Low mass dileptons
What for?

- Chiral symmetry??
- DCC
- some speculation

Current-Current Correlators

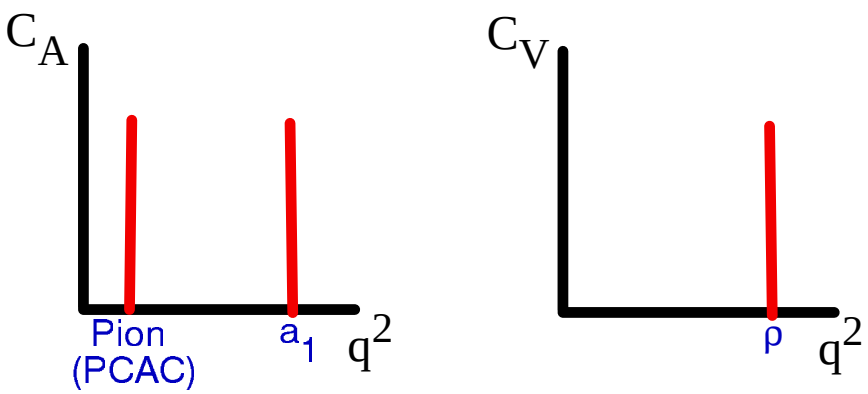
(axial current) $A_\mu \Leftrightarrow V_\mu$ (vector current)

chiral symmetry

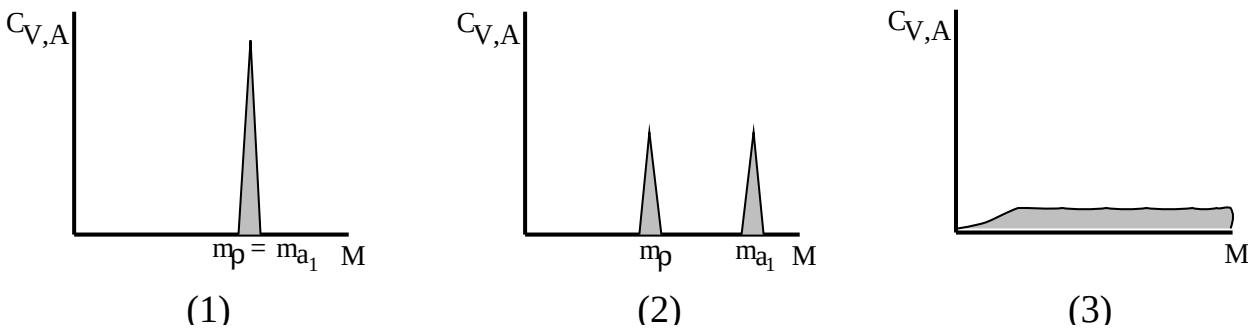
$$C_A \equiv \langle A_\mu A_\nu \rangle = \langle V_\mu V_\nu \rangle \equiv C_A$$

In the vacuum however:

$$\langle A_\mu A_\nu \rangle \neq \langle V_\mu V_\nu \rangle$$



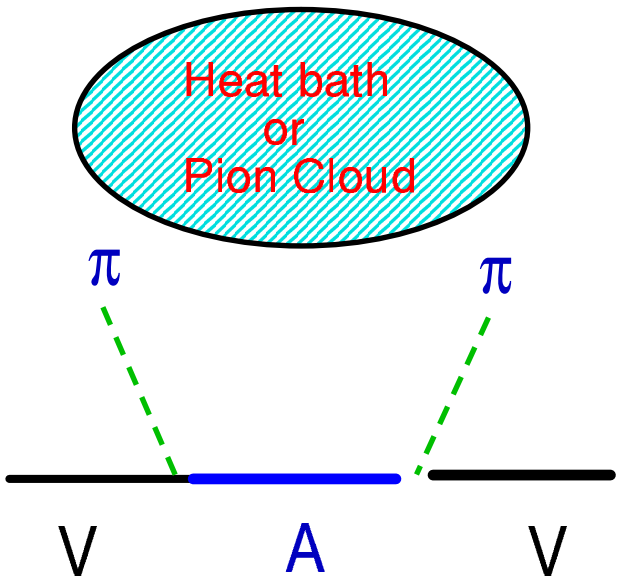
For $T > T_c$



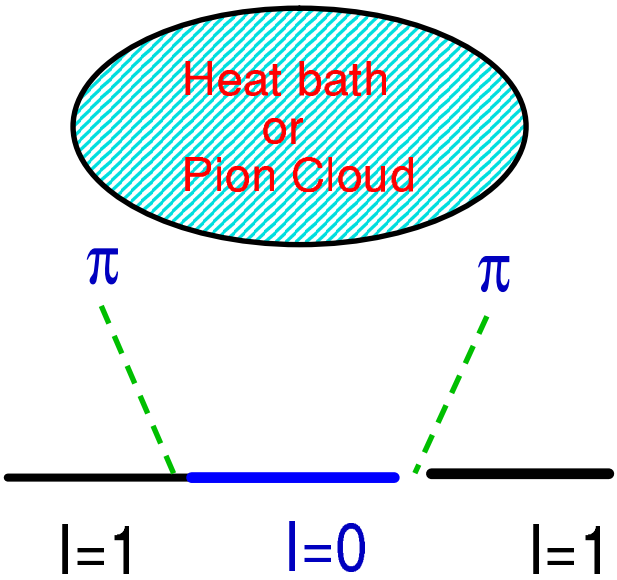
(1) (2) (3)

Mixing

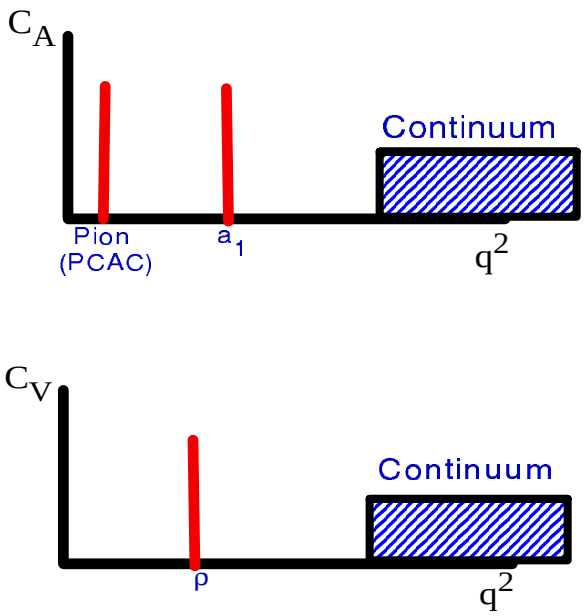
Dominant mechanism
at low T and ρ

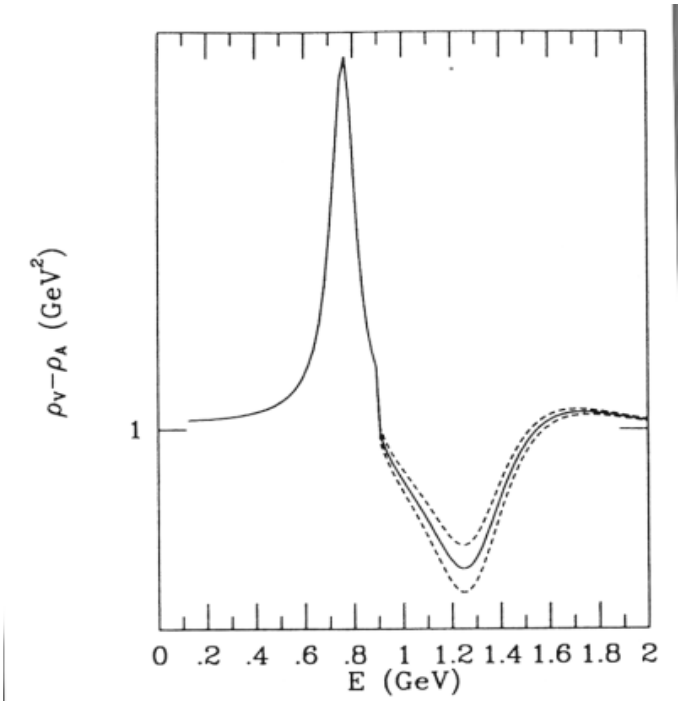


However: Also mixing between
Isovector and Isoscalar



Mass Scale





From:
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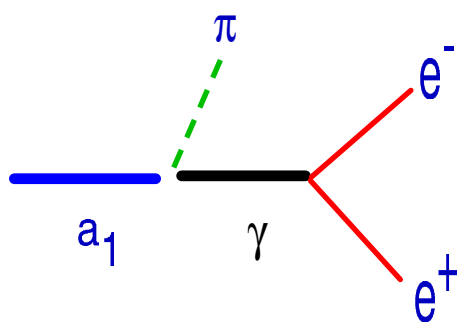
PRD49,(94) 4694

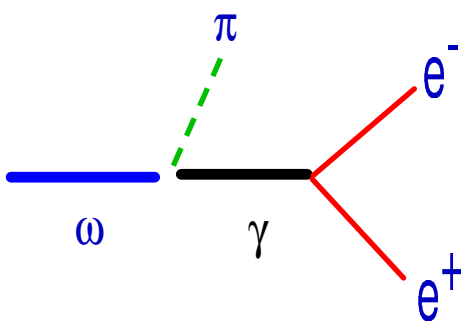
Chiral Symmetry breaking affects
Masses below ~ 1.5 GeV

Chiral Symmetry breaking is a soft phenomenon

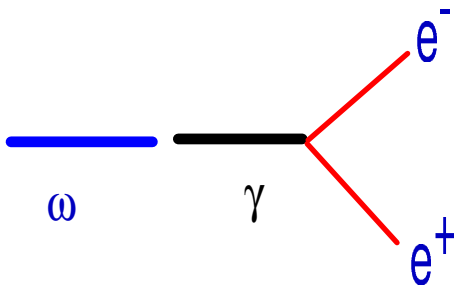
Production Channels and Mixing



A_1-Dalitz
leads to V-A- mixing
Good!



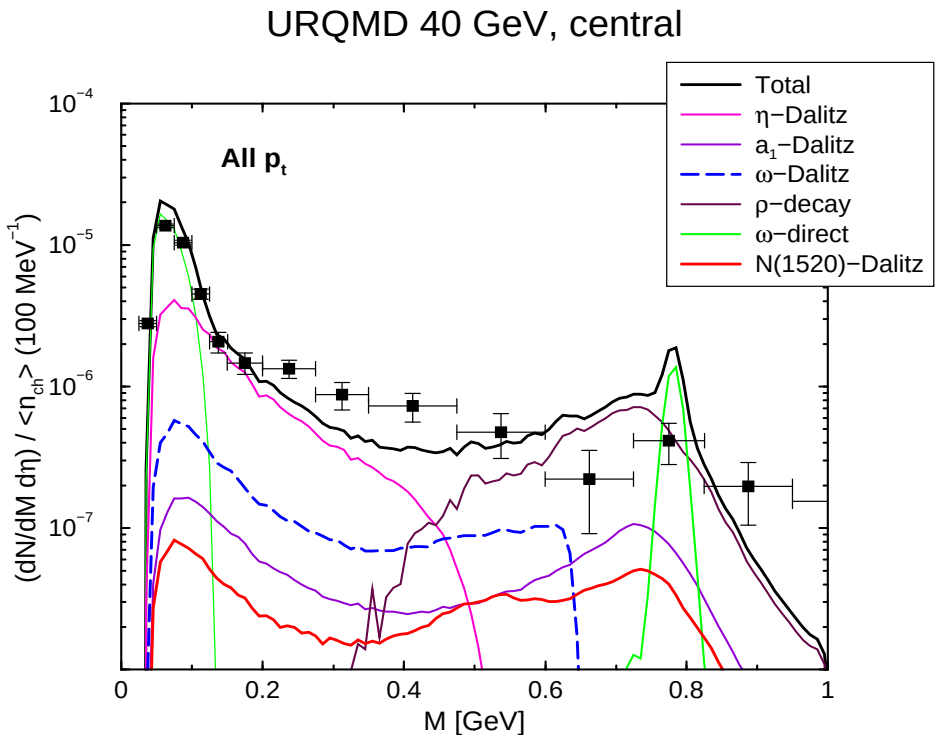
ω–Dalitz
leads to (I=0) - (I=1) - mixing
Not so Good!



ω–direct decay
leads to (I=0) - channel !
Not so Good!

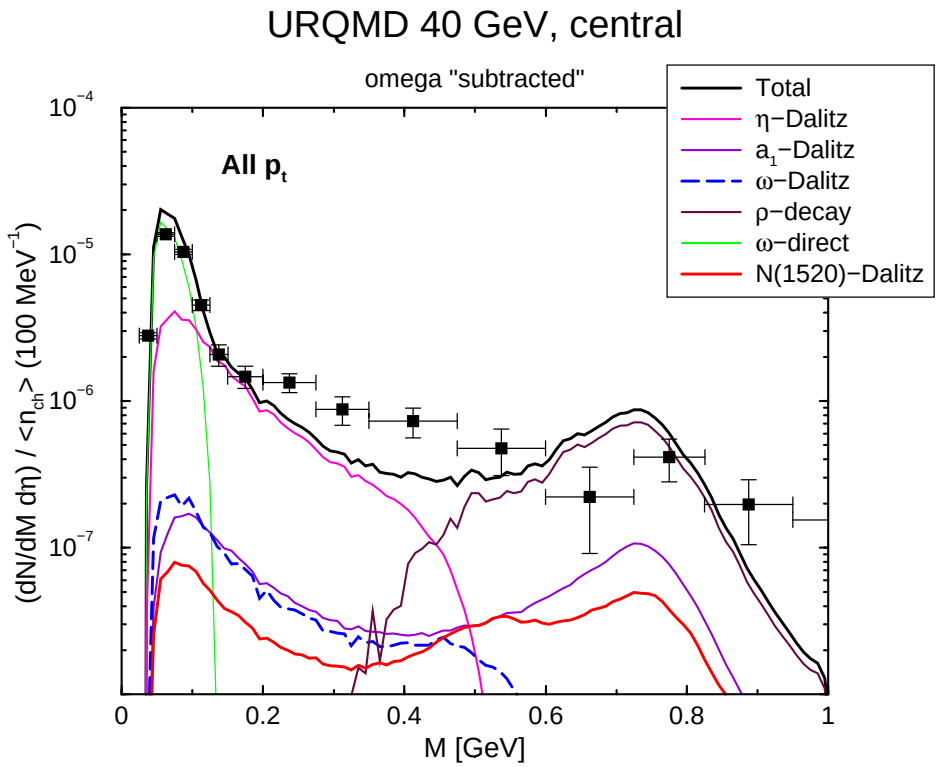
Low energy Prediction using URQMD

all p_t

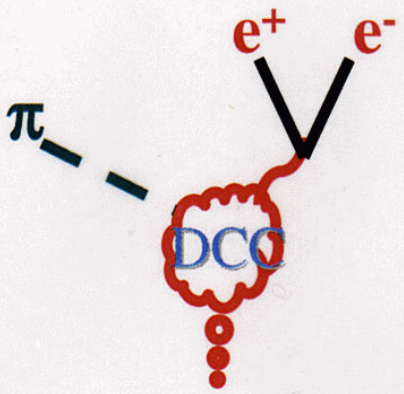


Data: CERES '96, Pb+Au 156 GeV for reference

all accepted omegas subtracted



What should we expect ?

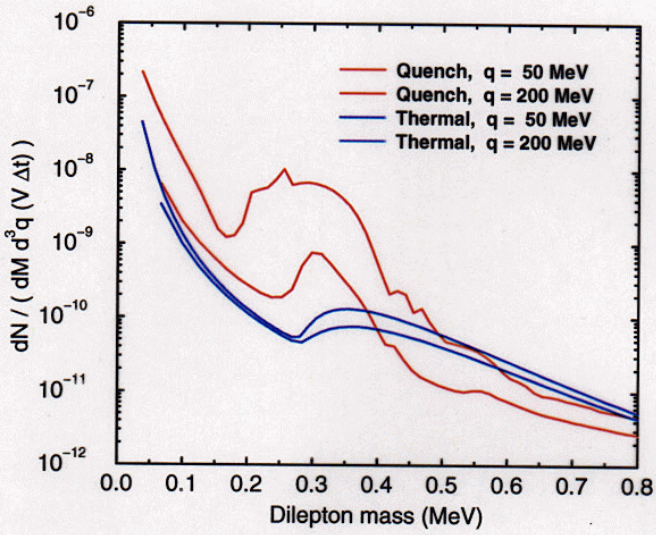


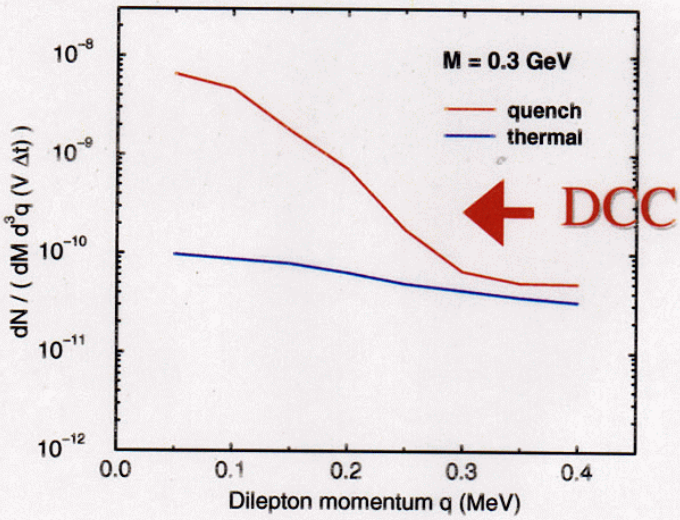
DCC ≡ enhancement of
low momentum modes

- Pion phase space density is enhanced in a narrow region
- this should be reflected in the dilepton spectrum

⇒ enhancement: $M \sim 2\, m_\pi$, small p_t

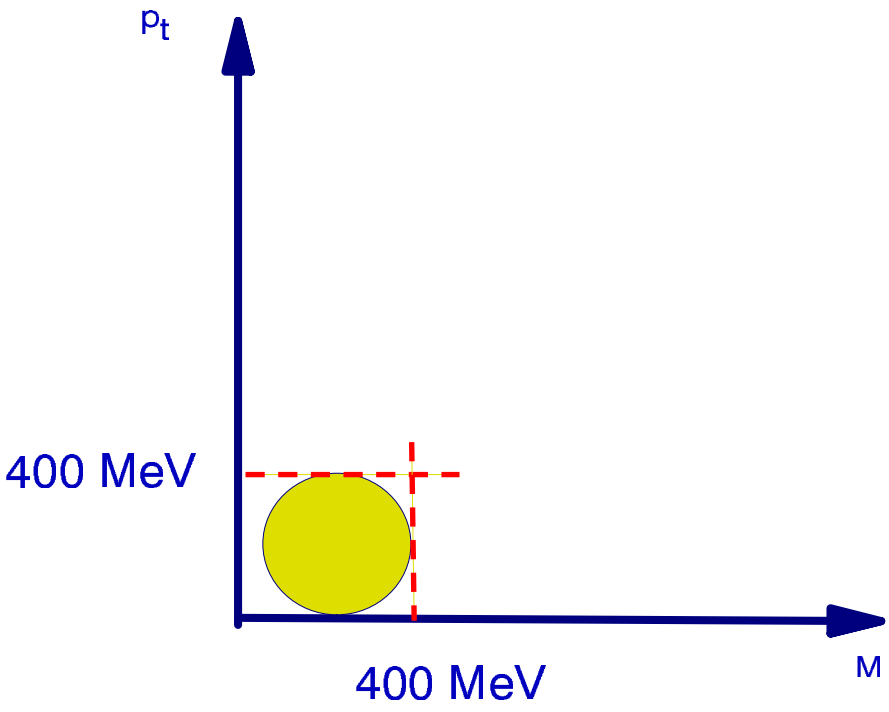
Results for mean field calculation



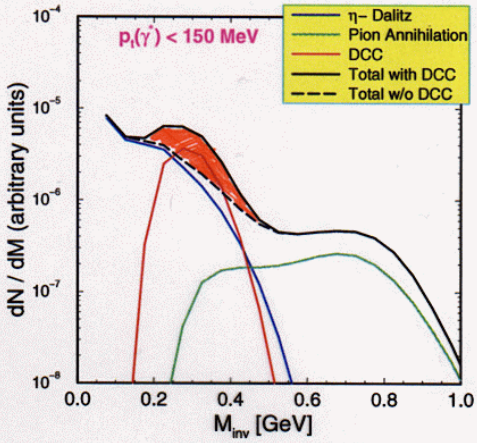


DCC
Dileptons

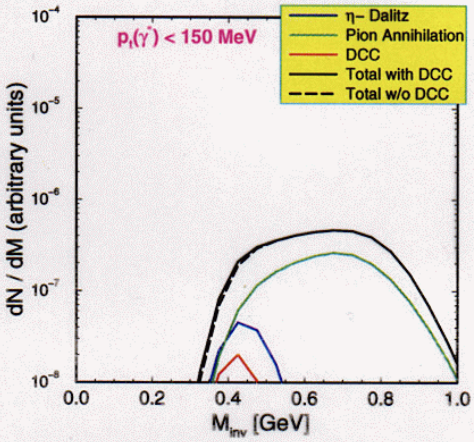
The experimental challenge



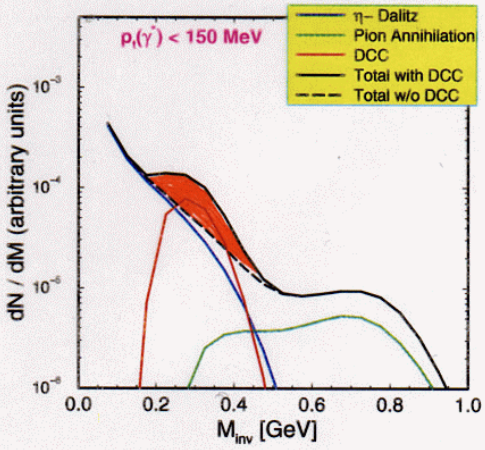
No acceptance cuts



CERES acceptance cuts
p_t (e^+) > 200 MeV
p_t (e^-) > 200 MeV
Phenix similar cuts
("hardware")



"NEW" acceptance cuts
p_t (e^+) > 60 MeV
p_t (e^-) > 60 MeV



Charge Fluctuations

Quark Gluon Plasma:

$$C_Q \equiv \frac{<(\delta Q)^2>}{S} = \frac{Q_u^2 N_u + Q_d^2 N_d}{4(\ N_u + N_d + N_g\ )} \quad = 0.04$$

Pion Gas:

$$C_Q \equiv \frac{<(\delta Q)^2>}{S} = \frac{1^2 <N_{\pi^-}> + 1^2 <N_{\pi^+}>}{4\ (\ <N_{\pi^+}> + <N_{\pi^-}> + <N_{\pi^+}>)} \quad = 0.15$$

$$\boxed{\frac{C_Q(QGP)}{C_Q(Pion\ Gas)} \cong \frac{1}{4}}$$

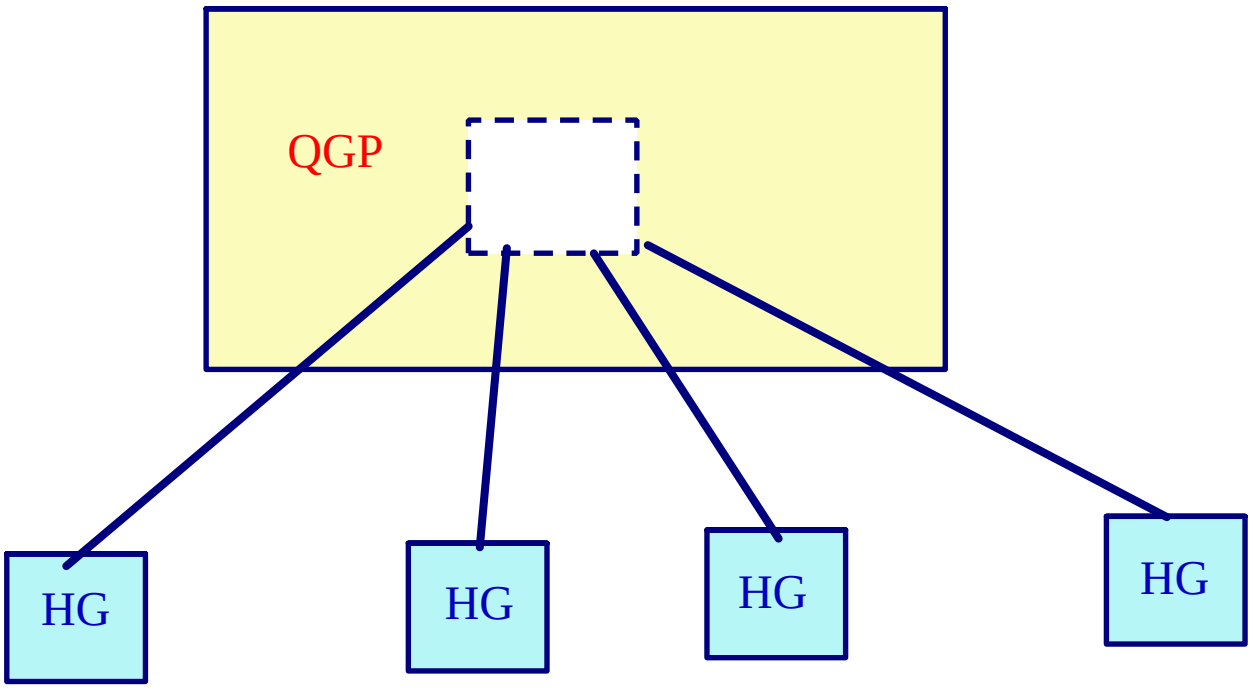
Extreme hadron gas: Hagedorn with $S_{Hagedorn} = S_{QGP}$

$$\boxed{\frac{C_Q(QGP)}{C_Q(Hagedorn)} \cong \frac{1}{2}}$$

Now what????

How does that system hadronize????

Gedanken-Experiment



Problem: Ensemble of HG-boxes should carry the same fluctuations per (entropy/energy) as QGP.
THIS is not a HG in chemical equilibrium

Do no want to violate Isospin symmetry

$\Rightarrow$

Enhance I=0 mesons, such as omega, eta ...

Simple estimate: ω up by factor ~5 $\Rightarrow$ PHENIX

Same factors for eta and Phi

Another way to look at this

What would one see in the final state?

Assume no rescattering in hadronic phase.

$$\langle Q^2 \rangle = \langle (N_+ - N_-)^2 \rangle = \langle (N^+)^2 \rangle + \langle (N^-)^2 \rangle - 2 \langle N^+ N^- \rangle$$

Resonances

Cavetas

In principle the system could also decide to produce as many π^+ as π^-

Unlikely !?

System needs to be isolated during hadronization

$\Longrightarrow$ Strong logitunial flow