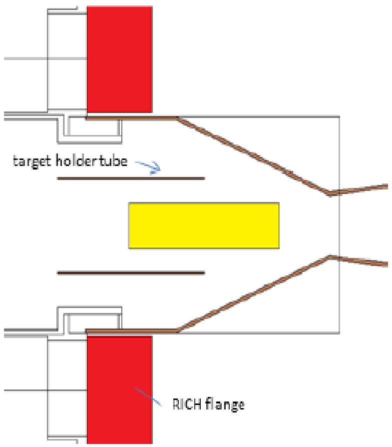
Targets for August run

element	Atomic number	Density [g/cm³]	Reaction Area [fm²]	reaction rate[%]	mass [g/cm²]	Width / segment [mm]
W	184	19.3	164.0	7.5	14.0	2.4
Nb	93	8.57	107.0	7.5	10.8	1.8
Pb	208	11.35	177.2	7.5	14.61	4.29
C	12	2.1	31.1	7.5	4.8	3.25
PE (C2H4)	12 / 1	1.0	31.1 / 6	6.27 / 1.23	4.14 / 0.387	46 1 seg.



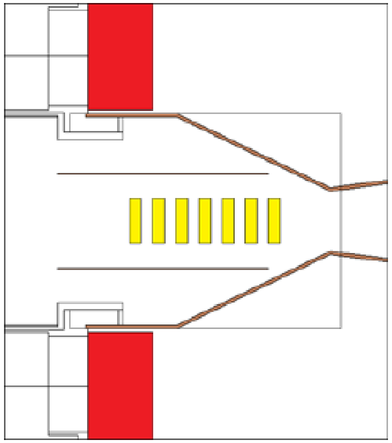
Targets for pion beam time AUG14

Polyethylen target

Diameter: 12 mm
Length: 46 mm
Lab position of center: -32.7 mm

Density of protons in 5 cm long PE 4*10^{23} /cm²
- factor 2 more than in LH_2

density of carbon ~ 2*10^{23} /cm²
- factor 2 less C than p



Carbon target

Number of segments: 7
Diameter of segments: 12 mm
Thickness of segments: 3.6 mm
Distance between segment centers: 7.1 mm
Total length: 46.2 mm
Lab position of center: -32.6 mm

Target holder:
carbon-fibre tube with outer diameter of 26mm and wall thickness of 0.5 mm

Density of carbon ~ 2.6*10^{23} /cm²

Numbers for normalization-gen2

p [MeV/c]	N_{ev} (PE) x 10^6	N_{el} (61-109^0) corr x 10^6	σ(61-109^0) [mb]	$\frac{\sigma}{N_{el}}$ x 10^{-7}	$N_{\pi+\pi-}$ x 10^5	$N_{\pi+\pi}$ x σ/N_{el} $=\sigma_{\pi+\pi}$ [mb]
656	42.64	2.14	2.99	13.97	3.99	0.557
690	776.82	34.68	3.077	0.88	78.1	0.687
748	76.90	3.45	3.055	8.85	7.83	0.693
800	52.66	1.92	2.57	13.38	4.86	0.65

N_{beam} calculated from:

$$N_{el} = N_{beam}\ 4*10^{23}\ \sigma_{el}$$

* *Does NOT include ~100 MLN events from July*

Final update with Witek analysis (see his reportin CM Paris 2016)

* events from July not included

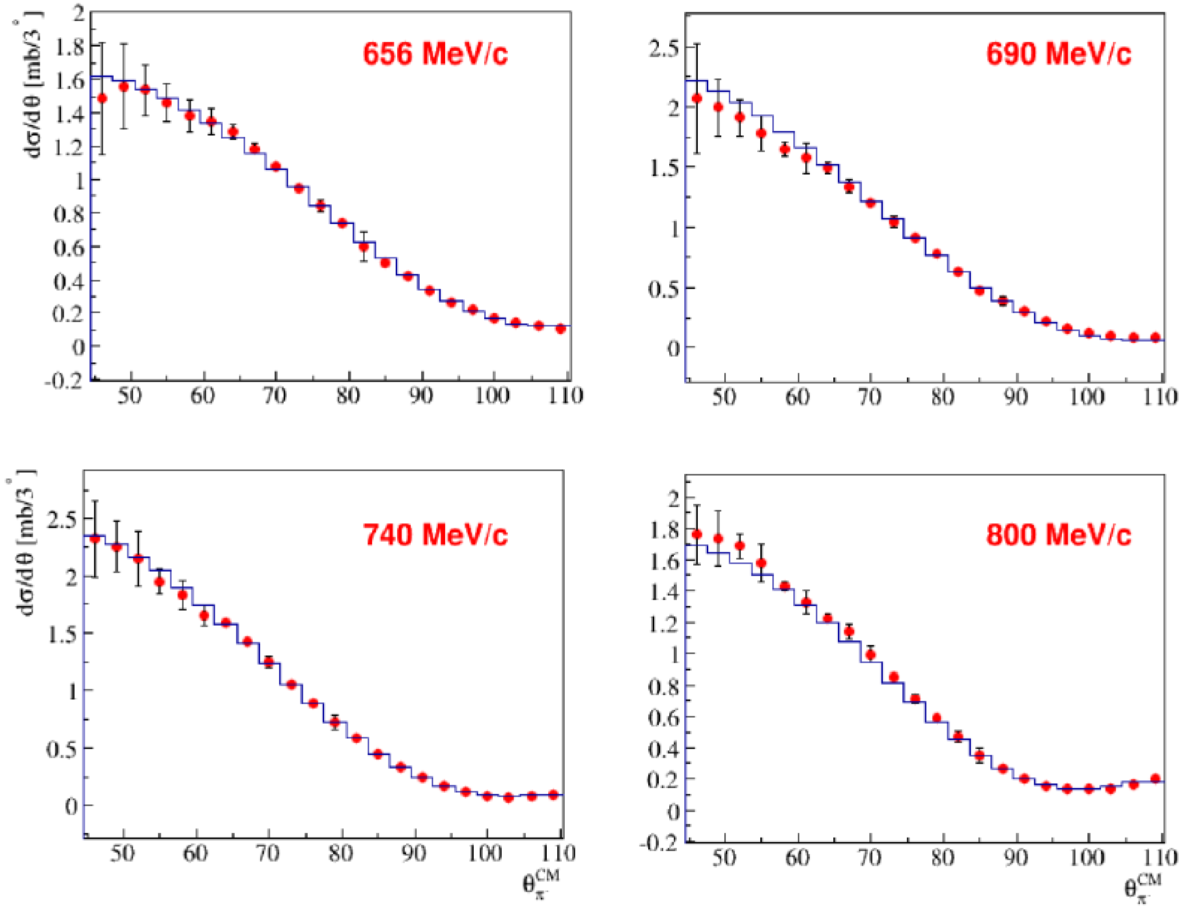
p [MeV/c]	N_{ev} (PE) x 10^6	N_{beam} x 10^9 corrected for dead time	N_{start} x 10^9 (scalers)	N_{el} (60-110)^{corr} x 10^6	σ (60-110) [mb]	$\frac{\sigma}{N_{el}} \cdot 10^{-7}$ [mb]
656	42.64	**2.13**	**2.95**	~~2.14~~ 2.088	~~2.99~~ 3.00939	~~13.97~~ 14.41
690	776.82 *	**36.59**	**47.11**	~~34.68~~ 36.93	~~3.077~~ 3.10248	~~0.88~~ 0.84
748	76.90	**3.67**	**4.52**	~~3.45~~ 3.42	~~3.055~~ 3.08054	~~8.85~~ 9.00
800	52.66	**2.46**	**3.04**	~~1.92~~ 1.911	~~2.57~~ 2.59335	~~13.38~~ 13.57

Scaling factors PE/C

p[MeV/c]	Nev (PE) x 10^6	N_{START} x 10^9 (scalers)	Dead time [%] PE/C	Scaling factor PE/C from Elastic scatering	Scaling factor PE/C from START detector*
656	42.64	2.95	0.84/0.86	1.31	1.37
690	776.82	47.11	0.77/0.83	0.2	0.19
748	76.90	4.52	0.77/0.78	0.77	0.75
800	52.66	3.04	0.75/0.75	1.1	1.08

$$* = \frac{N_{START(PE)}}{N_{START(C)}} \frac{\rho_{C(PE)}}{\rho_C} (=0.77)$$

Elastic scattering reconstruction from HADES with sys errors (from different sectors) : analysis of Iza Ciepal



Input to dilepton cocktail simulation

p=0.69 GeV/c √s=1.492 (for π- C avarage √s=1.461) -> p=0.65)

channel	σ [mb]	Data source	model
$\pi^- + p \to n\, \pi^0$ (π^0 Dalitz)	**9.2**	Landolt-Bornstain (LB) constant (±1 mb) for p ∈ (0.6-0.72)	45% N(1520),45%N(1440),10% N(1535)
$\pi^- + p \to n\, \pi^0 \pi^0$ **$\pi^- + p \to p\, \pi^- \pi^0$** **(single π^0 Dalitz)**	2 x **1.8** **3.72** ~ **7.4** tot	Crystall Ball L-B (for √s=1.461 20% reduction)	$\Delta\pi \to (N\pi)$ **π^0 $\to$(Nπ)e+e-γ**
$\pi^- + p \to \Delta\pi \to$Ne+e-π	**8.4**	From single and double pion -isospin relation	$\Delta^0 \pi^0 \to$ne+e-π^0
$\pi^- p \to$ N(1520)° $\to$ne+e- - Dalitz decay	**20.5**	From single and double pion -isospin relation	Wolf/Zetenyi „QED" model With BR=4.0e-5
$\pi^- + p \to n\, \eta$ (π^0 Dalitz)	**0.3 (p)** **0.7/p (C)**	Parametrization from L-B See next slide	

B. Ramstein & P. Salabura more details in document on wiki

Normalization of dilepton cocktail from PE target

$N_{PE} = (\sigma_P + 0.5\sigma_C)*4.0e23*N_{beam}$ *(there is 4.0e23 protons/cm² and 2.0e23 C/cm² atoms in target)*

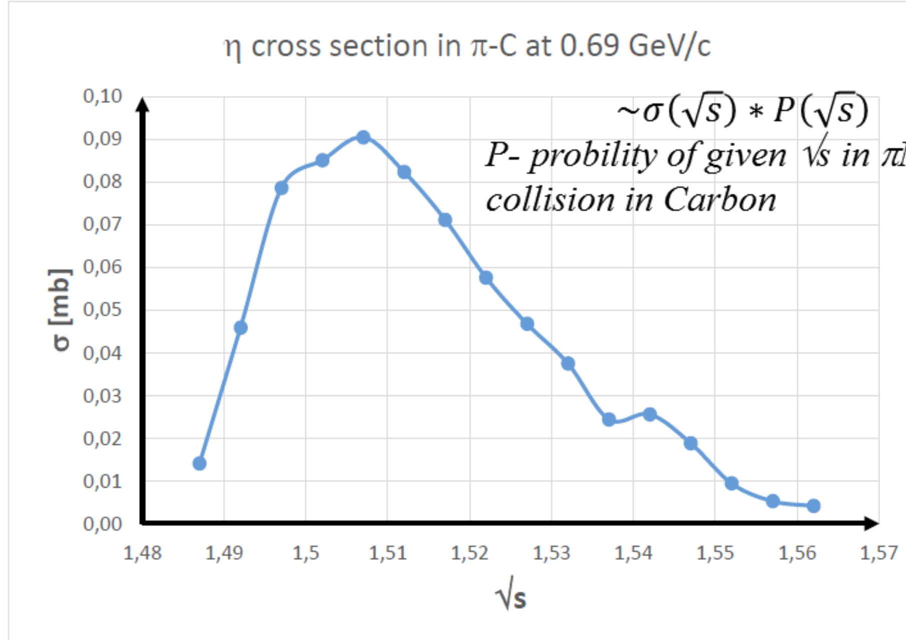
$N_{norm} = N_{elastic} = \sigma_{elastic} *4.0e23*N_{beam}$

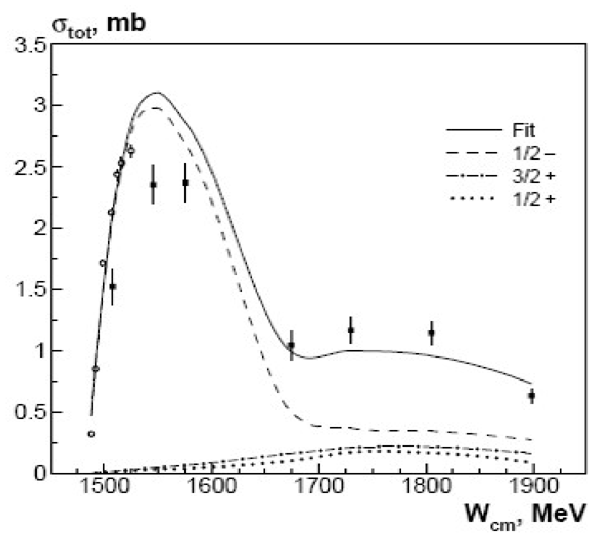
Normalization:

$N_{PE} * \sigma_{elastic} / N_{elastic} = \sigma_P + 0.5\sigma_C$

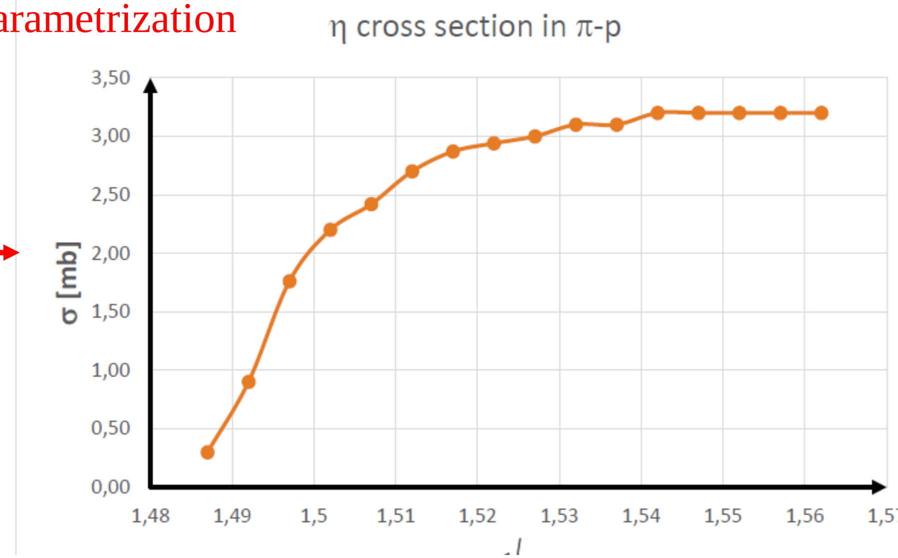
η contribution -dominatly comes from Carbon

bin	sqrt(s)	p(sqrt(s))	XS_eta	product
98	1,487	4,70E-02	0,3	0,0141
99	1,492	5,10E-02	0,9	0,0459
100	1,497	4,47E-02	1,76	0,078672
101	1,502	3,87E-02	2,2	0,08514
102	1,507	3,74E-02	2,42	0,090508
103	1,512	3,05E-02	2,7	0,08235
104	1,517	2,48E-02	2,87	0,071176
105	1,522	1,96E-02	2,94	0,057624
106	1,527	1,56E-02	3	0,0468
107	1,532	1,21E-02	3,1	0,03751
108	1,537	7,88E-03	3,1	0,024428
109	1,542	8,00E-03	3,2	0,0256
110	1,547	5,88E-03	3,2	0,018816
111	1,552	2,94E-03	3,2	0,009408
112	1,557	1,64E-03	3,2	0,005248
113	1,562	1,29E-03	3,2	0,004128
			SUM	0,697408





parametrization



Pang et. al.: LAMPF conference report

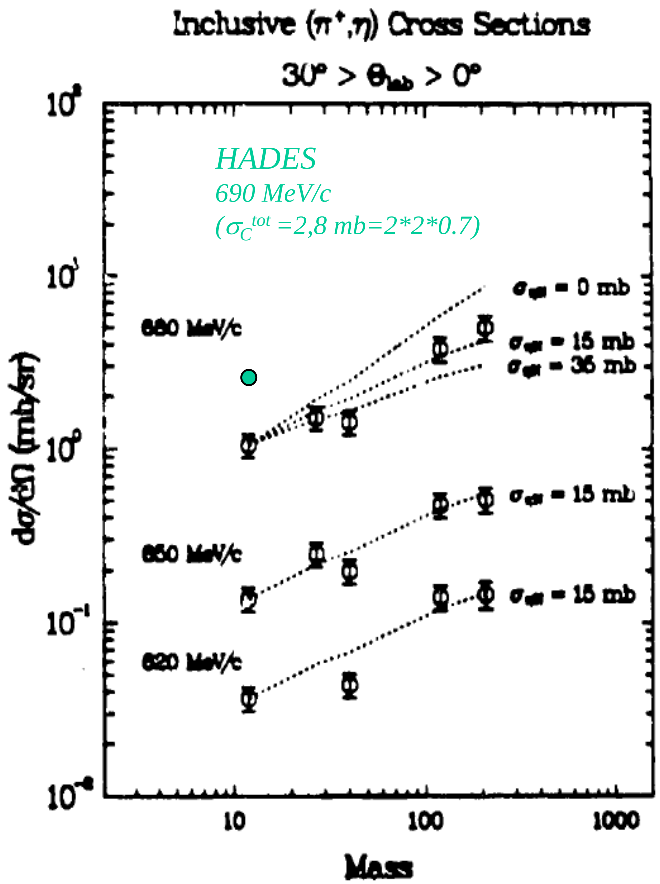


Fig. 9. Inclusive (π^+,η) cross sections on several target nuclei. The dashed curves correspond to Glauber calculations using various ηN total cross sections.

Kohno/Tanabe
Nuclear Physics A519 (1990) 755-7

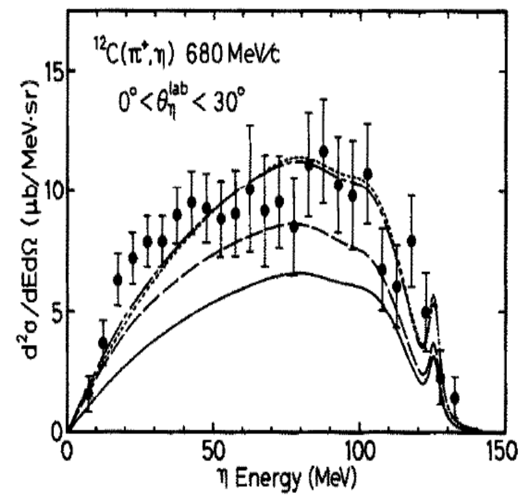


Fig. 10. (π^+,η) inclusive cross sections on ^{12}C at $p_\pi^{lab} = 680$ MeV/c. The solid curve is obtained with $V_{N^*} = -50-50i$ MeV and the dashed curve with $V_{N^*} = 0$. The result renormalized by a factor of 1.7 with respect to the solid curve in order to match the experimental absolute magnitude is shown by the dash-dotted curve. For comparison, the spectrum with assuming plane waves for the η is shown by the dotted curve. The data are taken from ref. [6]).

ρ contribution – off shell

- **See report** https://hades-wiki.gsi.de/foswiki/pub/PionBeam/WebHome/salabura_ect_PION.pdf
- VDM predicts $1/M^3$ which results in much higher average BR (~4 ! see below) as comapred to

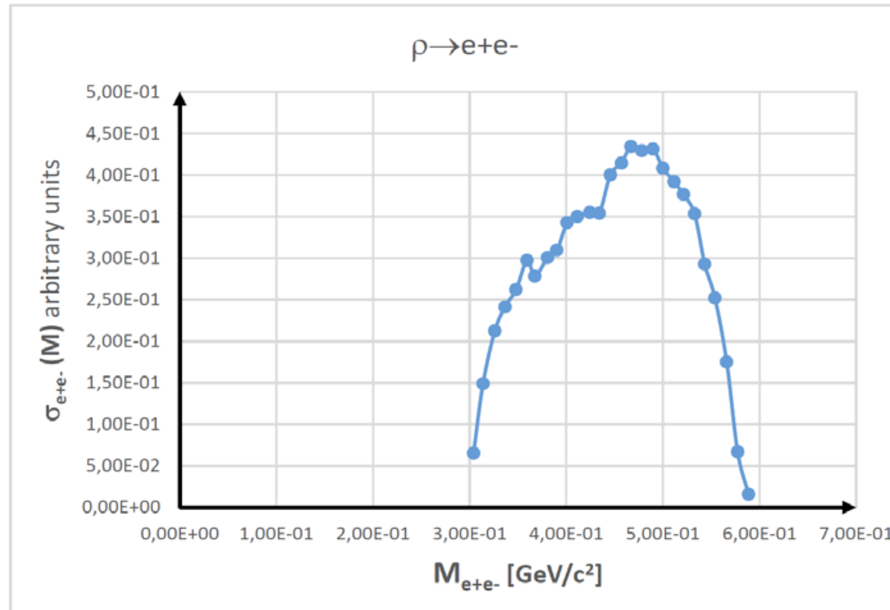
Value at the pole

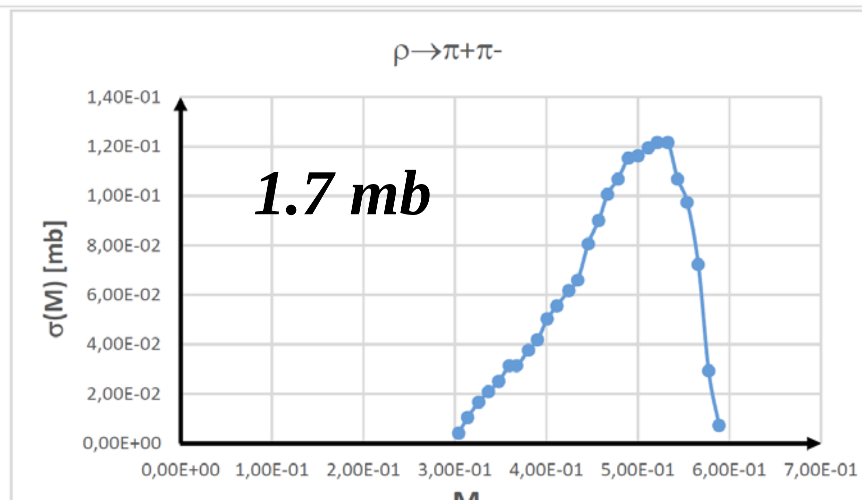
Note:

PLUTO simulation predicts slighlty different shape of e+e- (see next slides)

Since it uses also 1/M3 scaling must be due to different 2pion mass distribution

mass	rho_XS	VDM (1/m3)	product
3,04E-01	4,19E-03	15,61366255	6,55E-02
3,14E-01	1,05E-02	14,20091609	1,49E-01
3,26E-01	1,68E-02	12,66505858	2,12E-01
3,37E-01	2,10E-02	11,50844232	2,41E-01
3,48E-01	2,52E-02	10,41514376	2,62E-01
3,59E-01	3,14E-02	9,455788455	2,97E-01
3,68E-01	3,14E-02	8,842060636	2,78E-01
3,81E-01	3,77E-02	7,96530894	3,01E-01
3,90E-01	4,19E-02	7,382426161	3,10E-01
4,01E-01	5,03E-02	6,813086495	3,43E-01
4,11E-01	5,56E-02	6,301052508	3,50E-01
4,24E-01	6,18E-02	5,73892679	3,55E-01
4,34E-01	6,60E-02	5,360496552	3,54E-01
4,46E-01	8,07E-02	4,959360928	4,00E-01
4,57E-01	9,01E-02	4,597528169	4,14E-01
4,67E-01	1,01E-01	4,314782768	4,34E-01
4,78E-01	1,07E-01	4,013707862	4,29E-01
4,90E-01	1,15E-01	3,739926802	4,31E-01
5,00E-01	1,16E-01	3,50778875	4,08E-01
5,12E-01	1,19E-01	3,278724205	3,92E-01
5,21E-01	1,22E-01	3,098015318	3,77E-01
5,33E-01	1,22E-01	2,903650904	3,53E-01
5,43E-01	1,07E-01	2,73782466	2,93E-01
5,54E-01	9,75E-02	2,584269529	2,52E-01
5,66E-01	7,23E-02	2,42132848	1,75E-01
5,77E-01	2,94E-02	2,281757596	6,70E-02
5,89E-01	7,34E-03	2,152336802	1,58E-02
SUM	**1,74E+00**		**7,96E+00**





***Remark**: most recent PWA result gives 1.3 mb !*

$$\sigma_{e+e-} = 7.96x4.5e\text{-}5 = 3.66e\text{-}4 \ [mb]$$