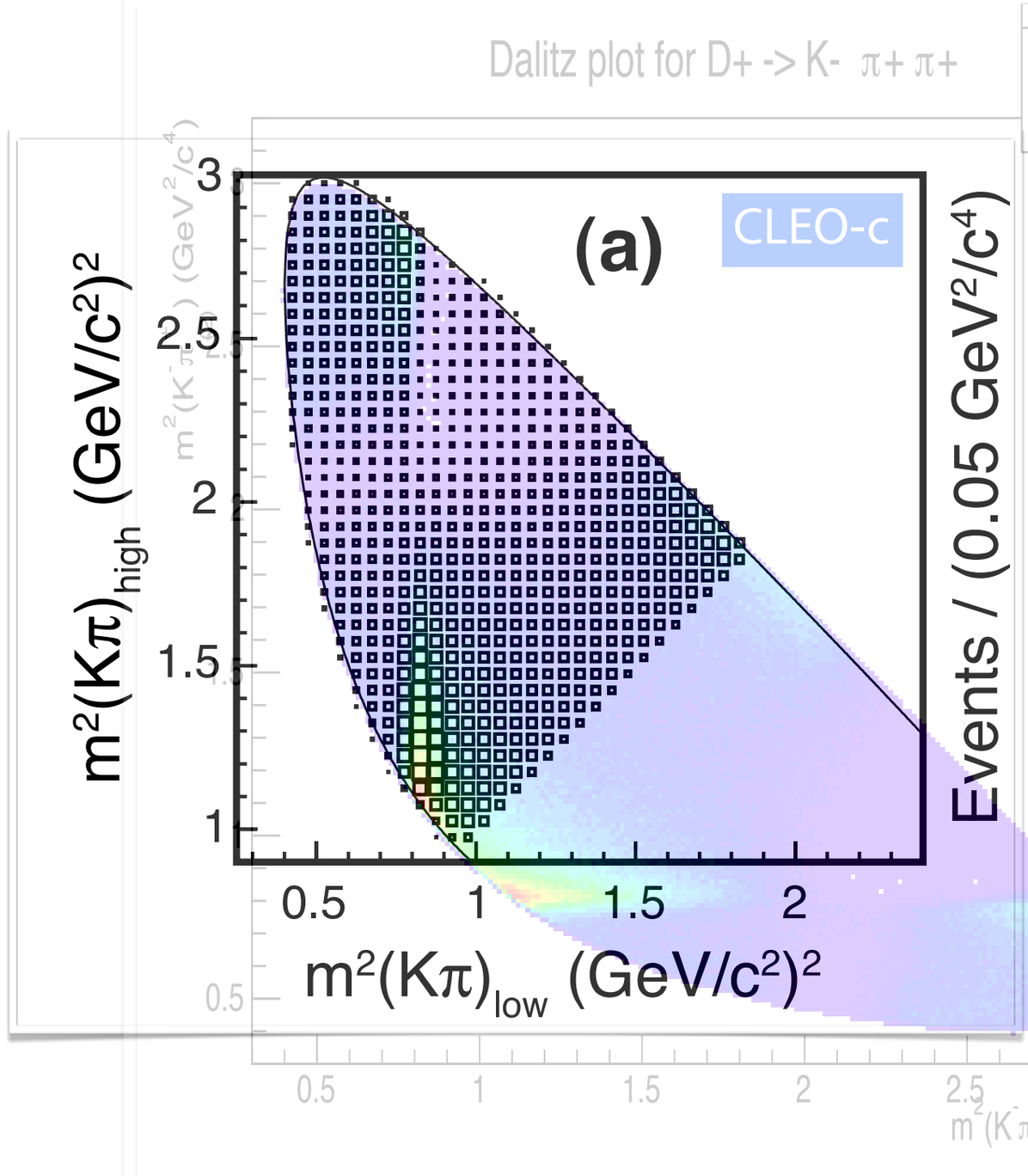
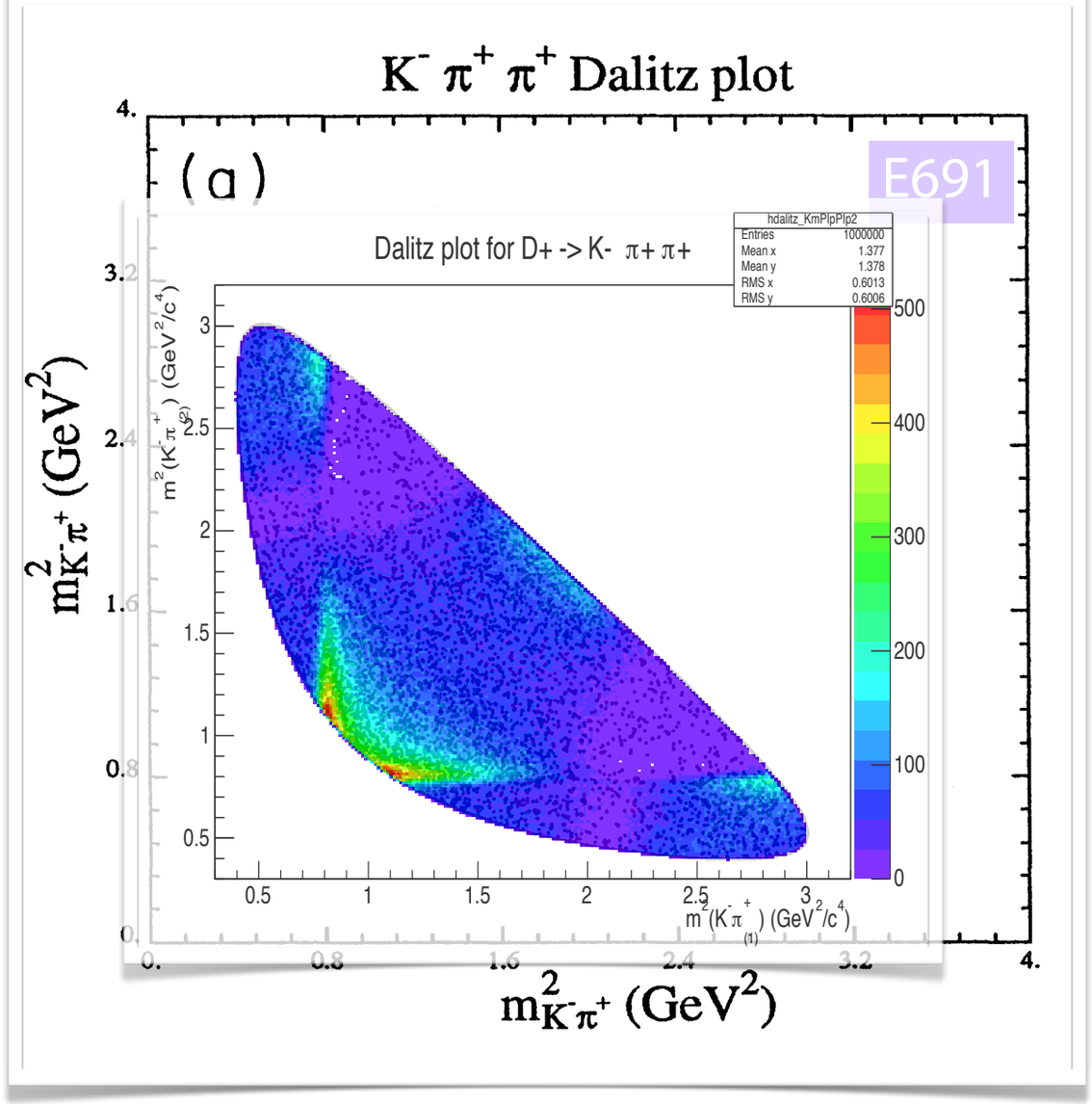
MC – Comparison

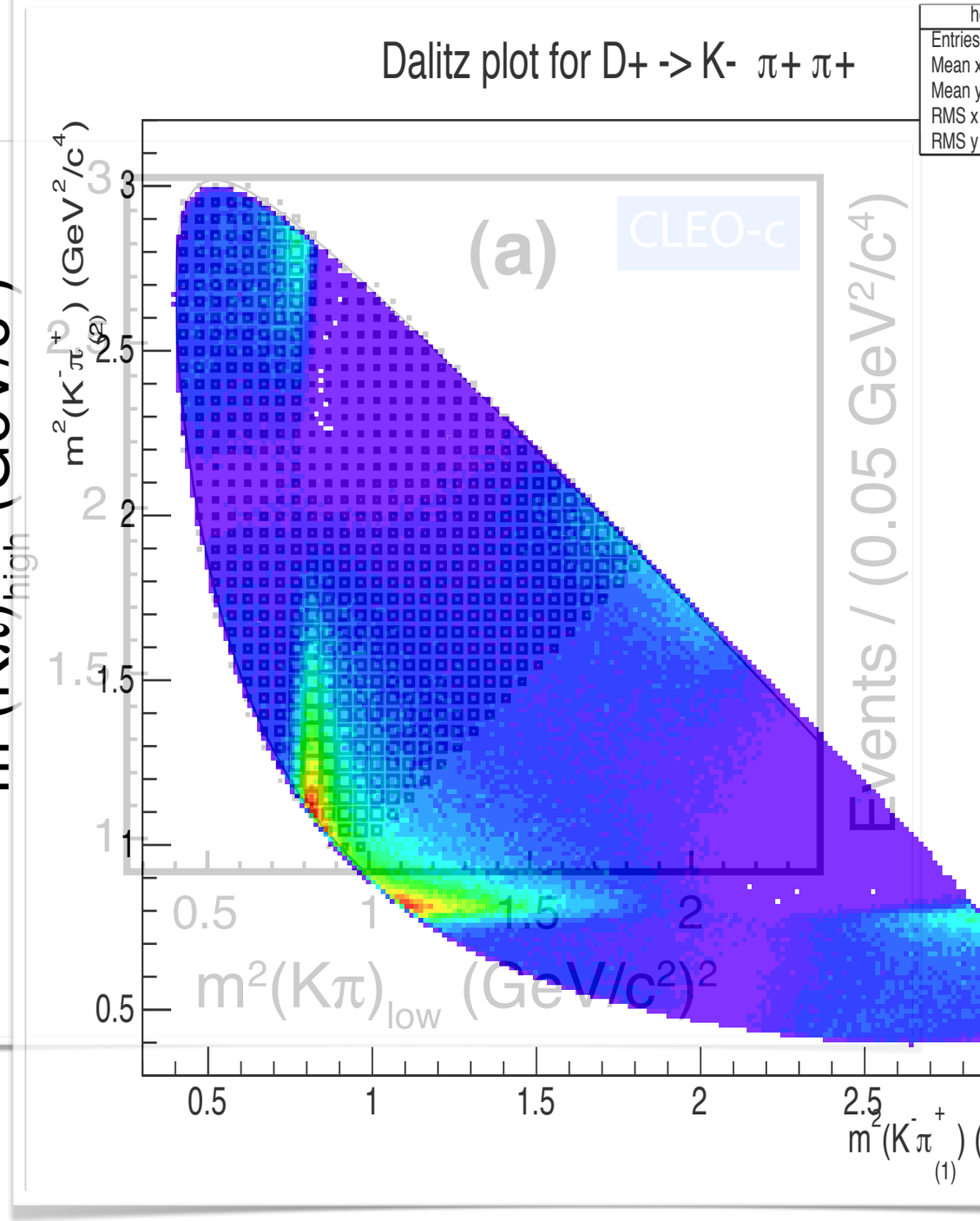




Mitglied der Helmholtz-Gemeinschaft

MC – Comparison





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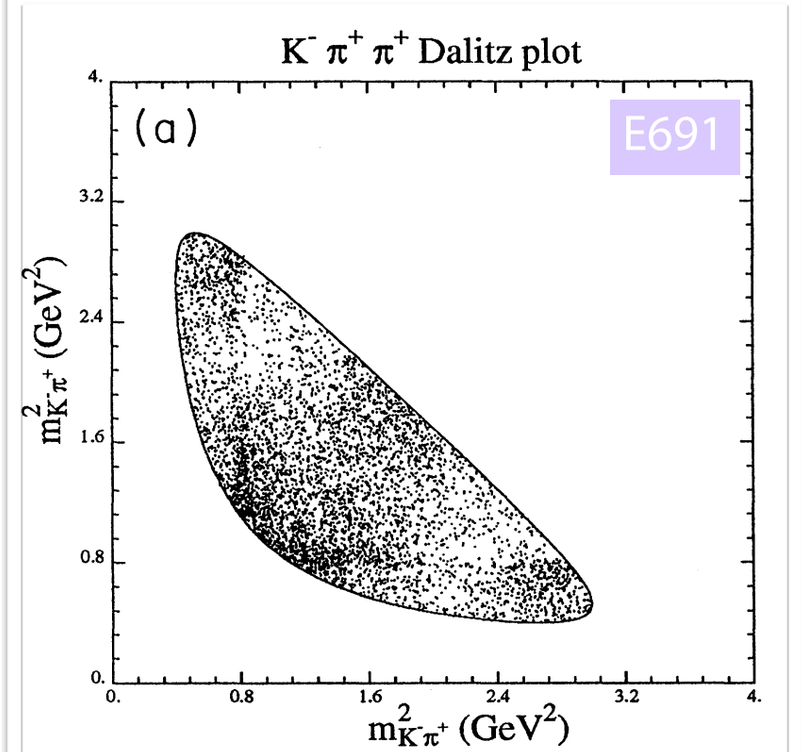
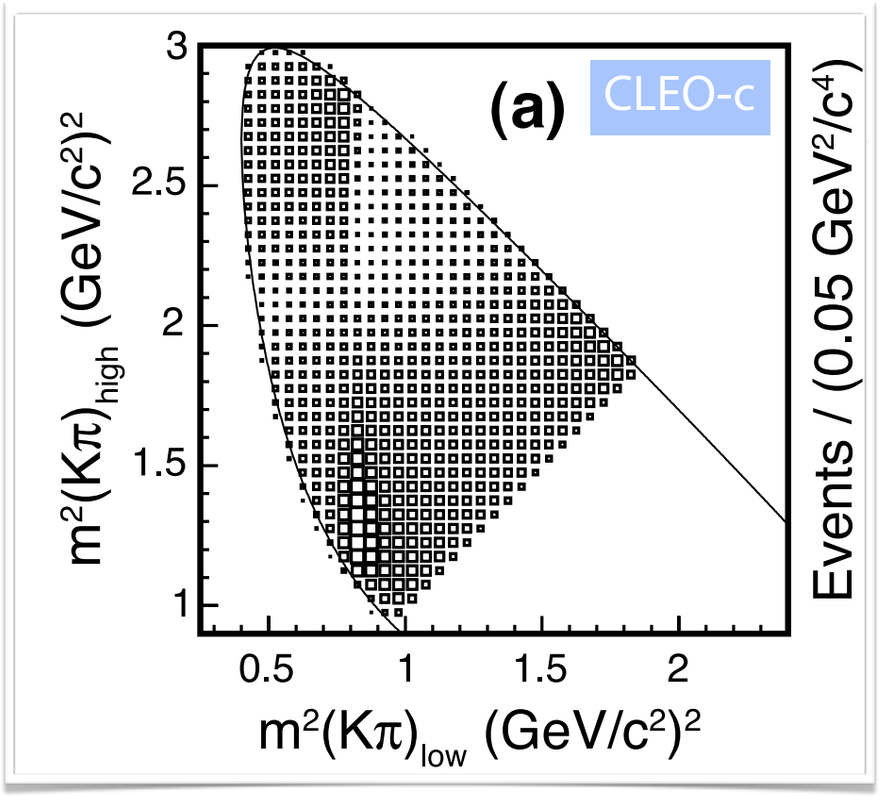
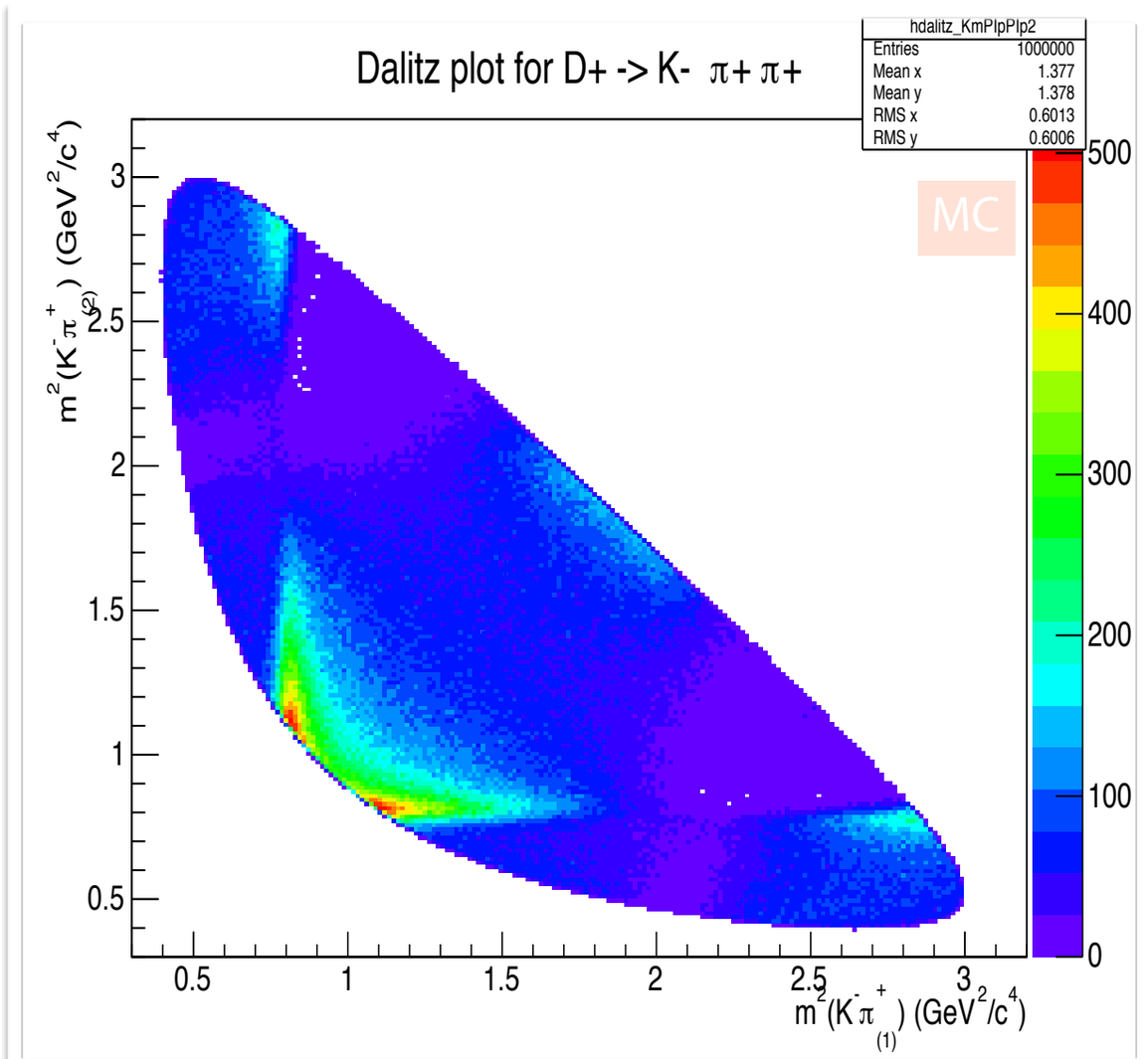
MC – Comparison







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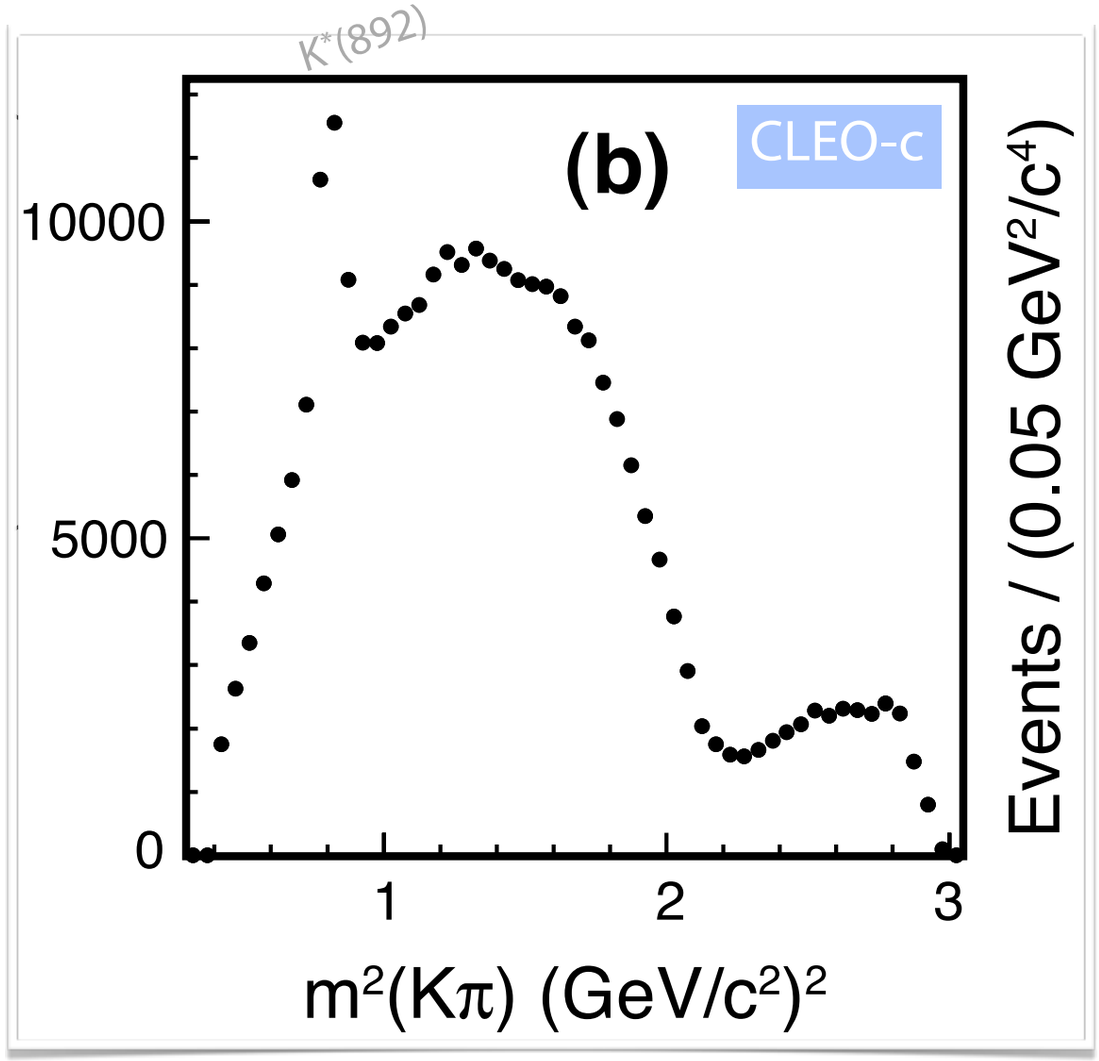
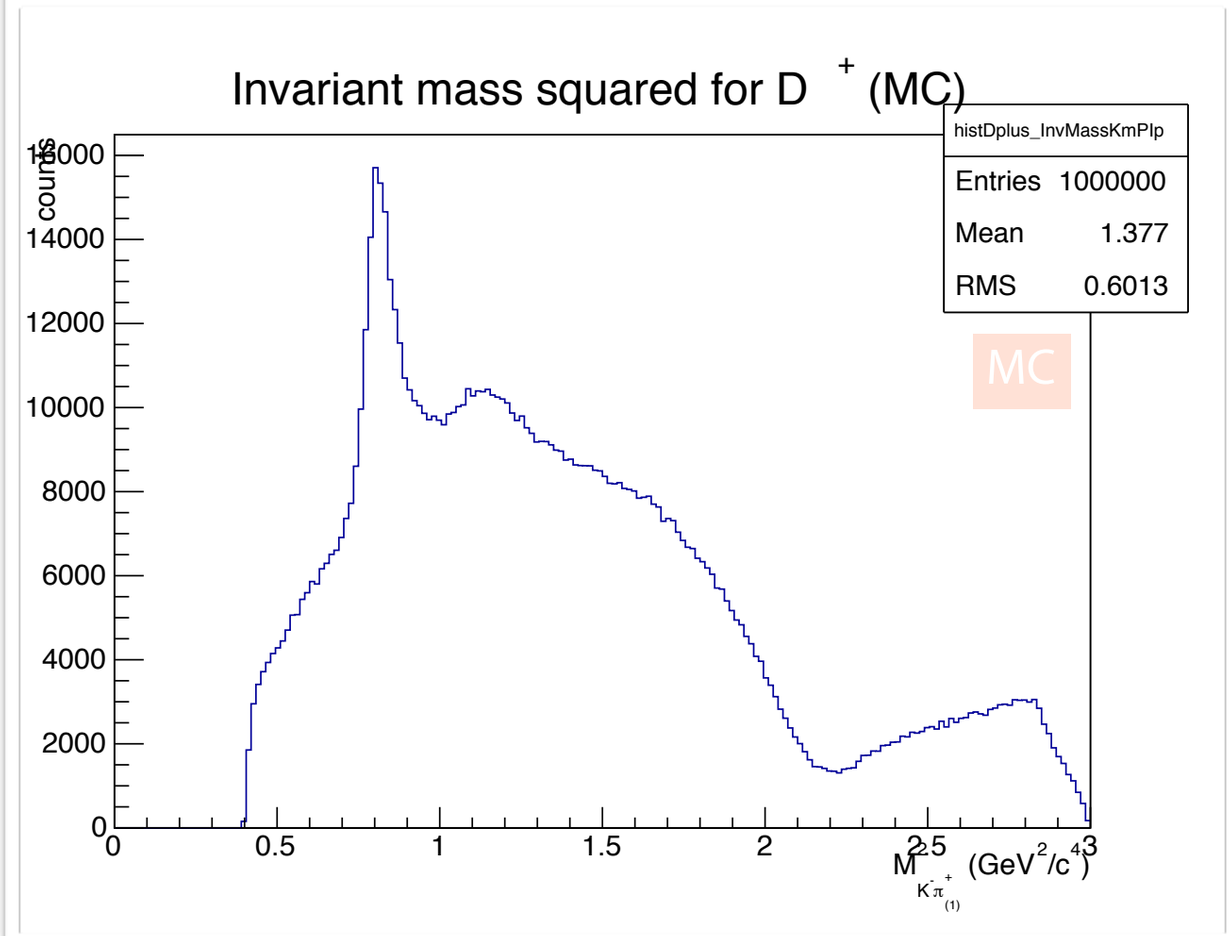
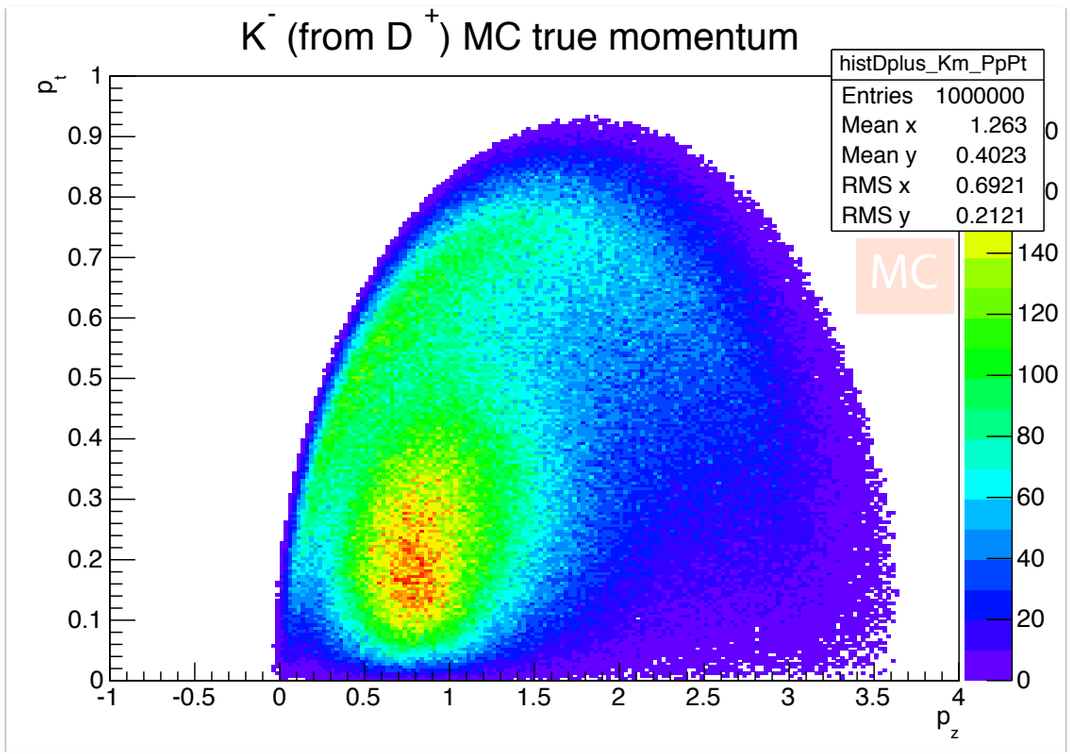
MC – Comparison

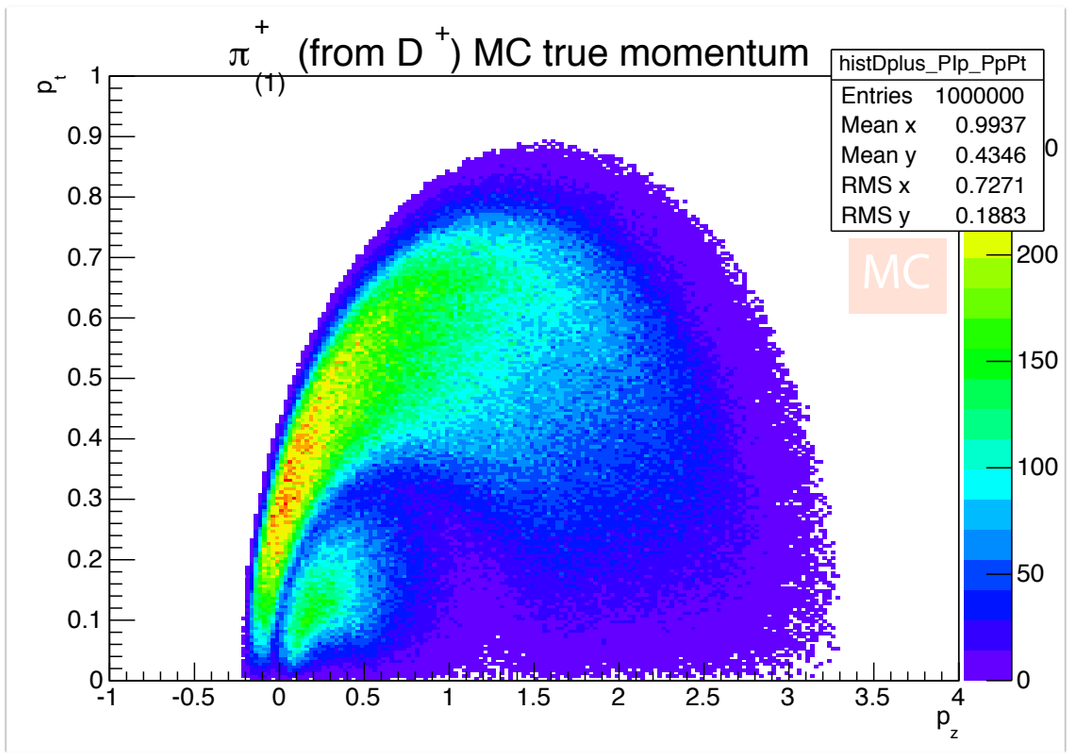




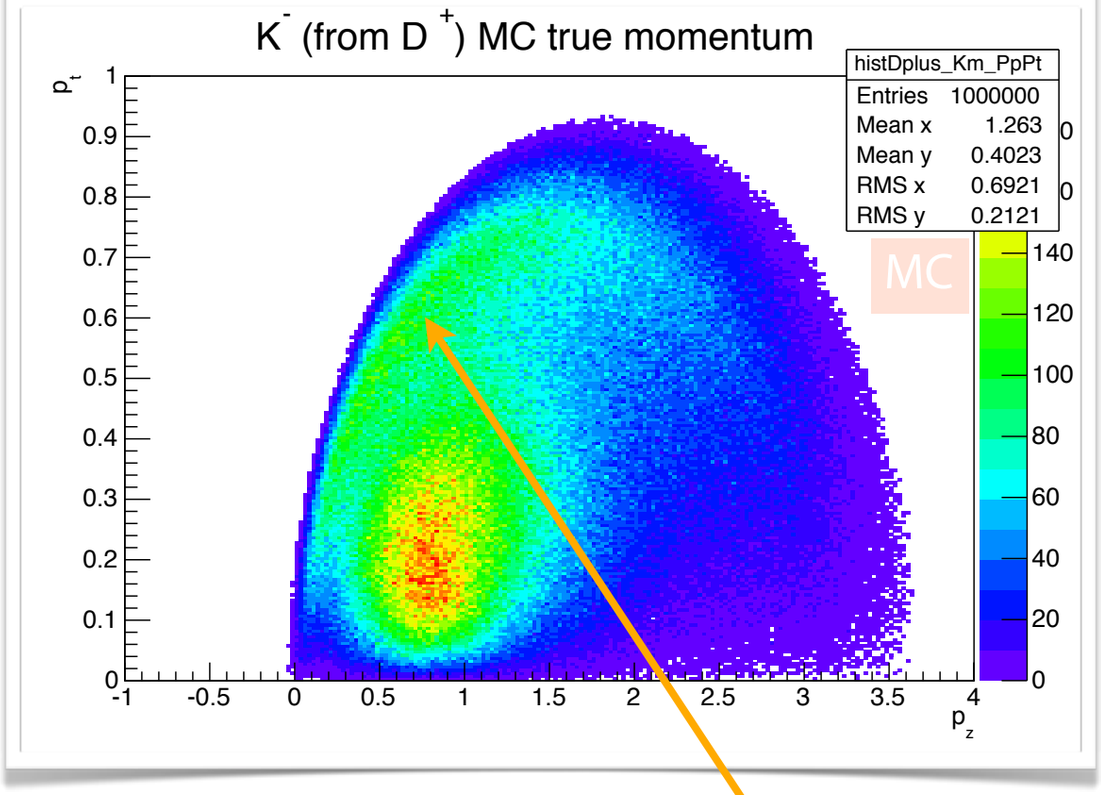
Mitglied der Helmholtz-Gemeinschaft

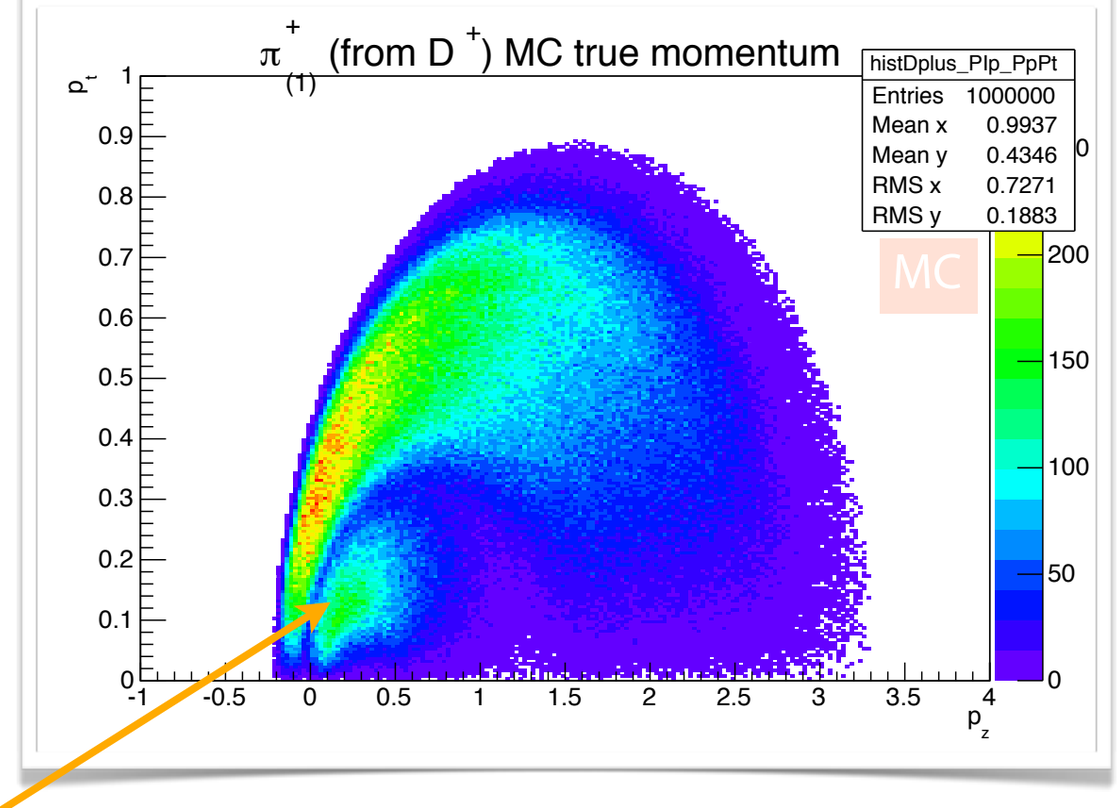
Momentum Distribution (p_t vs p_z)

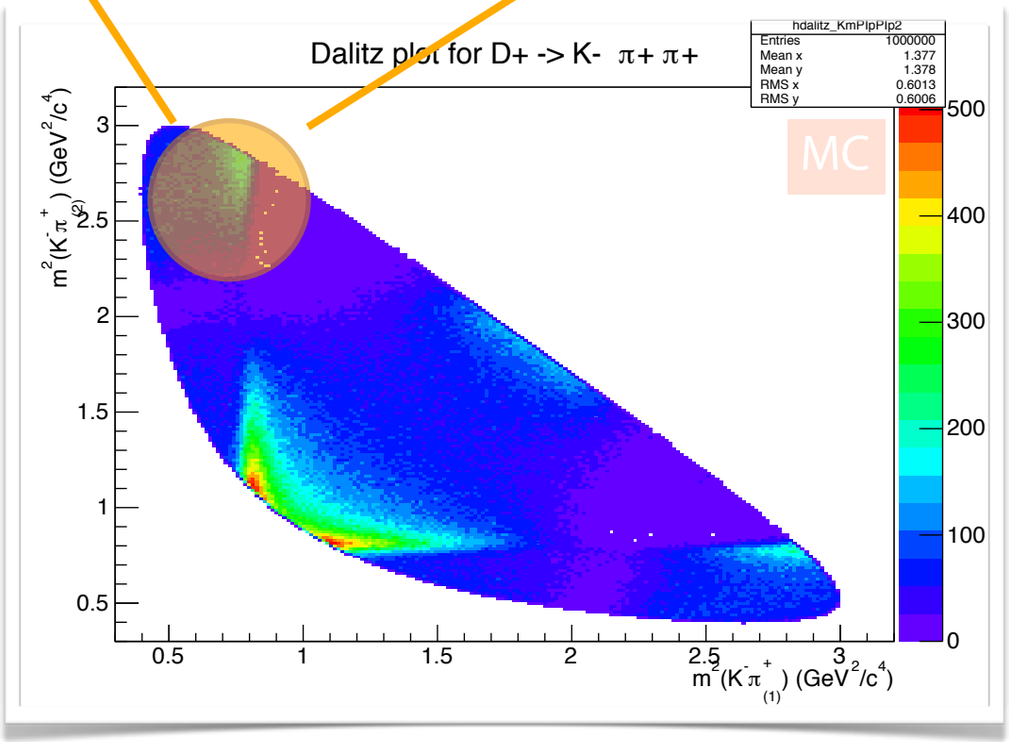




Momentum Distribution (p_t vs p_z)







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FastSim

Scrut (Rev. 25221)

Mitglied der Helmholtz-Gemeinschaft

FastSim Coordinates

- Based on Klaus‘ ana_jpsi.C
- PID algorithms: `KaonBest`, `MuonBest`

```
theAnalysis->FillList(kminus, "KaonBestMinus", pidalg);
theAnalysis->FillList(piplus,  "PionBestPlus", pidalg);

dpluslist.Combine(kminus, piplus, piplus);
dpluslist.SetType(411);
```

- $\bar{p}$ momentum: 6.5 GeV/c

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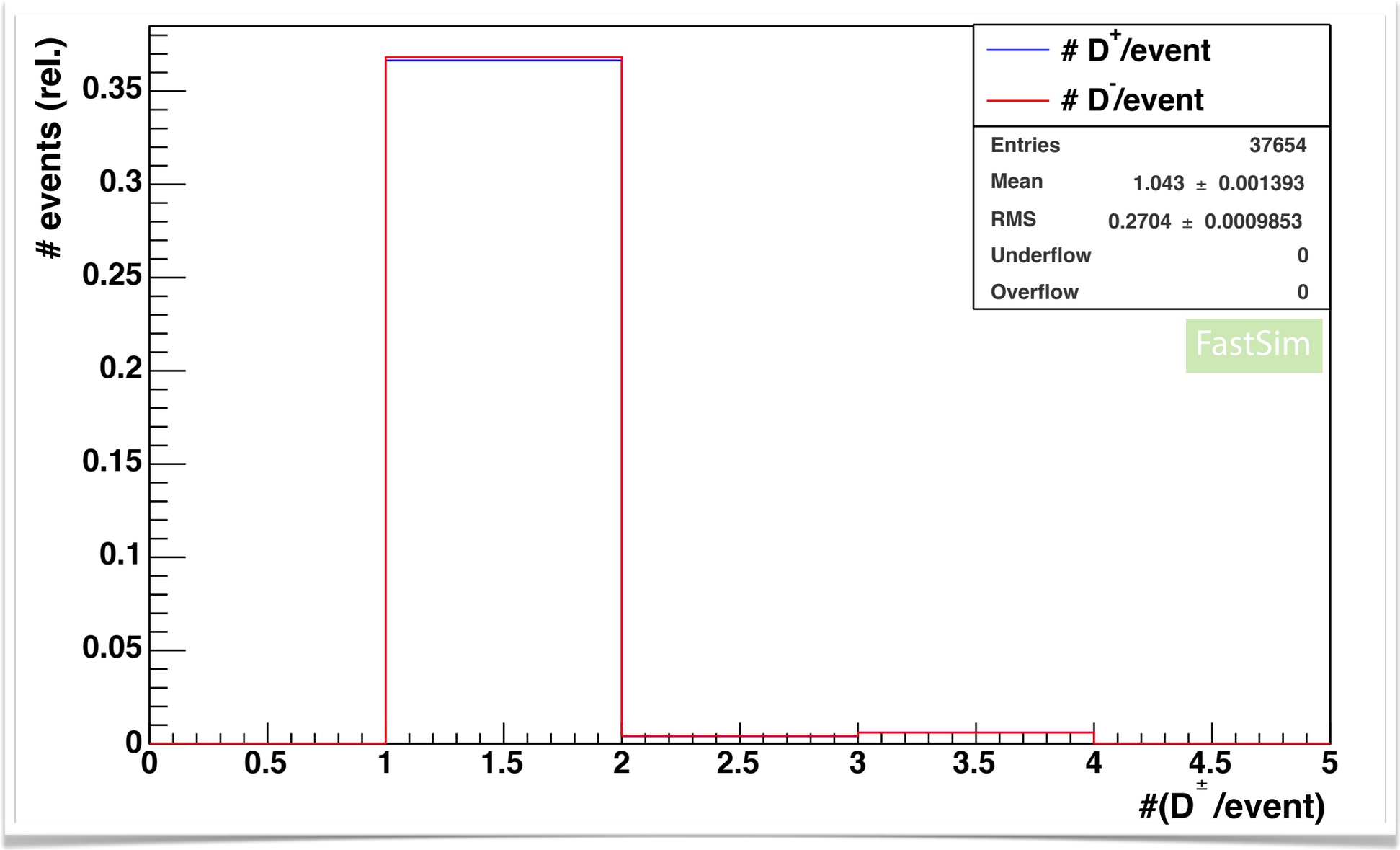
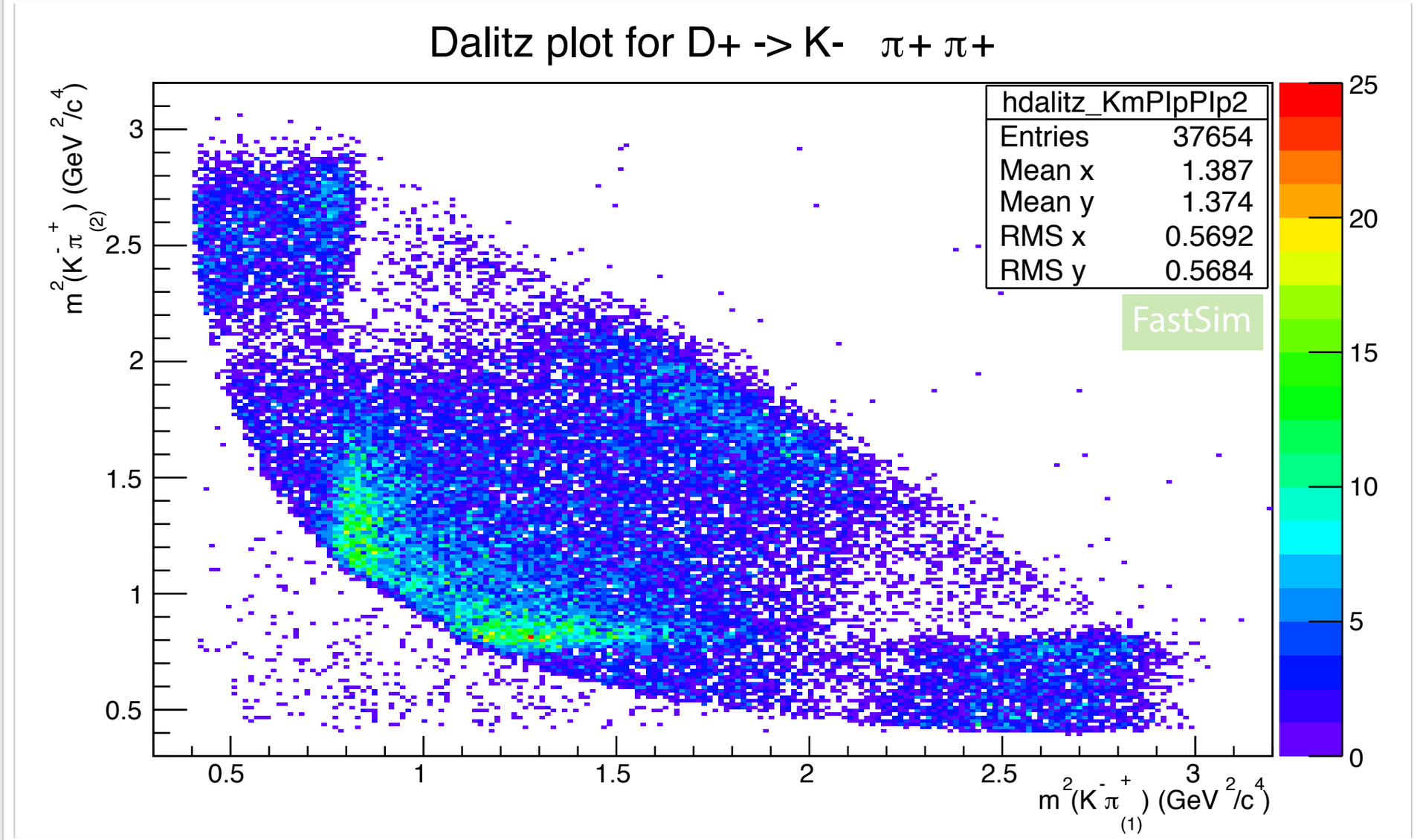
Number Of Combined $D^{\pm}$ per Event

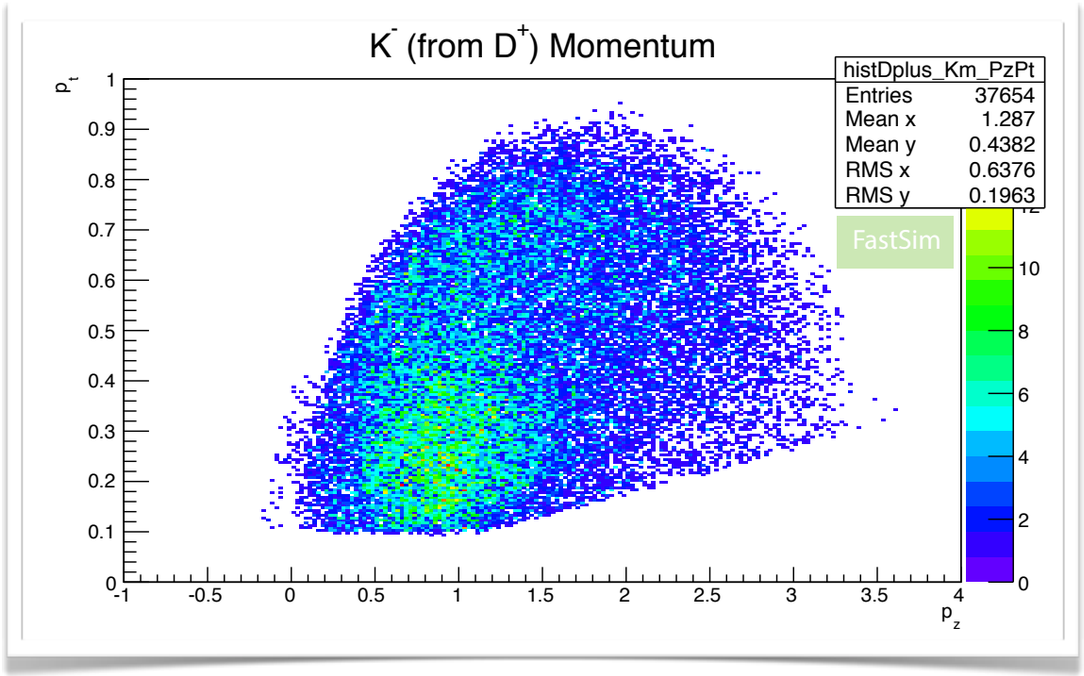


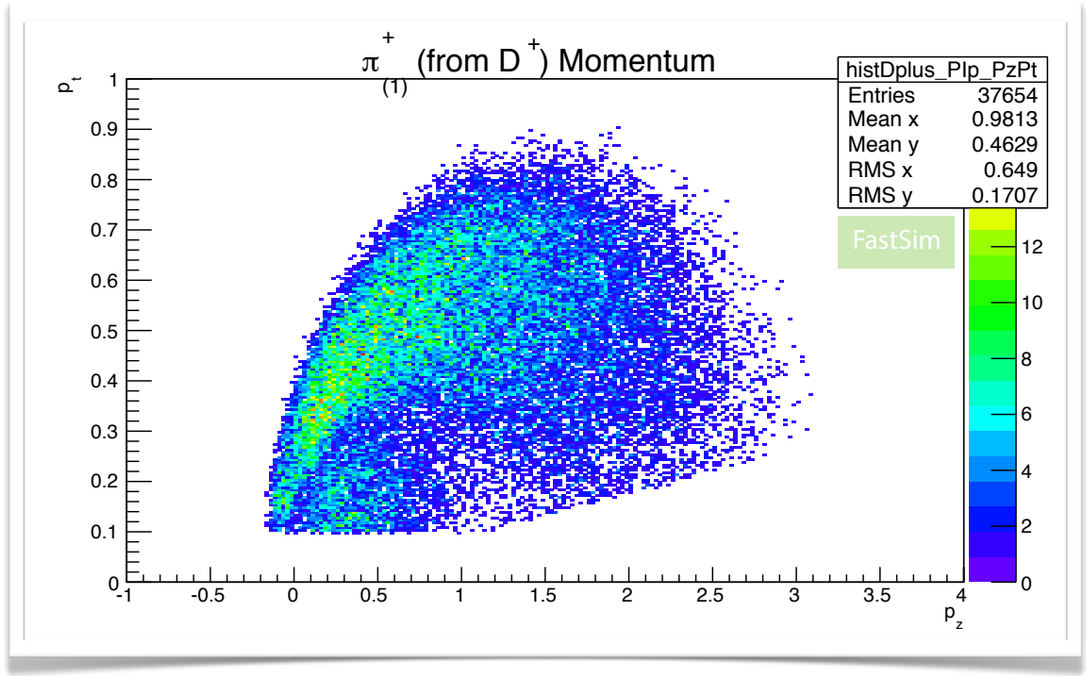
$N_{sim} = 100\,000$

Dalitz


Dalitz plot for D+ -> K- π+ π+
hdalitz_KmPlpPlp2
Entries 37654
Mean x 1.387
Mean y 1.374
RMS x 0.5692
RMS y 0.5684
FastSim
m²(K⁻π⁺₍₂₎) (GeV²/c⁴)
m²(K⁻π⁺₍₁₎) (GeV²/c⁴)
0.5
1
1.5
2
2.5
3
0
5
10
15
20
25

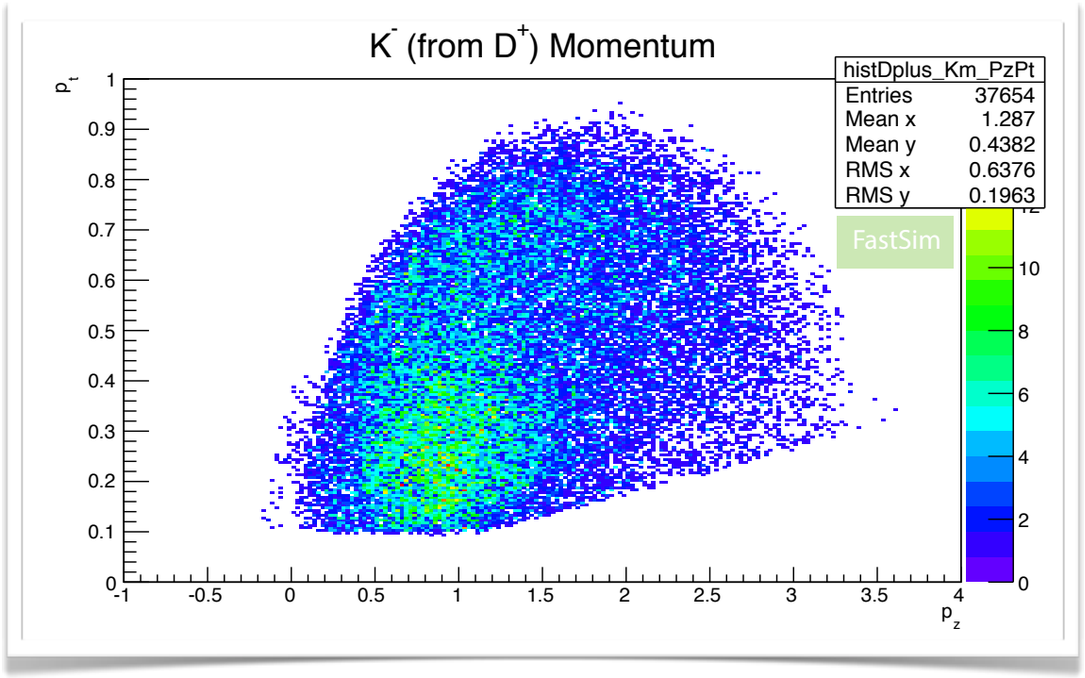
Momenta

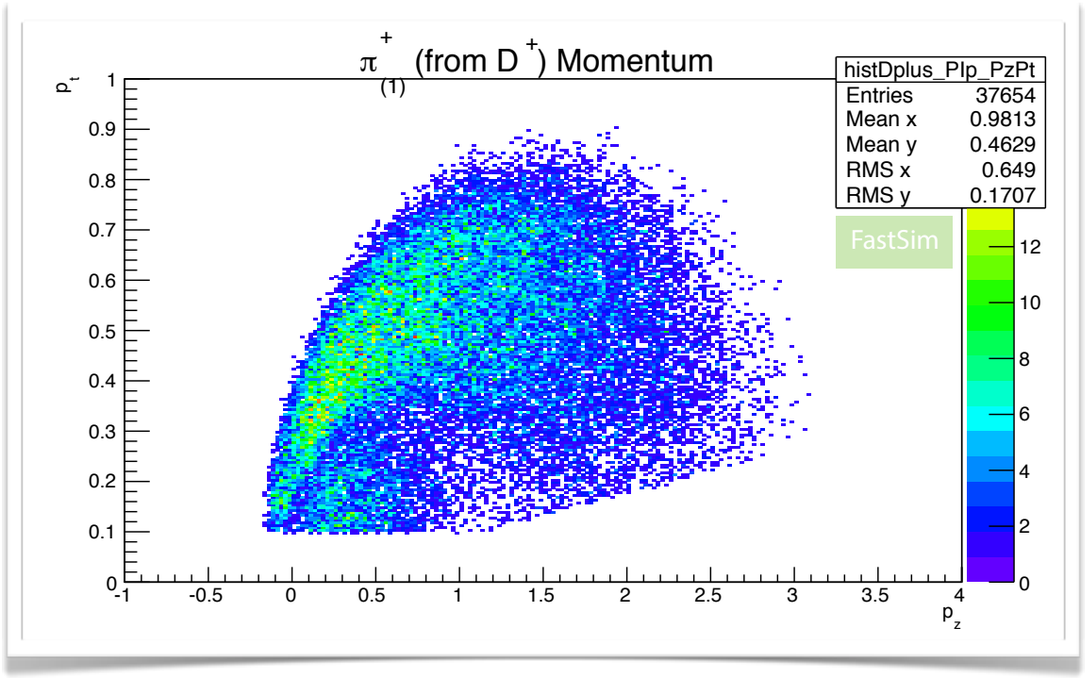


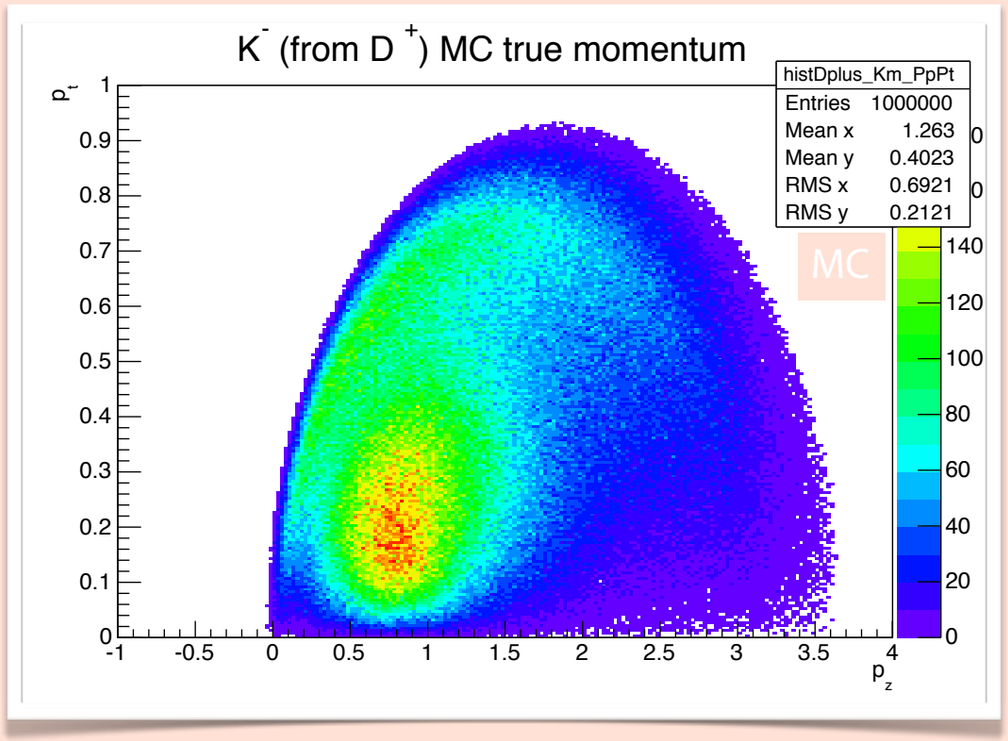


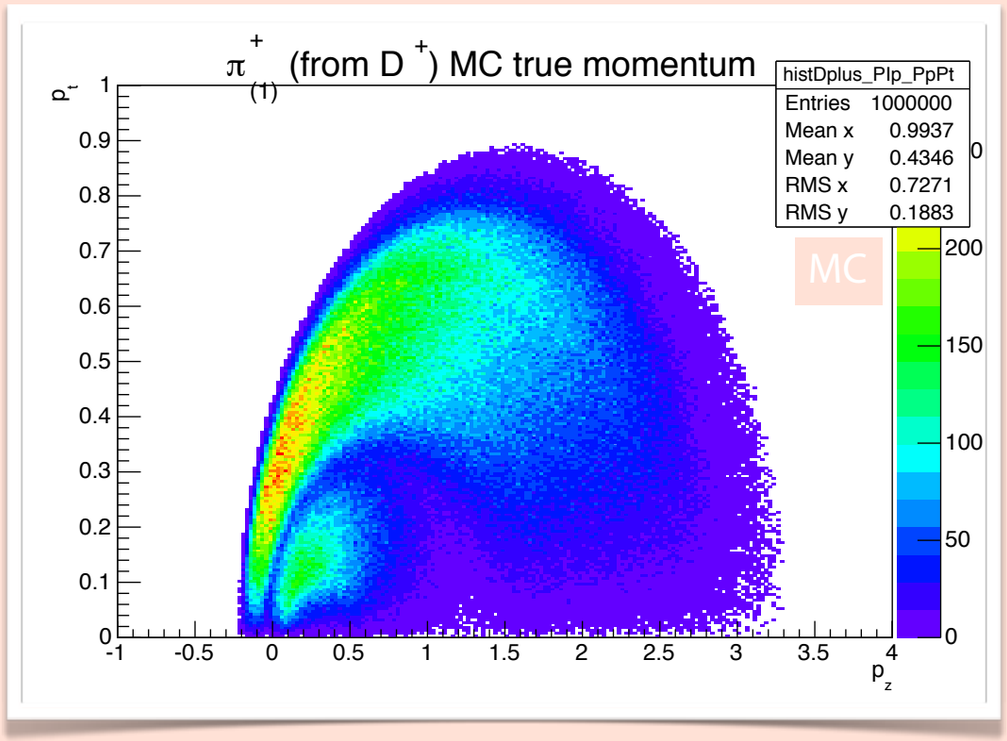
Mitglied der Helmholtz-Gemeinschaft

Momenta



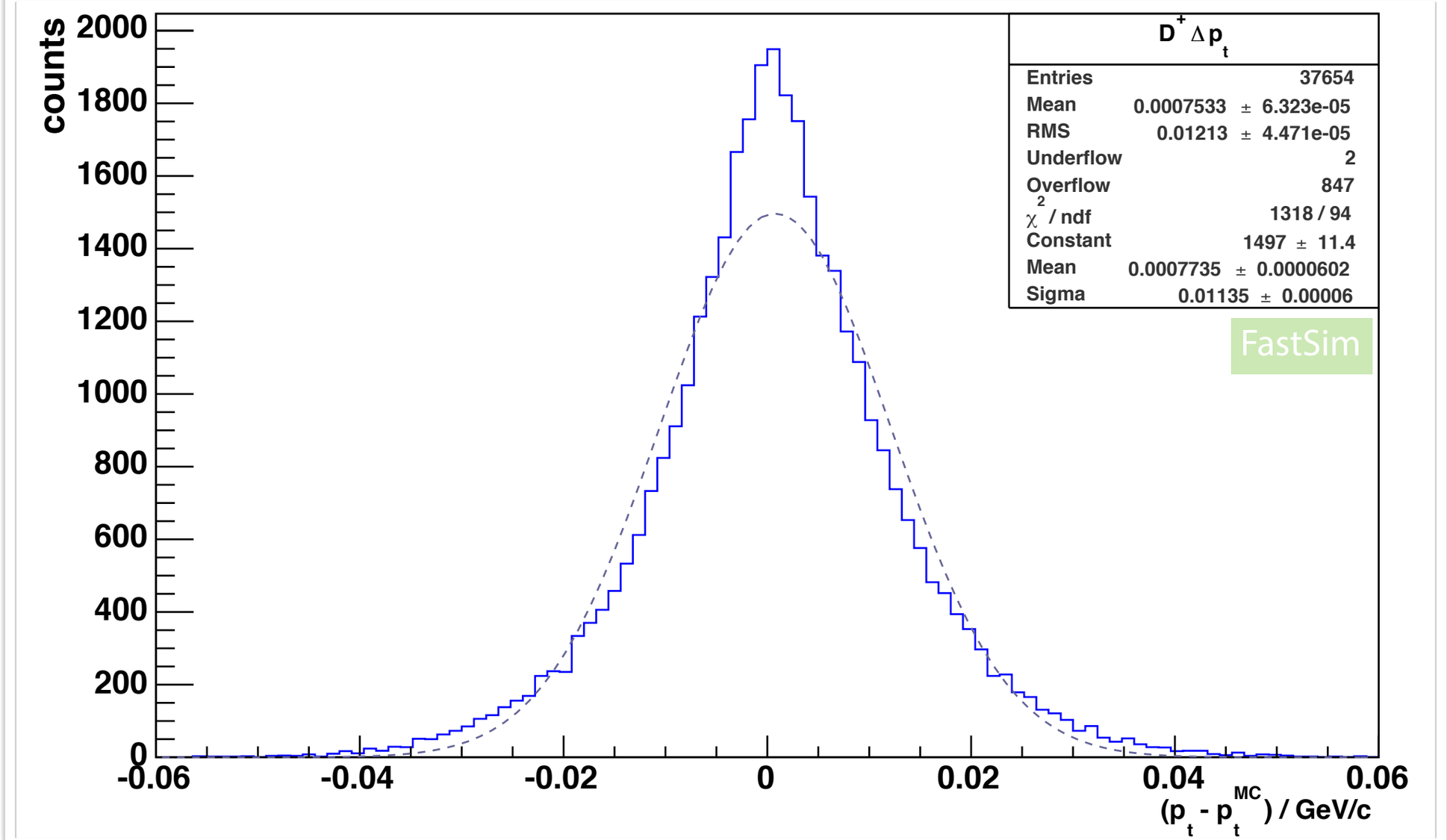






Mitglied der Helmholtz-Gemeinschaft

Resolutions – Δp_t



$\sigma = 11$ MeV/c

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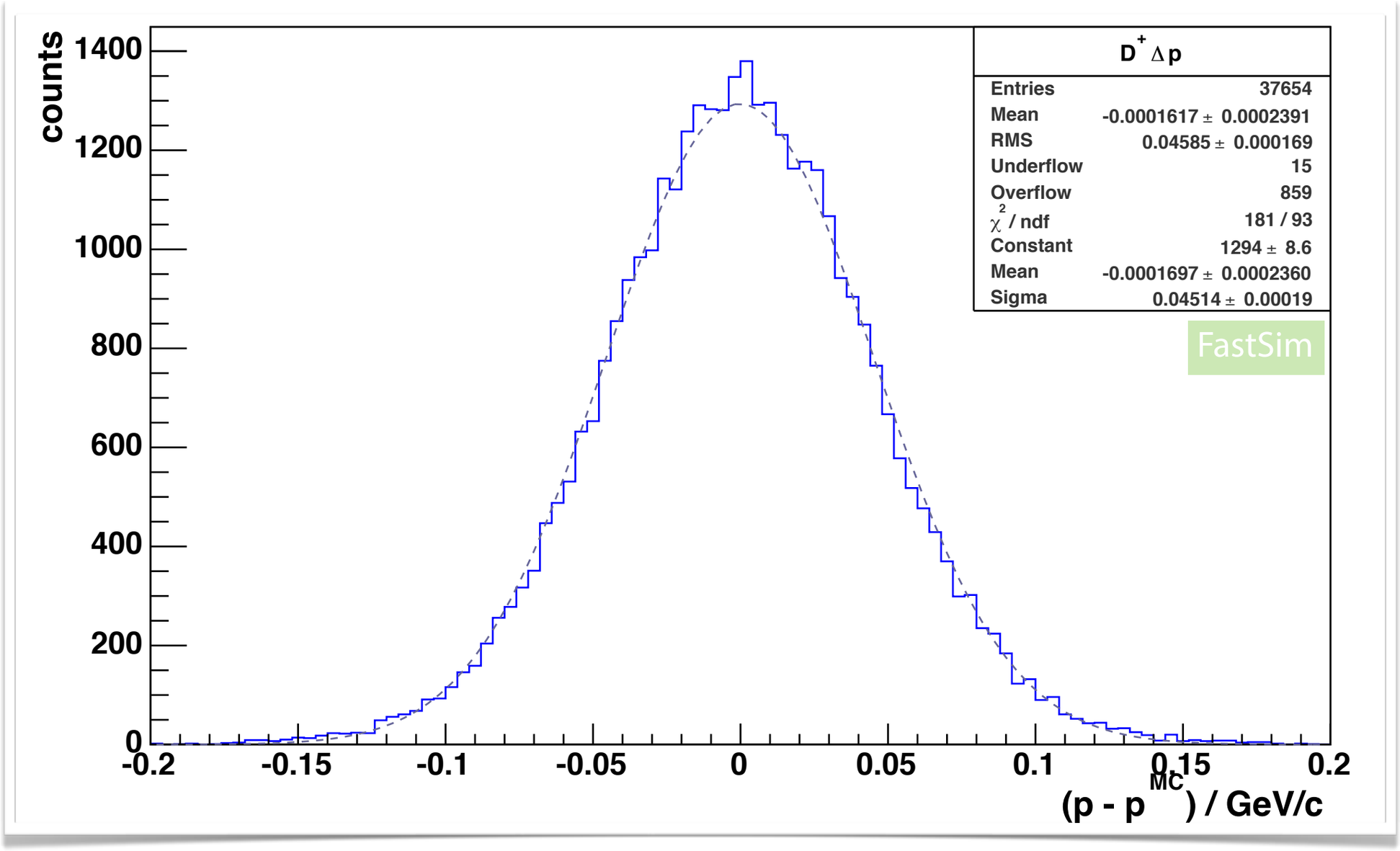
Resolutions – Δp



σ = 45 MeV/c

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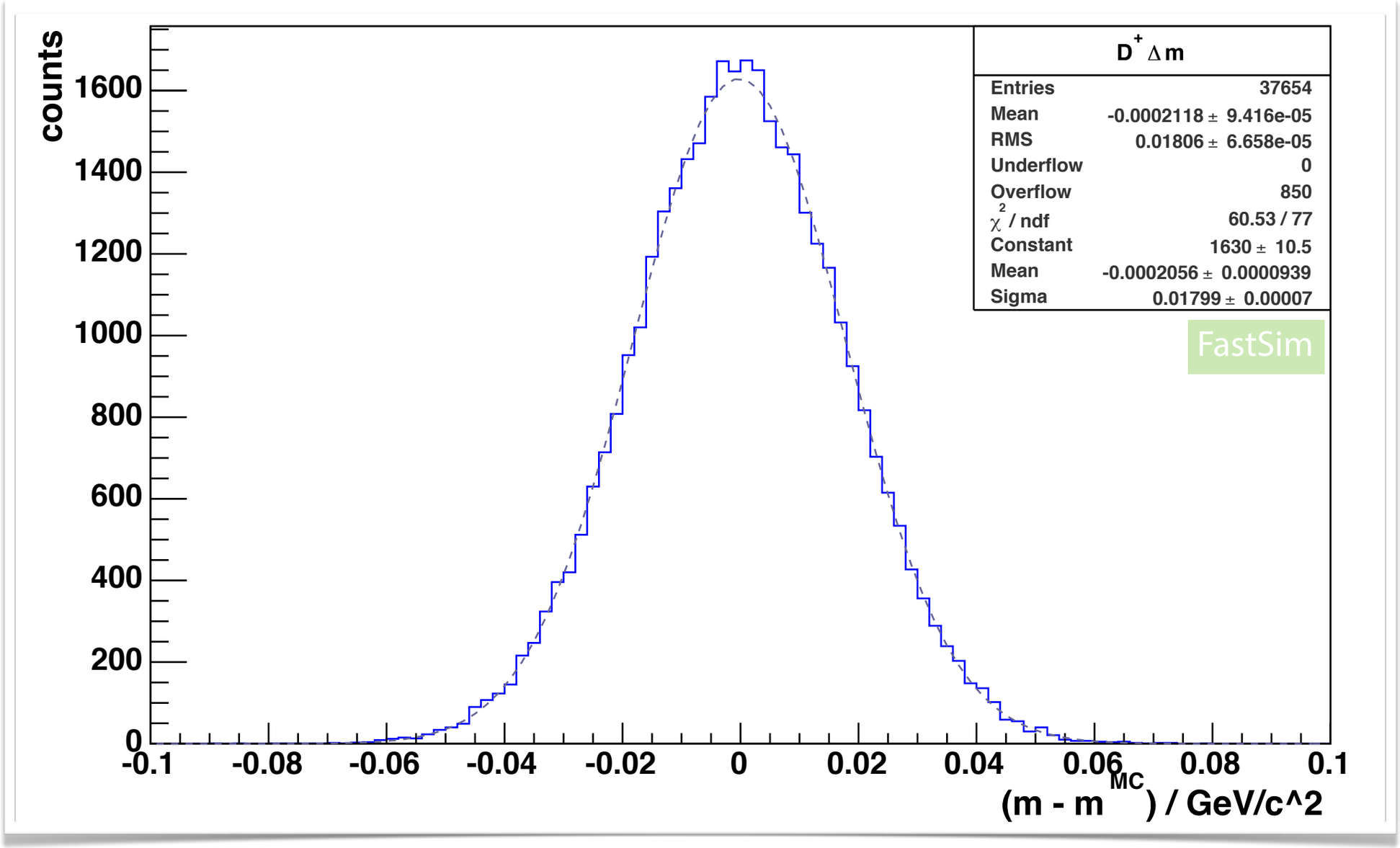
Resolutions – Δm



$\sigma = 18\ \mathrm{MeV/c^2}$

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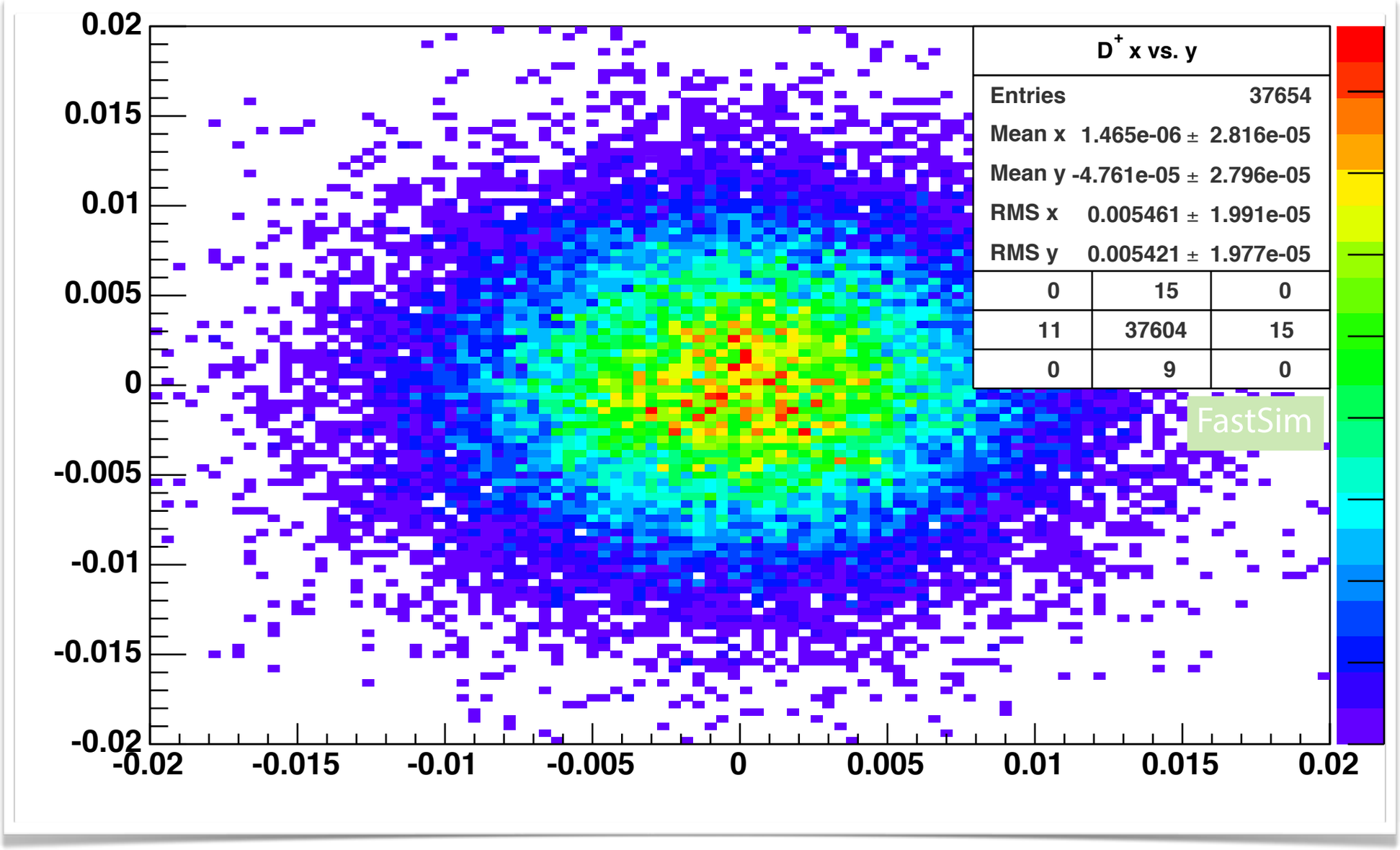
Vertex Position – x vs. y



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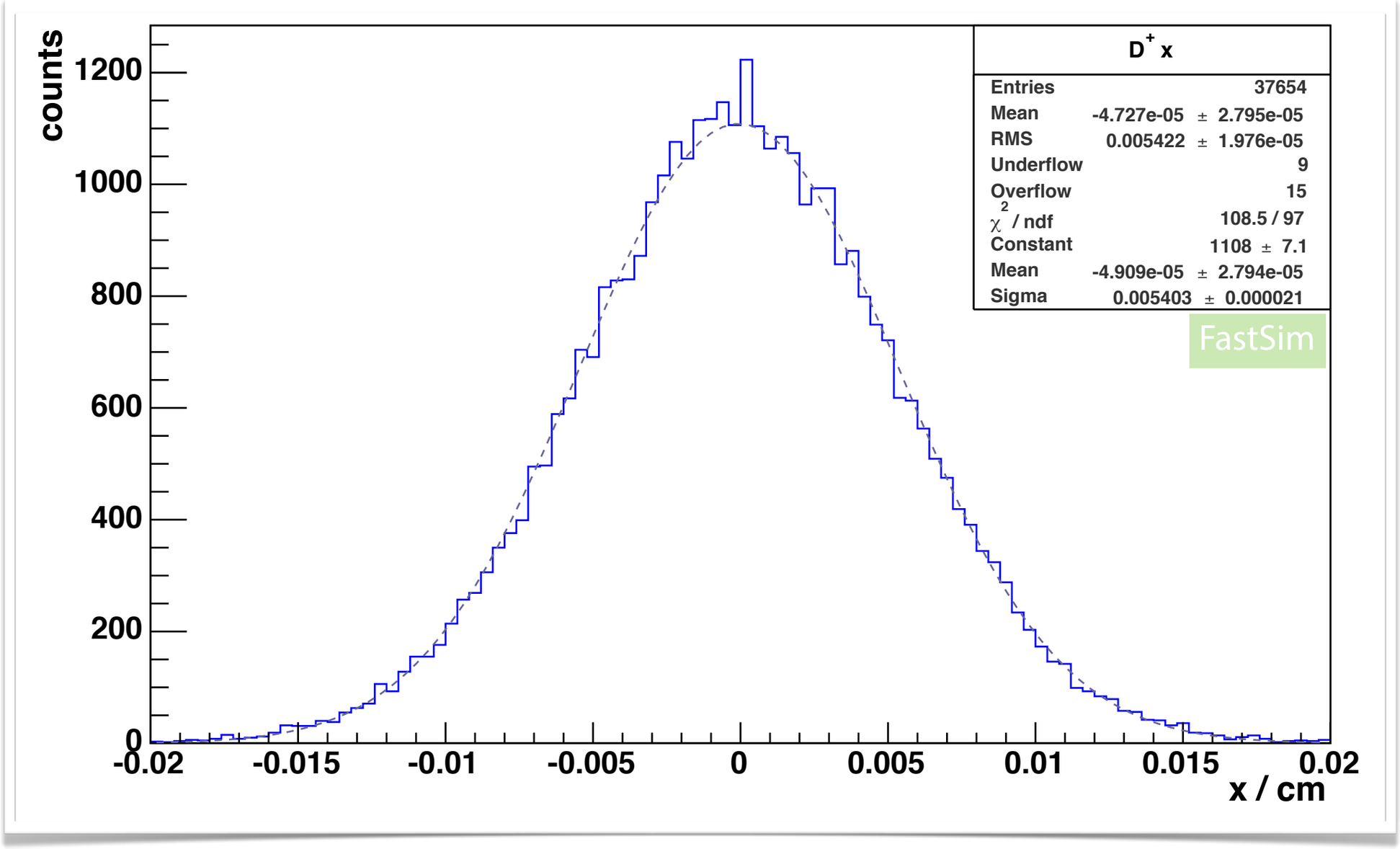
Vertex Position – x



$\sigma = 54\ \mu m$

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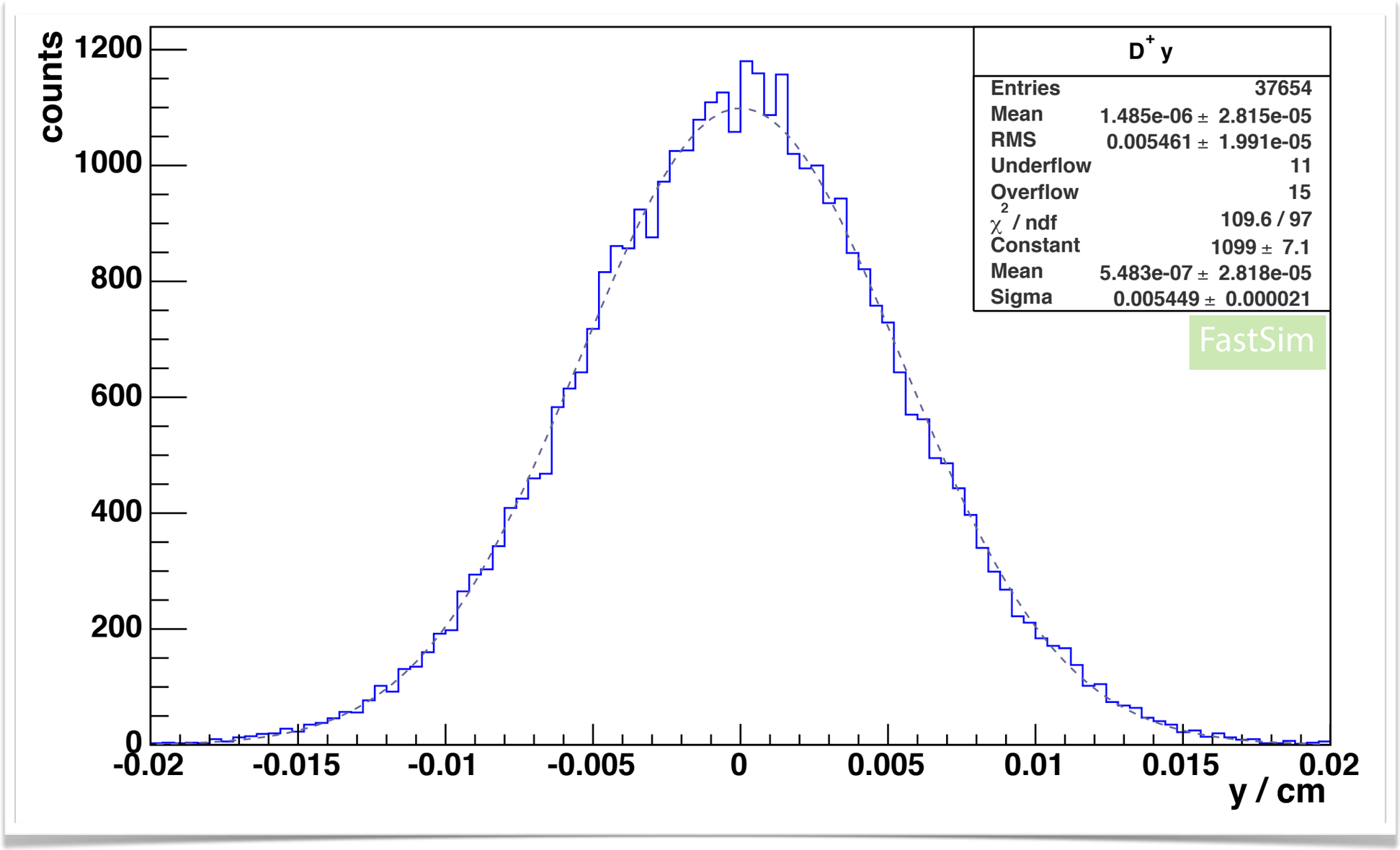
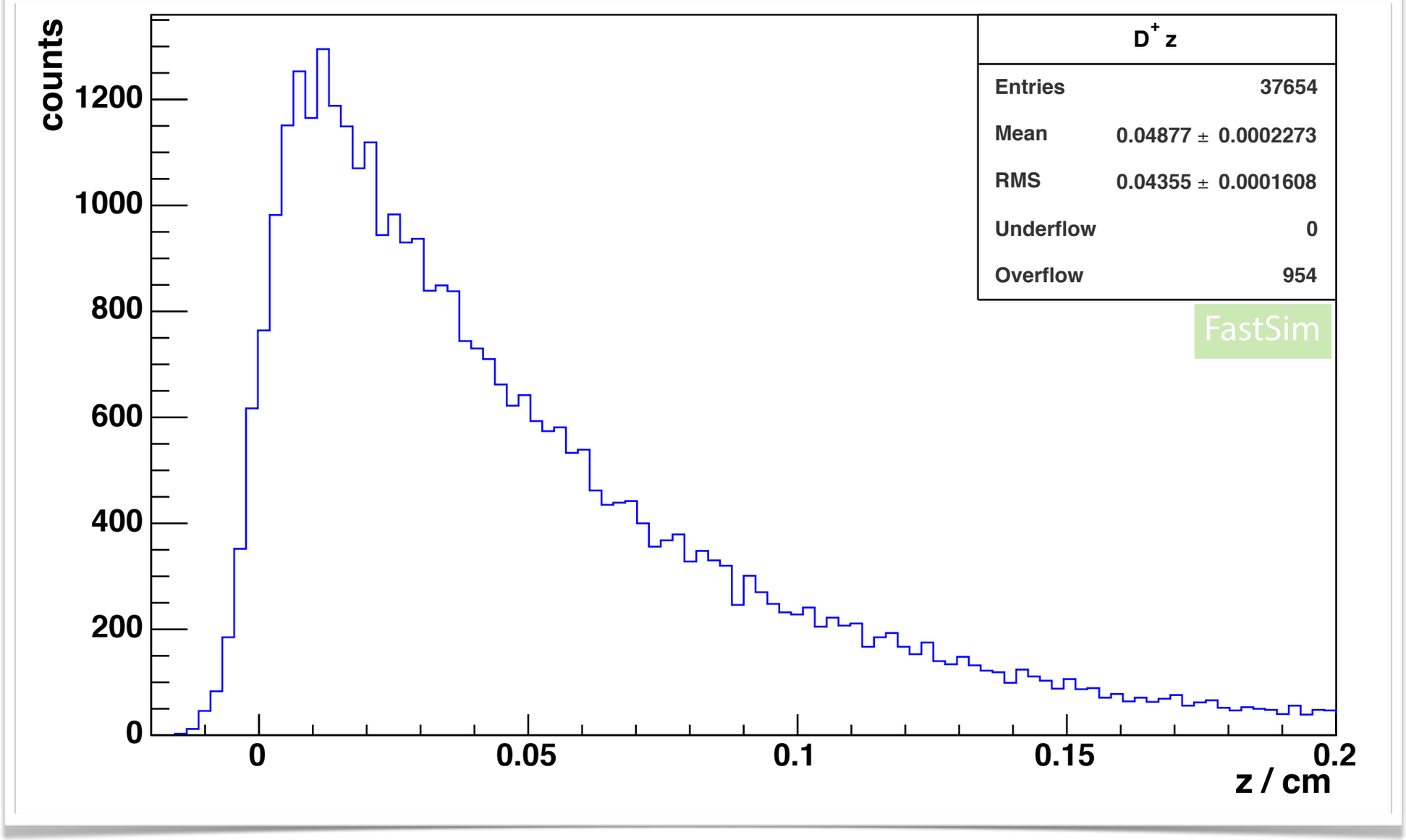
Vertex Position – y



$\sigma = 54\ \mu m$

Mitglied der Helmholtz-Gemeinschaft

Vertex Position – z



Mitglied der Helmholtz-Gemeinschaft

Outlook

- Higher statistics
- More properties
- FullSim comparisons

Mitglied der Helmholtz-Gemeinschaft

Outlook

- Higher statistics
- More properties
- FullSim comparisons

Thank you!

a.herten@fz-juelich.de

Mitglied der Helmholtz-Gemeinschaft

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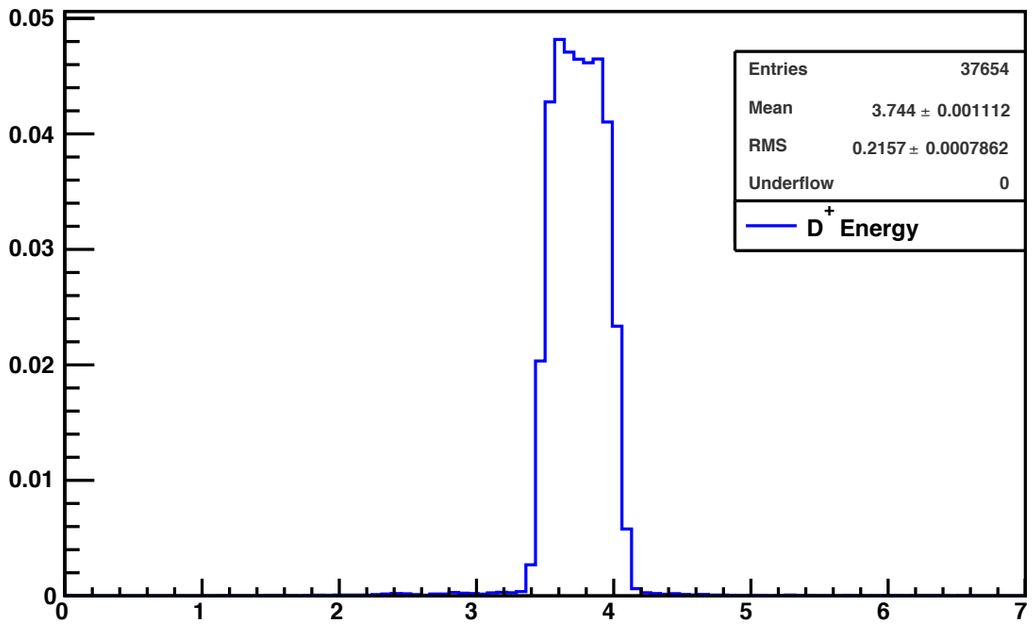
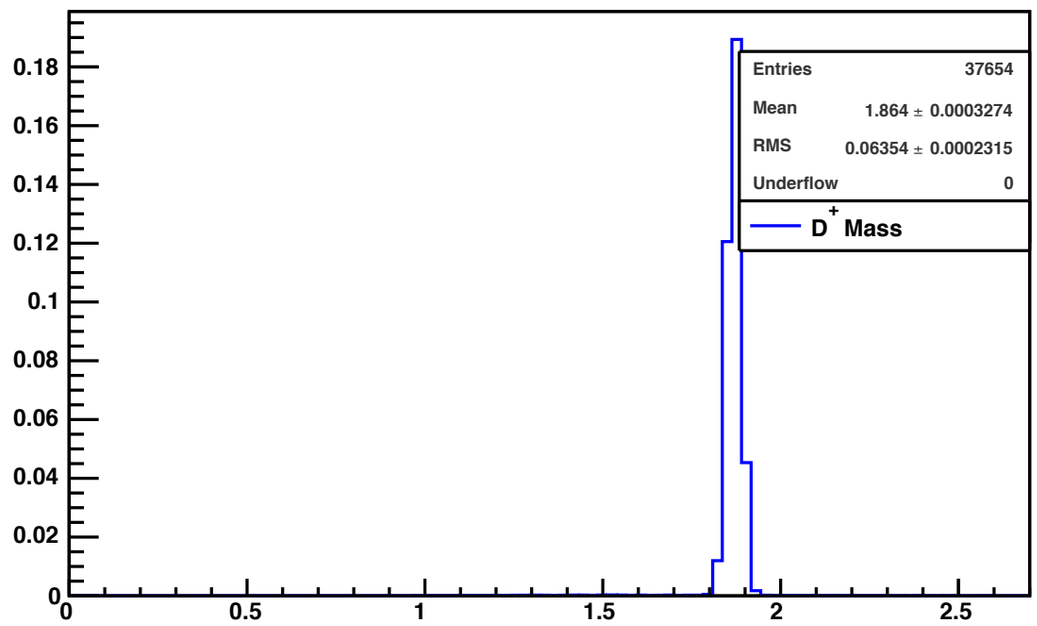
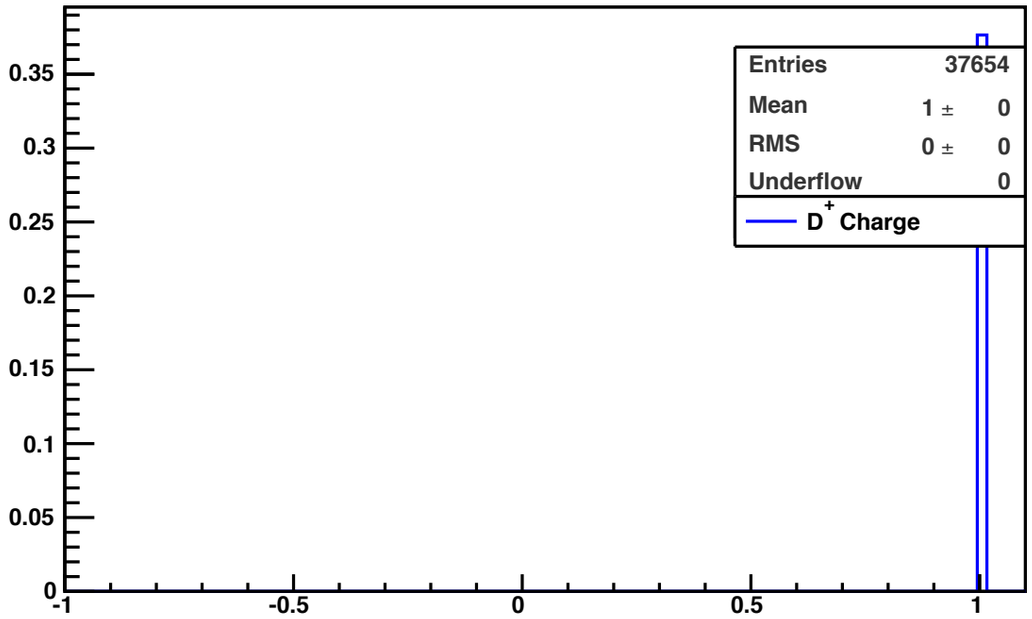
APPENDIX

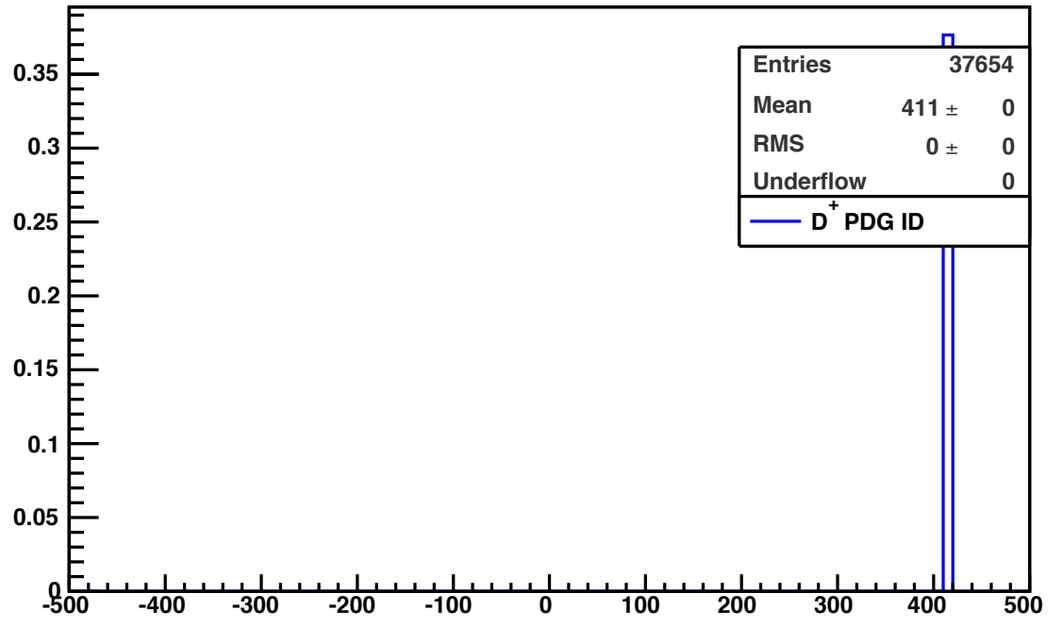
Mitglied der Helmholtz-Gemeinschaft

Properties of $D^{\pm}$



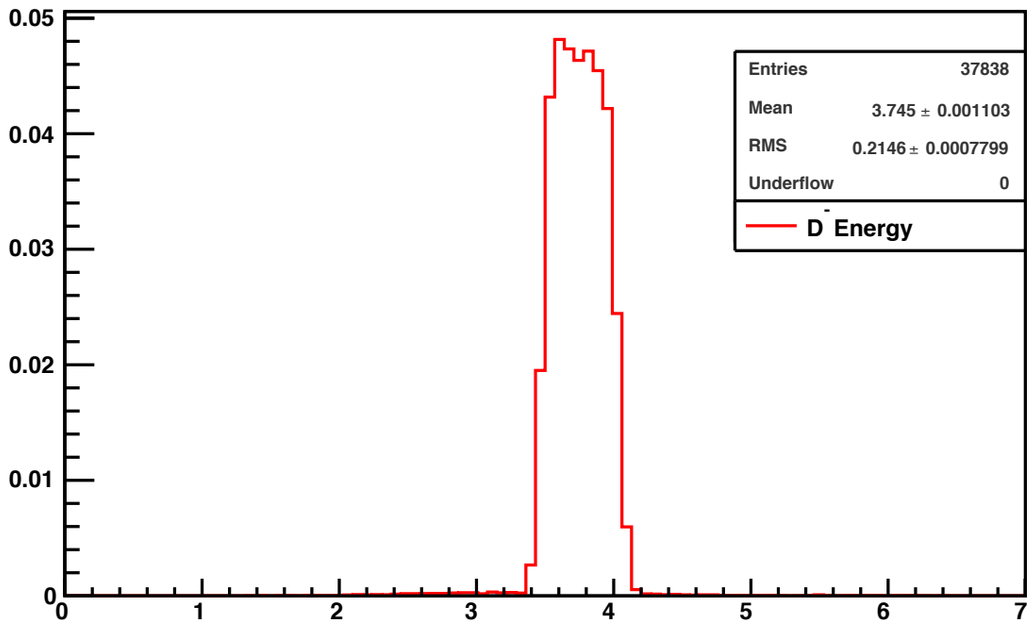


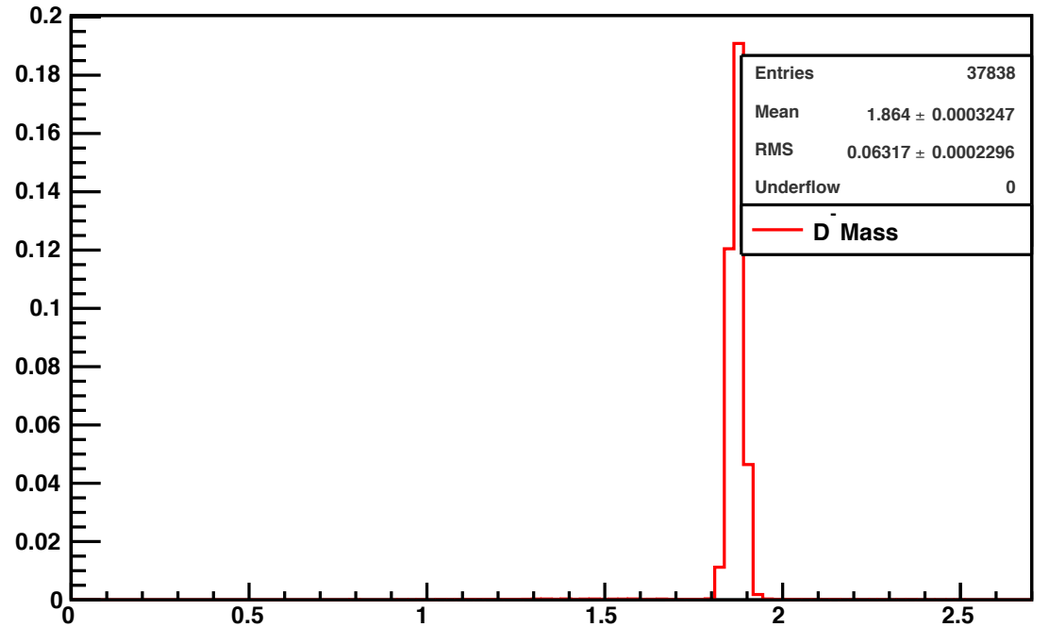


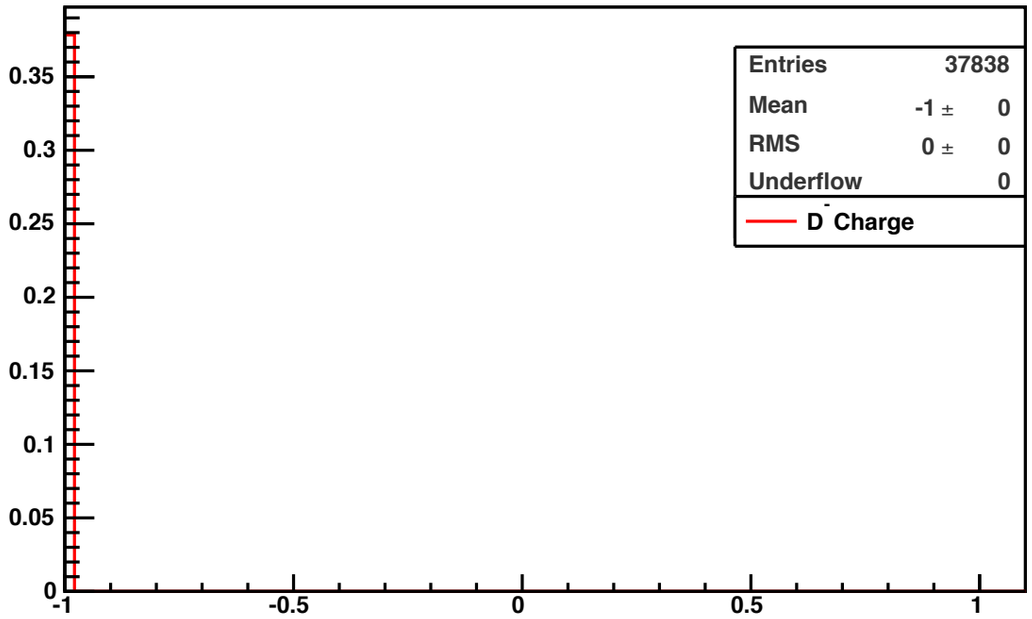


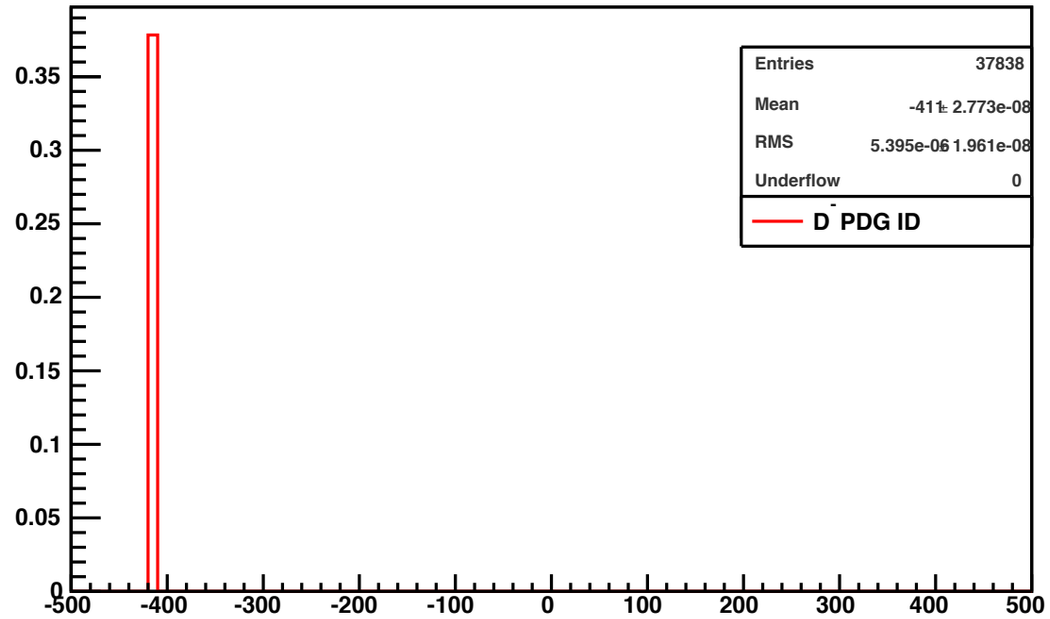
Mitglied der Helmholtz-Gemeinschaft

Properties of $D^{\pm}$



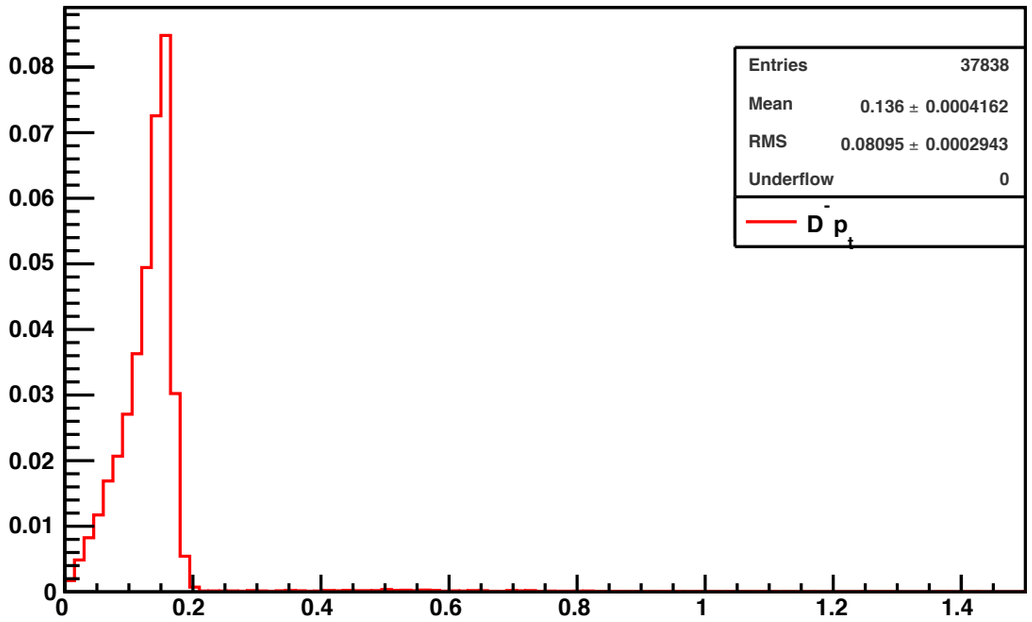


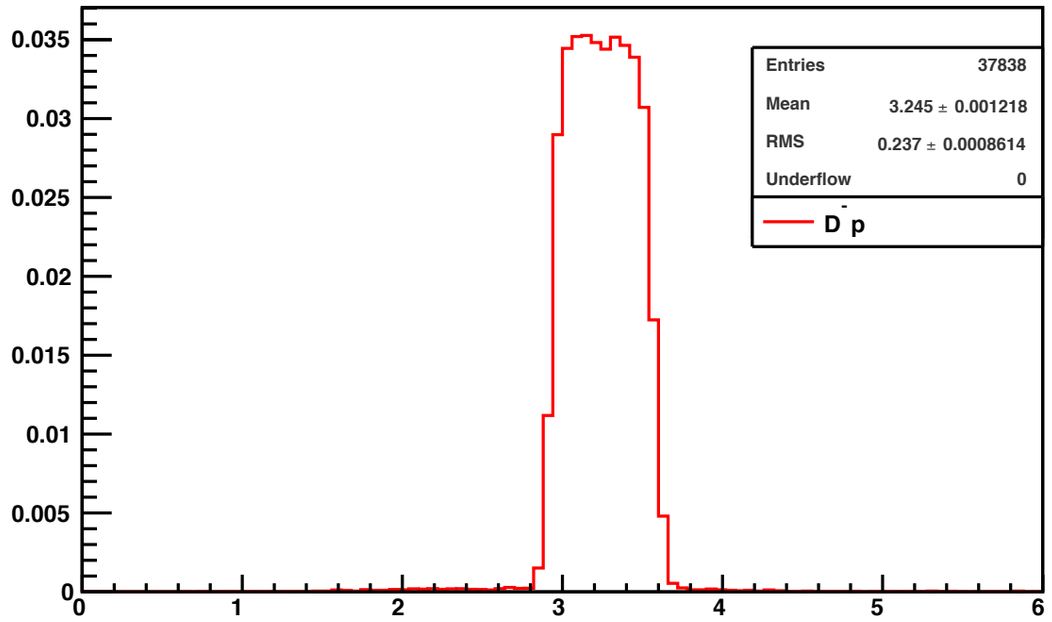


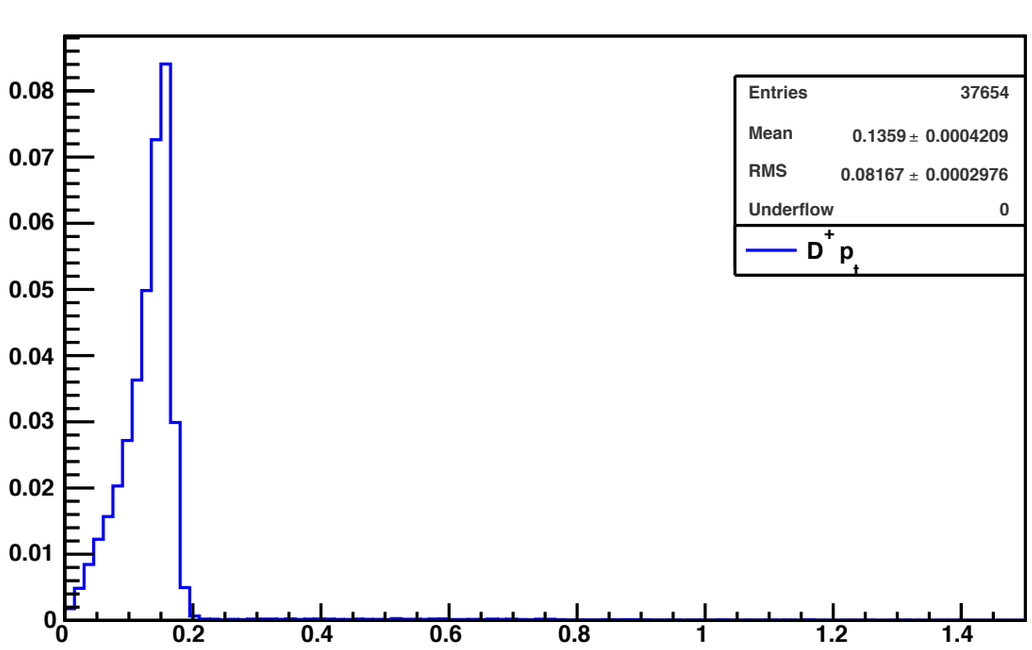


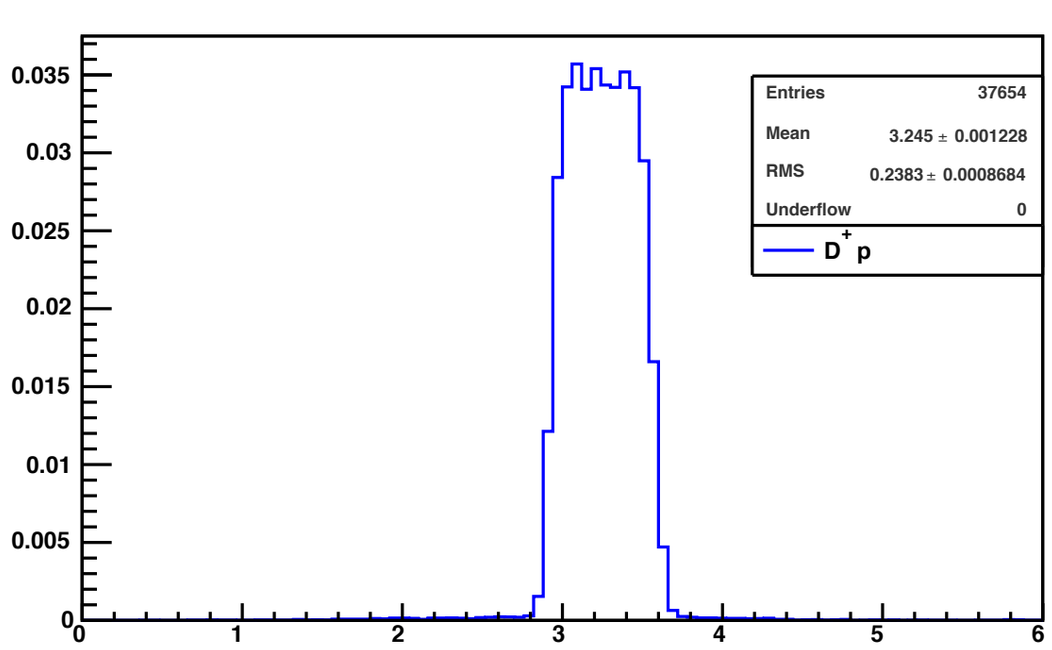
Mitglied der Helmholtz-Gemeinschaft

Properties of $D^{\pm}$



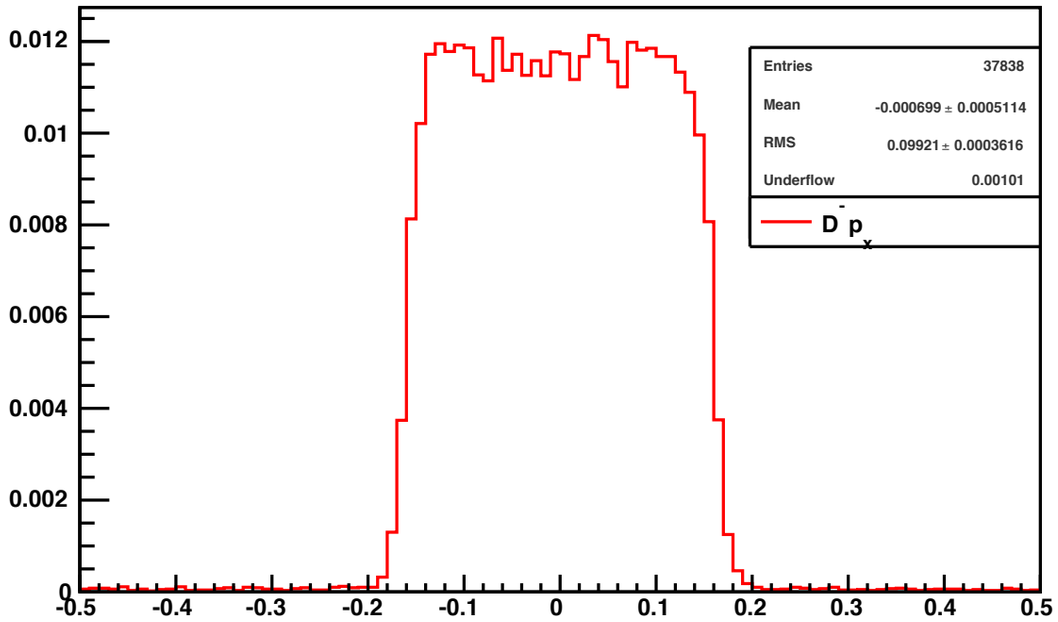


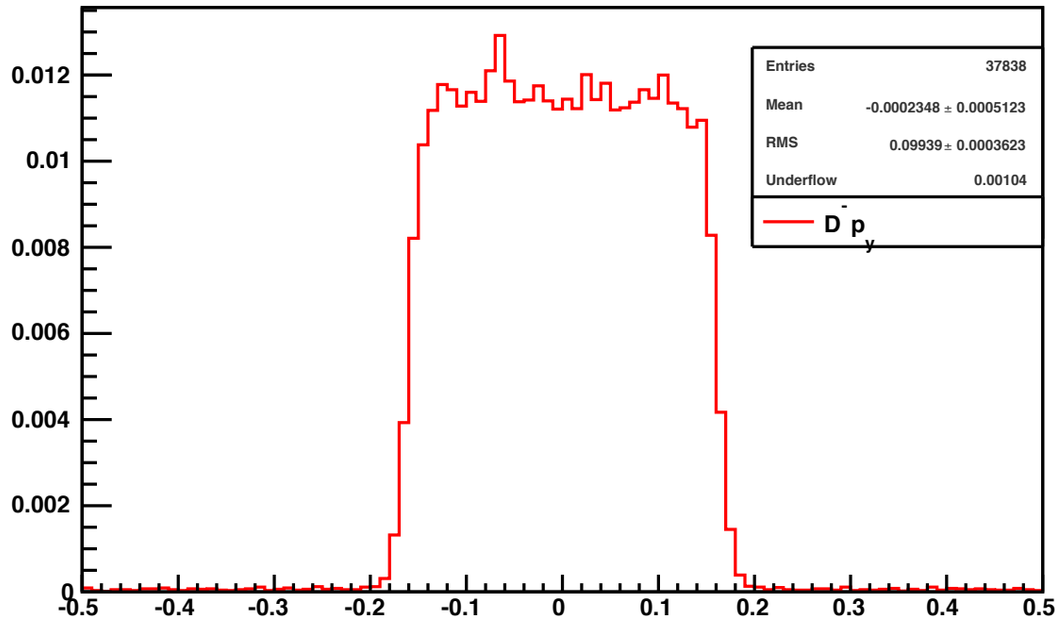


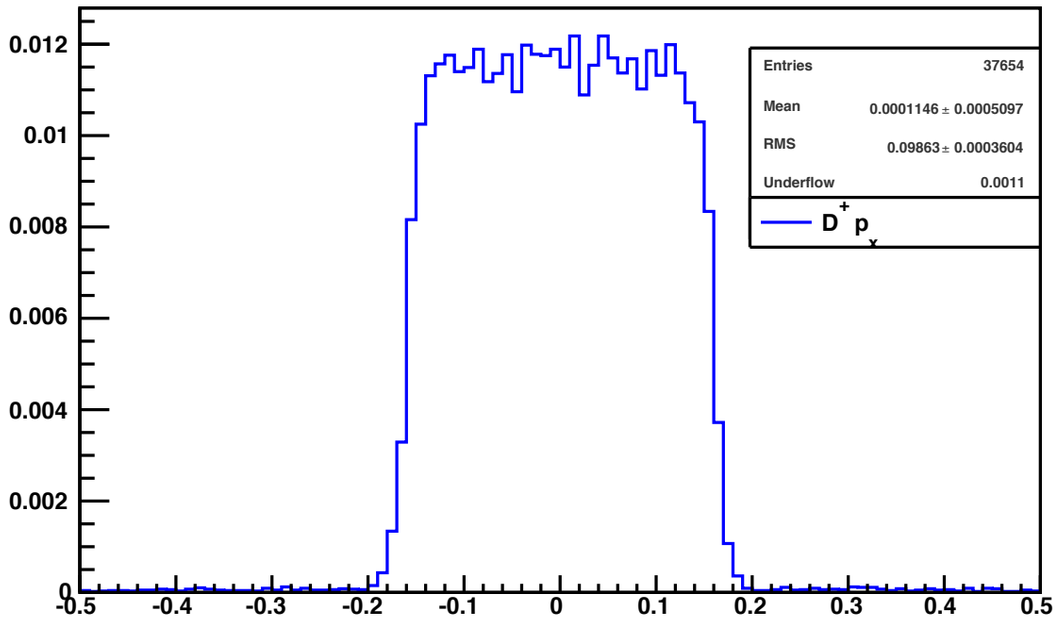


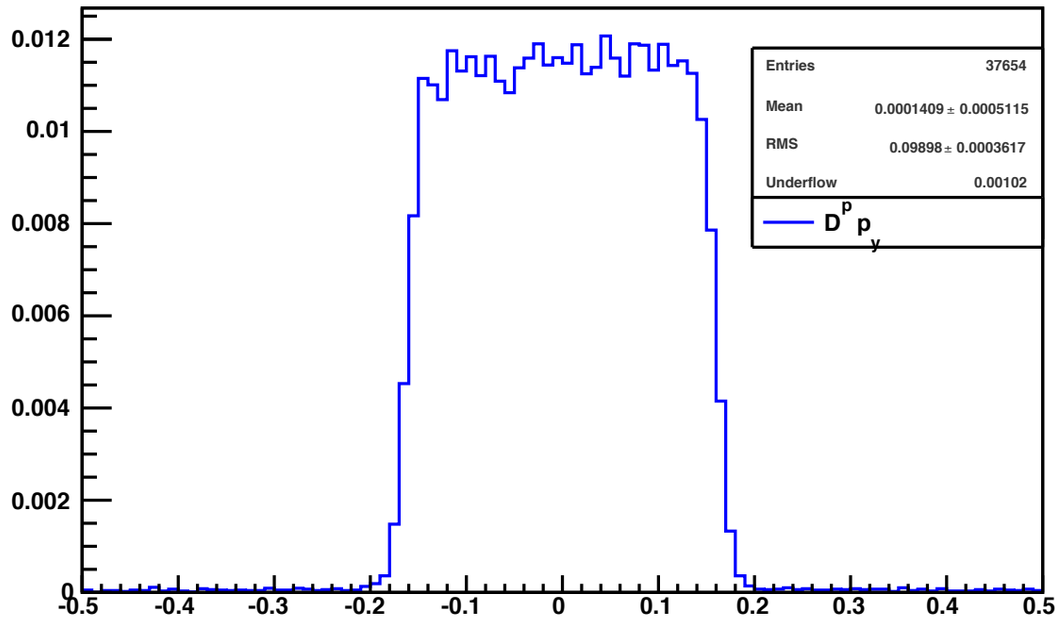
Mitglied der Helmholtz-Gemeinschaft

Properties of $D^{\pm}$









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