Baryon Spectroscopy with Photoproduction of Mesons at MAMI - Mainz
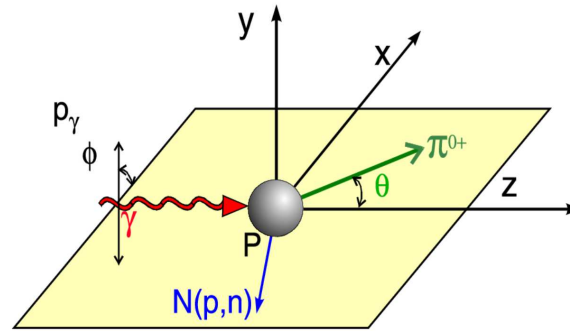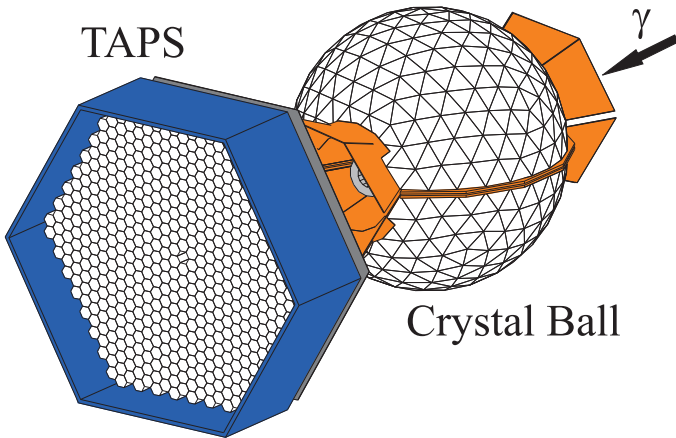
Mainz MAMI accelerator: E<1.6 GeV

Crystal Ball (NaI), TAPS (BaF$_2$) forward wall, inner detectors

linearly and circularly polarized photons

Polarized protons, deuterons, ^{3}He

photon polarization	target polarization			
	-	x	y	z
unpolarized	σ	-	T	-
linearly	Σ	H	-P	-G
circularly	-	F	-	-E

TAPS

Crystal Ball

All combinations of beam and target polarization possible!

$$\frac{d\sigma}{d\Omega} = \frac{d\sigma_0}{d\Omega}\{1 - P_l\mathbf{\Sigma}\cos(2\phi) + P_x\left[-P_l\mathbf{H}\sin(2\phi) + P_c\mathbf{F}\right]$$
$$-P_y\left[-\mathbf{T} + P_l\mathbf{P}\cos(2\phi)\right]$$
$$-P_z\left[-P_l\mathbf{G}\sin(2\phi) + P_c\mathbf{E}\right]\}$$
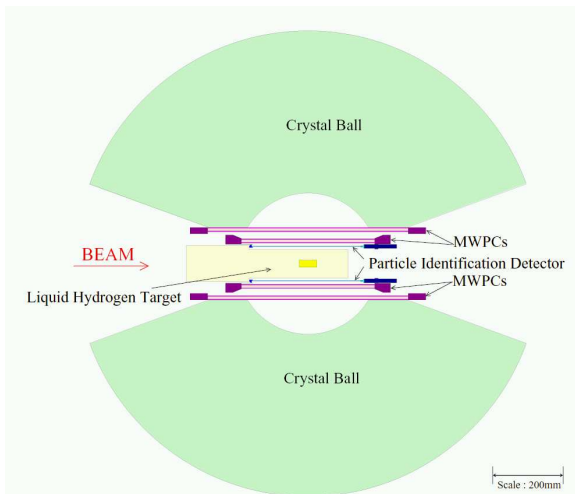
Model independent multipole analysis requires measurement of:

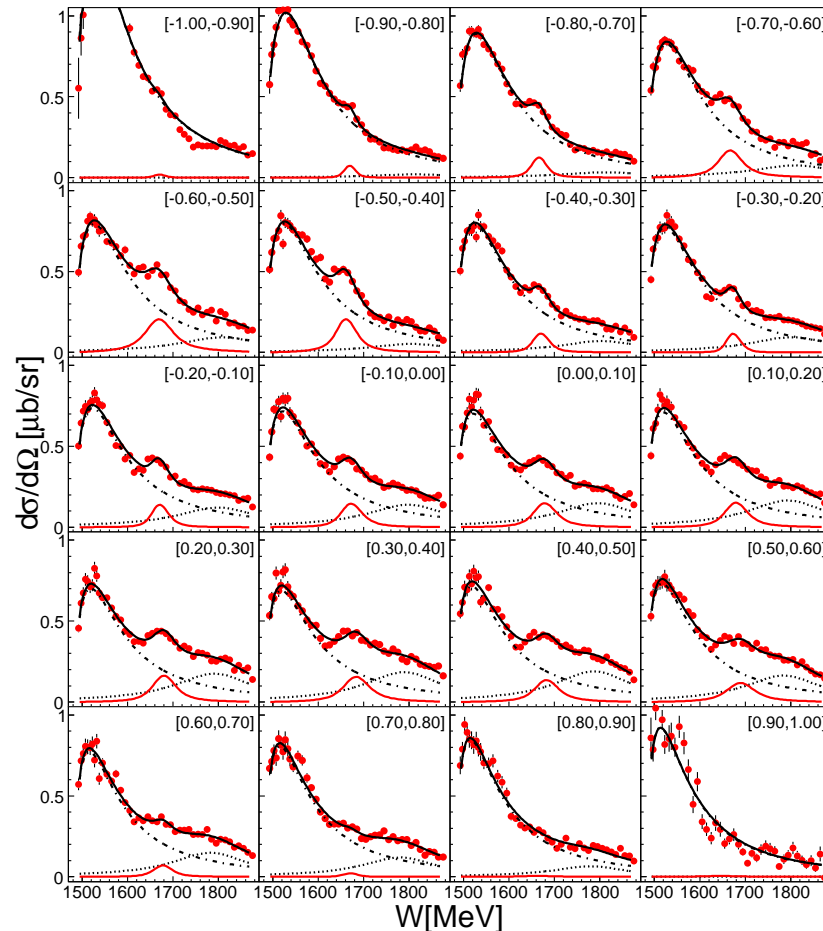**4 single polarization observables (σ, Σ, T, P)**
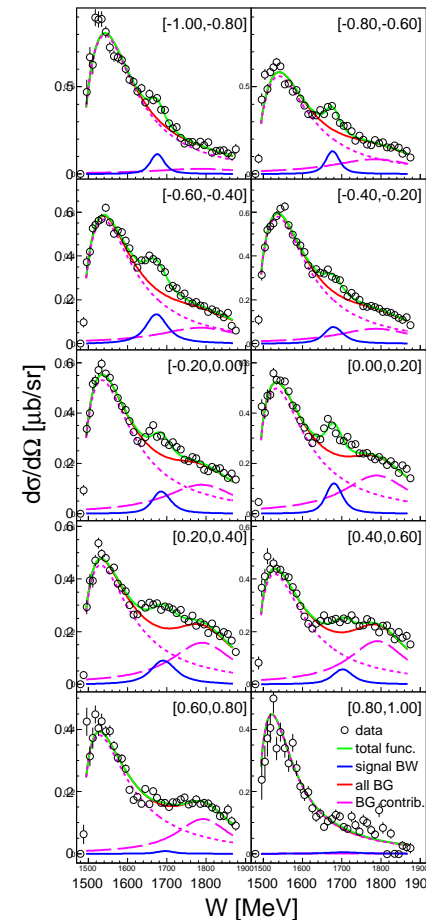
4 carefully chosen double polarization observables

Chiang & Tabakin PRC 55 (1997)

$\gamma n \to n \eta$ - excitations functions for different angular bins

(D. Werthmüller and L. Witthauer et al.)

● **deuteron target**

● ^{3}**He target**

Exploraration of polarization observables (beam, target, recoil) to establish a data base allowing almost model independent analyses.

Investigation of different final states including multi-meson production so that coupled-channel analyses can identify excited states decoupled from dominant decays like π^0 emission to the nucleon ground-state.

Investigation of reactions off quasi-free neutrons to establish also the photocouplings for neutron resonances.

● **analysis of polarization observables E, T, F under way**