

# **Design of a Scintillating Active Transverse** Energy Filter (scint-aTEF) for Background **Suppression at the KATRIN Experiment**



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## The <u>Karlsruhe Tritium Neutrino Experiment (KATRIN)</u>



## **Concept of the scint-aTEF**

- large angles (isotropic)
- background: small angles



## **Development of the scint-aTEF**

#### **3d printed plastic scintillator**

• 2 photon polymerization at µm scale at KIT-APH

#### **Readout: SPAD arrays**

• "IDP4" from ZITI (Heidelberg) for single *e*<sup>-</sup> event detection





*3d printed microstructure, non scintillating. From* https://doi.org/10.5445/IR/1000167180



Single electron event (top left), captured with a SPAD array and a commercial scintillator.

www.kit.edu

## **Simulations for Optimal Geometry**

**Angular detection efficiency** 

• Purely based on Geometry



### **ROC curve for bkg-suppression**

assuming 30 % Rydberg fraction



## Expected improvement on $m_{\perp}^2$

- KNM2-like scenario
- assumes scint-aTEF from day zero





#### Conclusion

- Valid concept in case of *large* angular separation between  $\beta$  and background  $e^-$  (Rydberg electrons)
- good light yield of scintillator is essential Implementation of scint-aTEF in KATRIN unlikely due to long development time



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