$\pi\pi$ in hepdata

Fedor Ignatov

26 May 2021

STRONG2020-db zoom meeting

2pi Novosibirsk data

#NOVOSIBIRSK-VEPP-2-CMD2

Akhmetshin et al, JETP Lett.84:413-417,2006. https://www.hepdata.net/record/ins728191
Akhmetshin et al, Phys.Lett.B527(2002)161;Phys.Lett.B578:285-289,2004 https://www.hepdata.net/record/ins568807
Akhmetshin et al, Phys.Lett.B648:28-38,2007 https://www.hepdata.net/record/ins728302
Aulchenko et al., JETP LETTERS Vol. 82 No. 12 (2005) 743-747 https://www.hepdata.net/record/ins712216

#NOVOSIBIRSK-VEPP-2-OLYA,
#NOVOSIBIRSK-VEPP-2M-CMD
Summary paper for both experiments:
L.M. Barkov et al. Nucl.Phys.B256:365-384,1985 https://www.hepdata.net/record/ins221309

#NOVO-TOF
I.B. Vasserman et al Yad.Fiz.33:709-714,1981, Sov.J.Nucl.Phys.33:368-370,1981 https://www.hepdata.net/record/ins167191

#NOVOSIBIRSK-VEPP-2
Preliminary results in V.L.Auslander et al., Phys. Lett. 25B (1967) no.6, 433 https://www.hepdata.net/record/ins1392895
final: Yad.Fiz. 9 (1969) 114-119, Auslender 69 BINP-243(1968) https://www.hepdata.net/record/ins57008

Balakin et al. Phys.Lett.B34(1971)328 https://www.hepdata.net/record/ins69313
Balakin et al. Phys.Lett.B41(1972)205 https://www.hepdata.net/record/ins75634

2pi Novosibirsk data

#NOVOSIBIRSK-VEPP-2-CMD2

https://www.hepdata.net/record/ins728191 ✔ OK values, stat, syst errors
https://www.hepdata.net/record/ins568807 ✔ OK values, stat, syst errors
https://www.hepdata.net/record/ins728302 ✔ OK values, stat, syst errors
https://www.hepdata.net/record/ins712216 ✔ OK values, stat;

x systematic error is mentioned only in comment:
SYS - 1.2 TO 4.2////Systematic uncertainty from lowest to highest energy.

It will be necessary to add systematic by hand as: syst= 0.012+(E-0.98)/(1.38-0.98)*(0.042-0.012)
Or to modify hepdata entry to include additional systematic column

#NOVOSIBIRSK-VEPP-2-OLYA, #NOVOSIBIRSK-VEPP-2M-CMD
https://www.hepdata.net/record/ins221309

x 5 typos in values (OLYA: at E=1152,1317, CMD: at E=380,778,782)
OLYA: no systematic provided in hepdata - should be syst=$\sqrt{(0.04^2+ 0.04^2/|F_\pi^2|^2)}$
CMD: Systematic error is mentioned only in comment: "Axis error includes +- 2./2. contribution (Total systematic error)" – 2%
Misleading comment "SIG [NB] Summed error" - it is only statistical error in the tables, systematic should be as addition
It will be better to modify the hepdata entry to include additional systematic column

#NOVO-TOF
https://www.hepdata.net/record/ins167191 ✔ OK values, stat errors (table with cross-section, FSR should be returned)

x systematic error not given in paper, (at least some of systematic included in total error)
Table 2 in hepdata entry is same as Table 1; comment for "SQRT(S) 1.4-40.0 GeV" - is mess

2pi Novosibirsk data

#NOVOSIBIRSK-VEPP-2

Preliminary results in V.L.Auslander et al., Phys. Lett. 25B (1967) no.6, 433 https://www.hepdata.net/record/ins1392895

final: Yad.Fiz. 9 (1969) 114-119, Auslender 69 BINP-243(1968) https://www.hepdata.net/record/ins57008

x Provided only ρ-peak value of BW fit. Points wasn't provided in papers, but in principal it is available

Maybe it will be usefull to insert this points in HepData entry for historical reasons

It was first ever paper of e+e- → hadrons

Volume 25B, number 6 PHYSICS LETTERS 2 October 1967

INVESTIGATION OF THE ρ-MESON RESONANCE WITH ELECTRON-POSITRON COLLIDING BEAMS

V. L. AUSLANDER, G. I. BUDKER, Ju. N. PESTOV, V. A. SIDOROV, A. N. SKRINSKY and A. G. KHABAKHPASHEV
Institute of Nuclear Physics, Siberian Branch of the USSR Academy of Sciences, Novosibirsk, USSR

Received 1 September 1967

Preliminary results on the determination of the position and shape of the ρ-meson resonance with electron-positron colliding beams are presented.

When experiments with electron-positron colliding beams were planned [1, 2] investigation of the process

$$e^- + e^+ \to \pi^- + \pi^+$$
$$e^- + e^+ \to K^- + K^+$$

coming particles and the coordinates of the interaction point. The nature of the particles is identified by their interaction with the material of the plates in the "shower" and "range" spark chambers. The "shower" chamber has eleven copper plates 6 mm thick, the "range" chamber

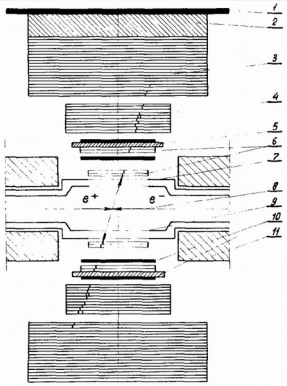

Fig. 1. Spark chambers system:
1) Anticoincidence scintillation counter
2) Lead absorber 20 cm thick
3) "Range" spark chamber
4) "Shower" spark chamber
5) Duraluminium absorber 2 cm thick
6) Thin-plate spark chambers
7) Window of outer vacuum chamber
8) Interaction region
9) Inner vacuum chamber
10) Storage ring magnet
11) Scintillation counters

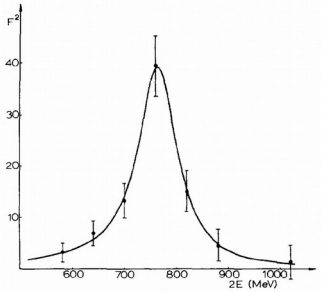

Fig. 2. Experimental values of F^2 (E) approximated by the Breit-Wigner formula.

ment geometry and F- modulus of the form factor for pion pair production [1]. In the case of QED with no other forces F=1. If the particles are produced at the angle 90° with respect to the beam axis then a=18. Integration over the solid angle gives a=20.4.

Experimentally obtained values of the function F^2 (E) shown in fig. 2 clearly demonstrate its resonant character.

Approximation of the experimental results by

https://www.hepdata.net/record/ins69313 ✔ OK values x error as summed of stat, syst

https://www.hepdata.net/record/ins75634 ✔ OK values x error as summed of stat, syst

Additional corrections

K.Hagiwara, T. Teubner et al., hep-ph/0312250

OLYA, CMD, TOF:

was using only lepton part of vacuum polarization in e+e- → e+e- normalization, and also VP_{lep} was subtracted from data with rad correction

It is necessary to add correction to $|F_\pi|^2$:

$$C_{vp} = (\alpha(t_{min})/\alpha_{lep}(t_{min}))^2 \cdot (\alpha_{lep}(s)/\alpha)^2$$

$$t_{min} = -s(1-\cos(\theta_{cut}))/2$$

$\cos(\theta_{cut})$ = OLYA: 0.71, CMD: 0.6, TOF: 0.24

Corrections ~ +2-3%

Cross check

Simple a_μ integral with linear interpolation between points (with applied corrections)

HepData is loaded via json file (with hardcoded systematic for some of entries).

Difference because of rounded numbers in papers

CMD2

a_μ = 4.93565e-08 +- 3.10683e-10 +- 3.47659e-10 my own db

4.93584e-08 +- 3.10136e-10 +- 3.47669e-10 loaded from HepData

OLYA

5.32086e-08 +- 2.21145e-09 +- 2.15538e-09 my own db

5.32086e-08 +- 2.21154e-09 +- 2.15538e-09 loaded from HepData

5.32086e-08 +- 2.21145e-09 +- 2.15538e-09 corrected HepData table in exported json file

CMD

4.30911e-08 +- 1.13146e-09 +- 8.61823e-10 my own db

4.30914e-08 +- 1.13144e-09 +- 8.61829e-09 loaded from HepData

4.30911e-08 +- 1.13146e-09 +- 8.61823e-10 corrected HepData table

TOF

1.87329e-09 +- 1.53187e-10 +- 3.74657e-10 my own db

1.87329e-09 +- 1.53187e-10 +- 3.74657e-10 loaded from HepData

VEPP

3.35194e-08 +- 4.14809e-09 +- 6.70388e-09 my own db

3.35194e-08 +- 4.14809e-09 +- 6.70388e-09 loaded from HepData + missed table