

Analysis of $\pi^- p \rightarrow N\pi\pi$ reaction in the N(1520) resonance region

(how the data for PWA are prepared)

XXXII HADES Collaboration Meeting
19 Oct 2016, Paris



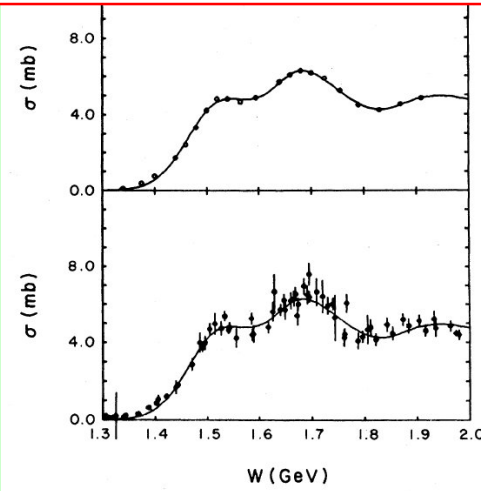
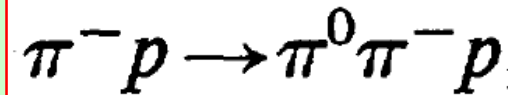
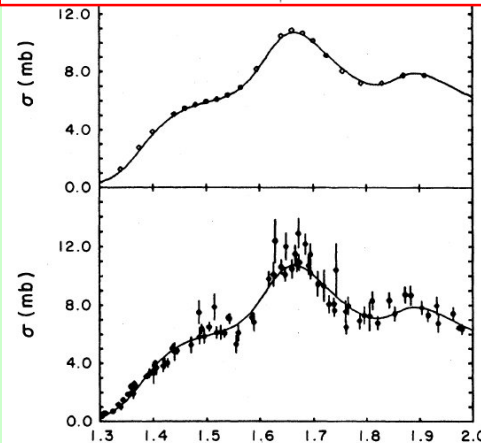
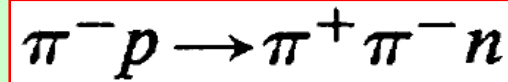
Hello, it's me again!

Witold Przygoda
Jagiellonian University in Kraków

HADES physics for pion beams (2014)

D. M. Manley *et al.*
 Phys. Rev. D 30 (1984) 904

W (MeV)	$\pi^0\pi^0n$	$\pi^+\pi^-n$	$\pi^0\pi^-p$	$\pi^0\pi^+p$	$\pi^+\pi^+n$
1340	0.59	1.27	0.12	0.01	0.00
1375	1.18	2.77	0.39	0.52	0.10
1400	1.45	3.87	0.76	0.70	0.16
1440	1.71	5.09	1.72	1.20	0.25
1460	1.53	5.49	2.43	1.48	0.29
1480	2.10	5.74	3.33	1.99	0.35
1500	2.29	5.96	4.22	2.57	0.44
1520	2.47	6.10	4.83	3.32	0.56
1540	2.64	6.39	4.82	4.54	0.72
1565	2.69	6.92	4.67	6.33	1.04
1595	2.96	8.17	4.88	8.57	1.51
1620				9.55	1.77
1640	3.17	10.47	5.71	9.81	1.77
1660	3.21	10.86	6.07	9.76	1.84
1680	2.79	10.68	6.28	9.47	1.79
1700	3.04	10.16	6.17	8.91	1.55
1725	2.53	9.12	5.89	8.34	1.31
1755	2.54	8.04	5.25	8.24	1.49
1790	1.68	7.21	4.50	9.54	1.48
1830	1.30	7.20	4.24	10.67	2.17
1870	1.80	7.74	4.54	11.39	2.84
1910	2.05	7.76	4.84	10.95	3.16

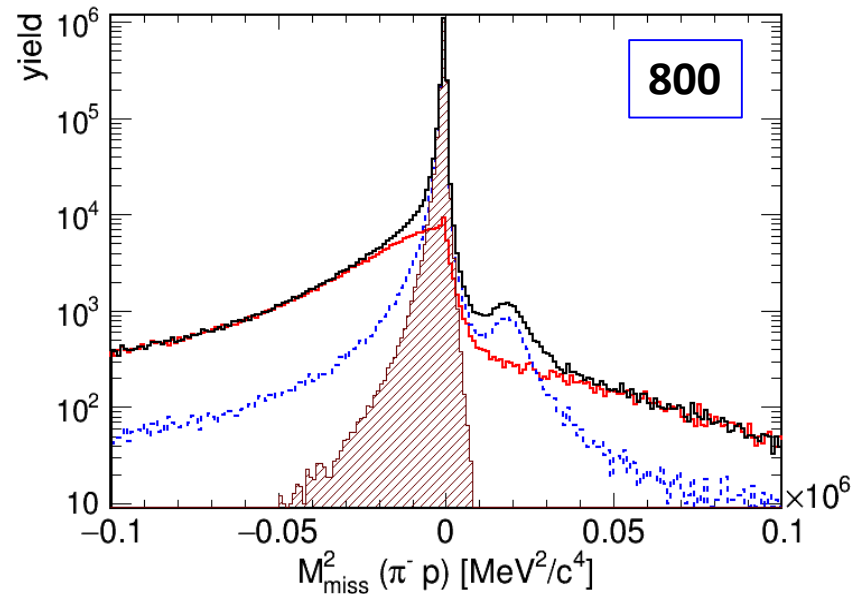
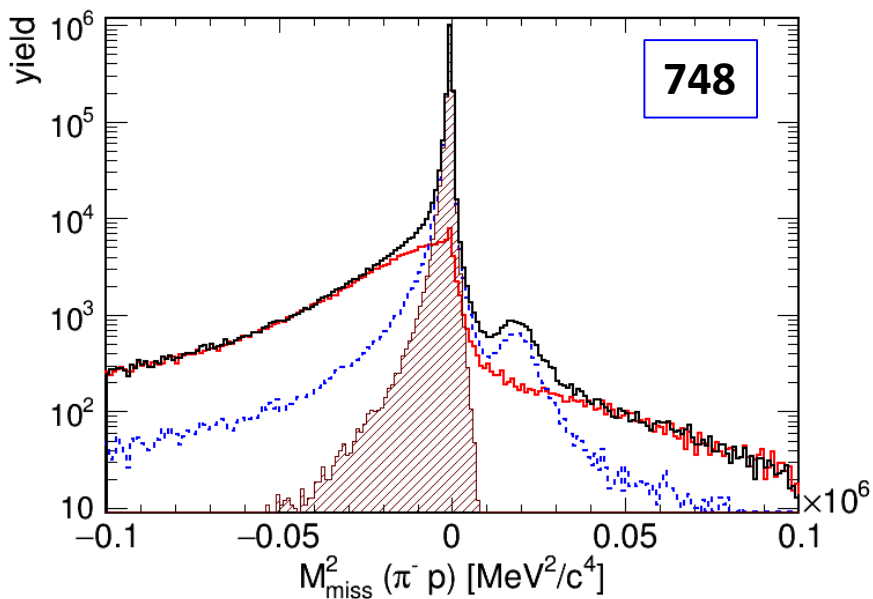
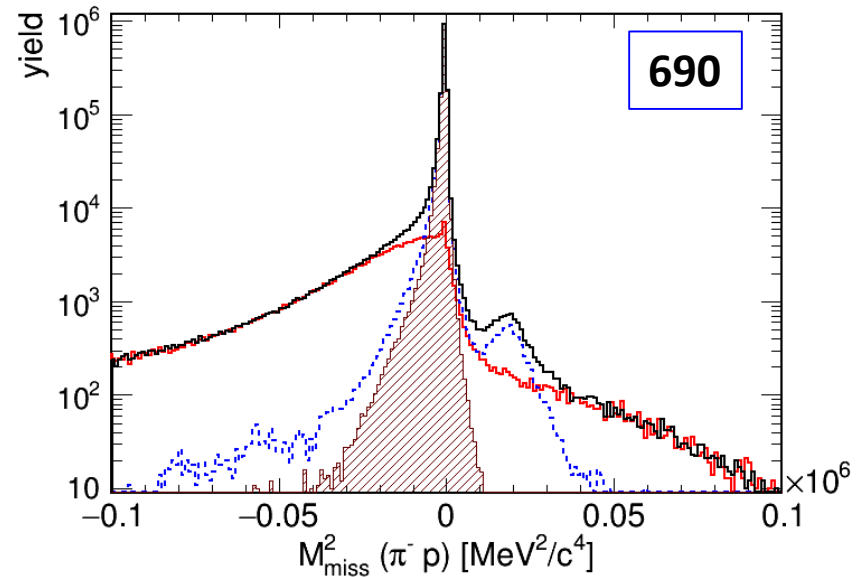
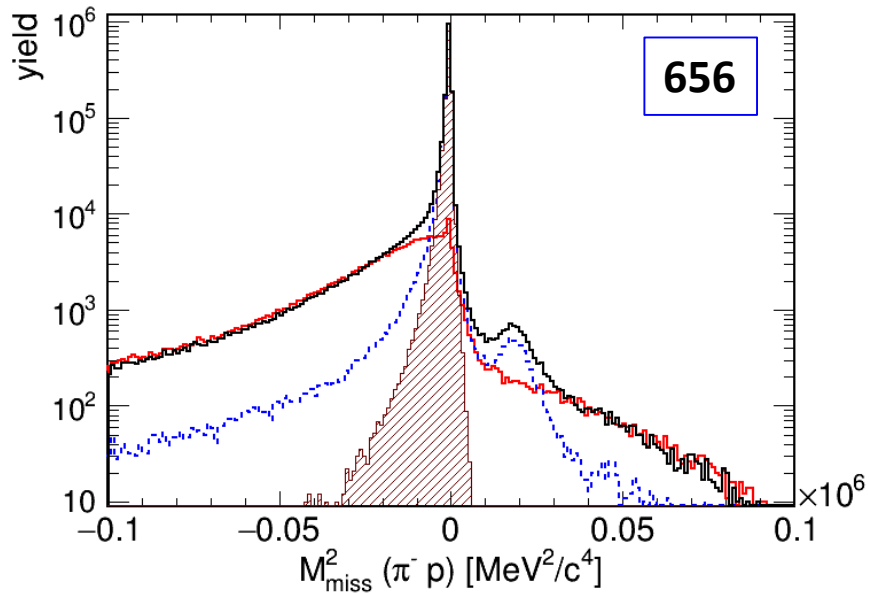


see also SAID database

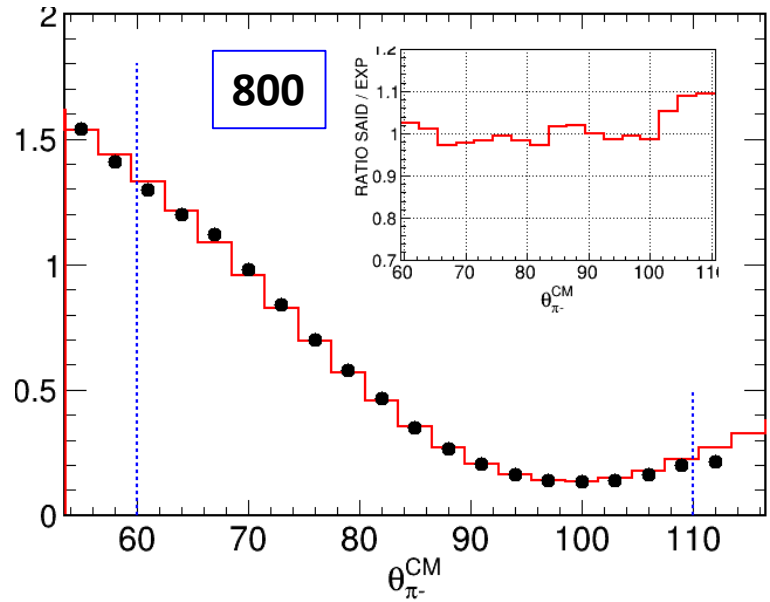
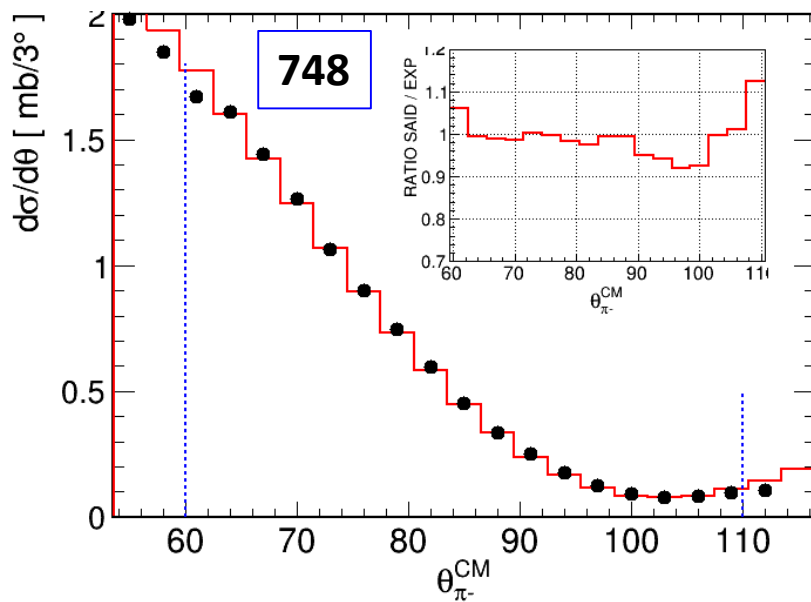
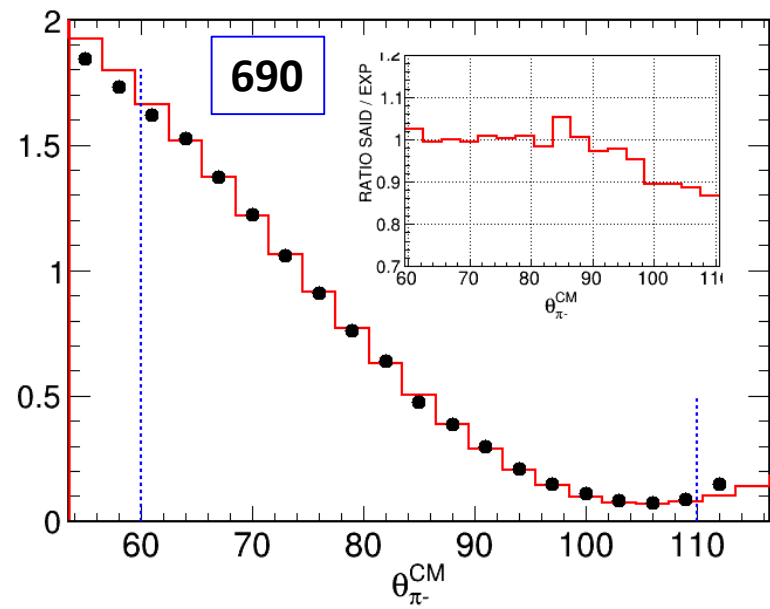
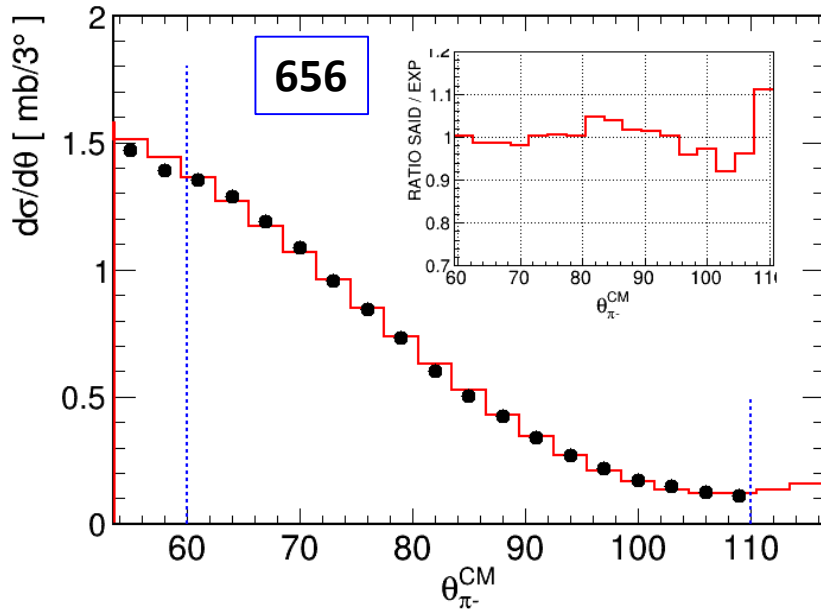
elastic events | strategy

- DST gen2 with energy loss corrections (p, π^-, π^+)
- Beam momentum: max. probability momentum from PT (for PE data): **654.1, 683.5, 738.9, 791.1** MeV/c
- C subtraction based on HADES momentum reconstruction (since no good momentum in C for PT)
- Relative norm. PE to C on ($p\pi^-$) missing mass spectrum „left tail”
- Cross check of C contribution in 2-pion channels
- Matching of C events with PE (**event-by-event**) pre-selection of elastic scattering:
 $|\Delta\varphi| < 5^\circ \quad \tan\theta_p \cdot \tan\theta_{\pi^-} > 1 \quad \textit{reconstructed vertex}$
- After C-events subtracted from PE, fine elastic events selection
 - various cuts tested (i.e. momentum vs theta, momenta in CM)
- The same cuts applied in the full analysis of simulated elastic events
- 1-dimensional (total) correction on $\cos\theta_{\pi^-}^{CM}$ applied
- Normalization (and comparison) to SAID database distribution

elastic events (C subtr.) + el. cut



elastic events | SAID comparison



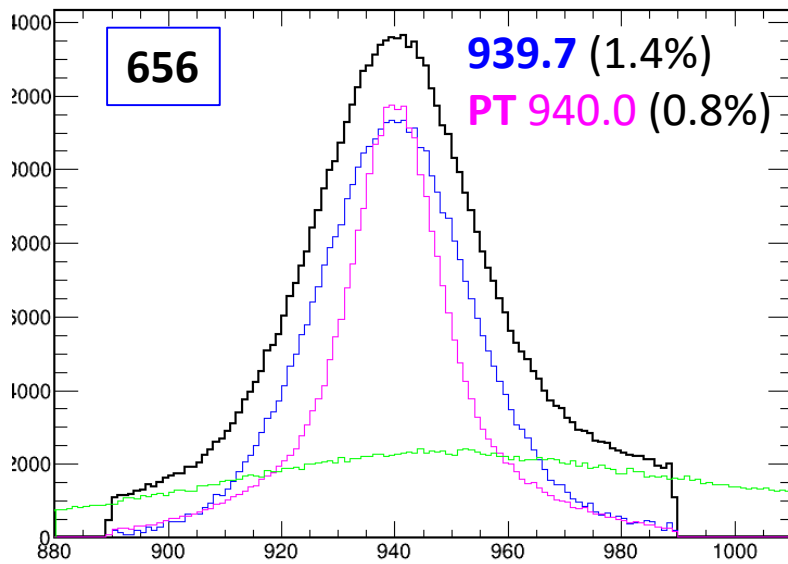
elastic events – normalization data

* events from July not included

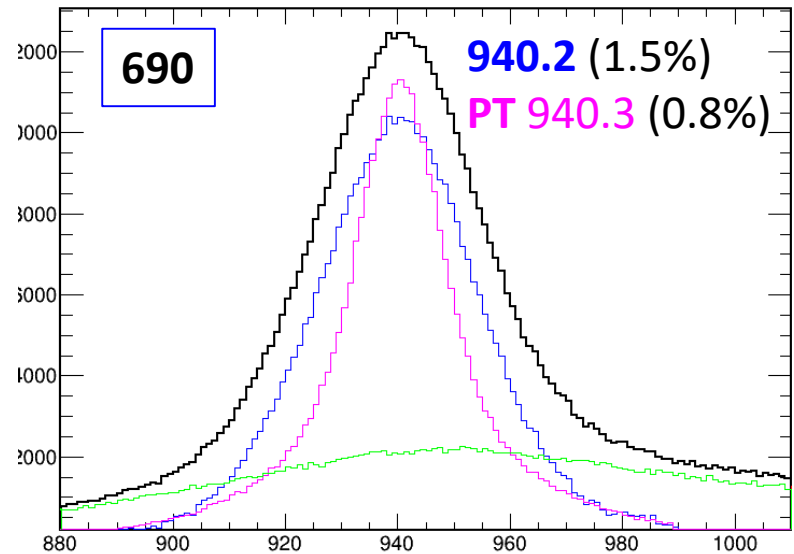
p [MeV/c]	N _{ev} (PE) x 10 ⁶	N _{beam} x 10 ⁹ corrected for dead time	N _{start} x 10 ⁹ (scalers)	N _{el} (60-110) ^{corr} x 10 ⁶	σ (60-110) [mb]	$\frac{\sigma}{N_{el}} \cdot 10^{-7}$ [mb]
656	42.64	2.13	2.95	2.14 2.088	2.99 3.00939	13.97 14.41
690	776.82 *	36.59	47.11	34.68 36.93	3.077 3.10248	0.88 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

$(n \pi^+ \pi^-)$ – events

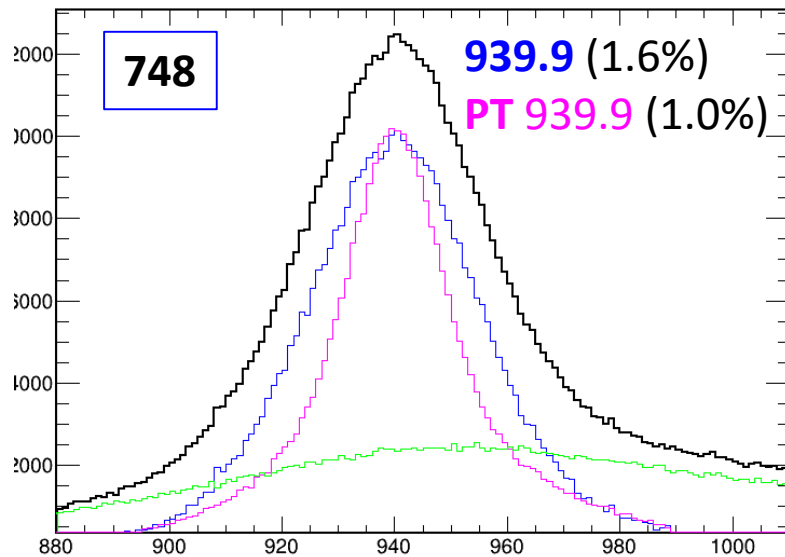
missing mass (656)



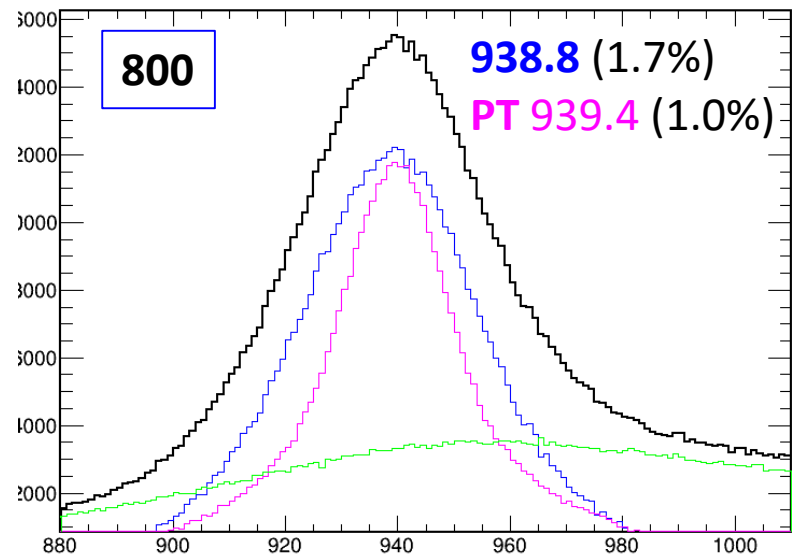
missing mass (690)



missing mass (748)

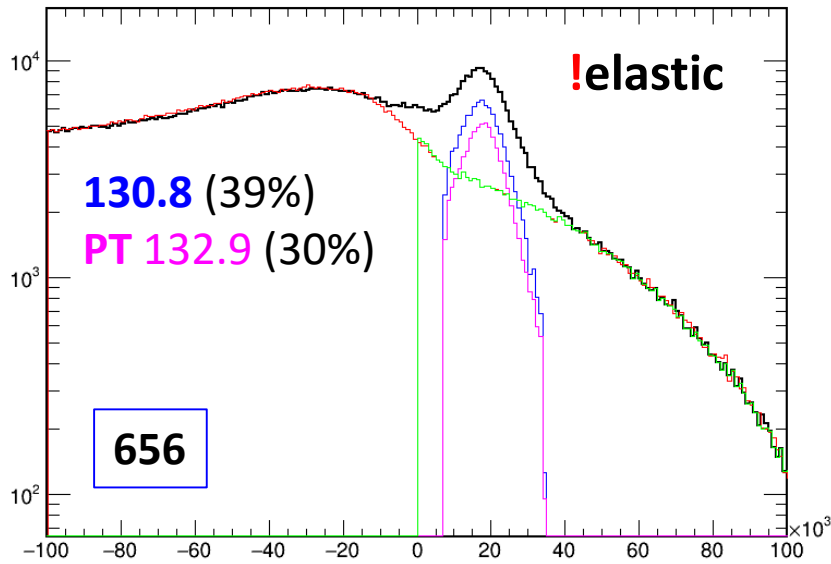


missing mass (800)

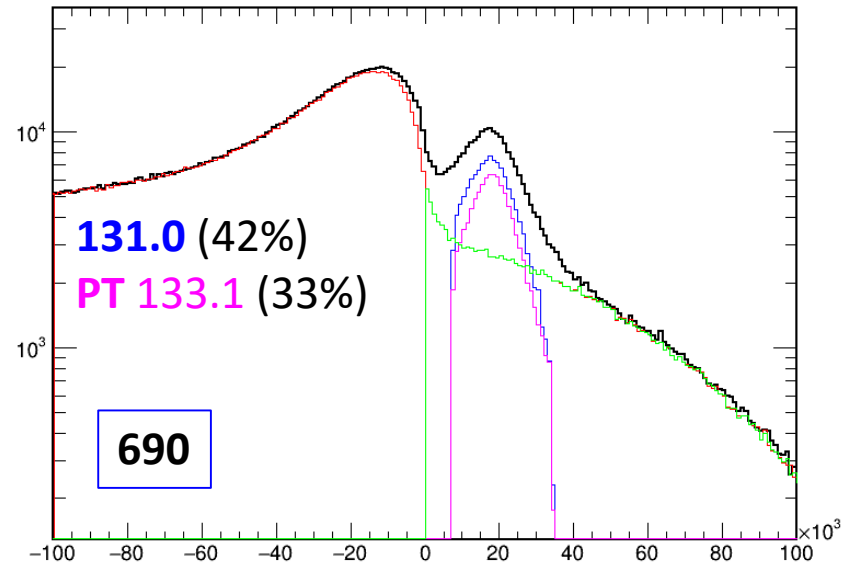


$(p \pi^- \pi^0)$ – events

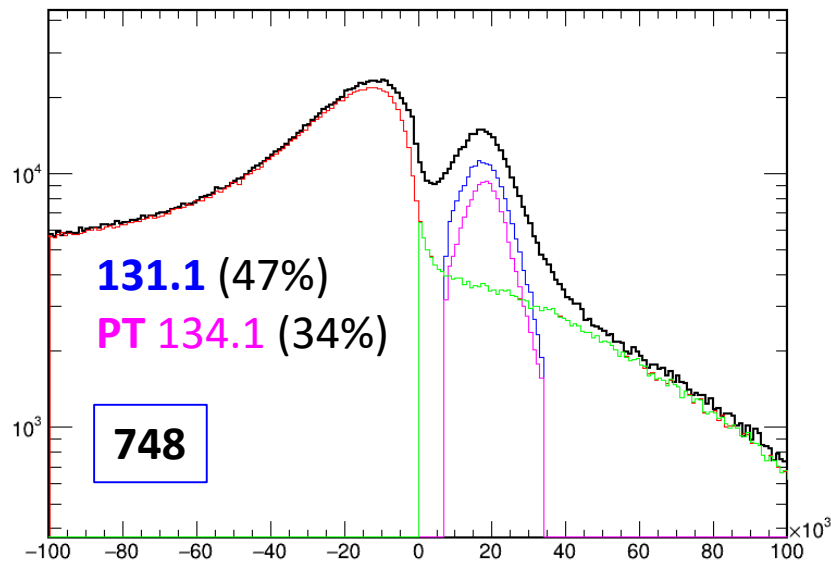
missing mass² (656)



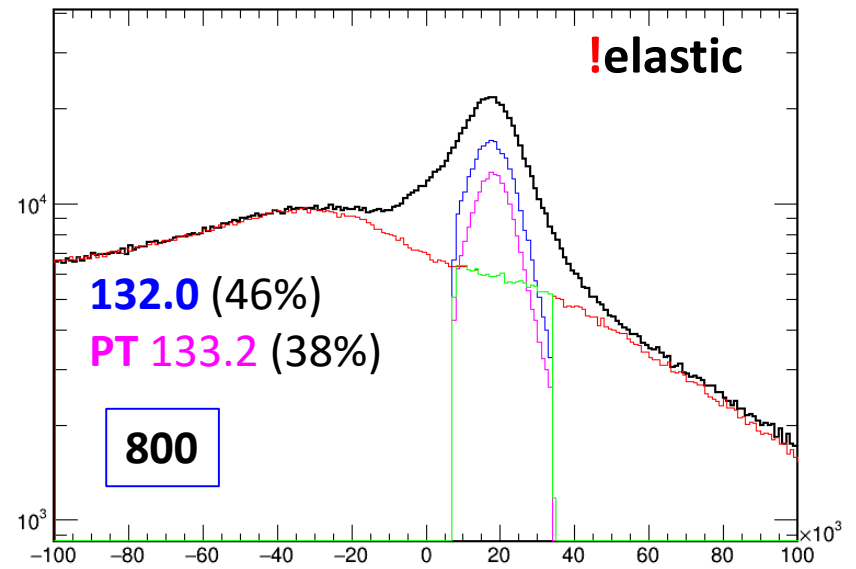
missing mass² (690)



missing mass² (748)



missing mass² (800)



SUMMARY DATA

	# n	# π^0	PT efficiency
656	402'533	121'974	77%
690	387'906	151'620	81%
690 all	7'913'282	3'093'048	[*]
748	407'875	249'175	78%
748 all	815'750	490'350	
800	526'200	368'301	77%

RED – full statistics available

!elastic – no influence on signal
(C subtraction procedure)

[*] beginning of data taking 68%
CARBON efficiency – similar within 1-2%

Auxiliary input to PWA

Phase space MC simulation of
events with 2 pions:
full solid angle + data after full analysis