The KATRIN experiment
Searching for the neutrino mass scale and beyond

The KATRIN experiment aims to measure the Kurie plot of tritium $\beta$-decay. The end-point of the spectrum will tell us about the absolute neutrino mass scale. Measuring the full spectrum could reveal the presence of new neutral particles.

3+1 effective model
Minimal bottom-up approach
3 light active neutrinos + 1 sterile neutrino

If KATRIN discovers a sterile neutrino with a mass of $[1,18.5]$ KeV and mixing to electrons $|U_{e3}|^2 > 10^{-6}$, it will impact the effective electron neutrino mass relevant for $0\nu\beta\beta$.

Type-I seesaw model
Minimal realization with 2 $\nu_e$

One of the $\nu_e$ is in the KATRIN regime and modifies the $m_{ee}^{(SM)} \rightarrow m_{ee}^{(3+1)}$. The second $\nu_e$ modifies the effective mass according to:

$$m_{ee} = \sum_{i=1}^{N} U_{ei}^2 \frac{m_i}{p^2 - m_i^2} \approx m_{ee}^{(3+1)} \left[ 1 - \frac{p^2}{p^2 - m_3^2} \right]$$

This implies a strong cancellation below $p \approx 100$ MeV and saturation above.

If no signal is observed in $0\nu\beta\beta$ it would point towards a light $m_3$, which could be observed as a second kink in KATRIN.

Conclusions
The interplay between $\beta$ and $0\nu\beta\beta$ could help revealing the mechanism behind neutrino mass generation.