# PTOLEMY: A challange for a future Cosmological Neutrino experiment

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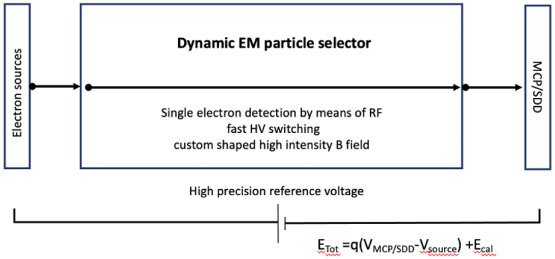
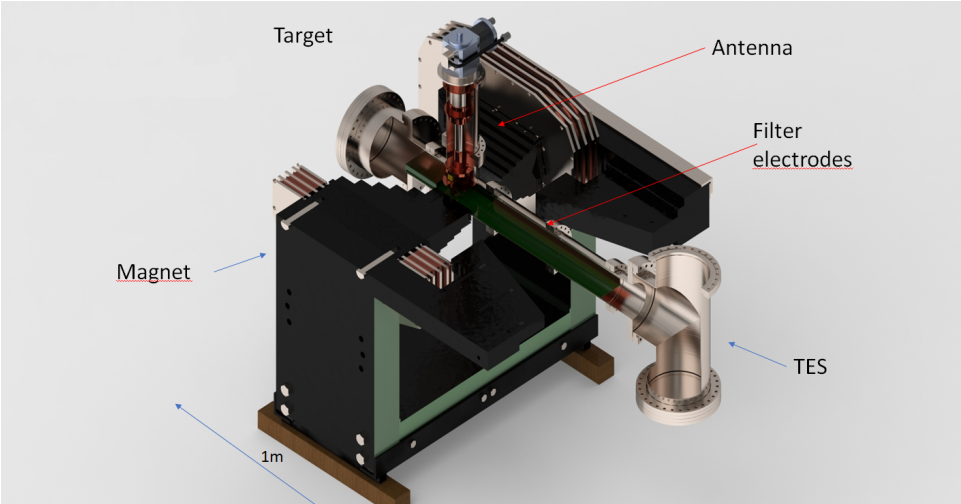
# PTOLEMY: C$\nu$B direct detection

- Cosmological Neutrino radiation emitted 1s after BB, $K = 10^{-4}\ eV$
- Neutrino Capture on Beta decaying nuclei (NCB) reaction
- Target in **Atomic** Tritium
- Huge BKG rate, need real time filter (EMF) by using RF spectroscopy
- Energy measure of endpoint electrons by using TES $\sigma_E \sim 50\ meV$




- Measure difference potential between target and TES (need a stable HV)
- $K = q\Delta V + E_{RF} + E_{TES}$

# PTOLEMY first goal: demonstrator at LNGS (2025)



# PTOLEMY: R&D activities

- Tritium Target (Princeton, INFN Rome)★ ♣
- Transverse electromagnetic filter (Princeton, LNGS, NIKHEF)♣
- Electron Spectroscopy by RF emission (Princeton, LNGS, NIKHEF)♣
- RF readout (NIKHEF) ♣
- TES for electrons (INRIM Turin, LNGS, Milano Bicocca) ♣

★=Theoretical effort
♣=Experimental and Technological challenge

# PTOLEMY LNGS: Group and activities

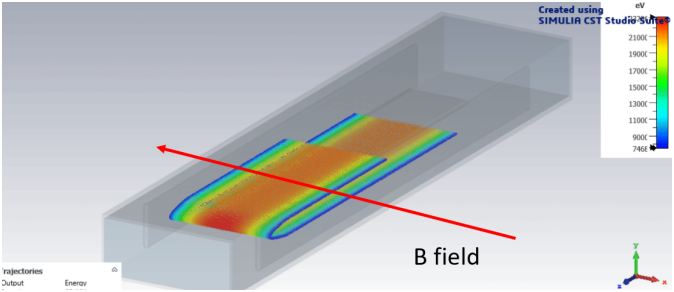
- Marcello Messina
- Alfredo Cocco
- Nicola Rossi
- Federico Virzi
- Andrei Puiu
- Alfredo Ferella
- Nicola D'Ambrosio

- RF Readout electronics
- Electron trap (Test Antenna Region EMF)
- Ultra-stable HV
- Electromagnetic Filter
- TES for electrons

# PTOLEMY LNGS: RF Readout + Electron trap

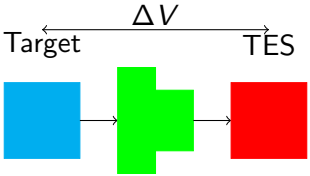
Before the proper EMF $\rightarrow$ "antenna region" where we analyze $K_e$ in 10 $\mu s$ by measuring *Power* and *Frequency* of the RF emission

- Test readout electronic chain with calibration source of $26\,GHz$ and $1\,fW$
- Simulation Electron Trap
- Test electron trap with electron in cyclotron motion (Q2 2023)



# PTOLEMY LNGS: HV and Test Filter

- Transverse EMF needs exponential B field
- HV for EMF electrodes
- High stability $10^{-6}$
- $\vec{V_\perp} = (q\vec{E} + \vec{F} - \mu\vec{\nabla}B - m\frac{d\vec{V}}{dt}) \times \frac{\vec{B}}{q|\vec{B}|^2}$
- Test PTOLEMY magnet at LNGS




Antenna region

Filter electrodes