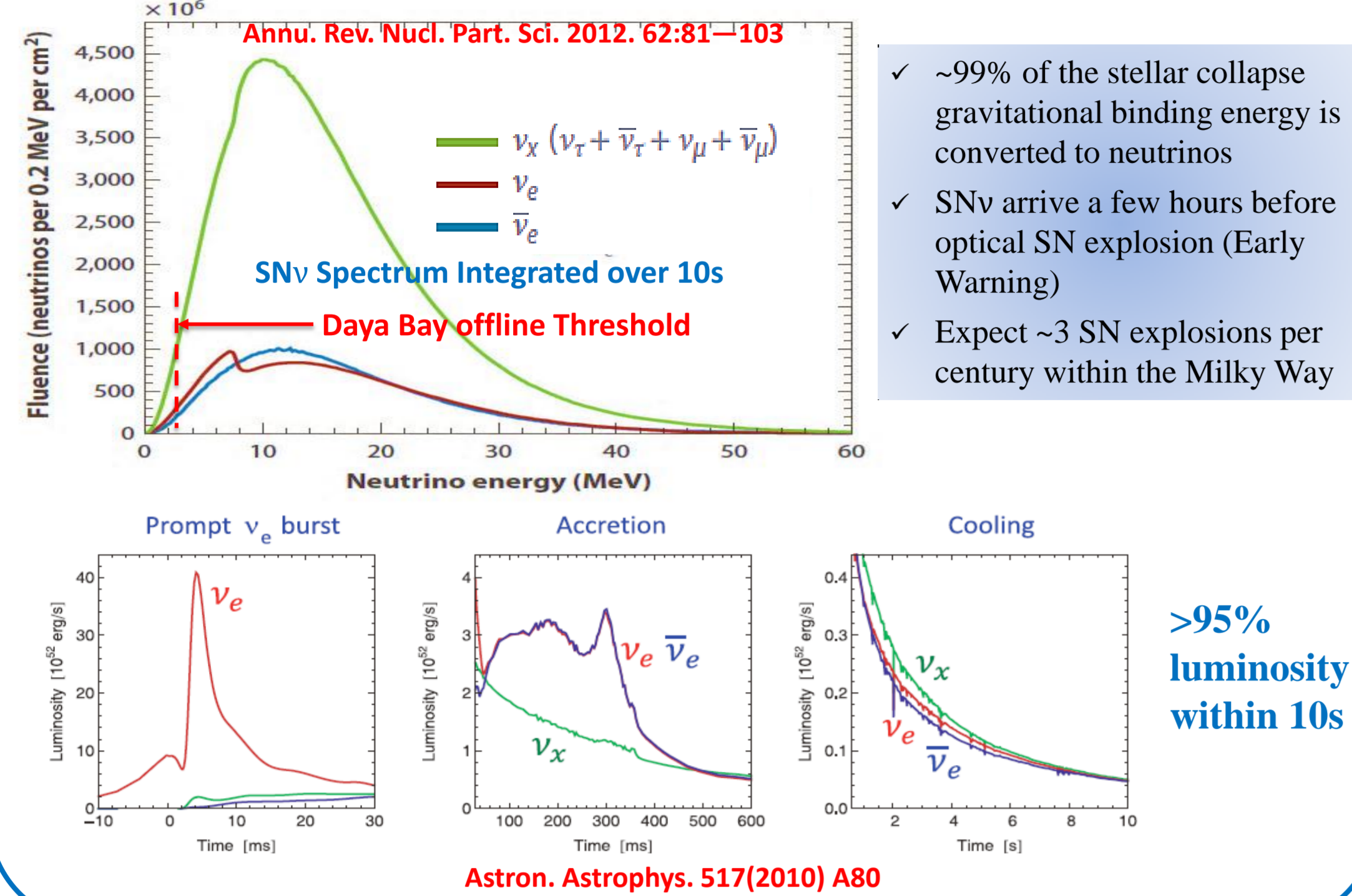


Supernova Early Warning in the Daya Bay Reactor Neutrino Experiment

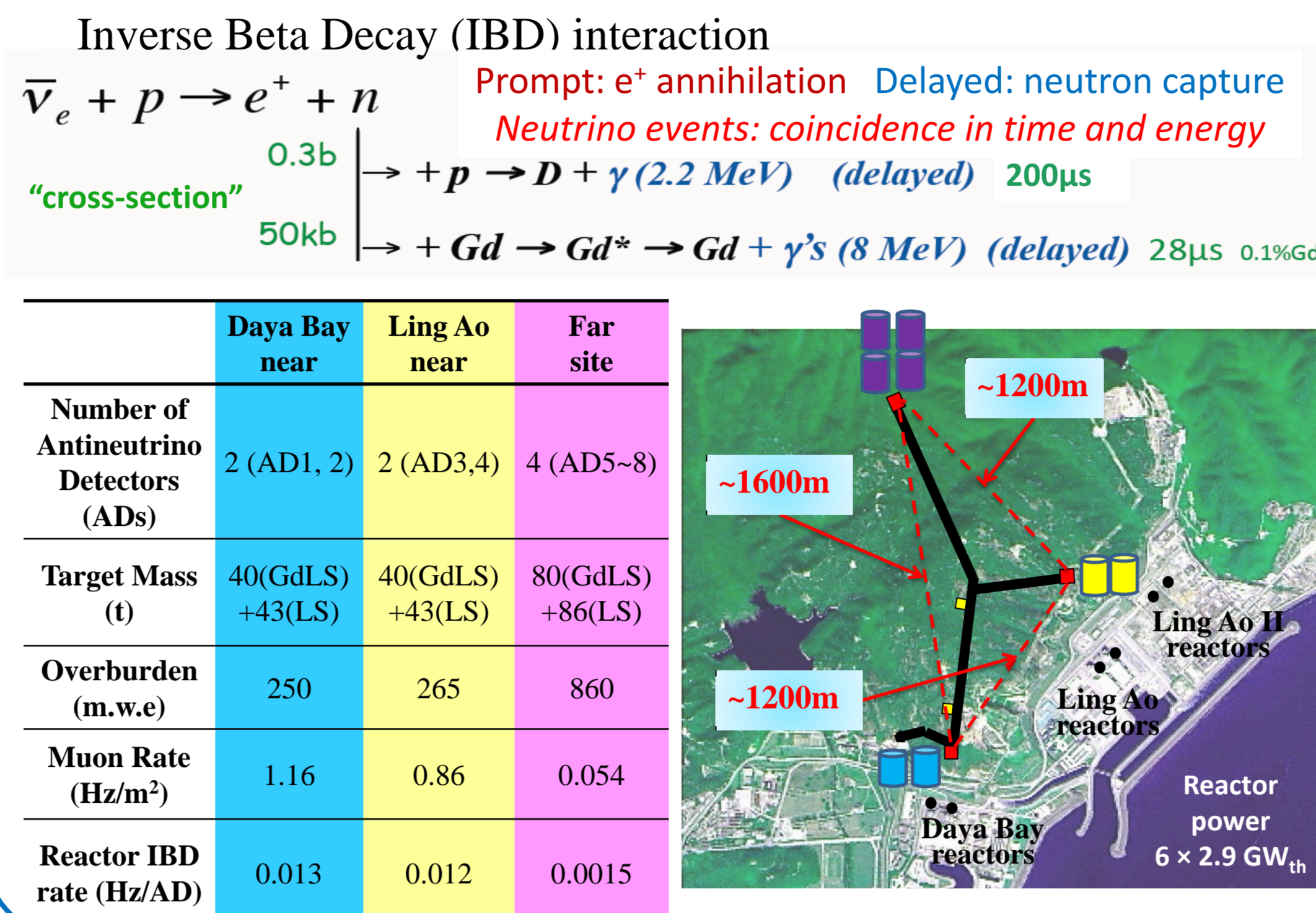
Hanyu Wei for the Daya Bay collaboration

Department of Engineering Physics, Tsinghua University, Beijing, China

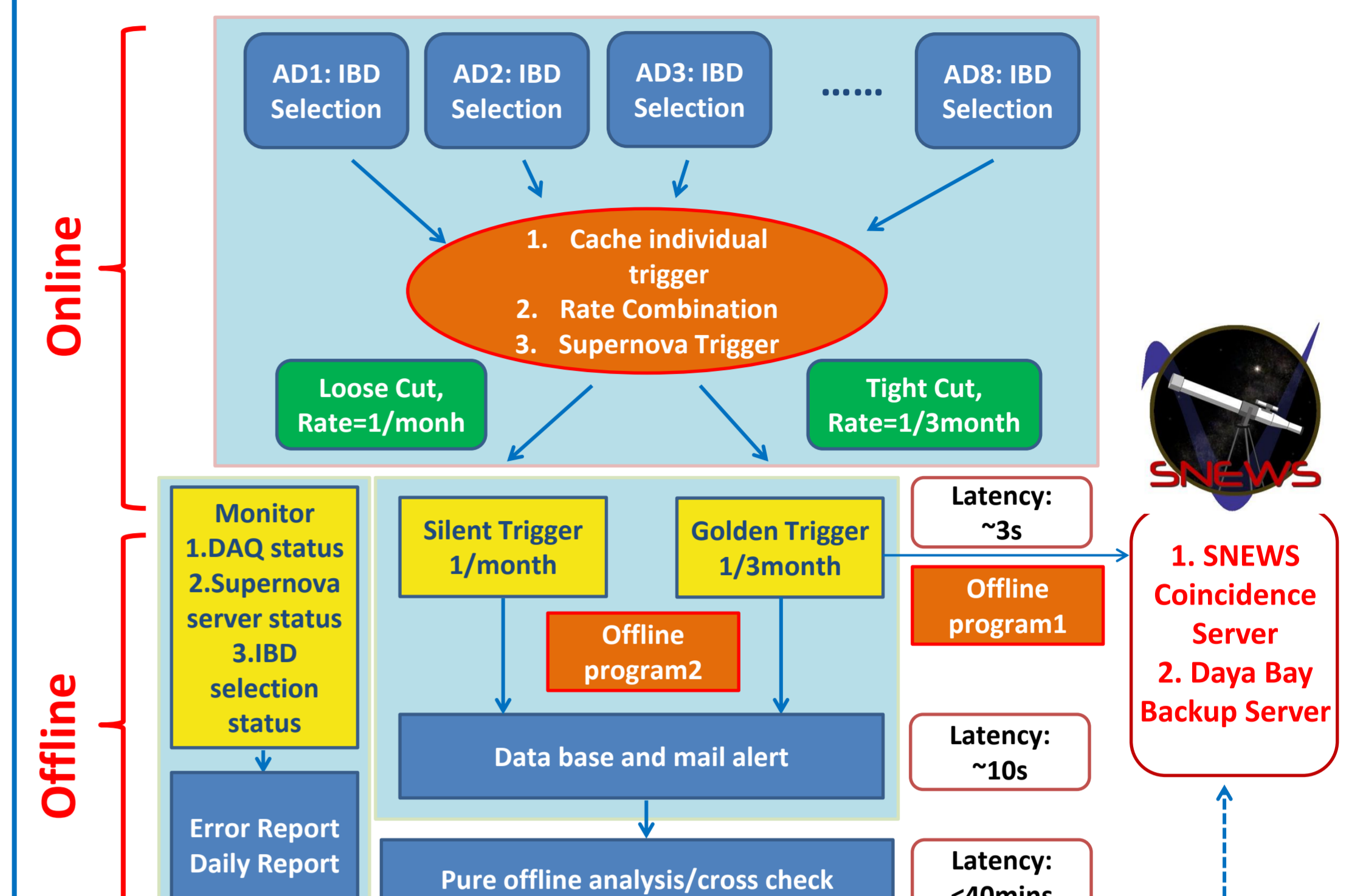
Core-collapse Supernova Burst Neutrino



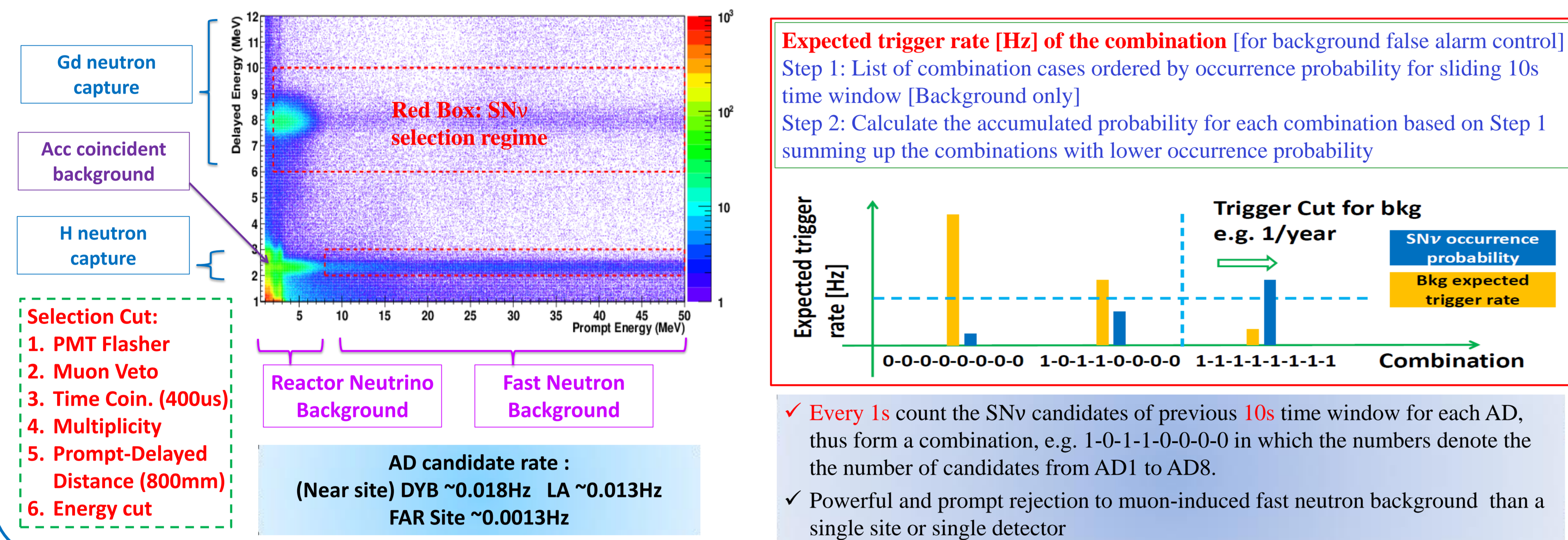
Detection of Electron-antineutrino



Supernova Online Trigger System Diagram



SNv Selection and Trigger Cut Setting



Daya Bay is online looking for increases in multi-AD signals in a 10s-time-window with (2/8) MeV online energy threshold.

A datagram due to a packet types including supernova online trigger date time, duration, significance level, number of signals etc. is transferred to SNEWS server with ~3 seconds time latency.

Highlight

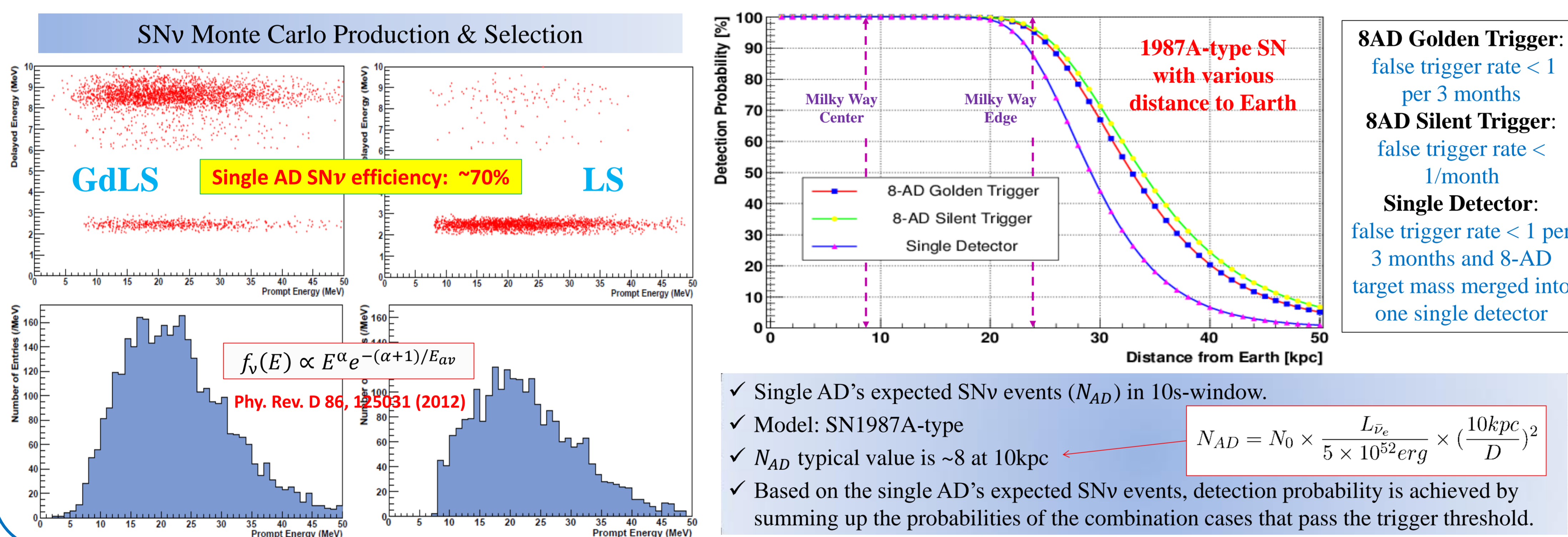
- Get access to all raw data and make a simple reconstruction.
- Trigger decision is issued from a prompt analysis of the candidate distribution in all the ADs and the experimental halls.
- In order to exclude any unexpected triggers in one detector or experimental hall, an additional uniformity cut based on a chi-square assuming a uniform multi-AD candidate distribution is applied. This results in a <1% detection probability loss for supernova explosions.
- A method for background combination rate prediction has been studied so as to set the trigger cut.

Aug. 8, 2013: The supernova online trigger system was official installed.

Dec. 27, 2013: Communicate with SNEWS for debugging and testing.

Feb. 21, 2014: Real test with normal trigger threshold.

Supernova Early Warning Online Detection Probability



Summary for Supernova Online Trigger

| Function | Performance | Specific Feature |
|--|--|---|
| IBD selection, Combination, Control the false alarm rate | Entire design works smooth and effective. | Low Energy Threshold: Online 2(8)MeV |
| Access Database, Email Alert, DAQ status cross check, Auto error report & daily report | Workload to DAQ: Minor CPU consumption; Be able to handle 1kHz candidates of each AD | Good Energy Resolution 0.3MeV@10MeV |
| Sent supernova trigger datagrams to SNEWS & DYB backup server | Time Latency from trigger to alarm <10s | Time Accuracy (GPS) |
| | Background false alarm control performs well. | Online Detection Probability > 95% within Milky Way |
| | | More powerful than a single site or detector |

Ready for official participation in SNEWS

Test communication with SNEWS

