

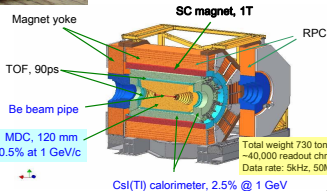
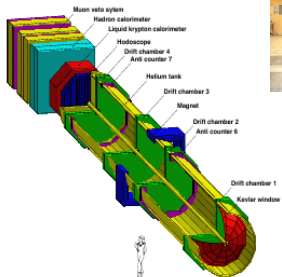
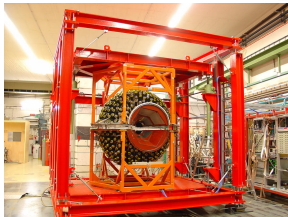
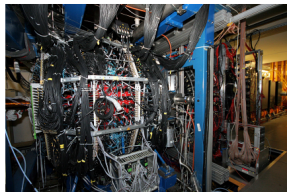
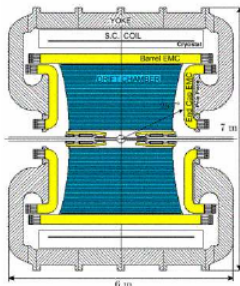
# Experimental Summary

Michael Ostrick, Stefan Scherer, Wolfgang Gradl



Workshop on  
Light Meson dynamics  
12<sup>th</sup> February 2014

# Experiments

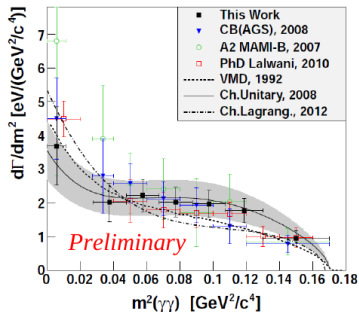
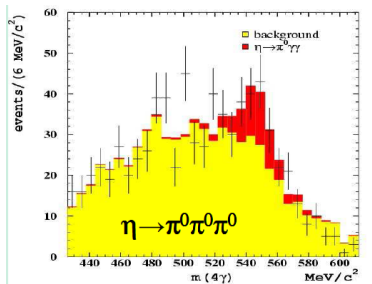


# Meson production, environment

- Different production mechanisms for  $\pi^0$ ,  $\eta$ ,  $\eta'$ :  
 $e^+e^-$ ,  $\gamma\gamma$ , decays of  $K$ ,  $\phi$  and  $J/\psi$ ,  $p\rho$ ,  $pA$
- Very different background conditions
- Very large data samples in hand now, or in near future  
 $\mathcal{O}(10^6 \dots 10^8)$  mesons produced  
 $\mathcal{O}(10^3 \dots 10^4)$  signal decays
  - ▶ for precision measurements of decay dynamics (Dalitz plots) and transition form factors
  - ▶ to study ChPT (box anomaly,  $\mathcal{O}(p^6)$  contributions ...)
  - ▶ to search for very rare and ultrarare decays  
(e.g. NA60: expect  $10^{13}$   $K^+$ ,  $2.5 \times 10^{12}$  tagged  $\pi^0$ )

# Doubly radiative decay $\eta \rightarrow \pi^0 \gamma \gamma$

“golden mode” to test ChPT:  $\mathcal{O}(p^6)$  expected to dominate  
distinguish between models using  $\Gamma(\eta \rightarrow \pi^0 \gamma \gamma)$  and  $d\Gamma/dm^2(\gamma\gamma)$   
Current statistics: KLOE  $\sim 70$  events (expect 1000 with KLOE-2),  
A2  $\sim 1200$  events



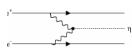
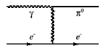
not enough statistics!

# Time-like form factors

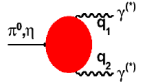
Low energy QCD

$|I\rangle$  spectra for HI

$\pi^0, \eta, \eta', \eta_c \dots \rightarrow \gamma^* \gamma^*$



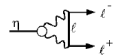
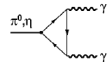
$$\Gamma(P \rightarrow \gamma\gamma)$$



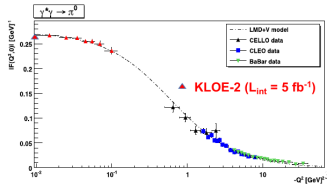
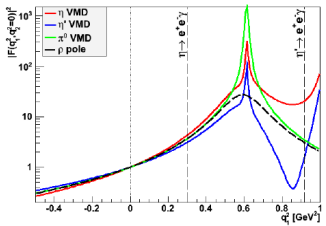
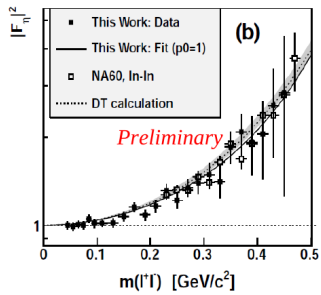
$$F_P(q_1^2, q_2^2)$$



dark photon (U boson)

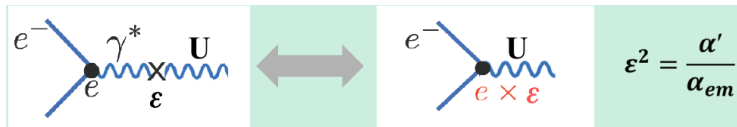


LbL for  $\mu\mu$

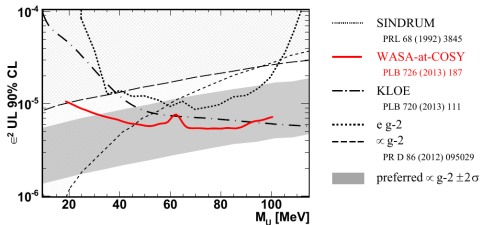
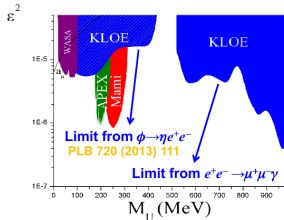


# Search for dark forces

Hidden gauge sector connected to dark matter  
kinetic mixing with  $\gamma$  provides coupling to ordinary matter



Serendipity: Almost accidental use of TFF analyses  
(e.g.  $\phi \rightarrow \eta U \rightarrow \eta e^+e^-$ ,  $\pi^0/\eta \rightarrow \gamma e^+e^-$ ) to look for  $U$   
as peak in  $e^+e^-$  mass



# Summary

- Very active field, both theoretically and experimentally
- Many interesting tests  
still limited by statistics
- Guidance for interpretation and parametrisation
- Brilliant sources of  $\pi^0$ ,  $\eta$ ,  $\eta'$ , ...  
with statistics in the  $10^7 \dots 10^8$  in near future
  
- Very inspiring workshop — thanks to all for making it a success!