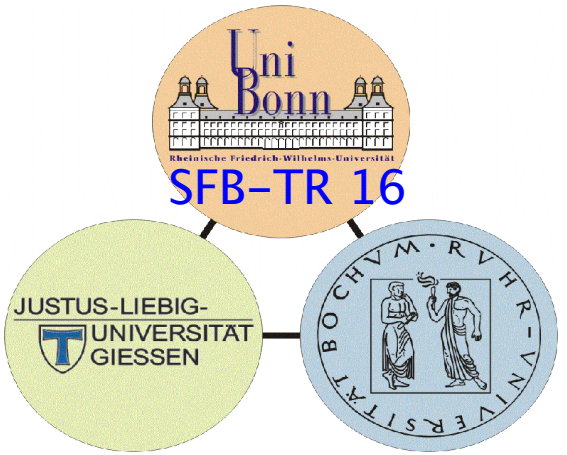
SFB/TR-16
Bommerholz
27. & 28. Nov 2005

Status Teilprojekt B1: Photoproduction of Mesons

spokespersons: **H. Kalinowsky**
H. Schmieden

- overview
- status analysis CB/TAPS data
- status B1 detectors
  - tagger & polarimetry
  - forward spectrometer
  - budget
  - schedule
- summary & outlook



Overview

Analysis of "CB/TAPS" channels

- linear polarisation
- $p(\gamma,\eta)p$ photon asymmetry
- $p(\gamma,\omega)p$ photon asymmetry
- $p(\gamma,K^0)\Sigma^+$ recoil polarisation

(D. Elsner),
R. Ewald,
Frank Klein,
A. Süle

Hardware status

- tagger
- Møller polarimetry
- MOMO / SciFi 2 (tracker A)
- forward spectrometer

B. Bantes,
H. Eberhardt,
K. Fornet-Ponse,
I. Horn,
R. Jahn,
S. Kammer,
V. Kleber,
S. Materne,
A. Ramseger,
(M. Seimetz),
D. Walther

"complete experiment" in p(γ, η)p

$$\gamma + p \rightarrow p + \eta$$

λ	±1	±½	±½	0
	4	x	2	

parity consv. → 4 complex amplitudes

→ 7 observables

→ 8 independent quantities

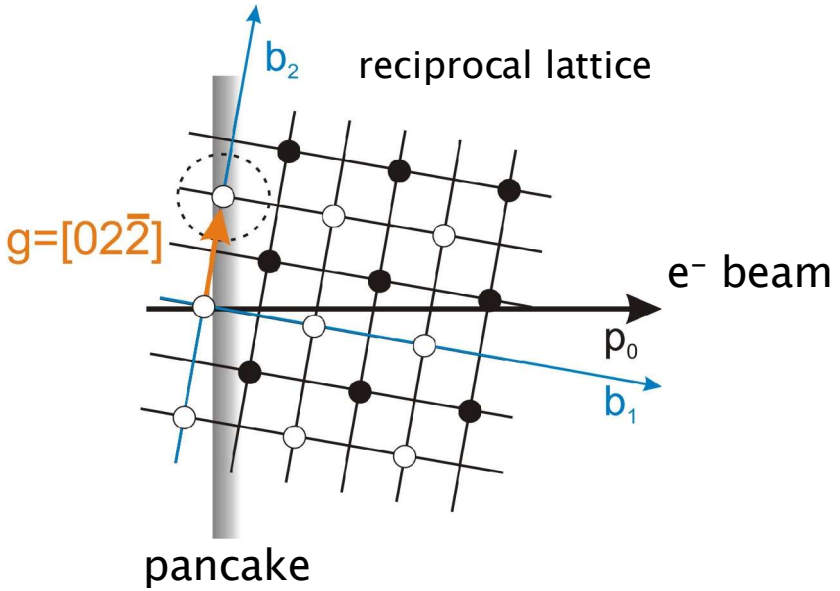
need

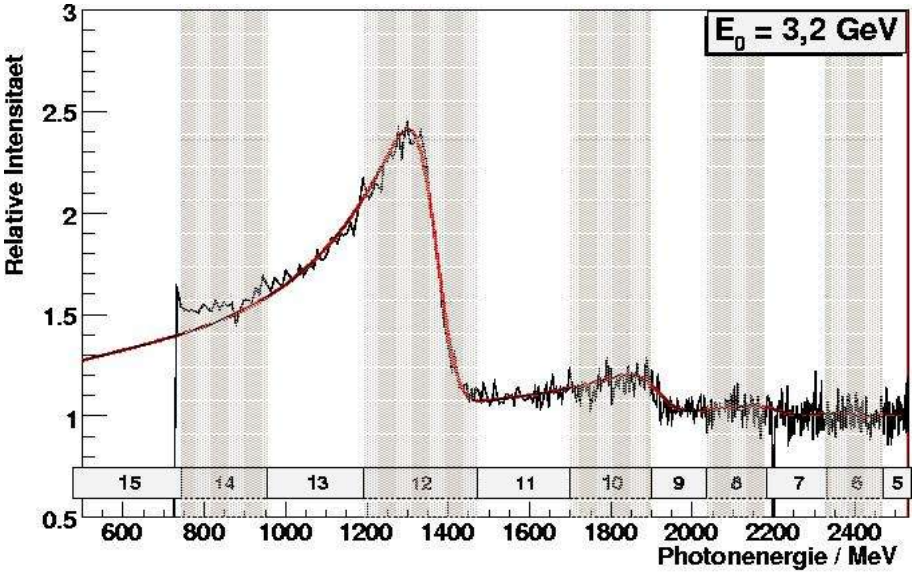
- dσ/dΩ
- Σ photon asymmetry
- T target asymmetry
- P recoil polarisation
- 4 DPO BT/TR/BR

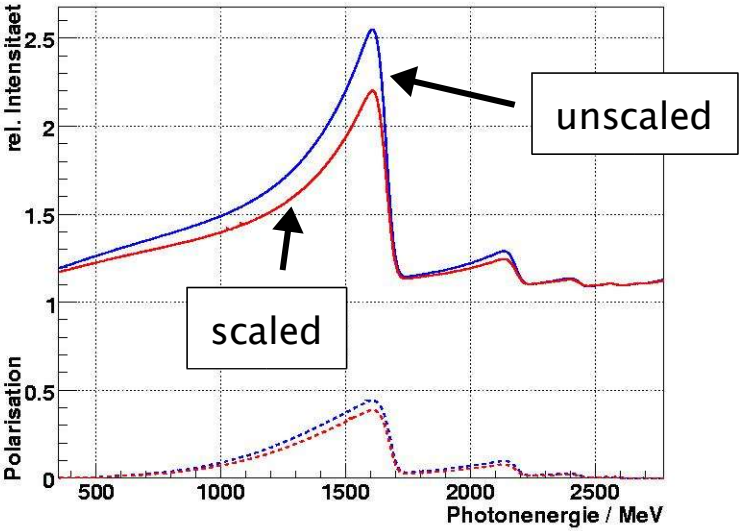
Chiang & Tabakin, PRC55 (97) 2054
Barker, Donnachie, Storrow: 9

Linear polarisation

D. Elsner





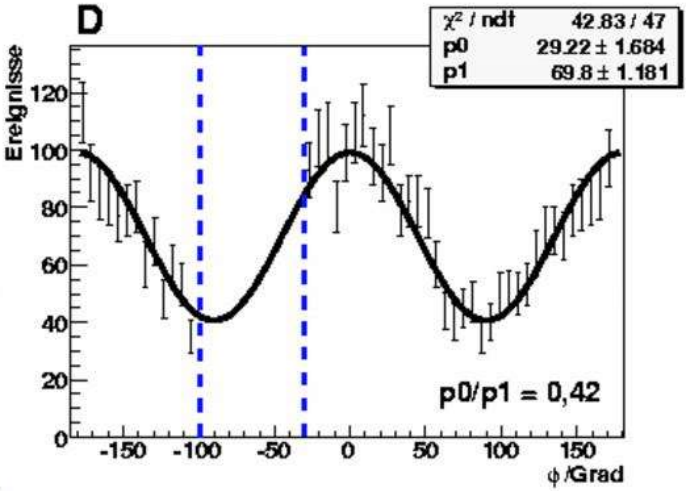


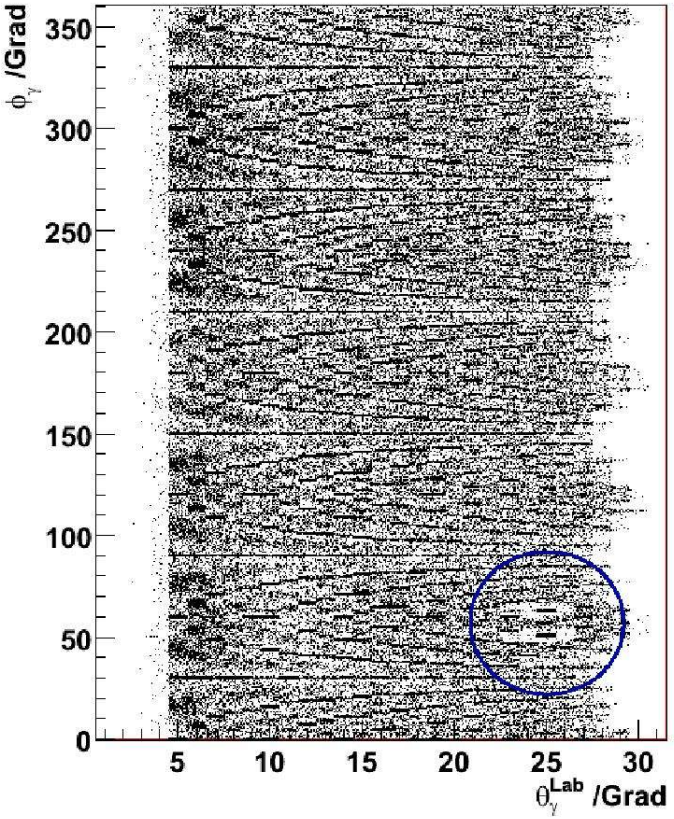
- ANB code
  F.A..Natter et al, NIM B211 (2003) 465
- scale “incoherent“ by factor 1.35
- atomic form factor
- multiple scattering

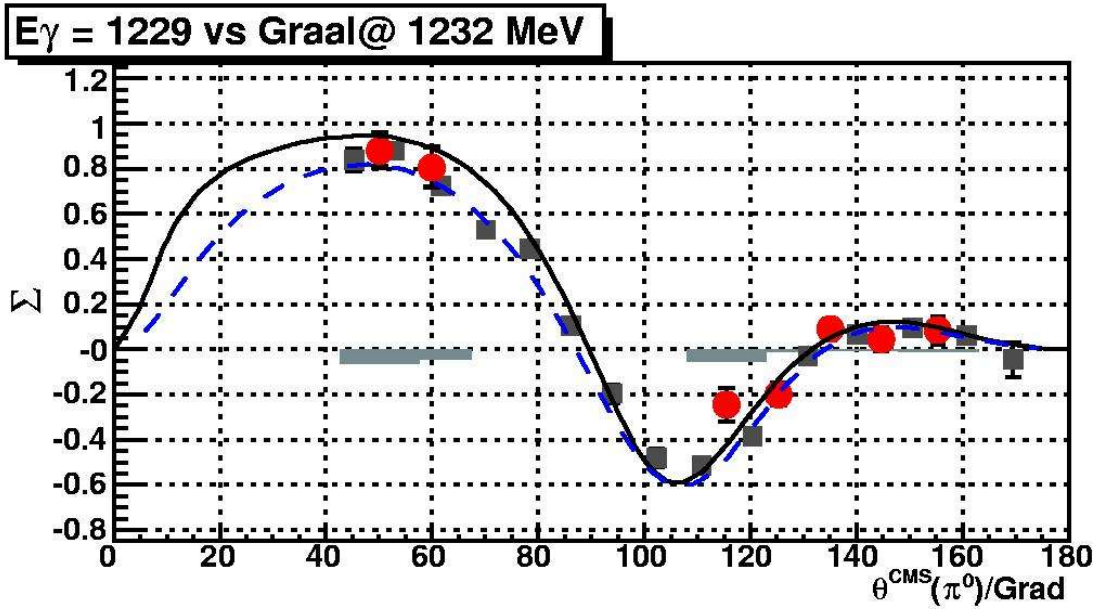
Linear polarisation – check in π^0 channel

D. Elsner / Frank Klein

$$d\sigma = d\sigma_0 [\, 1 + P_\gamma \Sigma \cos 2\Phi \,]$$

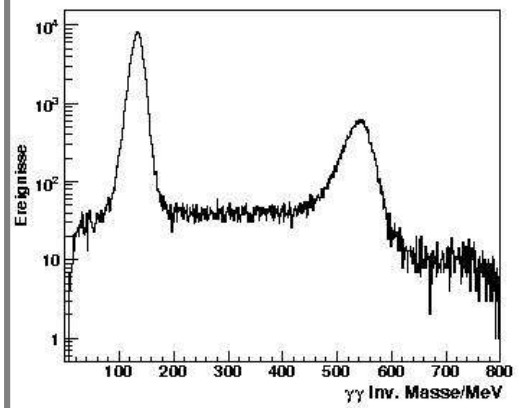




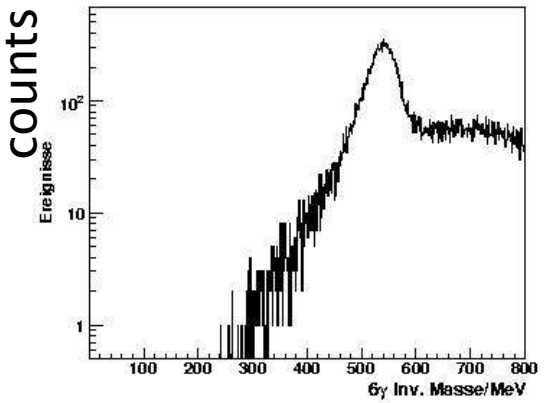


$p(\vec{\gamma}, \eta)p$ photon asymmetry

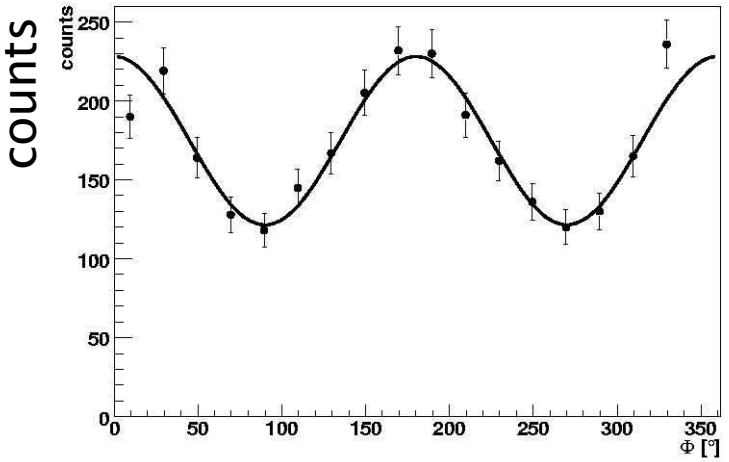
D. Elsner / Frank Klein



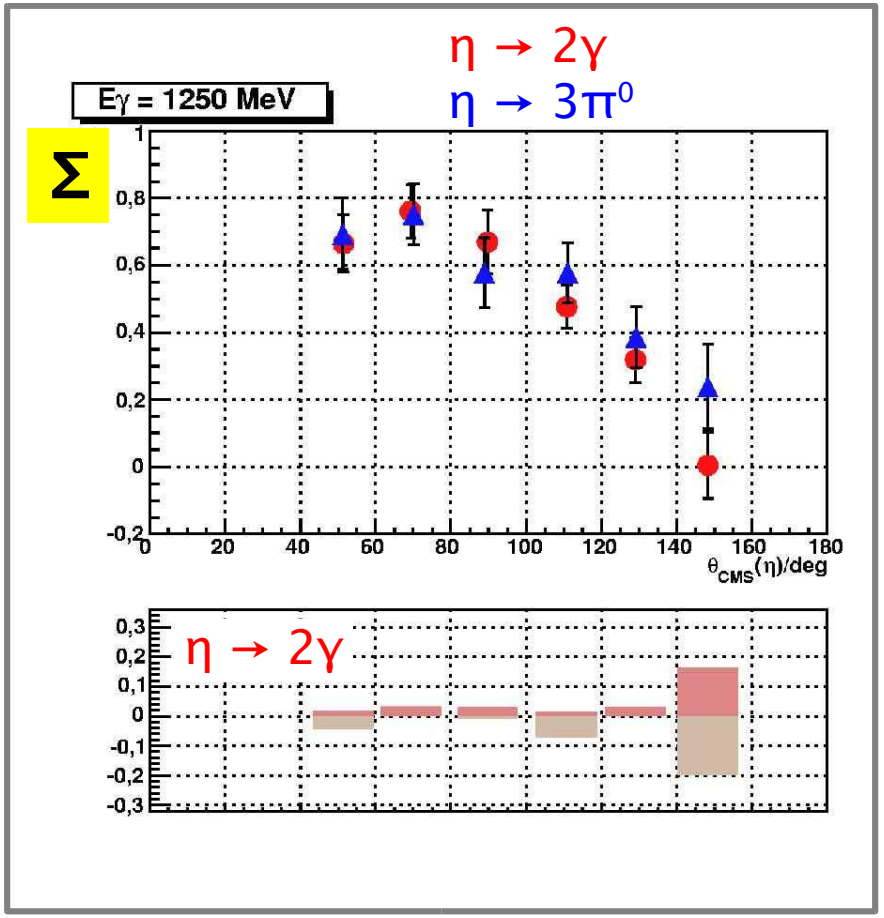
$M_{\gamma\gamma}$



$M_{\gamma\gamma}$

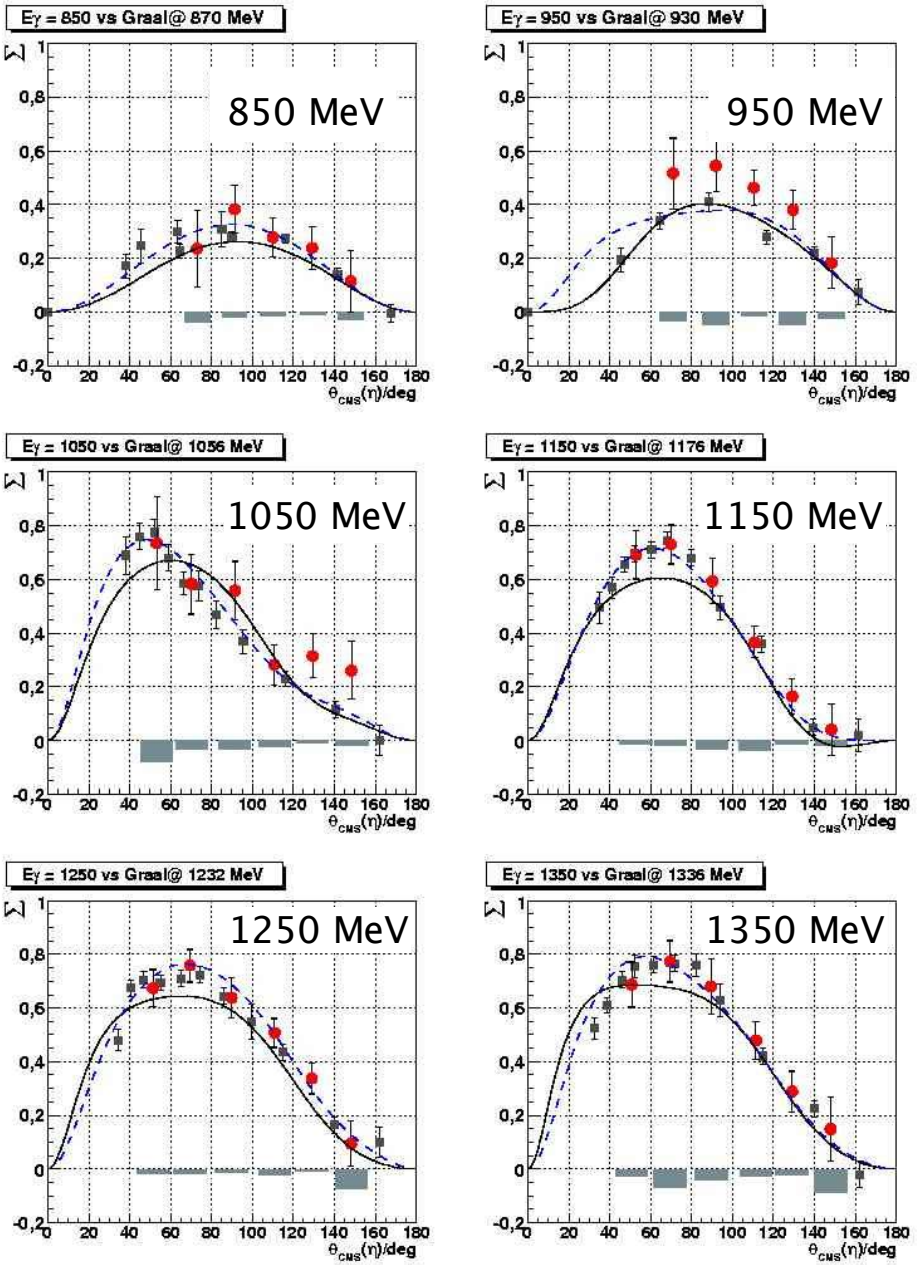


Φ



$p(\vec{\gamma}, \eta)p$ photon asymmetry

Σ



GRAAL data

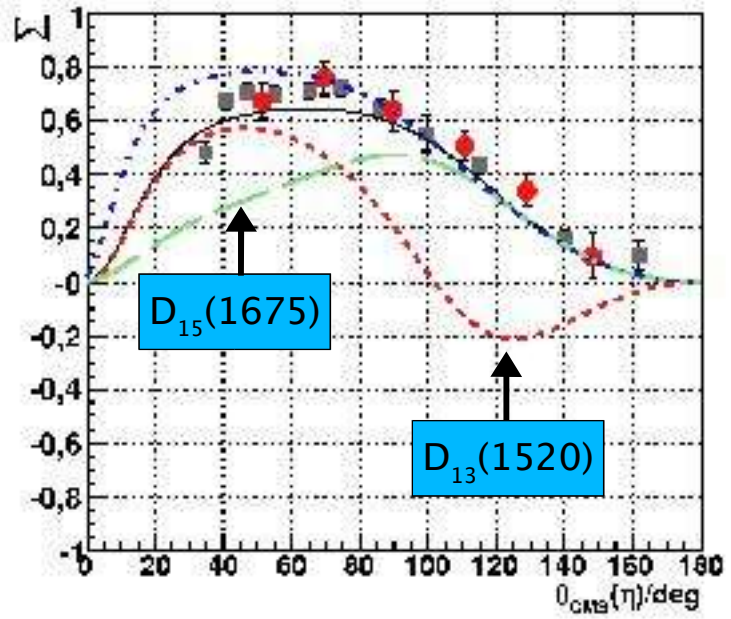
J. Ajaka et al., PRL 81 (1998) 1797
↗ 1050 MeV

V. Kouznetsov,
πN-Newsletter 16 (2002) 160
↗ 1445 MeV

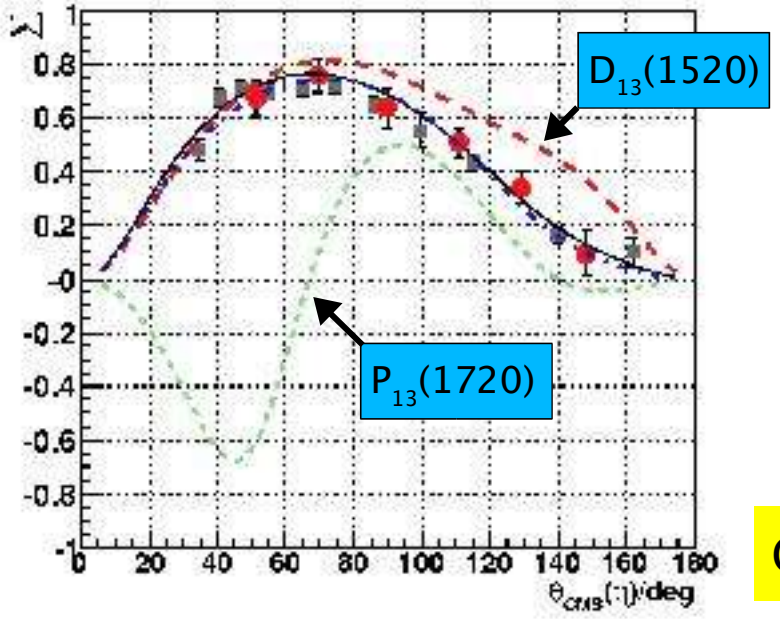
Θ_{cm}

$p(\vec{\gamma}, \eta)p$ photon asymmetry – comparison to models

η-MAID



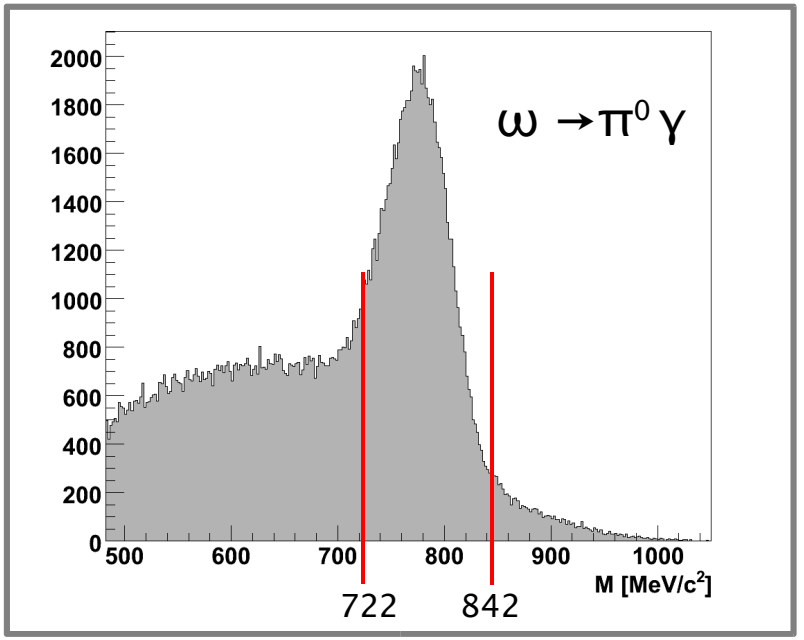
BoGa-PWA

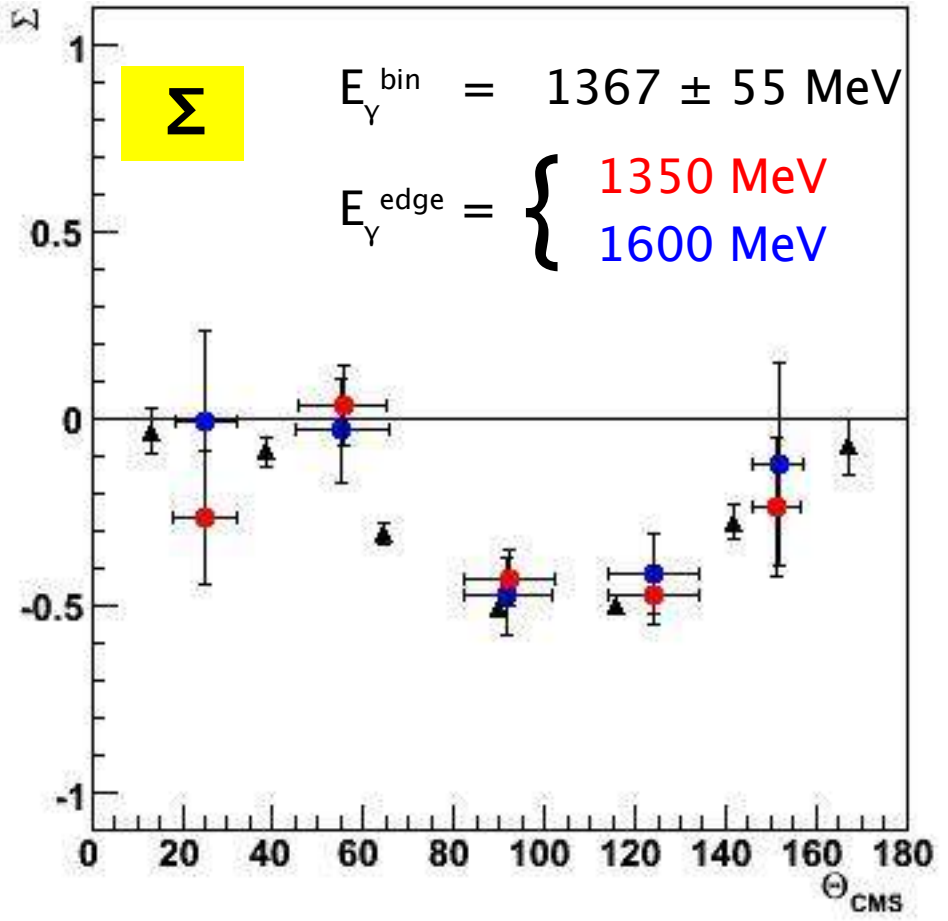


- $S_{11}(1535)$ & $P_{13}(1720)$ dominate x-sec
- Σ overall ok in MAID & PWA
- MAID → $D_{13}(1520)$ & $D_{15}(1675)$ affect Σ strongly
  $P_{13}(1720)$ not
- PWA $P_{13}(1720)$ affects Σ strongly
  $D_{13}(1520)$ & $D_{15}(1675)$ weak or negligible

$p(\vec{\gamma}, \omega)p$ photon asymmetry

Frank Klein





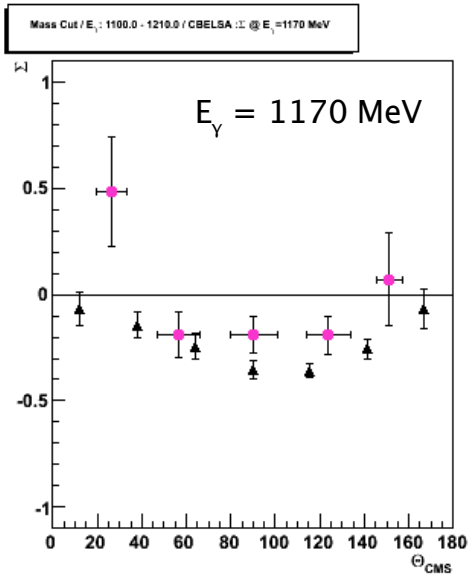
- cut M_{inv} = 722 ... 842 MeV
- background ***not*** subtracted

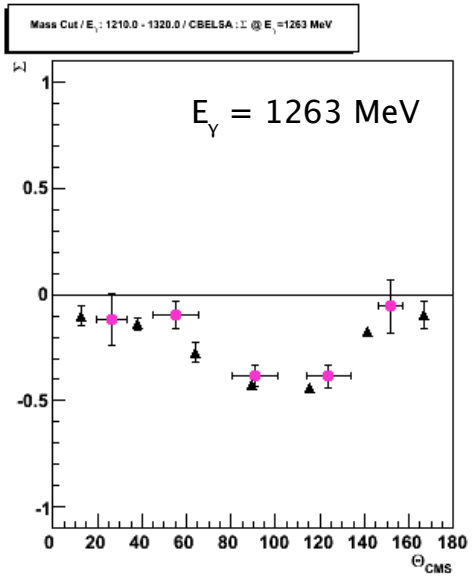
GRAAL data: J. Ajaka et al., PRL 96 (2006) 132003

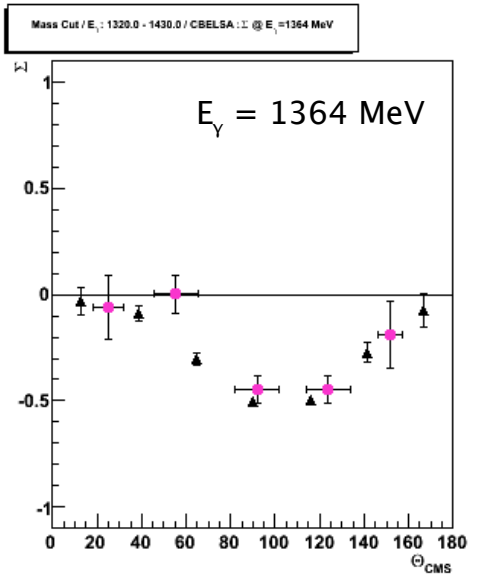
$p(\vec{\gamma}, \omega)p$ photon asymmetry

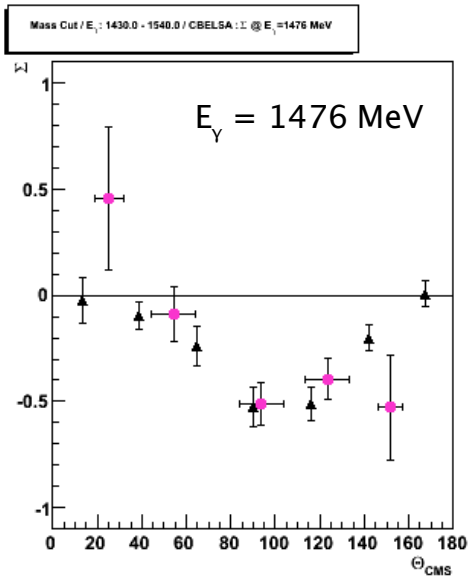
Frank Klein

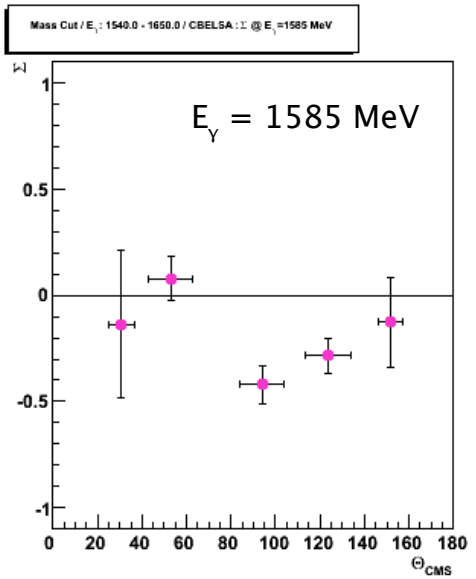
Σ









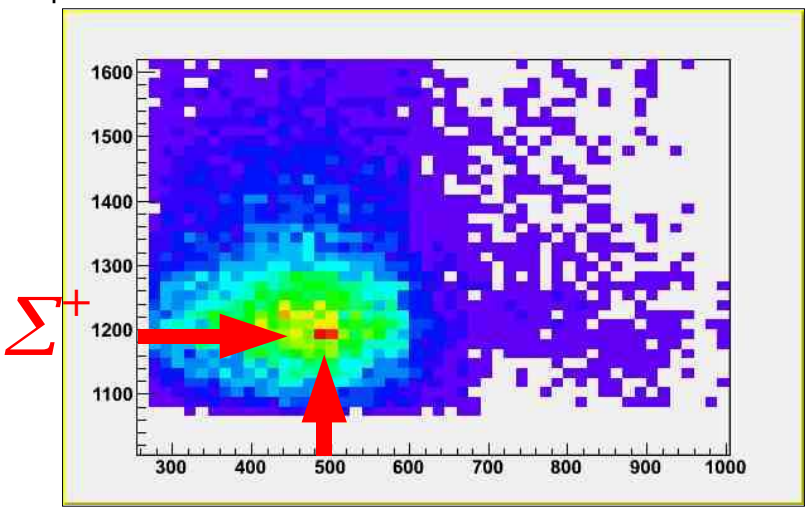


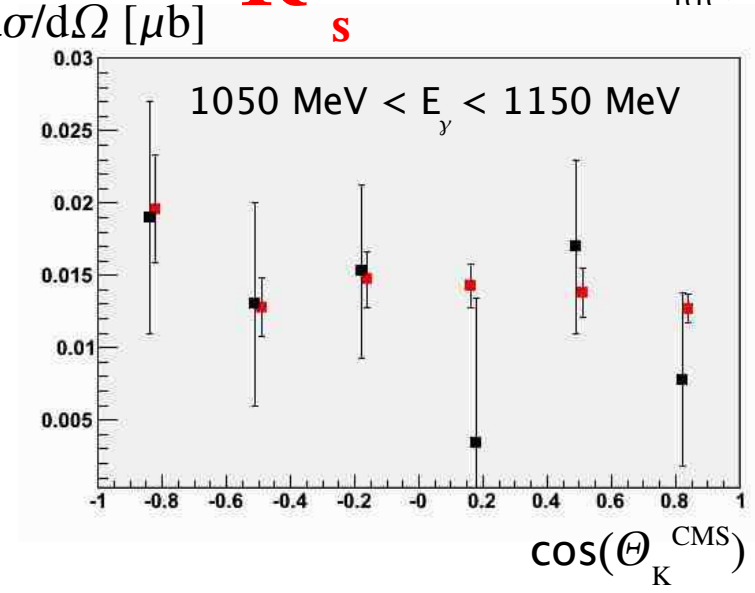
Θ_{cm}

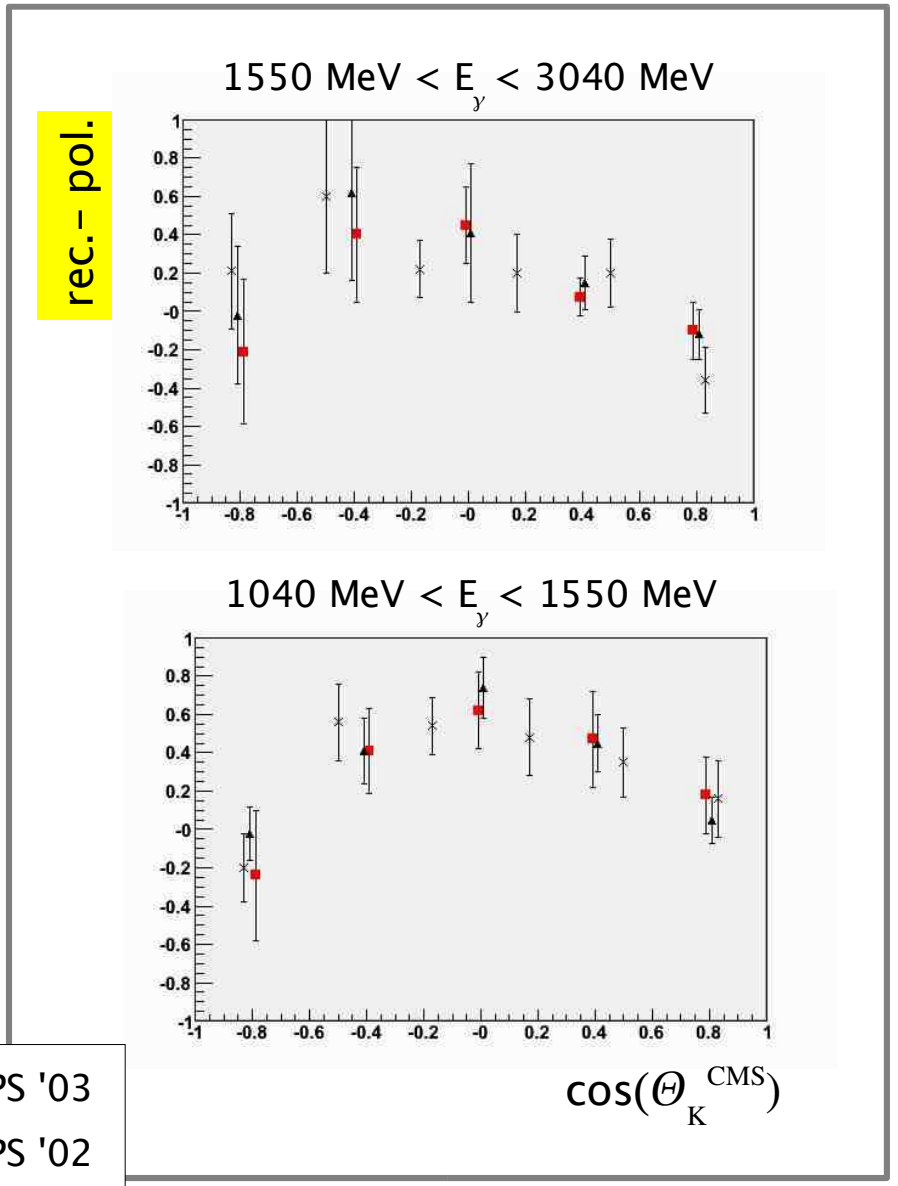
E_γ^{edge} = 1350/1600
combined data sets

$p(\vec{\gamma}, K^0_s)p$ photon asymmetry & recoil polarisation

R. Ewald

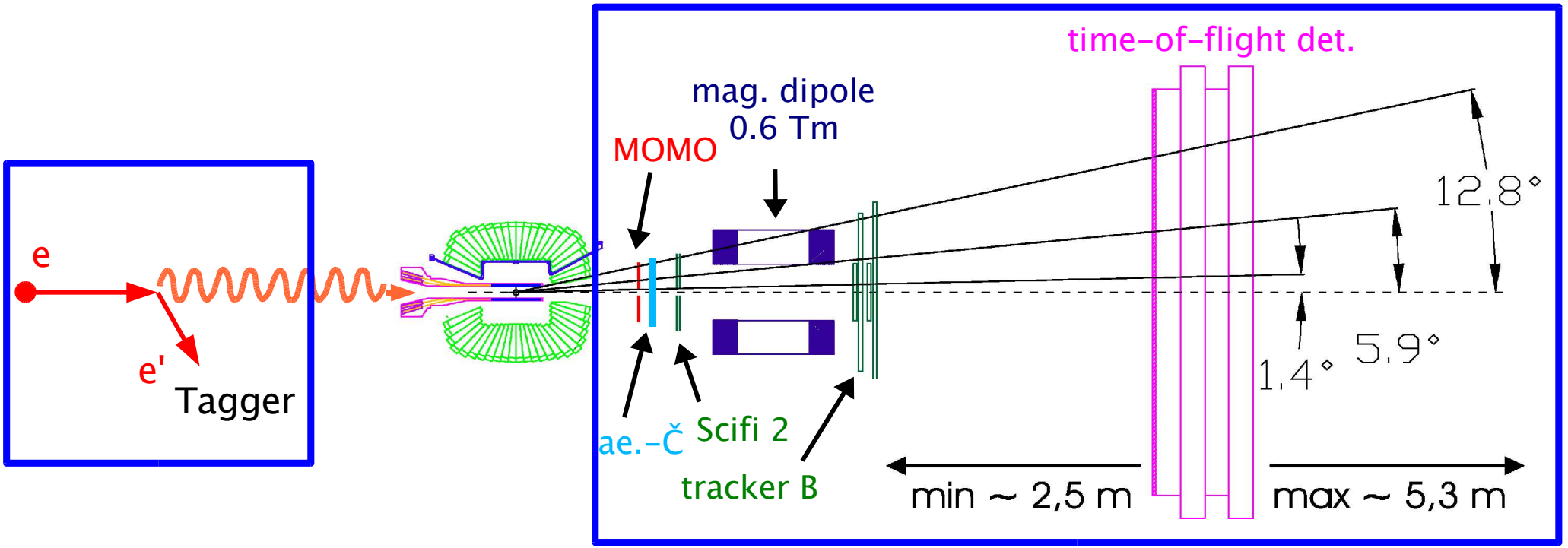






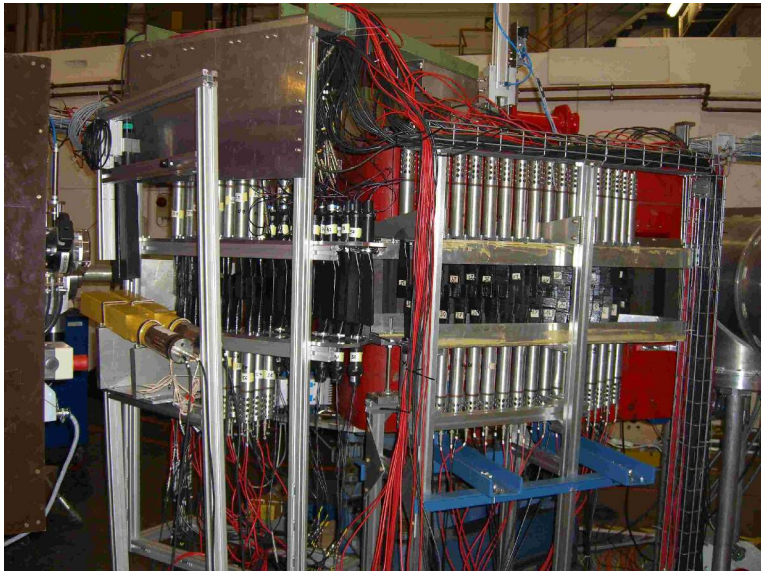
CBTAPS '03
CBTAPS '02
SAPHIR

Status Hardware

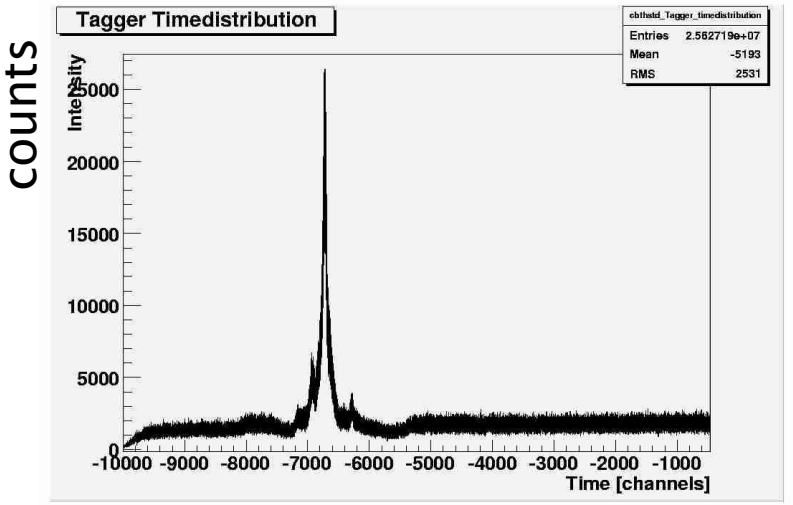


Tagger

K. Fornet-Ponse

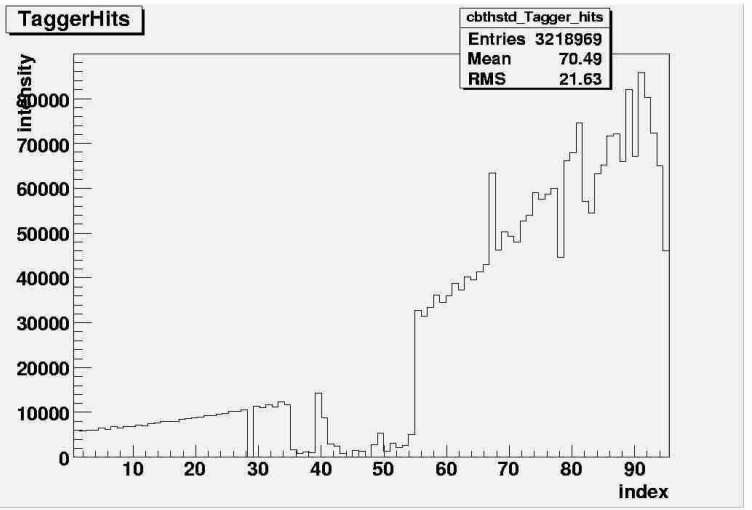


- magnet ✔
- scintillator hodoscope ✔
- coincidences ✔
- readout ✔
- tagger-scifi
- scifi support



counts

time

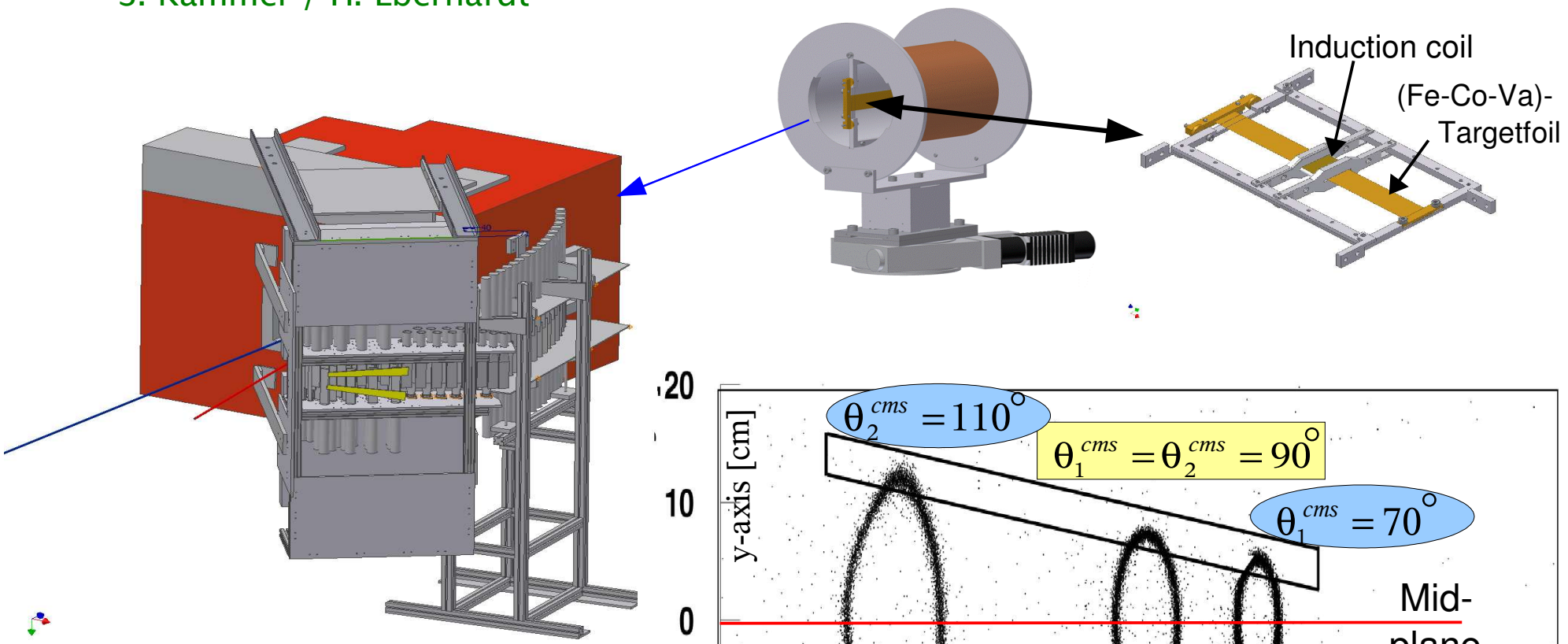


counts

channel

Møller polarimetry

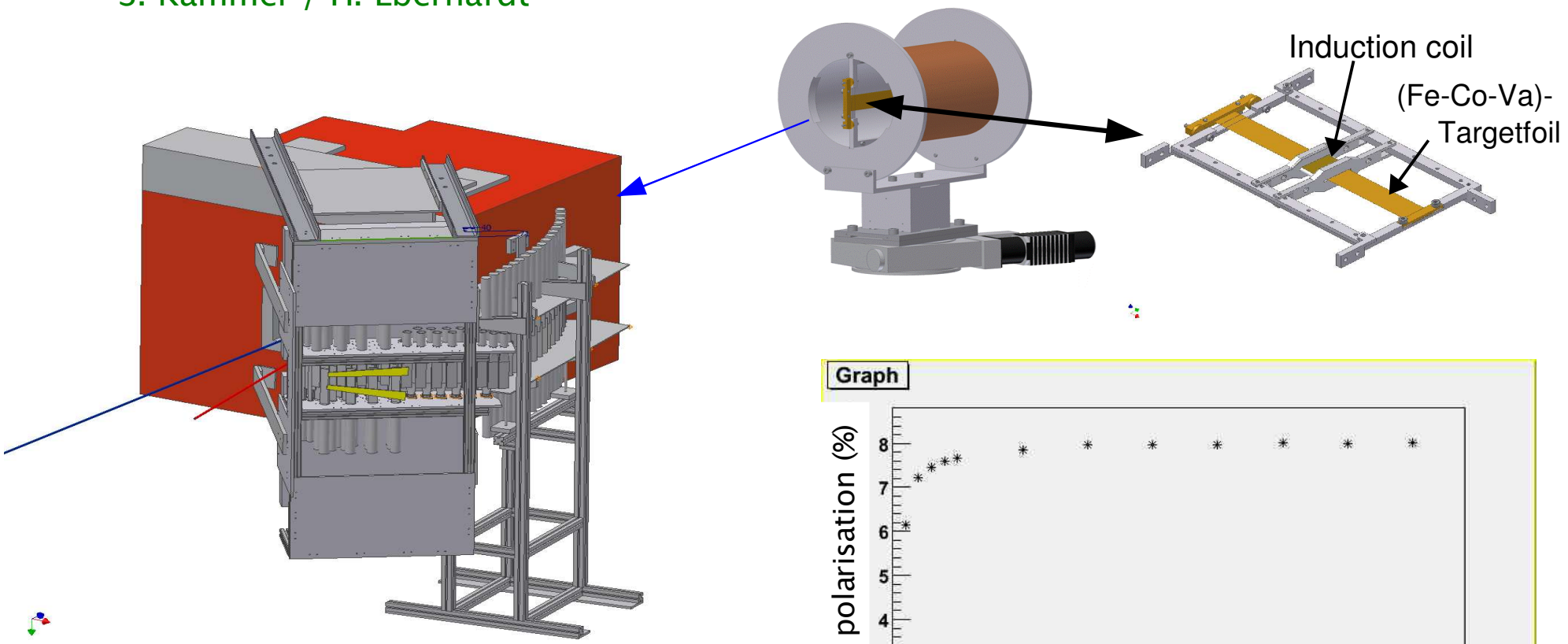
S. Kammer / H. Eberhardt



- solenoid ✓
- target foil ✓
- magnetisation measurem. ✓
- „slow control“ ✓
- detectors: Pb-glass! ✓
- readout ✓

Møller polarimetry

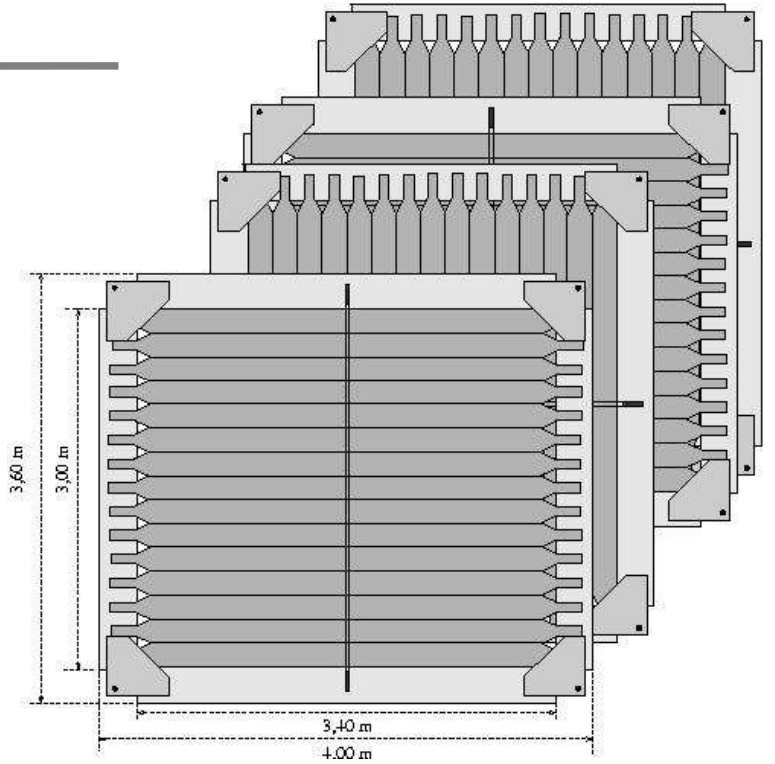
S. Kammer / H. Eberhardt

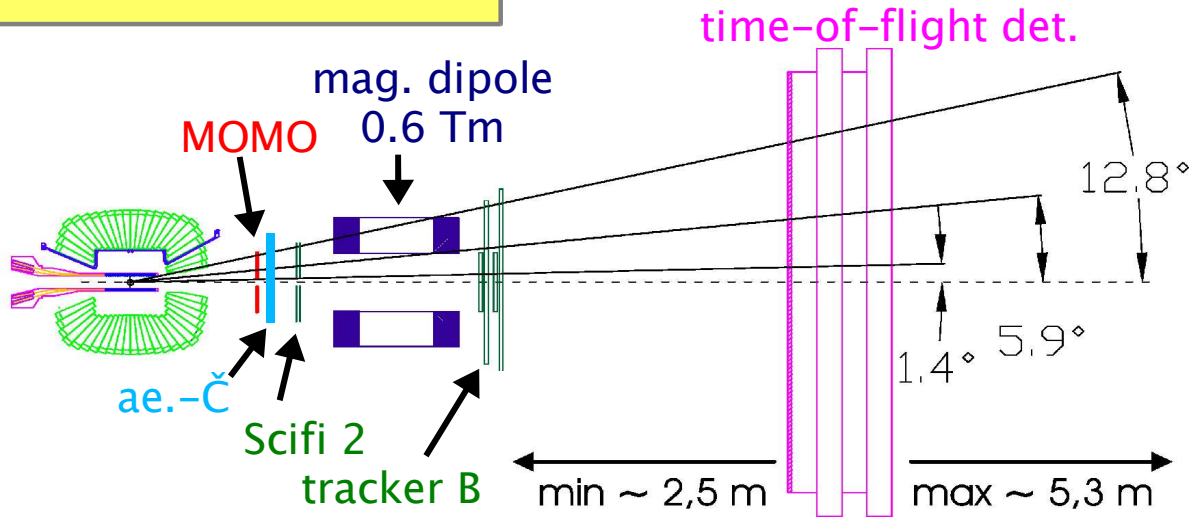


- solenoid ✓
- target foil ✓
- magnetisation measurem. ✓
- „slow control“ ✓
- detectors ✓
- readout ✓

B1 – spectrometer

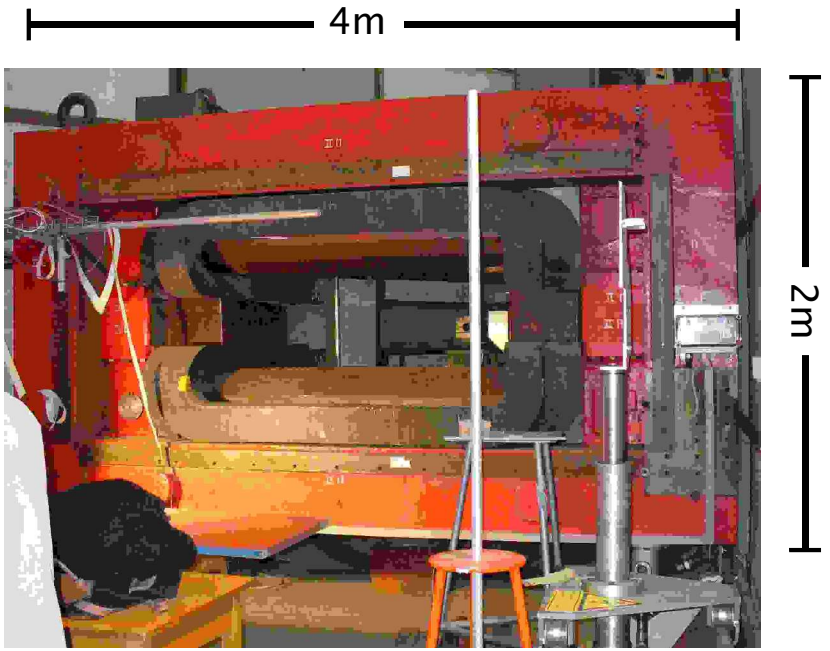
- TOF (B. Bantes, A. Ramseger) ✔
  - ~~upgrade~~, except ΔE layer
- aerogel – Čerenkov (S. Materne) ✔
- MOMO (R. Jahn, I. Horn) ✔
- SciFi 2 (R. Jahn, I. Horn) ✔
- magnet ↔ DESY (V. Kleber) ✔
- drift chambers
  - size (V. Kleber) ✔
  - construction ↔ PNPI ✔
  - readout ↔ PNPI ✔





magnet

V. Kleber

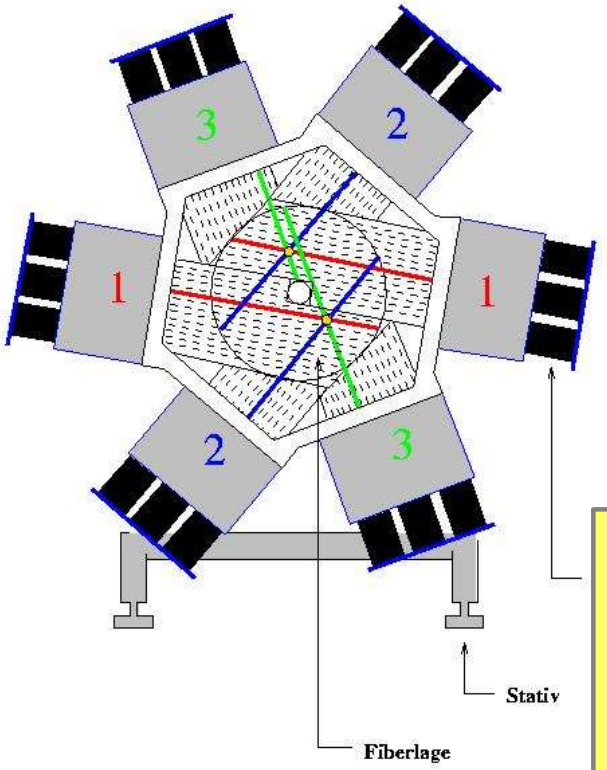


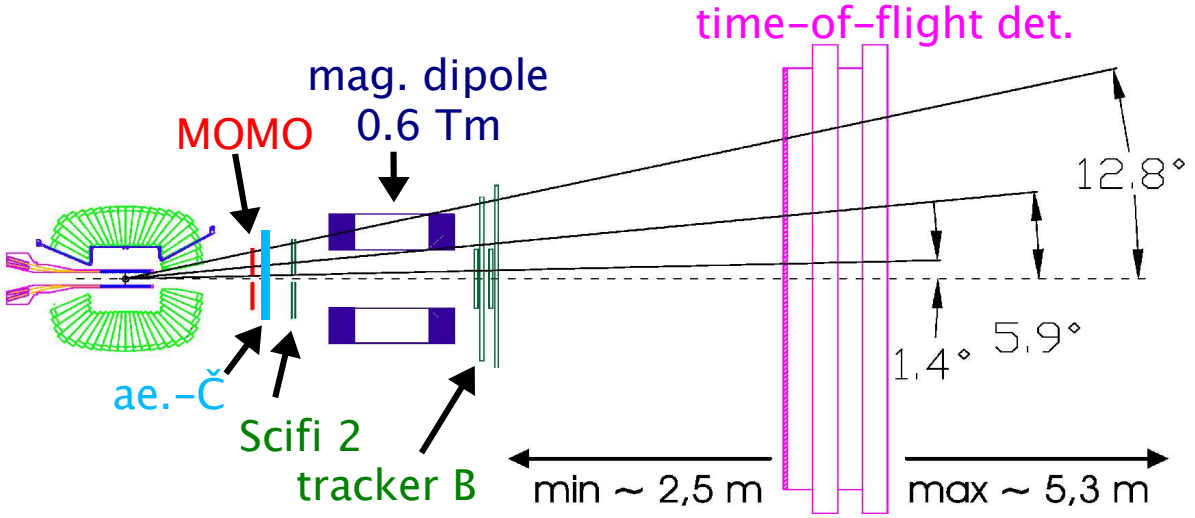
- borrow from DESY
- contract signed
- gap modification ↗ 8° vert. accept.
- tilted pole tips ?
- magnetic field simulations
- transport december
- power supply ?

- m = 80 t
- B = 0.9 T (midplane)
- I = 1500 A
- P = 330 kW

Tracker "A" – MOMO

R. Jahn / I. Horn

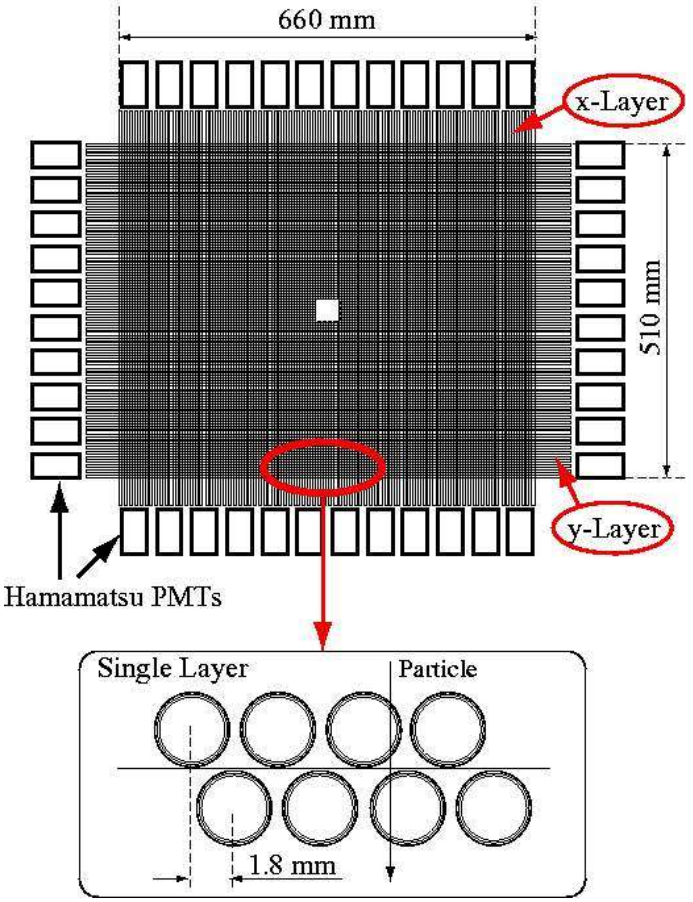




- Jülich → Bonn ✔
- full channel test ✔
- catch readout ✔
- support frames –
- compatibility gas-Čerenkov ↯

Tracker "A" – SciFi 2

R. Jahn / I. Horn



- planar hodoscope 51x66 cm²
- 4x4 cm² beam hole
- 2 planes x / y
- double layer each
- ∅ 3mm multi-clad
- pos. resol. ≲ 1.8 mm
- 44 modules à 16 fibres
- 44 16ch PMs
- readout ~ MOMO
  (discr. & catch multihit TDC)

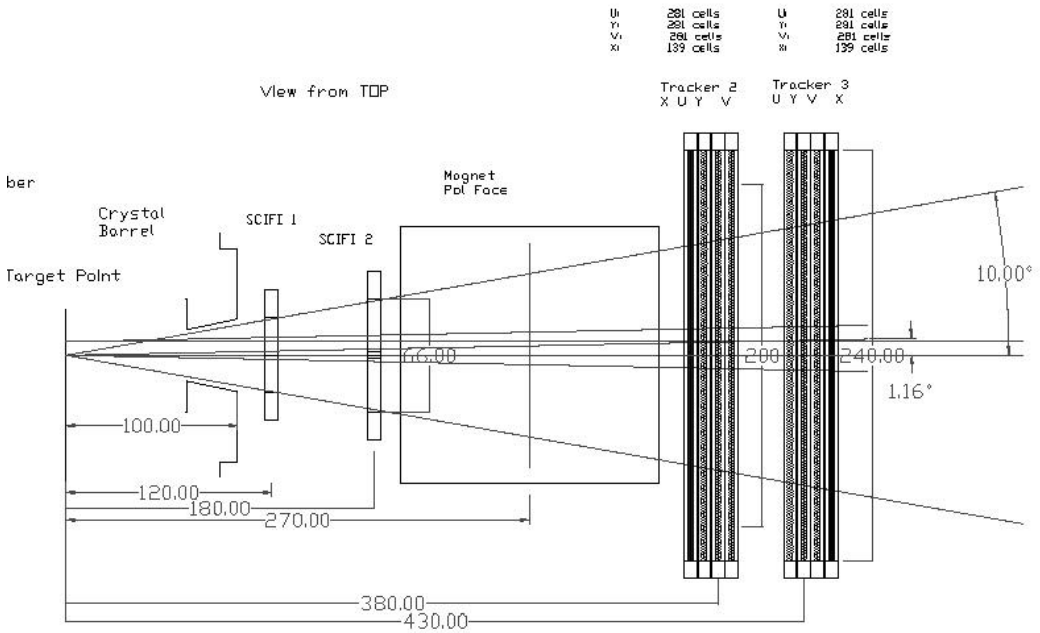
Tracker "B" – drift chambers

Planar drift chambers

cooperation w/ PNPI, St. Petersburg
Dr. V. Sumachev

1.	Monte Carlo Simulation V. Kleber	δp / δx – resolution, design magnet	✔
2.	prel. tech. design detector PNPI/H. Kalinowsky	# channels, drift-cell geom., mech. construction	✔
3.	offer for constr. @ PNPI PNPI	complete DC tracker B	✔
4.	prototype PNPI	realistic cell geometry gas system & readout	?
6.	agreement of cooperation		2/07

Tracker "B" – drift chambers



- 2 chamber packages 2.4x1.4 m^2
- (2X+2Y+2U+2V) planes each
- signal-wire pitch 17 mm
- ~ 2000 wires
- ITEP front-end electronics w/
- current sens. amplifiers/discr.
- Xilinx FPGA ↔ TDC
- USB readout

→ $\delta p/p = 1.4\%$ K^+ $p = 1200$ MeV
$\int Bdl = 0.6$ Tm

TOF detector

A. Ramseger / B. Bantes / M. Seimetz

- standard electronics
- $\delta t \simeq 0.5$ ns
- $L_{att} \simeq 1$m
- $\delta x \simeq 5-10$ cm
- ready for installation

Budget

Year	detector	status	SFB	GA	application	
2006	SciFi 2	ordered	115	25		
2007	SciFi 2	open	83			
			198	25	166.5	(Scifi 2 total)
2007	dc-tracker	open	129*		117.4	(*PNPI offer)
		sum 2007	**212**			
		plus aerogel material		~40	GA/SFB ?	
		transport magnet		~10		
		gap extension		~15		
		power supply		?		

Schedule

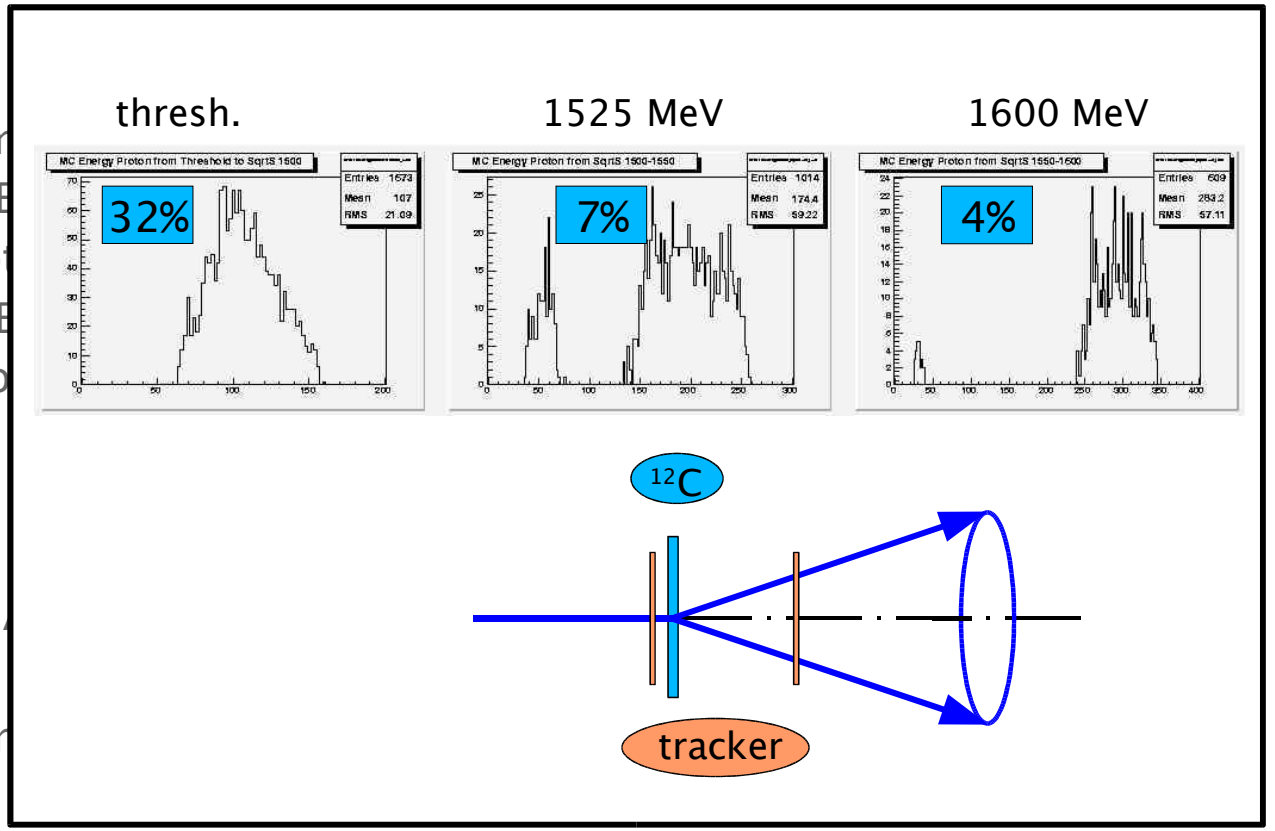
application		current planning	
2005	Tagger “focal plane“	01/2007	
	Møller-Polarimetrie	01/2007	
2006	installation TOF-Detektor	02/2007	
	upgrade TOF-D.	-	(ΔE-layer)
	(Aerogel-Čerenkov)	04/2007	test setup
	design tracker „A“ SciFi 2	12/2006	
	design magnet	12/2006	
2006/07	setup tracker „A“	✔	
	preparation mag.-Install.	✔	
	design Tracker „B“ DC	12/2006	
2007/08	complete setup	2008 ✔	
	Λ(1405)-Expt.		
~ 2007	first experiments w/o magnet	SAPHIR area?	interference w/ dpol program ?

Summary & outlook

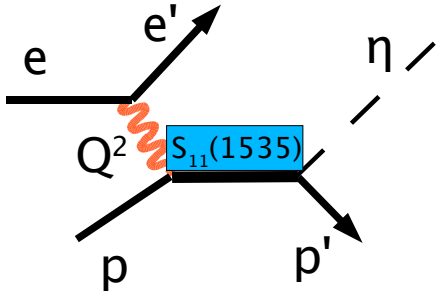
- analysis of CB/TAPS data
  - linear polarisation (paper soon)
  - ηp x-sec
    photon asymmetry ↗E_γ = 1350 MeV (paper written)
    have data ↗E_γ = 1950 MeV
  - ωp x-sec & photon asymmetry ↗E_γ = 1585 MeV (paper soon)
    have data ↗E_γ = 1950 MeV
  - $K^0\Sigma^+$ x-sec & recoil polarisation
- hardware
  - tagger & Møller
  - MOMO
  - SciFi 2
    } tracker A
  - magnet
  - tracker B drift chambers
- future options
  - recoil polarimetry $p(\gamma,p)\eta$
  - electron scattering @ small Q^2

Summary & outlook

- analysis of CB/TAPS data — V. Kleber
  - linear polarisation
  - ηp x-sec
    photon asym
    have data ↗E
  - ωp x-sec & phot
    have data ↗E
  - $K^0\Sigma^+$ x-sec & reco
- hardware
  - tagger & Møller
  - MOMO } tracker
  - SciFi 2 }
  - magnet
  - tracker B drift cham
- future options
  - recoil polarimetry p(γ,p)η – statistics ?
  - electron scattering @ small Q^2



Summary & outlook



$$F(q^2) = 1 - \frac{1}{6} q^2 \langle r^2 \rangle + \ldots$$

- analysis of CB/TAPS
  - linear polarisation
  - ηp x-sec
    photon asym
    have data ↗E
  - ωp x-sec & phot
    have data ↗E
  - $K^0\Sigma^+$ x-sec & reco
- hardware
  - tagger & Møller
  - MOMO, SciFi 2 } tracker
  - magnet
  - tracker B drift cham
- future options
  - recoil polarimetry p(γ,p)η
  - electron scattering @ small Q^2 – resolution ?

R. Thompson, PRL 86 (2001) 1702