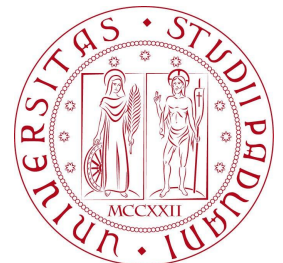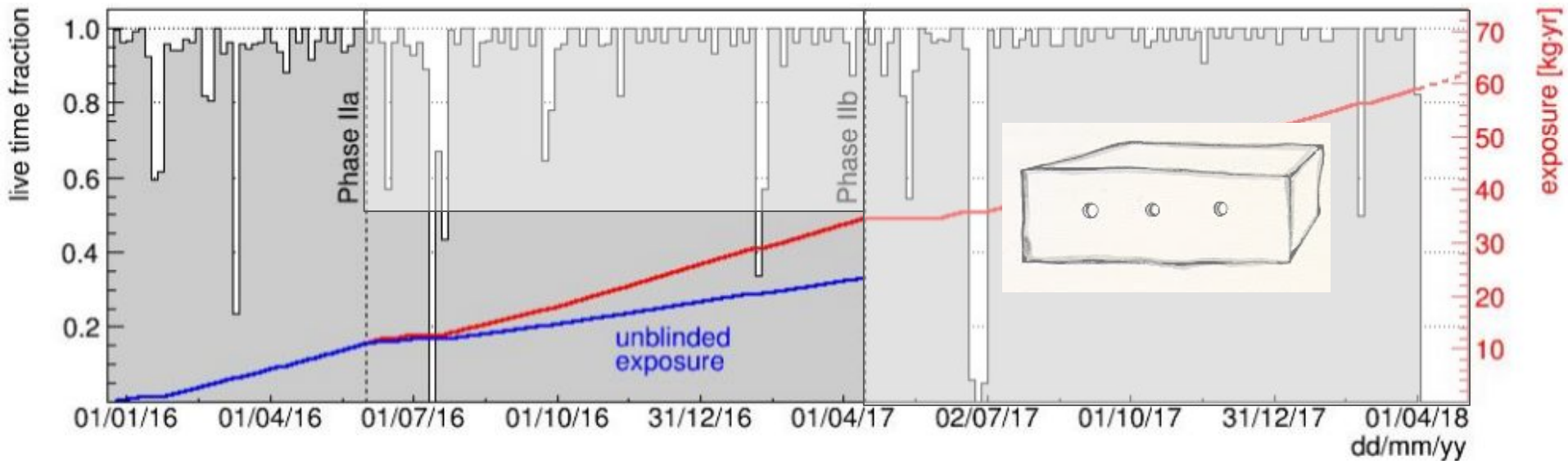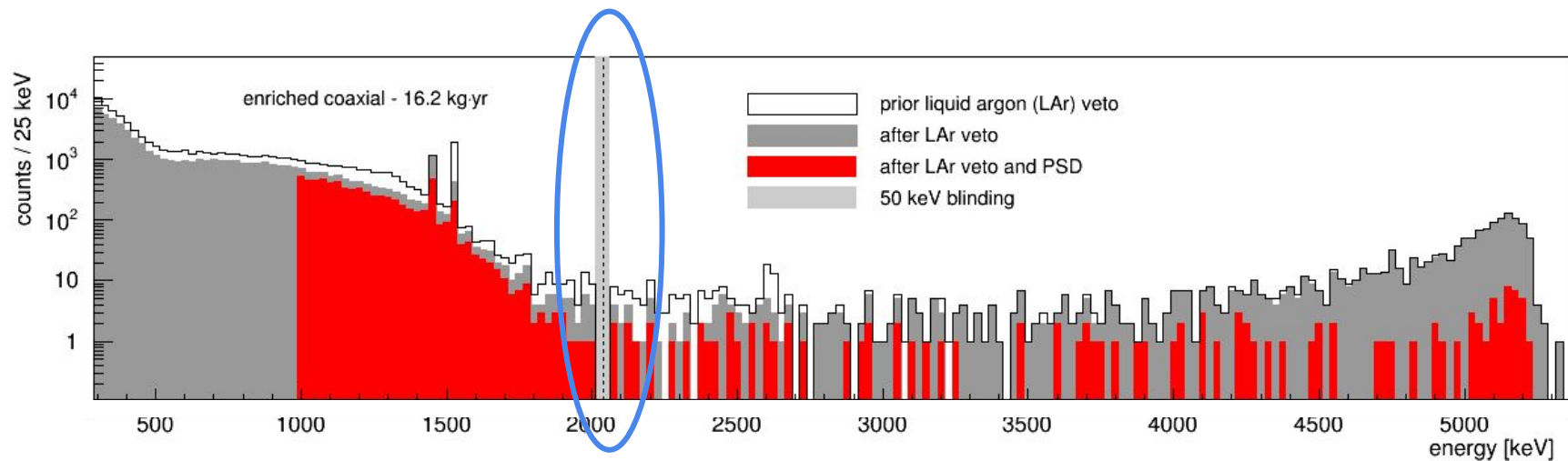# GERDA new results for Nu18

K.v.Sturm for the GERDA Collaboration
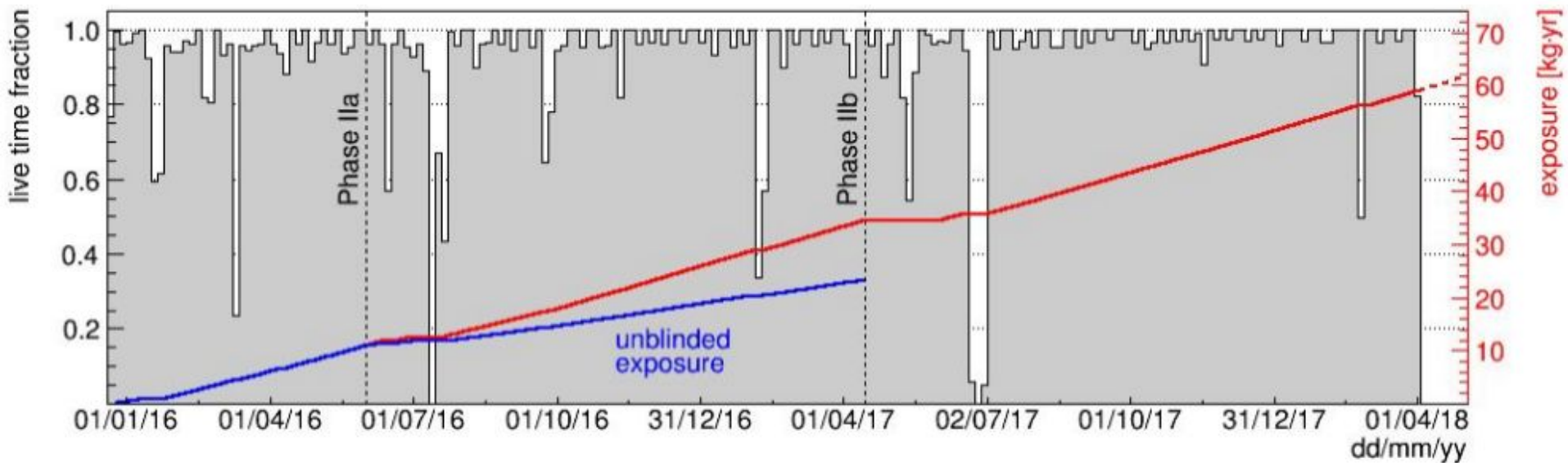
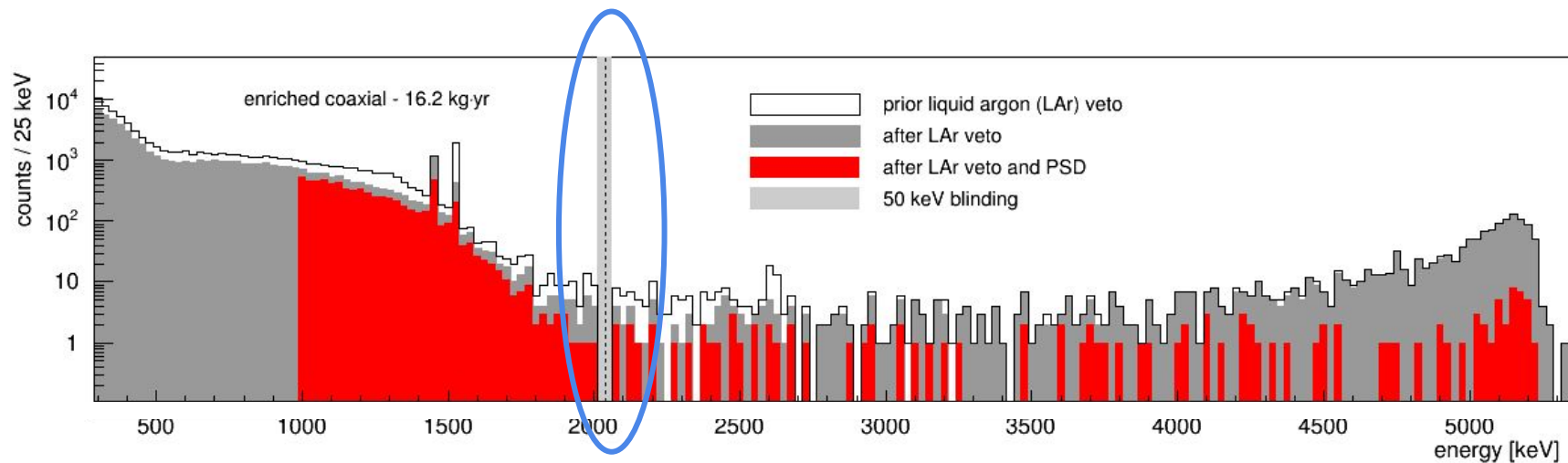exposure build up - Phase II ~60 kg yr

blind: Qbb +- 25 keV   ROI: Qbb +- 5 keV

exposure build up - Phase II ~60 kg yr
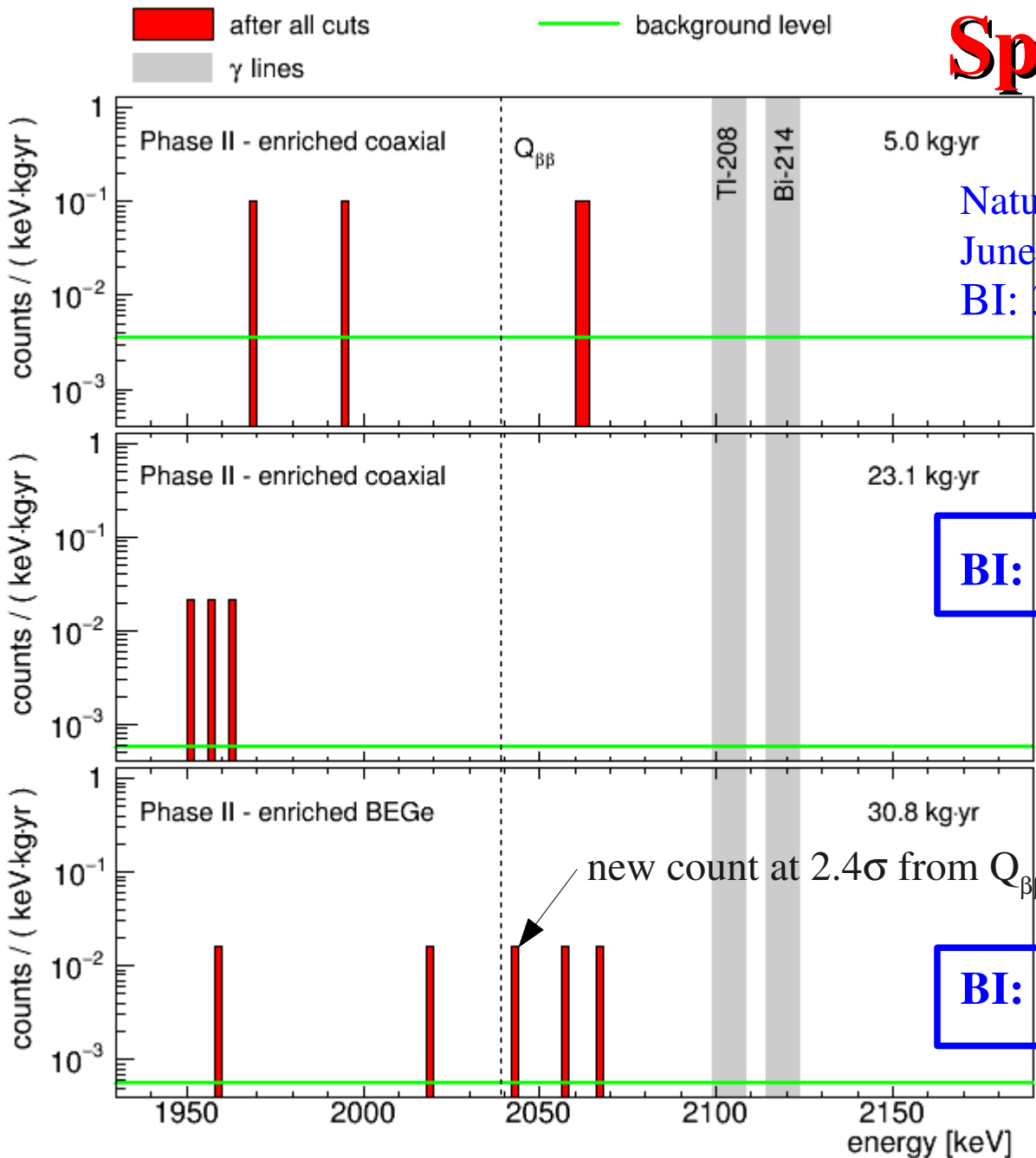

blind: Qbb +- 25 keV   ROI: Qbb +- 5 keV

Legend:
- **after all cuts** (red)
- **γ lines** (gray)
- **background level** (green)

Top panel: Phase II - enriched coaxial — 5.0 kg·yr, with markers for $Q_{\beta\beta}$, Tl-208, Bi-214

Middle panel: Phase II - enriched coaxial — 23.1 kg·yr

Bottom panel: Phase II - enriched BEGe — 30.8 kg·yr

new count at 2.4σ from $Q_{\beta\beta}$

energy [keV]

Nature release: data from Dec. 2015 to June 2016
BI: $3.5^{+2.1}_{-1.5} \cdot 10^{-3}$ cts/(keV·kg·yr)

BI: $0.6^{+0.4}_{-0.3} \cdot 10^{-3}$ cts/(keV·kg·yr)

after the unblinding the amplitude of the energy window for the BI calculation changes from 190 keV to 230 keV

BI: $0.6^{+0.4}_{-0.3} \cdot 10^{-3}$ cts/(keV·kg·yr)

Statistical Analysis

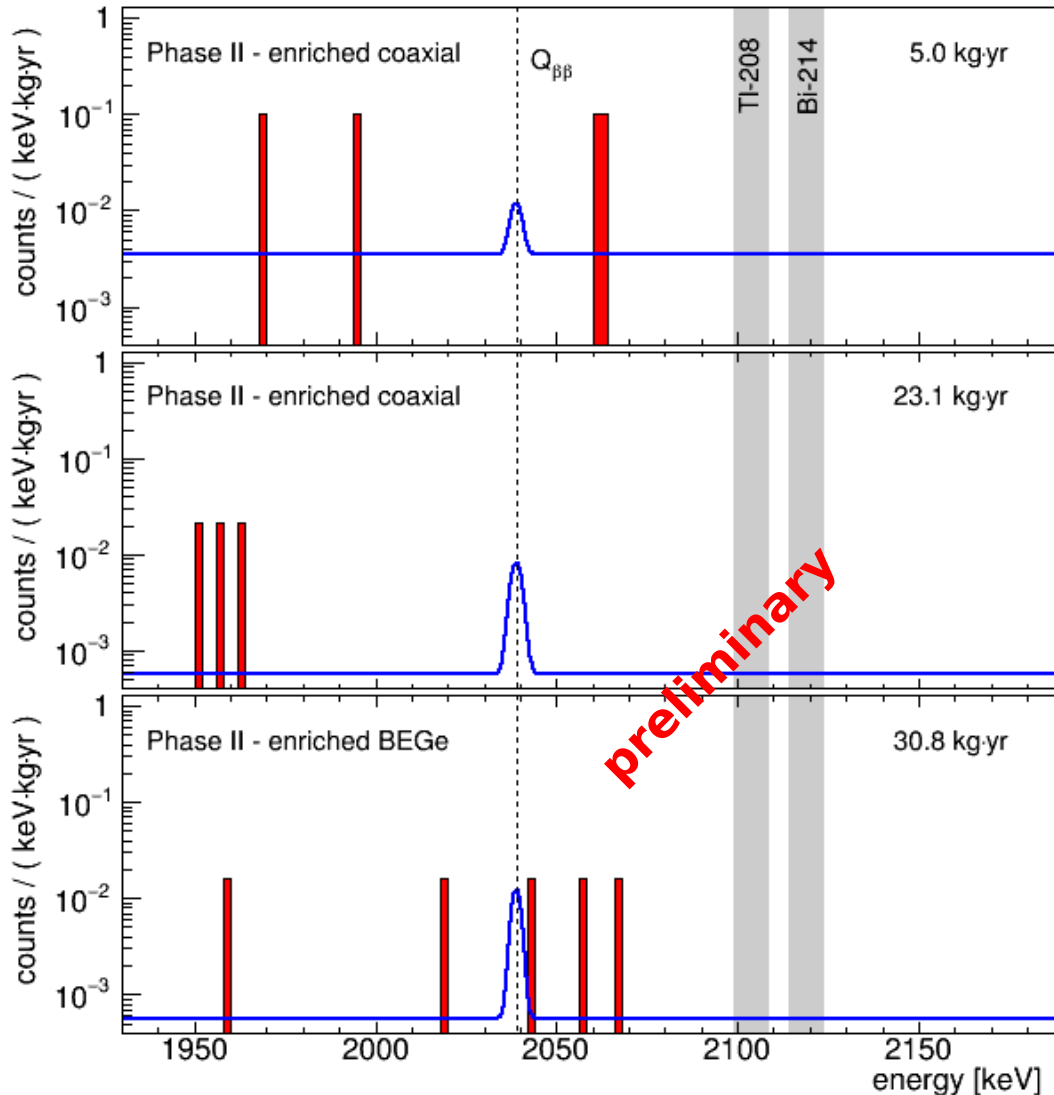| dataset	exposure [kg·yr]	FWHM [keV]	ϵ	BI [10^{-3}cts/(kevkgyr)]
PI golden	17.9	4.3 ± 0.1	0.57 ± 0.03	11±2
PI silver	1.3	4.3 ± 0.1	0.57± 0.03	30±10
PI BEGe	2.4	2.7 ± 0.2	0.66 ± 0.02	5^{+4}_{-3}
PI extra	1.9	4.2 ± 0.2	0.58 ± 0.04	5^{+4}_{-3}
PII coaxial-1	5.0	3.6 ± 0.1	0.52 ± 0.04	$3.5^{+2.1}_{-1.5}$
PII coaxial-2	**23.1**	**3.6 ± 0.1**	**0.48 ± 0.04**	$\mathbf{0.6^{+0.4}_{-0.3}}$
PII BEGe	**30.8**	**3.0 ± 0.1**	**0.60 ± 0.02**	$\mathbf{0.6^{+0.4}_{-0.3}}$

Total exp.   82.4 kg

➢ **Combined** unbinned **maximum likelihood** fit (flat background + gaussian signal) of the 7 spectra:
  ◆ **Frequentist:** test statistics and method described in Nature 544, 47 (2017)
  ◆ **Bayesian:** flat prior on $1/T^{0\nu}_{1/2}$ between 0 and 10^{-24} yr^{-1}
  ◆ Systematic uncertainties folded as pull terms or by Monte Carlo

Statistical Analysis

R. Brugnera   GERDA

➢ **Frequentist (preliminary results):**
Best fit $N^{0\nu} = 0$
$T^{0\nu}_{1/2} > 0.9 \cdot 10^{26}$ **yr @ 90% C.L.**
Median Sensitivity (NO Signal)
$T^{0\nu}_{1/2} > 1.1 \cdot 10^{26}$ **yr @ 90% C.L.**
63% of MC realizations yield limit stronger than data

➢ upper limit on
$m_{\beta\beta} < 0.11 - 0.26$ eV

➢ **Bayesian (preliminary results):**
$T^{0\nu}_{1/2} > 0.7 \cdot 10^{26}$ **yr @ 90% C.I.**
Median Sensitivity:
$T^{0\nu}_{1/2} > 0.8 \cdot 10^{26}$ **yr @ 90% C.I.**
59% of MC realizations yield limit stronger than data

➢ Bayes factor: $P(H_1)/P(H_0) = 0.054$
where:
H_1:signal+background hypothesis
H_0: background-only hypothesis

Pulse Shape Discrimination for enriched coaxials

Population of **degraded alpha events from the detector grooves** (separates n+ and p+ contact) not identified by ANN which was used to discriminate alpha events in enrCoax

- very short rise time
- new rise time based cut
- on 10-90% RT