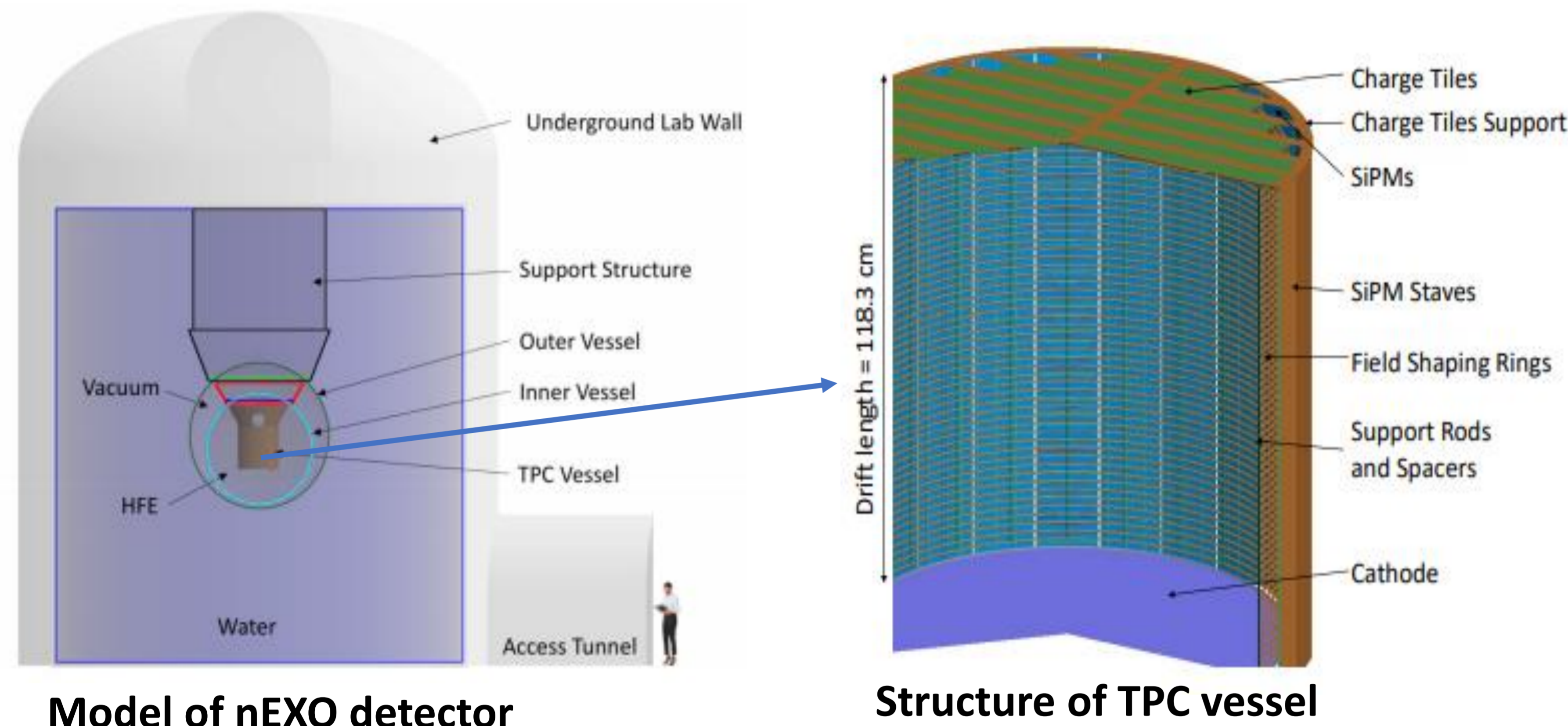


**nEXO** is a planned tonne-scale  $0\nu\beta\beta$ -decay search experiment with a cylindrical, single phase time projection chamber.

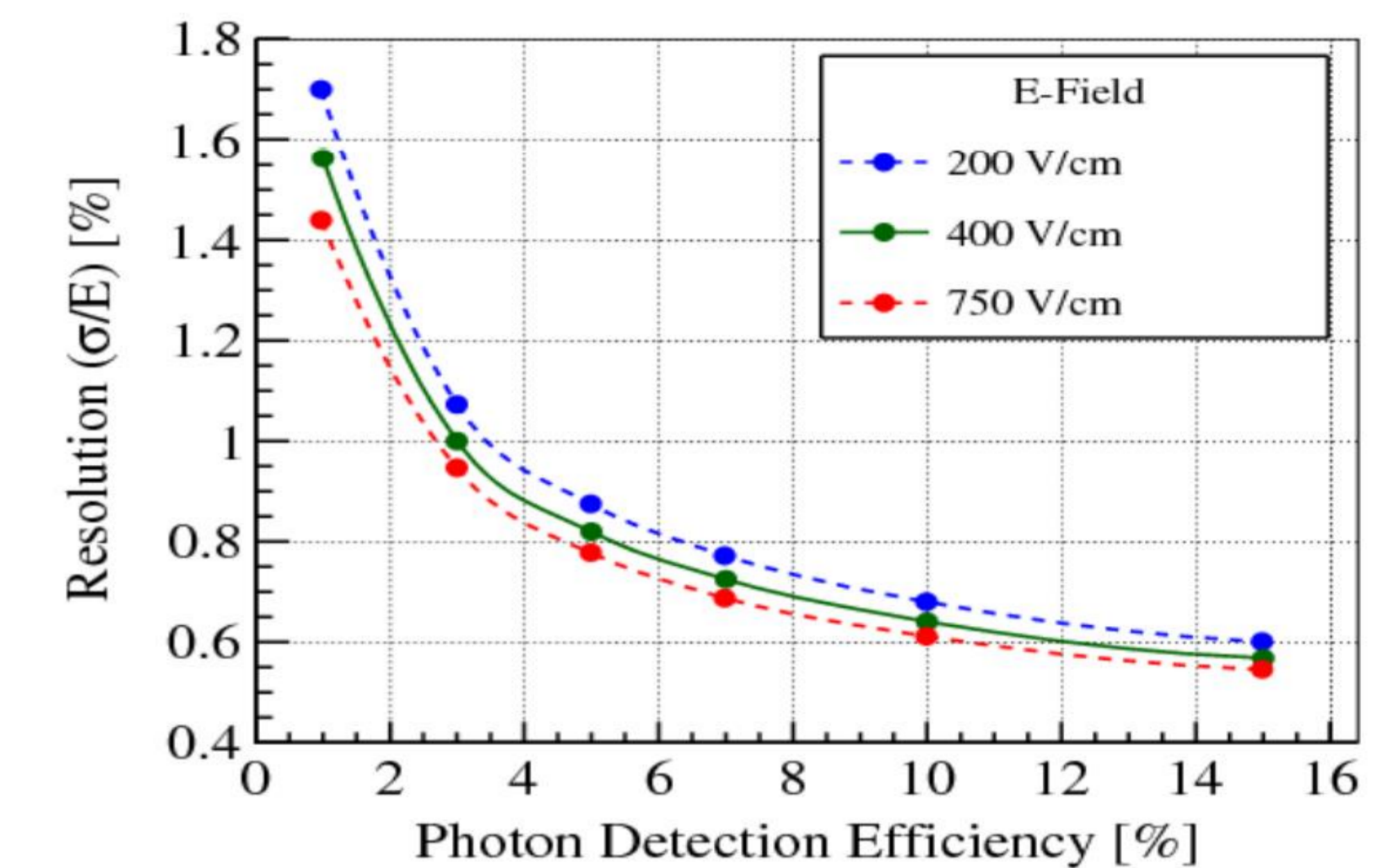
The TPC will be equipped with charge collection system[1] on top and **Silicon photomultiplier (SiPM) based light detection system** to detect scintillation light (175nm) in liquid xenon[3].



## SiPM requirements for nEXO

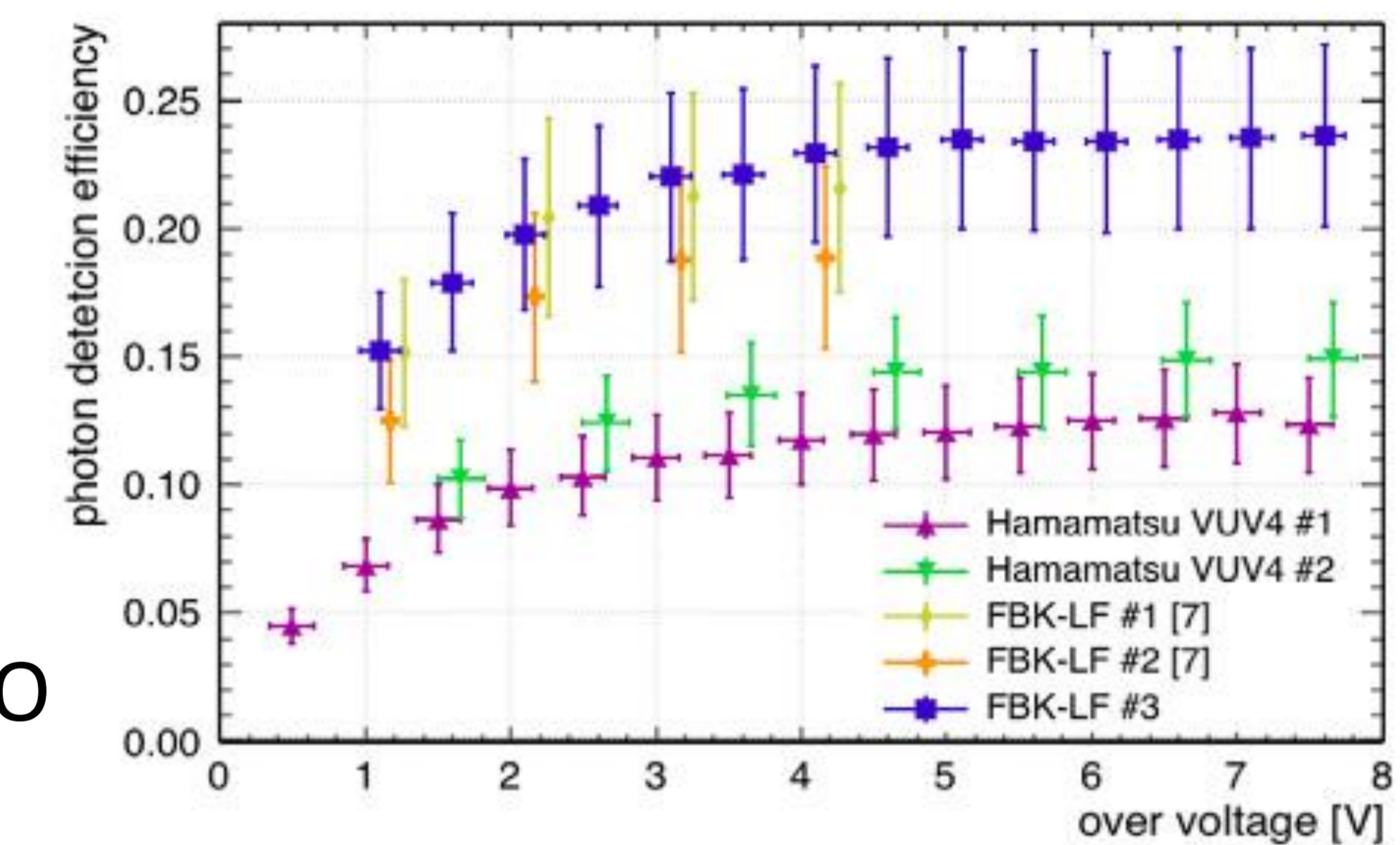
To achieve the **projected half-life sensitivity beyond  $10^{28}$  years**, [2] energy resolution of 1% or better by nEXO is required at the Q-value ( $Q_{\beta\beta} = 2.458$  MeV) of the decay. Scintillation detection efficiency is the key factor in improving the energy resolution of the detector. nEXO will have a total SiPM area of  $4.5 \text{ m}^2$  on the TPC walls to collect the scintillation signal[3].

- **Dark noise rate  $< 50 \text{ Hz/mm}^2$**
- **Overall photon detection efficiency  $\geq 3\%$**
- **SiPM photon detection efficiency (PDE) at 175nm  $\geq 15\%$**
- **Correlated avalanche rate  $< 0.2$**
- **Electronic noise  $< 0.1 \text{ PE}$**



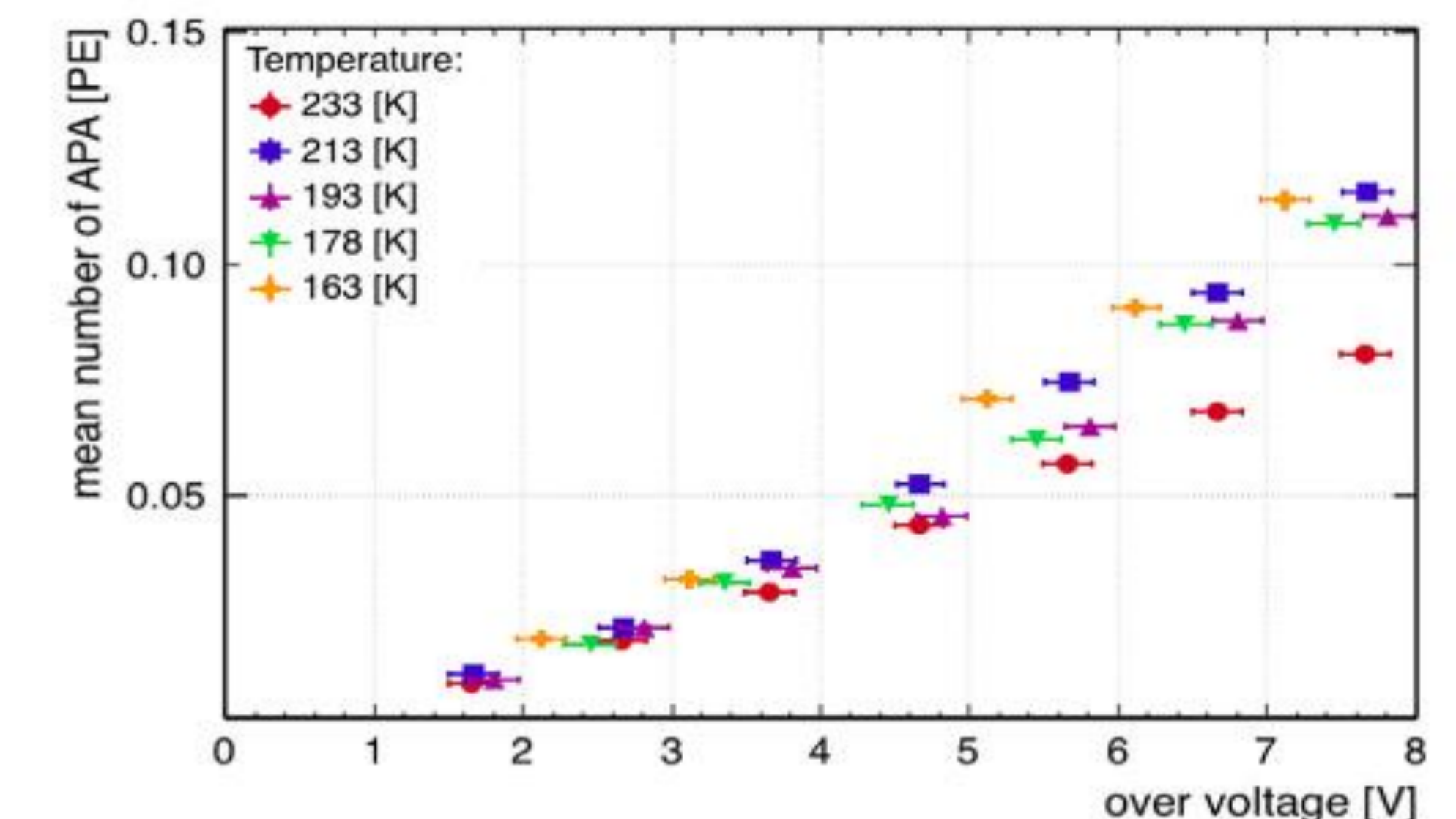
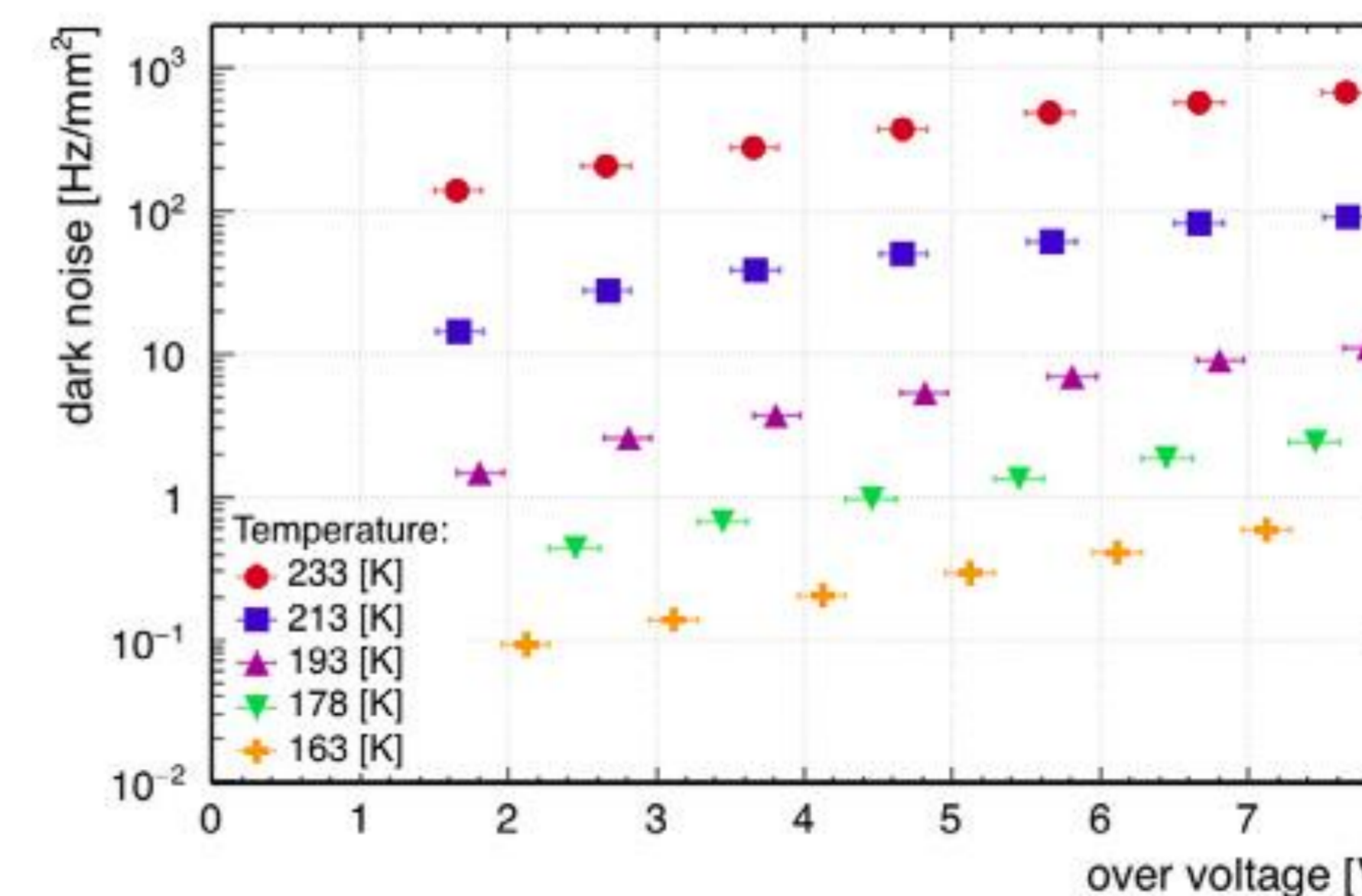
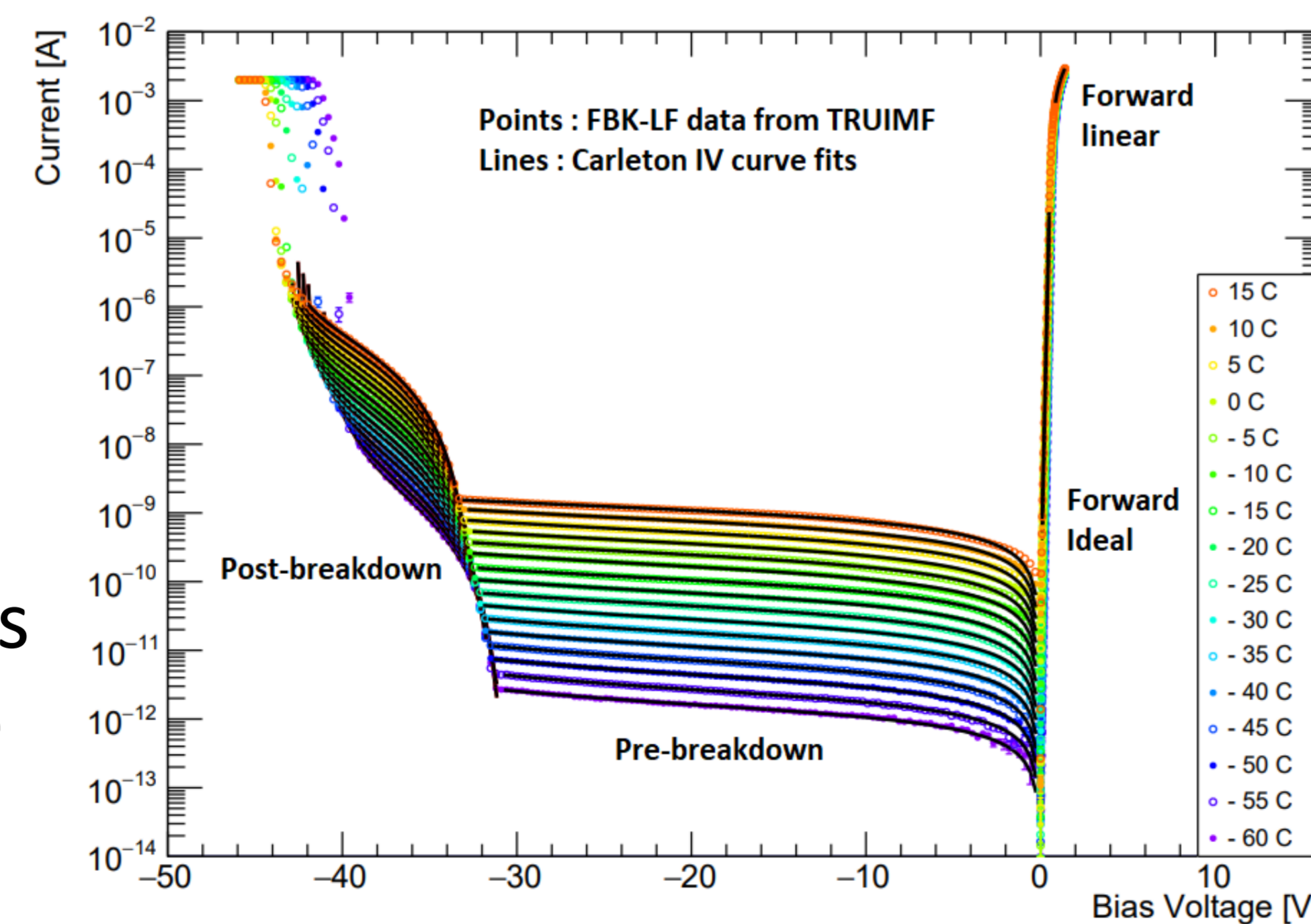
nEXO identified two prospective SiPM vendors : Hamamatsu and FBK (Fondazione Bruno Kessler) SiPM pulse data taken at TRIUMF shows:

- FBK SiPM devices have better PDE than Hamamatsu and qualify for nEXO
- Hamamatsu SiPMs have low dark noise rate and correlated avalanche rate which satisfies the nEXO requirements [4].



## I-V Characterization of SiPM

Current-voltage (IV) characterisation of SiPMs is being developed as quality monitoring tool for large scale testing towards nEXO construction. The IV curve fit model will be used to extract the empirical parameters like breakdown voltage, dark noise rate and correlated noise probability.



## References

1. Jewell et al. Characterization of an Ionization Readout Tile for nEXO (2018)
2. G. Adhikari et al. nEXO: Neutrinoless double beta decay search beyond the  $10^{28}$  year half-life sensitivity (2021)
3. S. Al Kharusi et al. nEXO Pre Conceptual Design Report (2018)
4. G. Gallina et al. Characterization of the Hamamatsu VUV4 MPPCs for nEXO (2019)

## Conclusions

- Results from SiPM measurements shows that both Hamamatsu and FBK SiPM devices meet nEXO requirements with some modest improvements.
- IV fit model is in good agreement with data in both forward and reverse bias region.