Results from CERES

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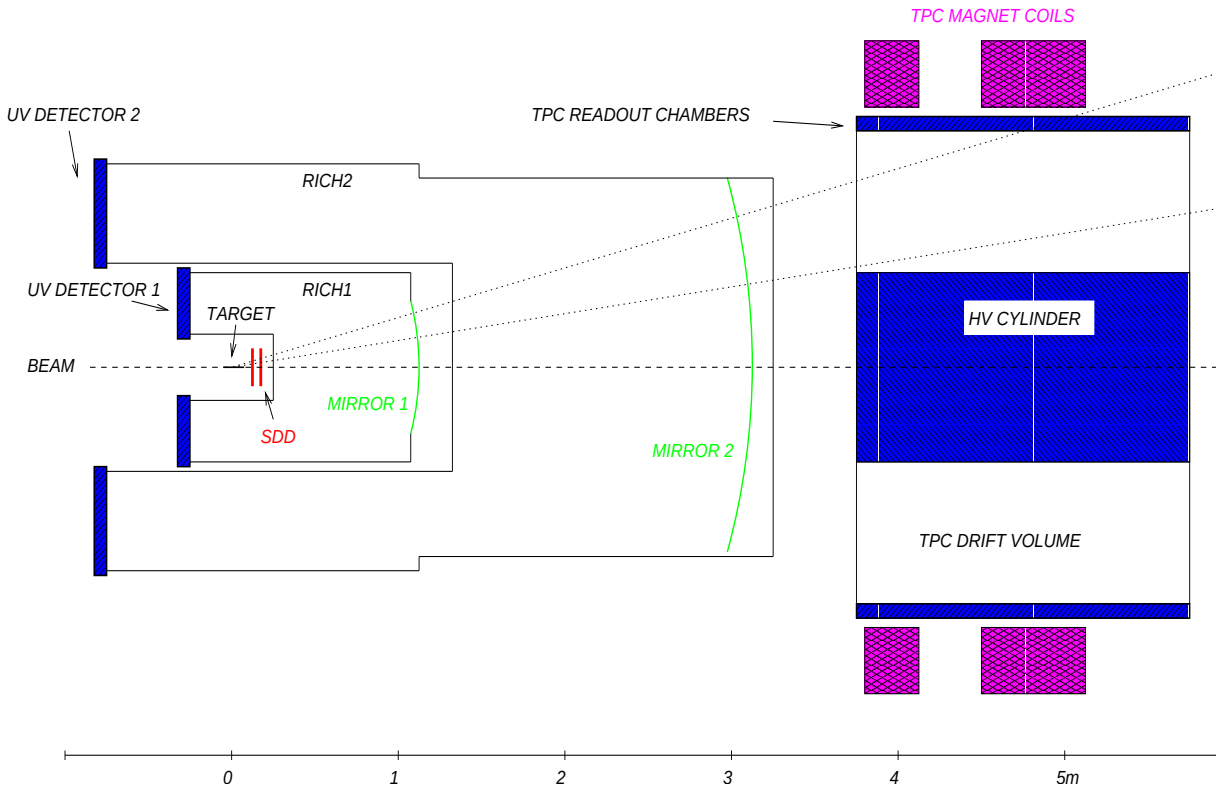
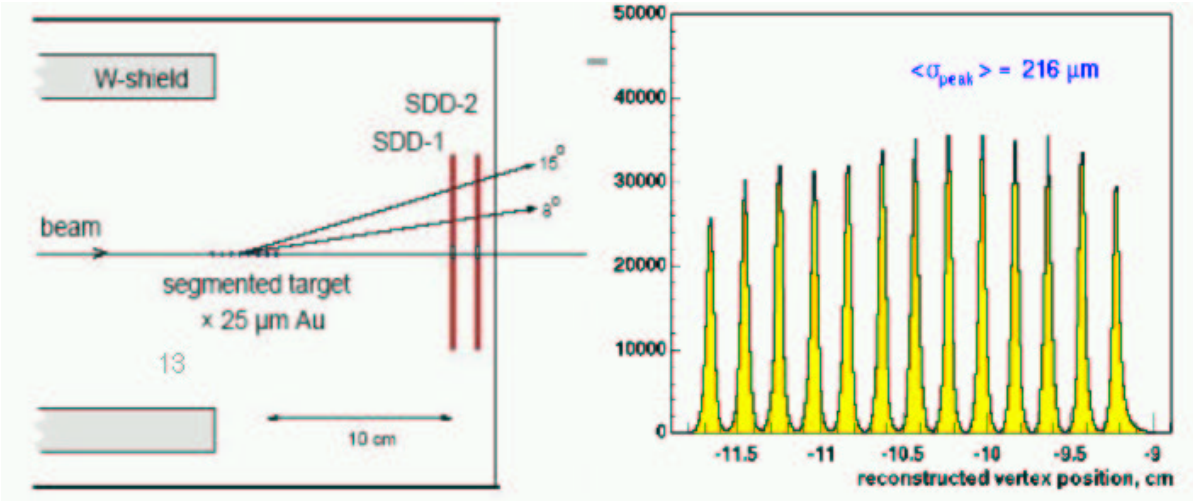
- CERES detector
- Particle identification
- Dilepton analysis
- Efficiency correction
- Results

Setup



- CERES - Cherenkov Ring Electron Spectrometer
- designed and built for measurement of low-mass dielectrons
- target area: 2 SD drift detectors - vertex reconstruction
- RICH detectors: electron ID
- 1999: TPC upgrade - tracking, PID
- 2000: Pb-Au run at 158 AGeV, 30M events, $\sigma/\sigma_{geo} = 7\%$

Target area



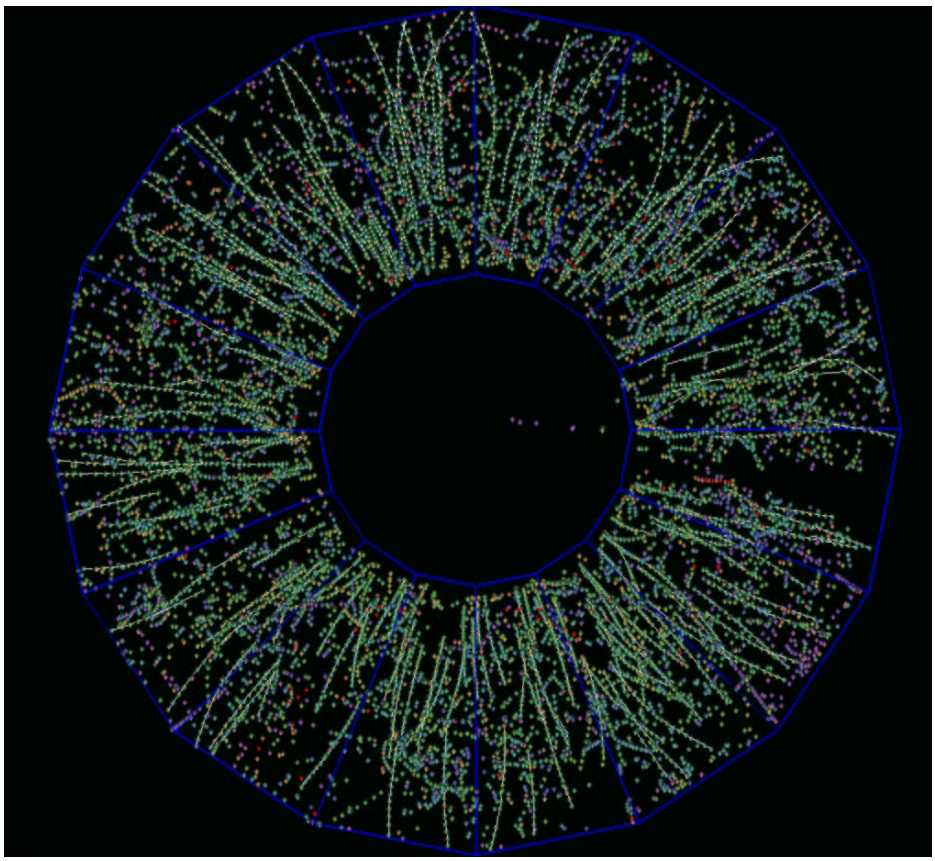
- segmented target: 13 Au disks of 25 μm thickness, 600 μm diameter

  $\longrightarrow$ minimize radiation length into acceptance

- 2 Silicon drift detectors:

  high resolution vertex reconstruction

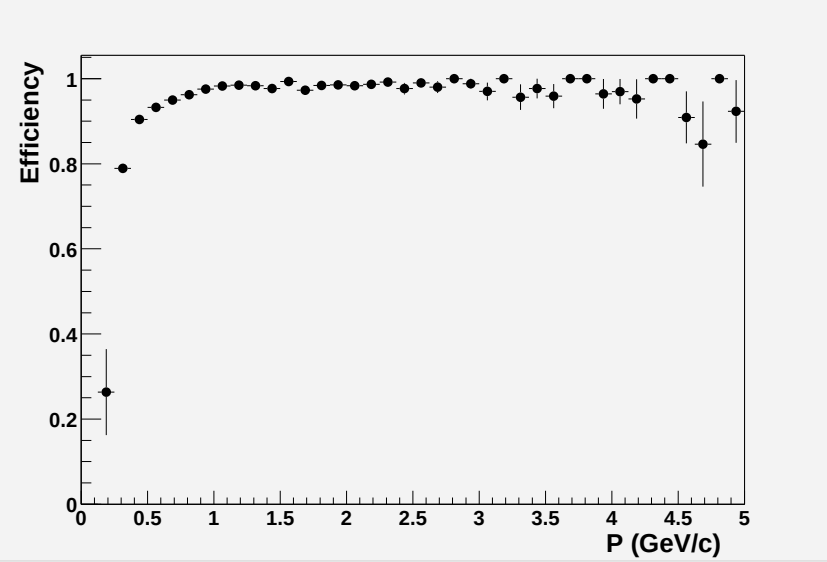
TPC



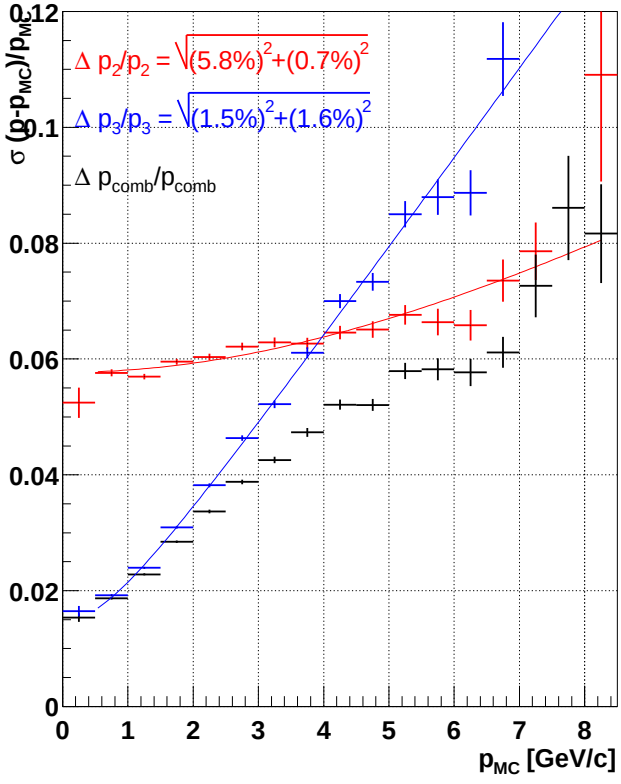
- tracking, momentum reconstruction
- B up to 0.5 T
- radial drift field
- precise treatment of ($\vec{E}$,$\vec{B}$), geometry,
  detailed understanding of gas properties mandatory

TPC performance

- tracking efficiency (MC):



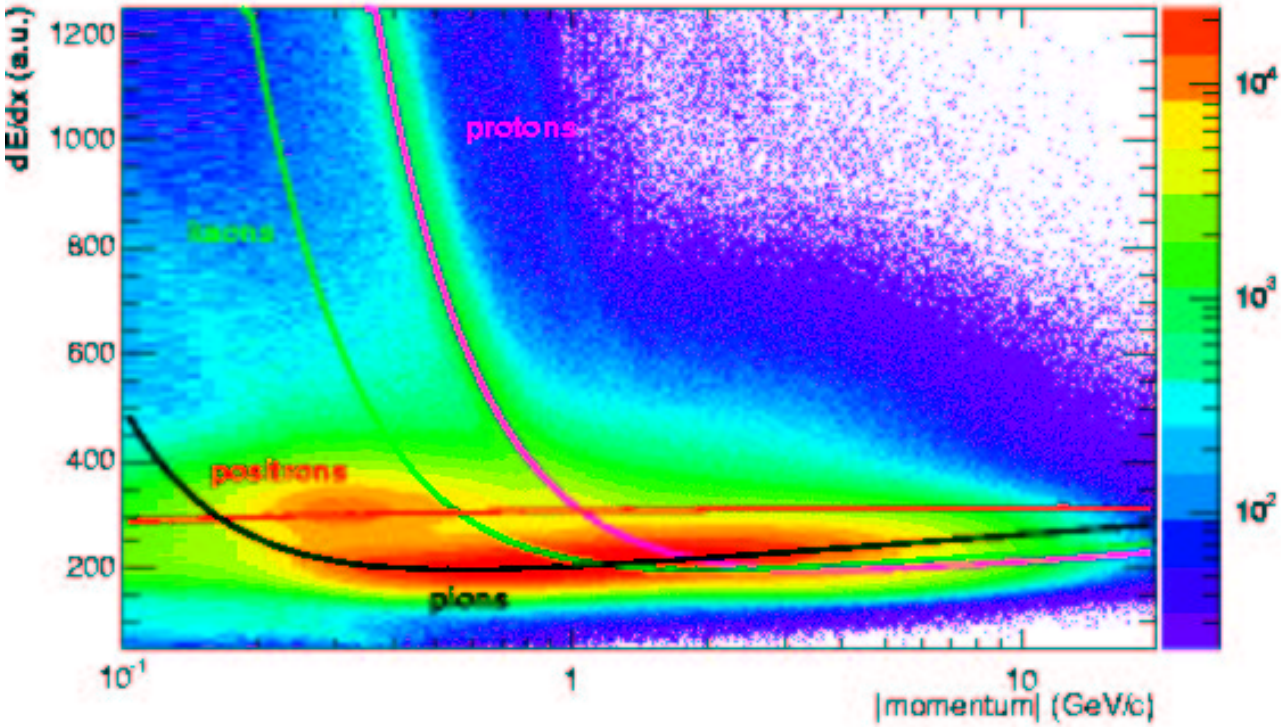
- momentum resolution (MC): $\Delta p/p \sim 2\% \oplus 1\% \cdot p/(GeV/c)$



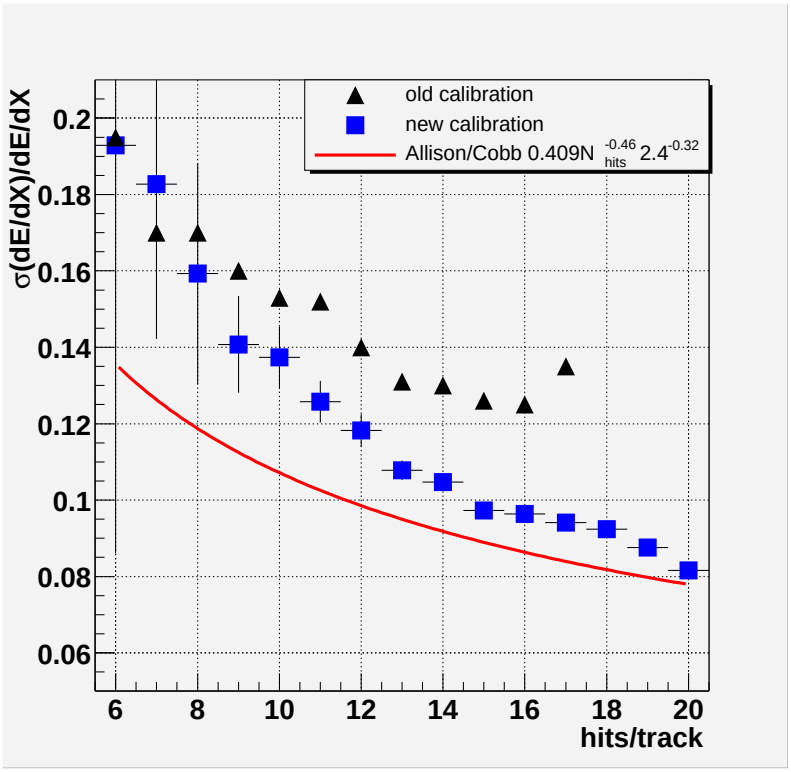
- mass resolution: $\Delta m/m \sim 4\%$ at the ϕ

TPC PID

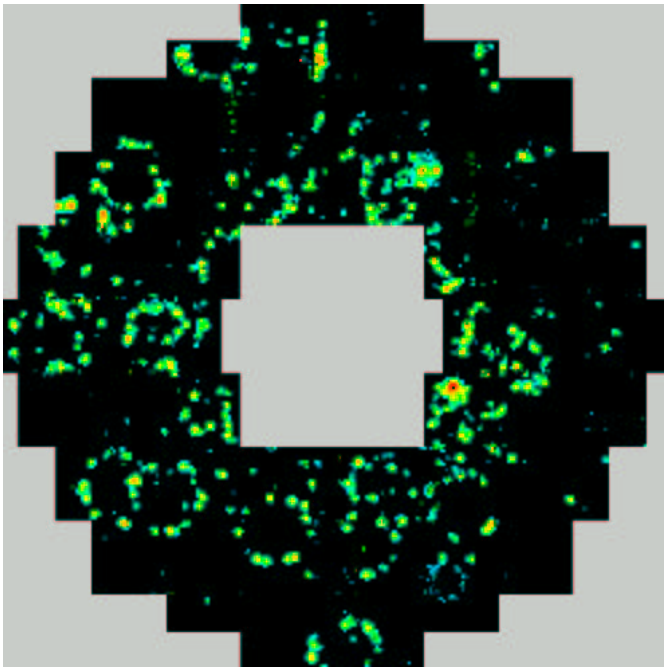
- particle identification via specific ionisation (dE/dx)
- dE/dx vs momentum, positive tracks:

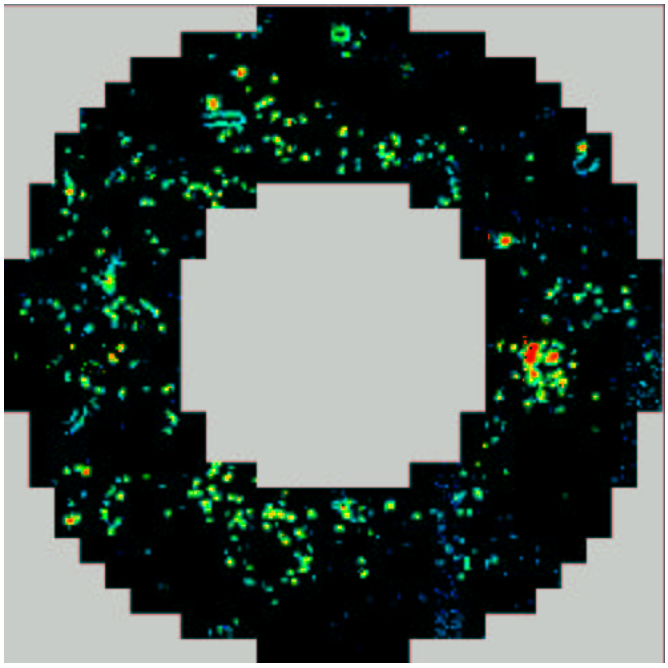


- dE/dx resolution better than 10%



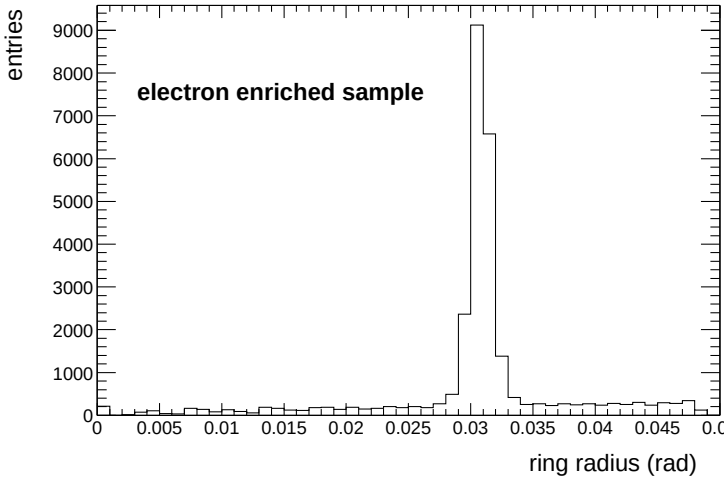
RICH electron identification

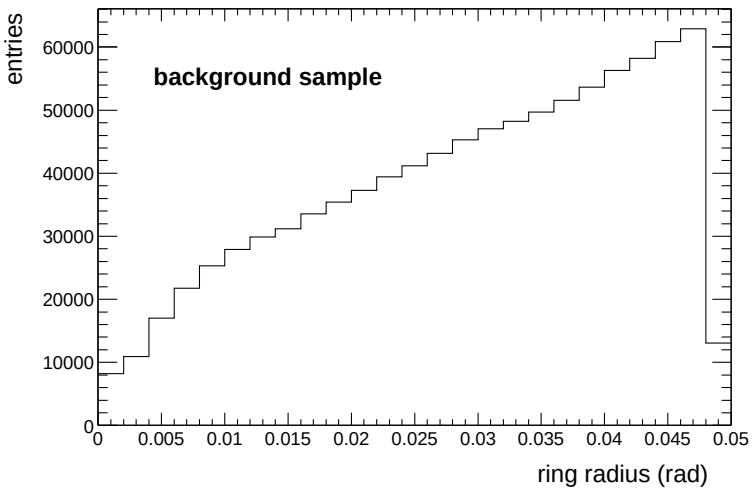




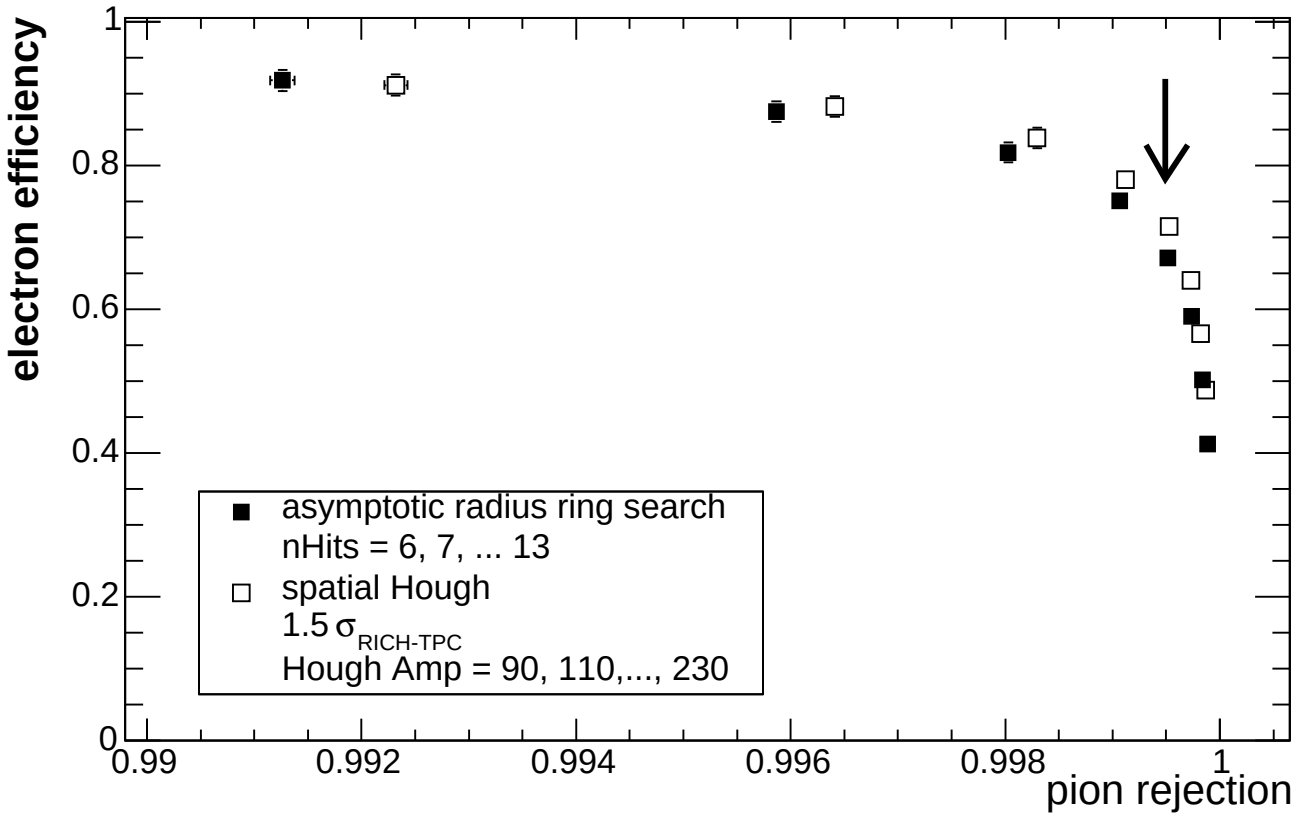
- electron ID = ring reconstruction
- use PID in TPC to prepare reference samples of
  - electrons (i.e. electron dominated)
  - non radiating pions

→ distributions of reconstructed radius:





RICH electron efficiency and pion rejection



- determined from data
- electron efficiency: fraction of accepted electrons
- pion efficiency: fraction of pions misidentified as electrons
- pion rejection = 1 - pion efficiency
- electron efficiency: 70%
- pion suppression factor: $2 \cdot 10^3$

dilepton analysis: experimental procedure

main sources for electrons:

- Dalitz decays, mainly $\pi_0 \longrightarrow e^+e^-\gamma$
- $\mathrm{e^+e^-}$ from γ conversions
- VM decays

$\longrightarrow$ large combinatorial background:

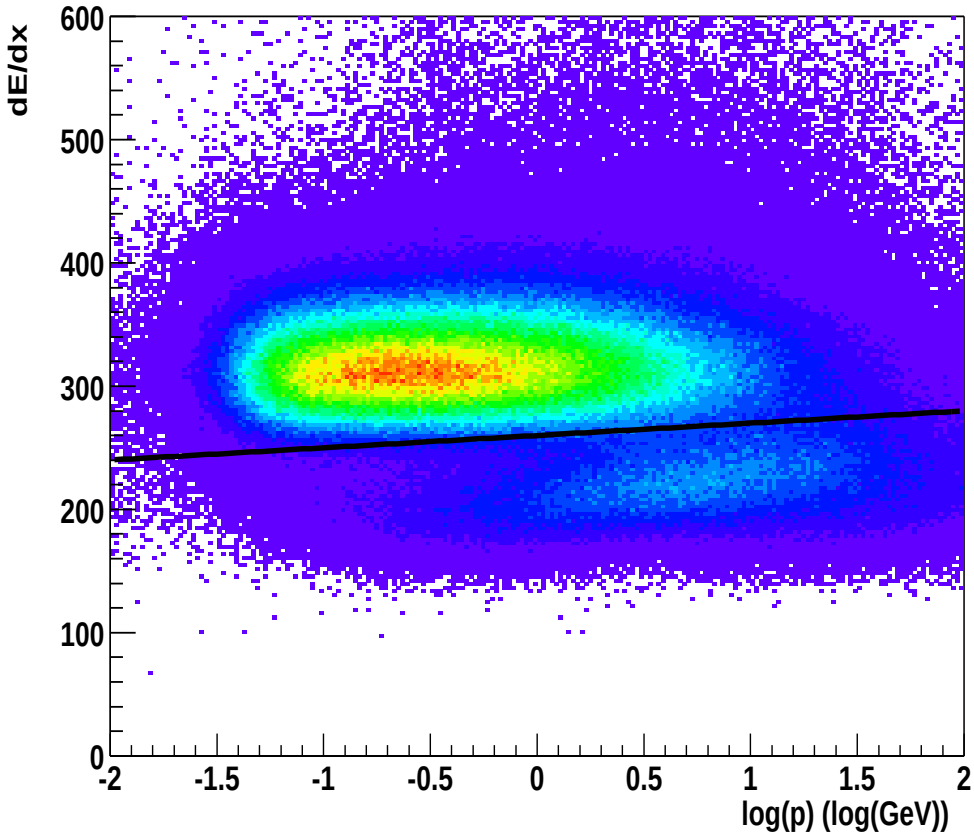
  - single legs due to finite acceptance and efficiency
  - misidentified pions

analysis procedure:

- tracking and electron identification
- π^0 Dalitz and γ conversion rejection
- pairing: unlike sign - like sign - unlike sign mixed events
- background subtraction
- efficiency correction

RICH - TPC combined electron ID

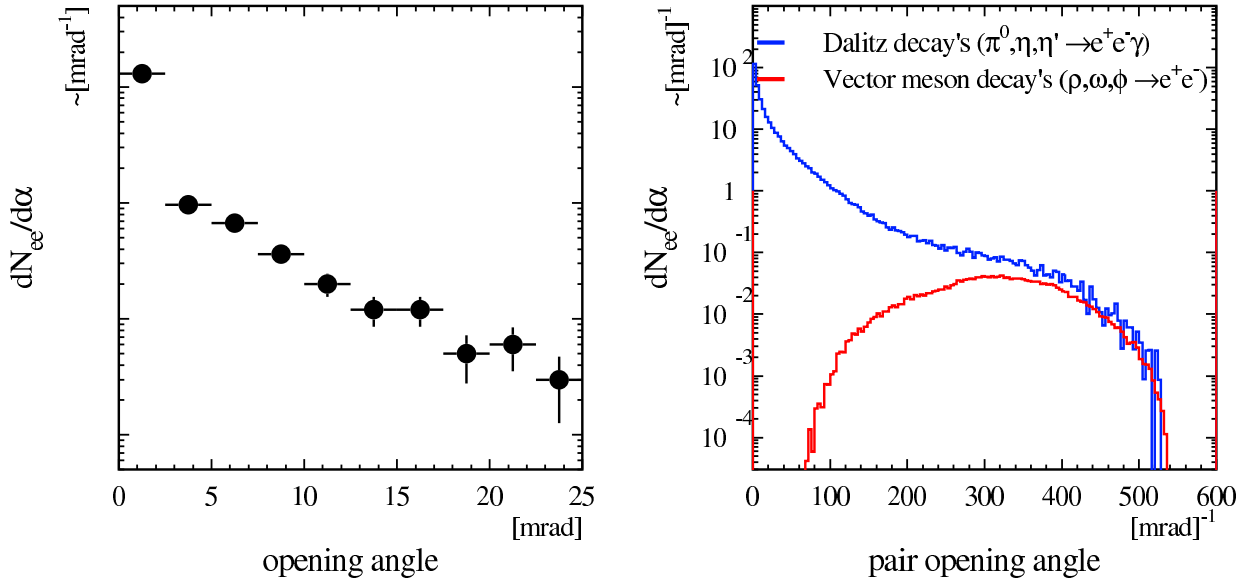
- TPC dE/dx requiring RICH ring:



$\rightarrow$ combined pion suppression factor: $4 \cdot 10^4$

Dalitz and conversion rejection

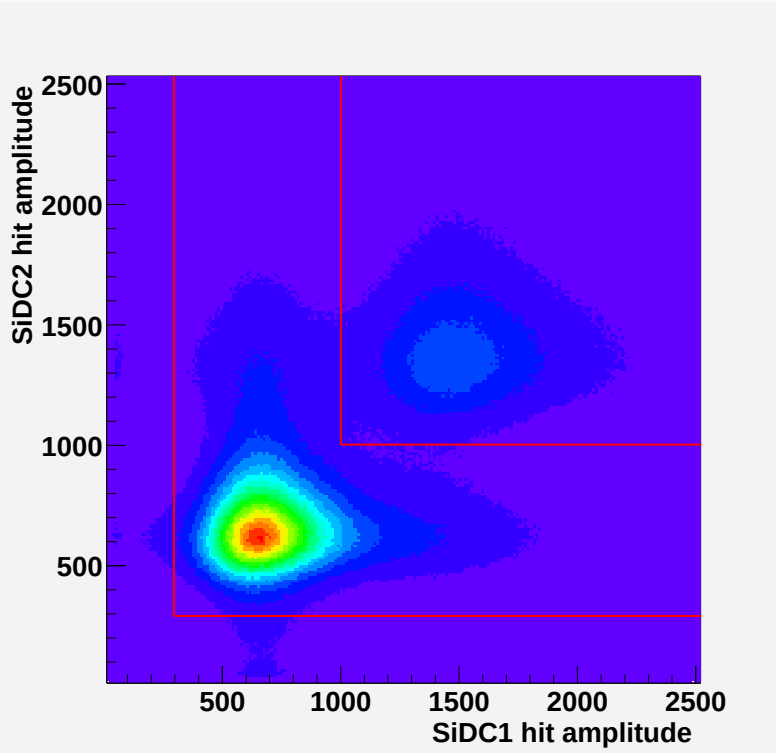
- simulated opening angle distribution for e^+e^- pairs from conversions, Dalitz and VM decays



$\longrightarrow$ require minimum opening angle 35 mrad

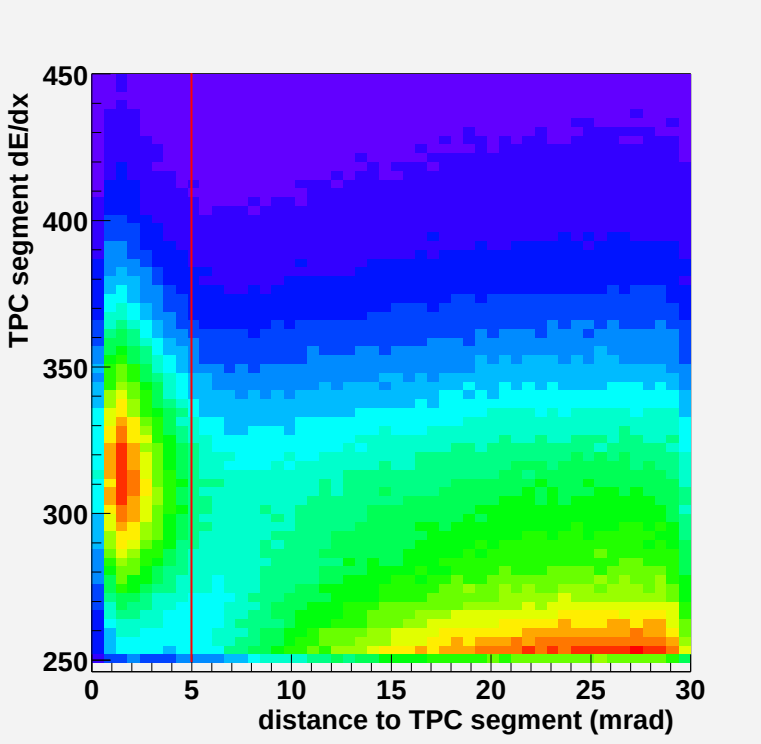
- require minimum single leg p_T

- target conversions and conversion in the SDD: cut on SDD dE/dx



- late conversions: e.g. RICH2 mirror

- rejection by pair cut on TPC segments: require isolation in TPC



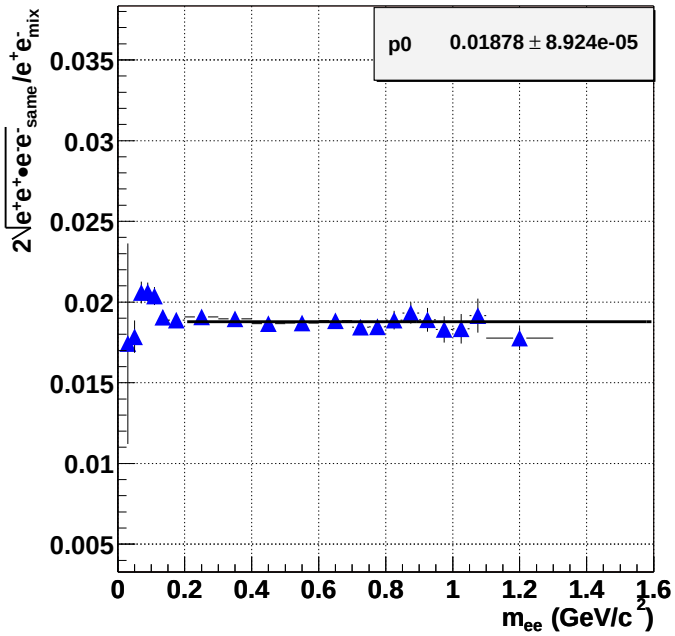
signal/background invariant mass distribution

- background: invariant mass distribution of uncorrelated pairs

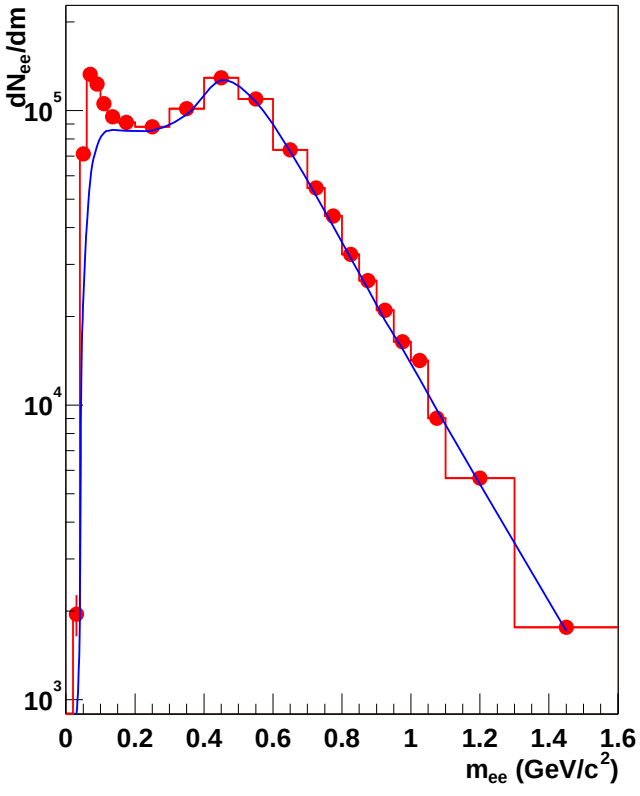
  $\longrightarrow$ same-event like sign pairs . . .

- . . . or mixed event unlike sign

- normalisation of mixed event to same event background



- inv mass distributions:

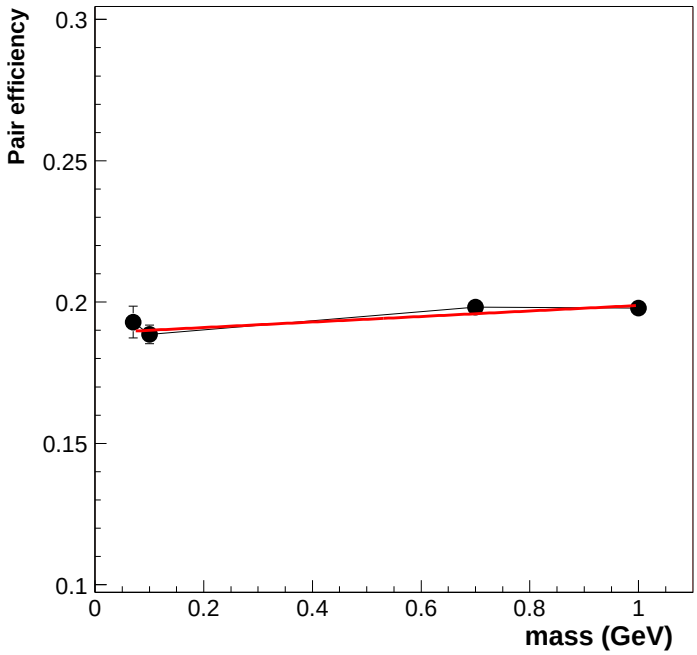


efficiency correction

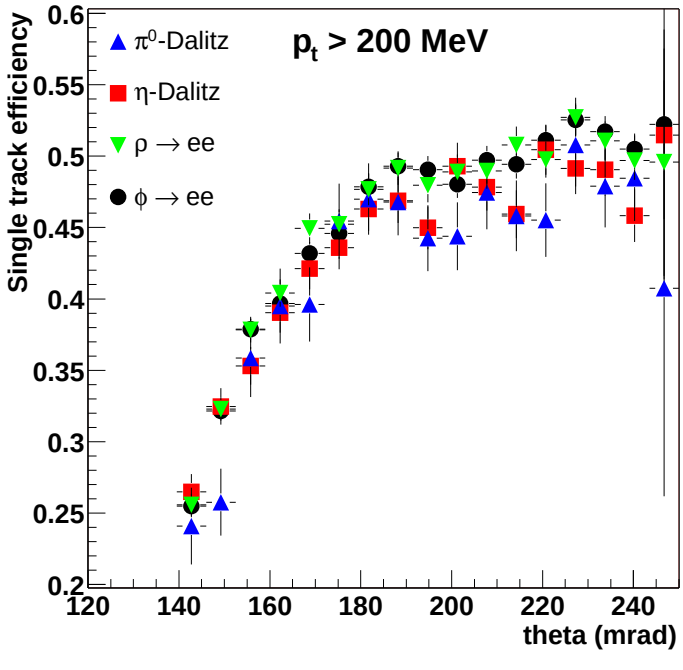
- efficiency obtained from MC simulation, embedding generated pair into real event:

  efficiency = reconstruction probability

- efficiency vs mass:

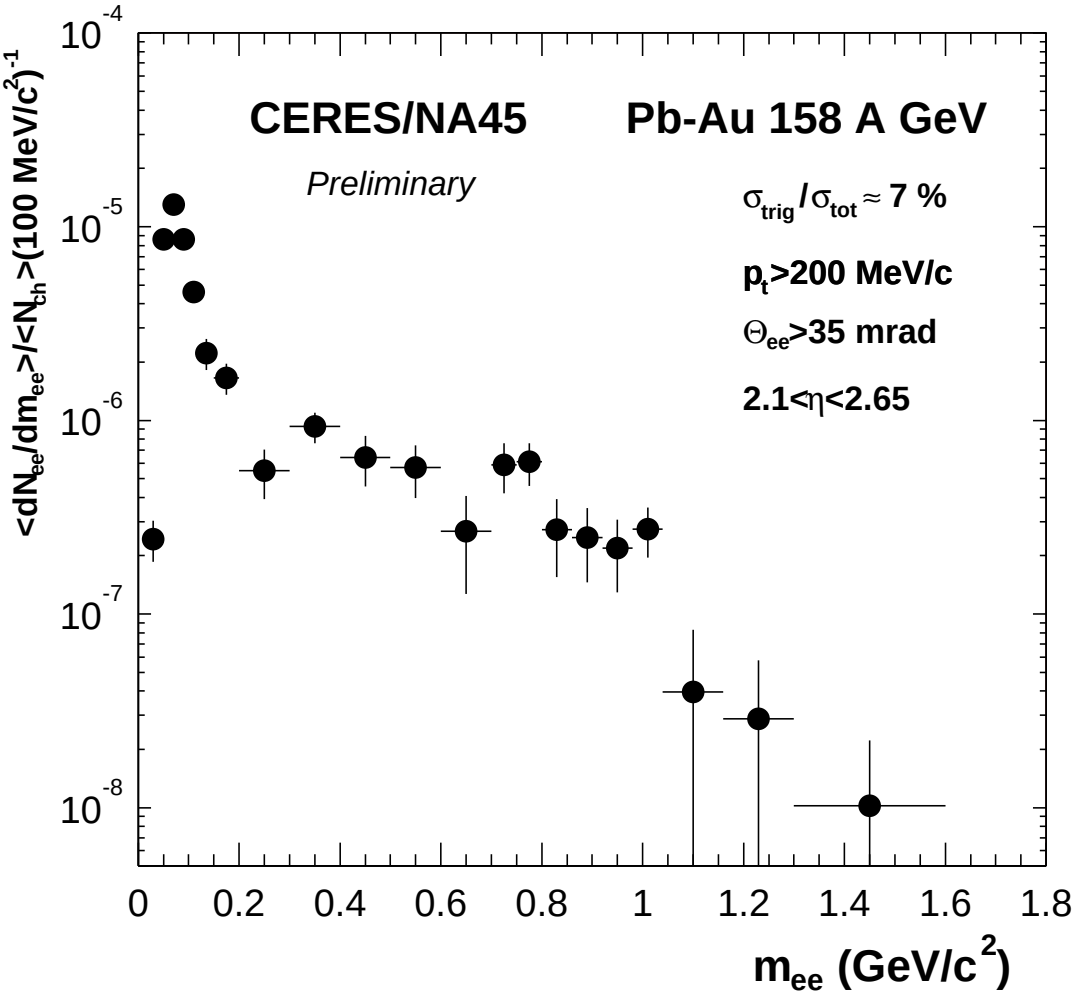


- single track efficiency vs azimuthal angle for different dilepton sources:



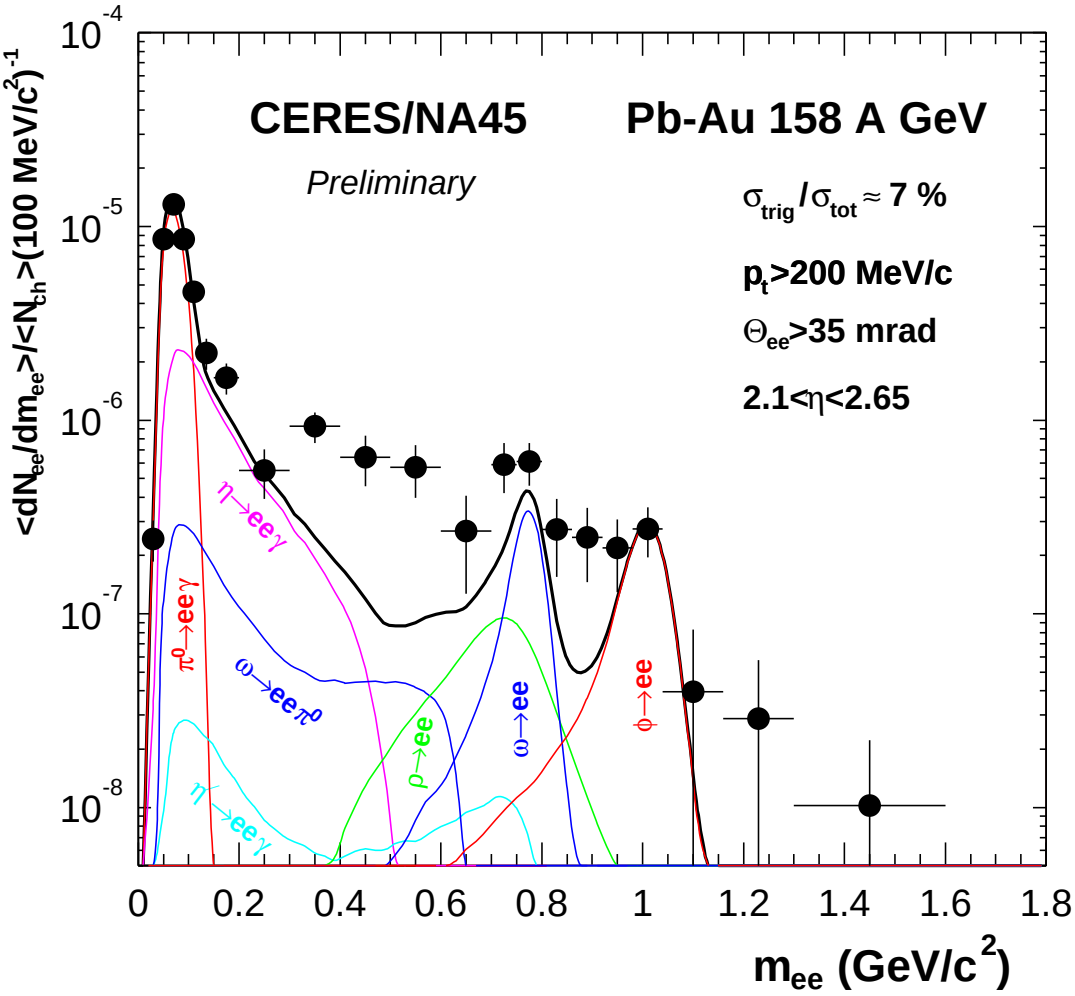
e^+e^- mass spectrum

- data absolutely normalized



- 2571 ± 224 e^+e^- pairs with $m_{ee} > 0.2\ GeV$
- S/B $= 1/21$
- $\langle dN_{ch}/d\eta \rangle = 322$

enhancement over cocktail



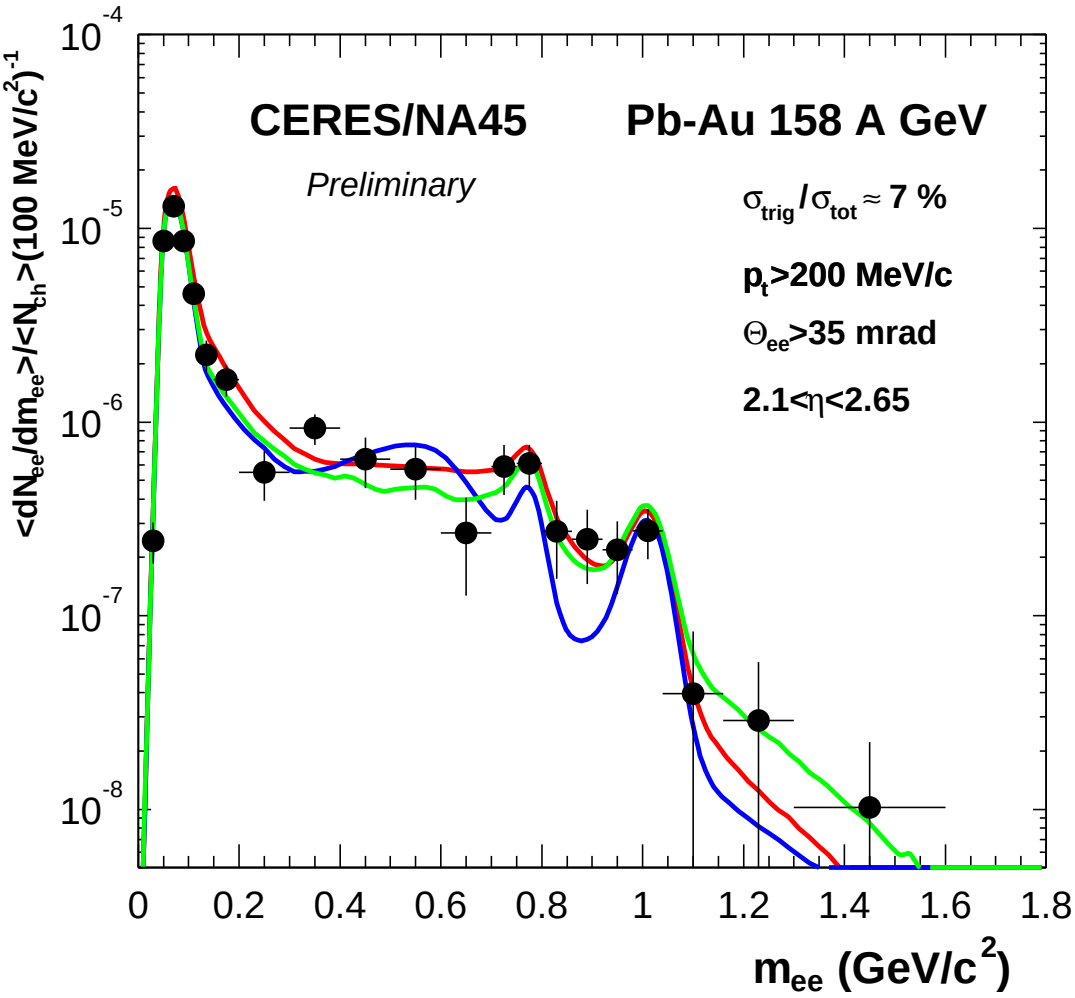
- enhancement over hadron decay cocktail:

  0.2 GeV $< m_{ee} <$ 1.1 GeV: 2.35 ± 0.31 (stat.)

  0.2 GeV $< m_{ee} <$ 0.6 GeV: 2.80 ± 0.50 (stat.)

- systematic uncertainty of normalization $\sim 20\%$

comparison to models



calculation by R.Rapp using Rapp/Wambach modification of rho spectral function + QGP contribution

calculation by R.Rapp using dropping mass scenario

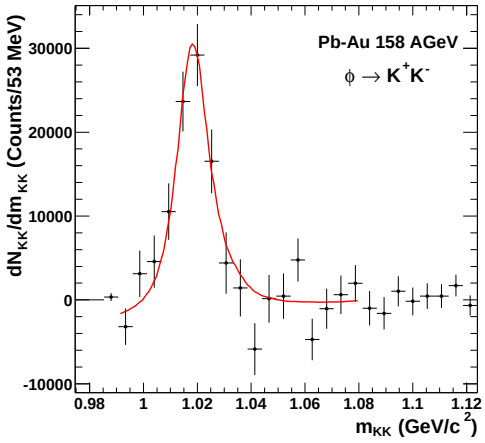
B.Kämpfer, thermal emission

p_T spectrum of the ϕ

- reconstruction in 2 decay channels:

$\phi \longrightarrow e^+e^-$

$\phi \longrightarrow K^+K^-$

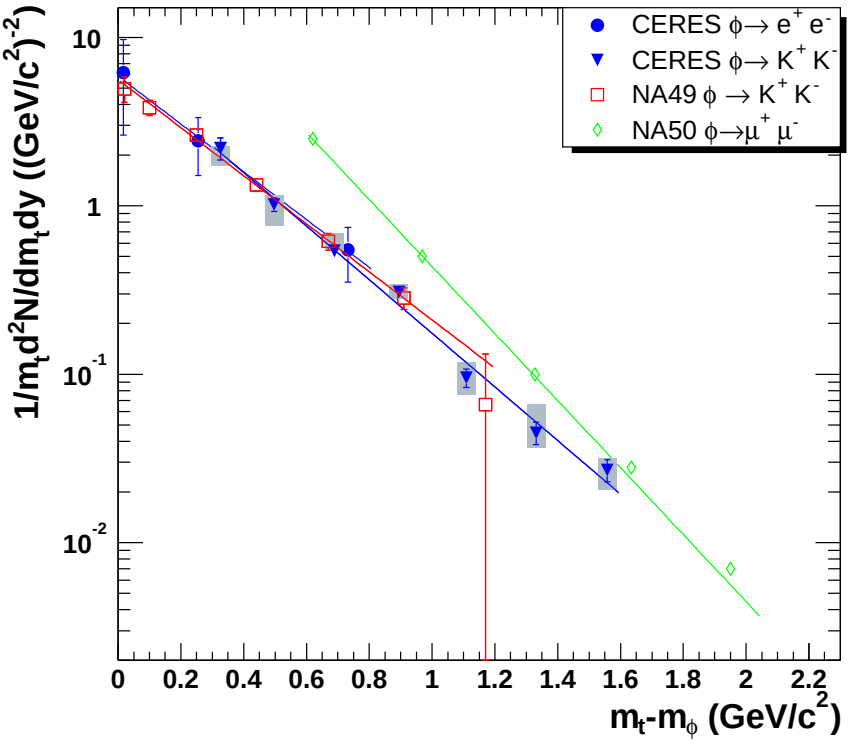


- ϕ spectra observed in both leptonic and hadronic channels agree

- $\phi \longrightarrow K^+K^-$: $\frac{dN}{dy} = 2.05 \pm 0.14(\text{stat}) \pm 0.25(\text{syst})$

  $\phi \longrightarrow e^+e^-$: $\frac{dN}{dy} = 2.04 \pm 0.49(\text{stat}) \pm 0.32(\text{syst})$

- $\frac{dN/dy_{e^+e^-}}{dN/dy_{K^+K^-}} \leq 1.6 \quad 95\%$ CL



A.Marin for the CERES collaboration
nucl-ex/0512007
submitted to PRL

conclusions and outlook

- 2000 data confirms dilepton excess between π and ρ
- improved mass resolution allows to distinguish between models
- consistent ϕ yield in the leptonic and hadronic channels
- event-by-event efficiency correction underway
- 3^{rd}, independent, analysis carried out, efficiency correction in preparation