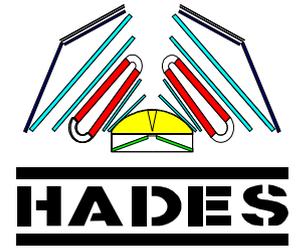
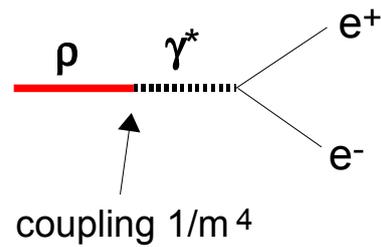
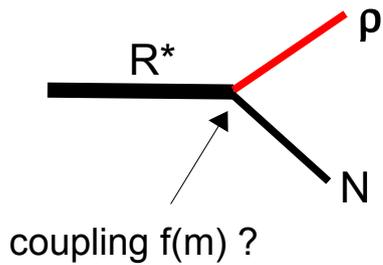


**The electromagnetic decay of low-mass rho's:
Questions to the experts by a confused experimentalist
Wolfgang Koenig, 12. August 2011**



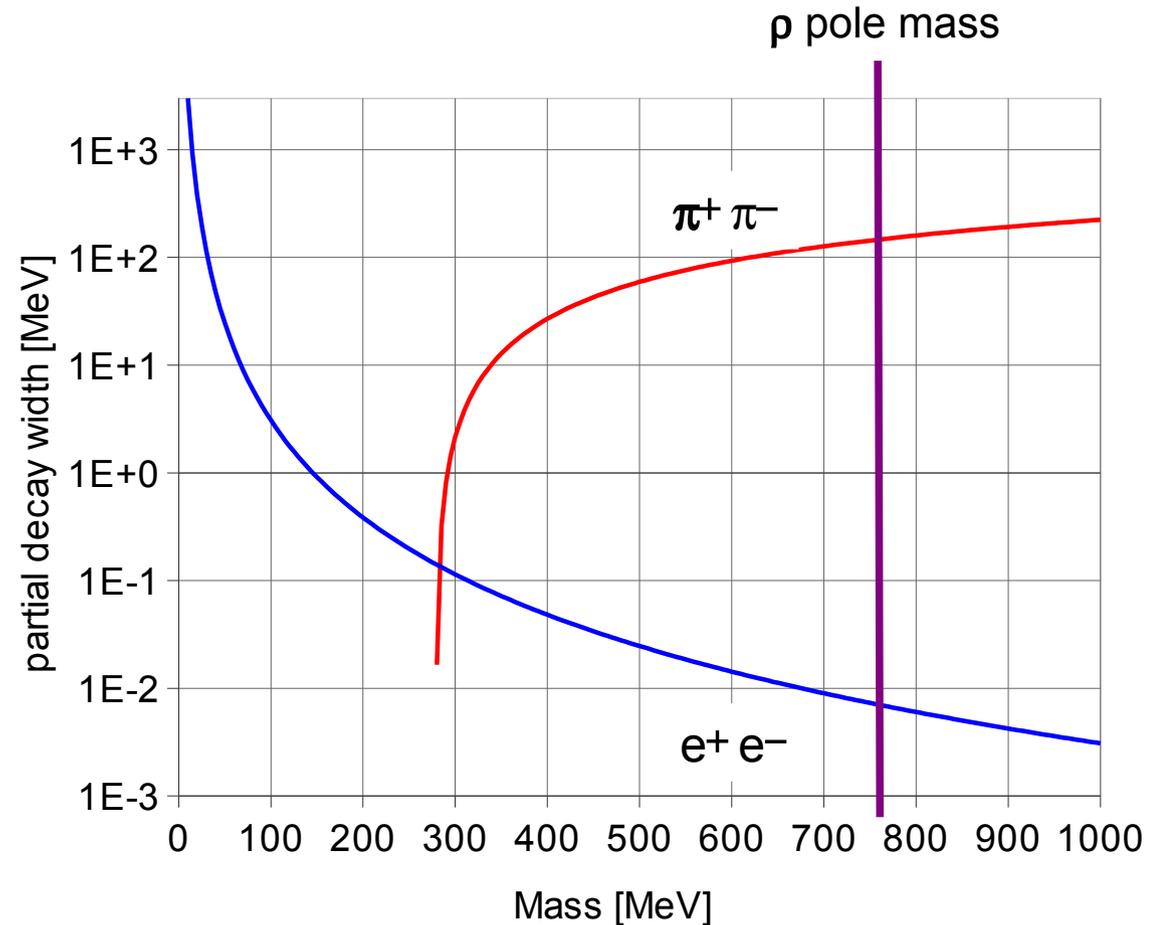
Mini menu:

- Explosion of the electromagnetic decay strength at low masses ?
- Double counting of different decay schemes or not ?
- I do not like N*1535 (regarding ρ , in agreement with PDG)

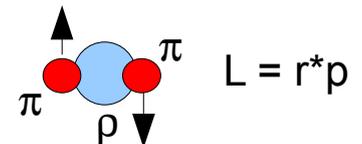


ρ has the quantum numbers of a γ but has mass (about $2 * \text{constituent quark mass}$)
Ideal 'mediator' between resonances and electromagnetic di-lepton decay (VDM)

- Coupling to resonances below $m_\rho = 2 * m_\pi$ kinematically allowed (no threshold).
- At low mass electromagnetic decay width exceeds pion decay width ?
- If ρ gets more and more γ like (low mass) what happens to the strong coupling to resonances ? Reduced correspondingly ?
- Extended vector dominance model reduces electromagnetic coupling at low masses but it is still huge¹⁾.
- Can we learn about in medium ρ via time reversal $\rho + N \rightarrow R^* + N^{-1}$?



$$\Gamma_{\pi\pi} \propto p_\pi^3 / (p_\pi^2 + (\hbar \cdot c / 1 \text{ fm})^2), \text{ Manley for } L=1$$



1) Electromagnetic transition form factors and dilepton decay rates of nucleon resonances. M.I. Krivoruchenko, B.V. Martemyanova, Amand Faessler, C. Fuchs

Double counting of ρ 's

- Dalitz decay of resonances
- Resonance decay via ρ (real or VDM)
- Direct ρ 's

What is a direct ρ ?

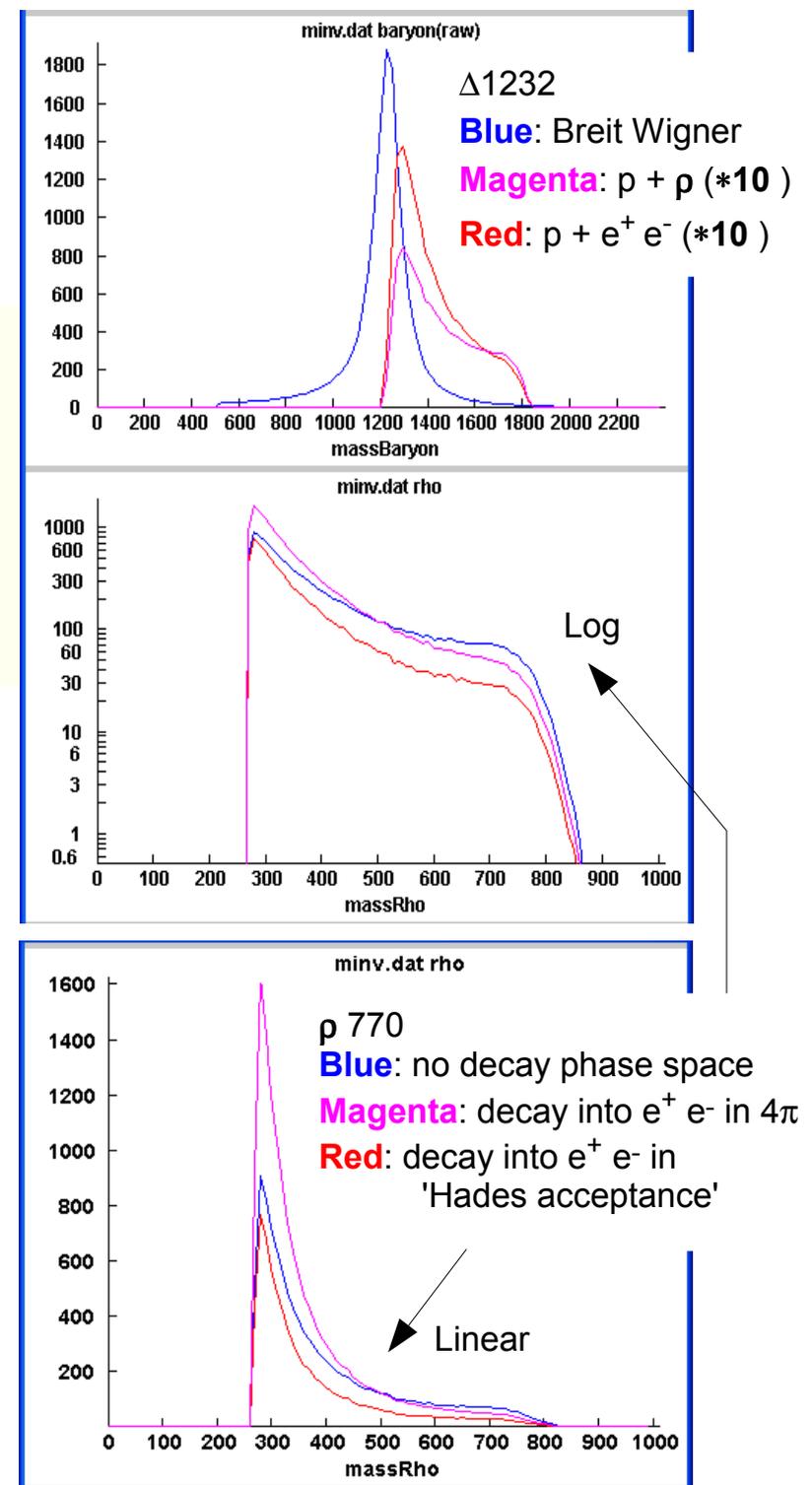
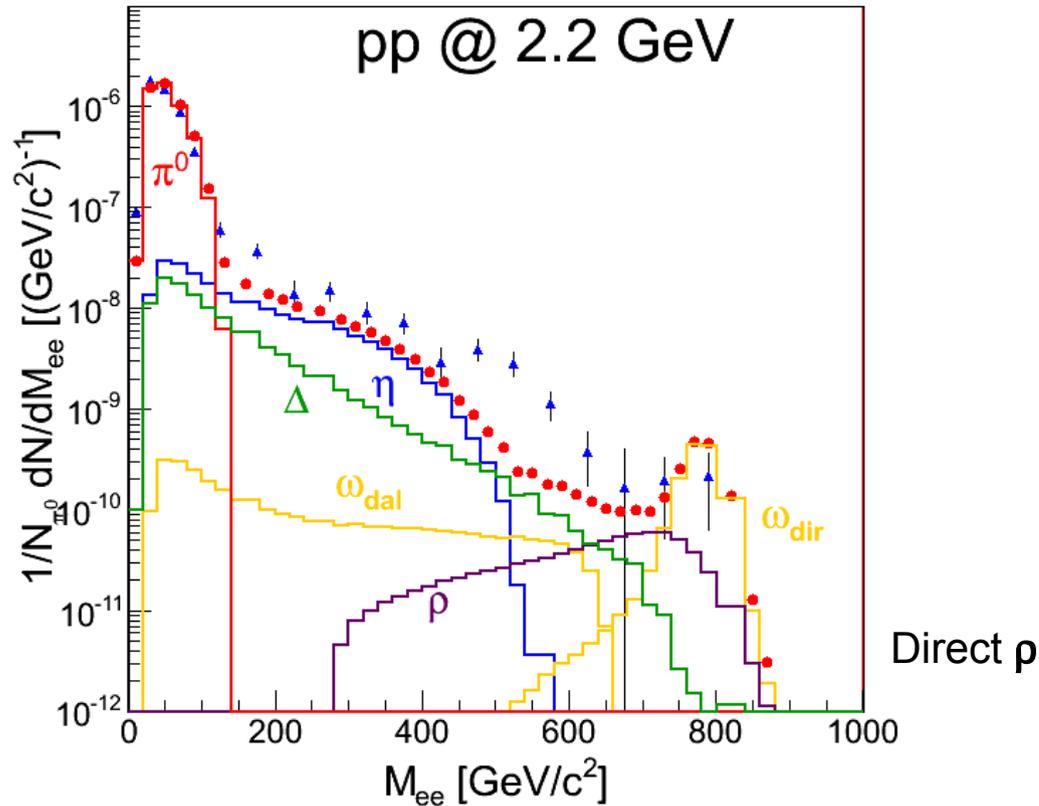
A strongly deformed $\pi^+\pi^-$ invariant mass distribution (wrong peak position, if any; no Breit Wigner shape) will not be recognized as a ρ .

Resonance decay differ from direct decays by ρ shape

(folding of resonance shape with rho shape)

Can a VDM ρ decay into $\pi^+\pi^-$?

Dalitz decay is replaced by VDM ?



Last question + Summary

N*1520 versus N*1535

PDG decays:

$\pi\pi$: 40-50% 1-10%

ρ : 15-25% < 4%

η : 0.2% 45-60%

Why is N*1535 considered relevant ?

Summary using p + p 2.2 GeV as example:

N*1520 via ρ should be extended below $2m_\pi$
(like Dalitz decay)

Including VDM in Dalitz: double counting ?

Get rid of N*1535 ?

Get rid of direct ρ (Somebody knows what it is ?)

Tune η (< 2* exclusive η)



Enjoy the result

p + p 2.2 GeV: all sources (double counting)

