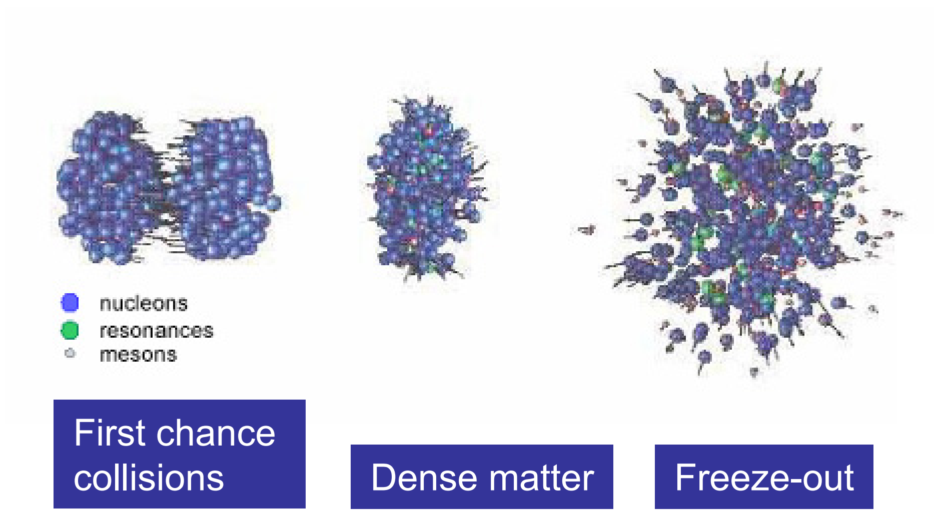
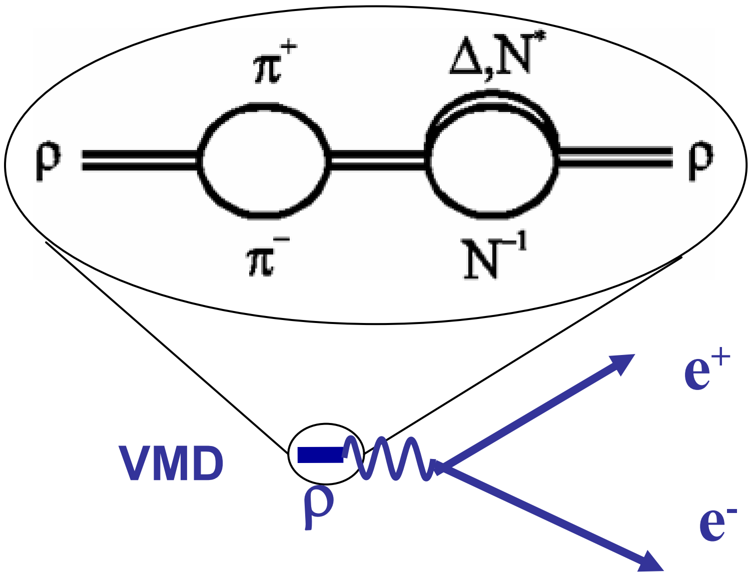
Trento 2006

Low Mass Electron Pairs
Experiments

Joachim Stroth, Univ. Frankfurt

Motivation





- The dilepton signal contains **contributions from throughout the collision**, ..
- ... i.e. also **direct radiation** from the **early phase.**

⇨ It probes the **electromagnetic structure of dense/hot nuclear (or partonic) matter.**

Motivation (Chiral Symmetry Restoration)

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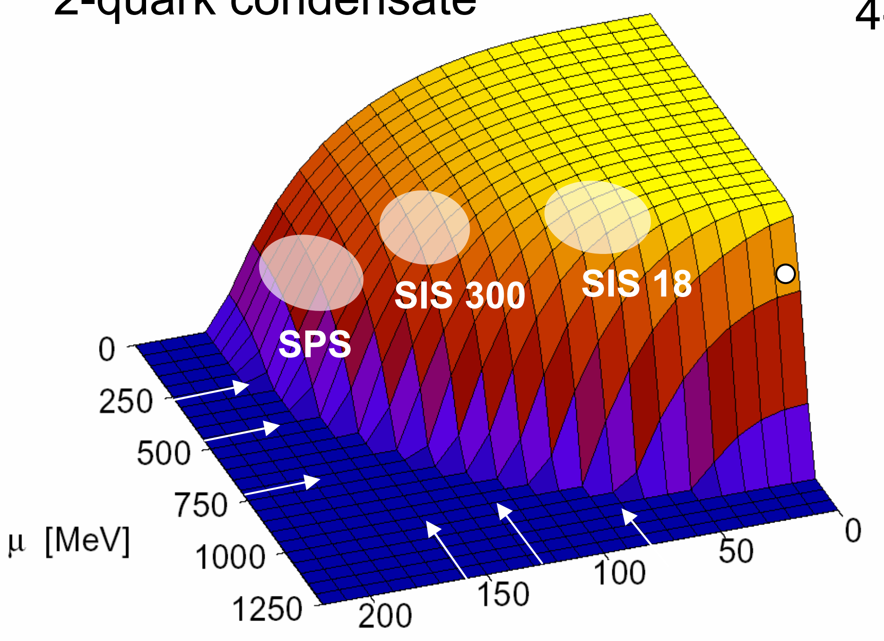
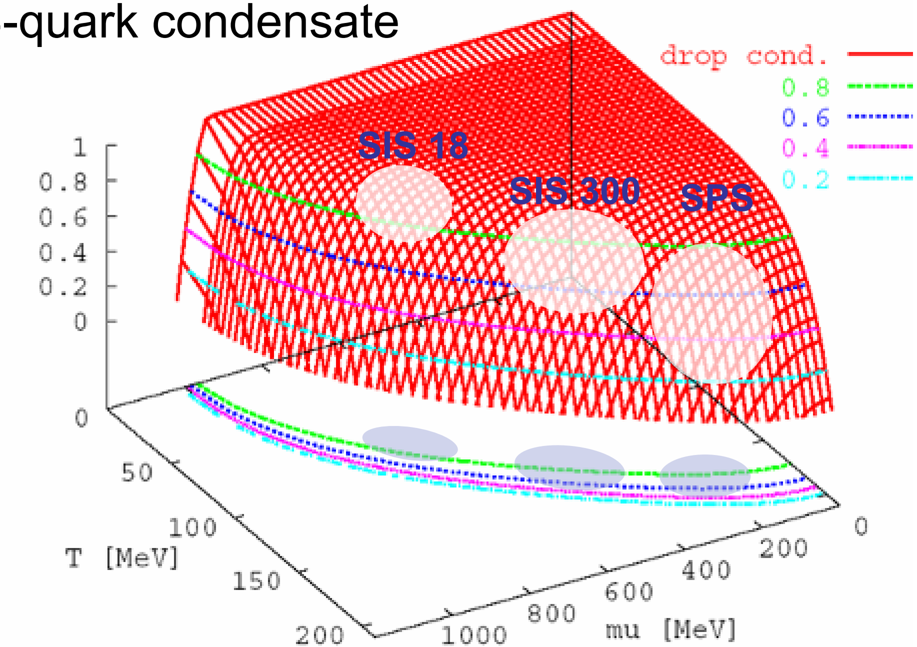
- Substantial depletion of the condensates already in collisions at moderate beam energy.

2-quark condensate



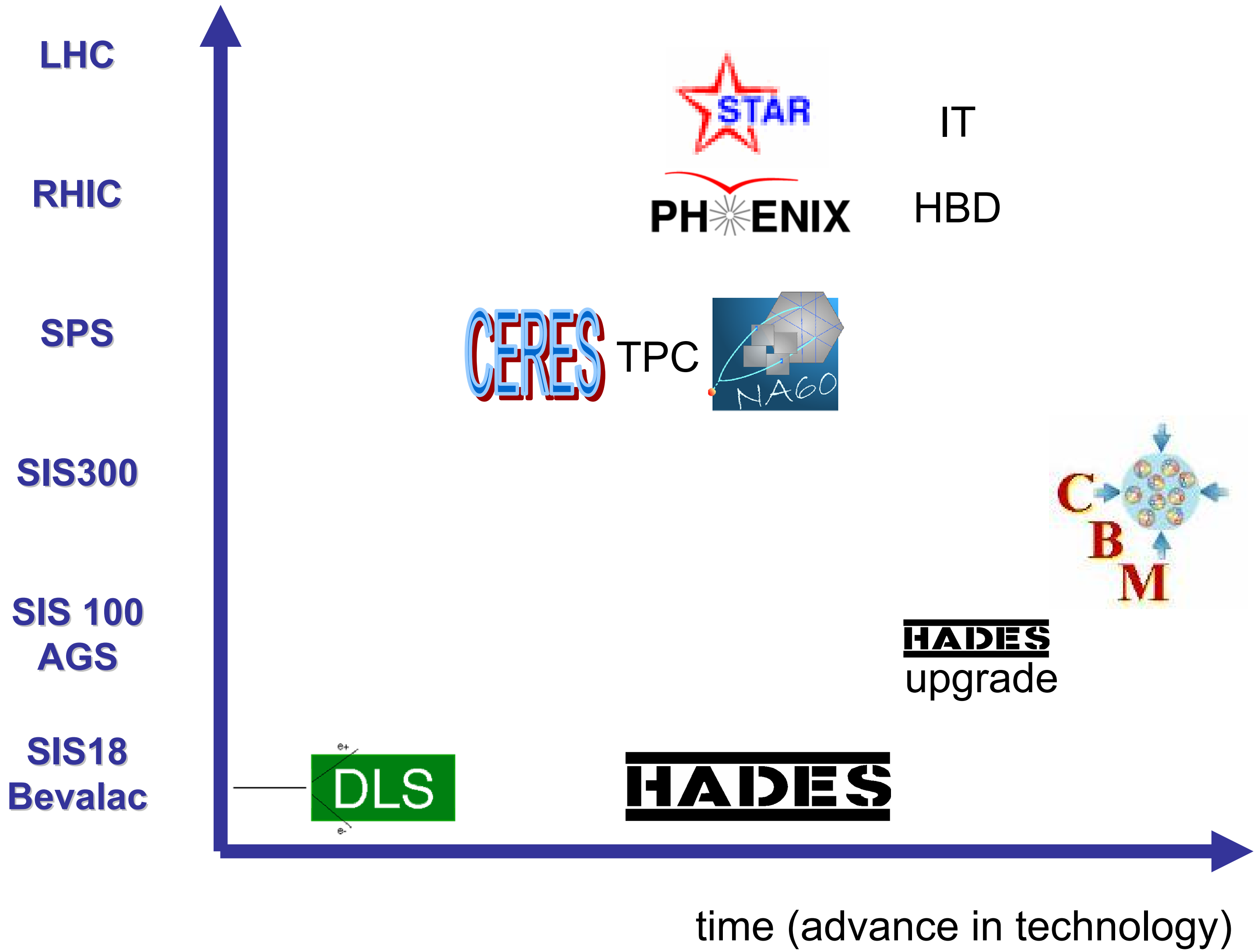
J. Wambach et al.

4-quark condensate

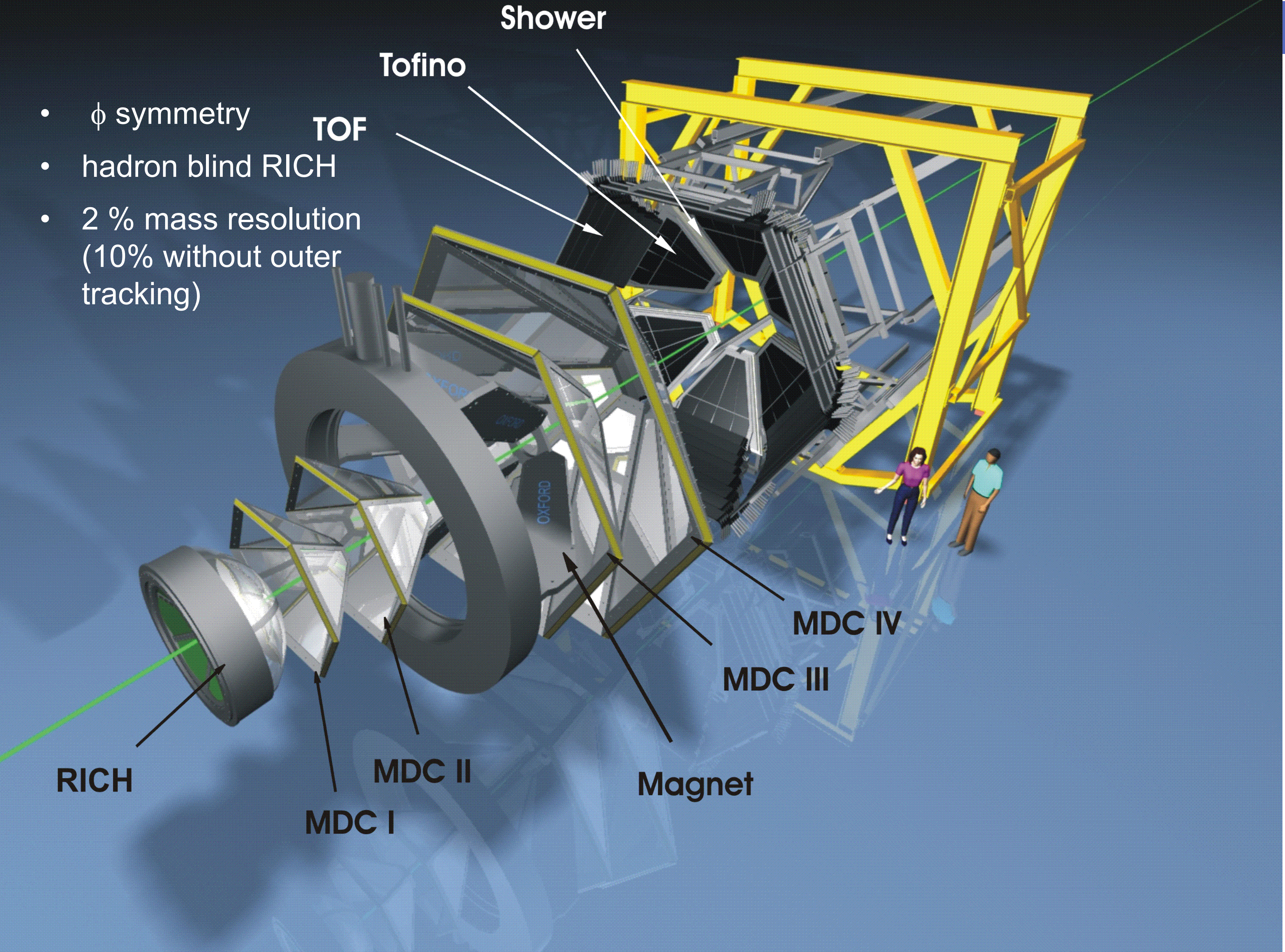


S. Leupold, Trento Workshop 2005

Overview

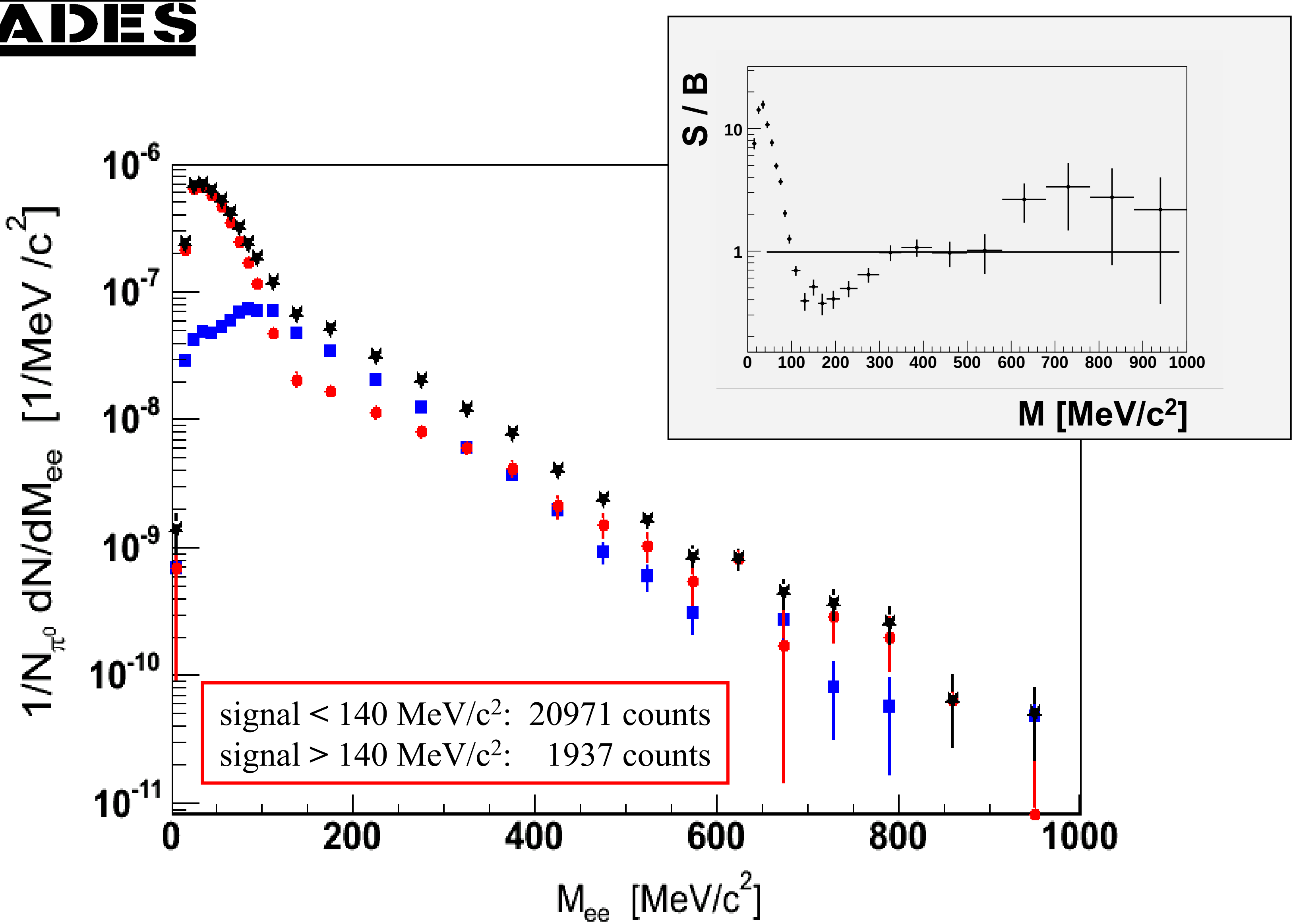

LHC
RHIC
SPS
SIS300
SIS 100
AGS
SIS18
Bevalac
STAR
IT
PHENIX
HBD
CERES
TPC
NA60
CBM
HADES
upgrade
DLS
HADES
time (advance in technology)

- ϕ symmetry
- hadron blind RICH
- 2 % mass resolution (10% without outer tracking)

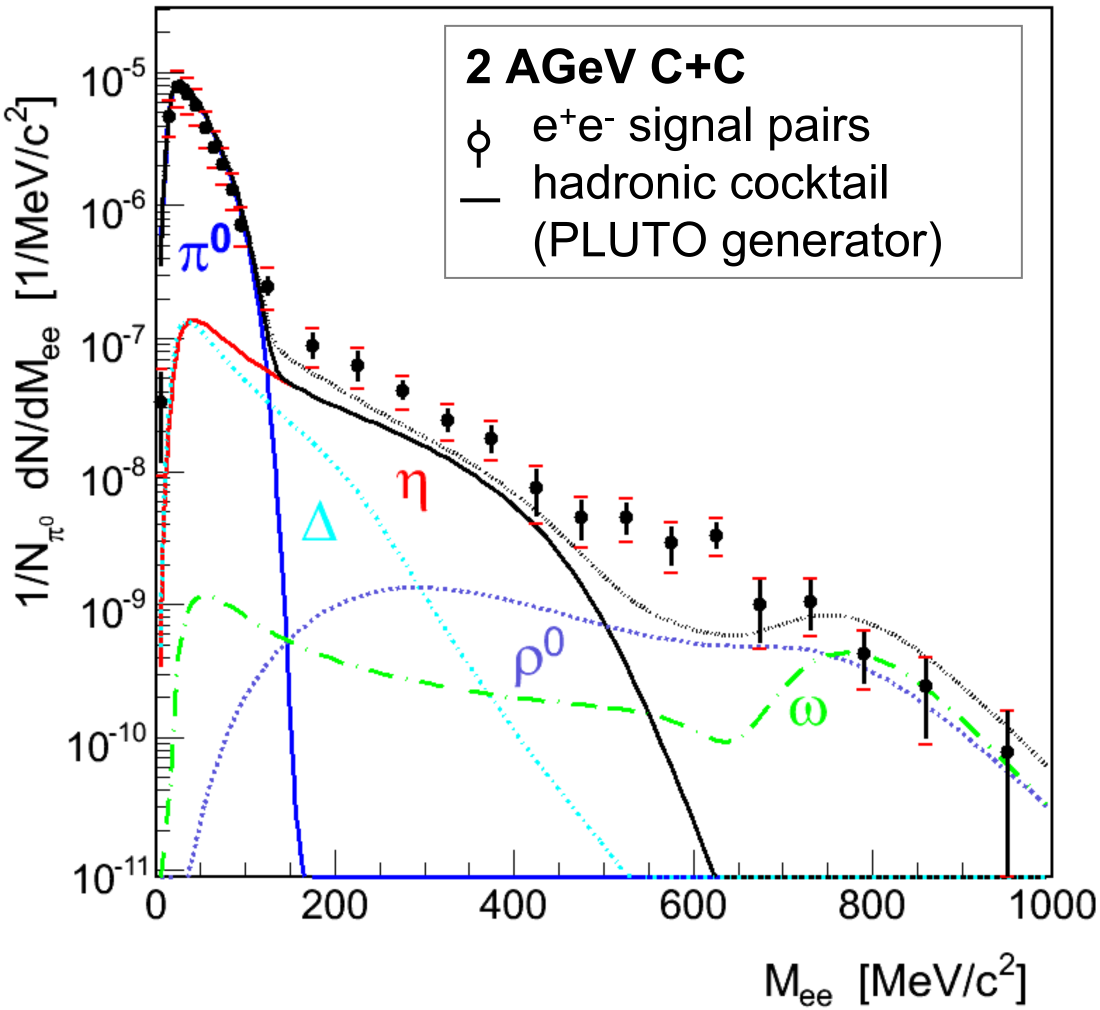


C+C 2AGeV: e^+e^- invariant mass spectrum

HADES



HADES data



- Electron pair yield observed in acceptance
- Corrected for reconstruction efficiency
- Cocktail yields from TAPS measurement and using m_t scaling

C+C 2AGeV: Comparison to transport

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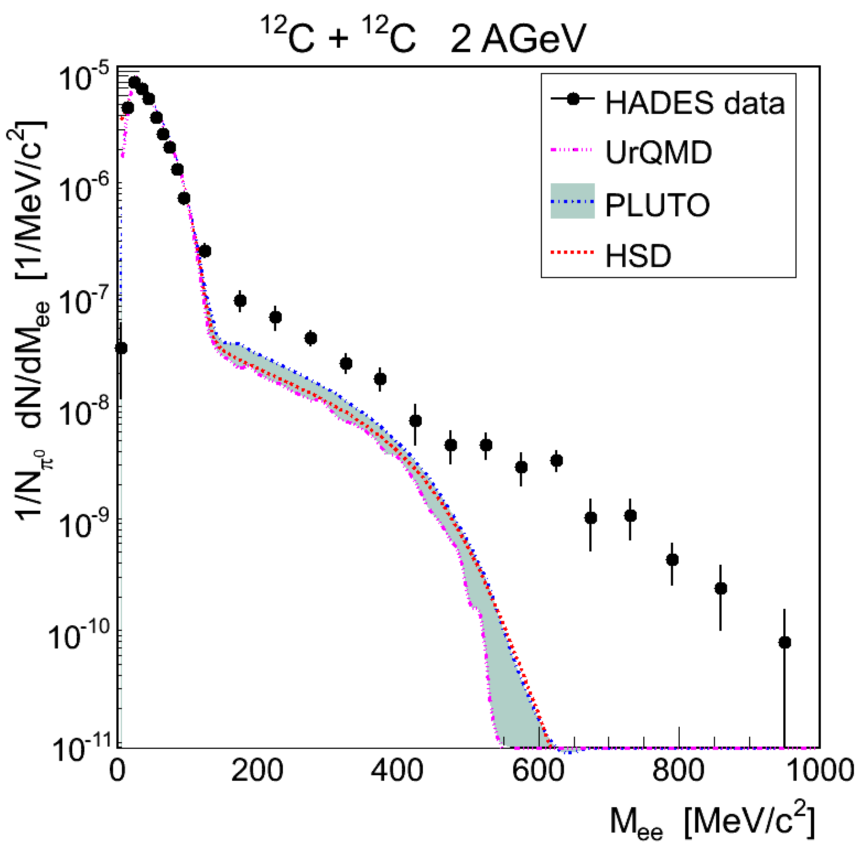
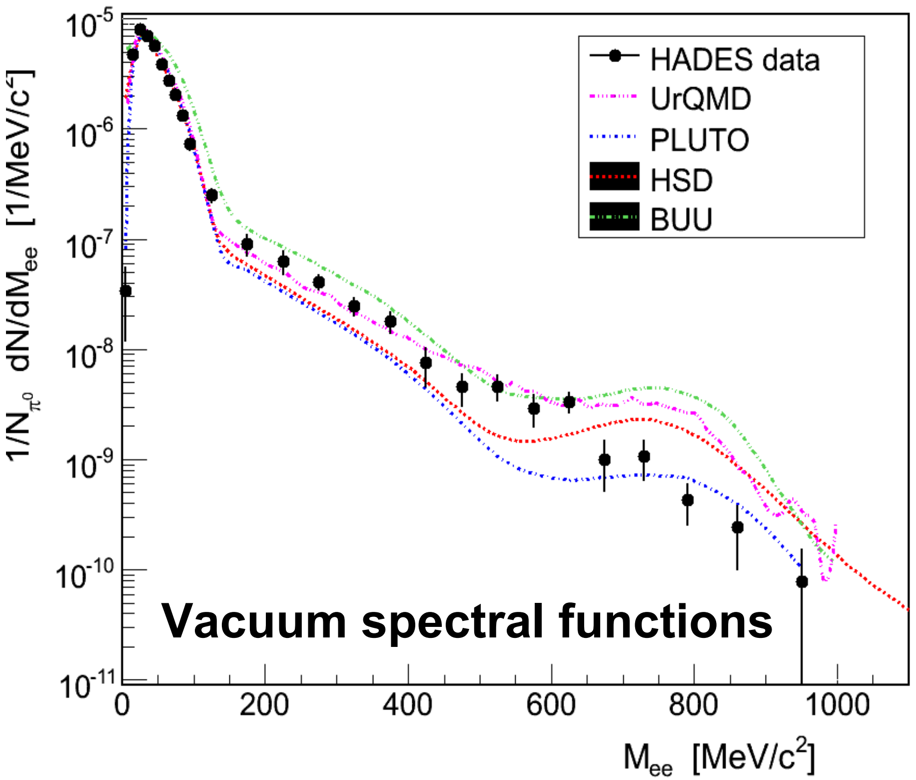
HADES

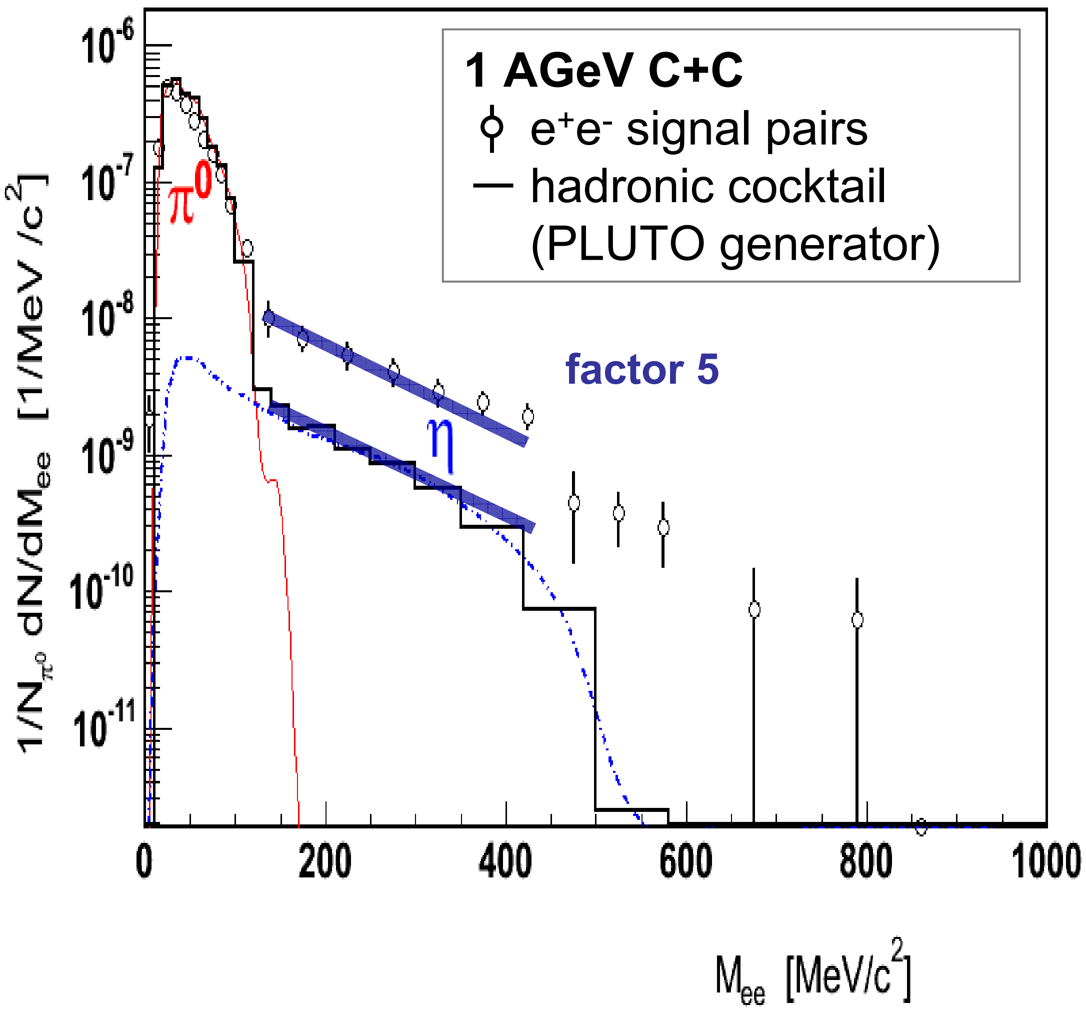
Conventional sources under control





C+C 1AGeV: HADES data (preliminary)

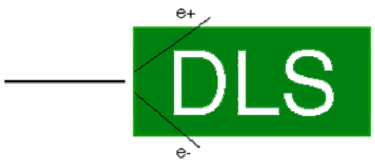
HADES



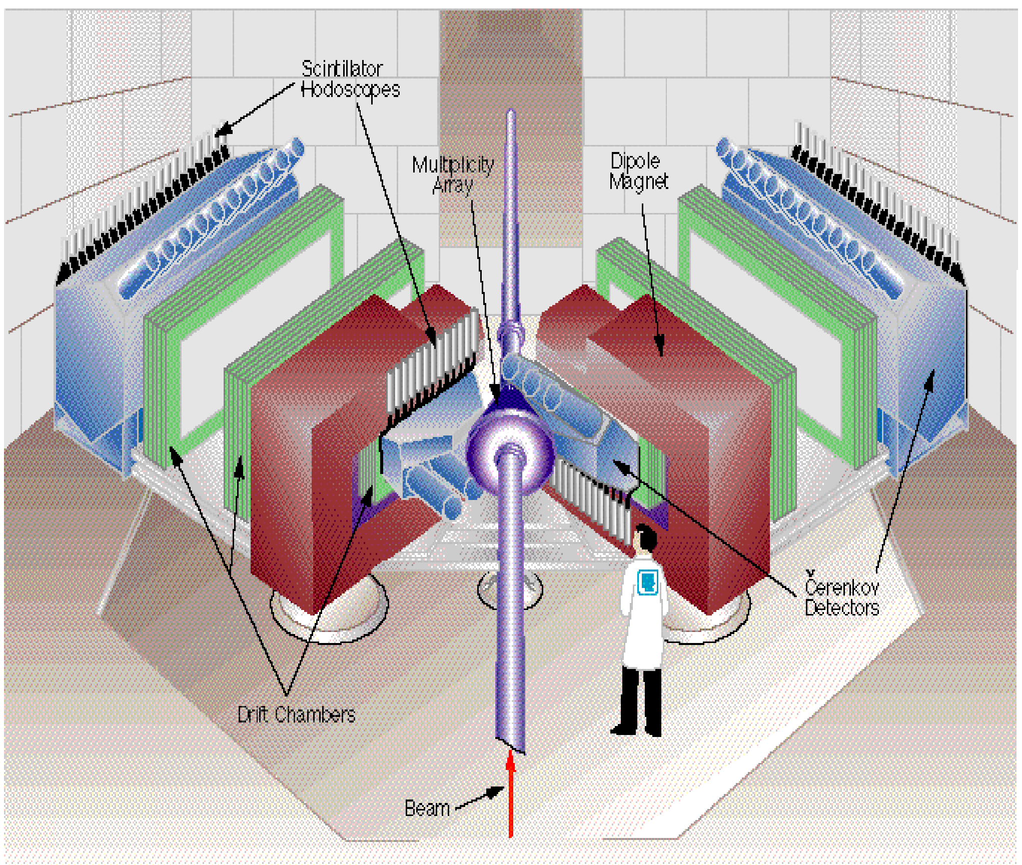
- Electron pair yield observed in acceptance
- Corrected for reconstruction efficiency
- Substantial yield above the η contribution

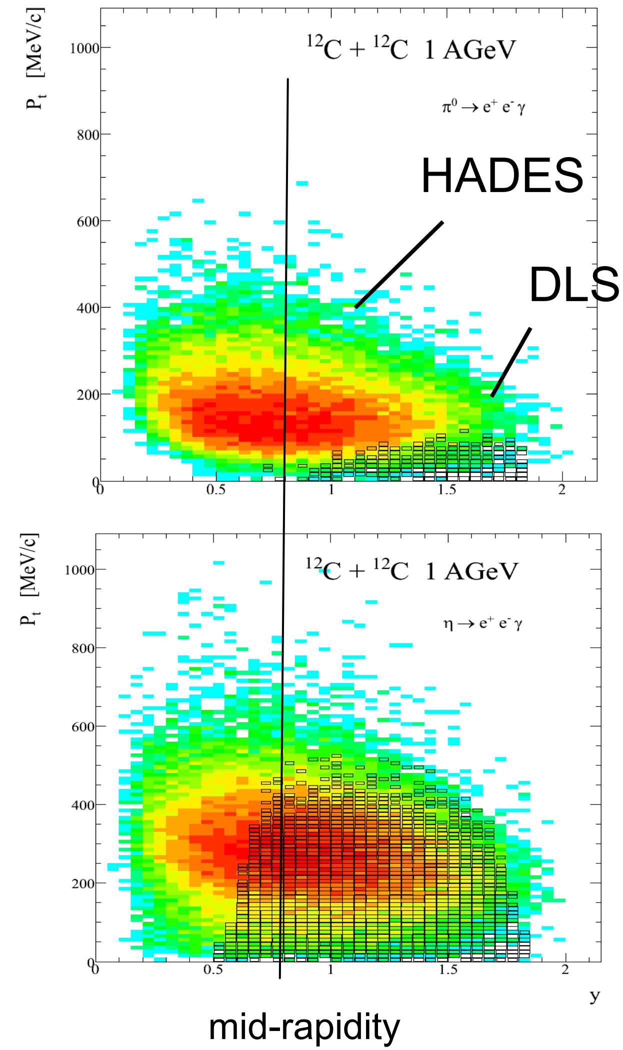
preliminary

The DLS spectrometer @ LBL

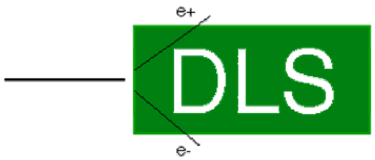


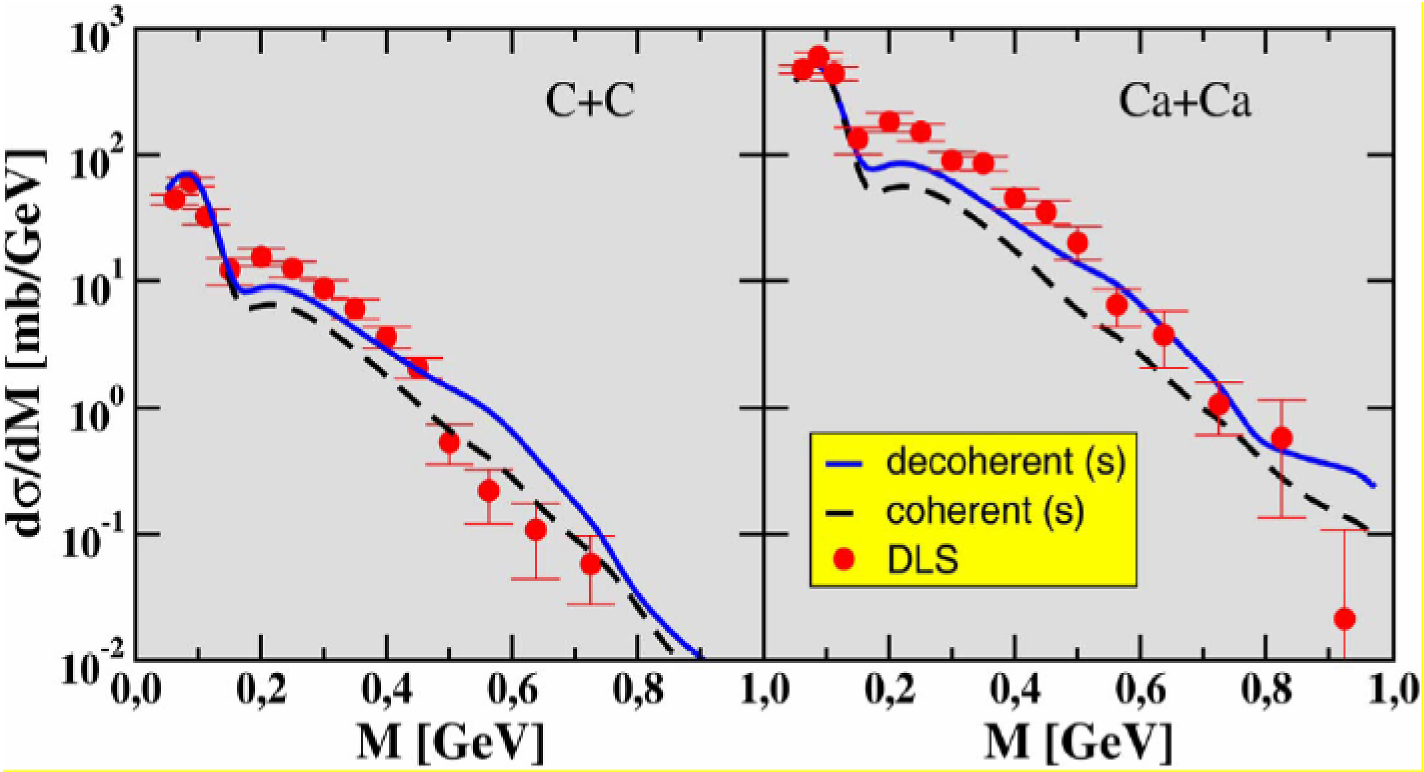
DiLepton Spectrometer





DLS and RQMD (Tübingen Group)





The puzzle remains

C. Fuchs et al.

Comparison with the DLS results

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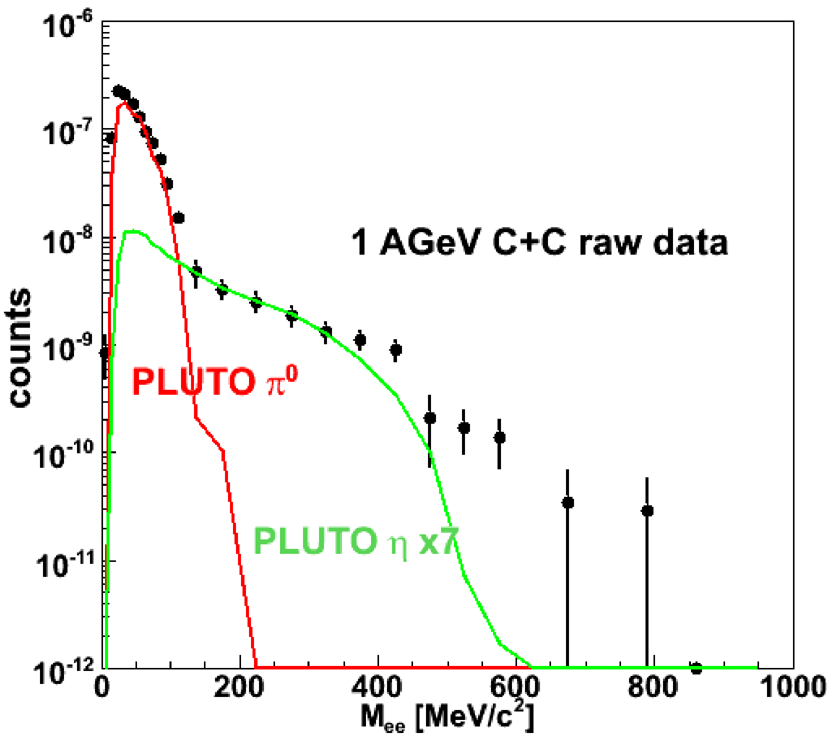
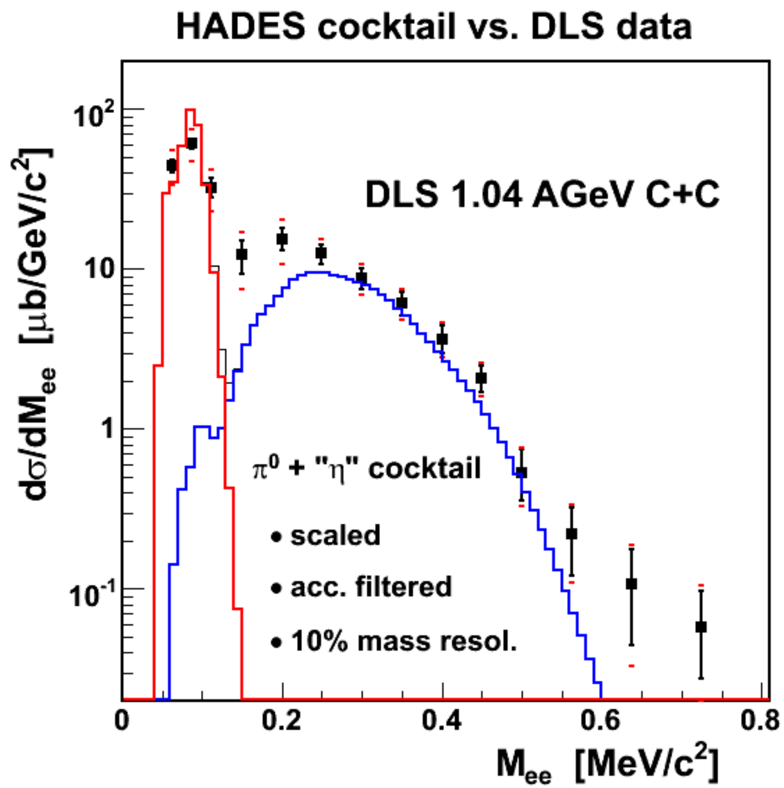
generated events processed by the full HADES analysis including:

- detector (in)efficiency
- reconstruction (in)efficiency

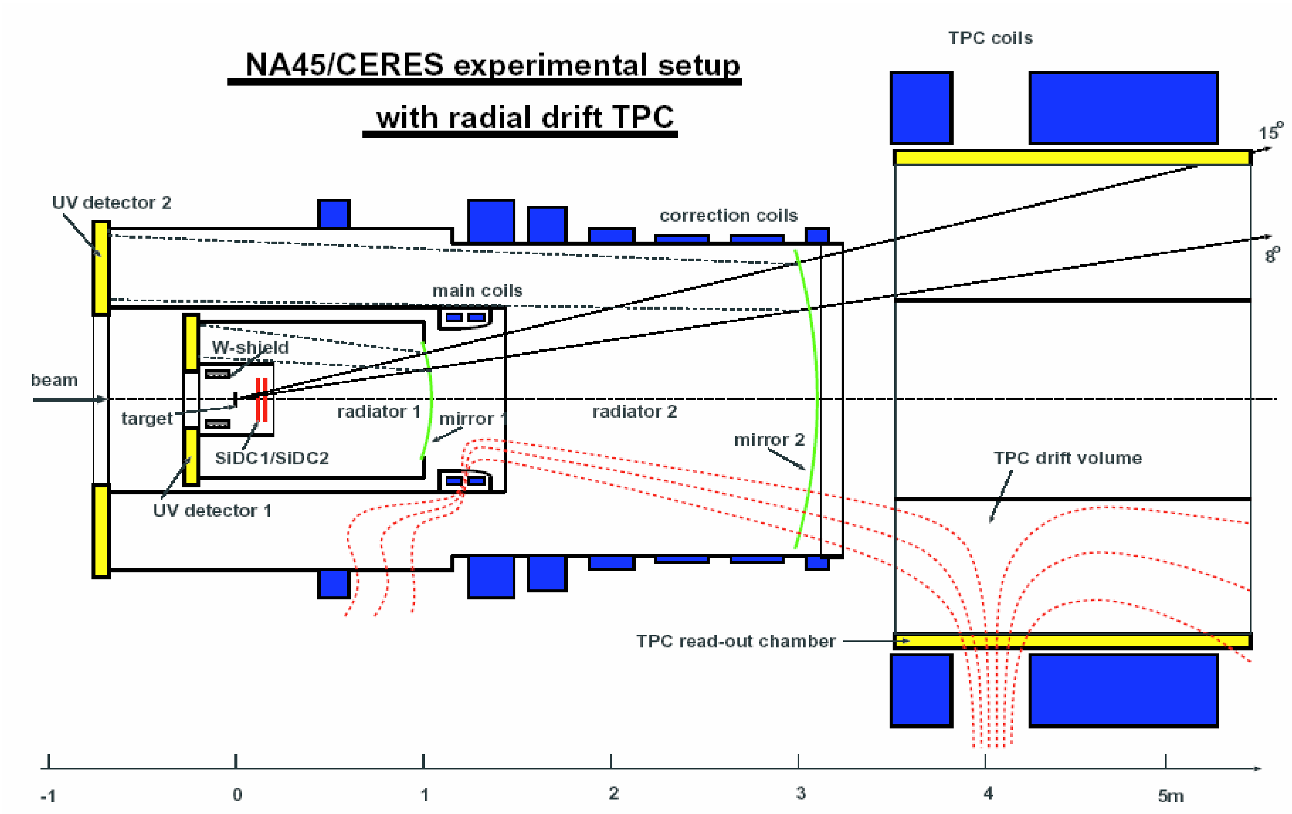




systematic errors

- data (bg subtraction)
- simplified event generator
  - (only π,η)
  - angular distributions

The CERES Spectrometer @ CERN



- ϕ symmetry
- dE/dX in silicon drift for background rejection
- 3.8 % mass resolution (TPC upgrade)

CERES data

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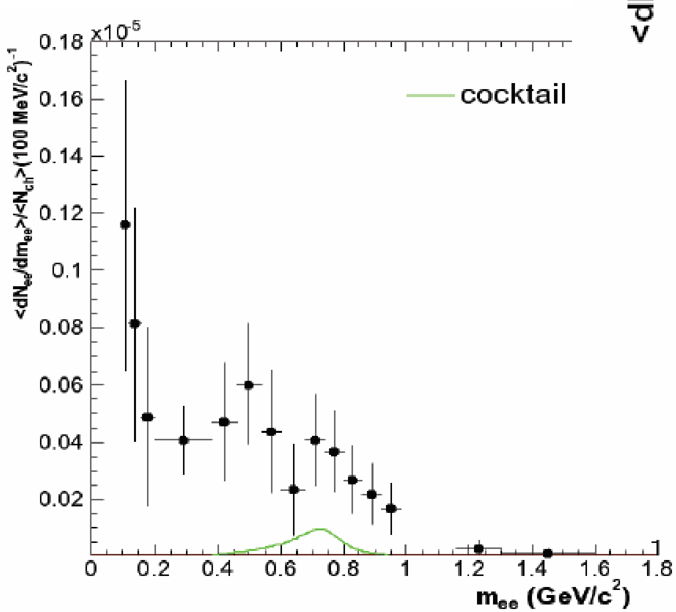
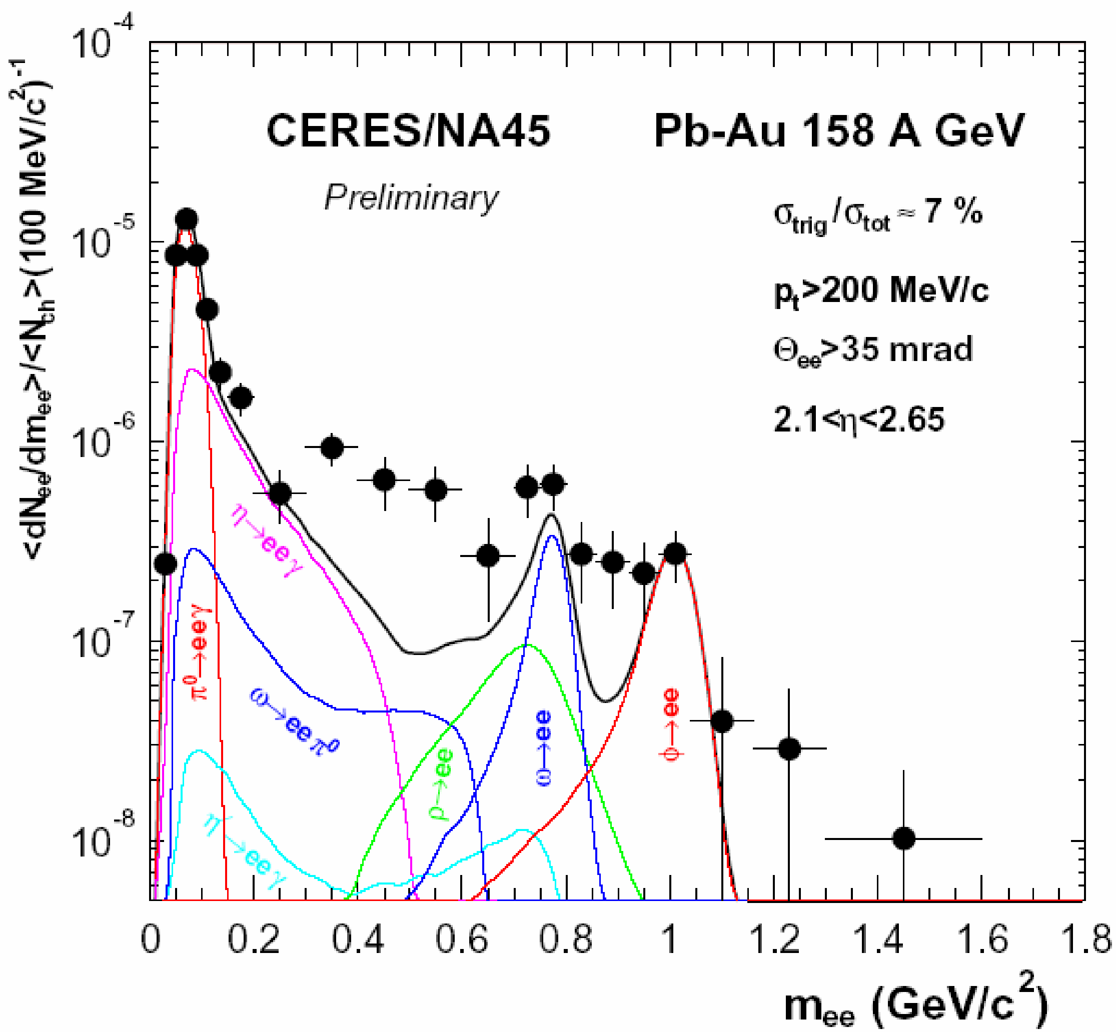
CERES

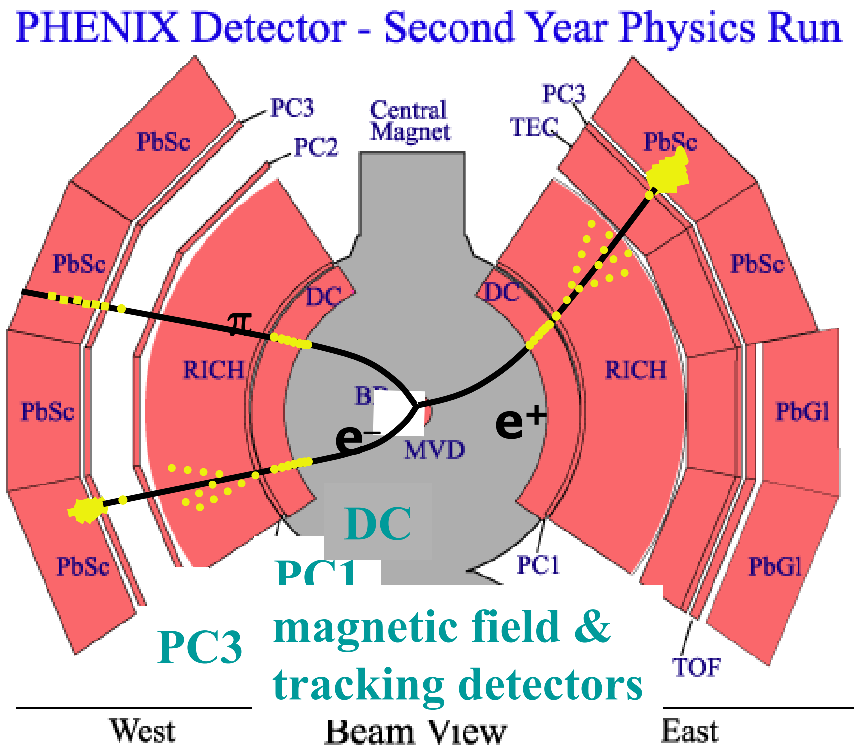
No substantial 'hole" between ω and φ pole mass



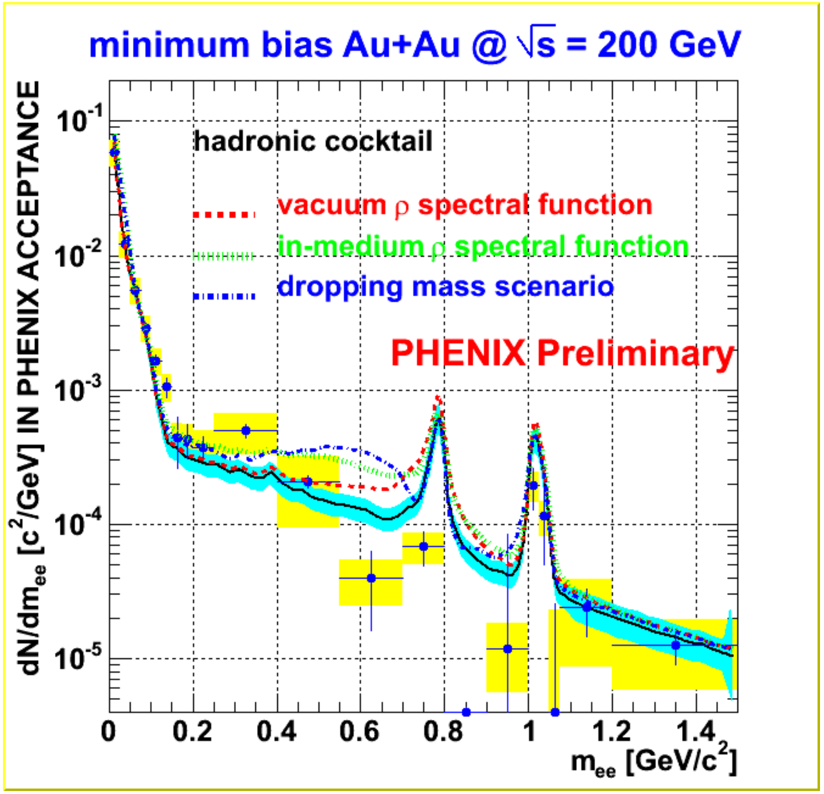


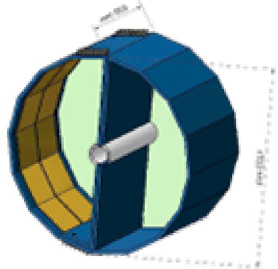
J. Stachel, ISHIP 2006 and nucl-ex/0511010

LMLP in PHENIX @ RHIC



S/B between 10^{-2} – 10^{-3}





S/B will get much better once
the HBD is operational

A. Toja, Hot Quarks 2006

From HADES to CBM @ FAIR

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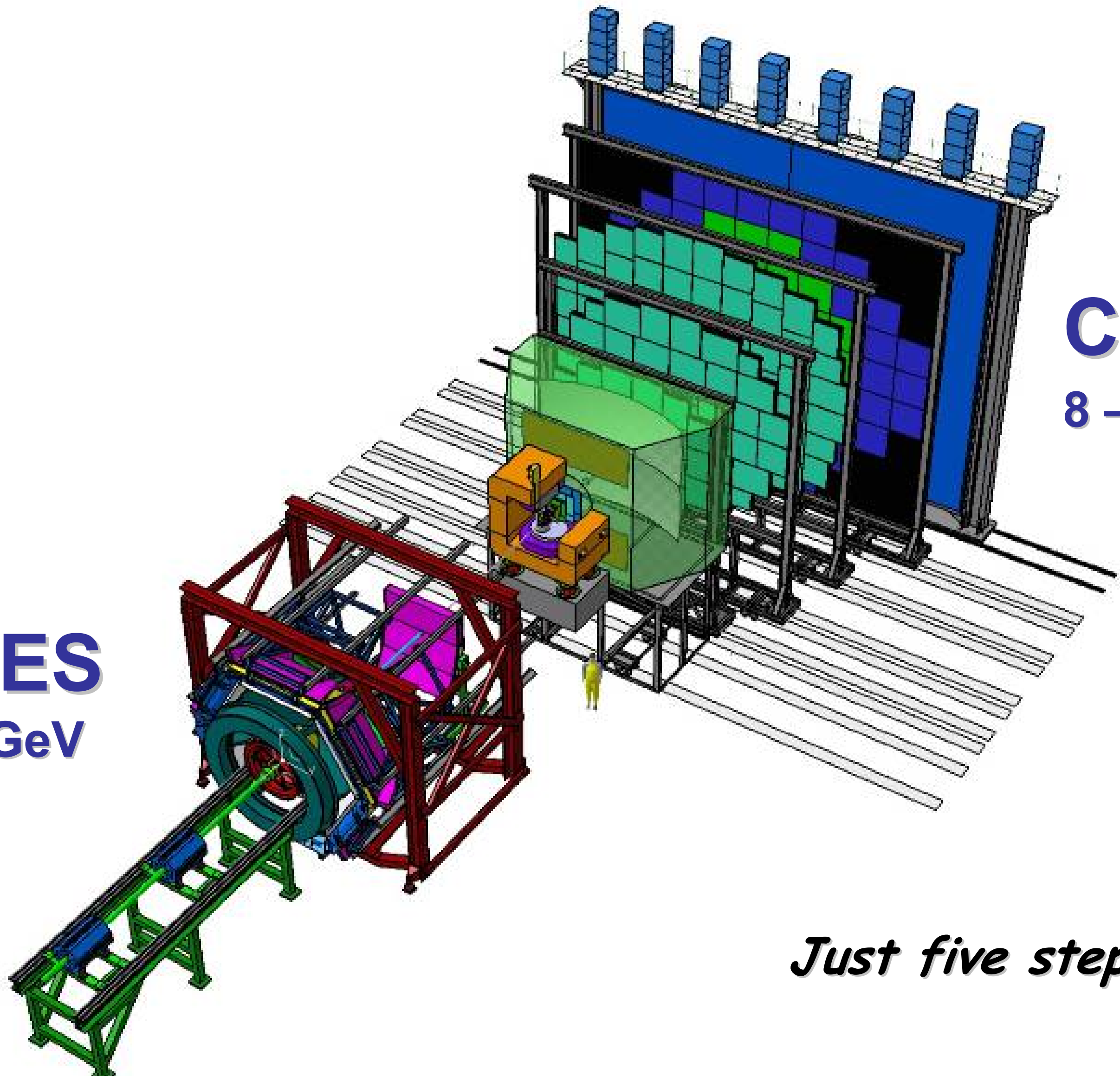


CBM

8 – 45 AGeV

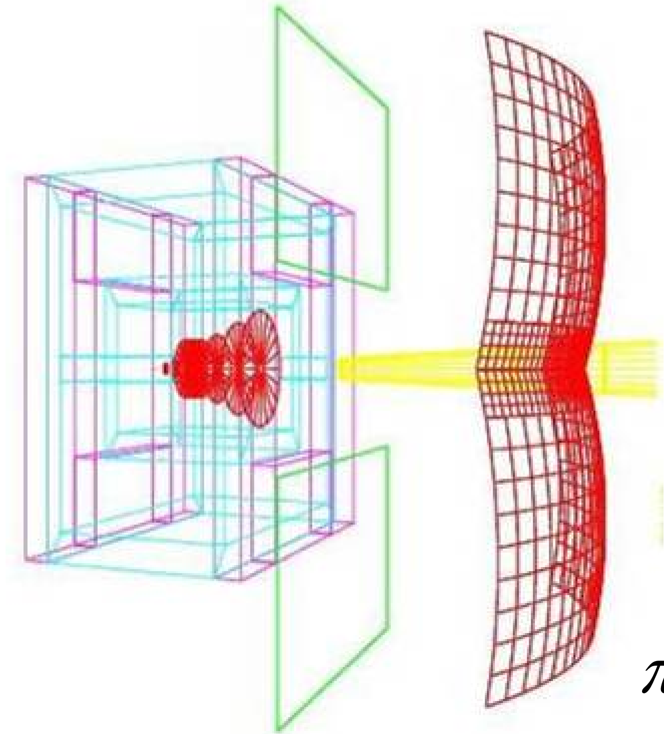
HADES

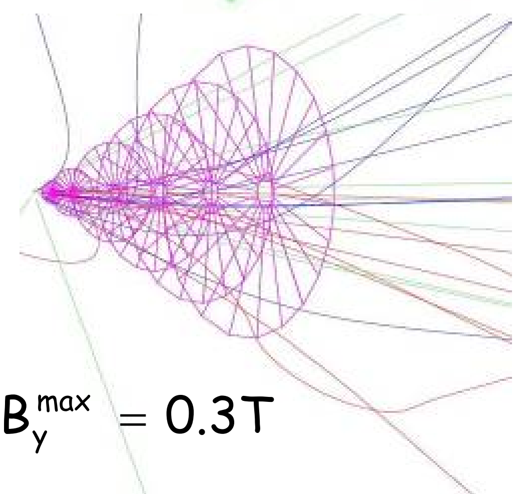
2 – 8 AGeV

Just five steps ;-)

Dielectron reconstruction in CBM

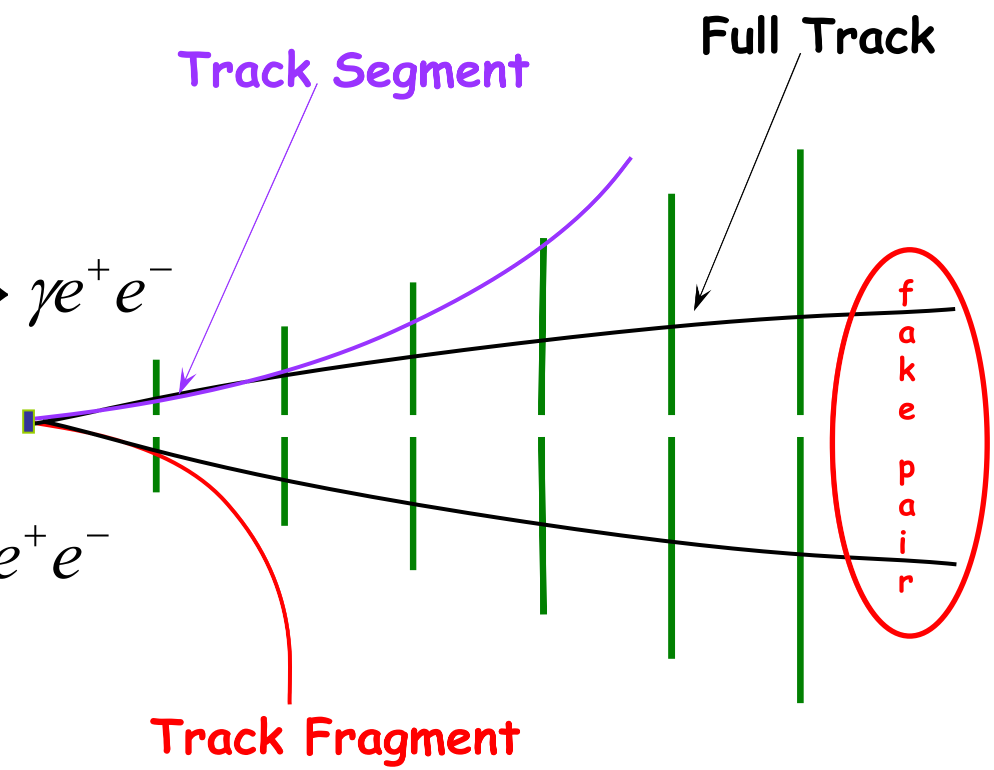
- Fast, high-precision tracking using silicon sensors.
- No electron identification before tracking





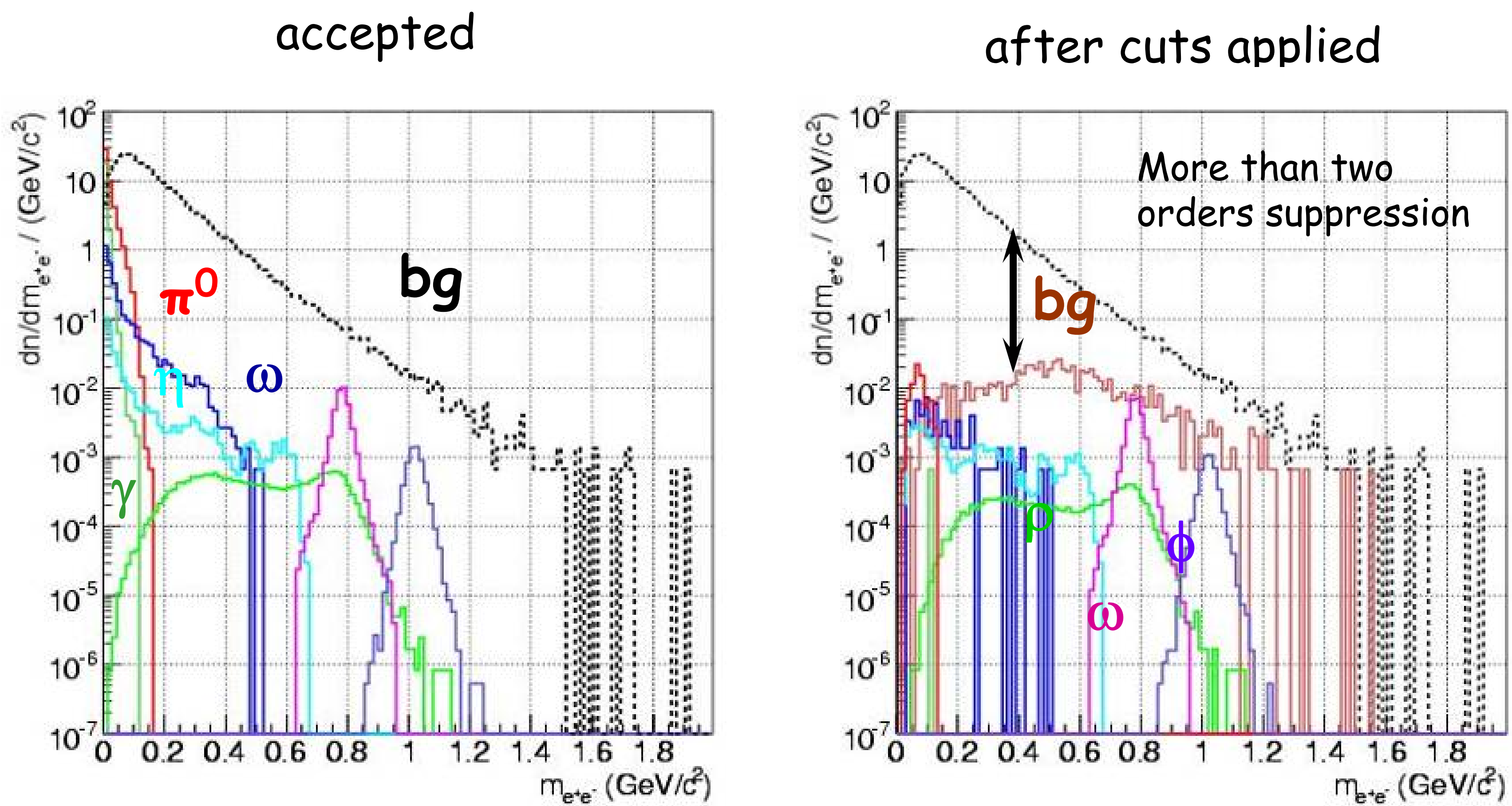
$\pi^0 \rightarrow \gamma e^+ e^-$

$\gamma \rightarrow e^+ e^-$

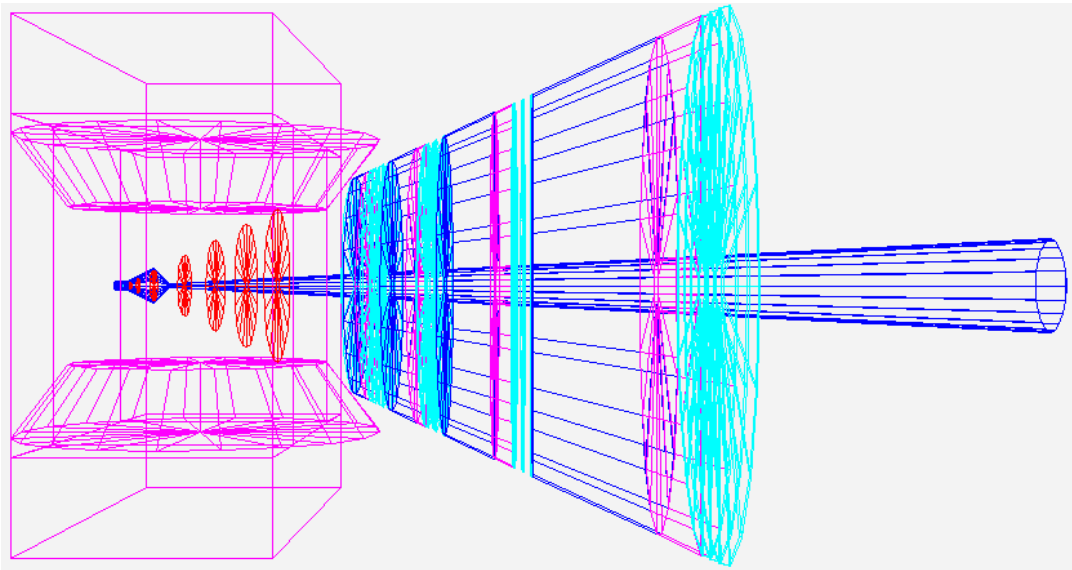


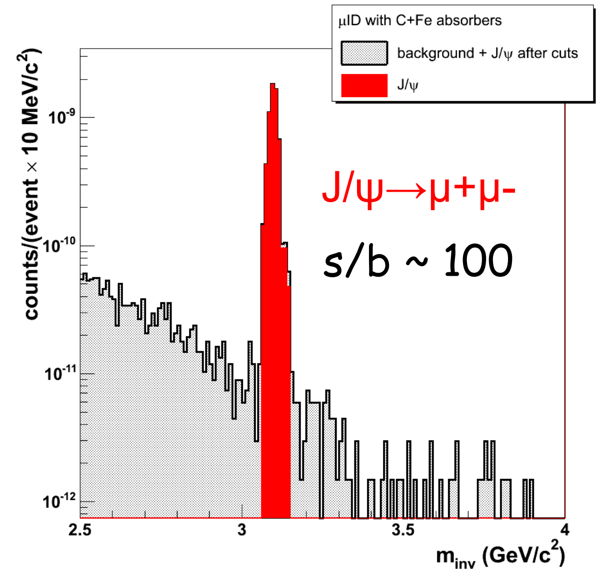
Background rejection performance

- Au+Au 25 AGeV, central collisions
- Signal mixed into UrQMD events



The muon option in CBM

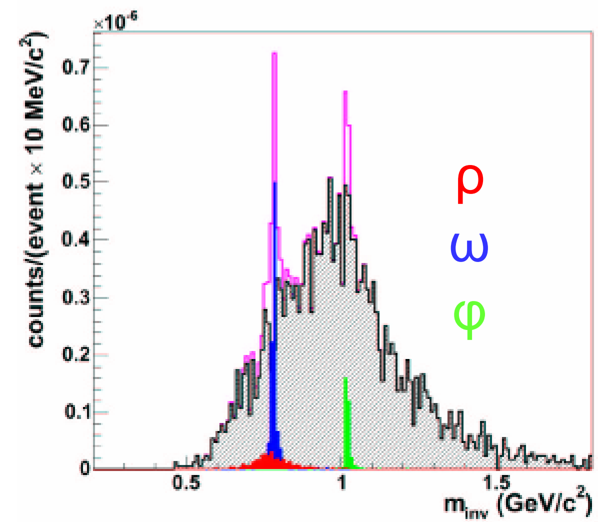




Simulations Au+Au 25 *AGeV*:

- ☺ Excellent signal to background ratio in high mass region.
- ☹ Low efficiency for small invariant masses and/or low p_t (enhancement region).

Challenging muon detector (high particle densities)



Challenges for next generation experiments

- **Improve characterization**
  - Double differential (e.g. inv. mass, p_t)
  - Centrality dependence
- **Reduce uncertainties**
  - Statistical errors
    - Fast detectors and DAQ
    - Develop a trigger (not always easy, excellent detectors needed)
  - Systematical errors
    - Control combinatorial background (good background rejection)
    - Fully understand efficiencies of detectors, track reconstruction, rejection cuts
- **Open questions**
  - What precision is really needed to distinguish between scenarios?
  - Can one control uncertainties due to missing information about the fireball evolution?