

# Update of the summation calculations for reactor antineutrino spectra

*martes, 5 de mayo de 2026 12:00 (40)*

SUBATECH, CNRS/IN2P3, Nantes Université, IMT Atlantique, F-44307 Nantes, France

Contact: estienne@subatech.in2p3.fr

Key words: reactor antineutrinos, summation calculations, nuclear data, TAGS

Abstract: The accurate determination of reactor antineutrino spectra remains a very actual research topic for which interrogations have emerged in the past decade. Indeed, after the “reactor anomaly” (RAA) [1] – a deficit of measured antineutrinos at short baseline reactor experiments with respect to spectral predictions – the three international reactor neutrino experiments Double Chooz, Daya Bay and Reno have evidenced spectral distortions in their measurements w.r.t the same spectral predictions (Shape Anomaly)[2]. This puzzle is called the “shape anomaly”. The latter predictions were obtained through the conversion of integral beta energy spectra obtained at the ILL research reactor[3]. Several studies have shown that the underlying nuclear physics required for the conversion of these spectra into antineutrino spectra is not totally under control [4]. The unique alternative to converted spectra is a complementary approach consisting in determining the antineutrino spectrum through nuclear data [5,6]. In the past years, the reactor neutrino experiments such as Prospect [7], STEREO [8] and Daya Bay [9] have published in 2023 their analysis with the complete statistics of the measured data. The outcome of these analyses, combined with the work carried out in experimental nuclear physics with the TAGS measurements in particular [10, 11, 12], is that the sterile neutrino hypothesis is strongly disfavored to explain the RAA, but that further efforts remain to be made both theoretically and experimentally to fully understand the origin of RAA and shape anomaly, and that accurate predictions of antineutrino fluxes and spectra are still needed for future discoveries. Indeed the Daya Bay collaboration provided the first measurement of the high energy part of the reactor antineutrino spectrum above 8 MeV. In addition, the Juno-Tao [13] experiment will perform a measurement of reactor antineutrino spectra with unprecedented energy resolution that will allow to tackle the contribution of specific fission products and constrain potentially nuclear data with the measured antineutrinos. The summation method based on the nuclear data will be the privileged tool to interpret these measurements. At this workshop, we propose to present an update of our summation calculations with recently published TAGS results for  $^{96}\text{Zr}$ ,  $^{96}\text{Y}$ ,  $^{95}\text{Rb}$  and  $^{137}\text{I}$  [15], as well as new TAGS results for  $^{138}\text{I}$ ,  $^{142}\text{Cs}$  and  $^{99}\text{Y}$ . The new SM2026 predictions will be compared with the most recent results from Daya Bay [16].

- [1] G. Mention et al. , Phys. Rev. D 83 , 073006 (2011)
- [2] Double Chooz and Reno Collab. in Proceedings of the Neutrino 2014 Conf., <http://neutrino2014.bu.edu/>; Daya Bay Collab. in Proceedings of the ICHEP 2014 Conf., <http://ichep2014.es/>.
- [3] P. Huber, Phys. Rev. C 84, 024617 (2011).
- [4] A. C. Hayes et al., Phys. Rev. Lett. 112, 202501 (2014).
- [5] M. Fallot et al., Phys. Rev. Lett. 109 , 202504 (2012).
- [6] A. A. Sonzogni et al. , Phys. Rev. C 91 , 011301 (R) (2015).
- [7] M. Andriamirado et al., Prospect Collab. Phys. Rev. Lett. 131, 021802 (2023)
- [8] F.P. An et al. Daya Bay collab., Phys. Rev. Lett. 130 (2023) 211801 and F.P. An et al. Daya Bay collab., Phys. Rev. Lett. 129 (2022) 041801).
- [9] H. Almazan et al., STEREO collab. Nature 613, 257–261 (2023). <https://doi.org/10.1038/s41586-022-05568-2>.
- [10] M. Estienne et al. Phys. Rev. Lett. 123, 022502 (2019).
- [11] A. Algora, B. Rubio, J.-L. Tain, M. Fallot, W. Gelletly Review Paper Eur. Phys. J. A 57, 85 (2021)
- [12] Chao Zhang a, Xin Qian a, Muriel Fallot bProgress in Particle and Nuclear Physics Vol. 136, (2024), 104106
- [13] A. Abusleme, et al., TAO Conceptual Design Report. arXiv:2005.08745.
- [14] V. Guadilla et al. Phys. Rev. C 106, 014306 (2022)
- [15] V. Guadilla et al. Phys. Rev. C 100, 044305 (2019)
- [16] DB collaboration, Phys. Rev. Lett. 134, 201802 (2025)

**Co-author(s)** : Prof. FALLOT, M. (SUBATECH, CNRS/IN2P3)

**Presenter(s)** : Dr. ESTIENNE, M. (SUBATECH, CNRS/IN2P3); Prof. FALLOT, M. (SUBATECH, CNRS/IN2P3)

