Cross-Section pion-induced reactions (K^+,K^-)

Joana Wirth

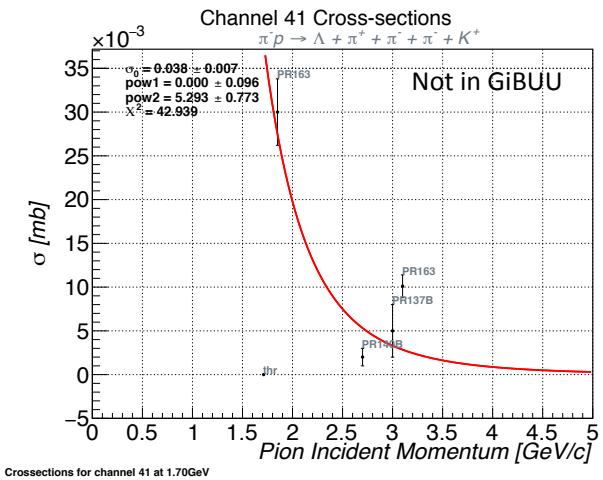
04.07.2016

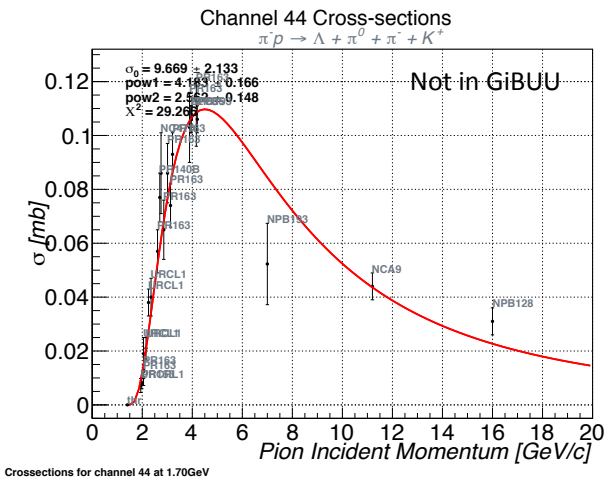
Channels: π^-+p

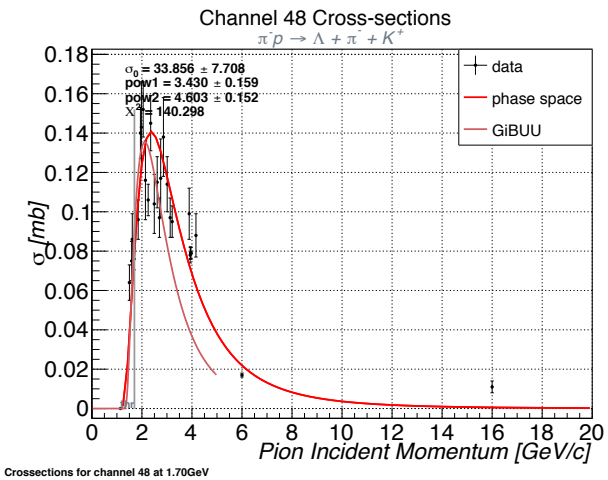
CROSS-SECTION	1.6 < p_lab [GeV/c] < 1.8					
LANDOLT-BÖRNSTEIN	π+p	Threshold (p_lab [GeV/c])	@ 2.1 GeV/c	@ 2.05 GeV/c	@ 1.3 GeV/c	@ 1.7 GeV/c
41	Λπ+2π-K+	1.711	0,0160438	0,0177877	0	0
44	Λπ0π-K+	1.407	0,0174714	0,0145627	2,58E-08	0,00147291
48	Λπ-K+	1.144	0,132829	0,12917	0,0125089	0,0793335
71	Σ+π02π-K+	1.861	1,40E-05	6,35E-06	0	0
74	Σ+2π-K+	1.568	0,00342972	0,0029487	0	0,000331551
77	Σ0π+2π-K+	1.879	0,00315569	0,00210666	0	0
79	Σ0π-K+	1.290	0,0603206	0,0569075	0,000268371	0,0220428
85	Σ-π+π0π-K+	1.879	0,00184049	0,00116596	0	0
87	Σ-π+π-K+	1.585	0,00317572	0,00251117	0	4,60E-05
91	Σ-π0K+	1.290	0,045925	0,043955	0,00021985	0,0189734
93	Σ-K+	1.035	0,0778015	0,0843959	0,236042	0,149846
98	Σ0(1385)π-K+	1.680	7,84E-07	1,54E-07	0	1,50E-29
103	Σ-(1385)π0K+	1.680	0,000225983	0,000152528	0	5,07E-09
104	Σ-(1385)K+	1.399	0,0336068	0,0365553	0	0,0692778
140	pπ0K0K-	1.785	0,00191437	0,00132192	0	0
141	pπ0K0SK-	1.785	1,08E-05	3,25E-06	0	0
151	pπ-K+K-	1.790	0,000219934	0,000108029	0	0
167	pK0K-	1.497	0,0422413	0,0379604	0	0,0071162
168	pK0SK-	1.497	0,00504276	0,004248505	0	0,000477958
180	nπ+K0K-	1.801	7,05E-14	1,16E-15	0	0
194	nπ-K+K0	1.801	1,01E-02	0,0100957	0	0
212	nK+K-	1.495	0,131654	0,0917201	0	1,12E-05

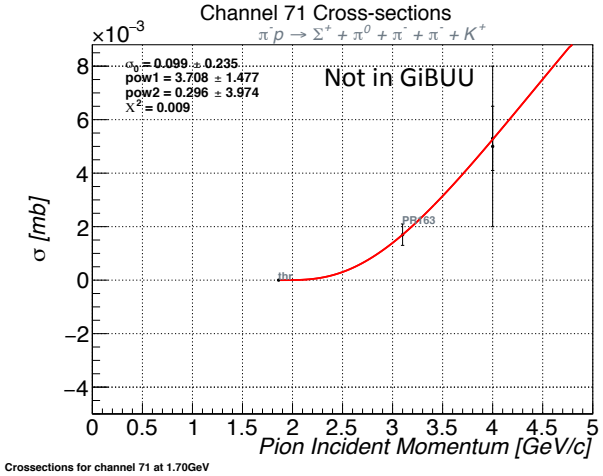
Phase Space: $$\sigma = A\left(1-\frac{s_0}{s}\right)^B\left(\frac{s_0}{s}\right)^C$$

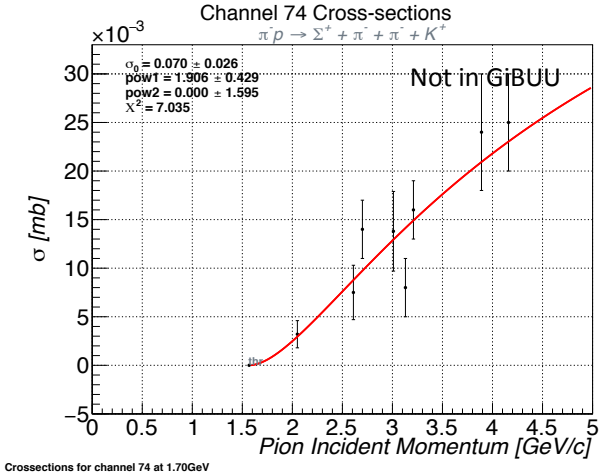
Channels: π^-+p

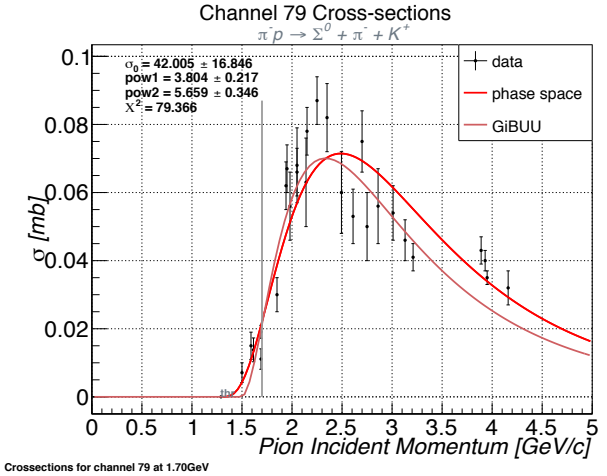




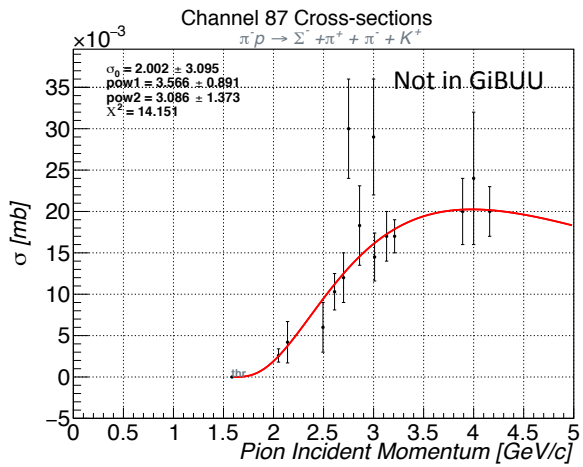




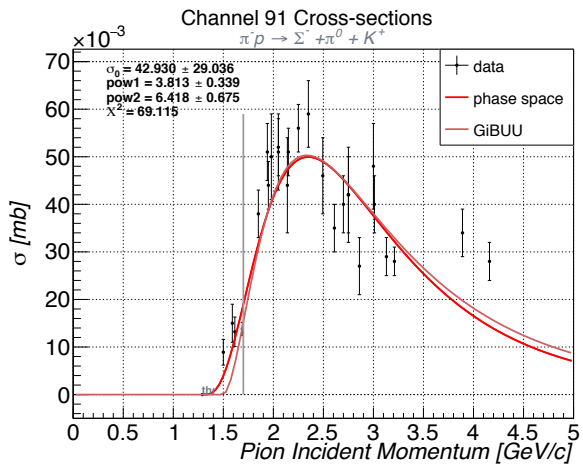




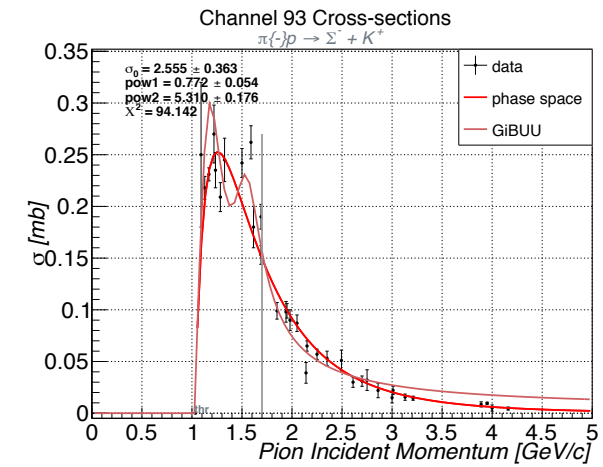
Channels: π^-+p



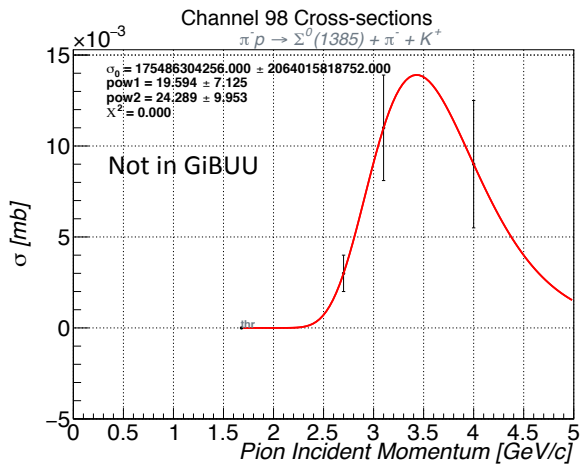
Crossections for channel 87 at 1.70GeV



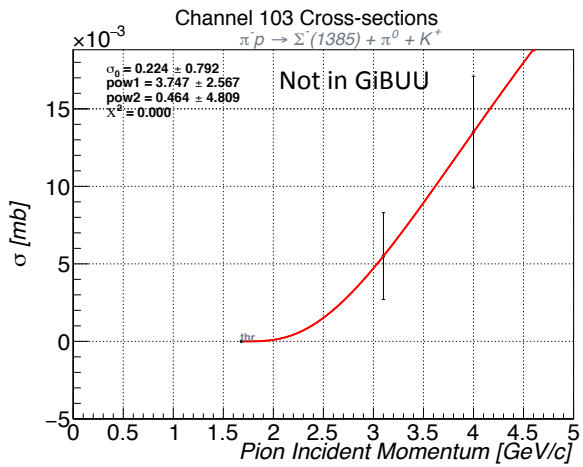
Crossections for channel 91 at 1.70GeV



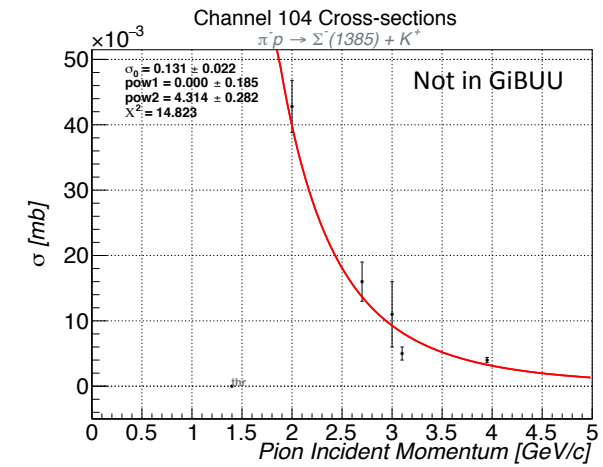
Crossections for channel 93 at 1.70GeV



Crossections for channel 98 at 1.70GeV

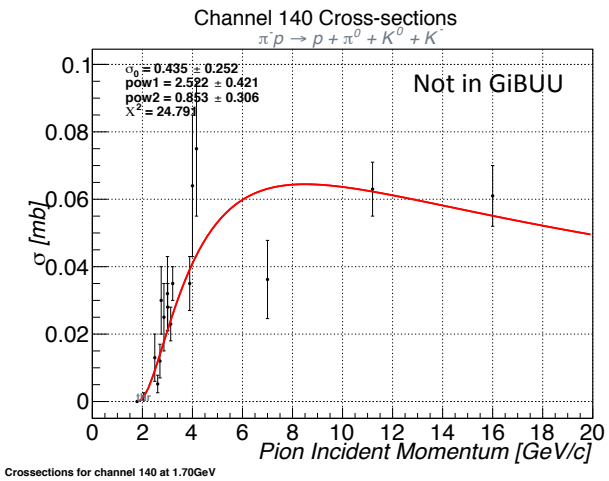


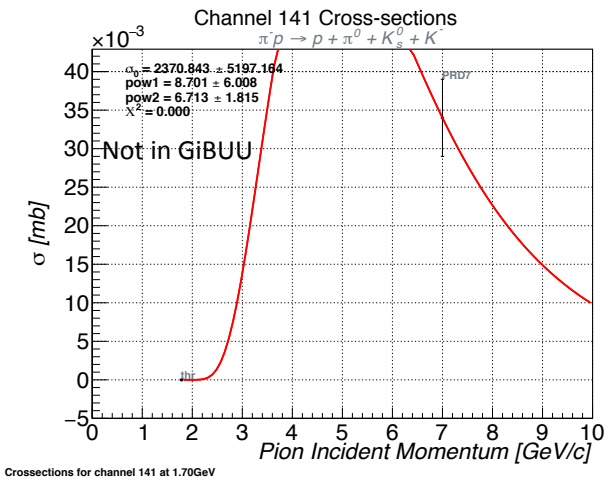
Crossections for channel 103 at 1.70GeV

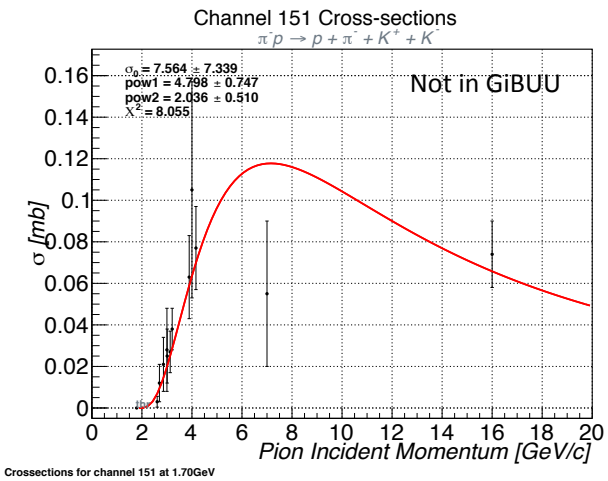


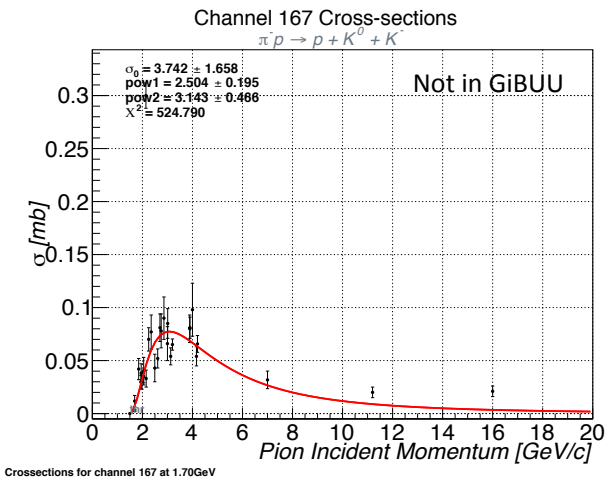
Crossections for channel 104 at 1.70GeV

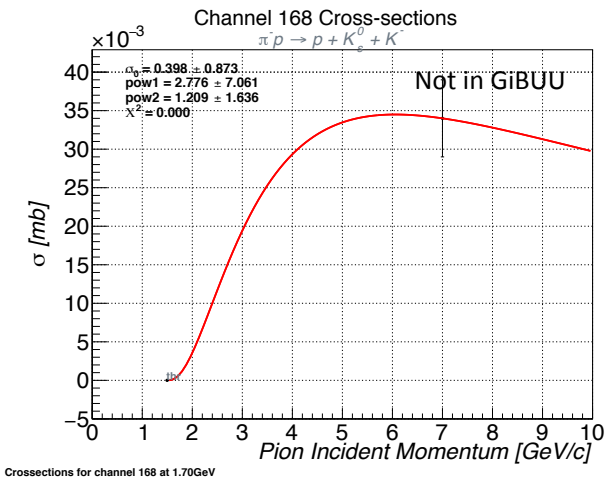
Channels: π^-+p

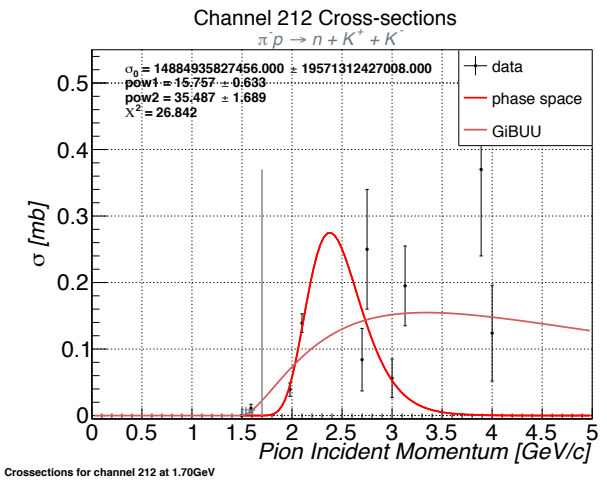






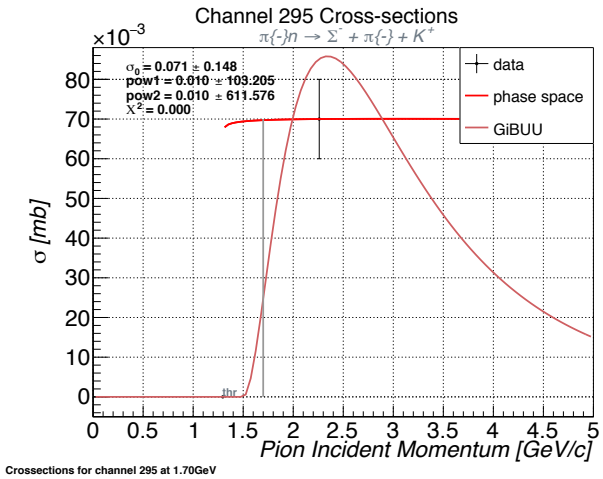


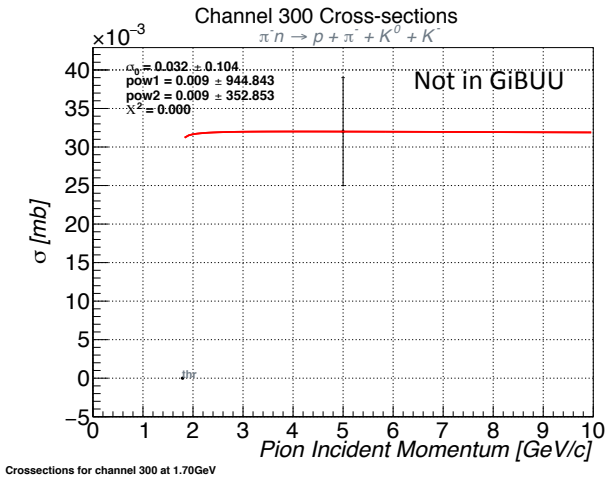




Channels: π^-+n

LANDOLT-BÖRNSTEIN	π+n	Threshold (p_lab [GeV/c])	@ 2.1 GeV/c	@ 2.05 GeV/c	@ 1.3 GeV/c	@ 1.7 GeV/c
295	Σ-π-K+	1.296	0,0699589	0,069942	0,0690658	0,0697227
300	pπ-K0K-	1.792	0,0317483	0,031707	0	0





→ **Too few data point available in Landolt-Börnstein**

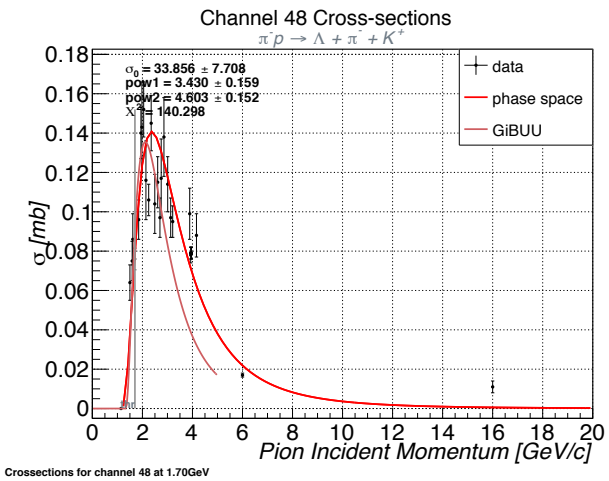
Phase Space: Ratio/Ratio

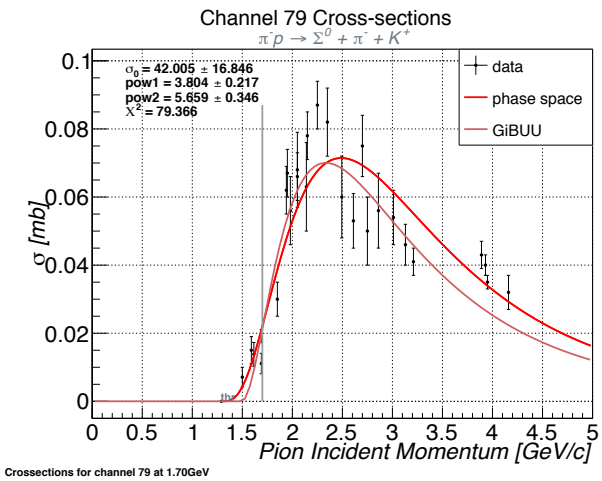
	Fermi:300	Fermi:250	Fermi:250	Fermi:250	Fermi:0	Fermi:0
	Tungesten	Carbon	Tungesten	Carbon	Tungesten	Carbon
p	74	6	74	6	74	6
A	184	12	184	12	184	12
n	110	6	110	6	110	6
σ_K-	1,69E+01	1,002415207	13,50457289	1,002415207	0,56279812	0,04563228
σ_K+	4,75E+01	3,135464884	39,81218557	3,135464884	32,9283023	2,466347441
σ_K-(A2/3)	546,4767341	5,254142054	436,8772219	5,254142054	18,20669792	0,23918081
σ_K+(A2/3)	1536,460833	16,43448522	1287,936847	16,43448522	1065,241037	12,92731766
σ_K-/σ_K+	0,355672414	0,319702259	0,339207021	0,319702259	0,017091623	0,018501967
ratio_ratio	1,11251142		1,061009148		0,923773258	
factor σ_n	2		2		2	
ratio	1,0299461		1,09429432		0,87634713	
factor σ_p	2		2		2	
ratio	1,16286654		1,03524658		0,956863	

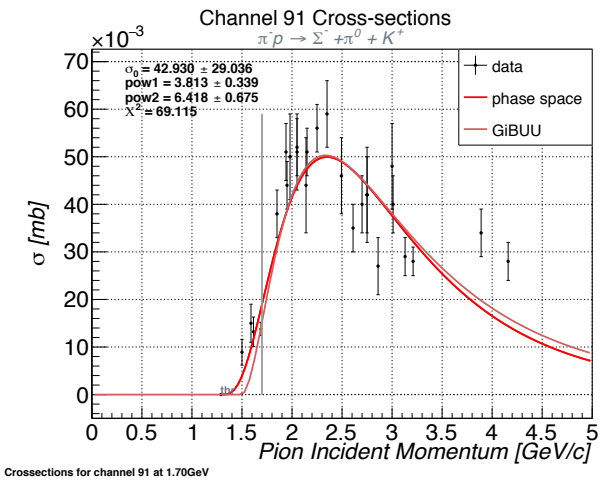
GiBUU vs. Phase Space: Ratio/Ratio

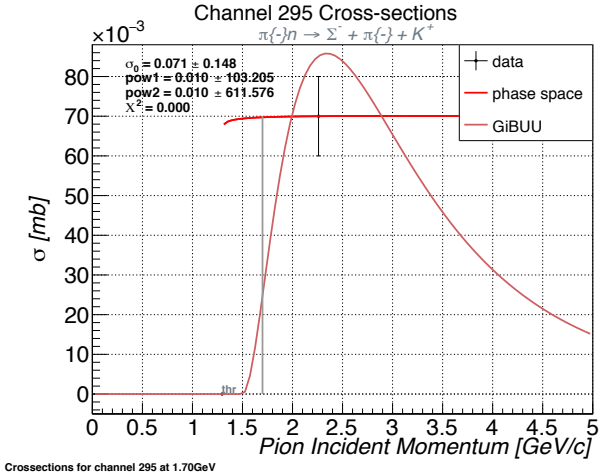
	GiBUU		Phase Space	
	Fermi:0	Fermi:0	Fermi:0	Fermi:0
	Tungesten	Carbon	Tungesten	Carbon
p	74	6	74	6
A	184	12	184	12
n	110	6	110	6
σ_K-	1,659413	0,134547	0,56279812	0,04563228
σ_K+	22,4364562	1,7470398	32,9283023	2,466347441
σ_K-(A2/3)	53,68253757	0,705225785	18,20669792	0,23918081
σ_K+(A2/3)	725,8264838	9,157079042	1065,241037	12,92731766
σ_K-/σ_K+	0,073960566	0,077014273	0,017091623	0,018501967
ratio_ratio	0,960348818		0,923773258	

GiBUU: Gallmeister Parametrization









$$\sigma[mb] = \sigma_0 A \left(\frac{s}{s_0} - 1 \right)^B \left(\frac{s_0}{s} \right)^C ,$$

$$A = 86.027$$

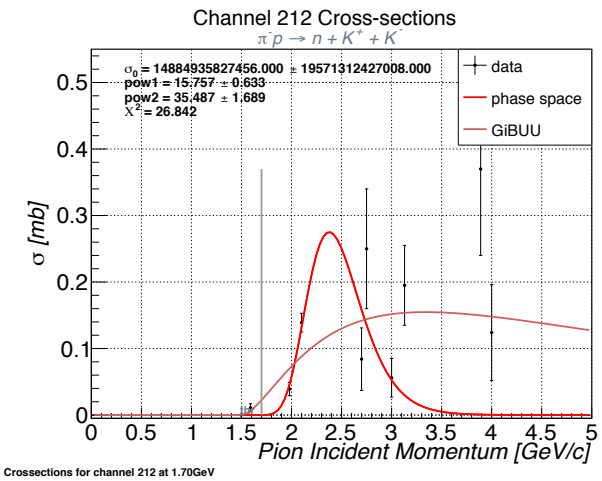
$$B = 2.197$$

$$C = 7.363$$

chan	σ_0	σ@1.7 GeV/c
48	0.140	0.079335
79	0.0724	0.0220428
91	0.0520	0.015239
295	0.0887	0.024712

(12/2008)

GiBUU: Sibirtsev Parametrization

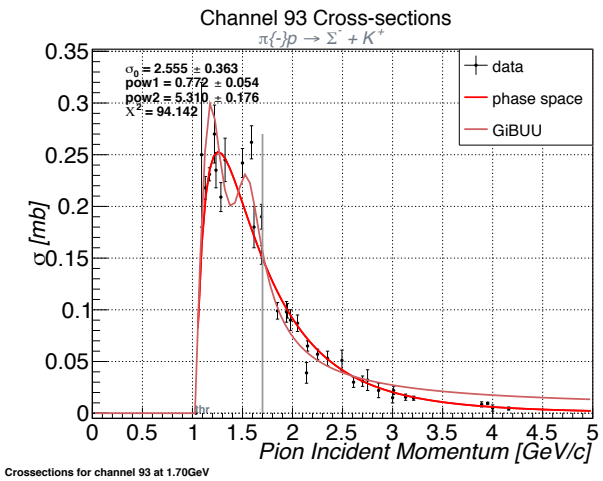


$$\sigma[mb] = 2.0 \cdot 1.12 \left(1 - \frac{s_0}{s}\right)^{1.86} \left(\frac{s_0}{s}\right)^2$$

chan	σ_0	σ@1.7 GeV/c
295		0.024712

W. Cassing, E.L. Bratkovskaya, U. Mosel, S. Teis and A. Sibirtsev, "Kaon versus Antikaon Production at SIS Energies", arXiv:nucl-th/9609050v1 23 Sep 1996

GiBUU: Huang Parametrization



$$\sigma[mb] = \frac{0.009803\left(\sqrt{s}-\sqrt{s_0}\right)^{0.6021}}{\left(\sqrt{s}-1.742\right)^2+0.006583} + \frac{0.006521\left(\sqrt{s}-\sqrt{s_0}\right)^{1.4728}}{\left(\sqrt{s}-1.940\right)^2+0.006248},$$

$$\sqrt{s_0} = 1.688$$

chan	σ_0	σ@1.7 GeV/c
93		0.149846

Tsushima et al., Phys. Lett. B337 (1994) 245-253

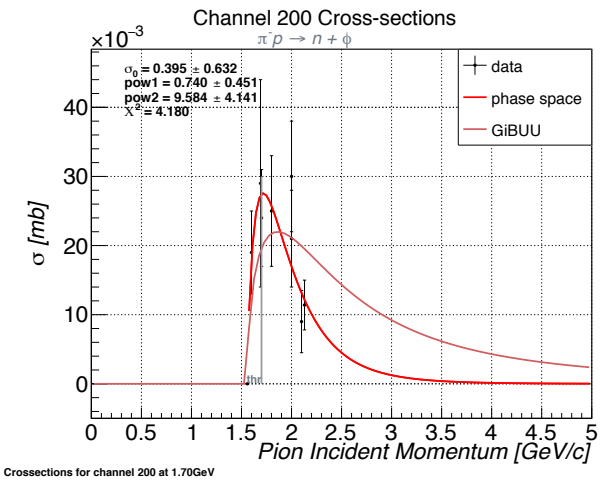
GiBUU vs. Phase Space: Ratio/Ratio

Kaon channels + 0.489 * $\sigma(\pi^- p \rightarrow n\Phi \rightarrow nK^+K^-)$

	GiBUU		Phase Space		**scaled GiBUU**	
	Fermi:0 Tungesten	Fermi:0 Carbon	Fermi:0 Tungesten	Fermi:0 Carbon	Fermi:0 Tungesten	Fermi:0 Carbon
p	74	6	74	6	74	6
A	184	12	184	12	184	12
n	110	6	110	6	110	6
σ_K-	2,368861242	0,19206983	1,556067634	0,126167646	710,6583725	57,62094912
σ_K+	23,14590444	1,80456263	33,92157182	2,546882807	2364,764922	170,0979991
σ_K-(A2/3)	76,63341351	1,00673071	50,33928216	0,661305545	22990,02405	302,0192131
σ_K+(A2/3)	748,7773597	9,458583968	1097,373622	13,3494424	76500,89628	891,5657347
σ_K-/σ_K+	0,102344726	0,106435669	0,04587251	0,049538065	0,300519669	0,338751481
ratio_ratio	0,961564172		0,92600528		0,887139057	

scaled GiBUU: **300*phiN** **30*SigmaKaon** **300*KaonKaonBarN** **300*SigmaKaonPion** **30*LambdaKaonPion**

GiBUU: Glubeva Parametrization



A. Sibirtsev et al.,
"Heavy meson production in proton-nucleus reactions with empirical spectral functions ", Z. Phys. A 358 (1997), 357

chan	σ_0	σ@1.7 GeV/c
200		0.027449

$$\sigma[\mu b] = \frac{B}{2} \cdot \frac{\pi^2}{\sqrt{s}} \cdot \frac{\Gamma^2}{\left(\sqrt{s} - M_R\right)^2 + \frac{\Gamma^2}{4}} \cdot \frac{\sqrt{[s-(m_n - m_\Phi)^2][s-(m_n - m_\Phi)^2]/(4\cdot s)}}{[s-(m_\pi - m_p)^2][s-(m_\pi - m_p)^2]/(4\cdot s)}$$

$$= \frac{5.88}{2} \cdot \frac{\pi^2}{\sqrt{s}} \cdot \frac{0.99^2}{\left(\sqrt{s} - 1.8\right)^2 + \frac{0.99^2}{4}} \cdot \frac{\sqrt{[s-(m_n - m_\Phi)^2][s-(m_n - m_\Phi)^2]/(4\cdot s)}}{[s-(m_\pi - m_p)^2][s-(m_\pi - m_p)^2]/(4\cdot s)}$$

Nucleon momentum distribution

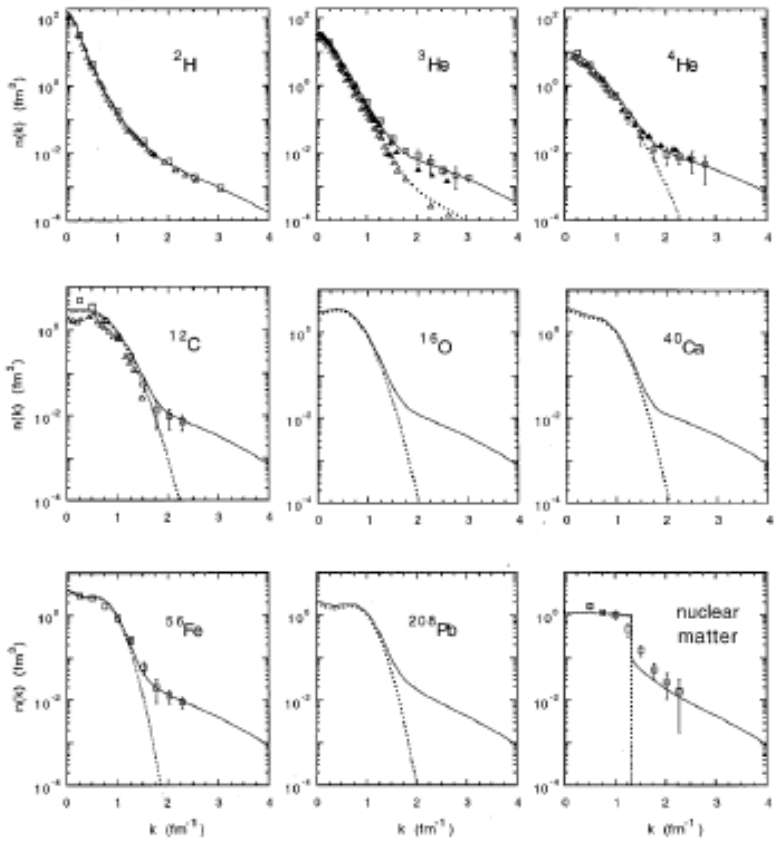


Figure 1: Nucleon momentum distributions $n(k)$ (solid lines) along with the momentum distribution for nucleons in an average potential (dotted lines) for various nuclei are shown. The deuteron distribution was calculated in [10] using the Paris potential [11]. Also shown are distributions for ^{3}He [12], ^{4}He [13] ^{12}C [14], ^{16}O [15], ^{40}Ca [14], ^{56}Fe [16], ^{208}Pb [17], and infinite nuclear matter [18]. The open squares represent the results obtained within the y-scaling analysis of inclusive data from Ref. [19] and the open and full triangles represent the values obtained from exclusive experiments on ^{2}H [20, 21], ^{3}He [22, 23, 24], ^{4}He [25, 26] and ^{12}C [27]. Figure reprinted with permission from Ref. [10]

Assuming that W has the same size as Pb, the difference in the momentum distribution is small.

arXiv:1104.1196v3 [nucl-ex] 26 Mar 2012