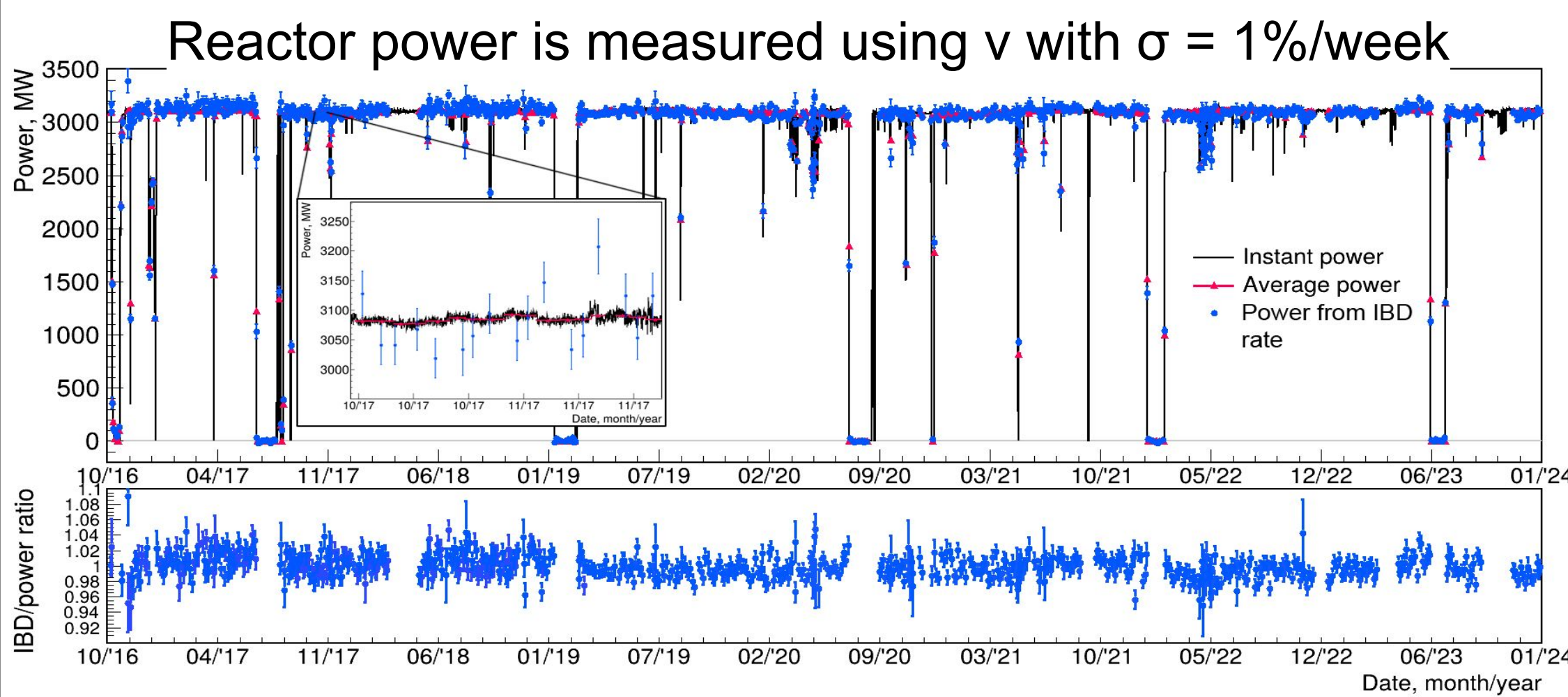
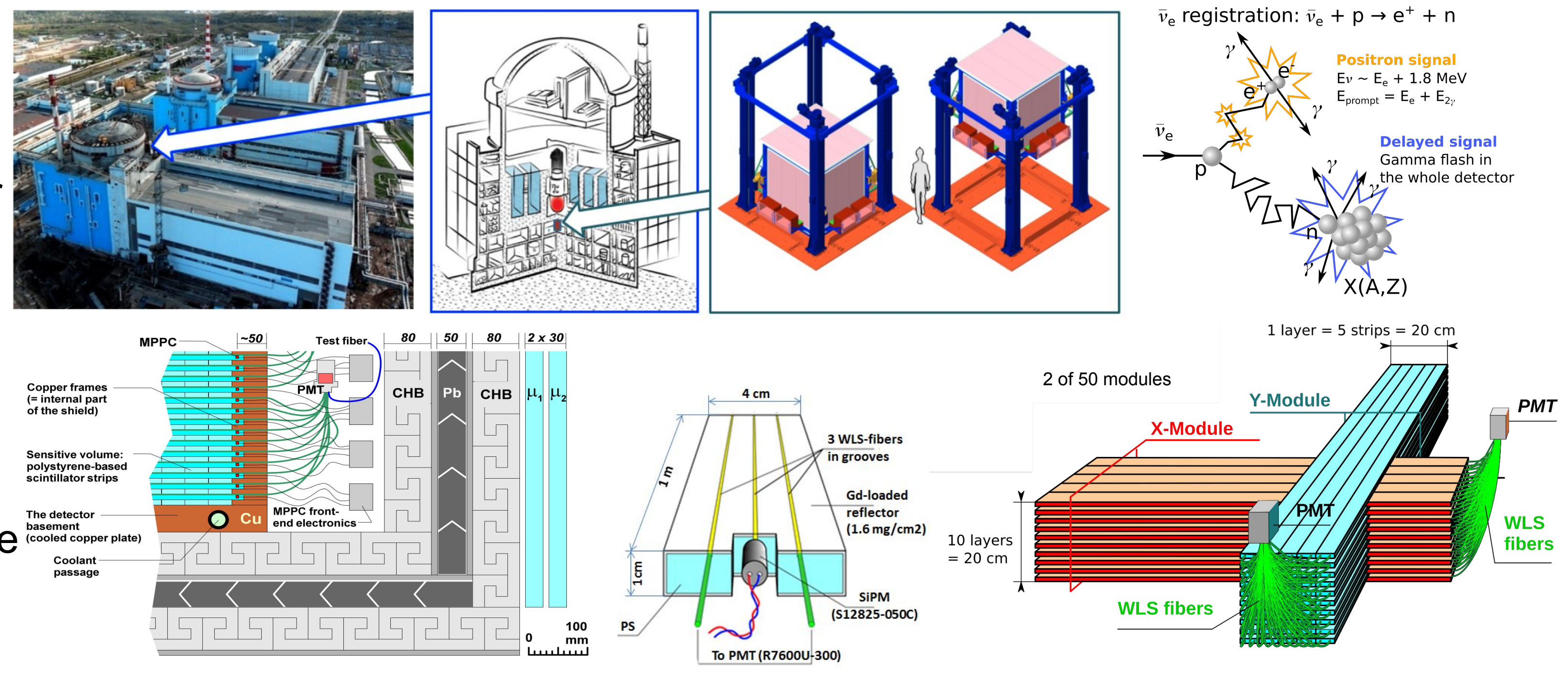


Searches for New physics at DANSS

EPS-HEP Conference 2025 (Marseille)
Mikhail Danilov(danilov@lebedev.ru) for the DANSS collaboration

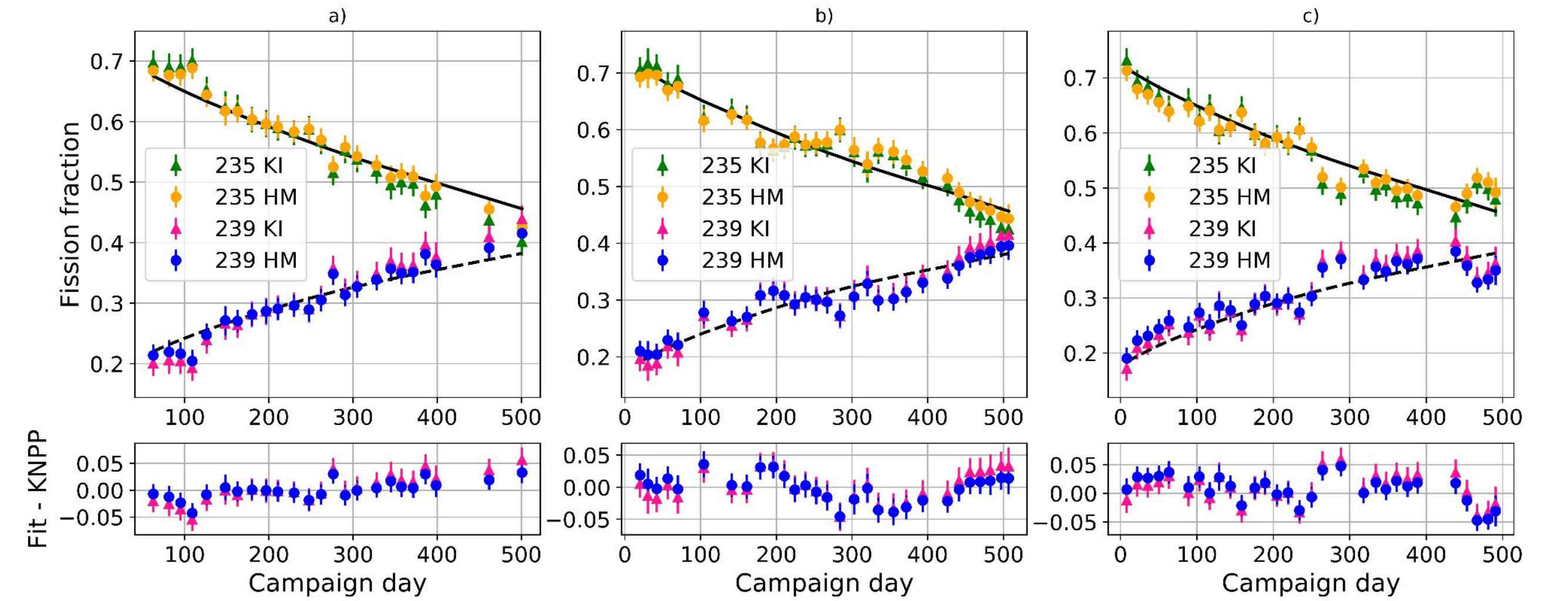
DANSS design [JINST 11 \(2016\) no.11, P11011](#)

- DANSS – Detector of reactor AntiNeutrino based on Solid-state Scintillator
- Location: Kalinin Nuclear Power Plant (KNPP), 3.1 GW commercial reactor $5 \cdot 10^{13} \text{ v cm}^{-2} \text{ s}^{-1}$, 50 m w.e. overburden
- 10.9 -12.9 m from the reactor core center, movement online
- Multilayer Cu + CHB + Pb + CHB passive shielding + muon veto
- 2500 scintillator strips with Gd containing coating for neutron capture
- Light collection with 3 WLS fibers
- Central fiber read out with individual SiPM
- Side fibers from 50 strips make a bunch of 100 on a PMT cathode = Module
- Dedicated WFD-based DAQ system
- 5000 v events/day. S/B>50



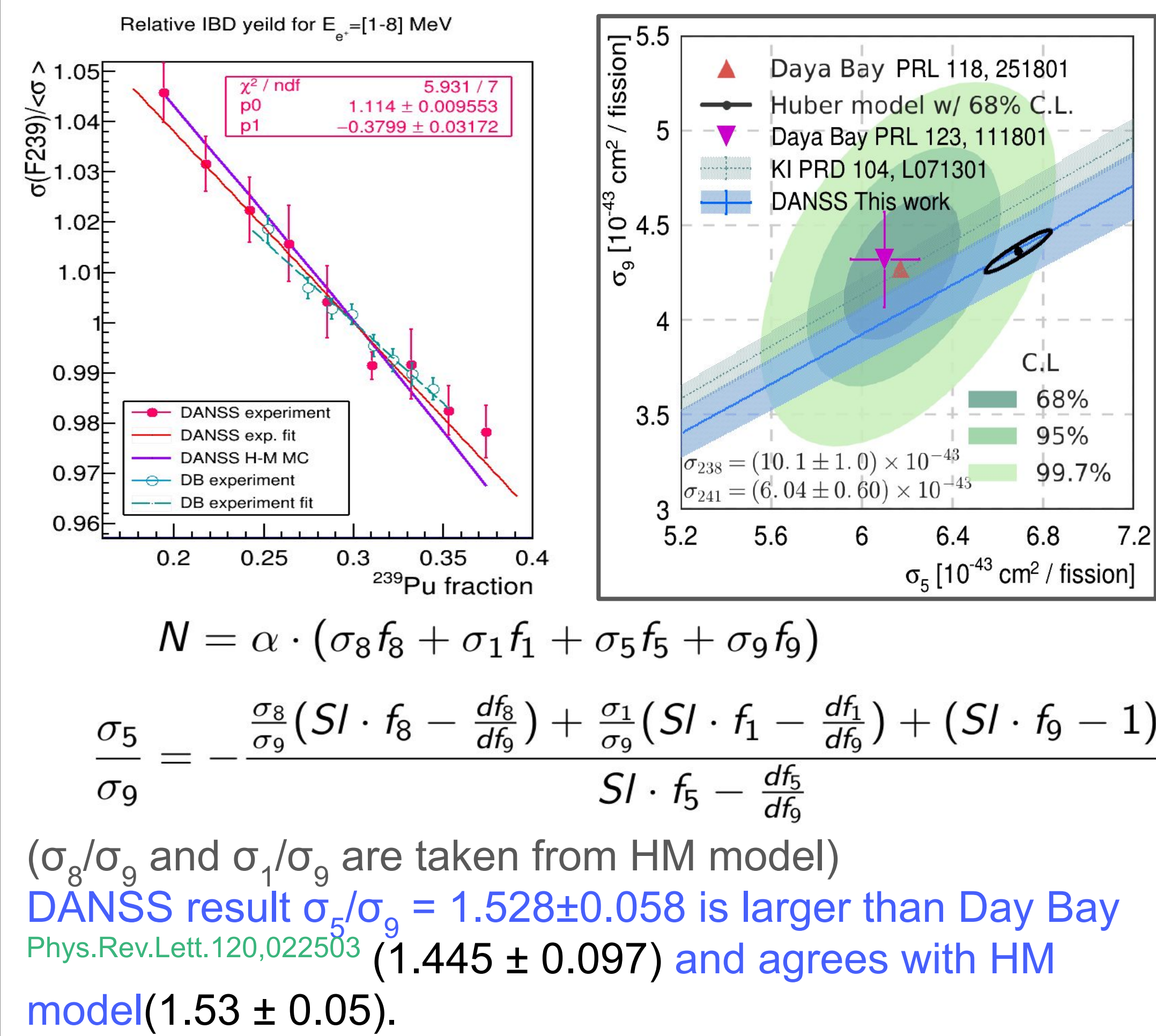
[Phys.Lett.B 866 \(2025\), 139575](#)

- ^{239}Pu fission fraction was measured using IBD spectra.
- Results are in excellent agreement (better than 3%) with calculations based on neutron flux simulation in the reactor

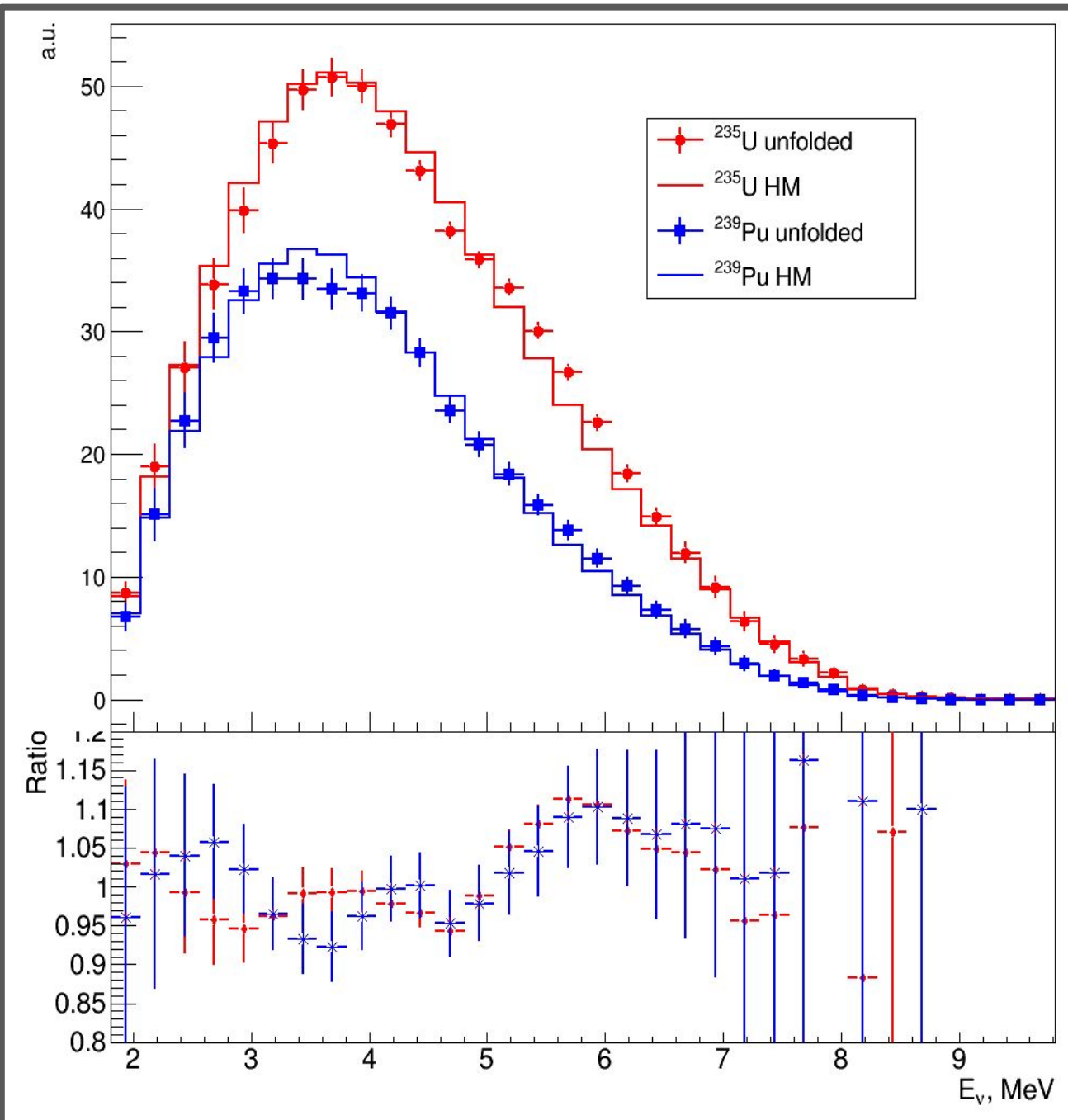


Measurements of σ_5/σ_9

[Arxiv: 2410.19182](#)

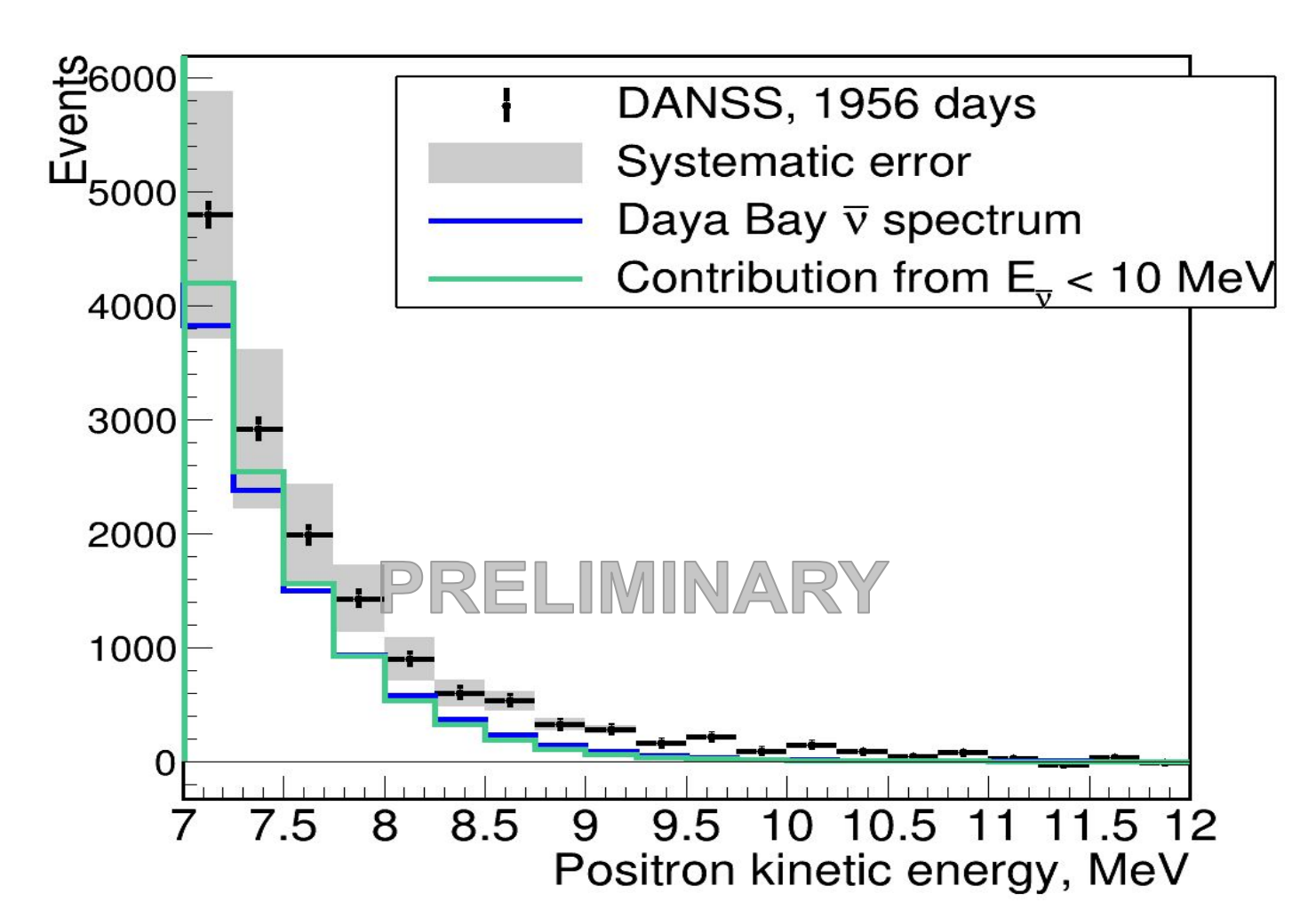


Neutrino spectra for ^{239}Pu and ^{235}U



- Positron spectra for ^{235}U and ^{239}Pu were reconstructed using IBD rate dependence on ^{239}Pu fission fraction (^{241}Pu and ^{238}U spectra were fixed to HM model)
- Neutrino spectra were reconstructed using SVD method
- 6 MeV bump is seen in both spectra

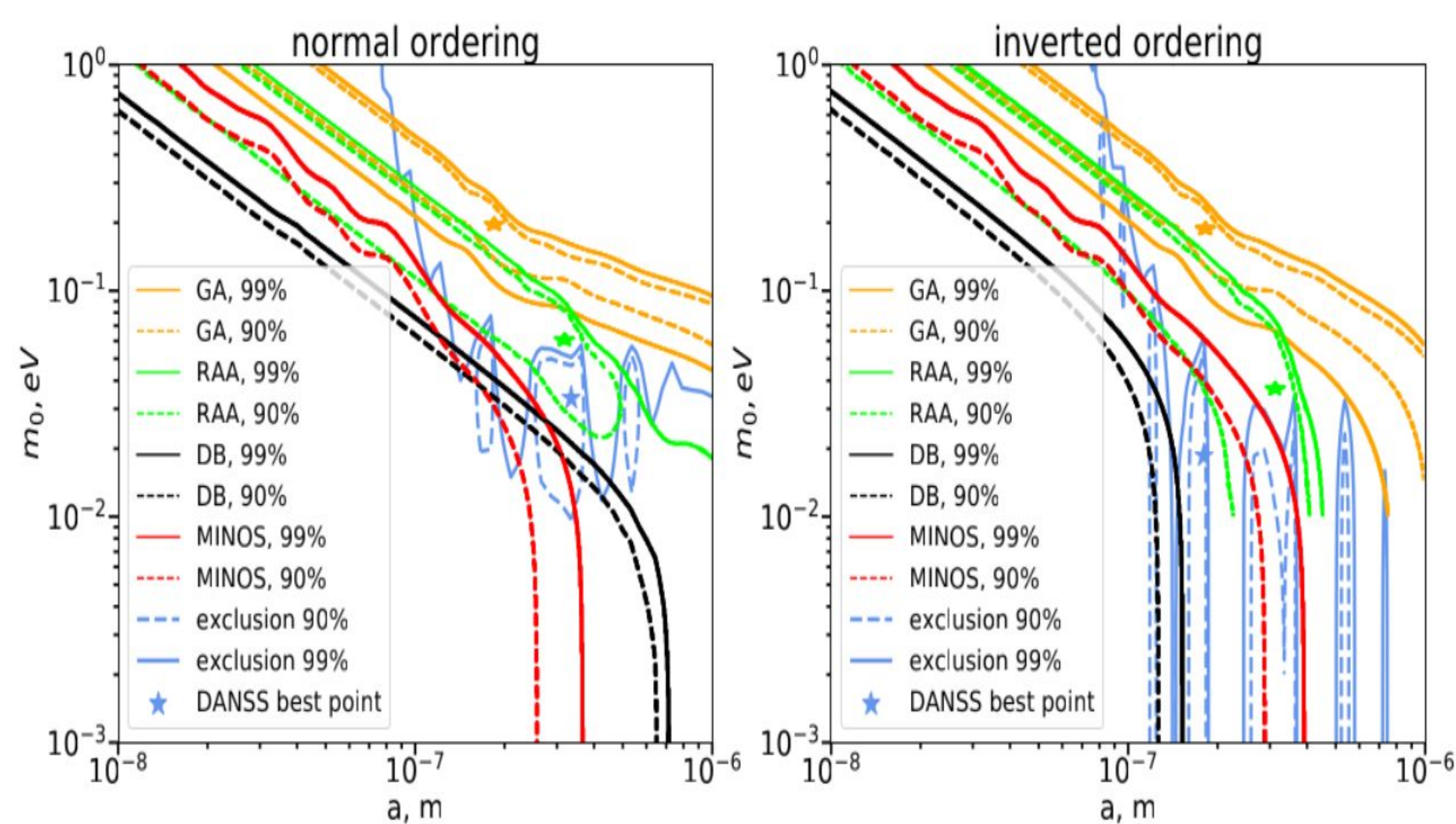
High energy neutrinos



- Background subtraction is based on 5 “reactor off” periods
- DANSS observes ν_e events with ν_e energy > 10 MeV: $1561 \pm 157^{\text{stat}} \pm 168^{\text{sys}}$ ev. (6.8σ)
- Fraction of high energy ν_e ($\sim 1.5 \times 10^{-4}$) is somewhat larger than at Daya Bay

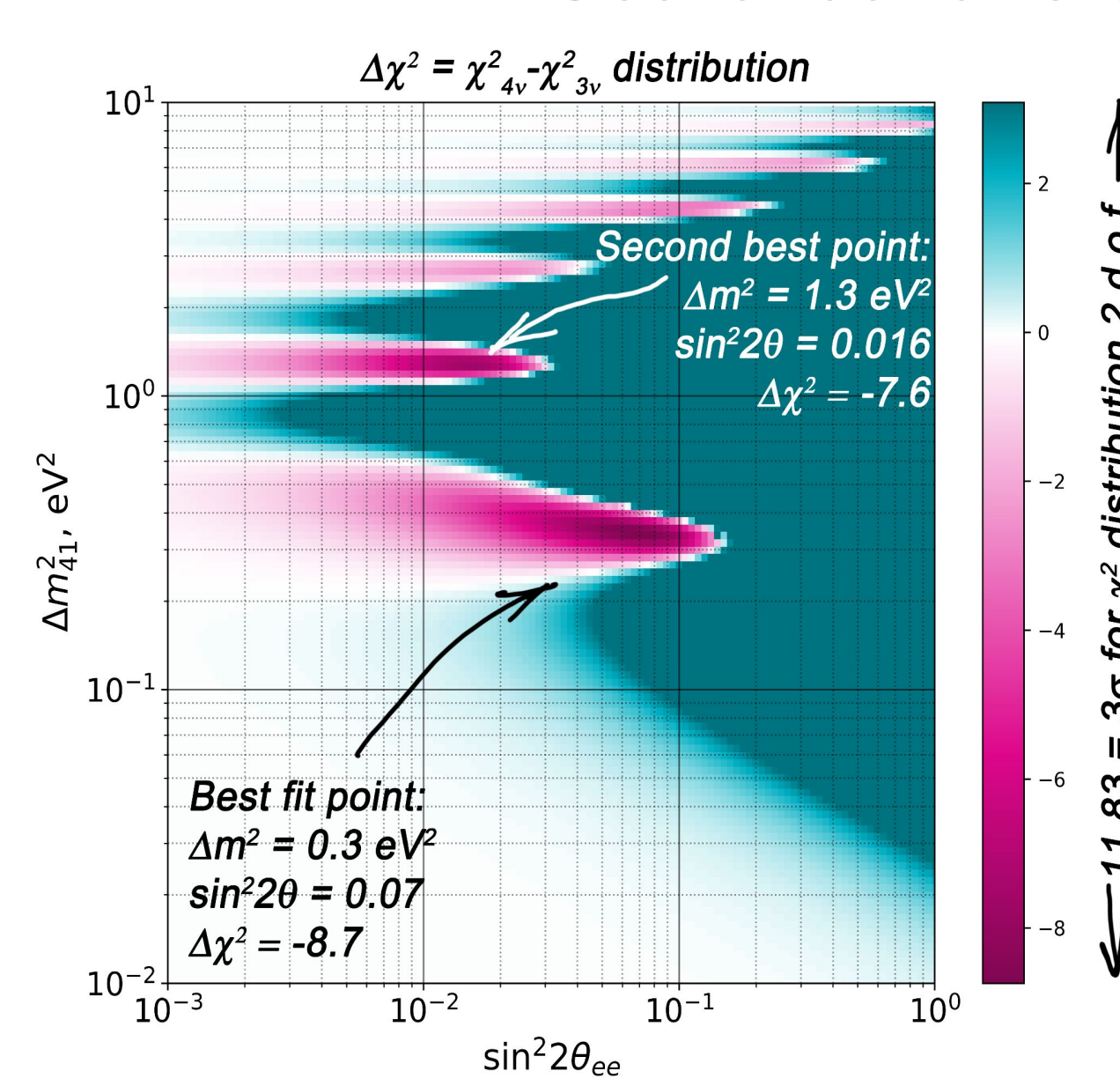
Searches for Large Extra Dimensions

[JETP Letters V.122 No.1 \(2025\)](#)



- DANSS best fit point significance is 2.0 (1.8) σ only for NO (IO)
- RAA best fit is excluded at 4.2 (4.2) σ C.L. for NO (IO).
- GA best fit is excluded by DANSS at > 5 σ CL.
- For NO DANSS exclusions are the most stringent for some a values and based only on spectra ratio information while Daya Bay exclusions are based on absolute counting rates as well.
- For IO DANSS exclusions are consistent with other experiments
- (6.3 mln, down-up only)

Searches for sterile neutrinos (6.8 mln. v during 2016-2024)



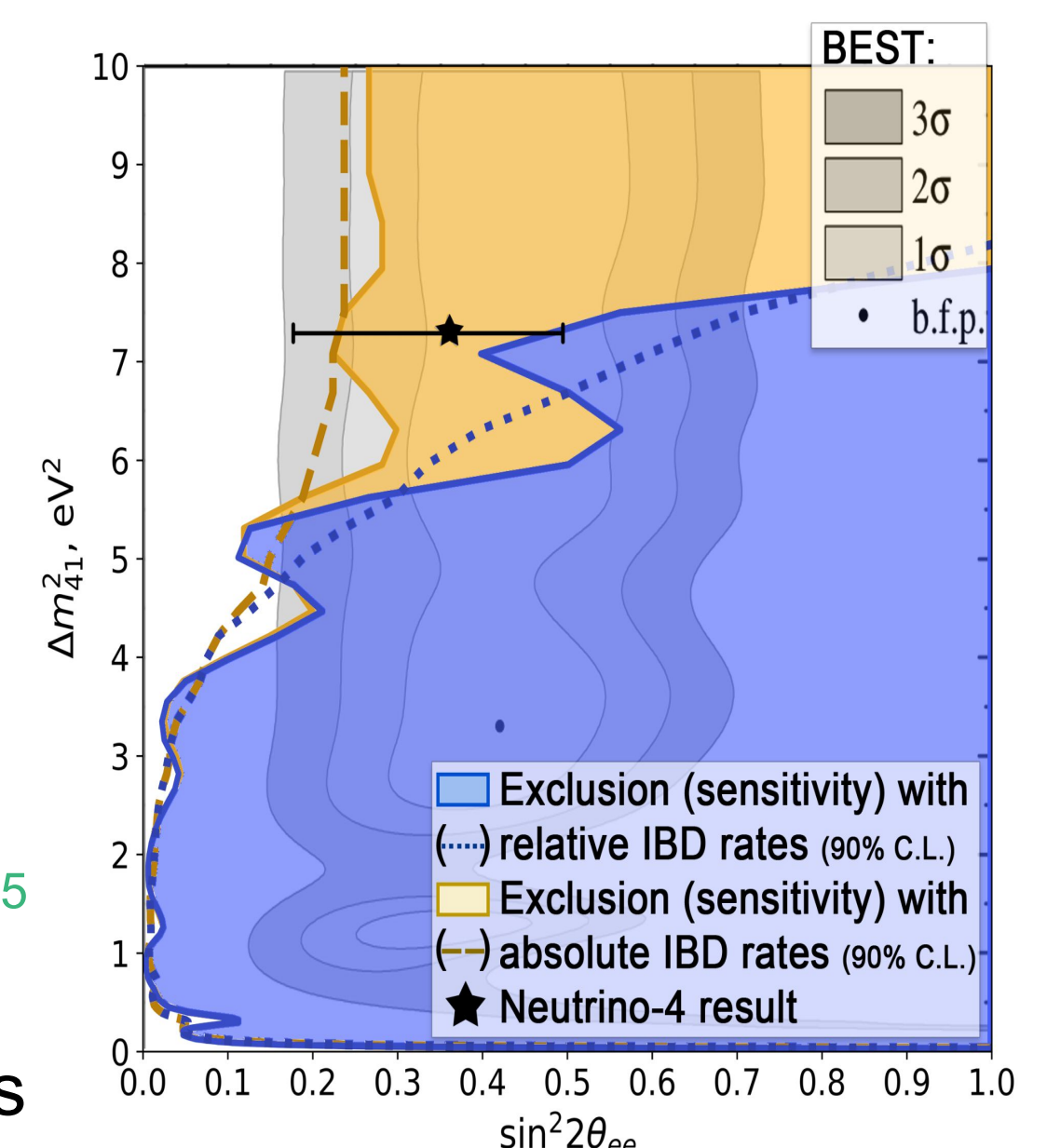
Systematic uncertainties (1 σ):

- Energy scale (2%) and shift (50 keV)
- Energy resolution (additional smearing 6%/√E ⊕ 2%)
- Correlated backgrounds (35%)
- Distance to the fuel burning profile center (5 cm)
- Relative efficiencies (0.4%)

Using current statistics we see **no statistically significant evidence of 4ν signal** (best point significance: $\sim 2.5\sigma$)

Exclusions are calculated using Gaussian CL_s method

- DANSS analysis without absolute counting rates **excludes a large and the most interesting fraction of sterile neutrino parameter space using only ratio of e⁺ spectra** at 3 distances.
- Oscillation analysis with absolute counting rates (HM model) **excludes practically all sterile parameter space preferred by BEST** [Phys.Rev.Lett.128,2325](#) and the best fit point of Neutrino-4 [Phys. Rev. D 104, 032003](#) experiment. A conservative uncertainty of 7% was assumed for absolute counting rates
- In KI model exclusion is even more strict.
- Exclusions based on absolute IBD rates for large Δm^2 support previous results (Daya Bay, Bugey-3, ..)



Conclusions

- The ratio of $\sigma_5/\sigma_9 = 1.528 \pm 0.058$ is the most precise and consistent with the HM model. It is slightly larger than the KI and Daya Bay results.
- Obtained accuracy in ^{235}U fission fraction reconstruction using neutrino spectra is better than 3%.
- Reactor power was measured remotely with neutrinos during 7 years with 1% accuracy in a week.
- Observed to predicted ratio of absolute ν_e counting rates is 0.98 ± 0.04 for HM model, and is 1.02 ± 0.04 for KI model.
- DANSS excludes a large and the most interesting fraction of sterile neutrino parameter space using only ratio of e⁺ spectra and practically all parameter space preferred by BEST and the best point of Neutrino-4 using absolute ν_e rates.
- DANSS excludes a large fraction of the LED parameter space (size of extra dimension and lightest m_ν) preferred for explanation of RAA and GA.
- DANSS observes about $\sim 1.5 \times 10^{-4}$ neutrino events with ν_e energy > 10 MeV (6.8σ).
- 6 MeV bump is seen in ^{235}U and ^{239}Pu neutrino spectra.