

# Energy Resolution of Runge-Kutta Reconstruction of Padded Microscopically Simulated Tracks

First Successful Attempt

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# Outline

- 1 Grid-like track simulation
- 2 Direction independent resolution
- 3 Direction dependent resolution
- 4 All track parameters dependence
- 5 2D cuts average bias
- 6 2D cuts average error



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# Grid-like track simulation

- We use Garfield++ for track simulation
  - Primary relativistic particle simulated using Heed program [1]
  - Secondary ionization electrons simulated using microscopic tracking (uses equation of motion)
- Microscopic tracks were simulated on MetaCentrum to test the Runge-Kutta padded reconstruction
  - 2000 jobs, each 20-160 hours runtime, 20 GB RAM allocated
  - 9702 tracks were simulated (electron vs positron, 21 theta angles, 21 phi angles, 11 energies 3-13 MeV)
  - Reconstruction lasts around 40 minutes



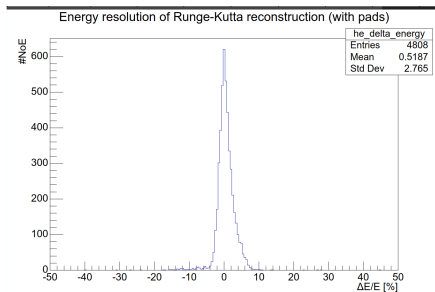
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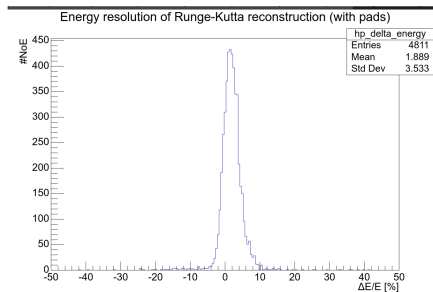


# Energy resolution for all tracks

## Electrons

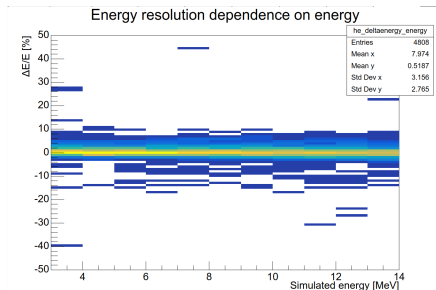


## Positrons

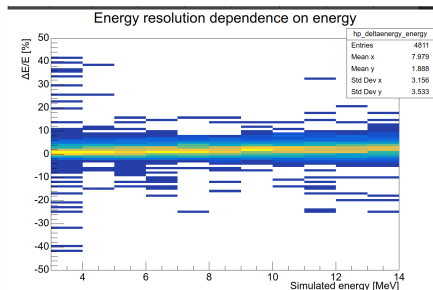


# Energy resolution dependence on simulated energy

## Electrons



## Positrons



# Outline

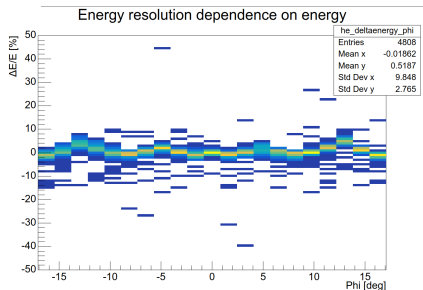
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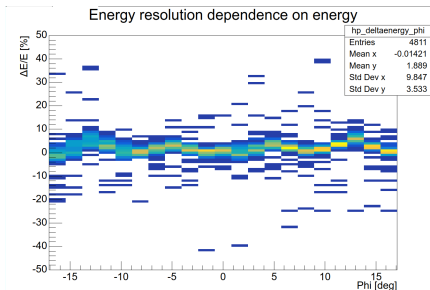


# Energy resolution dependence on phi

## Electrons

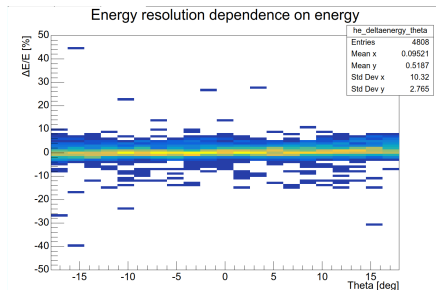


## Positrons

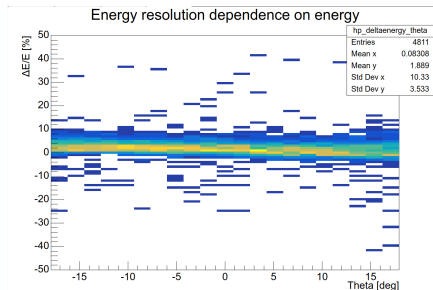


# Energy resolution dependence on theta

## Electrons



## Positrons



# Outline

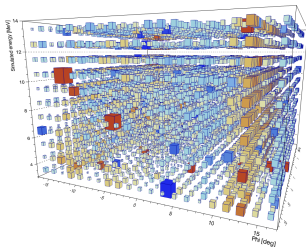
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# All track parameters (phi, theta and simulated energy)

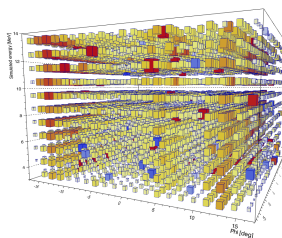
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

Energy resolution ( $\Delta E/E$ )



# Outline

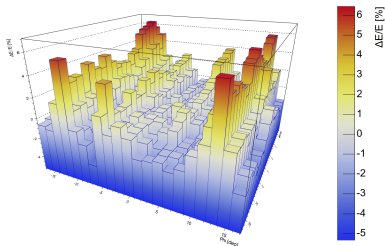
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# Theta-Phi cut average bias

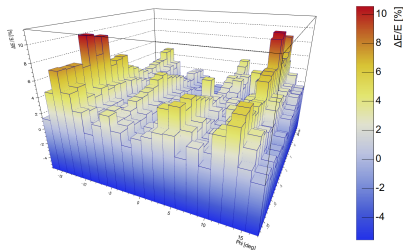
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

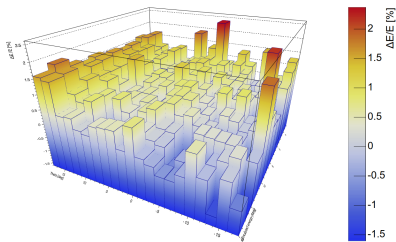
Energy resolution ( $\Delta E/E$ )



# Theta-Energy cut average bias

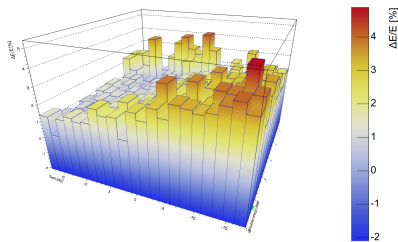
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

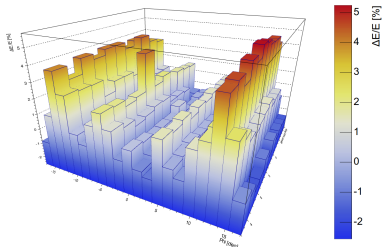
Energy resolution ( $\Delta E/E$ )



# Phi-Energy cut average bias

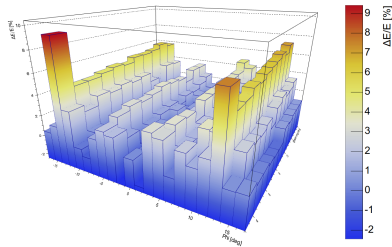
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

Energy resolution ( $\Delta E/E$ )





# Outline

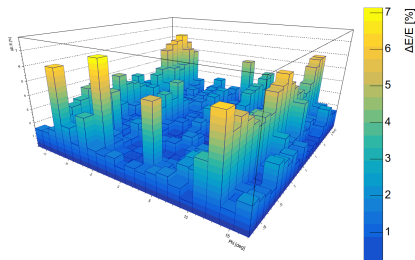
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# Theta-Phi cut average error

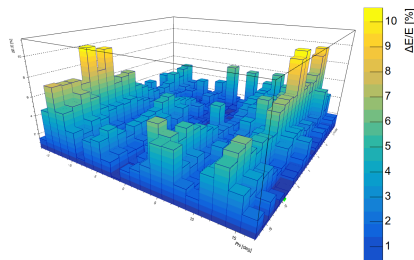
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

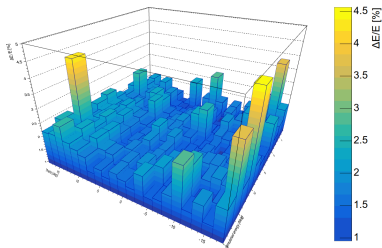
Energy resolution ( $\Delta E/E$ )



# Theta-Energy cut average error

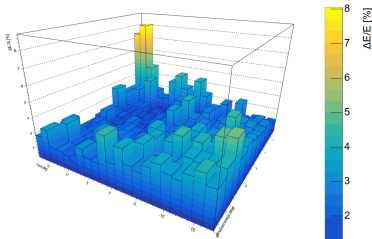
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

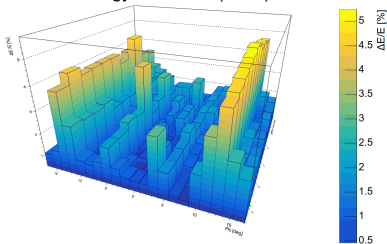
Energy resolution ( $\Delta E/E$ )



# Phi-Energy cut average error

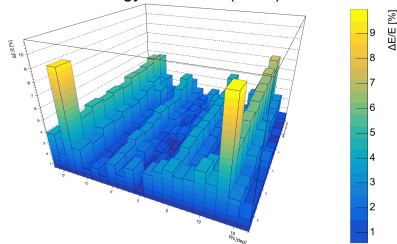
## Electrons

Energy resolution ( $\Delta E/E$ )



## Positrons

Energy resolution ( $\Delta E/E$ )



Thank you for your attention.



[1] I. B. Smirnov.

Modeling of ionization produced by fast charged particles in gases.  
*Nucl. Instr. Meth. A*, 554:474–493, 2005.

