The $^{3}He(\alpha,\gamma)^{7}Be$ cross-section at astrophysically relevant energies

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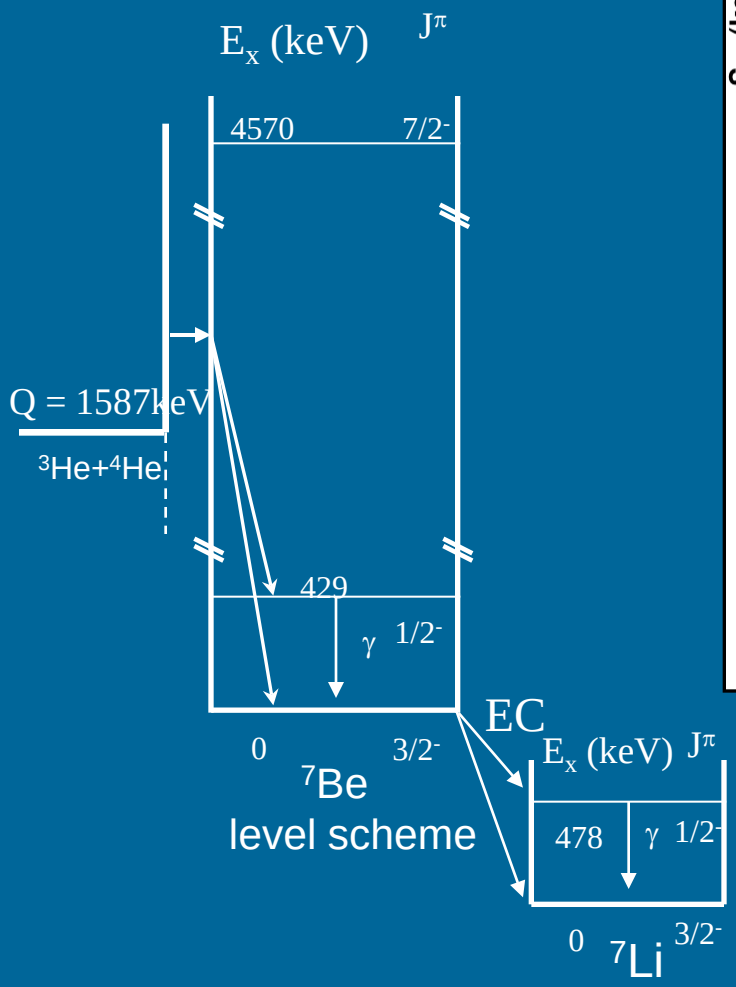
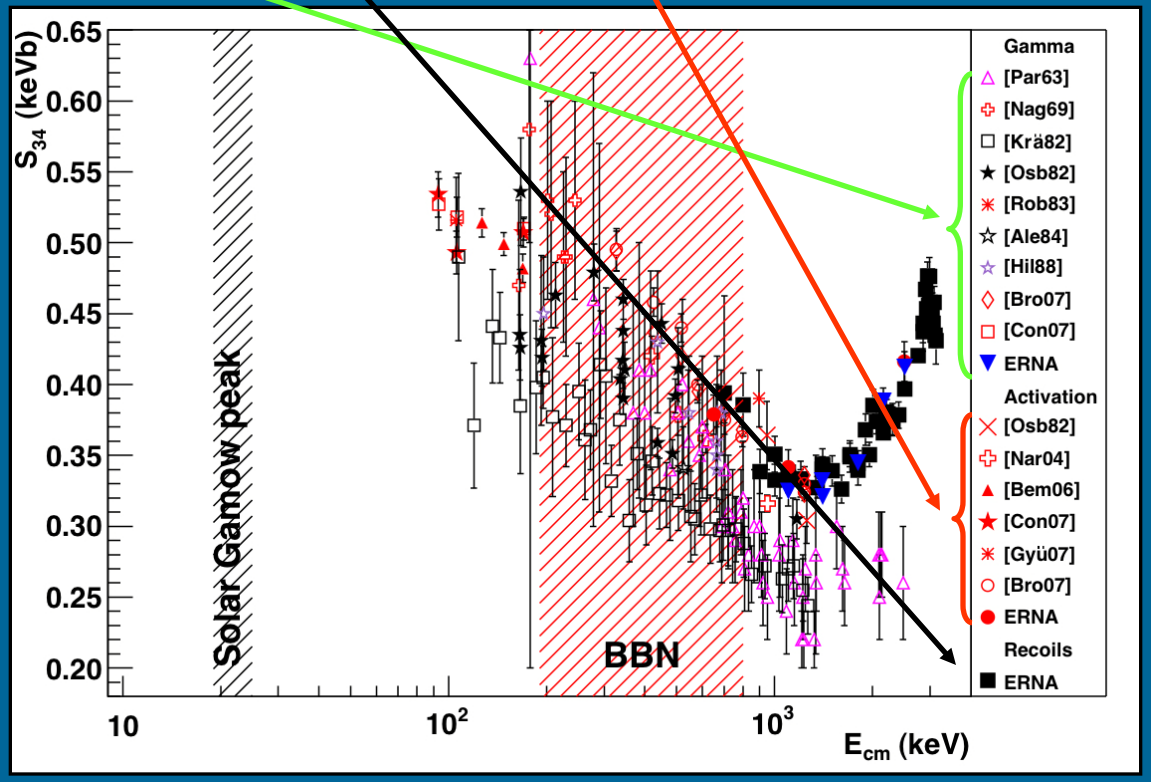
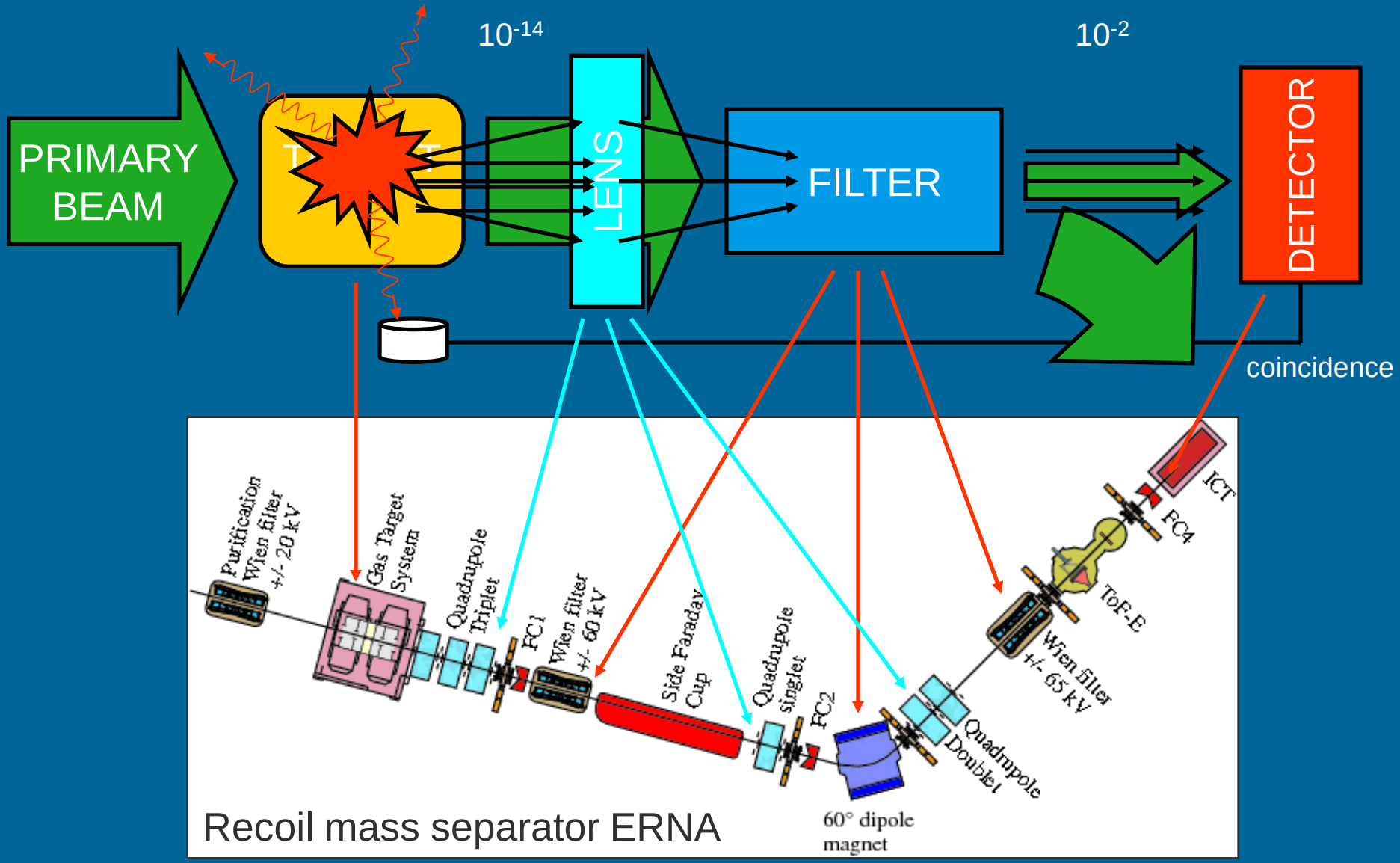
The $^3He(\alpha,\gamma)^7Be$ reaction

$^3He(\alpha,\gamma)^7Be(e,\nu)^7Li^*(\gamma)^7Li$





Recoil separator ERNA

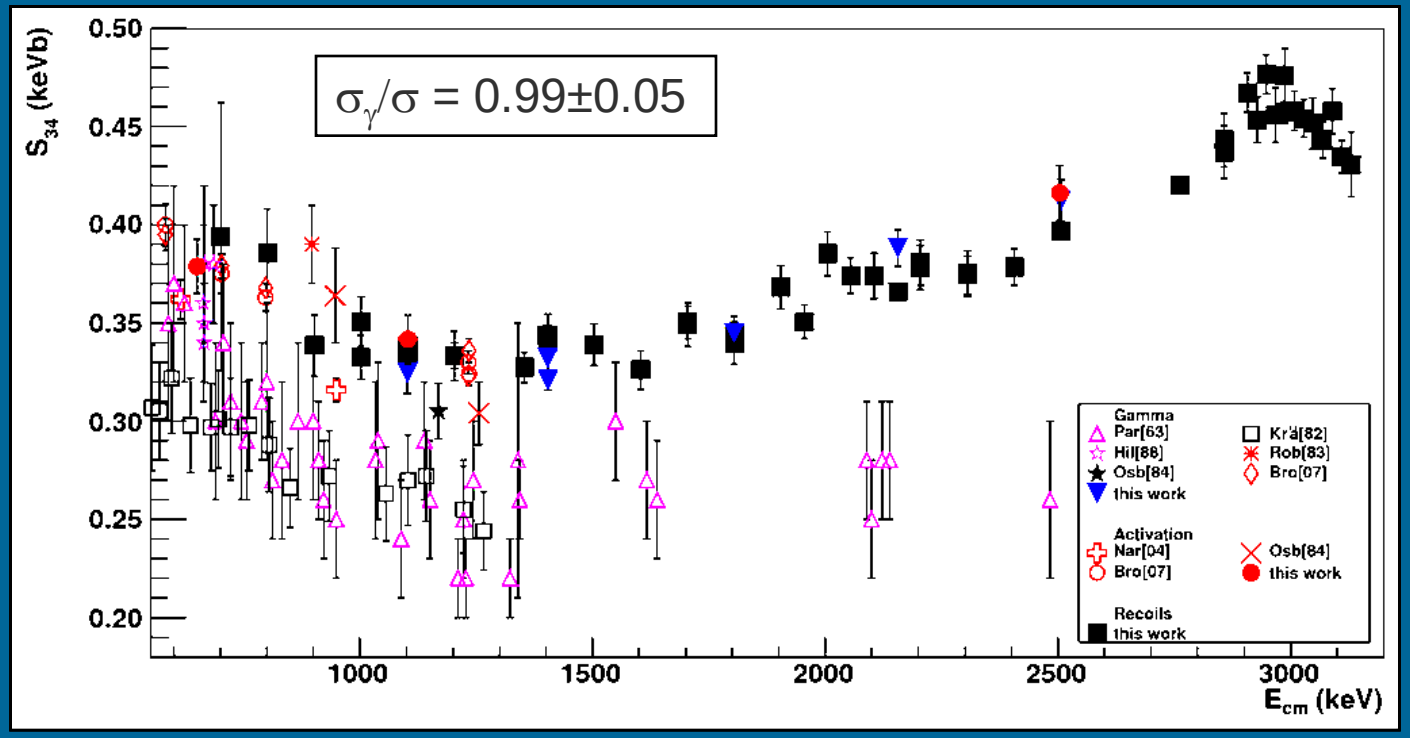


ERNA Results

$$\sigma(E) = \frac{1}{N_{\text{target}}\varepsilon}\sum_q \frac{Y(^7\text{Be}^{q+})}{N_{\text{projectiles}_q}}$$

Error budget

Number of projectiles	1%
Acceptance	1%
Target thickness	4%
Detection	0.6-1.7%

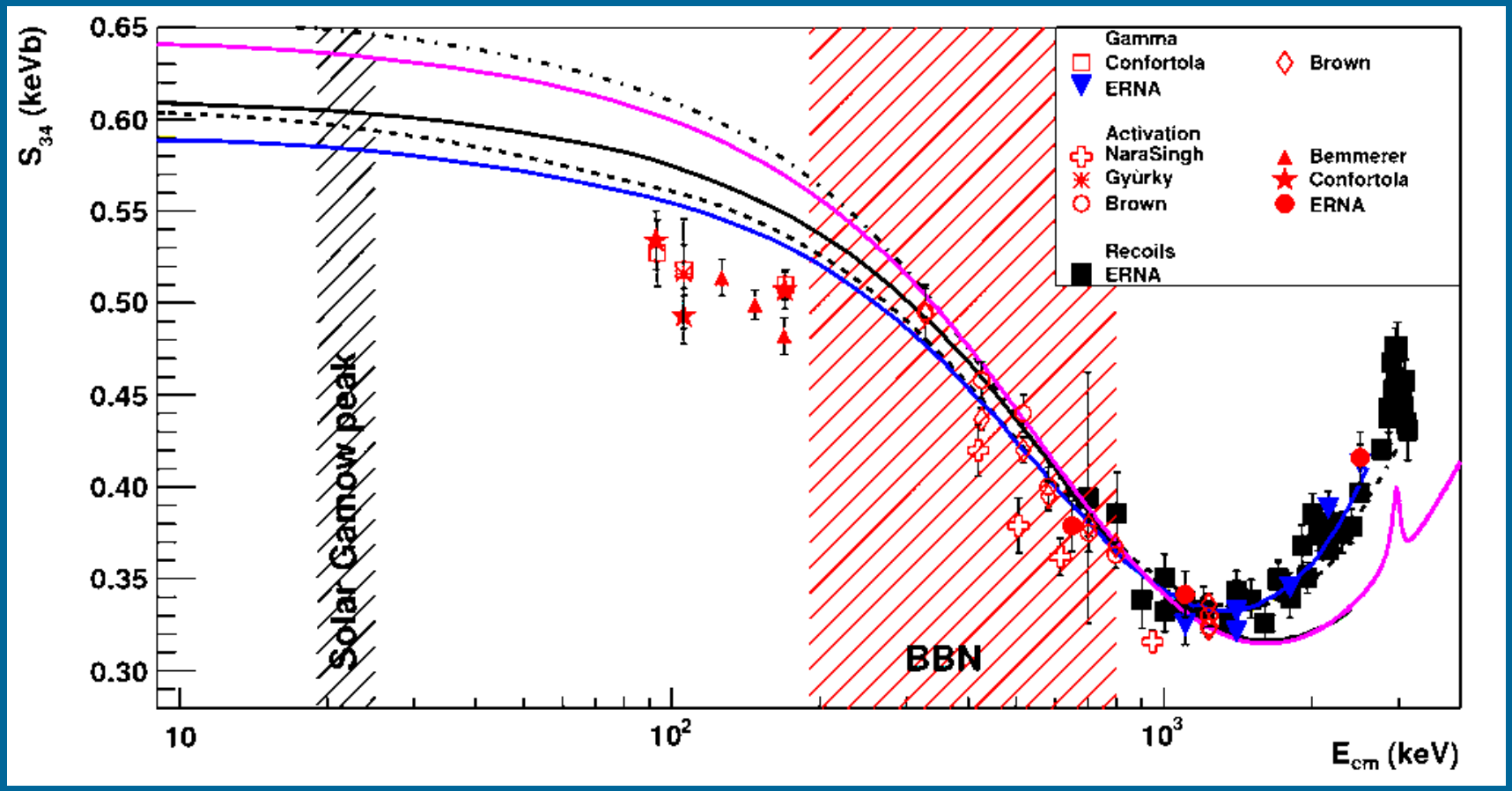


Extrapolation to solar energies

Potential models (global scaling parameter): Tombrello & Parker, Descouvemont (R-matrix based), Mohr

Microscopic models (no global scaling parameter): Csótó & Langanke, Kajino et al., Nollett, etc...

Usually claimed to be valid up to E_{cm}~2.0MeV



Datasets and models selection

The least square function is a χ^2 variable only under the conditions:

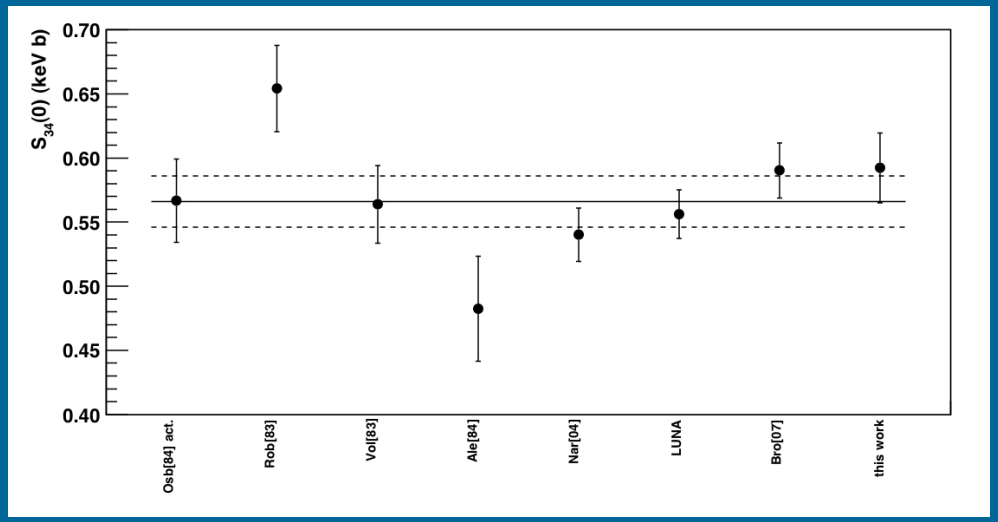
- model is adequate to describe the data;
- fitted measurements are independent;
- measured quantities have a gaussian distribution, whose standard deviations must be correctly evaluated.

Parker, Nagatani, Kräwinkel, Hilgemeier: include systematic uncertainties.

Robertson, Alexander, Volk: single data point.

	[Osb84] prompt	[Osb84] activation	[Nar04]	LUNA prompt	LUNA activation	[Bro07] prompt	[Bro07] activation	this work recoils	this work activation
ν	18	1	3	2	6	7	7	21	1
[Des04]	86	1.6	1.1	0.8	6.6	20.2	5.3	72	1.8
[Kaj87]	83	2.3	1.4	0.7	6.6	9.6	12.3	28	0.4
[Csó00]	95	2.5	0.9	1.4	6.7	18.8	3.4	17	1.1
[Mer86]	79	2.4	1.7	0.4	9.2	15.4	10.9	46	0.8
[Liu81]	79	2.4	2.8	0.1	7.3	16.5	21.5	32	0.3
[Nol01]	83	2.5	0.9	0.7	6.6	10.7	10.0	18	0.7
[Moh93]	91	1.5	2.0	1.2	6.6	31.1	6.6	75	2.7

$S_{34}(0)$



$$w_{ij} = \frac{\left|S_{34\,i}(0) - S_{34\,j}(0)\right|}{\sqrt{\sigma_i^2 + \sigma_j^2}}$$

$S_{34}(0) = 0.57 \pm (0.02)_{exp} \pm (?)_{model}$ keVb

$\sigma_{model} = 0.02$ keVb

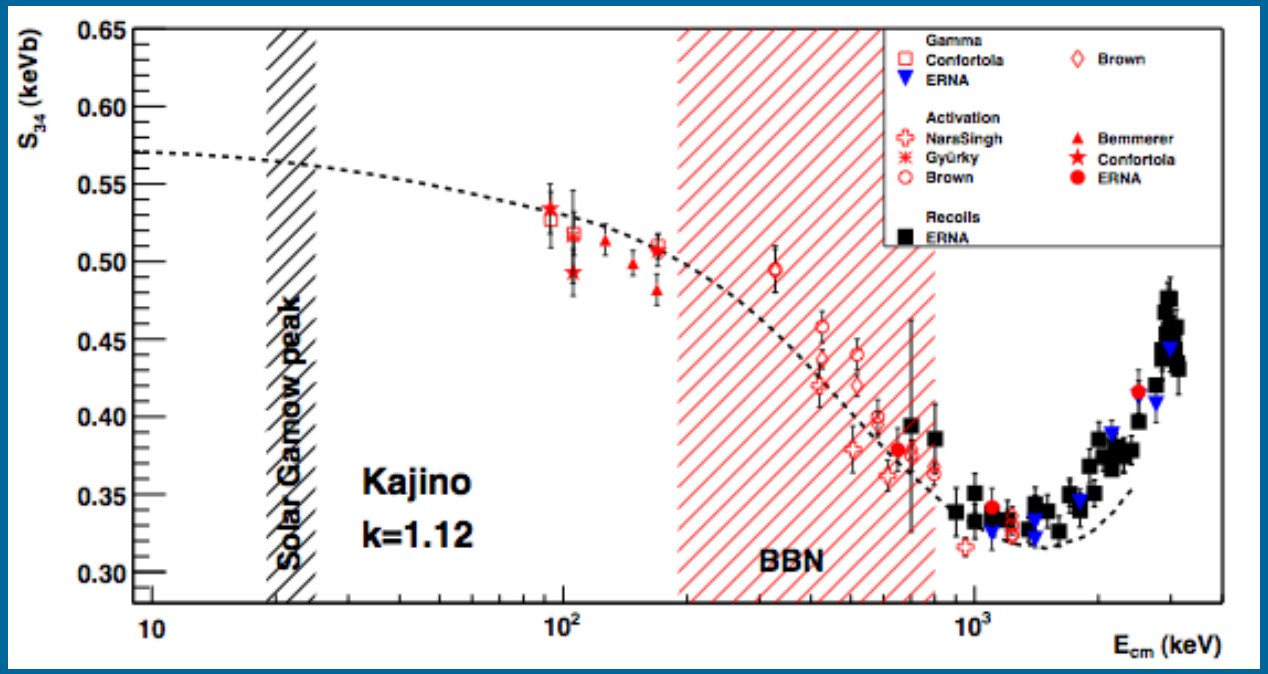
Adelberger et al.
arXiv:1004.2318v2 [nucl-ex]

$P(w>w_{ij})$	[Rob83]	[Vol83]	[Ale84]	[Nar04]	LUNA	[Bro07]	this work
[Osb84] activation	0.06	0.95	0.11	0.49	0.78	0.55	0.56
[Rob83]		0.04	0.00	0.00	0.01	0.11	0.14
[Vol83]			0.11	0.52	0.83	0.48	0.49
[Ale84]				0.21	0.10	0.02	0.02
[Nar04]					0.57	0.09	0.13
LUNA						0.23	0.28
[Bro07]							0.98

Summary and outlook

$S_{34}(0) = 0.57 \pm (0.02)_{exp} \pm (0.02)_{model}$ keVb

using Kajino or Nollet model



- Improved models are needed to assess the low energy slope of $S_{34}(E)$
- Additional experimental information to better constrain the models will help to reduce the uncertainty