

**GENIE comparison with world neutrino cross-section data**

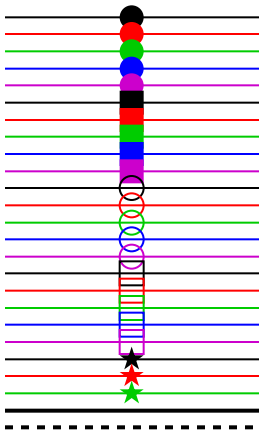
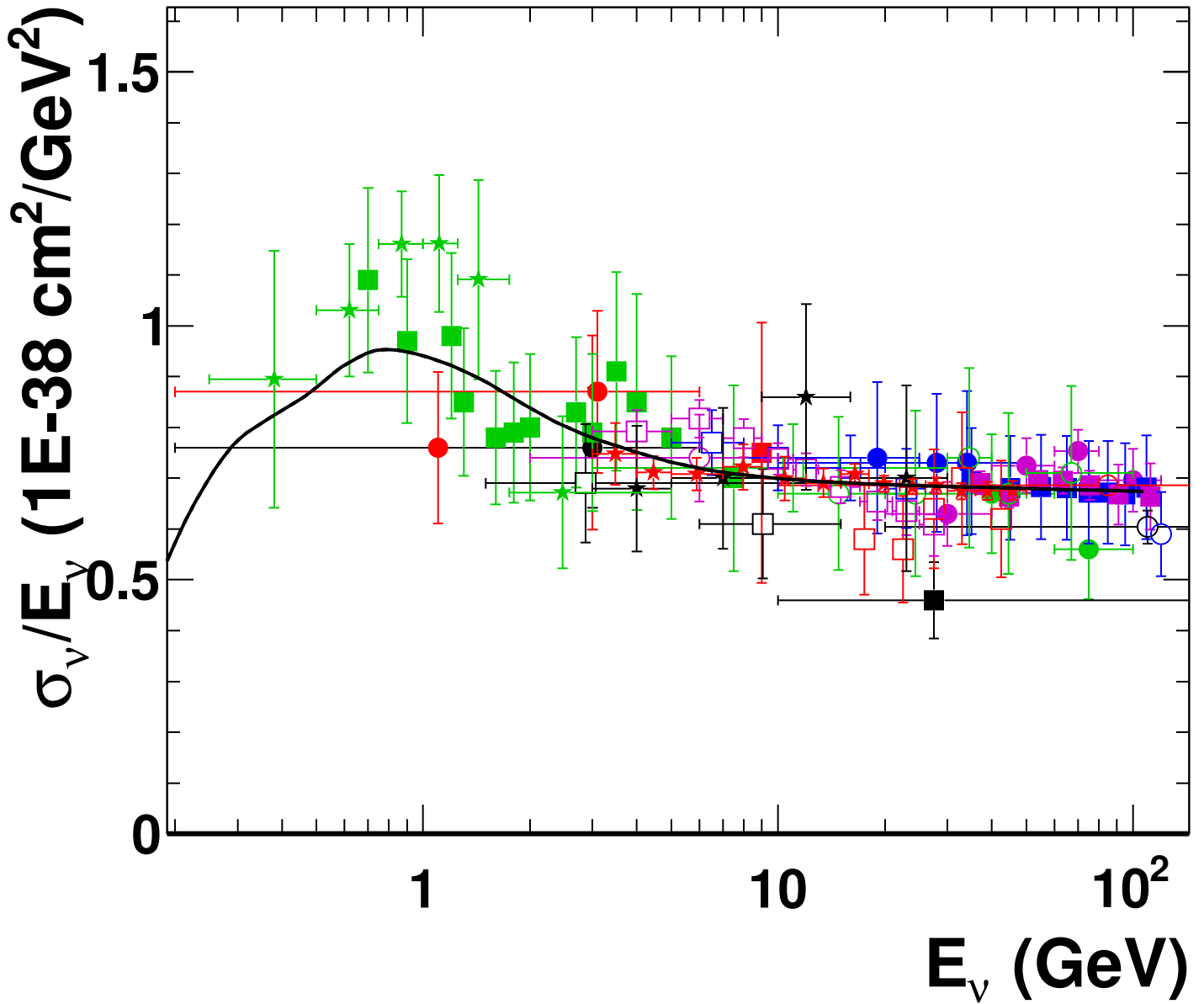
**Models included in the comparison:**

**0 : R-2\_10\_6-2016-04-04**

**1 : R-2\_10\_8-2016-05-12**

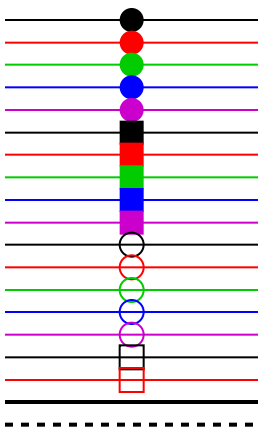
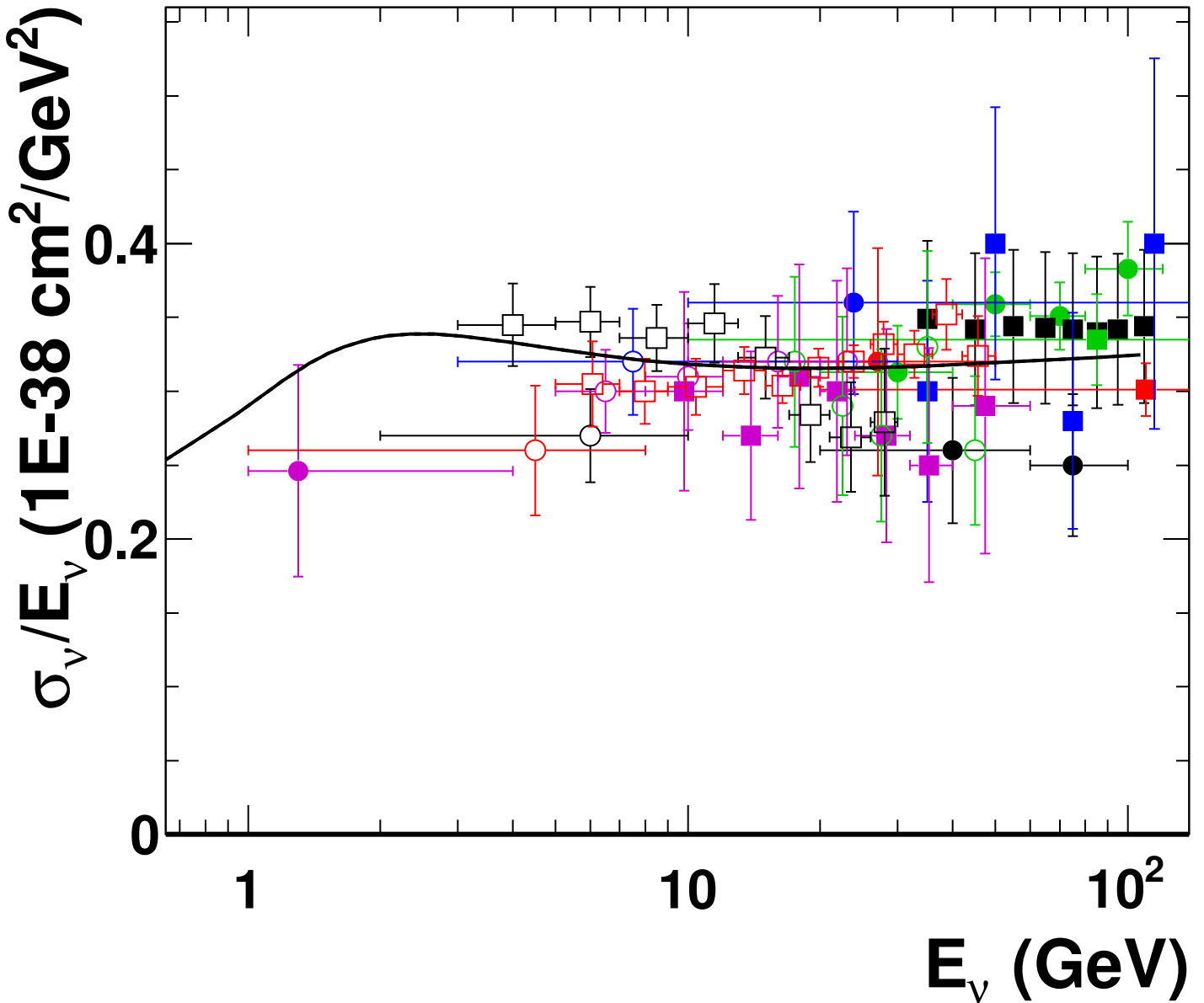
**2016/05/17 15:48:26**

# $\nu_\mu$ CC inclusive



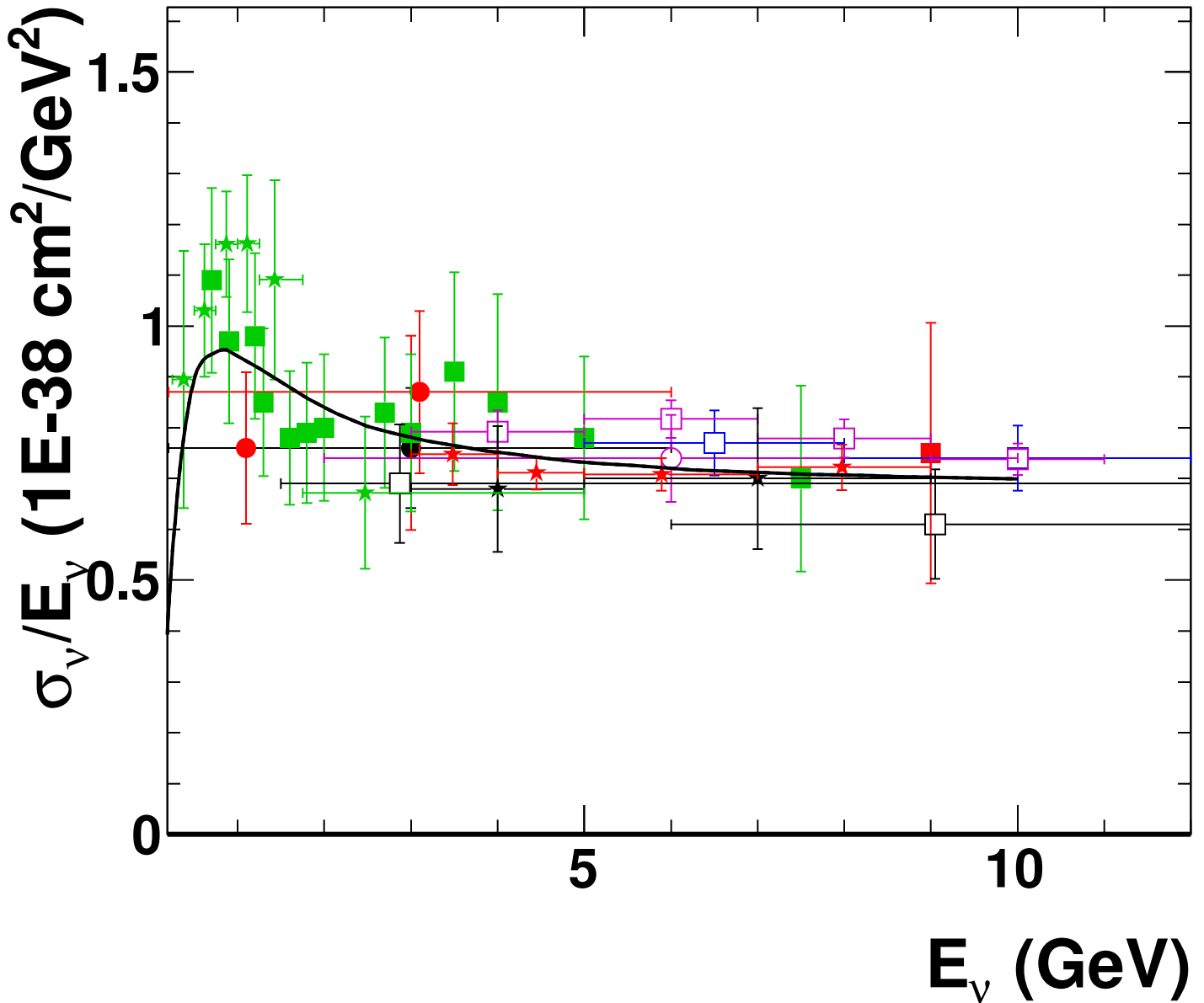
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 BEBC.2 [Colley et al., Zeit. Phys. C2:187 (1979)]  
 BEBC.5 [Bosetti et al., Phys. Lett. B110:167 (1982)]  
 BEBC.8 [Parker et al., Nucl. Phys. B232:1 (1984)]  
 BNL-7FT.0 [Baltay et al., Phys. Rev. Lett. 44:916 (1980)]  
 BNL-7FT.4 [Baker et al., Phys. Rev. D25:617 (1982)]  
 CCFE.2 [Seligman et al., Nevis Report 292 (1996)]  
 CCFE.0 [MacFarlane et al., Zeit. Phys. C26:1 (1984)]  
 CHARM.0 [Jonker et al., Phys. Lett. B99:265 (1981)]  
 CHARM.4 [Allaby et al., Zeit. Phys. C38:403 (1988)]  
 FNAL-15FT.1 [Kitagaki et al., Phys. Rev. Lett. 49:98 (1982)]  
 FNAL-15FT.2 [Baker et al., Phys. Rev. Lett. 51:735 (1983)]  
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 Gargamelle.10 [Ciampolillo et al., Phys. Lett. B84:281 (1979)]  
 Gargamelle.12 [Mortin et al., Phys. Lett. B104:235 (1981)]  
 IHEP-ITP.0 [Asratyan et al., Phys. Lett. B76:239 (1978)]  
 IHEP-ITP.2 [Voverko et al., Sov. J. Nucl. Phys. 30:528 (1979)]  
 IHEP-JINR.0 [Anikeev et al., Zeit. Phys. C70:39 (1996)]  
 SKAT.0 [Baranov et al., Phys. Rev. B81:255 (1979)]  
 MINOS.0 [Adamson et al., Phys. Rev. D81:072002 (2010)]  
 SciBooNE.0 [Nakajima et al., Phys. Rev. D83:012005 (2011)]  
 P-2\_10-6-2016-04-04  
 P-2\_10-8-2016-05-12

# $\bar{\nu}_\mu$ CC inclusive



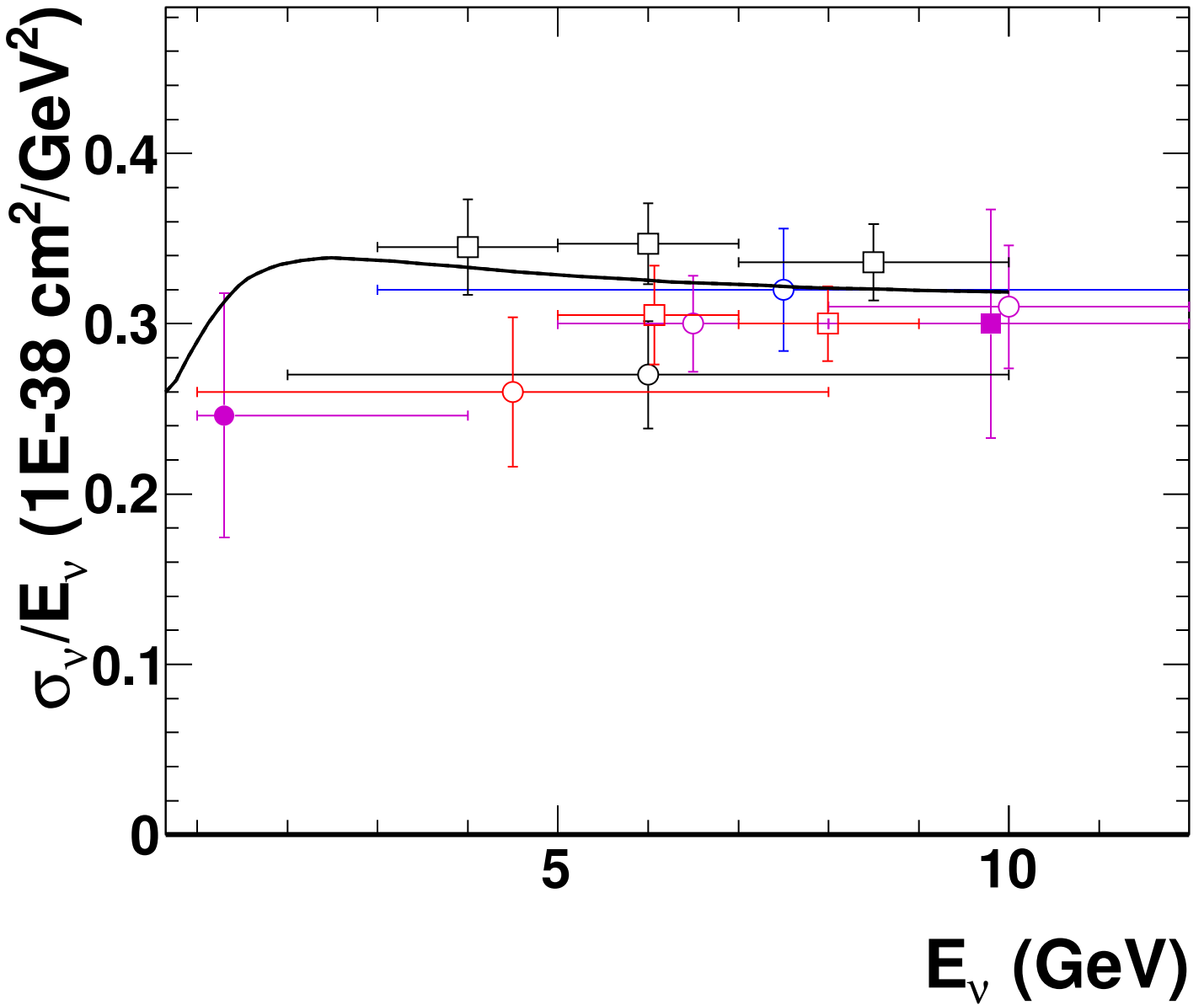
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- BEBC,7 [Parker et al., Nucl.Phys.B232:1 (1984) ]
- BNL\_7FT,1 [Fanourakis et al., Phys.Rev.D21:562 (1980) ]
- CCFR,3 [Seligman et al., Nevis Report 292 (1996) ]
- CHARM,1 [Jonker et al., Phys.Lett.B99:265 (1981) ]
- CHARM,5 [Allaby et al., Zeit.Phys.C38:403 (1988) ]
- FNAL\_15FT,4 [Taylor et al., Phys.Rev.Lett.51:739 (1983) ]
- FNAL\_15FT,5 [Asratyan et al., Phys.Lett.B137:122 (1984) ]
- Gargamelle,1 [Eichten et al., Phys.Lett.B46:274 (1973) ]
- Gargamelle,11 [Erriquez et al., Phys.Lett.B80:309 (1979) ]
- Gargamelle,13 [Morfin et al., Phys.Lett.B104:235 (1981) ]
- IHEP\_IJEP,1 [Asratyan et al., Phys.Lett.B76:239 (1978) ]
- IHEP\_IJEP,3 [Vovenko et al., Sov.J.Nucl.Phys.30:528 (1979) ]
- IHEP\_JINR,1 [Anikeev et al., Zeit.Phys.C70:39 (1996) ]
- MINOS,1 [Adamson et al., Phys.Rev.D81:072002 (2010) ]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

$\nu_\mu$  CC inclusive, low-energy data only



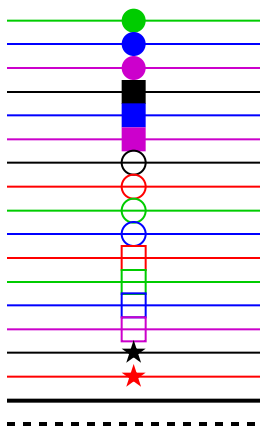
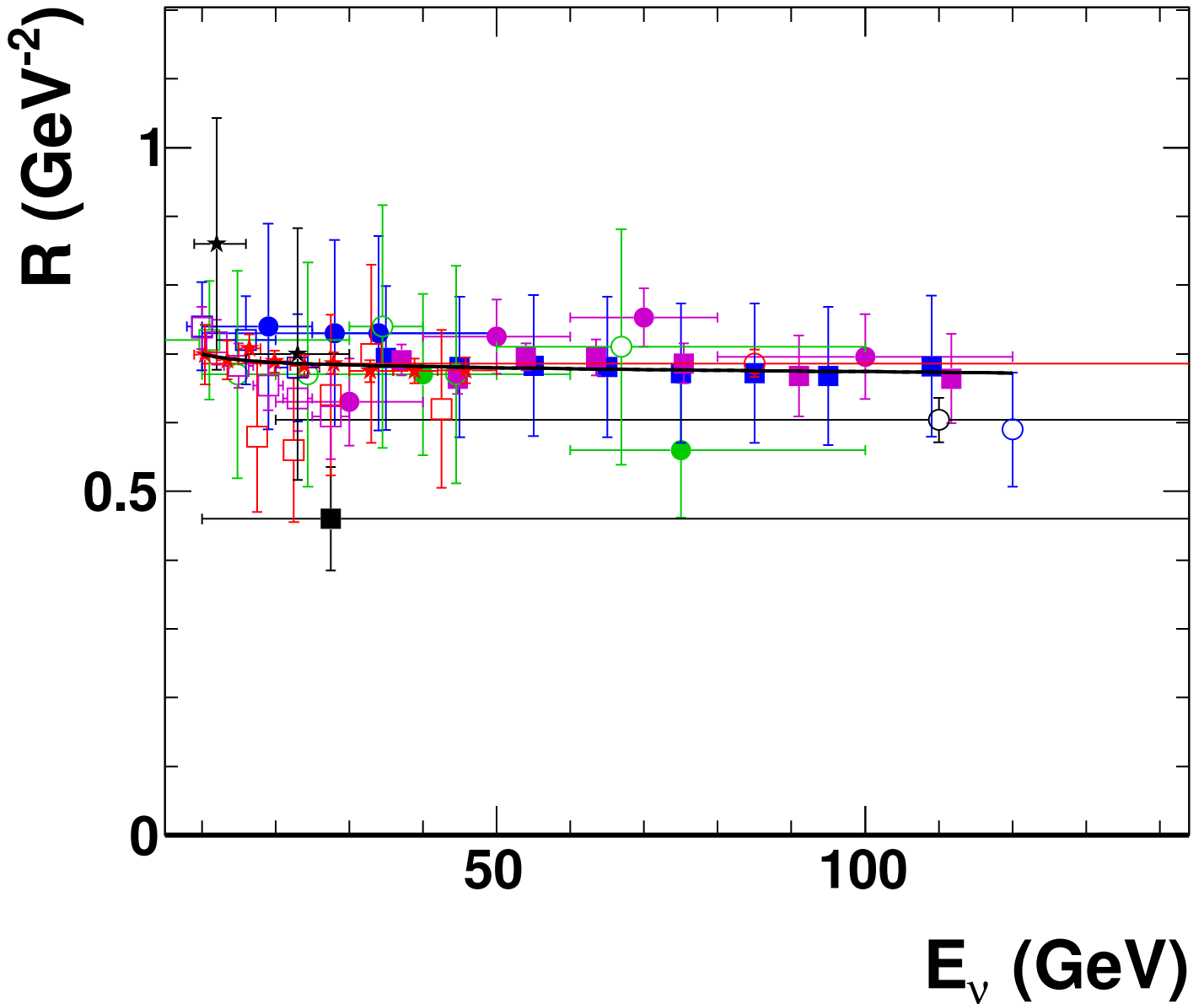
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- BNL\_7FT,0 [Baltay et al., Phys.Rev.Lett.44:916 (1980) ]
- BNL\_7FT,4 [Baker et al., Phys.Rev.D25:617 (1982) ]
- Gargamelle,0 [Eichten et al., Phys.Lett.B46:274 (1973) ]
- Gargamelle,10 [Ciampolillo et al., Phys.Lett.B84:281 (1979) ]
- IHEP\_ITEP,2 [Vovenko et al., Sov.J.Nucl.Phys.30:528 (1979) ]
- IHEP\_JINR,0 [Anikeev et al., Zeit.Phys.C70:39 (1996) ]
- ★ SKAT,0 [Baranov et al., Phys.Rev.B81 255 (1979) ]
- ★ MINOS,0 [Adamson et al., Phys.Rev.D81:072002 (2010) ]
- ★ SciBooNE,0 [Nakajima et al., Phys.Rev.D83:012005 (2011) ]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

$\bar{\nu}_\mu$  CC inclusive, low-energy data only



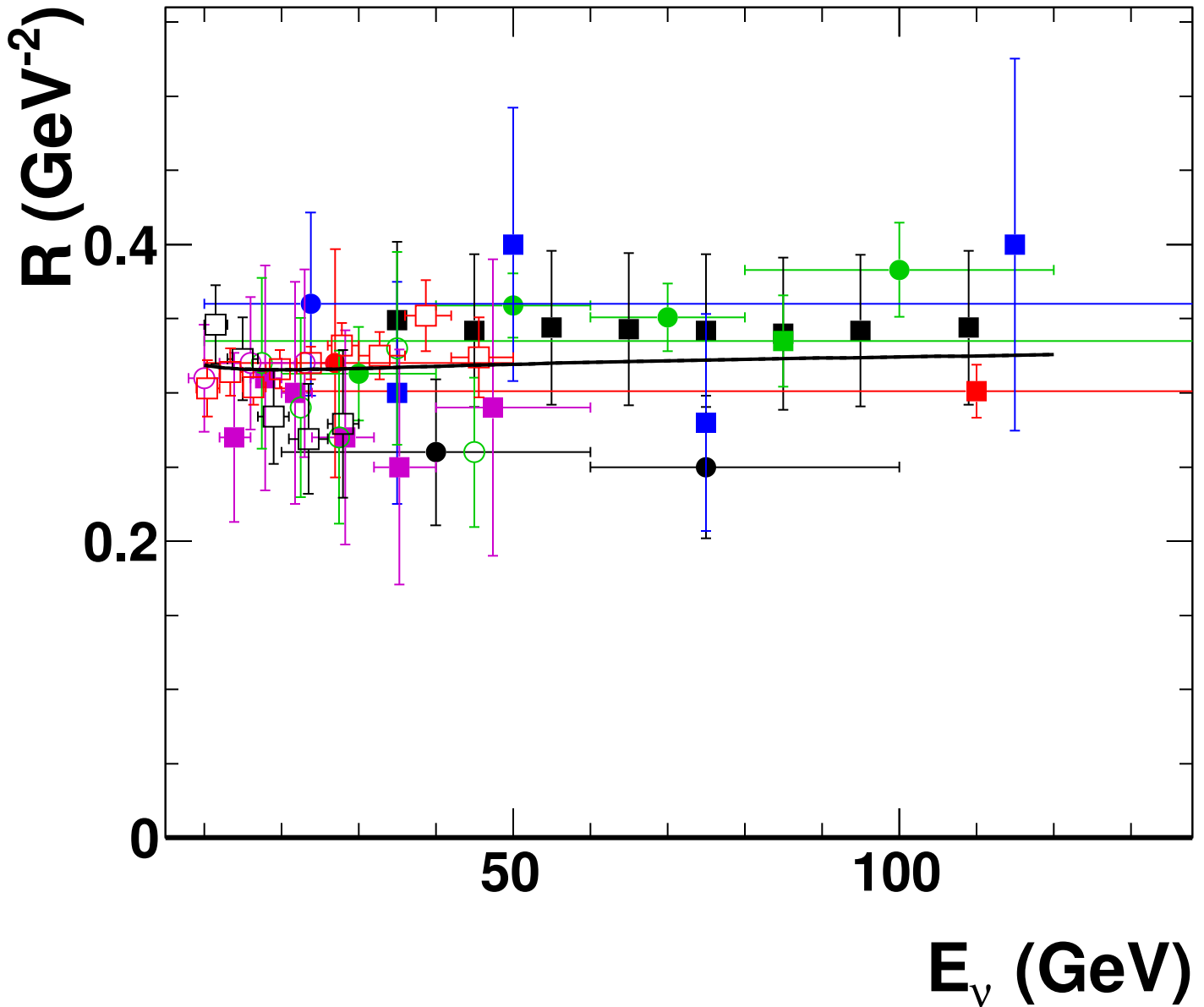
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- FNAL\_15FT,5 [Asratyan et al., Phys.Lett.B137:122 (1984)]
- Gargamelle,1 [Eichten et al., Phys.Lett.B46:274 (1973) ]
- Gargamelle,11 [Erriquez et al., Phys.Lett.B80:309 (1979) ]
- IHEP\_ITEP,1 [Asratyan et al., Phys.Lett.B76:239 (1978) ]
- IHEP\_ITEP,3 [Vovenko et al., Sov.J.Nucl.Phys.30:528 (1979)]
- IHEP\_JINR,1 [Anikeev et al., Zeit.Phys.C70:39 (1996) ]
- MINOS,1 [Adamson et al., Phys.Rev.D81:072002 (2010)]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

$\nu_\mu$  CC inclusive, medium/high-energy data only



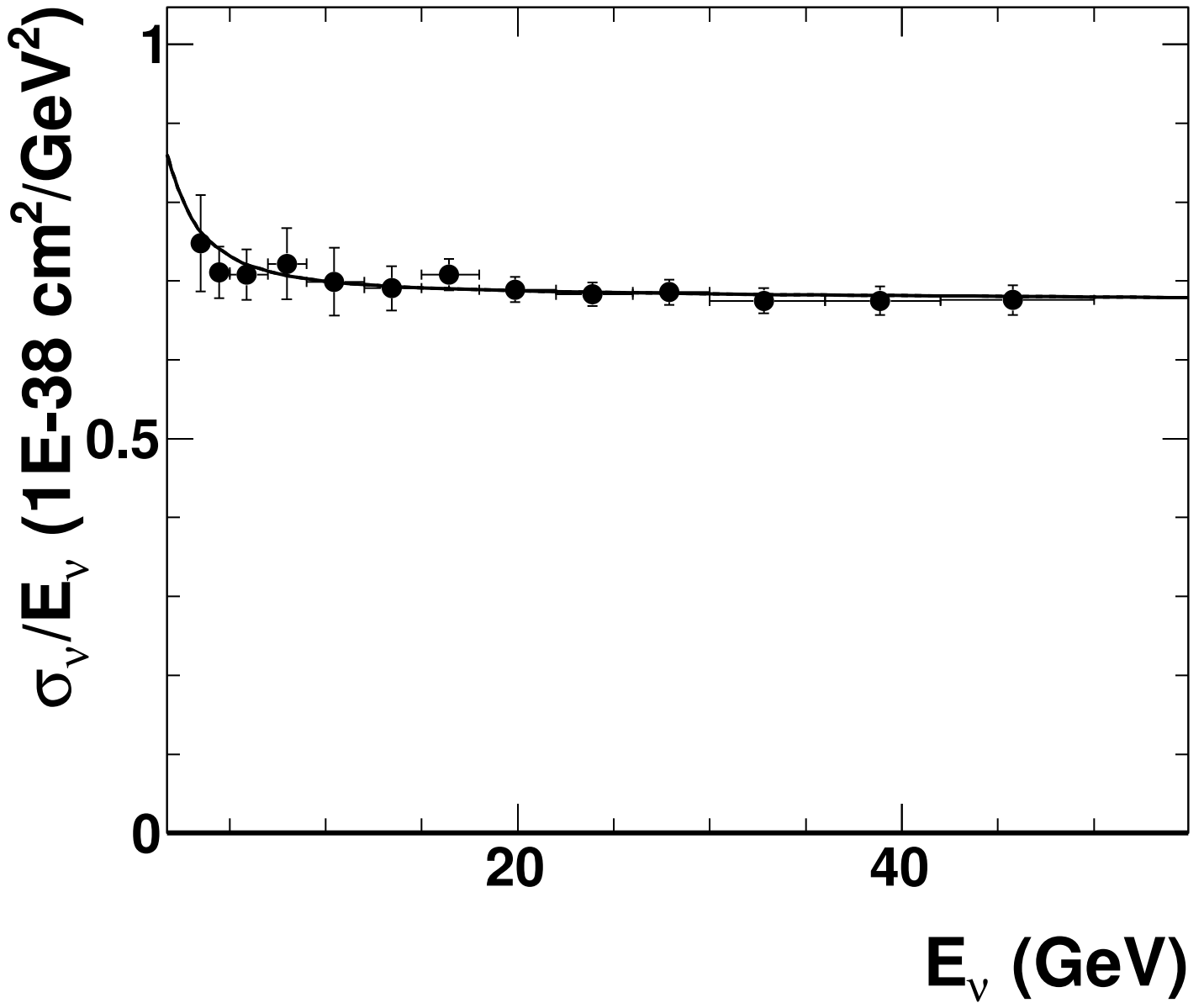
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- BEBC,5 [Bosetti et al., Phys.Lett.B110:167 (1982) ]
- BEBC,8 [Parker et al., Nucl.Phys.B232:1 (1984) ]
- CCFR,2 [Seligman et al., Nevis Report 292 (1996) ]
- CCFRR,0 [MacFarlane et al., Zeit.Phys.C26:1 (1984) ]
- CHARM,0 [Jonker et al., Phys.Lett.B99:265 (1981) ]
- CHARM,4 [Allaby et al., Zeit.Phys.C38:403 (1988) ]
- FNAL\_15FT,1 [Kitagaki et al., Phys.Rev.Lett.49:98 (1982) ]
- FNAL\_15FT,2 [Baker et al., Phys.Rev.Lett.51:735 (1983) ]
- Gargamelle,12 [Morfin et al., Phys.Lett.B104:235 (1981) ]
- IHEP\_ITEP,0 [Asratyan et al., Phys.Lett.B76:239 (1978) ]
- IHEP\_ITEP,2 [Vovenko et al., Sov.J.Nucl.Phys.30:528 (1979) ]
- IHEP\_JINR,0 [Anikeev et al., Zeit.Phys.C70:39 (1996) ]
- SKAT,0 [Baranov et al., Phys.Rev.B81 255 (1979) ]
- MINOS,0 [Adamson et al., Phys.Rev.D81:072002 (2010) ]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

$\bar{\nu}_\mu$  CC inclusive, medium/high-energy data only



- BEBC,1 [Bosetti et al., Phys.Lett.B70:273 (1977) ]
- BEBC,3 [Colley et al., Zeit.Phys.C2:187 (1979) ]
- BEBC,6 [Bosetti et al., Phys.Lett.B110:167 (1982) ]
- BEBC,7 [Parker et al., Nucl.Phys.B232:1 (1984) ]
- CCFR,3 [Seligman et al., Nevis Report 292 (1996) ]
- CHARM,1 [Jonker et al., Phys.Lett.B99:265 (1981) ]
- CHARM,5 [Allaby et al., Zeit.Phys.C38:403 (1988) ]
- FNAL\_15FT,4 [Taylor et al., Phys.Rev.Lett.51:739 (1983)]
- FNAL\_15FT,5 [Asratyan et al., Phys.Lett.B137:122 (1984)]
- Gargamelle,13 [Morfin et al., Phys.Lett.B104:235 (1981) ]
- IHEP\_ITEP,3 [Vovenko et al., Sov.J.Nucl.Phys.30:528 (1979)]
- IHEP\_JINR,1 [Anikeev et al., Zeit.Phys.C70:39 (1996) ]
- MINOS,1 [Adamson et al., Phys.Rev.D81:072002 (2010)]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

$\nu_\mu$  CC inclusive, MINOS data only



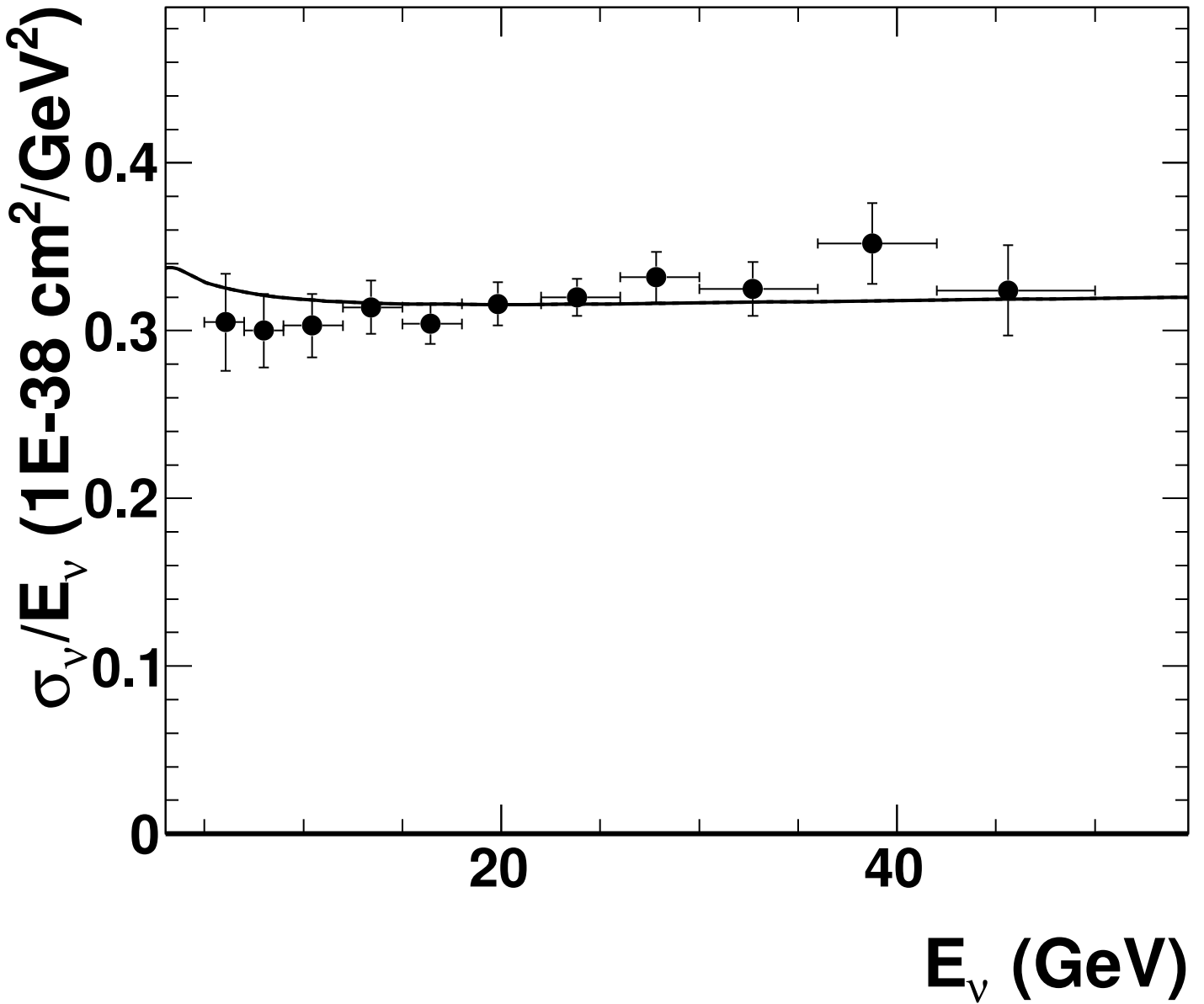
● MINOS,0 [Adamson et al., Phys.Rev.D81:072002 (2010)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12



$\bar{\nu}_\mu$  CC inclusive, MINOS data only

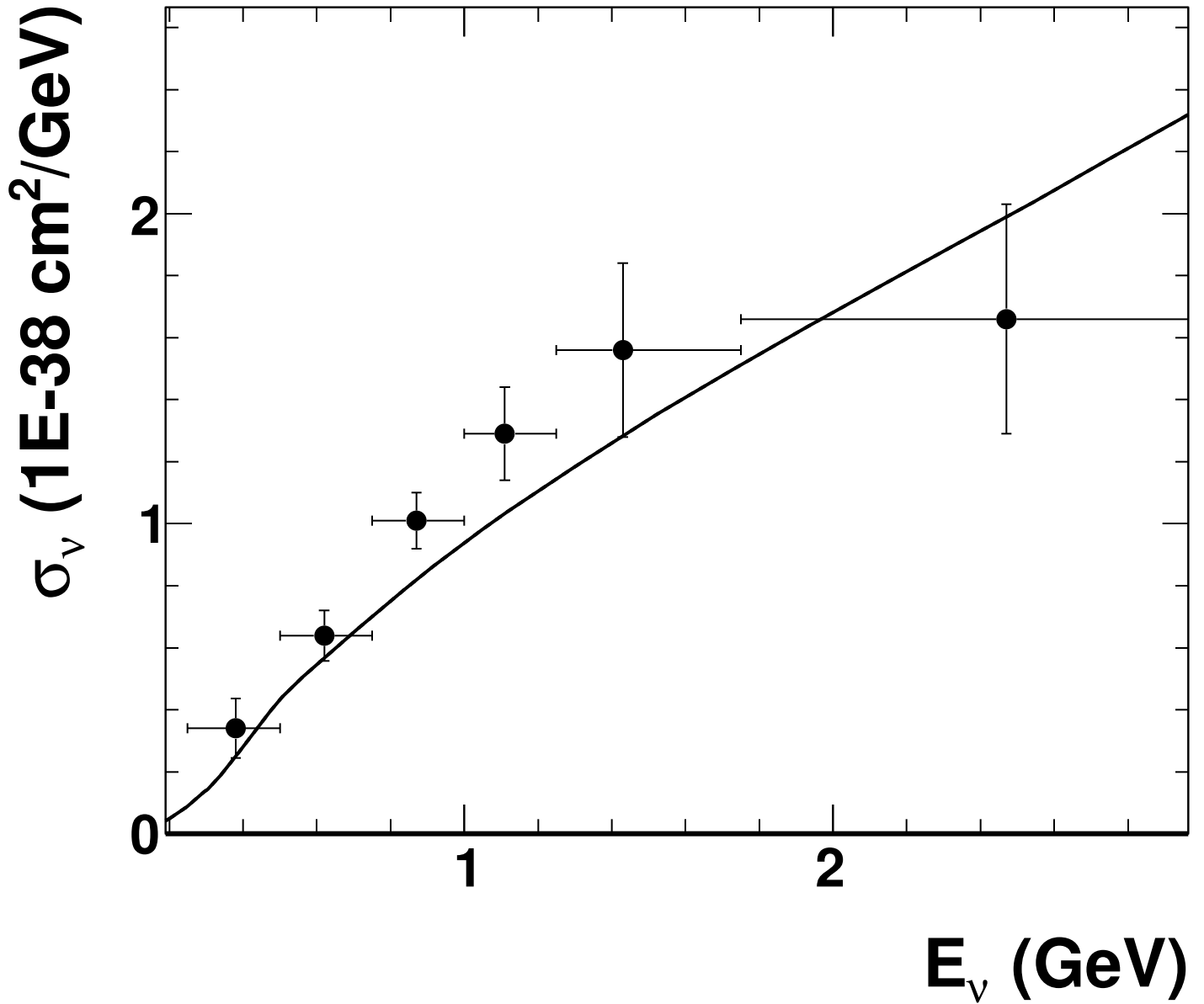


● MINOS,1 [Adamson et al., Phys.Rev.D81:072002 (2010)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

$\nu_\mu$  CC inclusive, SciBooNE data only

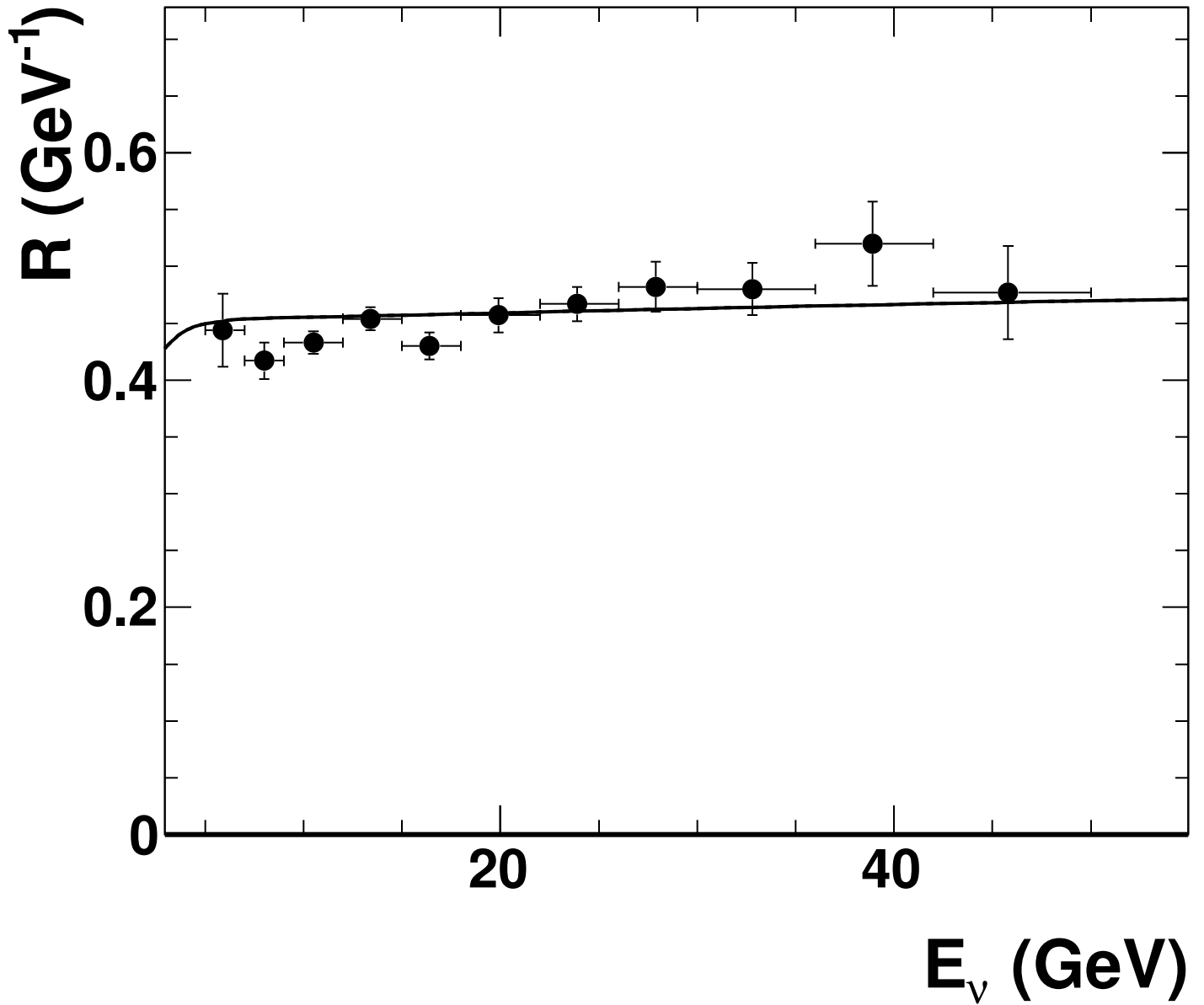


● SciBooNE,0 [Nakajima et al., Phys.Rev.D83:012005 (2011)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

$\bar{\nu}_\mu$  CC inclusive /  $\nu_\mu$  CC inclusive, MINOS data only

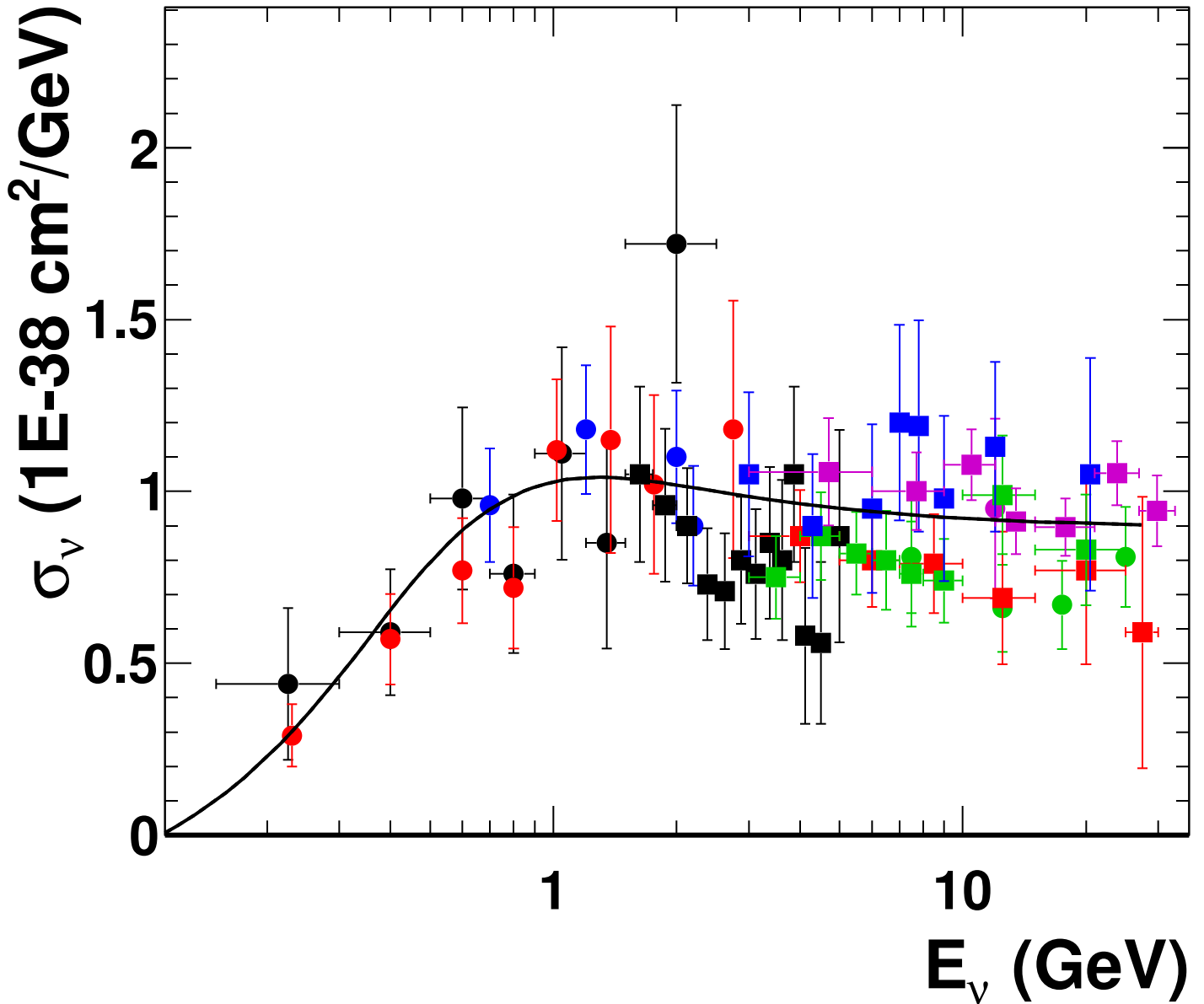


● MINOS,2 [Adamson et al., Phys.Rev.D81:072002 (2010)]

— R-2\_10\_6-2016-04-04

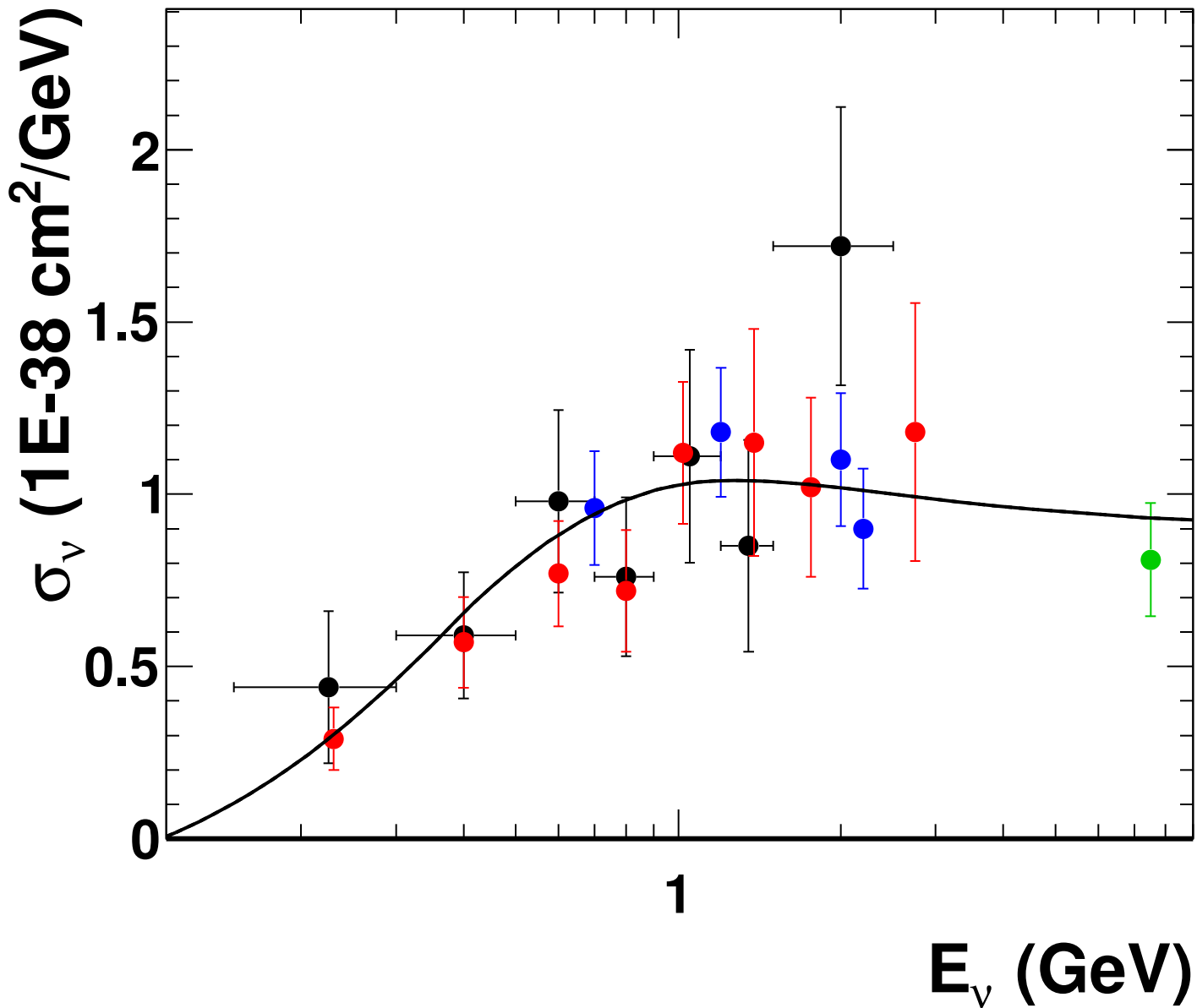
- - - R-2\_10\_8-2016-05-12

# $\nu_\mu$ CCQE, all data



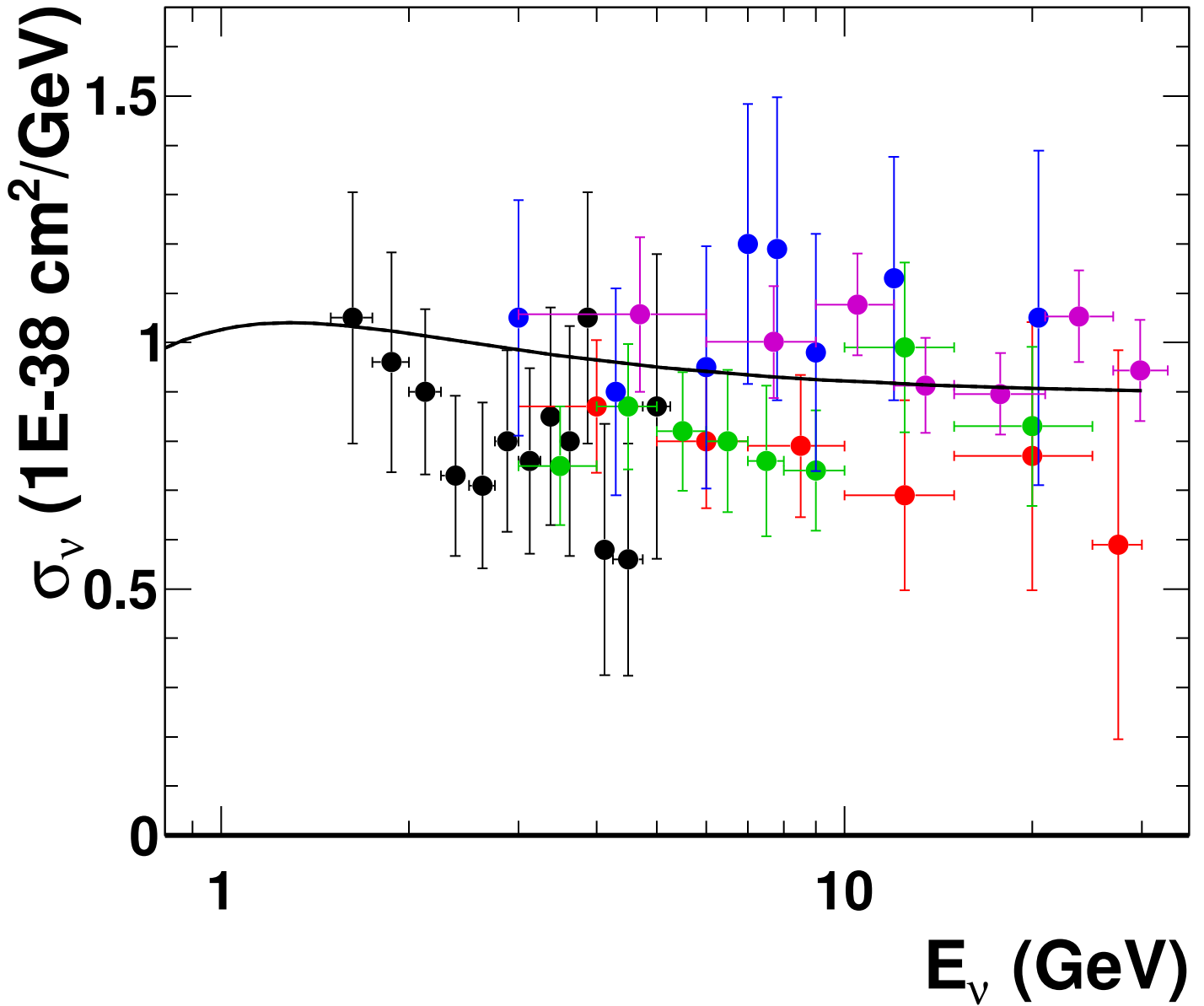
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- ANL\_12FT,3 [Barish et al., Phys.Rev.D16:3103 (1977) ]
- BEBC,12 [Allasia et al., Nucl.Phys.B343:285 (1990) ]
- BNL\_7FT,3 [Baker et al., Phys.Rev.D23:2499 (1981) ]
- FNAL\_15FT,3 [Kitagaki et al., Phys.Rev.D28:436 (1983) ]
- Gargamelle,2 [Bonetti et al., Nuovo Cim.A38:260 (1977)]
- SERP\_A1,0 [Belikov et al., Yad.Fiz.35:59 (1982)]
- SERP\_A1,1 [Belikov et al., Z.Phys.A320:625 (1985) ]
- SKAT,8 [Bruner et al., Zeit.Phys.C45:551 (1990) ]
- NOMAD,2 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

# $\nu_\mu$ CCQE, deuterium data



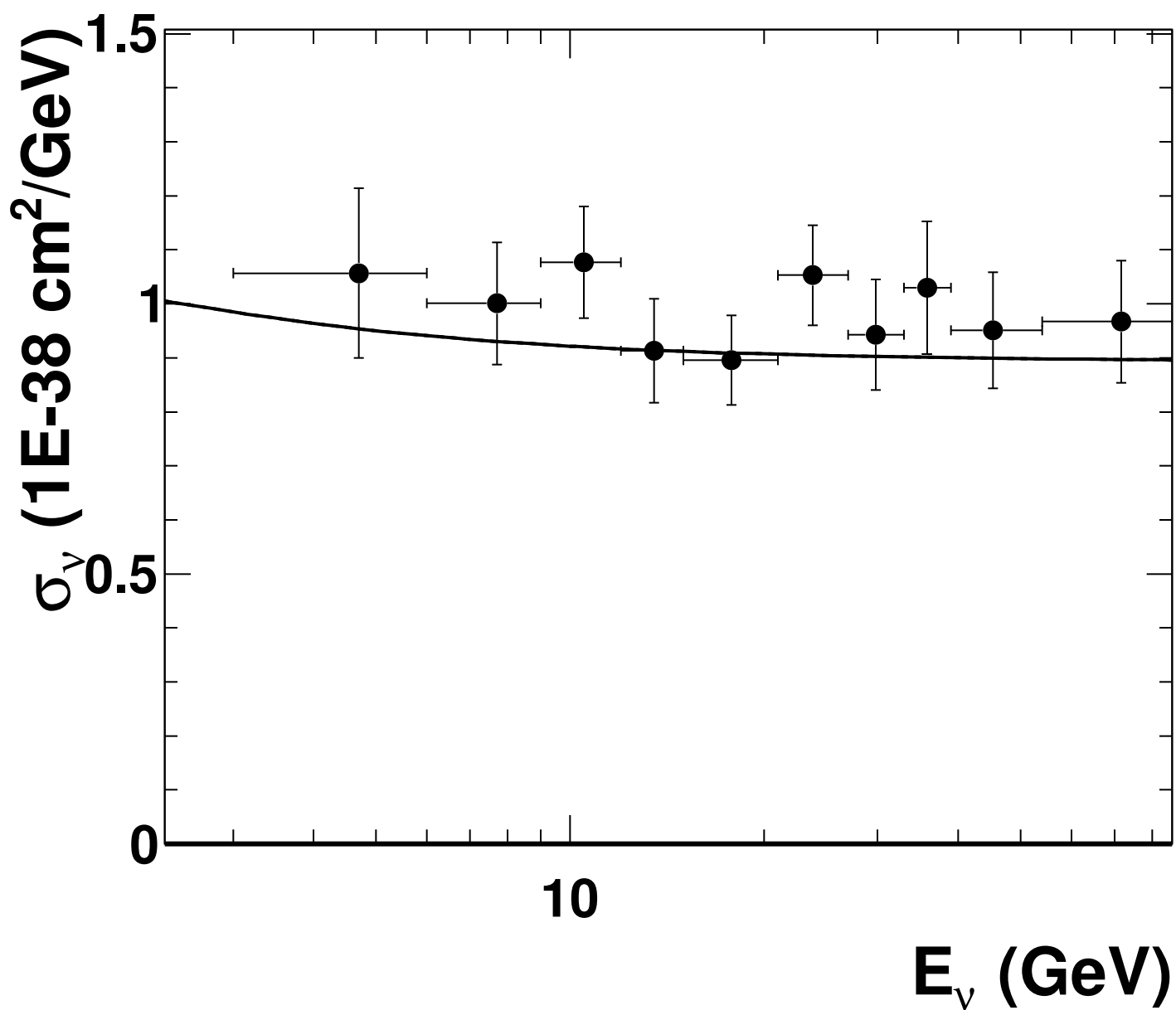
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- ANL\_12FT,3 [Barish et al., Phys.Rev.D16:3103 (1977) ]
- BEBC,12 [Allasia et al., Nucl.Phys.B343:285 (1990) ]
- BNL\_7FT,3 [Baker et al., Phys.Rev.D23:2499 (1981) ]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

# $\nu_\mu$ CCQE, heavy target data



- Gargamelle,2 [Bonetti et al., Nuovo Cim.A38:260 (1977)]
- SERP\_A1,0 [Belikov et al., Yad.Fiz.35:59 (1982)]
- SERP\_A1,1 [Belikov et al., Z.Phys.A320:625 (1985)]
- SKAT,8 [Bruner et al., Zeit.Phys.C45:551 (1990)]
- NOMAD,2 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]
- R-2\_10\_6-2016-04-04
- - - R-2\_10\_8-2016-05-12

$\nu_\mu$  CCQE, NOMAD, free-nucleon cross-section (incl. Smith-Moniz correction)



● NOMAD,2 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]

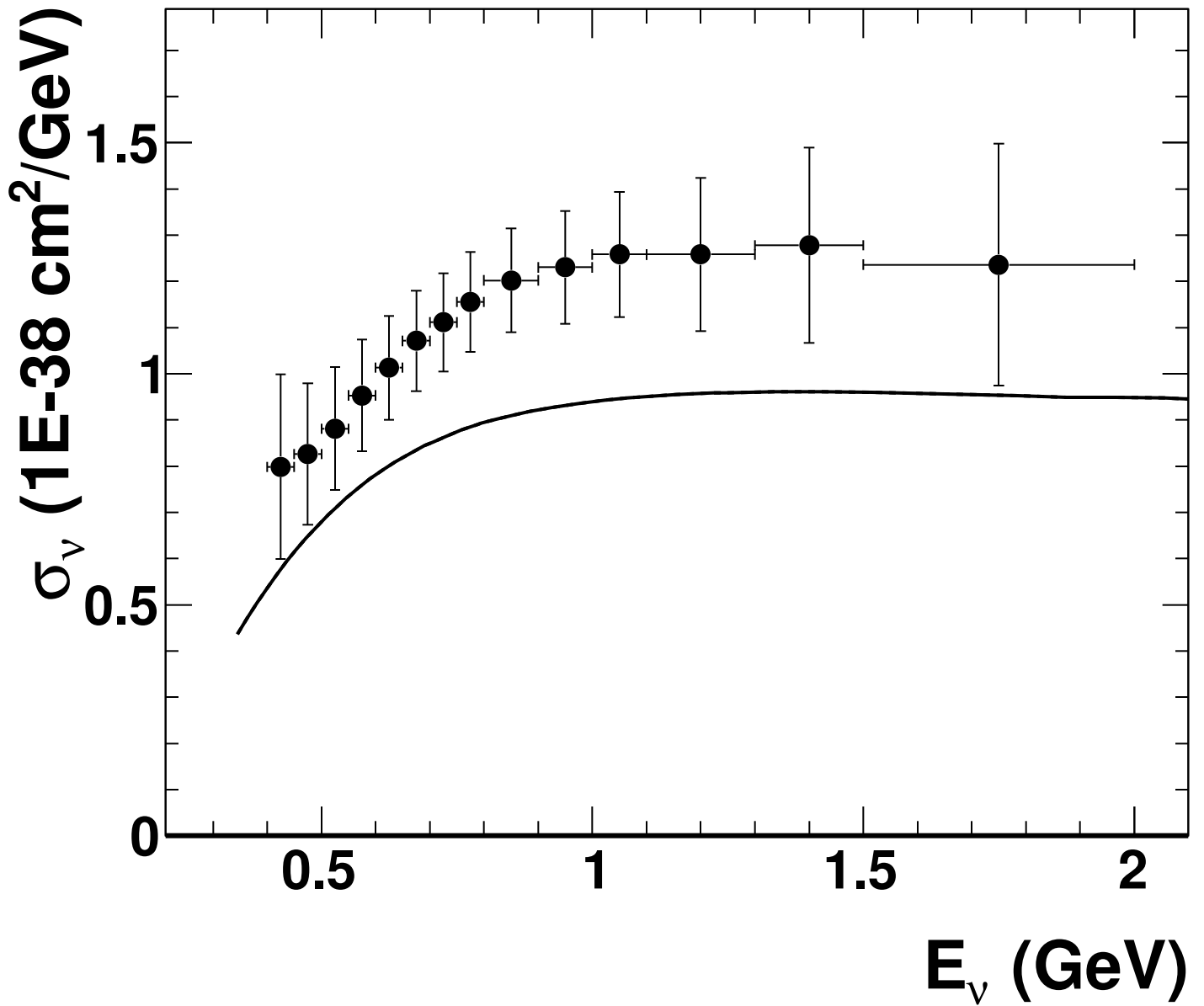
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- - - R-2\_10\_8-2016-05-12





$\nu_\mu$  CCQE, MiniBooNE,  $^{12}\text{C}$  cross-section per neutron (no nuclear correction)

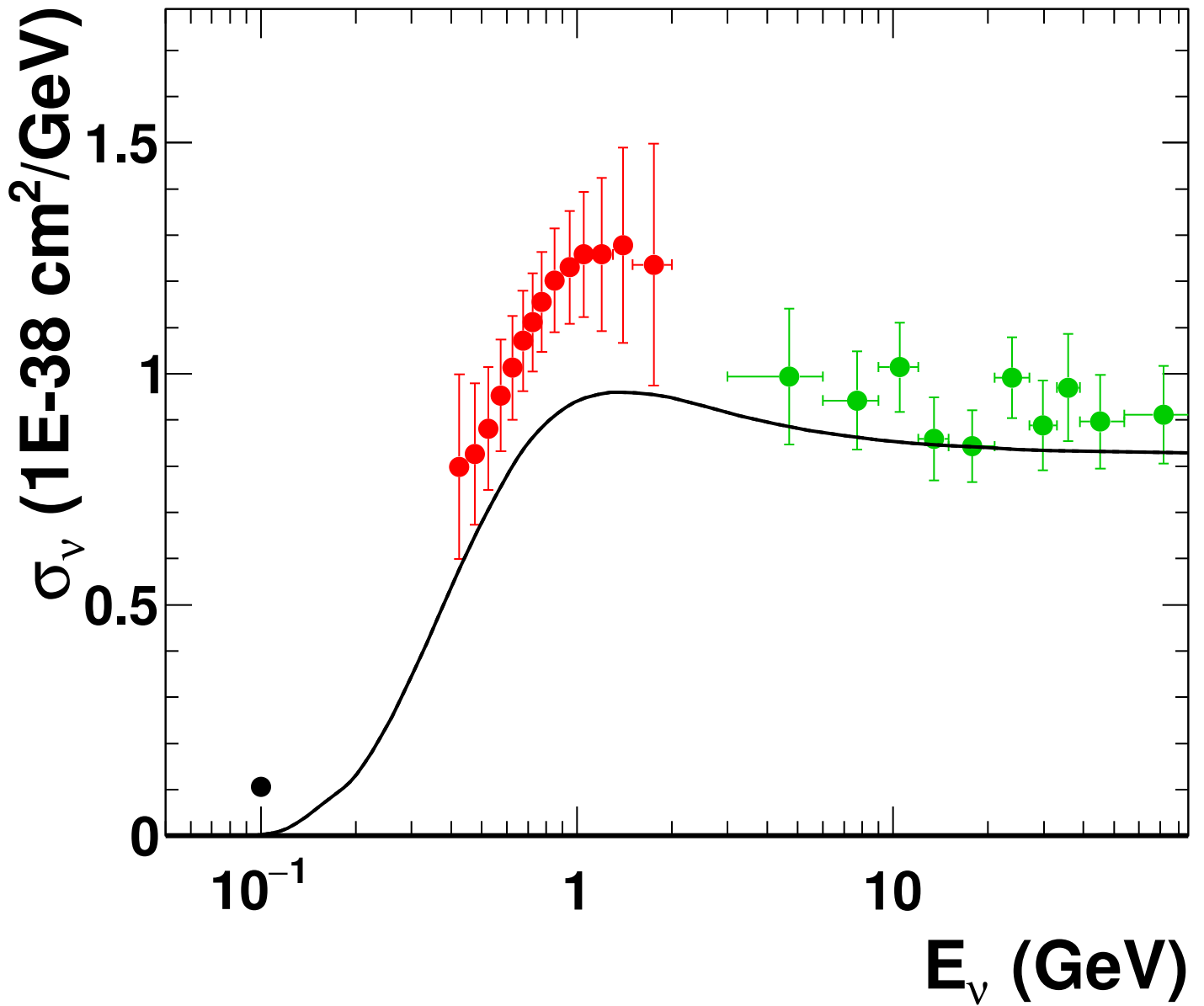


● MiniBooNE,0 [Aguilar-Arevalo et al., Phys.Rev.D81:092005 (2010)]

— R-2\_10\_6-2016-04-04

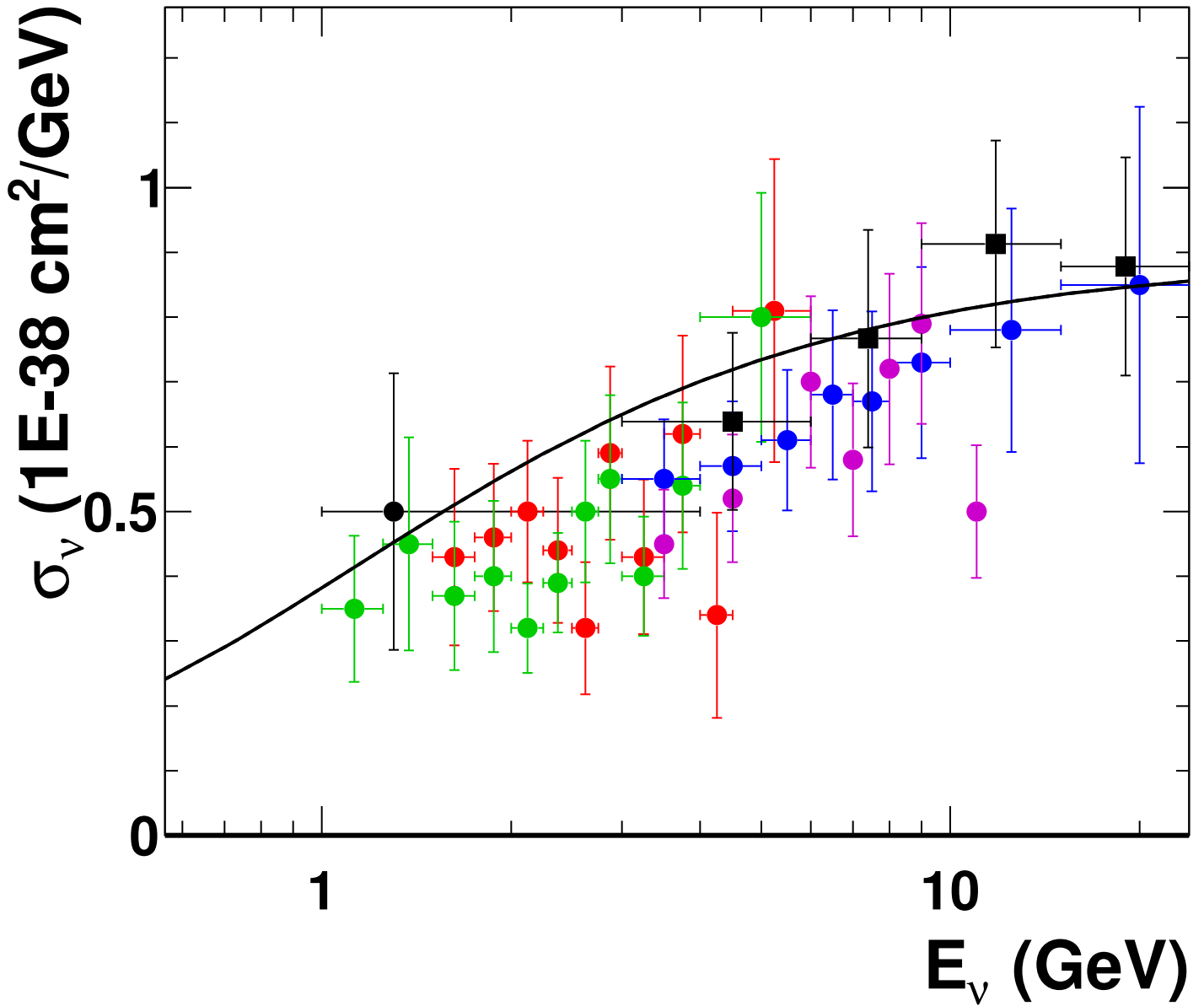
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$\nu_\mu$  CCQE,  $^{12}\text{C}$  cross-section per neutron (no nuclear correction)



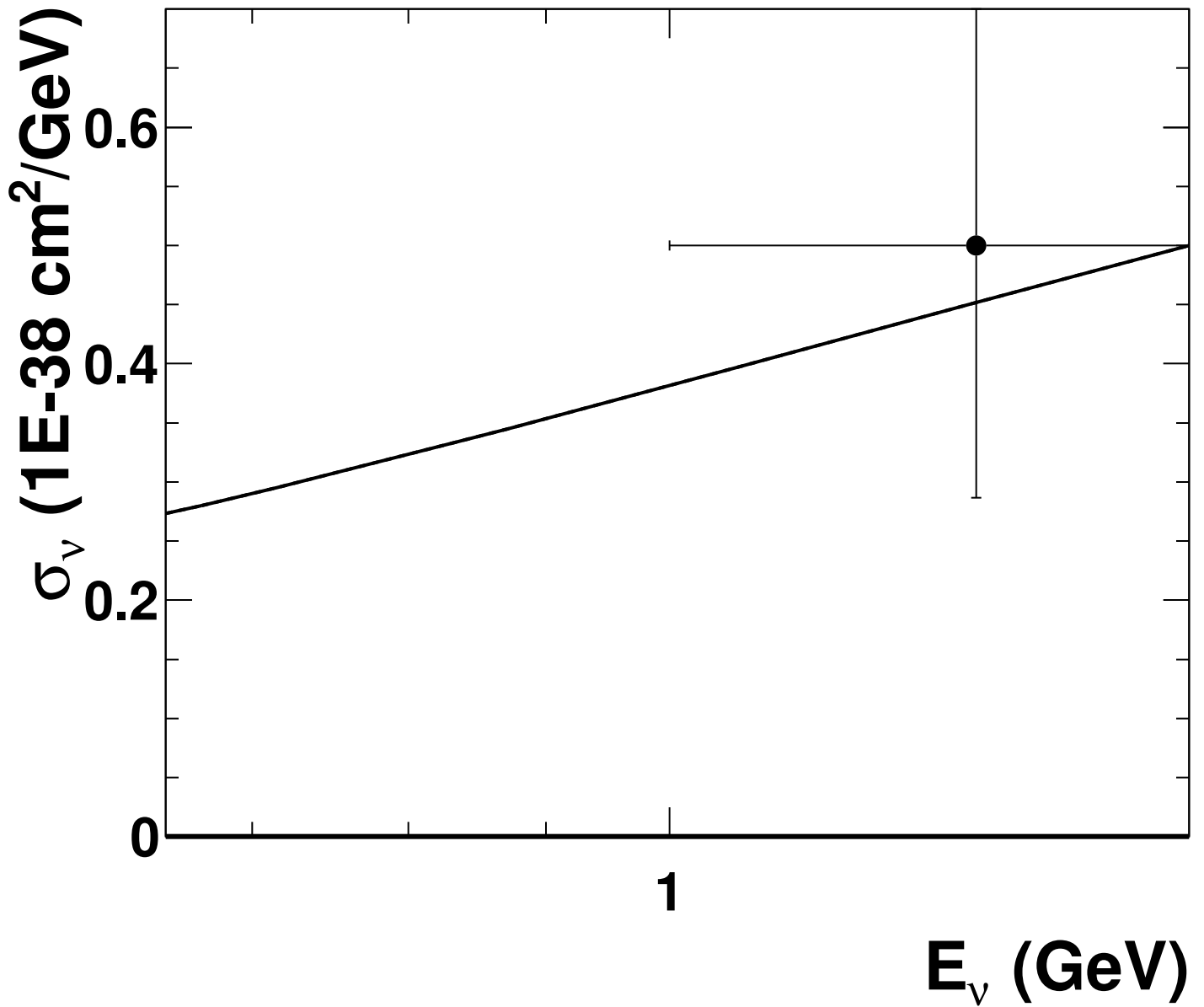
- LSND,0 [Auerbach et al., Phys.Rev.C66 (2002) ]
- MiniBooNE,0 [Aguilar-Arevalo et al., Phys.Rev.D81:092005 (2010)]
- NOMAD,0 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]
- R-2\_10\_6-2016-04-04
- - - R-2\_10\_8-2016-05-12

# $\bar{\nu}_\mu$ CCQE, all data



- BNL\_7FT,2 [Fanourakis et al., Phys.Rev.D21:562 (1980) ]
- Gargamelle,3 [Bonetti et al., Nuovo Cim.A38:260 (1977) ]
- Gargamelle,5 [Armenise et al., Nucl.Phys.B152:365 (1979)]
- SERP\_A1,2 [Belikov et al., Z.Phys.A320:625 (1985) ]
- SKAT,9 [Bruner et al., Zeit.Phys.C45:551 (1990) ]
- NOMAD,3 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

# $\bar{\nu}_\mu$ CCQE, deuterium data

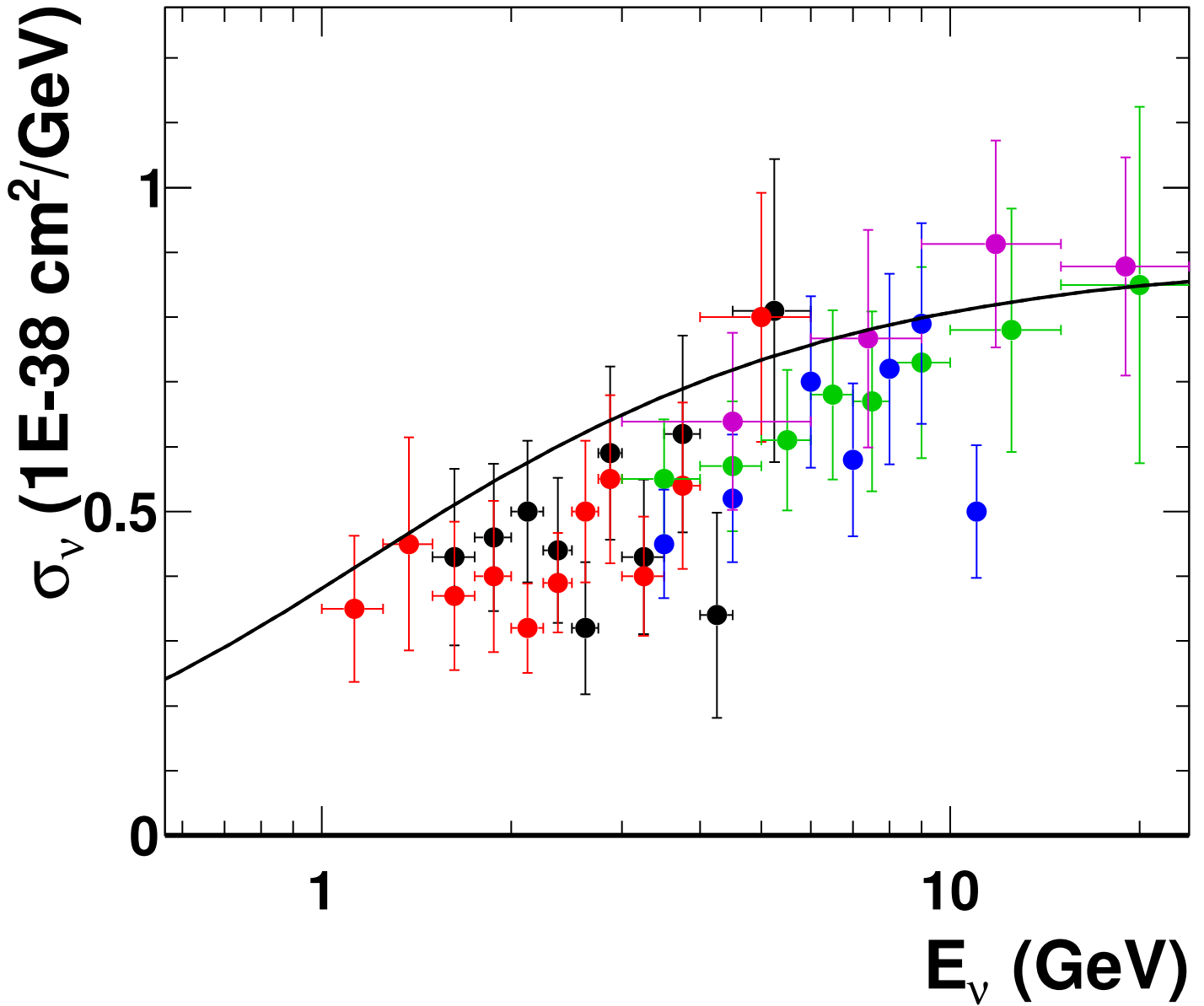


● BNL\_7FT,2 [Fanourakis et al., Phys.Rev.D21:562 (1980) ]

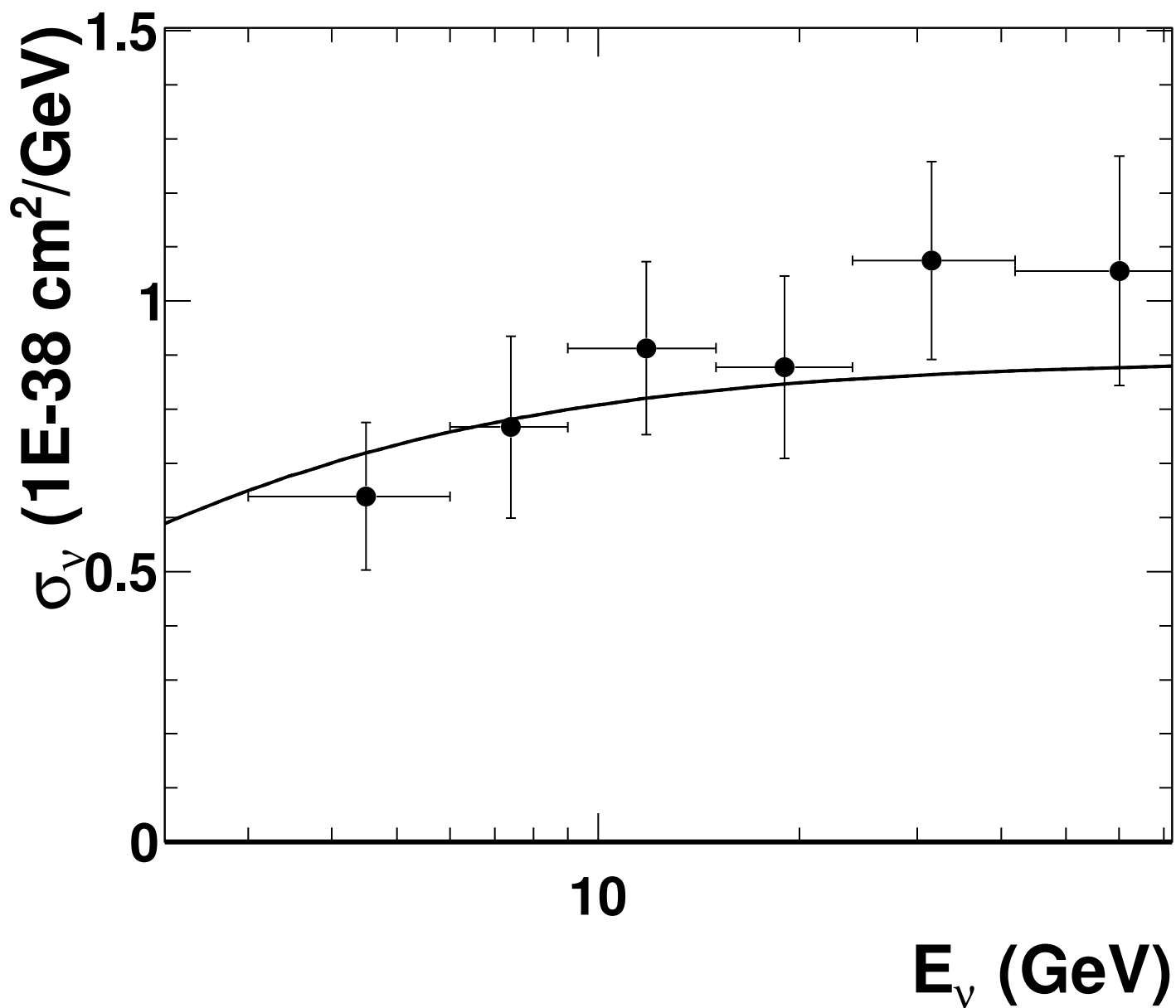
— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

# $\bar{\nu}_\mu$ CCQE, heavy target data



- Gargamelle,3 [Bonetti et al., Nuovo Cim.A38:260 (1977) ]
- Gargamelle,5 [Armenise et al., Nucl.Phys.B152:365 (1979)]
- SERP\_A1,2 [Belikov et al., Z.Phys.A320:625 (1985) ]
- SKAT,9 [Bruner et al., Zeit.Phys.C45:551 (1990) ]
- NOMAD,3 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]
- R-2\_10\_6-2016-04-04
- - - R-2\_10\_8-2016-05-12

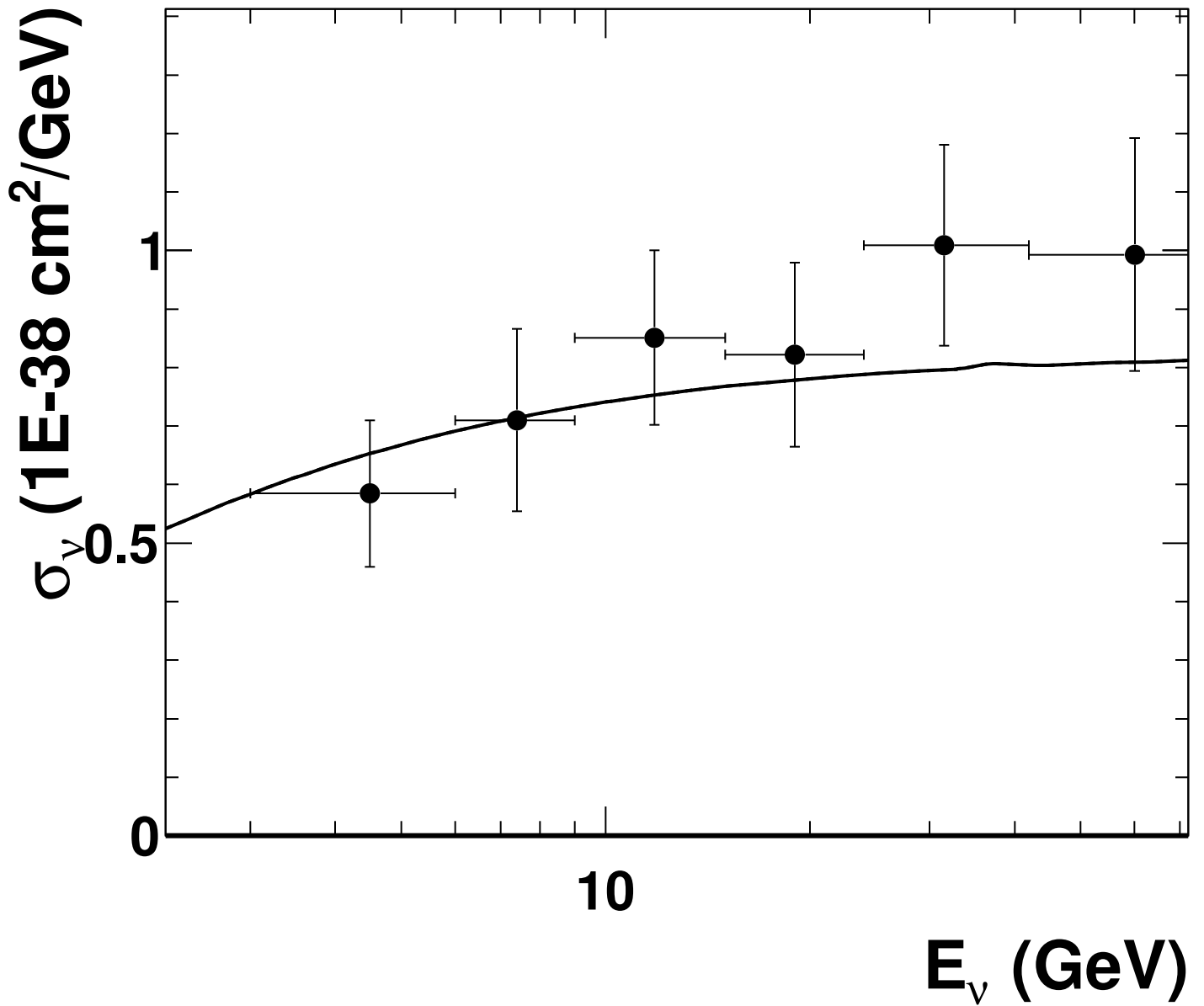


● NOMAD,3 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

$\bar{\nu}_\mu$  CCQE, NOMAD,  $^{12}\text{C}$  cross-section per proton (no nuclear correction)

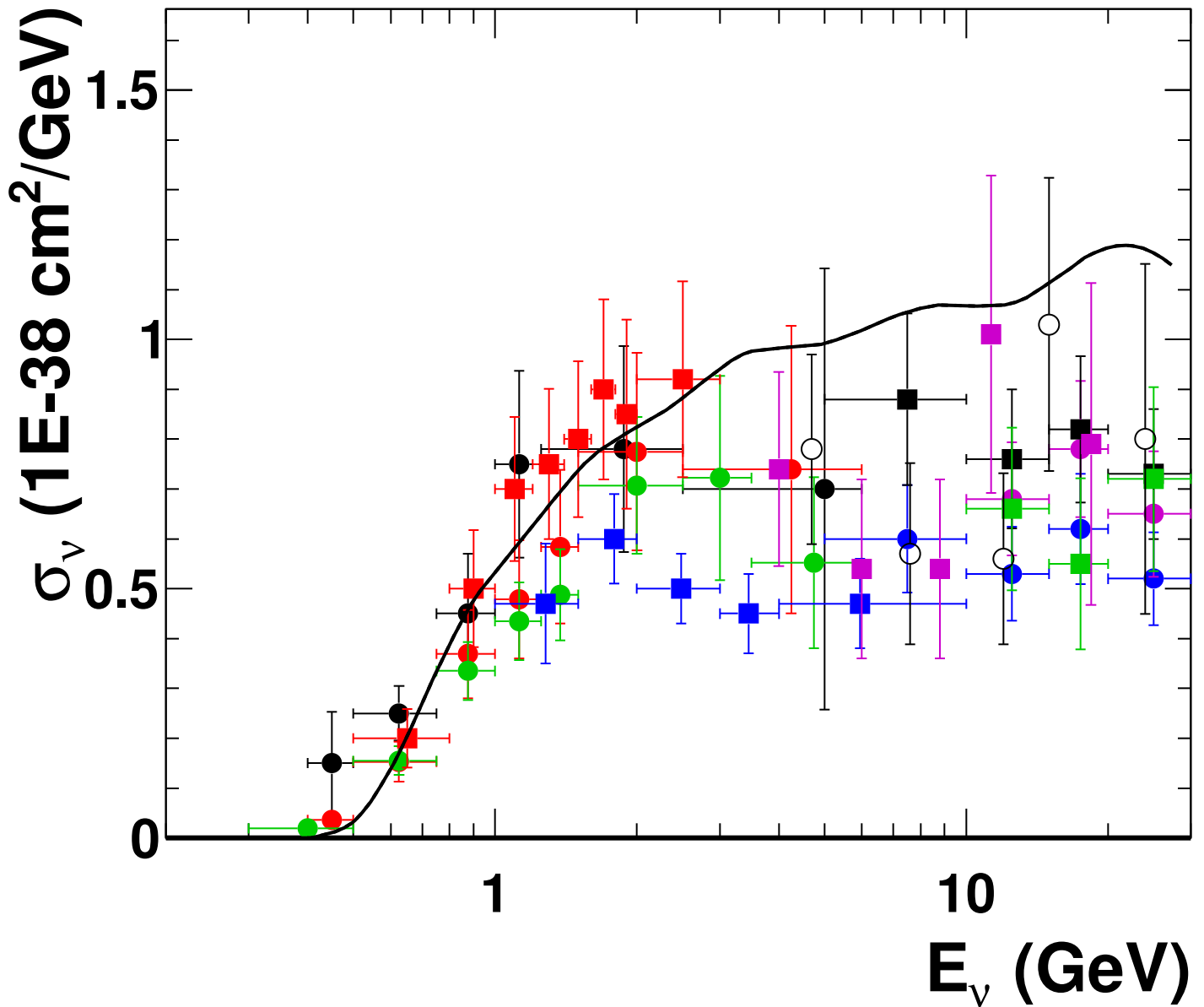


● NOMAD,1 [Lyubushkin et al., Eur.Phys.J.C63:355 (2009)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

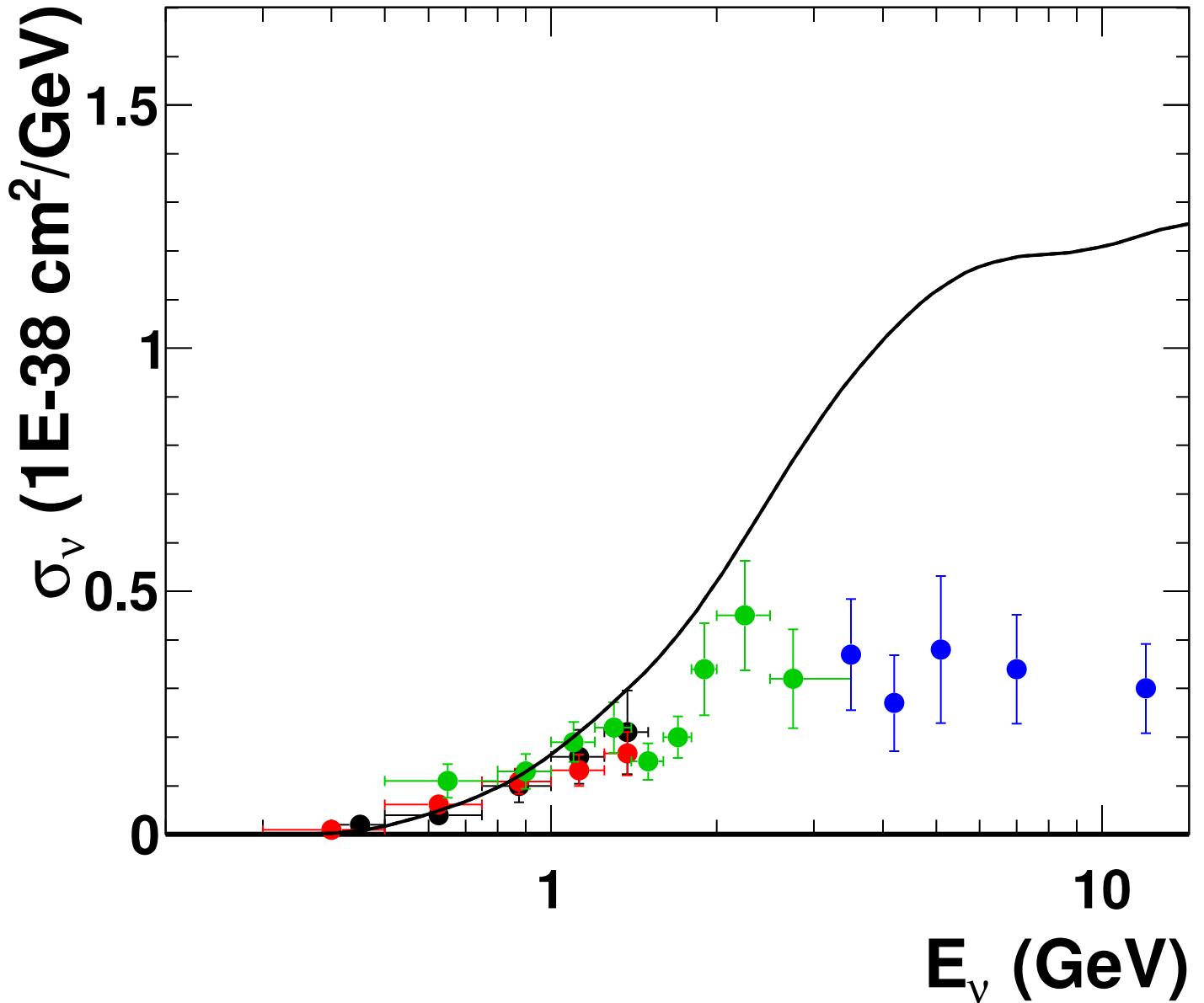
$$\nu_{\mu} \text{ CC } 1\pi^+ (\nu_{\mu} \text{ p} \rightarrow \mu^- \text{ p} \pi^+)$$



- ANL\_12FT,0 [Campbell et al., Phys.Rev.Lett.30:335(1973)]
- ANL\_12FT,5 [Barish et al., Phys.Rev.D19:2521 (1979) ]
- ANL\_12FT,8 [Radecky et al., Phys.Rev.D25:1161 (1982) ]
- BEBC,4 [Allen et al., Nucl.Phys.B176:269 (1980) ]
- BEBC,9 [Allen et al., Nucl.Phys.B264:221 (1986) ]
- BEBC,13 [Allasia et al., Nucl.Phys.B343:285 (1990) ]
- BNL\_7FT,5 [Kitagaki et al., Phys.Rev.D34:2554 (1986) ]
- FNAL\_15FT,0 [Bell et al., Phys.Rev.Lett.41:1008 (1978) ]
- Gargamelle,4 [Lerche et al., Phys.Lett.B78:510 (1978) ]
- SKAT,4 [Ammosov et al., Sov.J.Nucl.Phys.50:67 (1988)]
- SKAT,5 [Grabosch et al., Zeit.Phys.C41:527 (1988) ]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

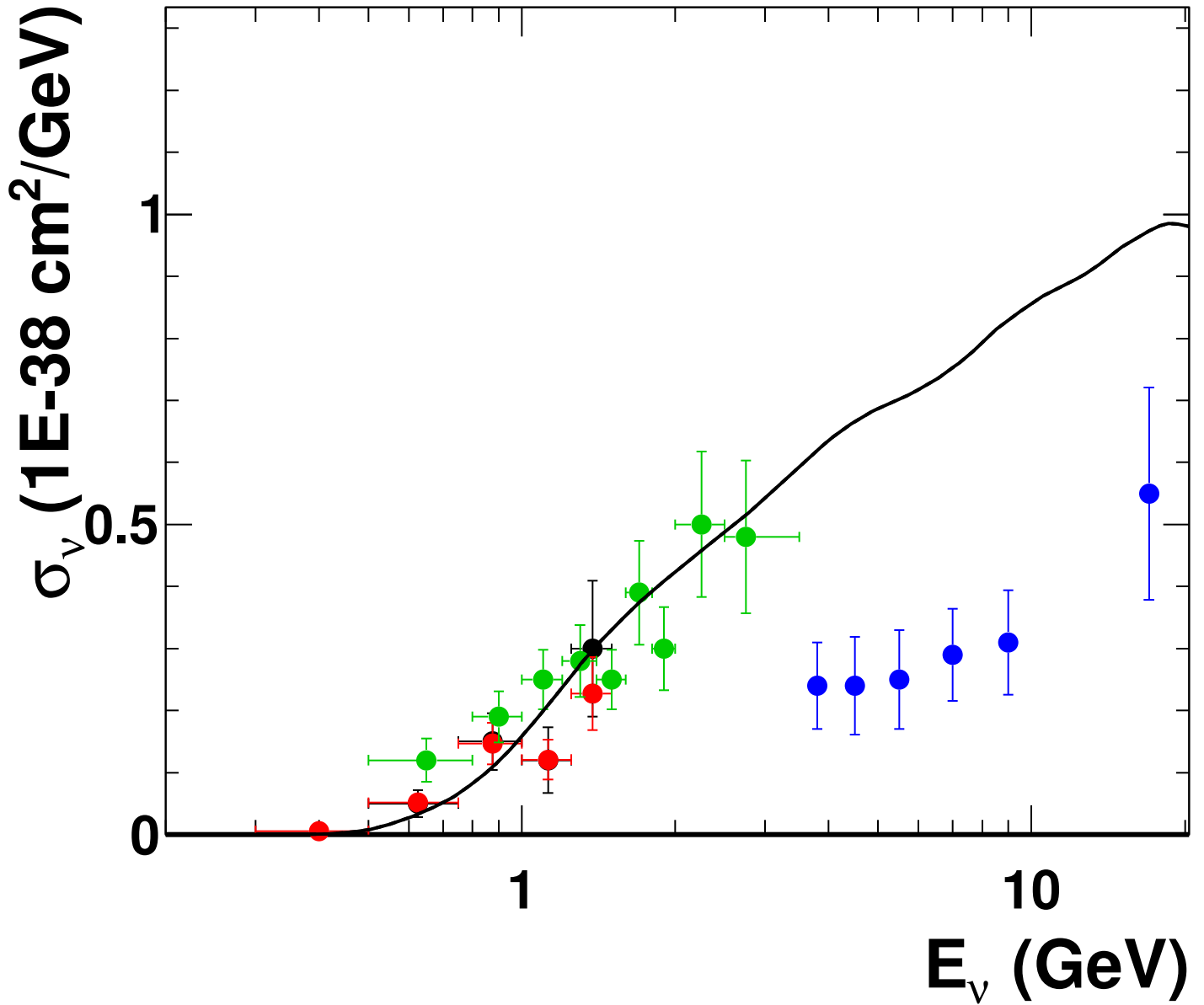


$$\nu_{\mu} \text{ CC1}\pi^{+} (\nu_{\mu} \text{ n} \rightarrow \mu^{-} \text{ n} \pi^{+})$$



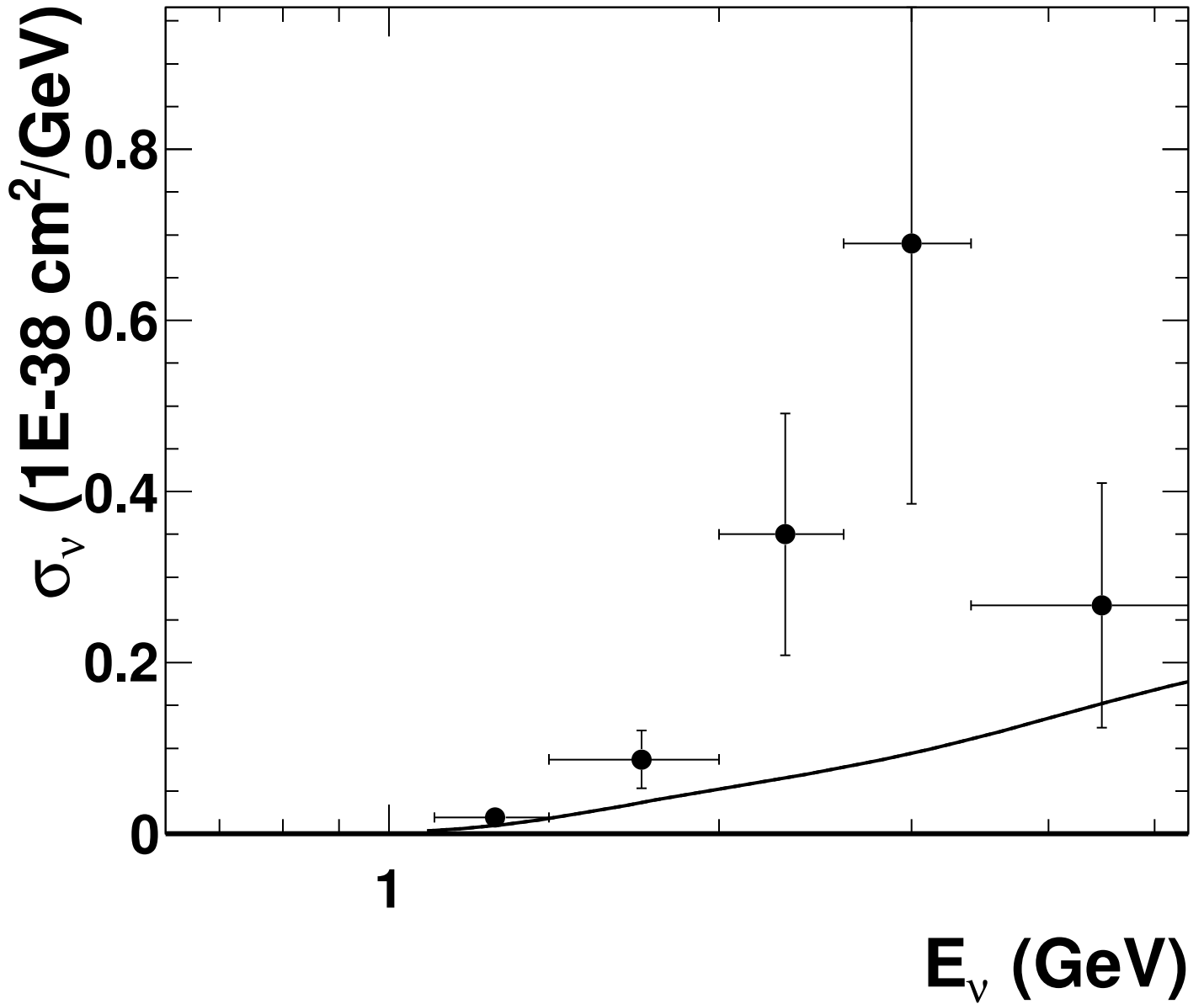
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- ANL\_12FT,10 [Radecky et al., Phys.Rev.D25:1161 (1982) ]
- BNL\_7FT,7 [Kitagaki et al., Phys.Rev.D34:2554 (1986) ]
- SKAT,7 [Grabosch et al., Zeit.Phys.C41:527 (1988) ]
- R-2\_10\_6-2016-04-04
- ..... R-2\_10\_8-2016-05-12

$$\nu_{\mu} \text{ CC } 1\pi^0 (\nu_{\mu} \text{ n} \rightarrow \mu^{-} \text{ p} \pi^0)$$



- ANL\_12FT,6 [Barish et al., Phys.Rev.D19:2521 (1979) ]
- ANL\_12FT,9 [Radecky et al., Phys.Rev.D25:1161 (1982) ]
- BNL\_7FT,6 [Kitagaki et al., Phys.Rev.D34:2554 (1986) ]
- SKAT,6 [Grabosch et al., Zeit.Phys.C41:527 (1988) ]
- R-2\_10\_6-2016-04-04
- R-2\_10\_8-2016-05-12

$\nu_\mu$  CC  $\pi^+\pi^+$  ( $\nu_\mu$  p  $\rightarrow$   $\mu^-$  n  $\pi^+$   $\pi^+$ )

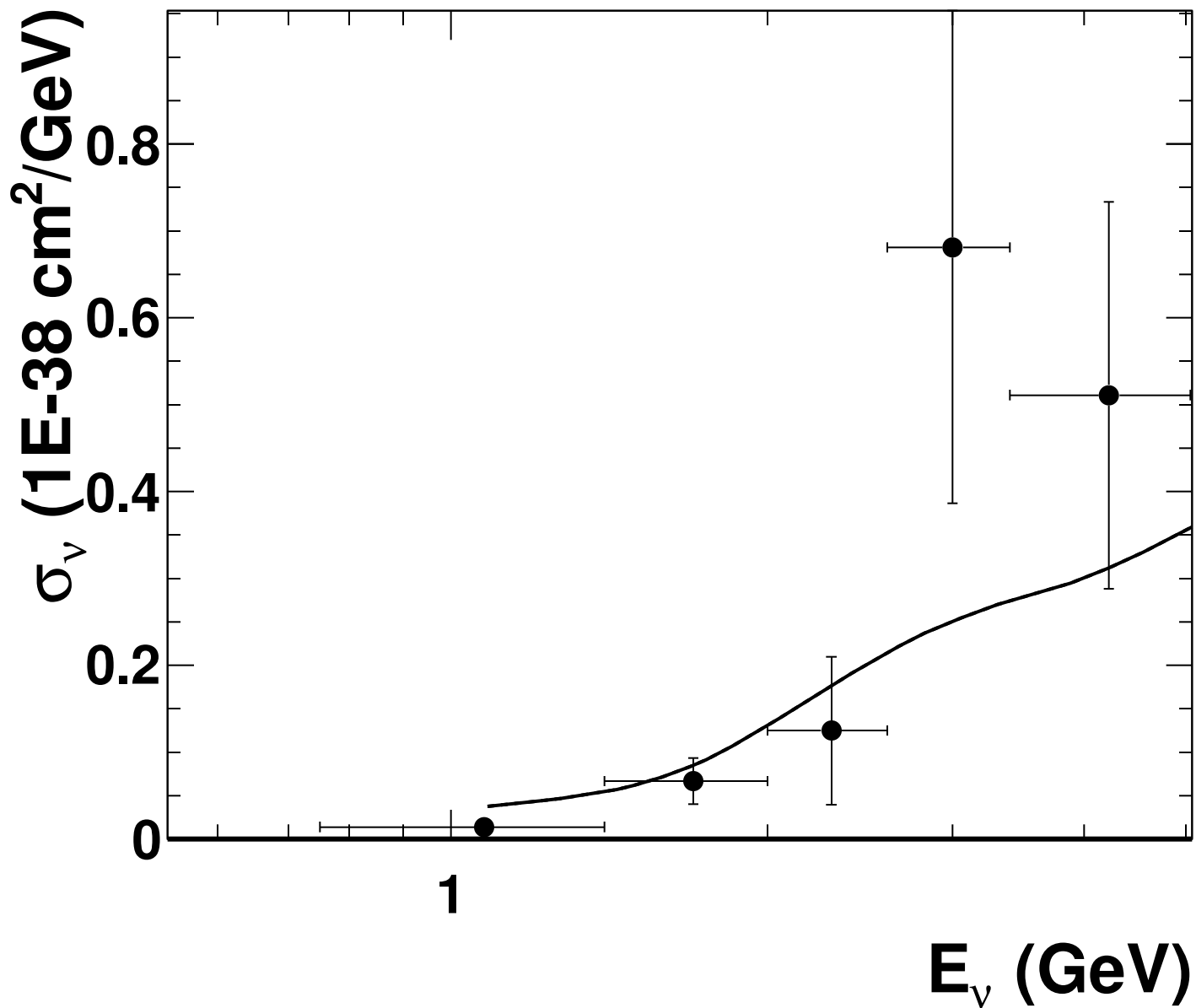


● ANL\_12FT,13 [Day et al., Phys.Rev.D28:2714 (1983) ]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

$\nu_\mu$  CC  $\pi^+\pi^0$  ( $\nu_\mu$  p  $\rightarrow$   $\mu^-$  p  $\pi^+$   $\pi^0$ )

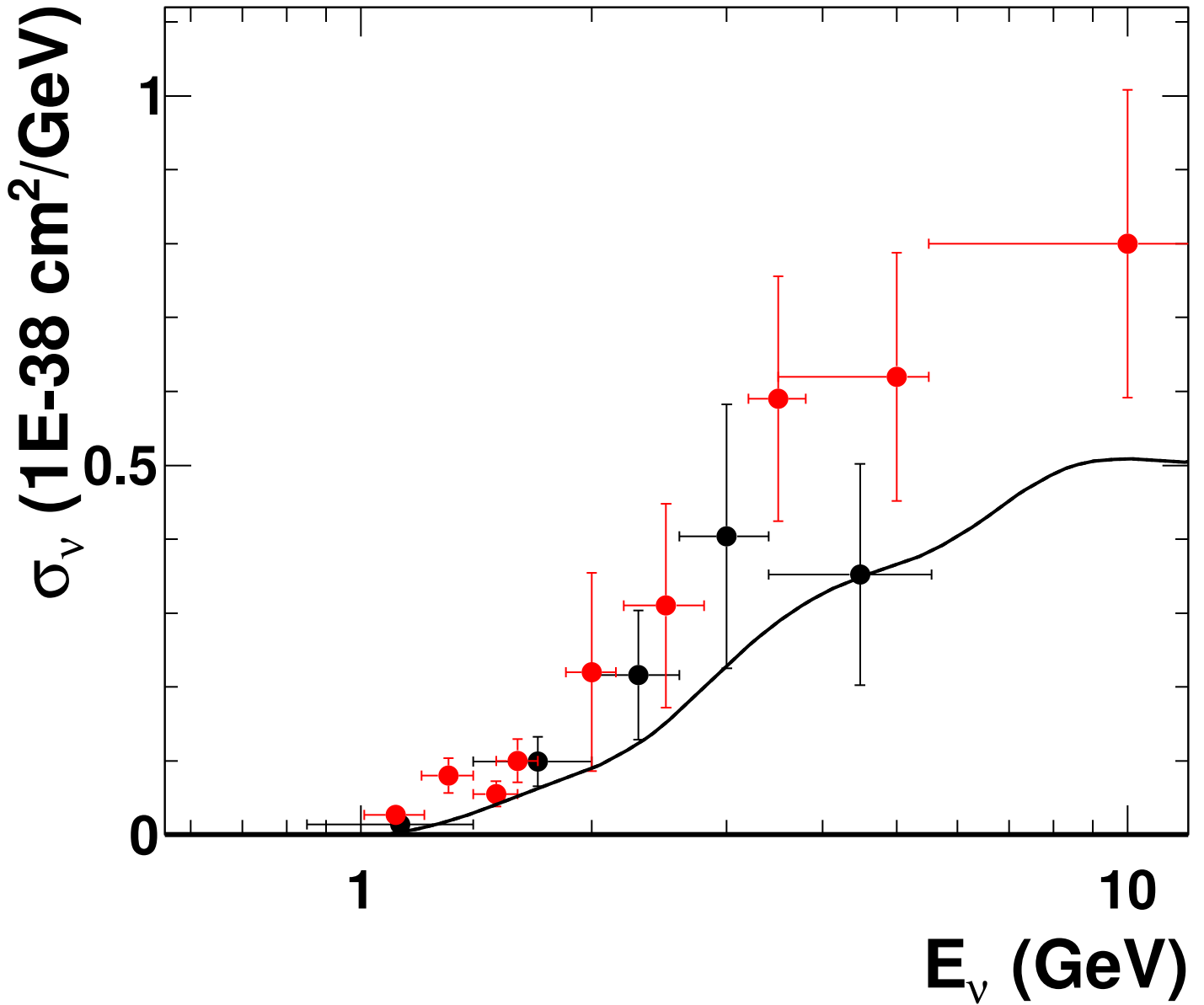


● ANL\_12FT,12 [Day et al., Phys.Rev.D28:2714 (1983) ]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

$\nu_\mu$  CC  $\pi^+\pi^-$  ( $\nu_\mu$  n  $\rightarrow$   $\mu^-$  p  $\pi^+$   $\pi^-$ )



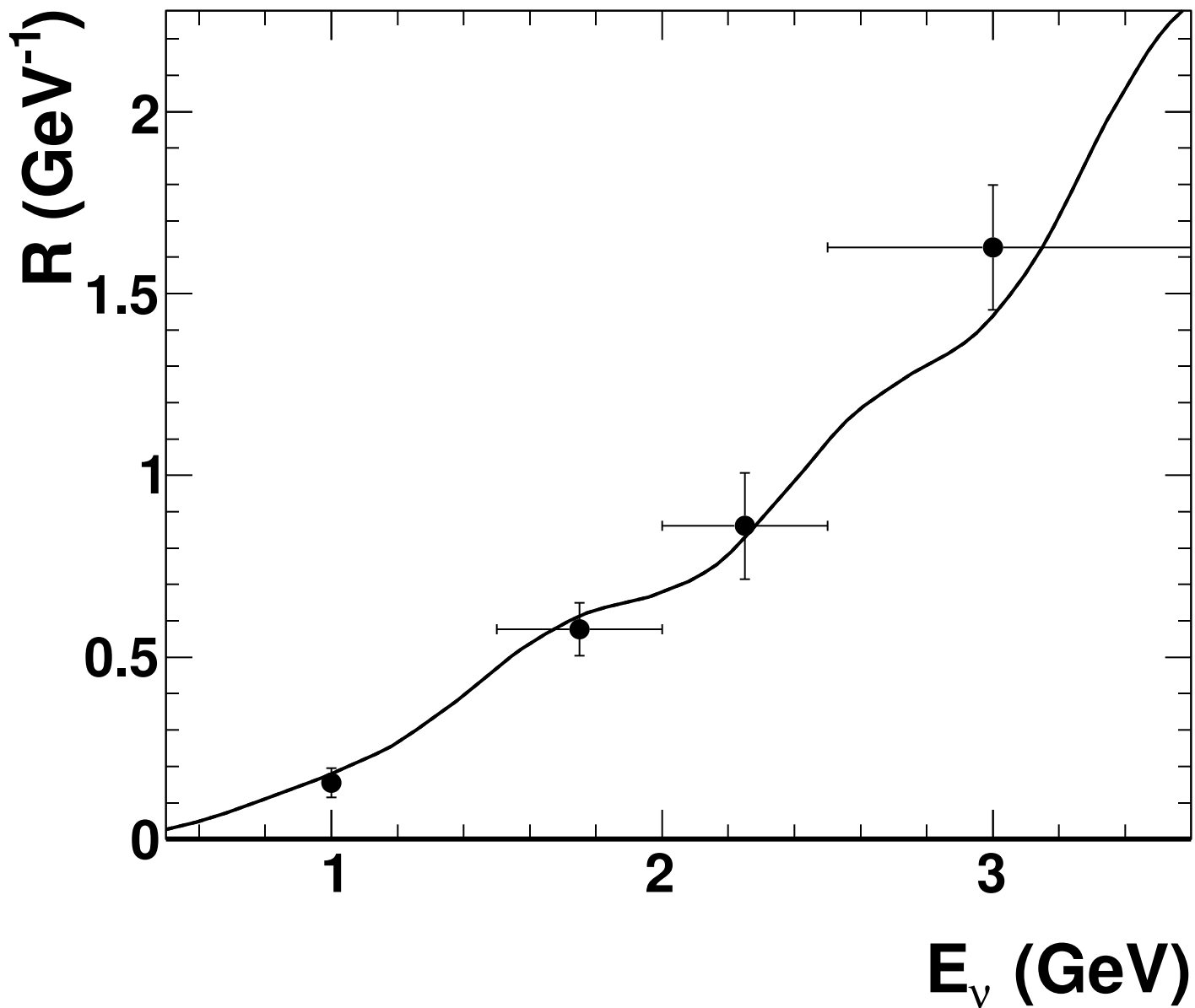
—●— ANL\_12FT,11 [Day et al., Phys.Rev.D28:2714 (1983) ]

—●— BNL\_7FT,8 [Kitagaki et al., Phys.Rev.D34:2554 (1986) ]

— R-2\_10\_6-2016-04-04

..... R-2\_10\_8-2016-05-12

$\nu_\mu$  CC $\pi^0$  /  $\nu_\mu$  CCQE, K2K data only

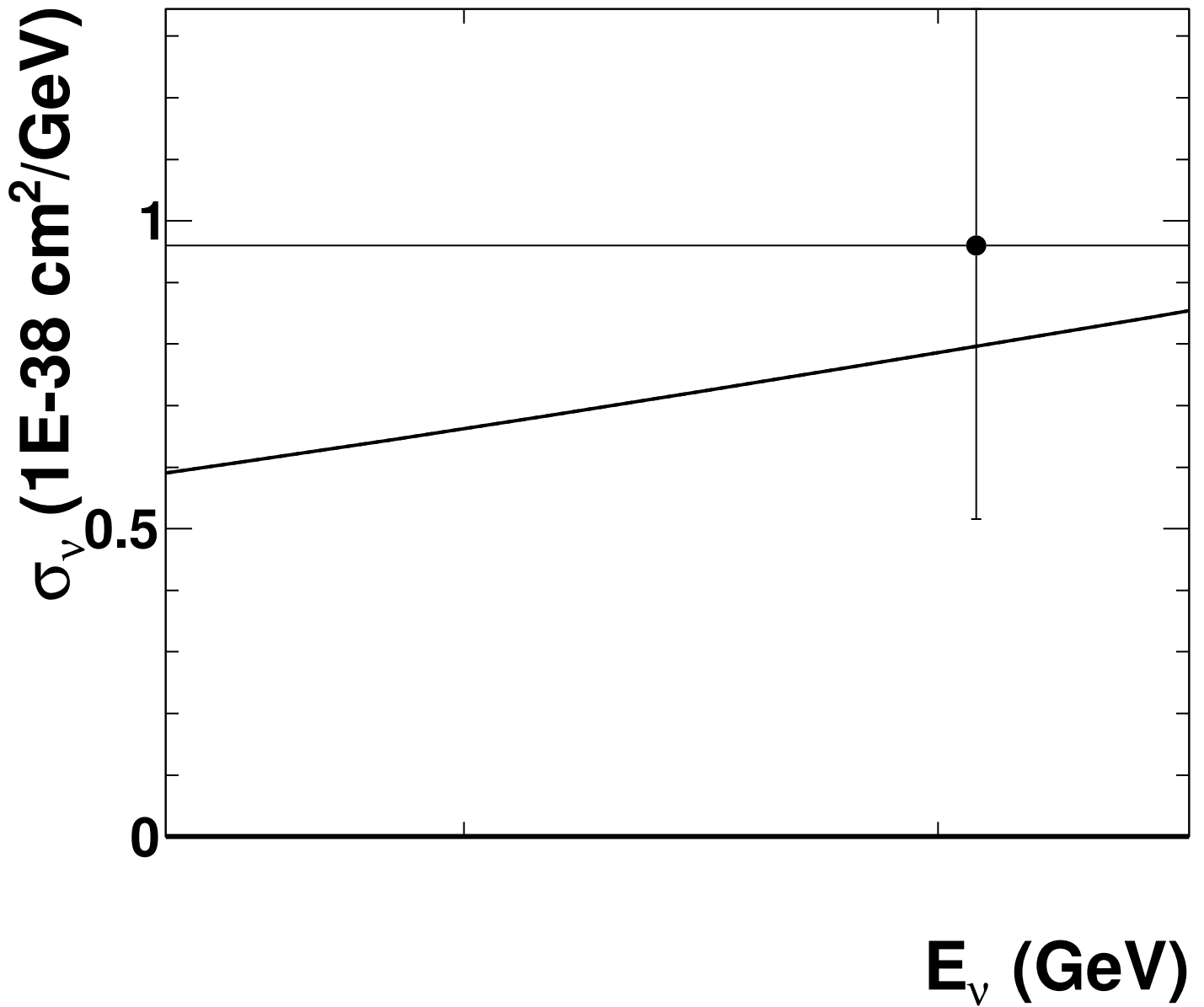


● K2K,0 [Mariani et al., Phys.Rev.D83:054023 (2011)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

# $\nu_\mu$ NC coherent $\pi^0$ ( $^{20}\text{Ne}$ )

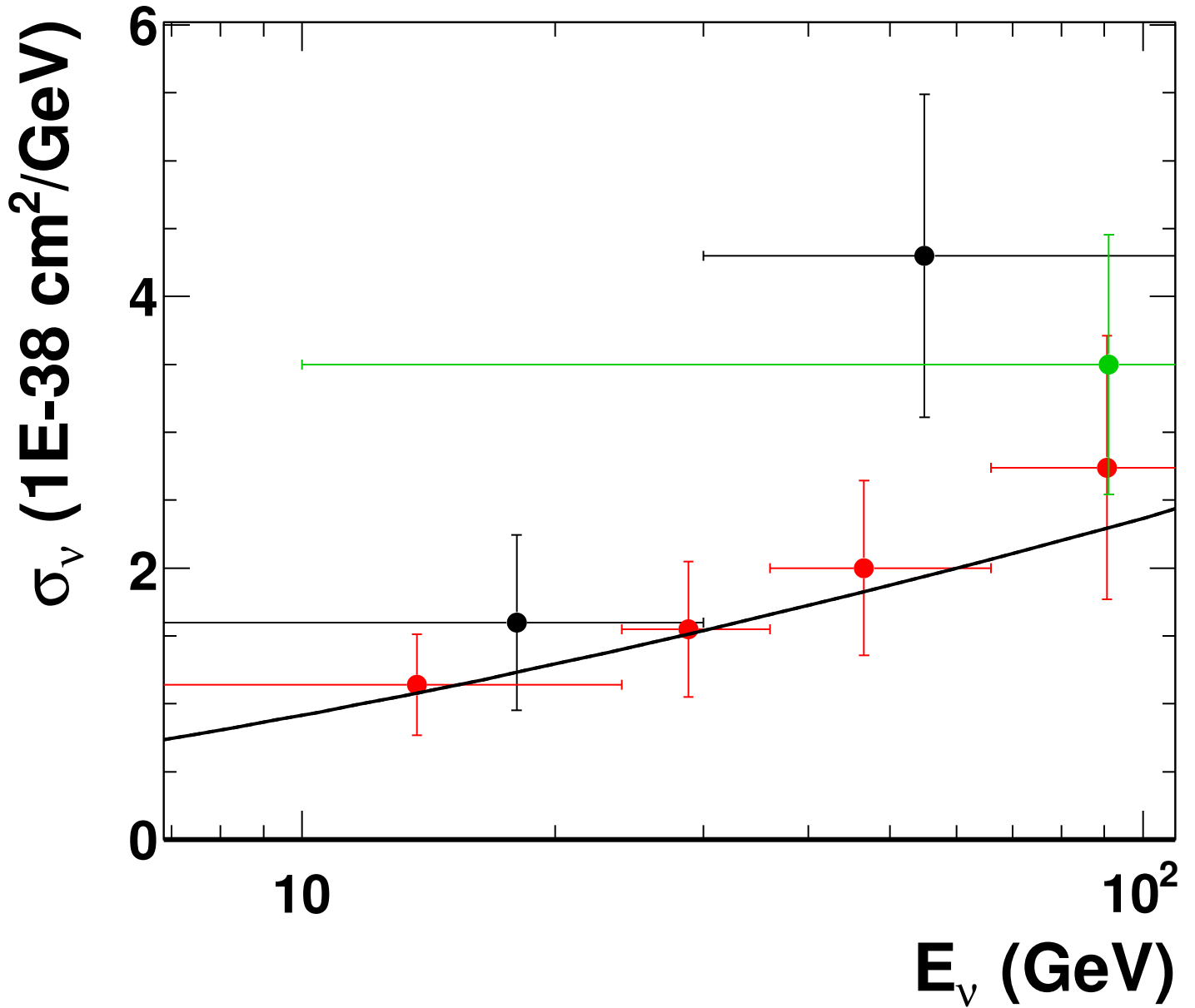


● CHARM,2 [Bergsma et al., Phys.Lett.B157:469 (1985) ]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

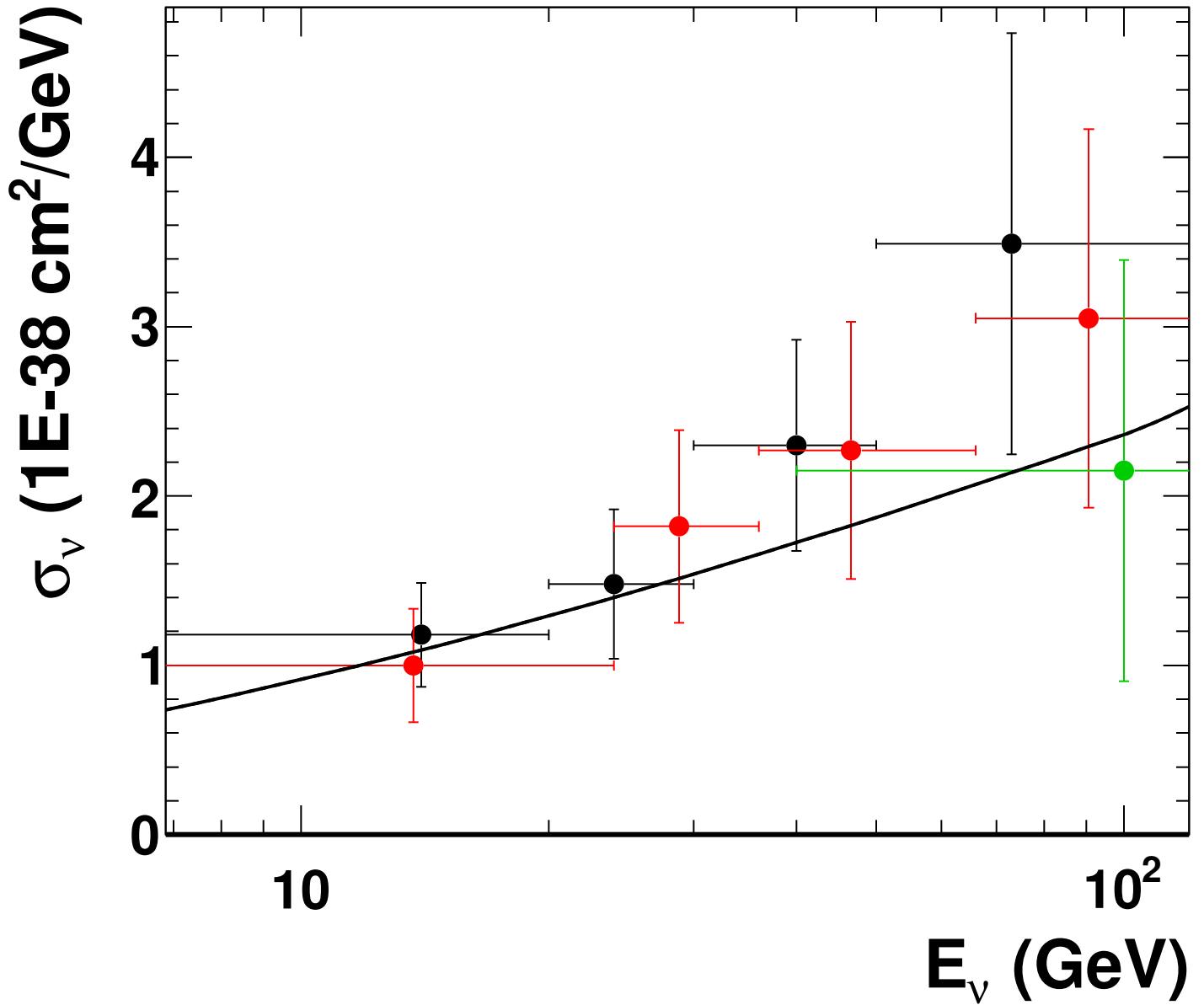
# $\nu_\mu$ CC coherent $\pi^+$ ( $^{20}\text{Ne}$ )



- BEBC,11 [Marage et al., Z.Phys.C43:523 (1989) ]
- CHARM,6 [Vilain et al., Phys.Lett.B313:267 (1993) ]
- FNAL\_15FT,8 [Willocoq et al., Phys.Rev.D47:2661 (1993) ]
- R-2\_10\_6-2016-04-04
- - - R-2\_10\_8-2016-05-12

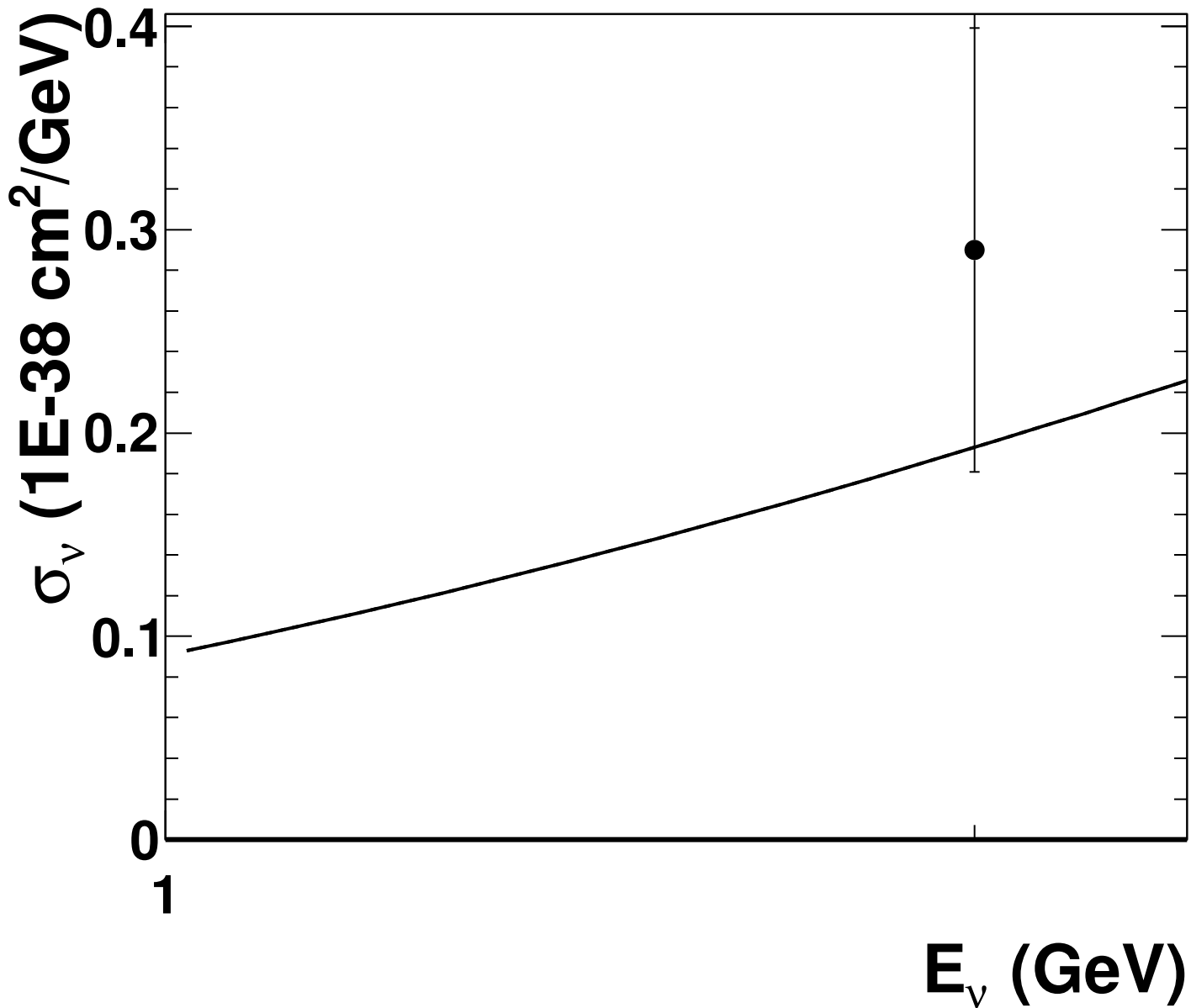


# $\bar{\nu}_\mu$ CC coherent $\pi^-$ ( $^{20}\text{Ne}$ )



- BEBC,10 [Marage et al., Z.Phys.C31:191 (1986) ]
- CHARM,7 [Vilain et al., Phys.Lett.B313:267 (1993) ]
- FNAL\_15FT,7 [Aderholz et al., Phys.Rev.Lett.63:2349 (1989)]
- R-2\_10\_6-2016-04-04
- - - R-2\_10\_8-2016-05-12

# $\nu_\mu$ NC coherent $\pi^0$ ( $^{27}\text{Al}$ )

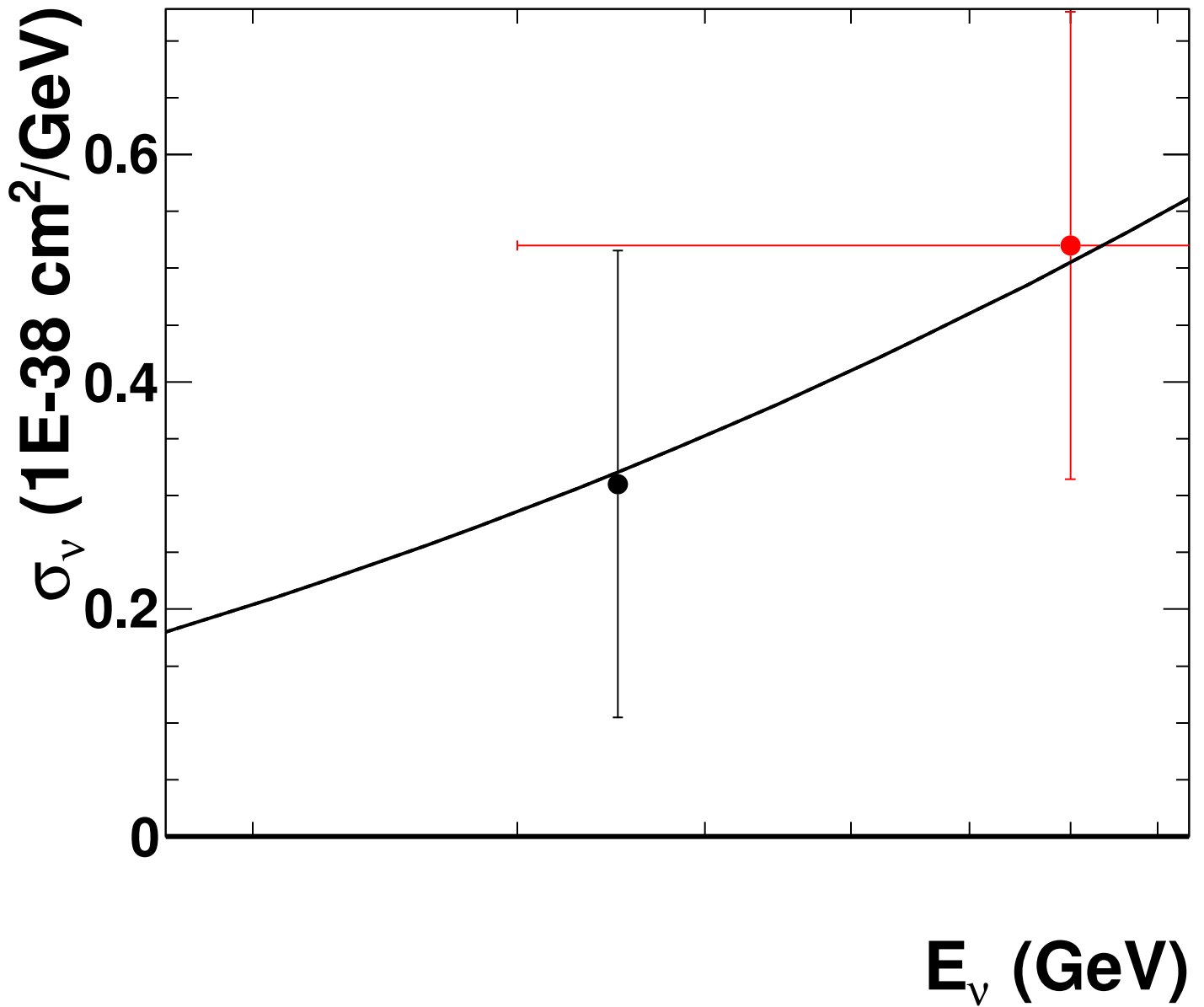


● AachenPadova,0 [Faissner et al., Phys.Lett.B125:230 (1983)]

— R-2\_10\_6-2016-04-04

⋯ R-2\_10\_8-2016-05-12

# $\nu_\mu$ NC coherent $\pi^0$ ( $^{30}\text{Si}$ )



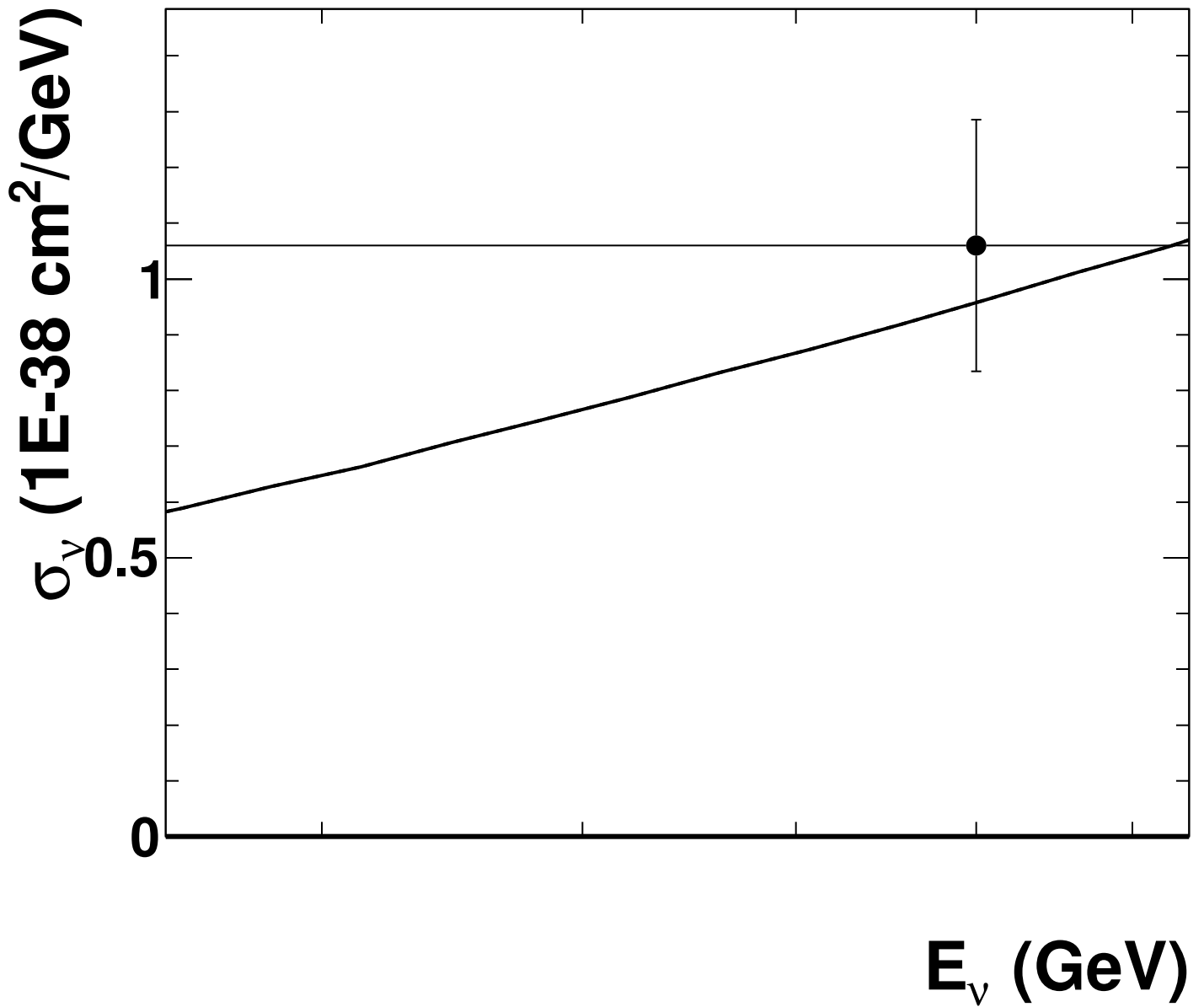
—●— Gargamelle,14 [Isiksal et al., Phys.Rev.Lett.52:1096 (1984)]

—●— SKAT,3 [Grabosch et al., Zeit.Phys.C31:203 (1986)]

— R-2\_10\_6-2016-04-04

..... R-2\_10\_8-2016-05-12

# $\nu_\mu$ CC coherent $\pi^+$ ( $^{30}\text{Si}$ )

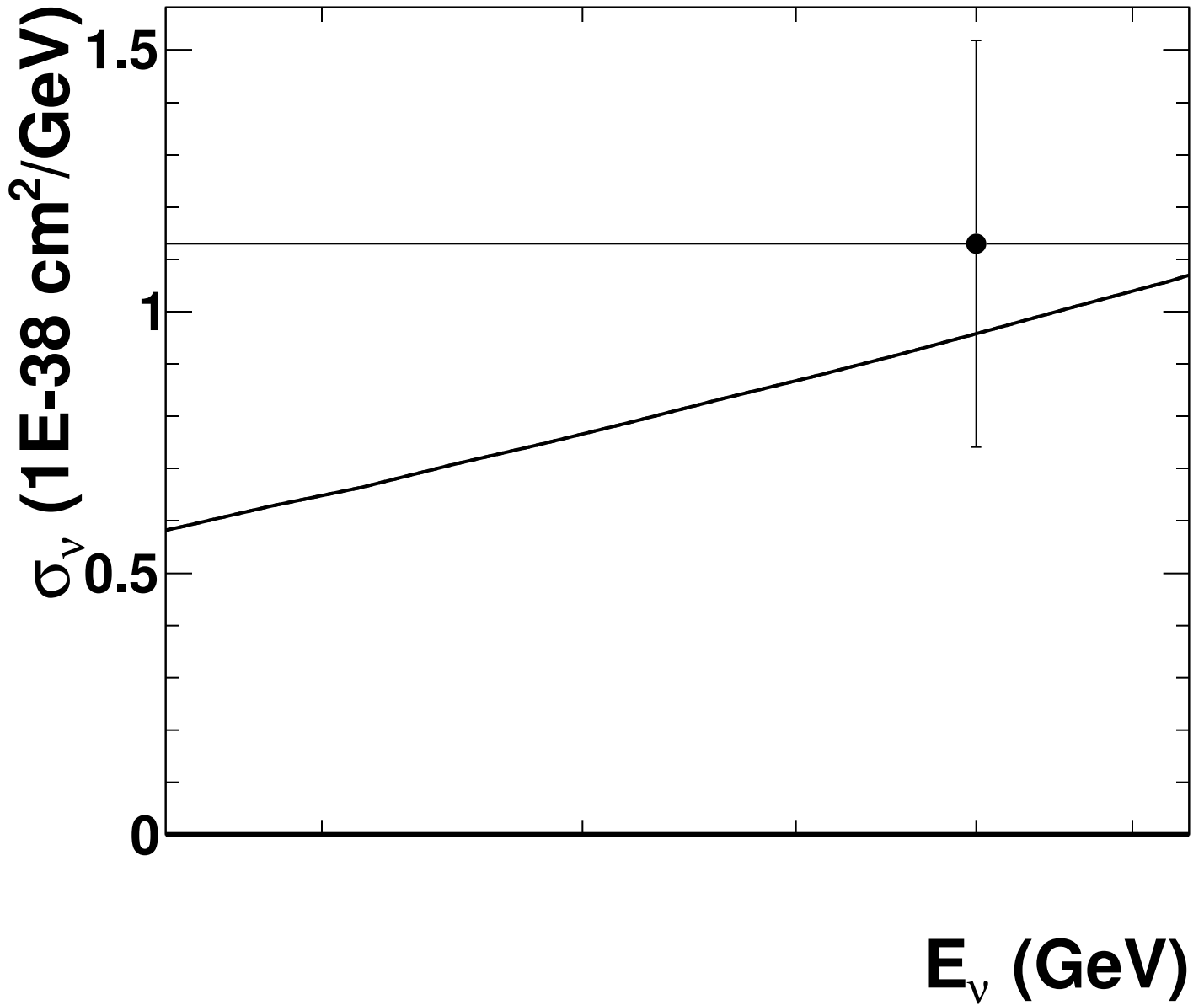


—●— SKAT,1 [Grabosch et al., Zeit.Phys.C31:203 (1986) ]

— R-2\_10\_6-2016-04-04

..... R-2\_10\_8-2016-05-12

# $\bar{\nu}_\mu$ CC coherent $\pi^-$ ( $^{30}\text{Si}$ )

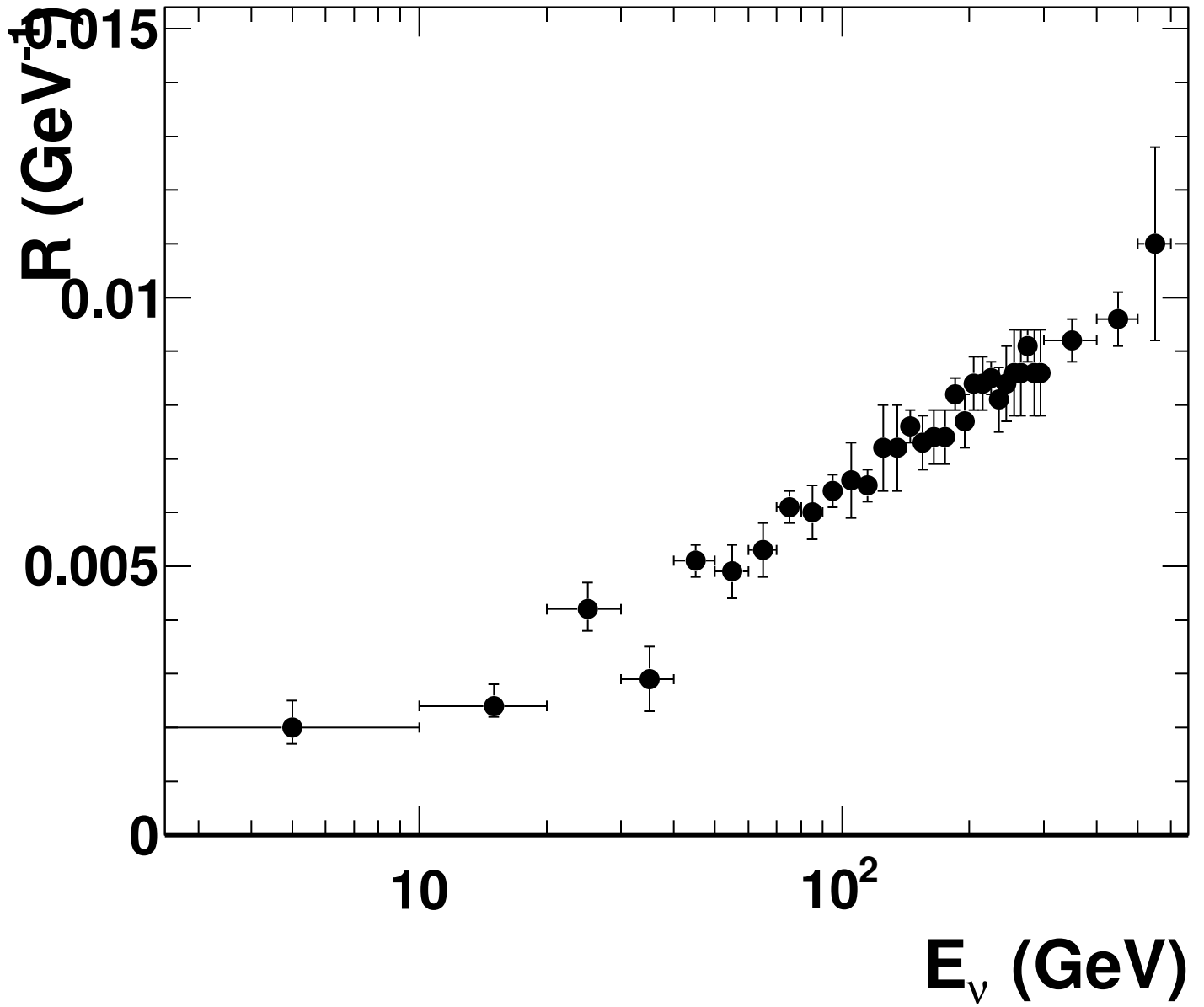


● SKAT,2 [Grabosch et al., Zeit.Phys.C31:203 (1986) ]

— R-2\_10\_6-2016-04-04

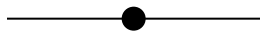
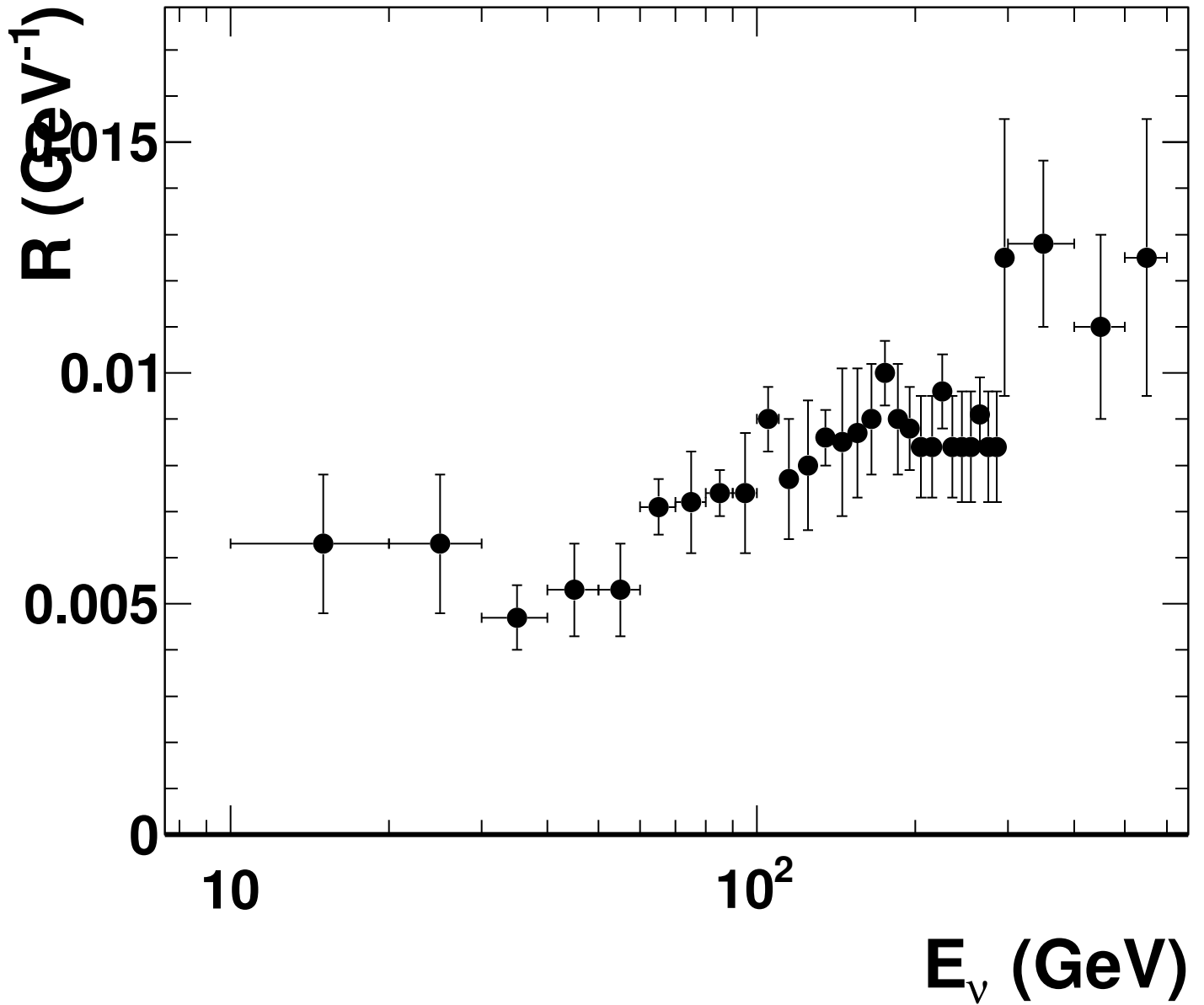
⋯ R-2\_10\_8-2016-05-12

$\nu_\mu$  CC  $\mu^- \Gamma^+$  /  $\nu_\mu$  CC (averaged world-data)



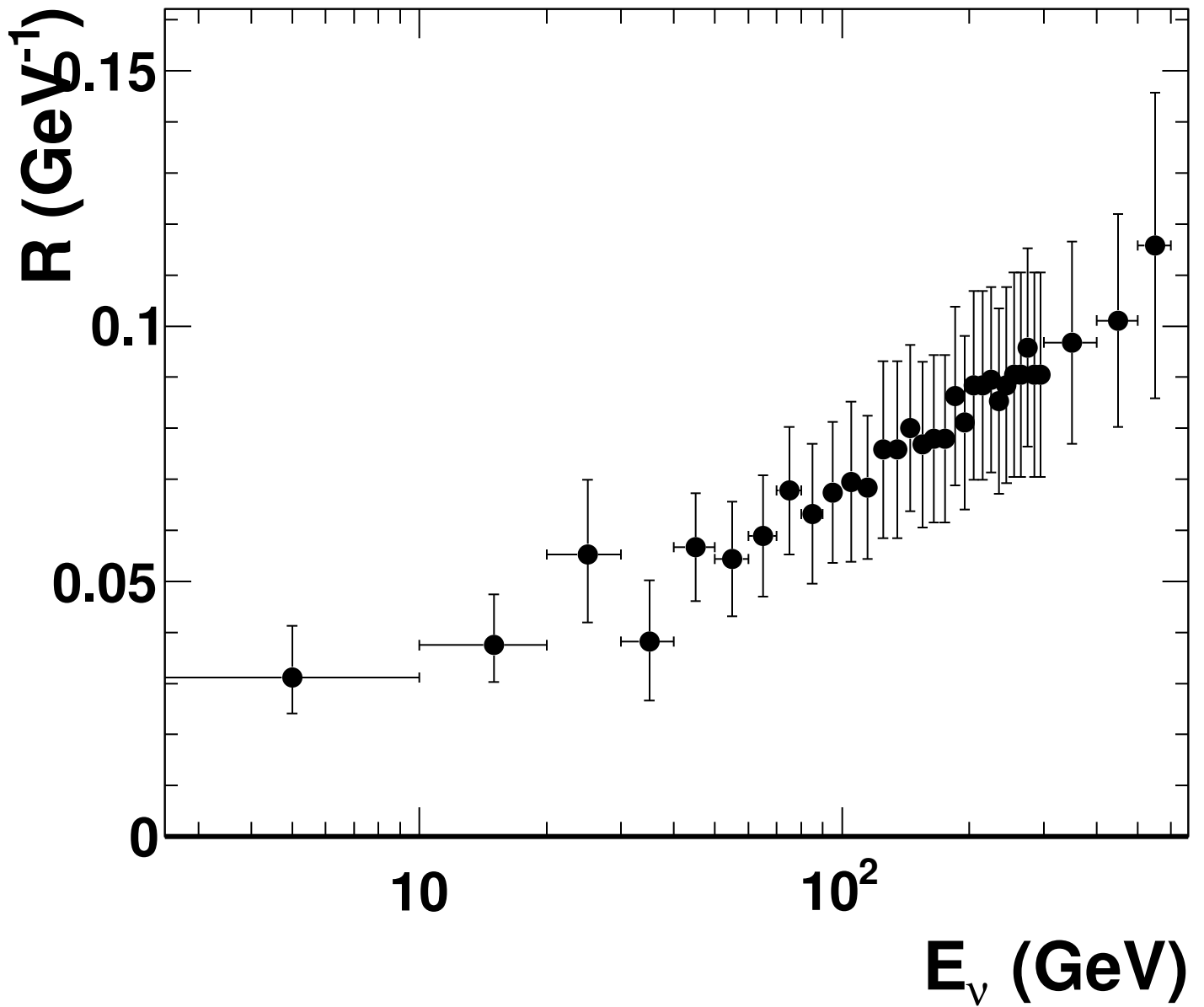
● LMM\_WorldAverage,0 [De Lellis et al., J.Phys.G28:713 (2002)]

$\bar{\nu}_\mu$  CC  $\mu^+\Gamma$  /  $\bar{\nu}_\mu$  CC (averaged world-data)



LMM\_WorldAverage,1 [De Lellis et al., J.Phys.G28:713 (2002)]

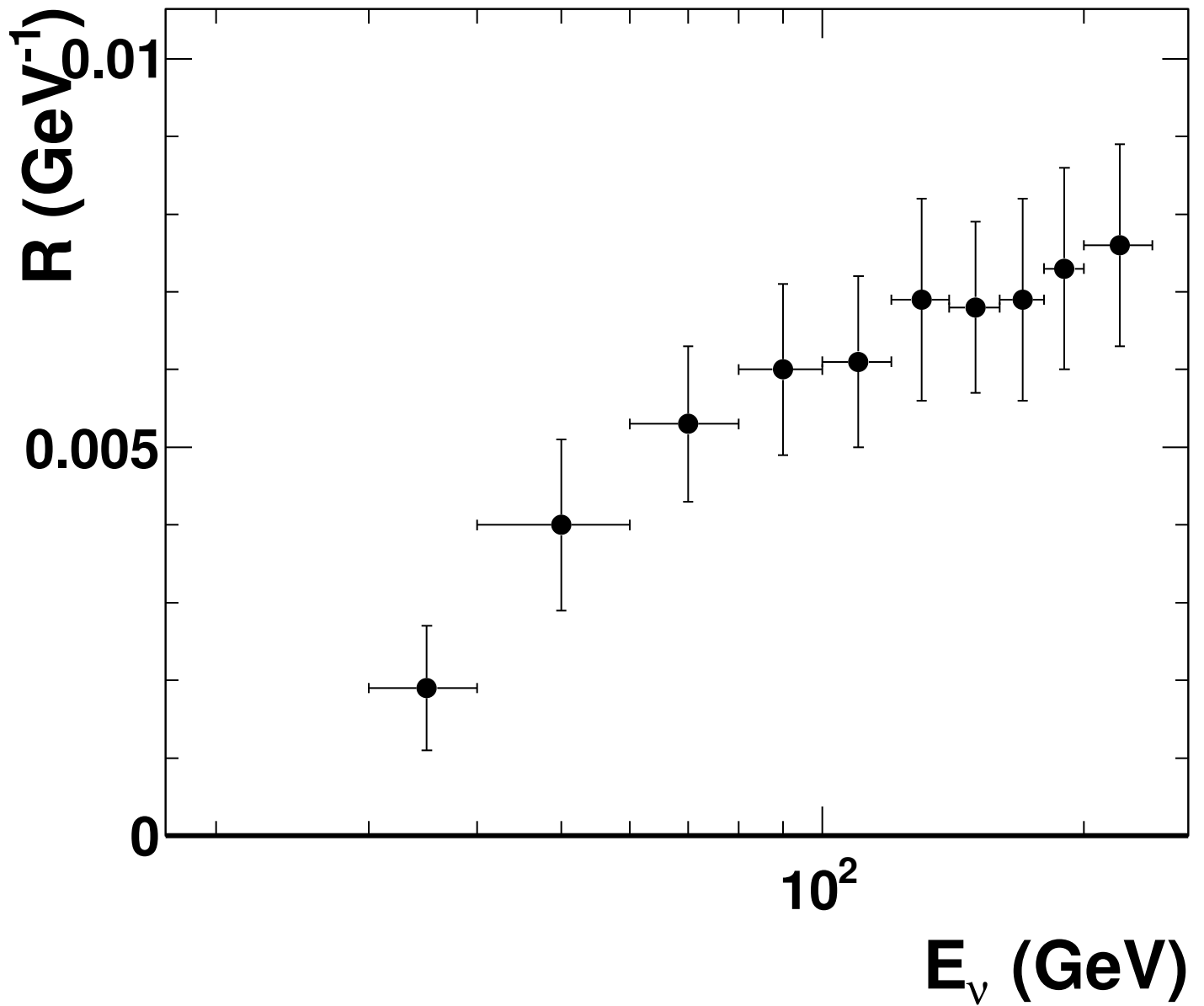
$\nu_\mu$  CC charm /  $\nu_\mu$  CC (averaged world-data)



● LMM\_WorldAverage,2 [De Lellis et al., J.Phys.G28:713 (2002)]

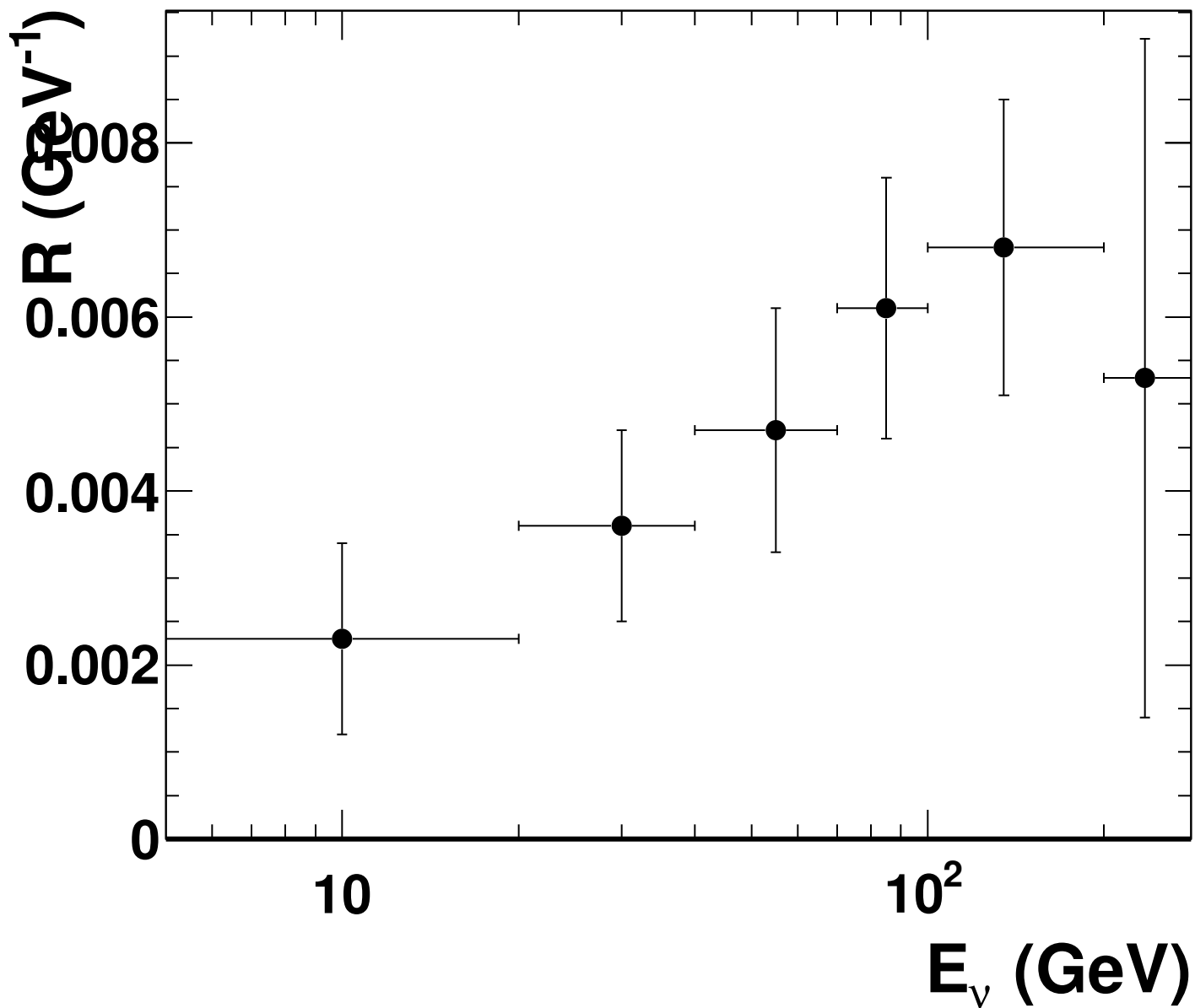


$\nu_{\mu} \text{ CC } \mu^{-}\mu^{+} / \nu_{\mu} \text{ CC } (p_{\mu^{-}}, p_{\mu^{+}} > 5 \text{ GeV}; E_{\text{vis}} > 20 \text{ GeV})$



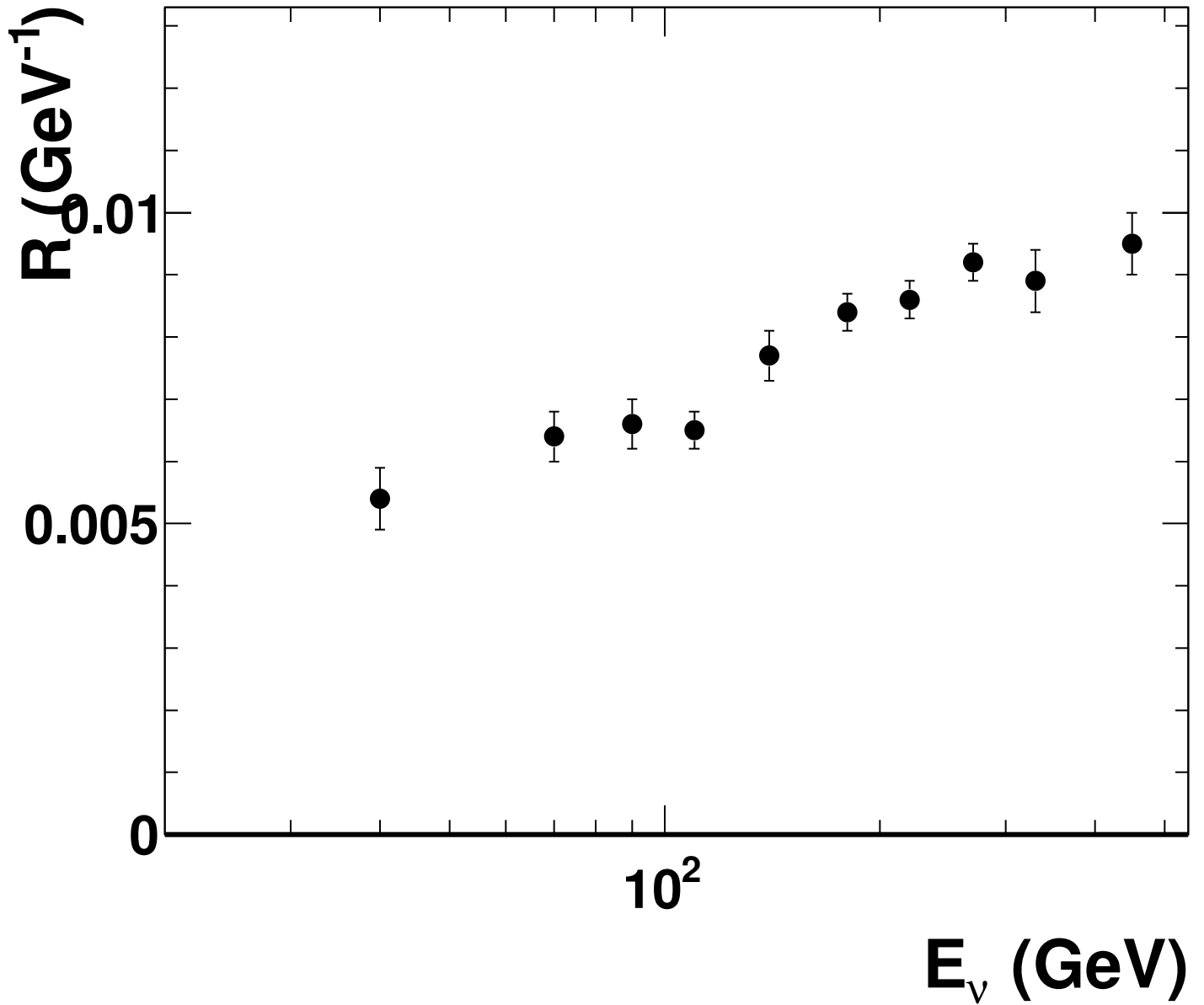
● CDHS,2 [Abramowicz et al., Z.Phys.C15:19 (1982)]

$\nu_\mu \text{ CC } \mu^- \mu^+ / \nu_\mu \text{ CC } (x_{\text{vis}} < 1; Q_{\text{vis}}^2 > 1 \text{ GeV}^2; p_{\mu^-}, p_{\mu^+} > 5 \text{ GeV})$



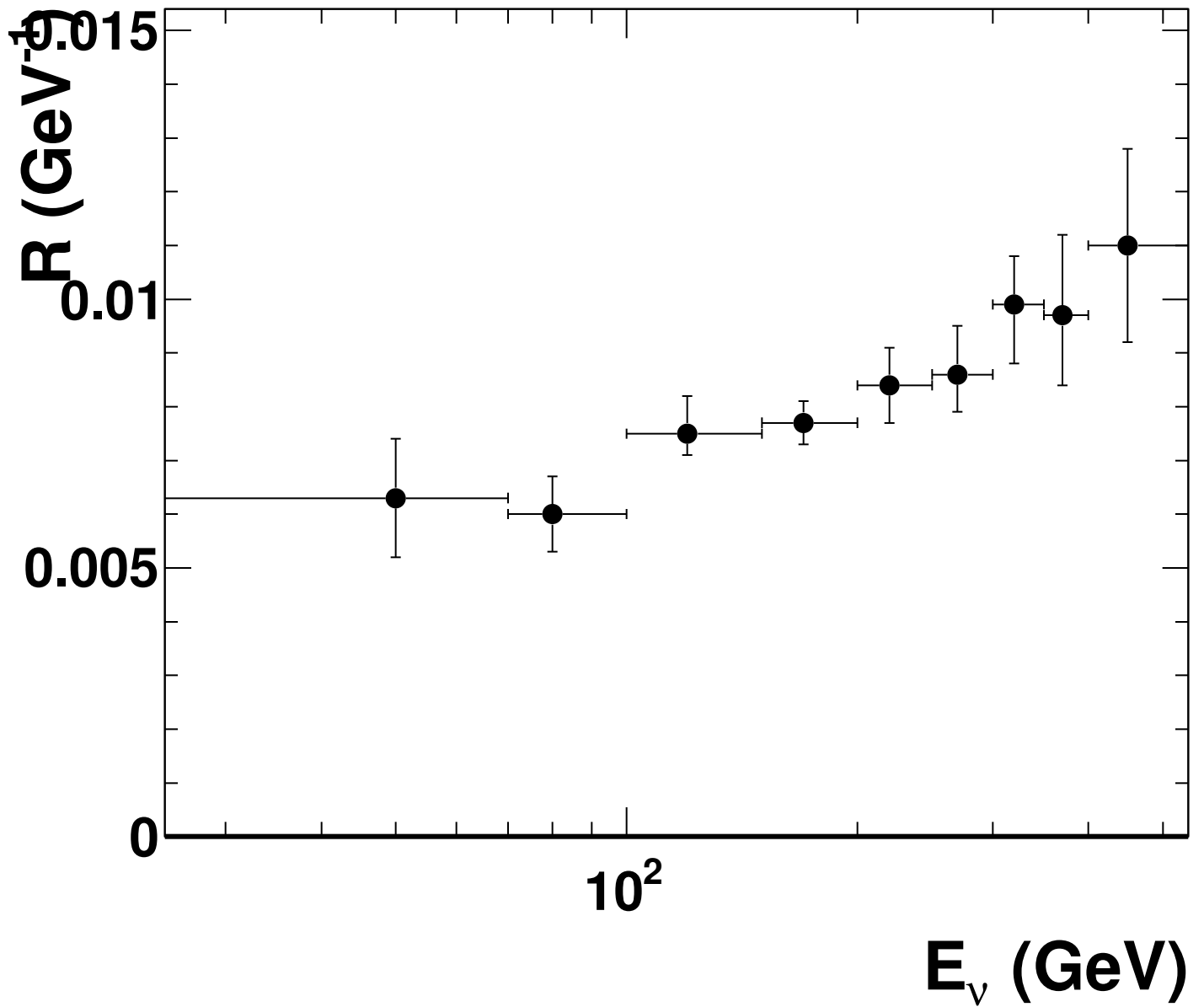
● NOMAD,4 [Astier et al., Phys.Lett.B486:35 (2000)]

$\nu_\mu \text{ CC } \mu^- \mu^+ / \nu_\mu \text{ CC } (E_{\text{had}} > 10 \text{ GeV}; p_{\mu^-} > 9 \text{ GeV}; p_{\mu^+} > 5 \text{ GeV})$



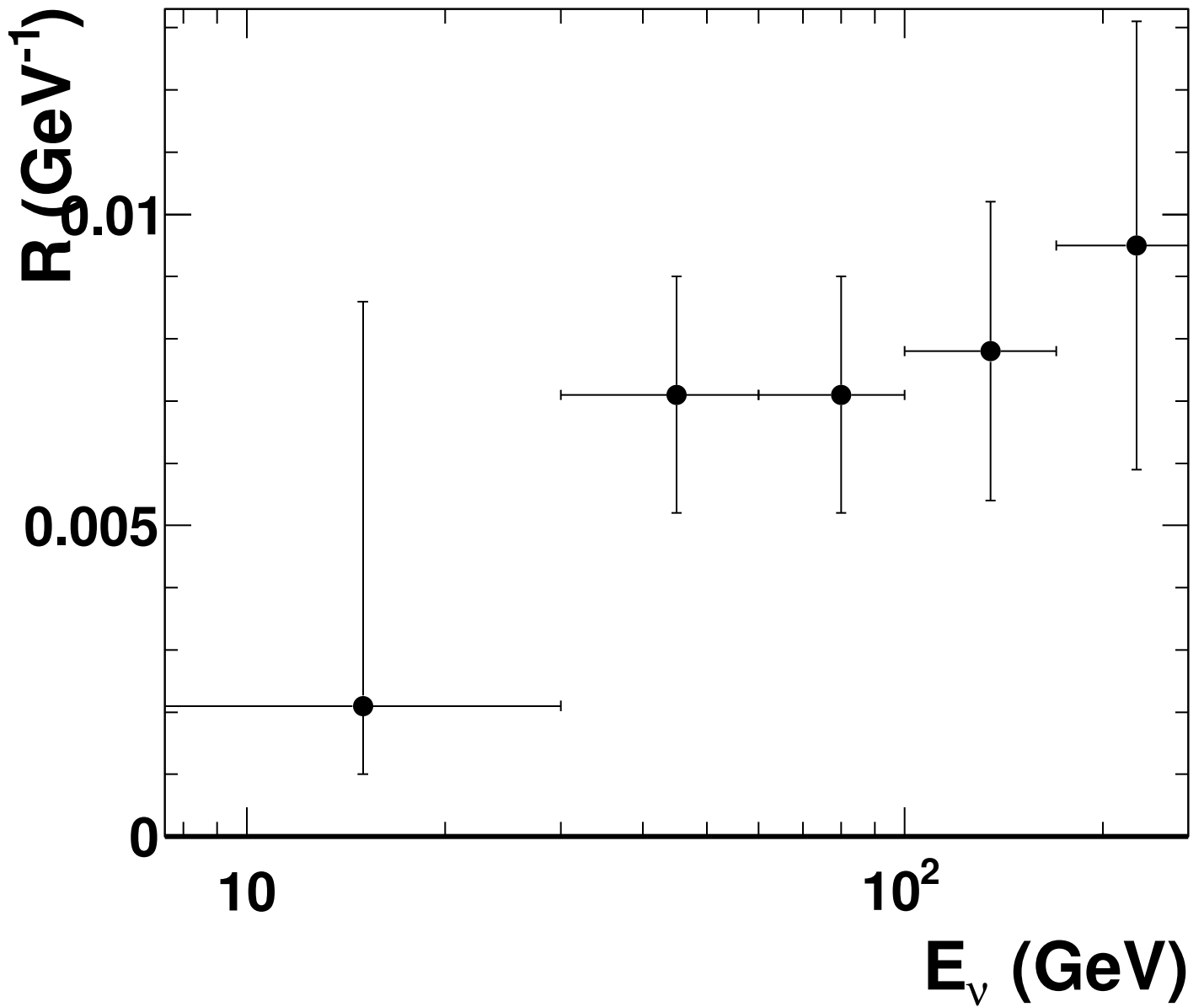
CCFR,4 [Rabinowitz et al., Phys.Rev.Lett.70:134 (1993)]

$\nu_{\mu} \text{ CC } \mu^{-}\mu^{+} / \nu_{\mu} \text{ CC } (p_{\mu^{-}}, p_{\mu^{+}} > 9 \text{ GeV}; \theta_{\mu^{-}}, \theta_{\mu^{+}} < 250 \text{ mrad})$



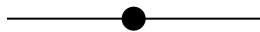
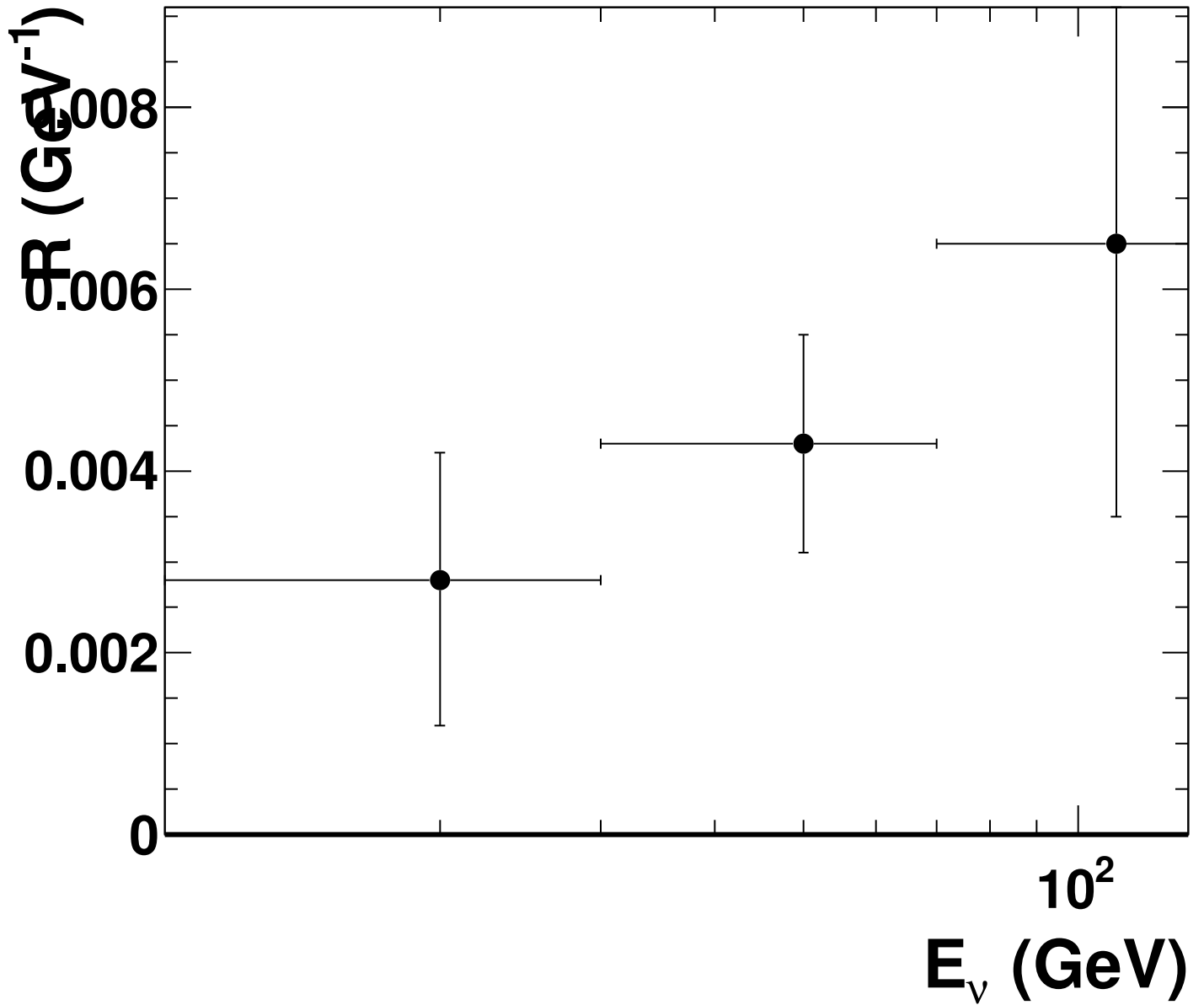
● CCFR,5 [Foudas et al., Phys.Rev.Lett.64:1207 (1990)]

$\nu_{\mu}$  CC  $\mu^-e^+$  /  $\nu_{\mu}$  CC ( $p_{\mu^-} > 4$  GeV;  $p_{e^+} > 0.3$  GeV)



FNAL\_15FT,11 [Ballagh et al., Phys.Rev.D24:7 (1981)]

$\nu_{\mu} \text{ CC } \mu^{-}e^{+} / \nu_{\mu} \text{ CC } (p_{\mu^{-}} > 4.5 \text{ GeV}; p_{e^{+}} > 0.3 \text{ GeV})$



Gargamelle,16 [Haatuft et al., Nucl.Phys.B222:365 (1983)]