Discussion em probes

ECT*, Friday, July 25, 2025

“Background” sources

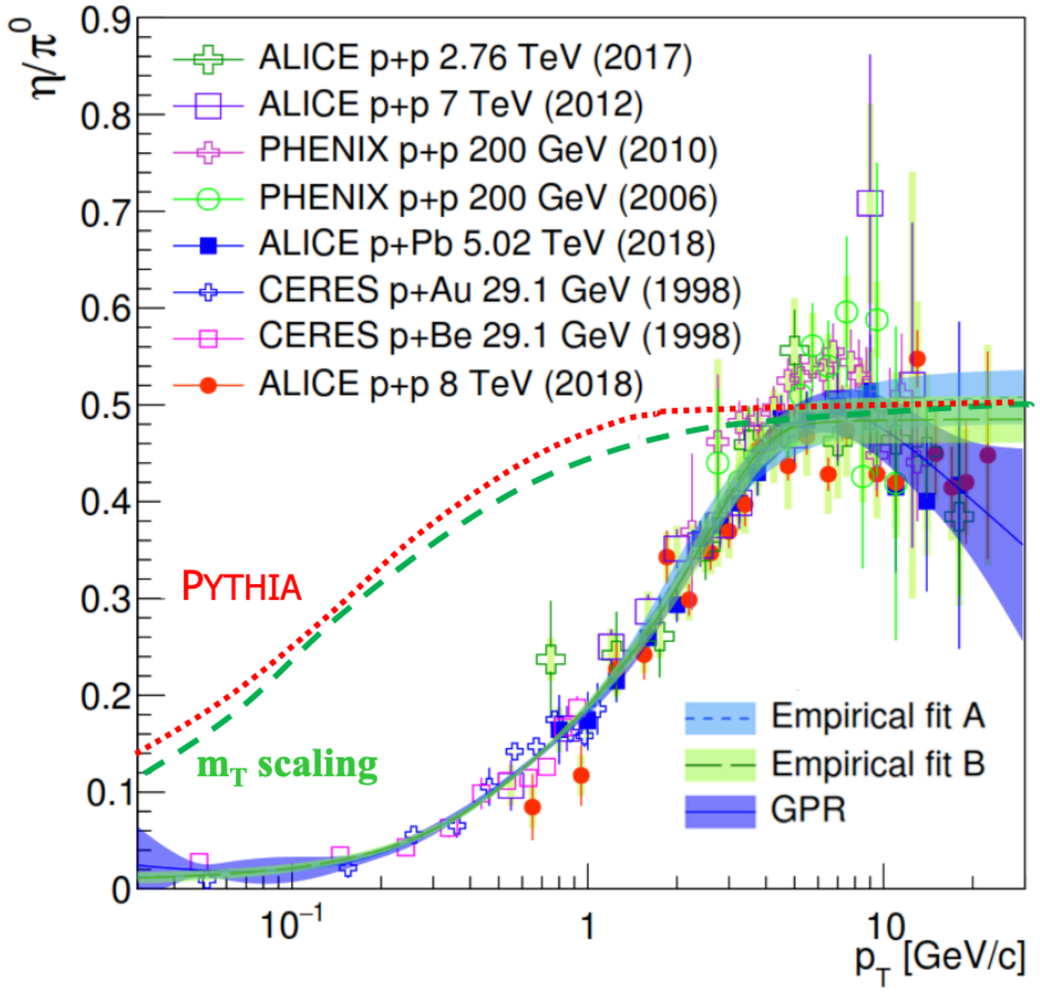
- Constraining non-equilibrium radiation at low energies
  - Partonic theory with HTL. How far down can this be applied. State of the art “KoMPoST”
  - “Pion DY”
- Radiative hadronization - what exactly is that?
  - Can there be a substantial contribution to the total?
- Can we constrain the cocktail precise enough in multi-differential analyses?
  - Details about the eta/pi ration a.f.o. p_T and consequences for direct photon puzzle
  - PYTHIA tunes for low energy?

“New” observables

- Electric conductivity:
  - Characteristics of the transport peak near $\omega \to 0$
  - What are the prospects for true conductivity measurements
  - Do we need to worry about Low’s theorem?
- Polarisation:
  - Importance for disentangling sources
  - Polarisation in non-equilibrium processes

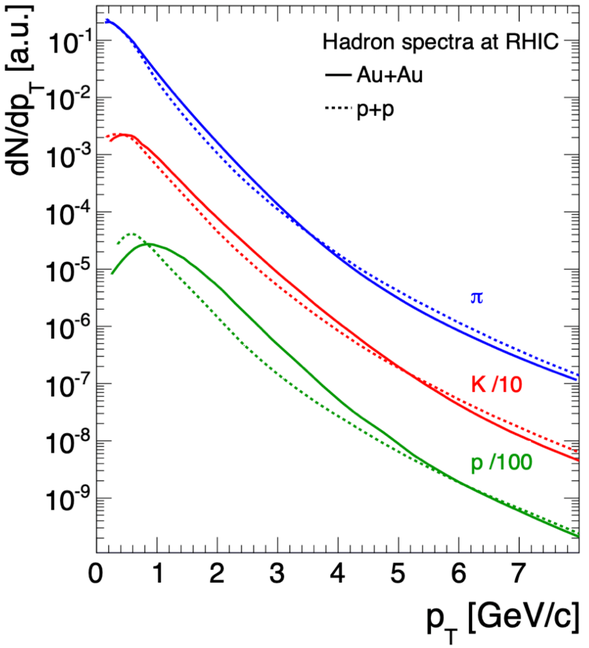
“Background” sources

Details about the eta/pi ration a.f.o. p_T



- Effect of radial expansion not sufficient to explain the observed shape
- Test with proxy charge kaons and pions
- Which PYTHIA tunes are used in micr. transport codes and above which $\sqrt{s_{NN}}$

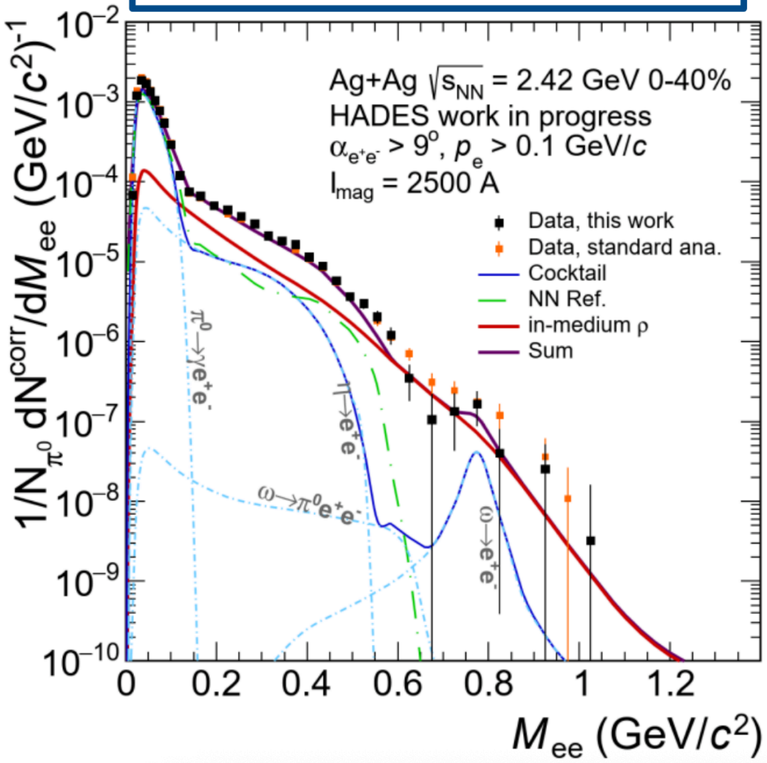
Y. Ren, A. Drees, arXiv:2102.05220v1



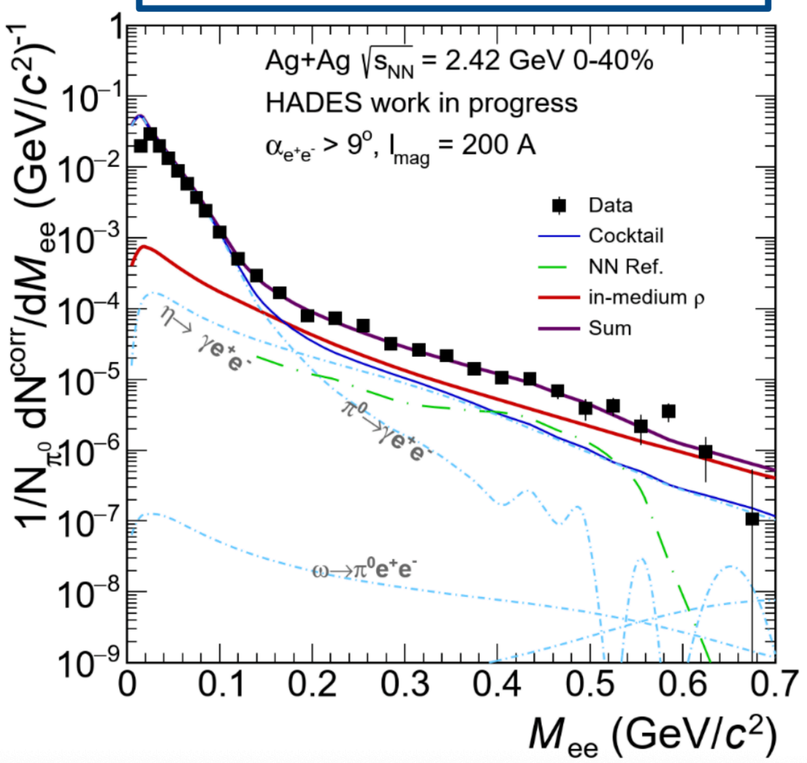
Electric conductivity

What are the prospects for true conductivity measurements

Standard analysis:
70% B-field & momentum cut



Dedicated analysis:
5% B-field & no momentum cut

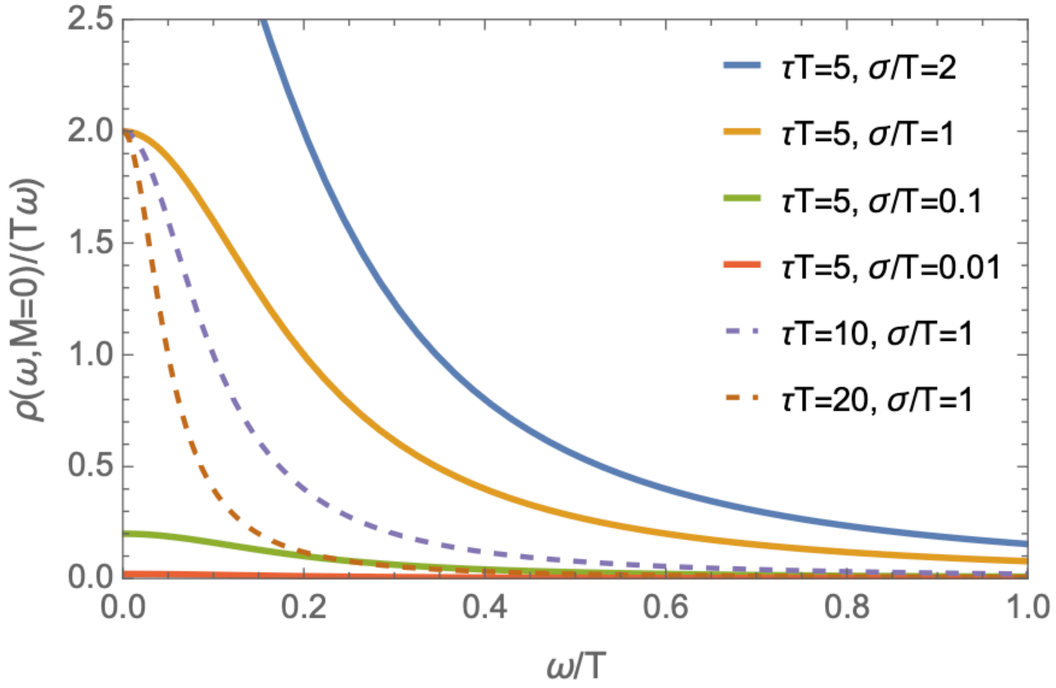


- Test run with reduced field (I = 200 A)

Electric conductivity

Characteristics of the transport peak

- What is the behaviour of the transport peak near $\omega \to 0$



From Stefan Floerchinger's slide

- from equations of motion we find the spectral function

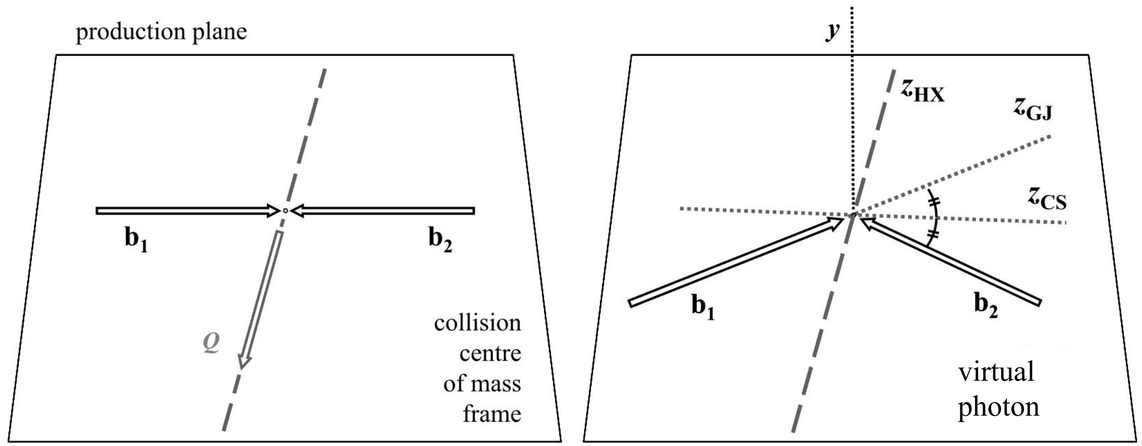
$$\rho(\omega, \mathbf{p}) = \frac{\sigma\omega(\omega^2 - \mathbf{p}^2)}{(\tau\omega^2 - D\mathbf{p}^2)^2 + \omega^2} + 2\frac{\sigma\omega}{\tau^2\omega^2 + 1}.$$

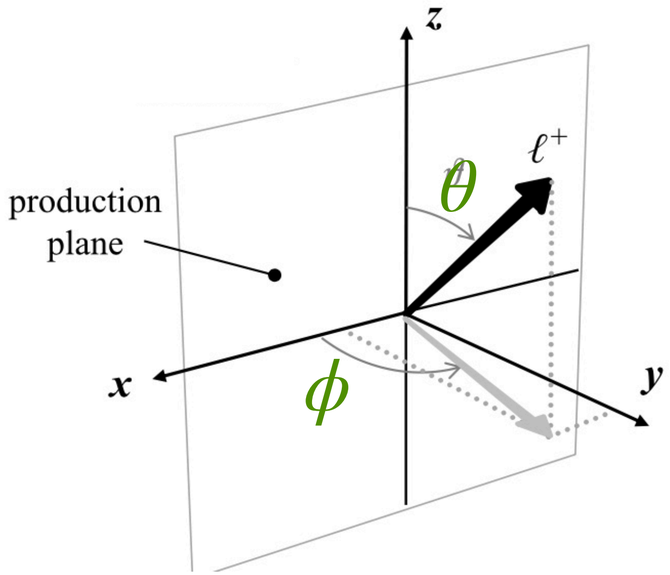
- height of peak proportional to conductivity
- decay governed by width $\sim 1/\tau$

Polarisation

Definitions

$$\frac{dN}{d^4K d\Omega_\ell} \propto 1 + \lambda_\theta \cos^2\theta_\ell + \lambda_\phi \sin^2\theta_\ell \cos 2\phi_\ell + \lambda_{\theta\phi} \sin 2\theta_\ell \cos\theta_\ell + \lambda_\phi^\perp \sin^2\theta_\ell \sin 2\phi_\ell + \lambda_\theta^\perp \phi \sin 2\theta_\ell \sin\phi_\ell$$





P. Faccioli et al., Eur. Phys. J. C (2010)

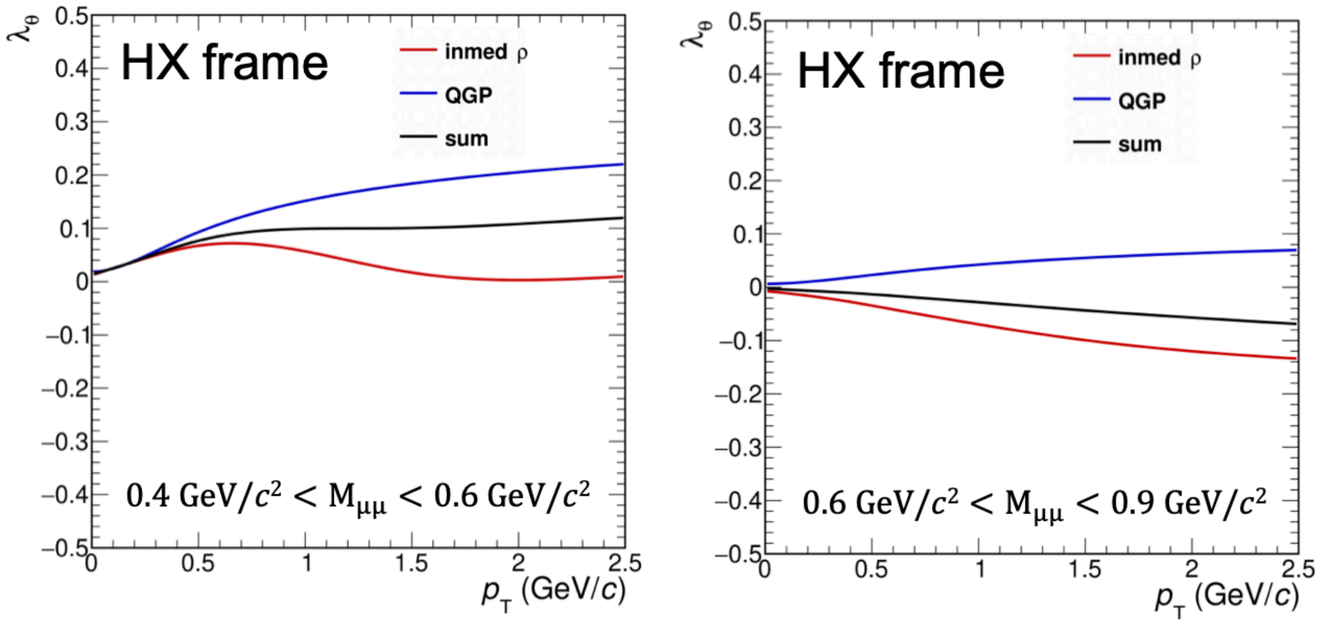
Polarisation

Importance for disentangling sources

- Compare the QGP contributions
- Pre-eq. contribution

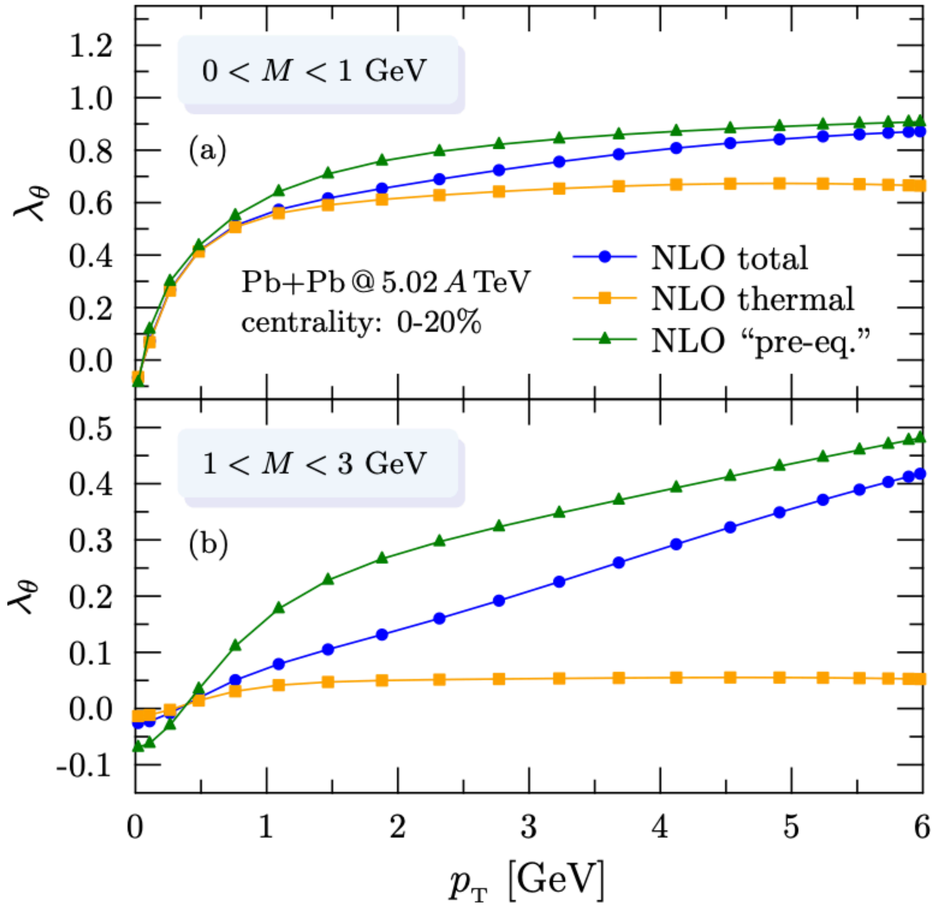
Au + Au $\sqrt{s_{\mathrm{NN}}} = 4.9$ GeV

F. Seck



(QCD@NLO)

Pb + Pb $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV



Polarisation

Feasibility at low energies

- HADES momentum kick at full field (2500 A)

ϑ [deg]	25	45	60	80
Δp_t [MeV/c]	103	70	62	50
200 A	8.2	5.6	5.0	4.0