Reactor antineutrinos in the world

V. Chubakov, F. Mantovani, B. Ricci, J. Esposito, L. Ludovica and S. Zavatarelli

1 Dip. di Fisica, Università degli Studi di Ferrara e INFN-Ferrara, Italy
2 INFN, Laboratori Nazionali di Legnaro, Padova, Italy
3 INFN-Milan, Italy 4 INFN-Genova, Italy

Why reactor antineutrinos?
- Reactor antineutrinos are the main source of background in the detection of geo-neutrinos (i.e. anti-νe from 238U and 232Th decay chains, present in the Earth interior).
- The High Energy Region (HER) has to be controlled by studying the different contributions from the nuclear reactors, if one wants to disentangle Ngeo-ν from Nreact-ν in the Low Energy Region (LER).

Signal Calculations
- Many ingredients: neutrino physics, nuclear physics, reactor properties...
  - ε = 100% efficiency
  - τ = 1 year
  - N = 1022 target protons
  - $P_i$ = thermal power
  - $E_{th}$ = cross-section
  - $\lambda_i$ = reactor anti-neutrino spectrum

Result: a world wide map
- Reactor antineutrino events all over the world
  - Total Thermal Power = 1023 GW
  - There are 128 reactors in operation, 38 under construction, 35 installed capacity
  - Total uncertainties on predicted signal is about 5%, coming from ν mixing, anti-spectrum, fuel composition and thermal power

React. signal and geo neutrino detection
- Reactor signal in Low Energy Region, for different sites.

Conclusions and perspectives
- We calculated reactor anti-νe signal all over the world, by taking into account updated data on nuclear plants, anti-νe spectrum and ν e oscillation parameters.
- We compare reactor signal with geo-neutrino signal for different places in the world.
- Study of time variation of reactor signal is also possible (+ 10% variation in summer/winter).
- Detailed study on the effect of exhausted fuel must be completed (we estimate a 2% increase in the signal).