Reactor Antineutrino Flux and Spectrum Measurement at Daya Bay and Study of its High-Energy Component

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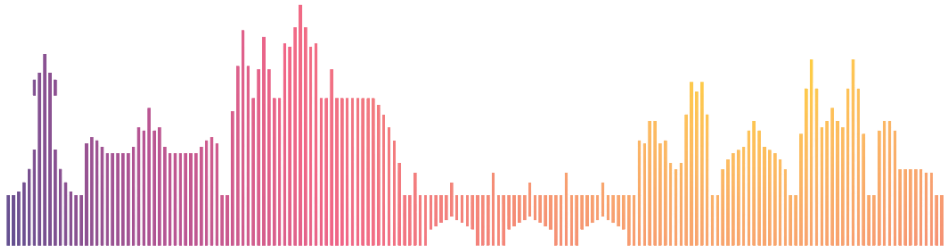
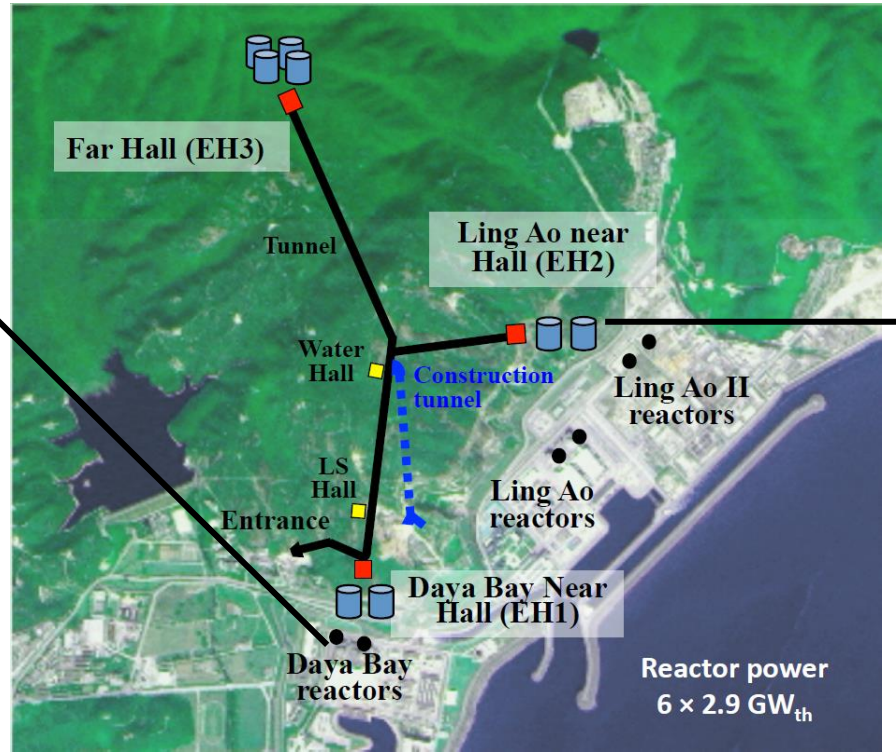
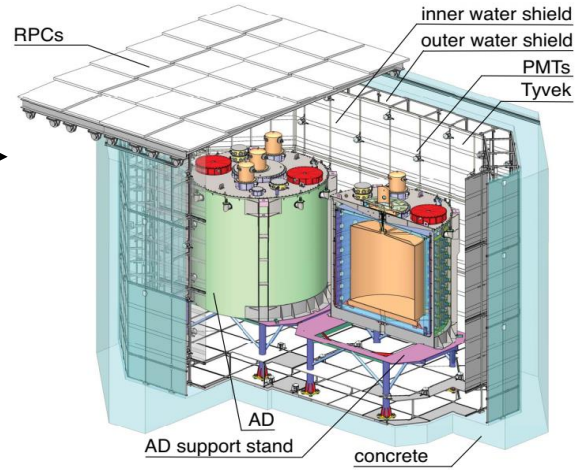


Daya Bay Experiment

- Six commercial reactors
  - Thermal power of each reactor is 2.9 GW (~2x10^{20} $\bar{\nu}_e$/s/GW)

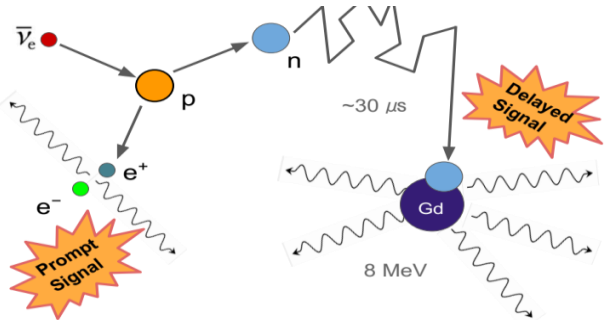


- Eight antineutrino detector (ADs) in three experimental halls (EHs)



- Antineutrino is detected via inverse beta decay process:

$$\bar{\nu}_e + p \rightarrow e^+ + n$$



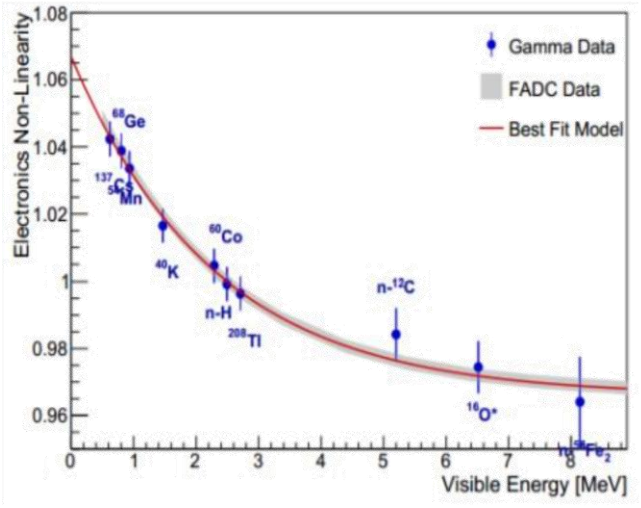
Improvement of uncertainty

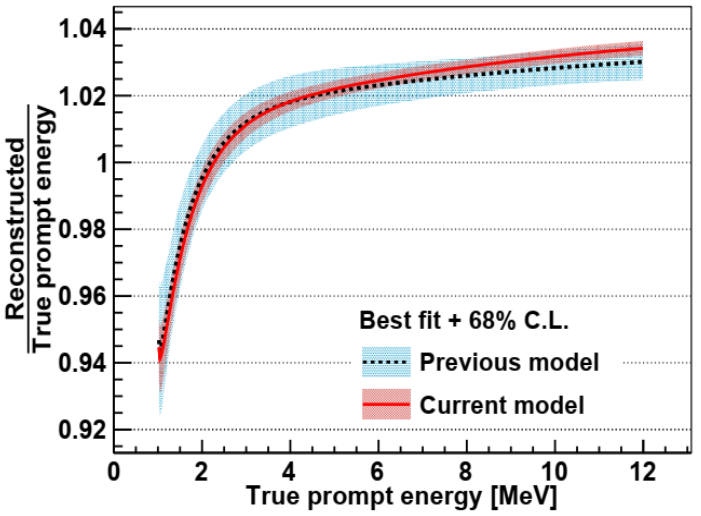
- The dominant uncertainty on the neutron detection efficiency is reduced by 56%.

	Previous		This work	
source	value	rel. err.	value	rel. err.
statistic	-	0.1%	-	0.1%
oscillation	-	0.1%	-	0.1%
target proton	-	0.92%	-	0.92%
reactor				
power	-	0.5%	-	0.5%
energy/fission	-	0.2%	-	0.2%
IBD cross section	-	0.12%	-	0.12%
fission fraction	-	0.6%	-	0.6%
spent fuel	-	0.3%	-	0.3%
non-equilibrium	-	0.2%	-	0.2%
$\varepsilon_{\mathrm{IBD}}$				
ε_n	81.83%	1.69%	81.48%	0.74%
$\varepsilon_{\mathrm{other}}$	98.49%	0.16%	98.49%	0.16%
total	-	2.1%	-	1.5%

F. P. An et al. Phys. Rev. D 100 (2019) 052004

- FADC data and new calibration campaign in 2017 help to reduced the energy nonlinearity uncertainty.





- Uncertainties in the absolute energy calibration is reduced to less than 0.5% from previous 1.0% for visible energies larger than 2MeV.

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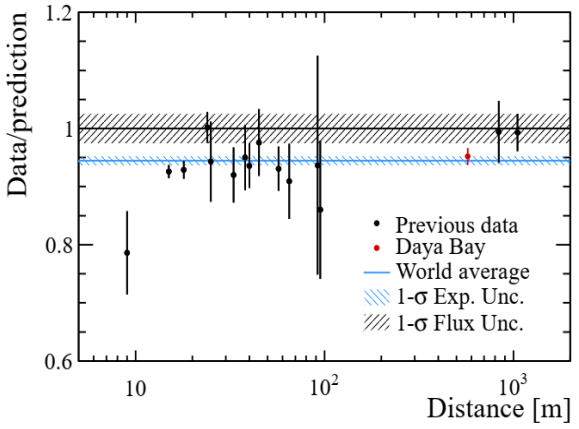
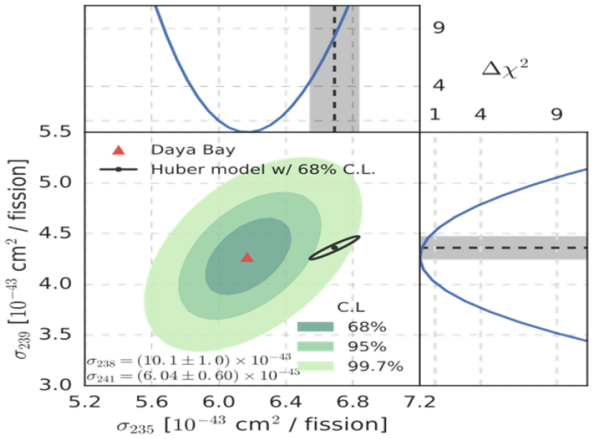
Antineutrino flux and spectrum measurement

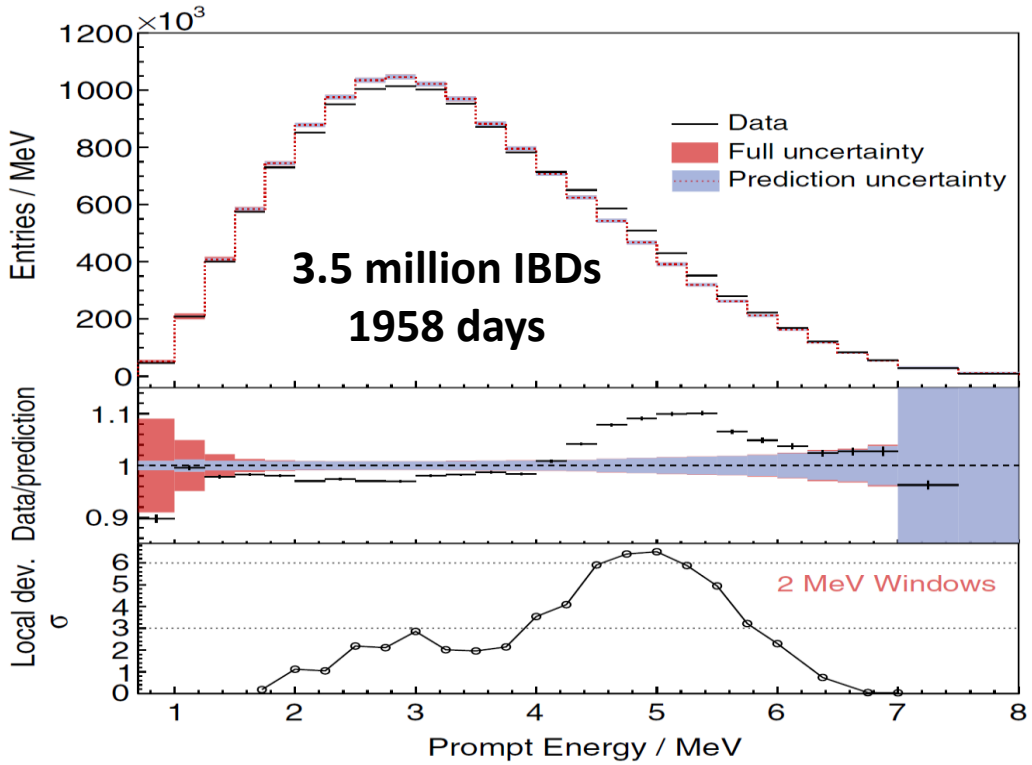
- Using 1230 days of data, the new reactor antineutrino flux measurement at Daya Bay is: $\sigma_f = (5.91 \pm 0.09) \times 10^{-43} cm^2/fisson$
- The ratio of data and prediction is:

$$R = 0.952 \pm 0.014(exp) \pm 0.023(model)$$





F. P. An et al. Phys. Rev. Lett 121 (2018) 241805
F. P. An et al. Phys. Rev. Lett 118 (2017) 251801



- A bump is obvious in the energy range 4-6MeV.
- The spectral shape disagrees with the Huber-Mueller model at 5.2 σ from 0.7 to 8 MeV.

F. P. An et al. Phys. Rev. Lett 123 (2019) 111801

How many candidates from high-energy reactor antineutrino (HERA) at Daya Bay?