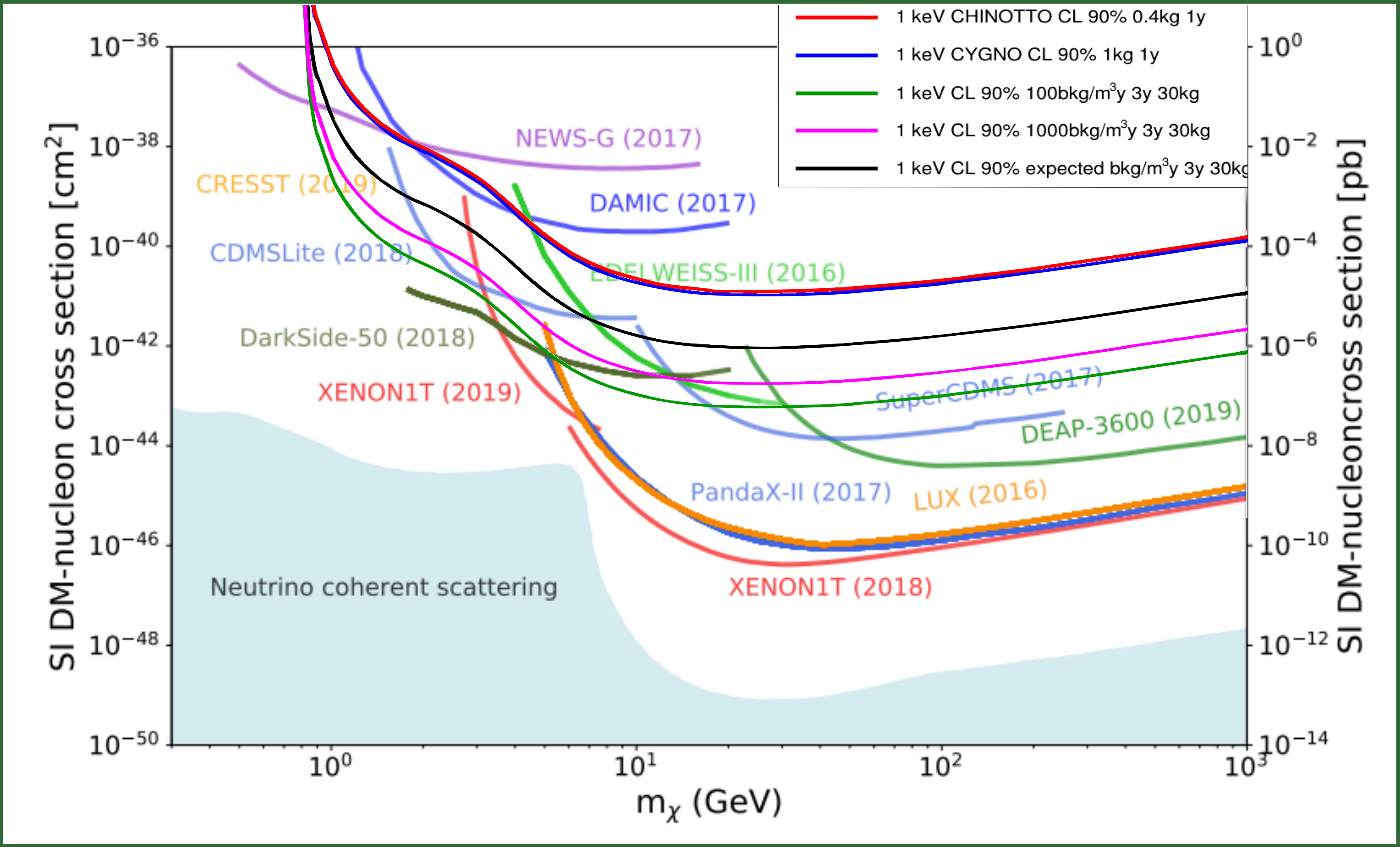
SIMULATION PLANS

CURRENT SITUATION



In current situation, the proposal for a possible 30 m³ experiment will be able to explore a small region between 1 and 3 GeV, already partially excluded by CRESST

CURRENT SITUATION

We should exploit as much as possible CYGNO performance to be competitive with the demonstrator and with the final experiment;

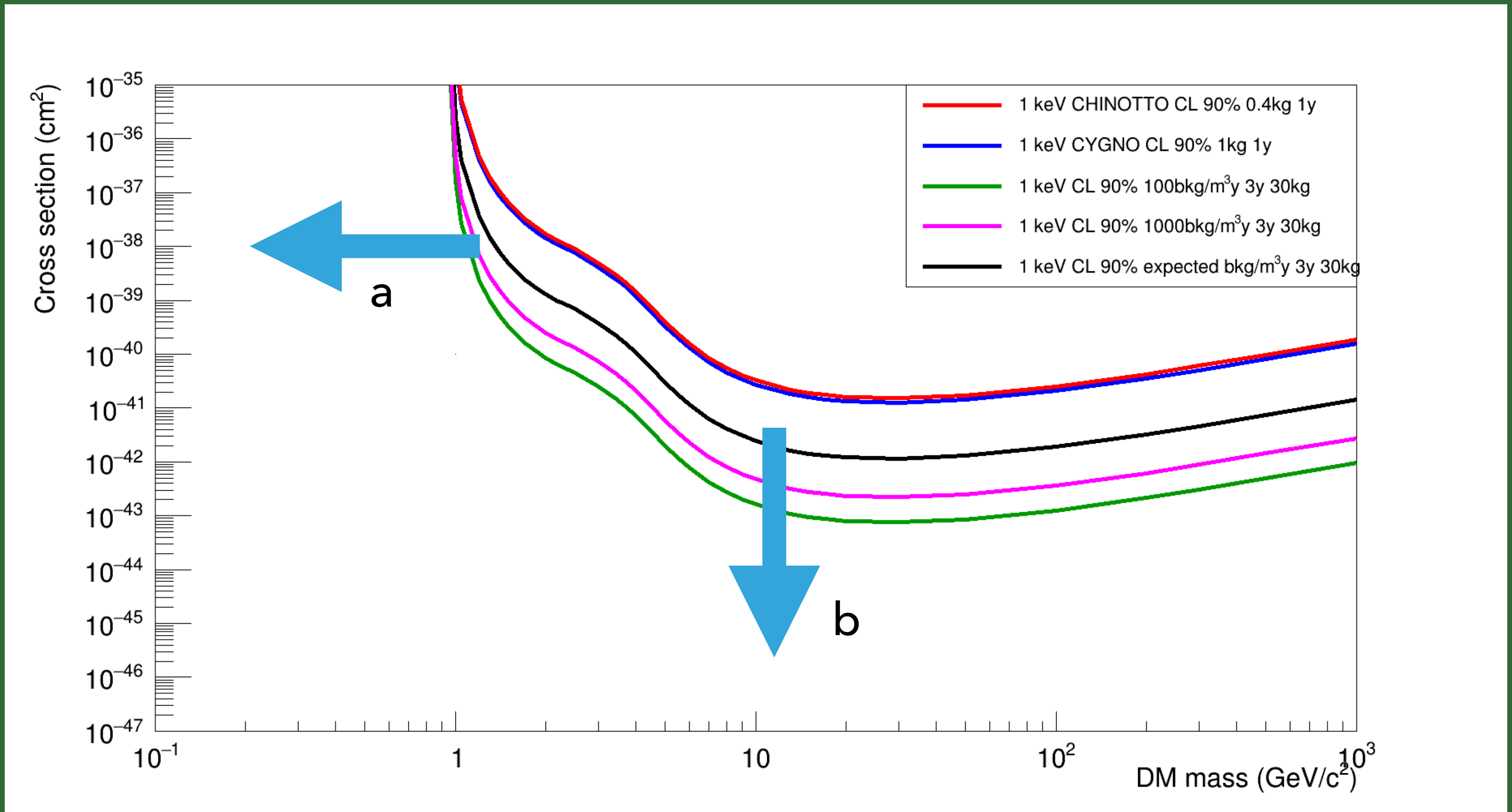
There is a twofold approach:

a) reduce affective threshold;

b) reduce background:

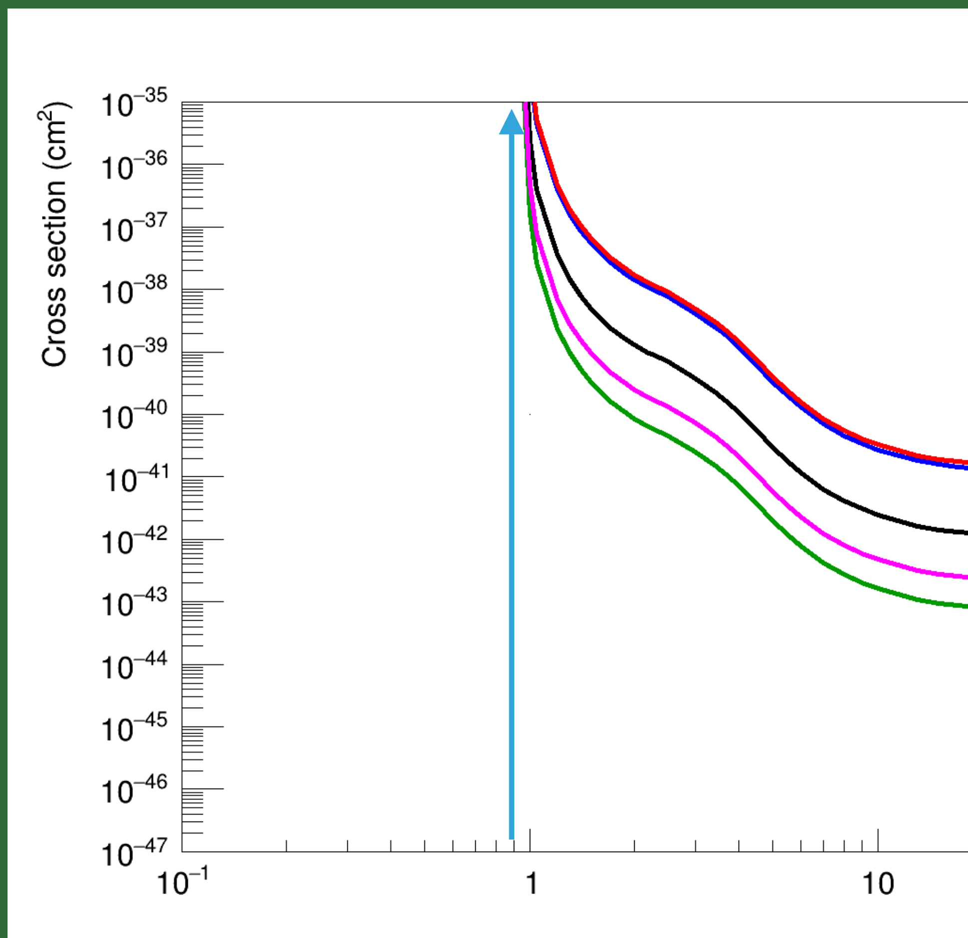
b1) reduce radioactivity;

b2) increase rejection capability;

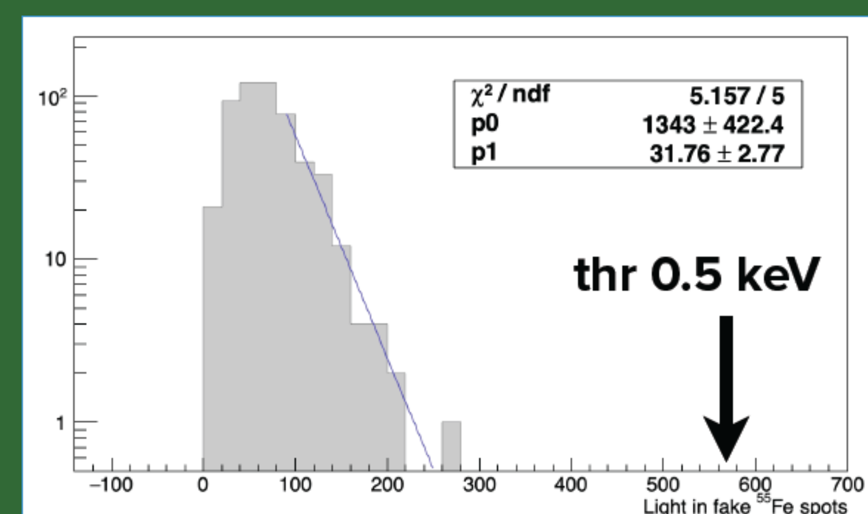


Both ways need software and hardware efforts that will be our main tasks for next months/years

A: THRESHOLD REDUCTION



Element	Max E transferred by a 1GeV DM	Min DM particle mass with 1 keV threshold
Ar	0.2 keV	5.25 GeV
He	1.2 keV	0.78 GeV
H	2.0 keV	0.5 GeV
C	0.6 keV	1.76 GeV
F	0.4 keV	2.63 GeV
S	0.2 keV	4.25 GeV
Xe	0.06 keV	16.6 GeV

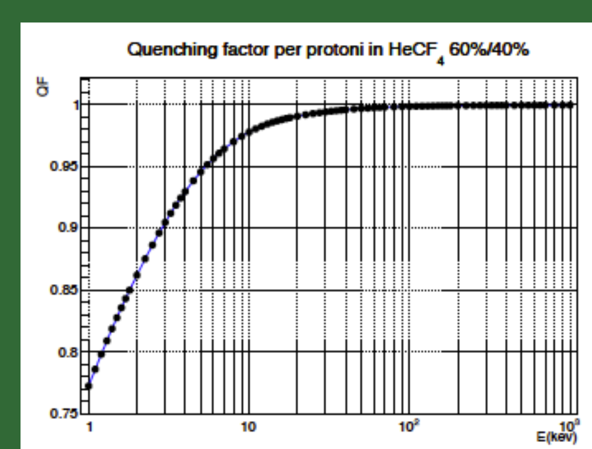


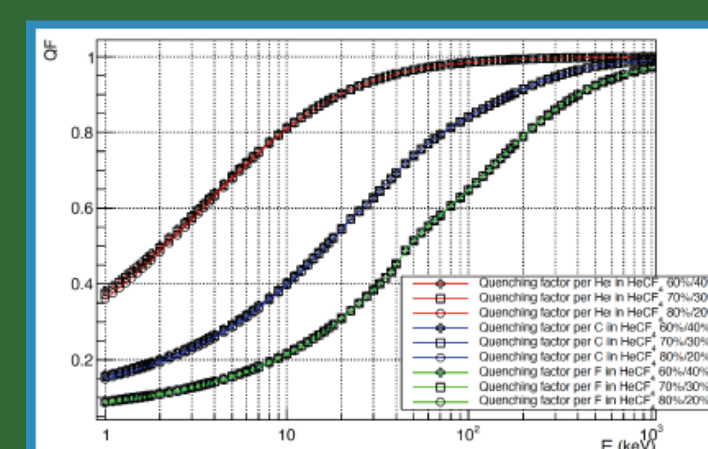
Curve behaviour on the left is due to the effective threshold that depends:

1) kinematics;

2) real threshold in keV_{ee};

3) quenching factors that translate keV into keV_{ee};





A: HYDROGEN (?)

The use of hydrogen as target for recoils will help from the point of view of kinematics and quenching factor;

We do not know if it is possible to run with some hydrocarbon component in the gas mixture and we have to investigate it;

Anyway we should try to simulate the effect of 10% of CH_4 or C_4H_{10} to the mixture;

QF GENERAL COMMENTS

The evaluation of QF performed in SRIM should be checked

A: LOWER THRESHOLD

LIME results (maybe because of the new camera) show that sensor noise would allow to run even with a 0.5 keV threshold:

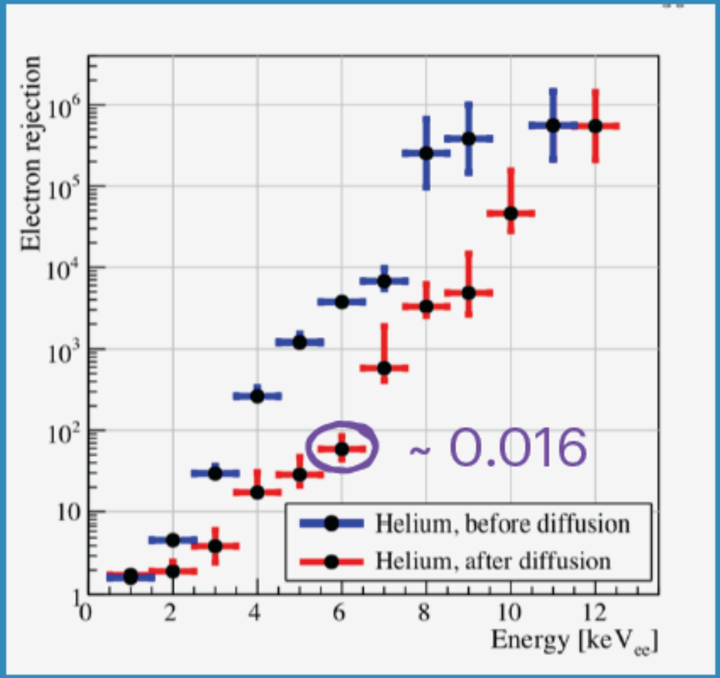
- what will happen to the curves in this case;
- (do we have any efficiency there?)

B: INCREASE ELECTRON REJECTION

Curves were obtained by making some assumption:

With LEMON we evaluated a sizeable efficiency in the range 5-10 keV was measured while more than **95% (99%) ^{55}Fe photons** were **rejected**

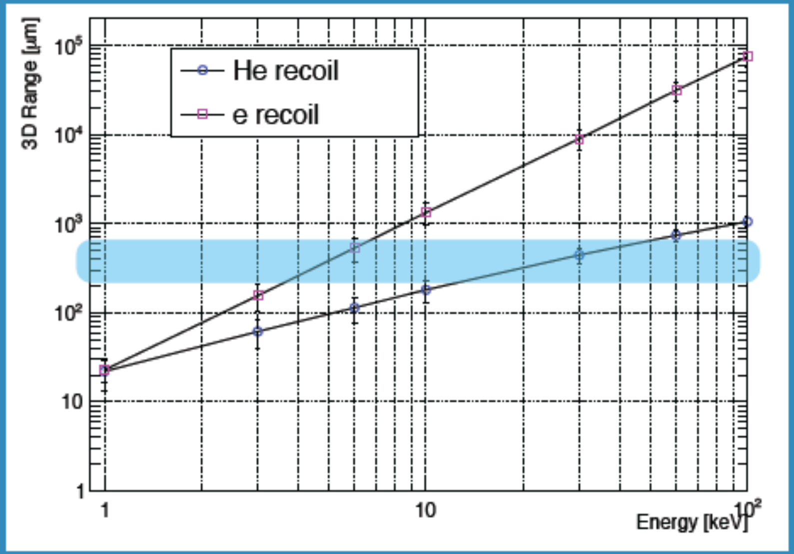
working point	Signal efficiency			Background efficiency		
	ε_S^{presel}	ε_S^{δ}	ε_S^{total}	ε_B^{presel}	ε_B^{δ}	ε_B^{total}
WP_{50}	0.98	0.51	0.50	0.70	0.050	0.035
WP_{40}	0.98	0.41	0.40	0.70	0.012	0.008



Simulation made by CYGNUS-TPC colleagues is in reasonable agreement with our measurement and expectations even if a factor 2 worst.

For energies larger than 10 keV, the electron range will be few millimetres (max diffusion sigma is 0.7 mm)

It should be "easy" identify them



Let's assume a RF:

- double of above plot in [1-10keV];
- larger than 10^5 for higher energies;

B: SIMULATION

To have a better idea about CYGNO performance, the toyMC will help a lot:

1) signal efficiency at low threshold;

2) behaviour of electron rejection as a function of the energy;

Needed Steps are:

- check (perform again) SRIM simulation;
- introduce GEM gain fluctuations;
- use electronic noise simulation provided by Brazilian group;
- compare with data;