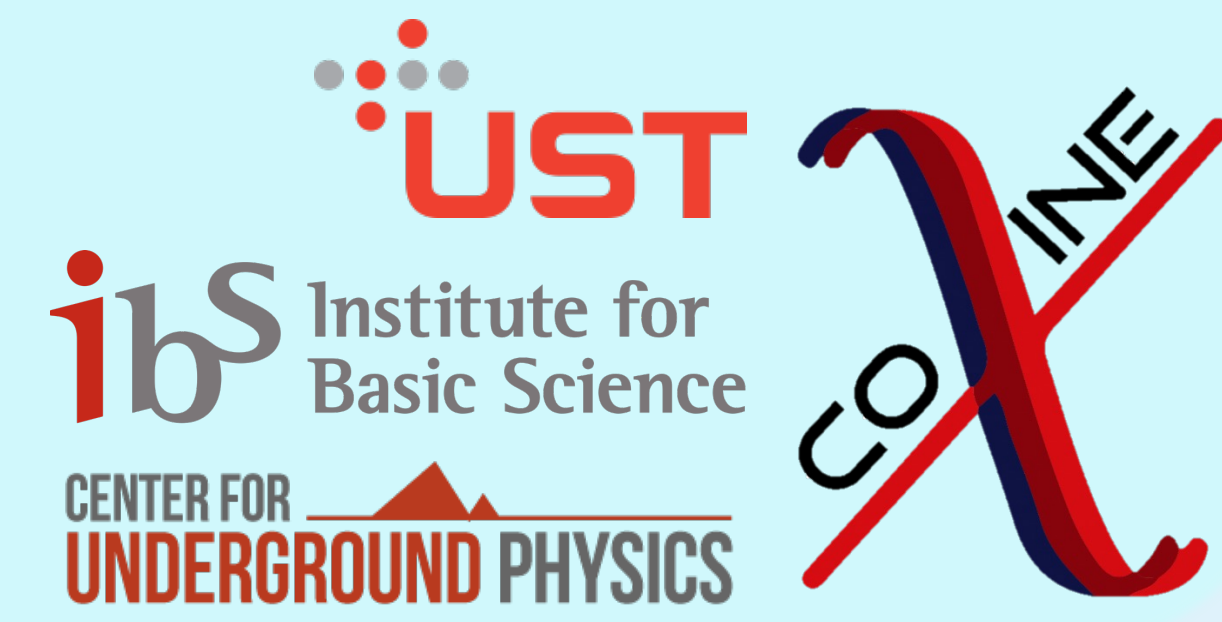


Low-Threshold Analysis for Low-Mass WIMP Search with COSINE-100

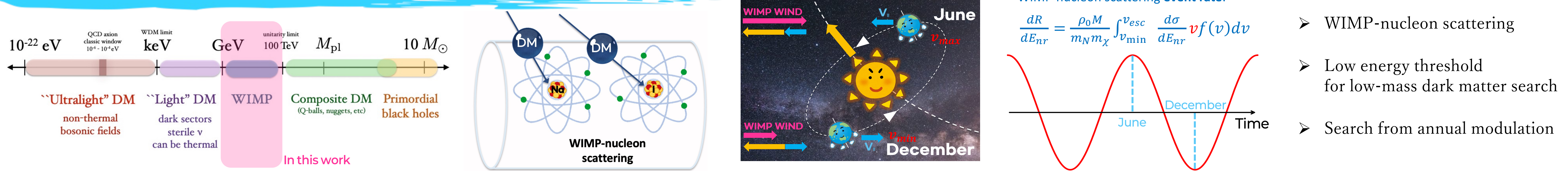


Won Kyung Kim^{1,2}
On behalf of the COSINE-100 Collaboration

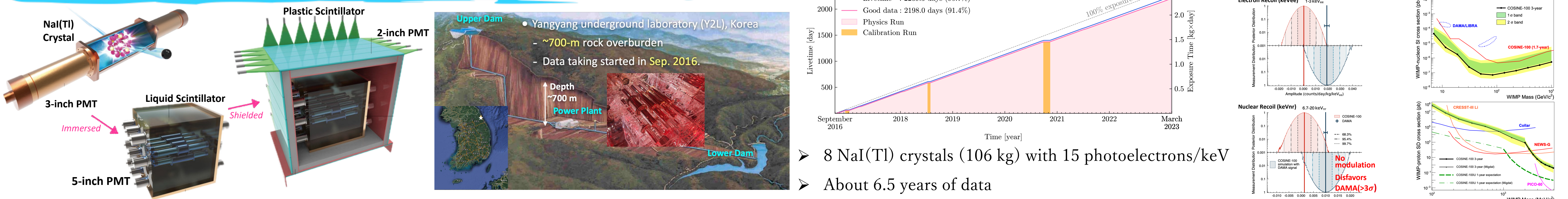
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Direct Search for Dark Matter



COSINE-100 Experiment

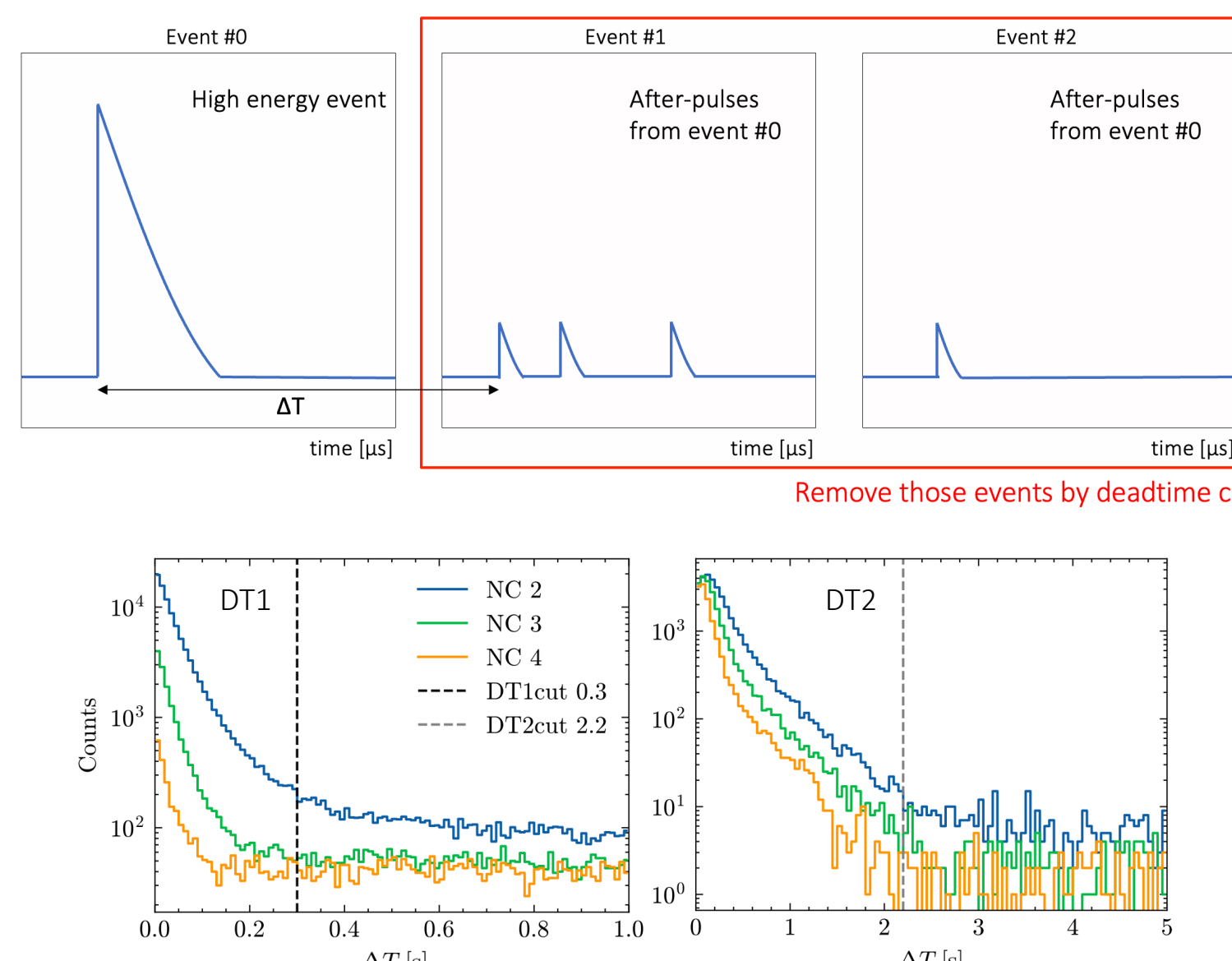


Event Selection

- Definition of cluster: Isolated pulse above threshold
- Analysis data: 2, 3, 4 number of cluster (NC)
- 1 NC \approx 1 Photoelectron \approx 0.067 keV

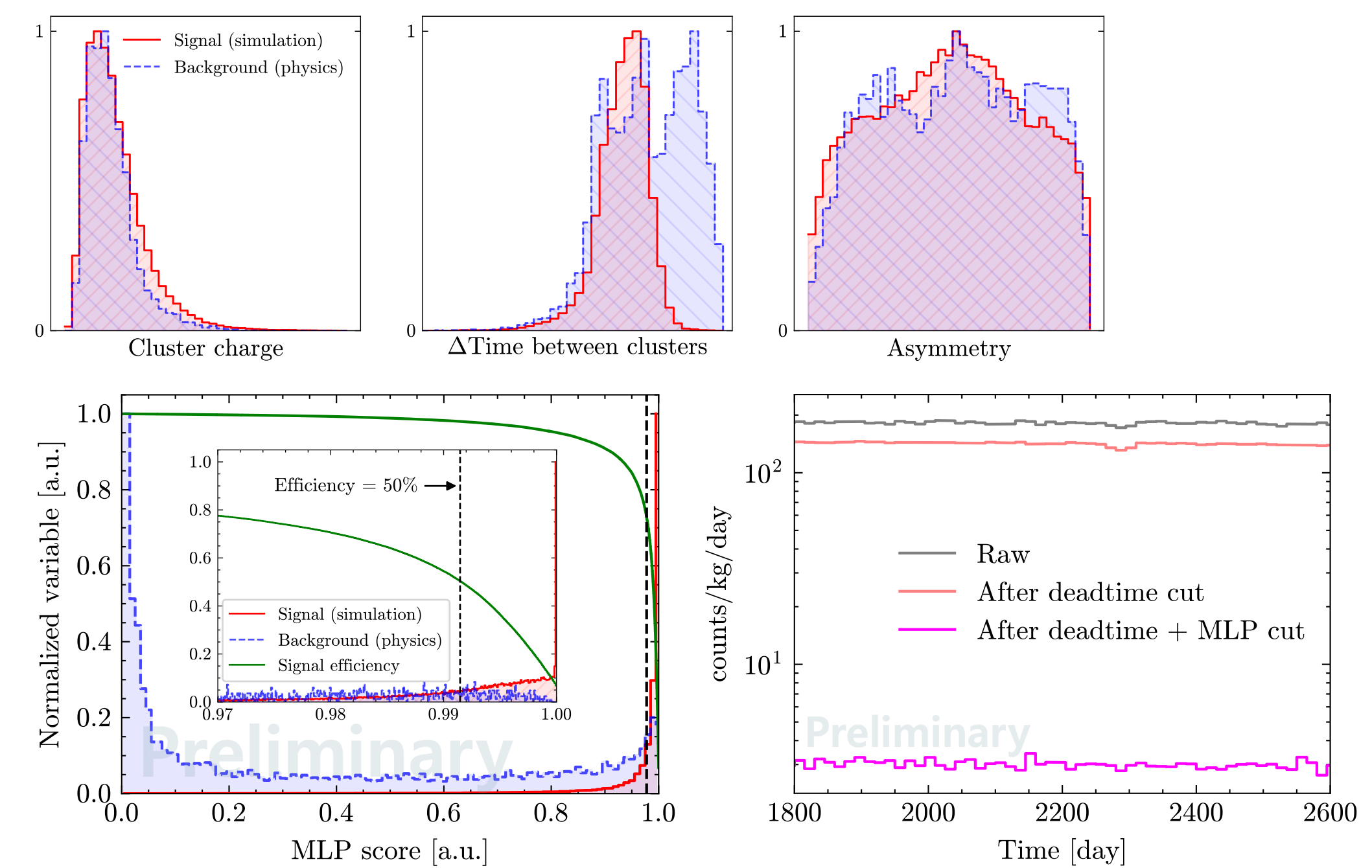
Deadtime cut

- Two time criteria for saturation
- 35.5% noise reduction w/ 97% efficiency

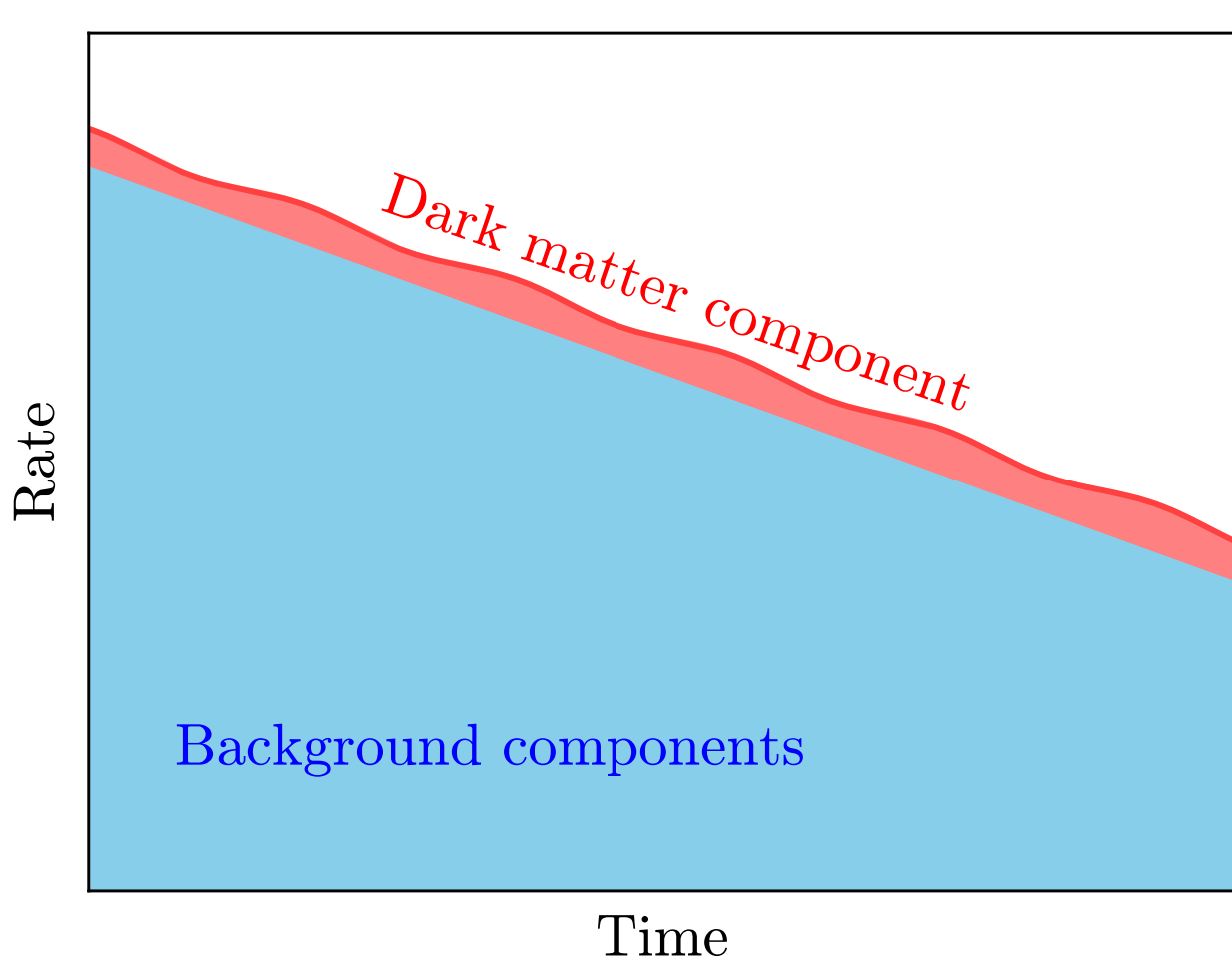


MLP (Multi Layer Perceptron) training

- Signal : Simulated data Background : COSINE-100 data
- 98% noise reduction w/ 50% efficiency



Extraction of Modulation Signal & Detector Sensitivity

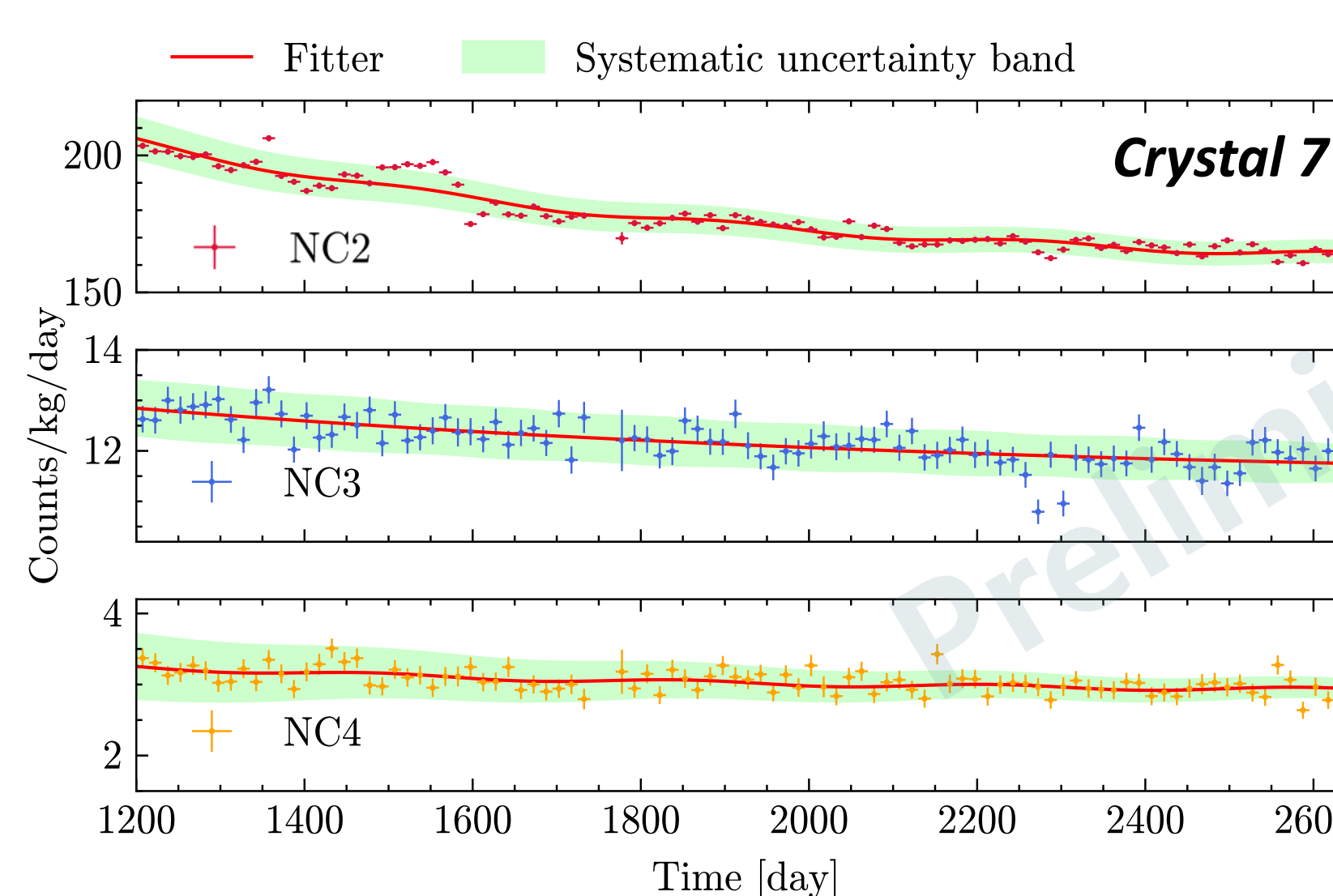


- Annual modulation fit with,

$$f(t) = A \cos\left(\frac{2\pi}{T}(t - \phi)\right) + e^{p_0 + p_1 t} + C$$

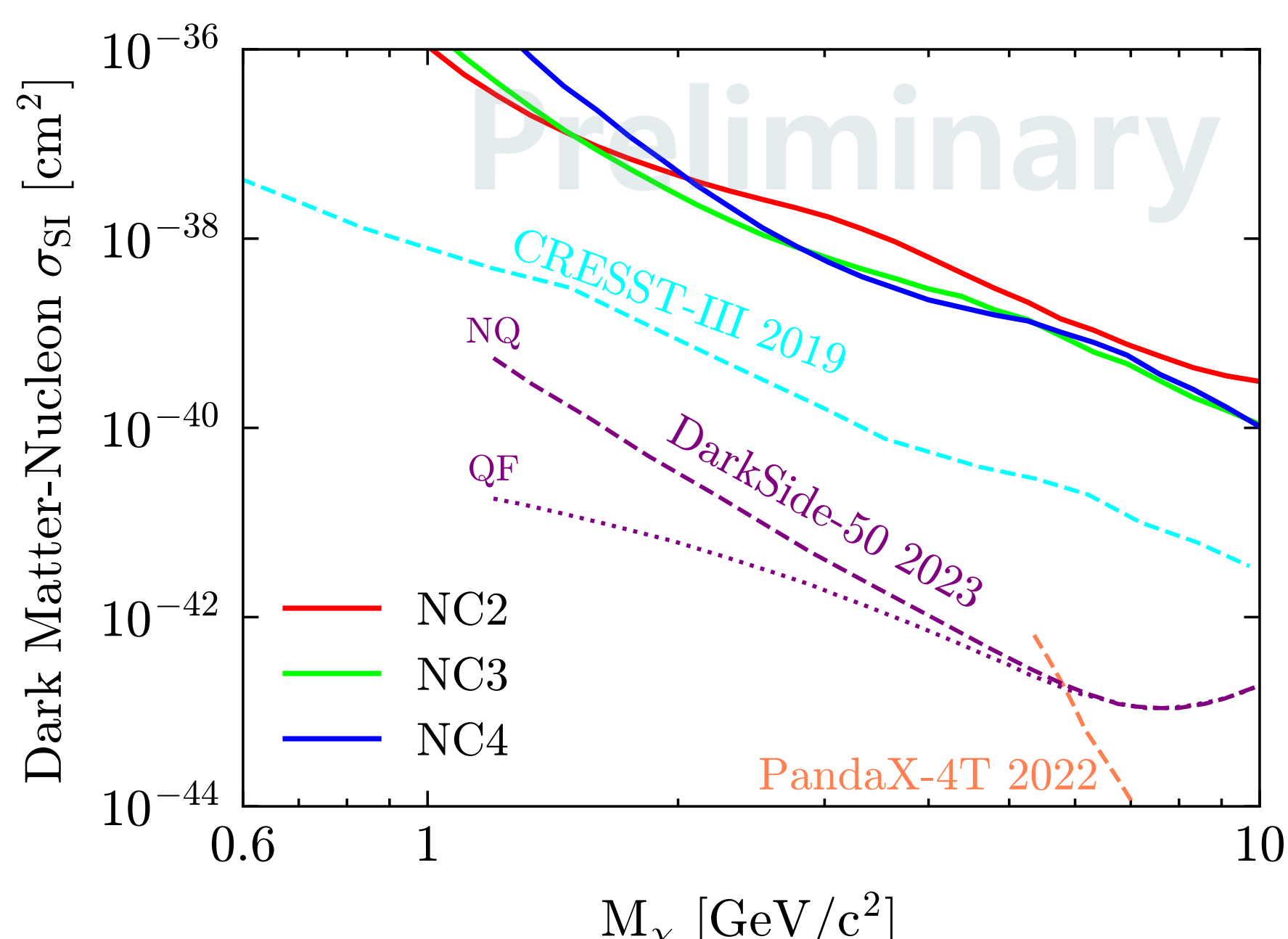
- A : modulation amplitude
- ϕ : phase
- T : 1 year = 365.25 days
- p_0, p_1 : background (exponential component)
- C : constant baseline

- Single-Hit events; triggered on a single crystal

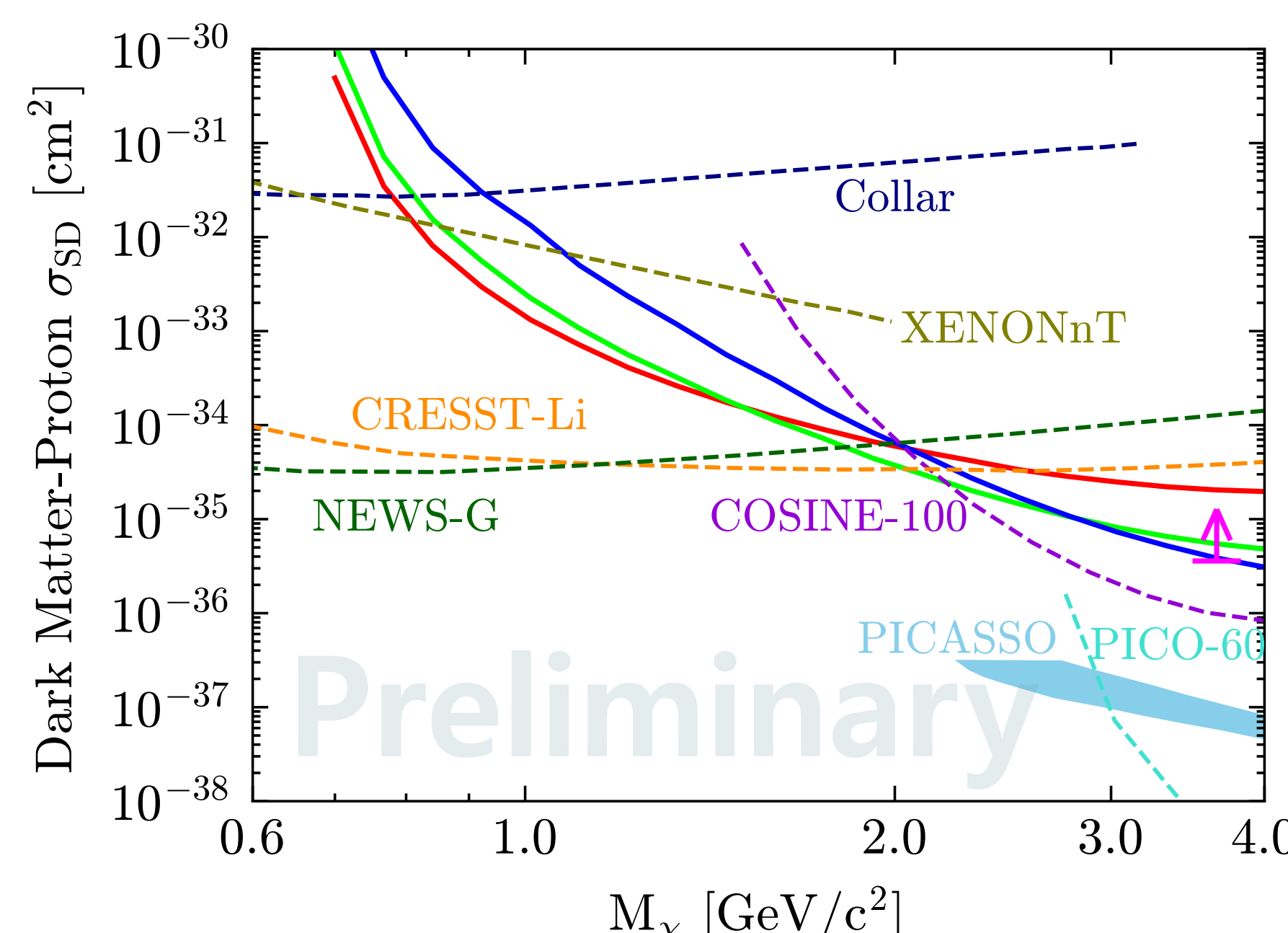


NC	χ^2 / NDF	A	ϕ	C
2	0.95	$1.18 \times 10^4 \pm 51.55$	$7.87 \times 10^4 \pm 25.53$	158.01 ± 1.06
3	0.93	$6.89 \times 10^4 \pm 16.04$	$2.18 \times 10^5 \pm 384.79$	11.36 ± 0.20
4	1.02	$3.07 \times 10^5 \pm 2.00$	$2.52 \times 10^6 \pm 40.20$	2.86 ± 0.07

Spin-independent



Spin-dependent



- Sensitivity estimation with pseudo data which based on real data
- 10,000 pseudo data generation & fitting to get an average 90% confidence limit
- We should conduct simultaneous fit for every crystal and NC
- Systematic is not yet considered (going to be considered)
- $\sigma_{SD} \leq 3.57 \text{ pb}$ (90% C.L.) @ $M_\chi = 3.65 \text{ GeV}$
- Our analysis shows the potential to explore regions of the low-mass WIMP parameter space

Reference

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