EXO-200 Status

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DOUBLE BETA DECAY

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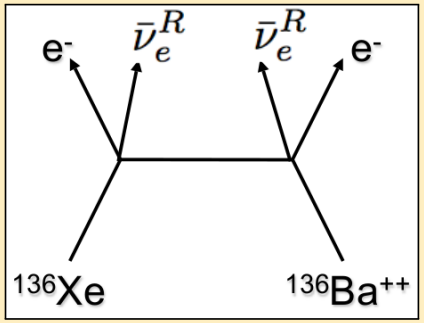
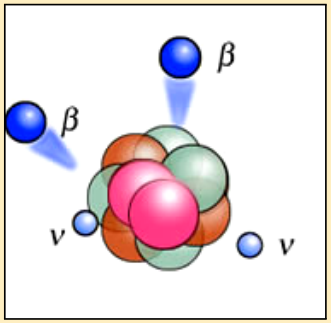
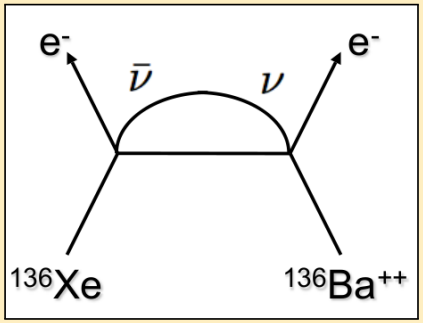
$$[T_{1/2}^{2\nu\beta\beta}]^{-1} = G^{2\nu\beta\beta}|M^{2\nu\beta\beta}|^2$$

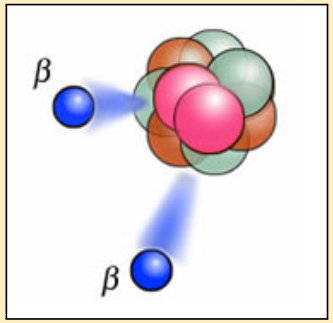




NEUTRINOLESS

$$[T_{1/2}^{0\nu\beta\beta}]^{-1} = G^{0\nu\beta\beta}|M^{0\nu\beta\beta}|^2|\langle m\rangle|^2$$



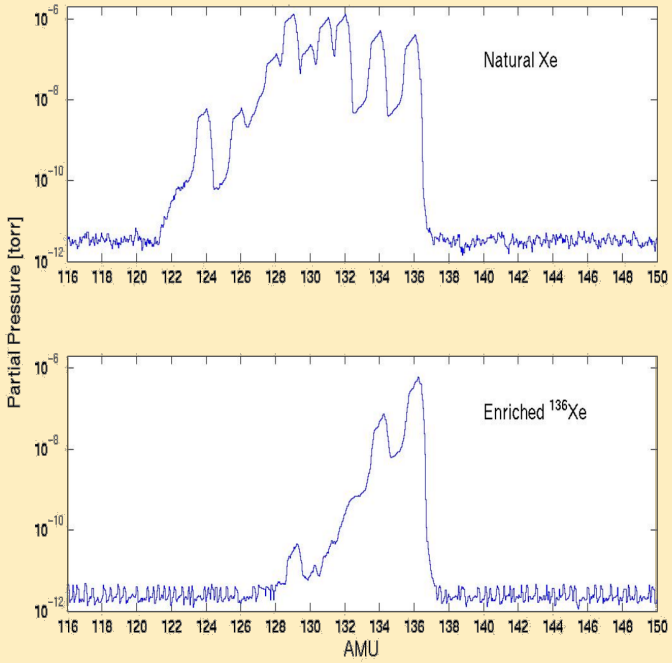


MASS MEASUREMENT

$$\langle m_{\beta\beta}\rangle = |\sum_{i=1}^{3} U_{ei}^2 m_i e^{i\alpha_i}| \propto [T_{1/2}^{0\nu\beta\beta}]^{-1/2}$$

^{136}XE

XE ISOTOPES



Mass spectra from RGA – 2001 test sample enriched to 89.5% in Xe^{136}.

CURRENT LIMITS

$T_{1/2}^{0\nu\beta\beta} > 1.2 \times 10^{24}$ year

$T_{1/2}^{2\nu\beta\beta} > 1 \times 10^{22}$ year

XE ADVANTAGES

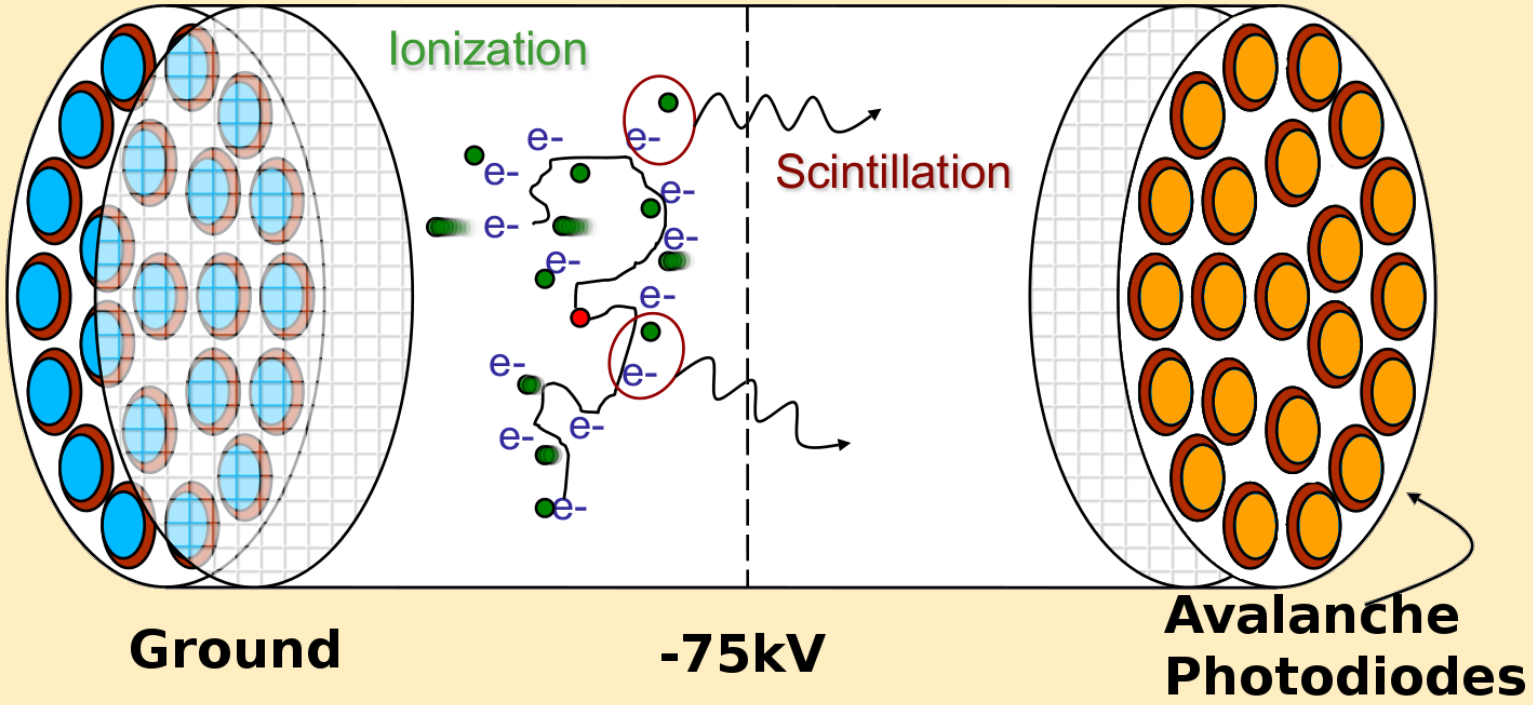
- High Q: 2.48 MeV
- Scintillation and Ionization
- Purification, reusability
- Easy to enrich
- Background rejection with Ba^{++}

TIME PROJECTION CHAMBER

DESIGN CONSIDERATIONS

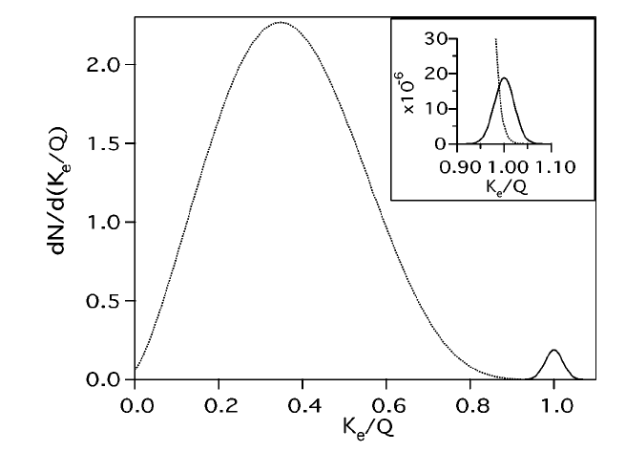
- Low Background
- Large Mass
- Resolution

WHAT WE SEE

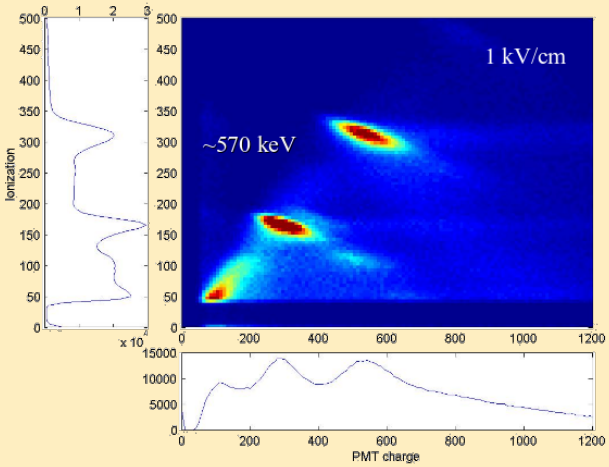


MEASUREMENT STRATEGY

$\sum E(e^-)$ MEASUREMENT



ANTICORRELATION

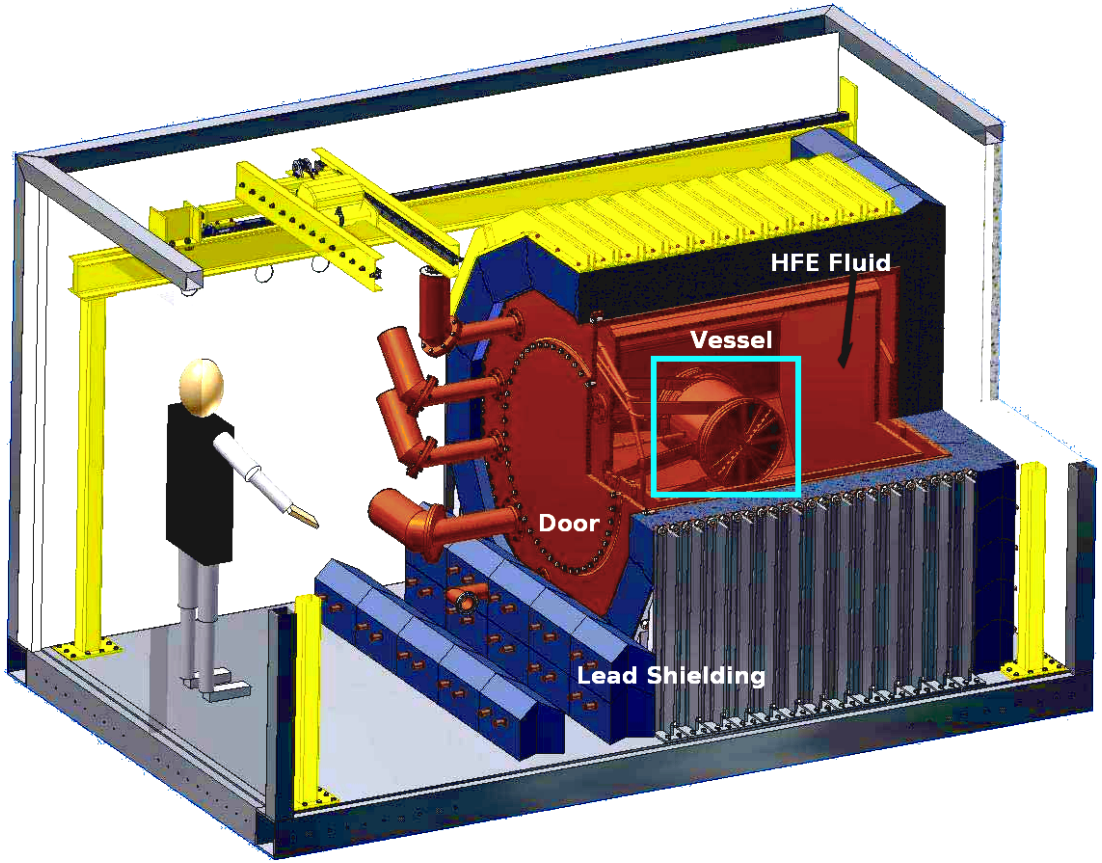


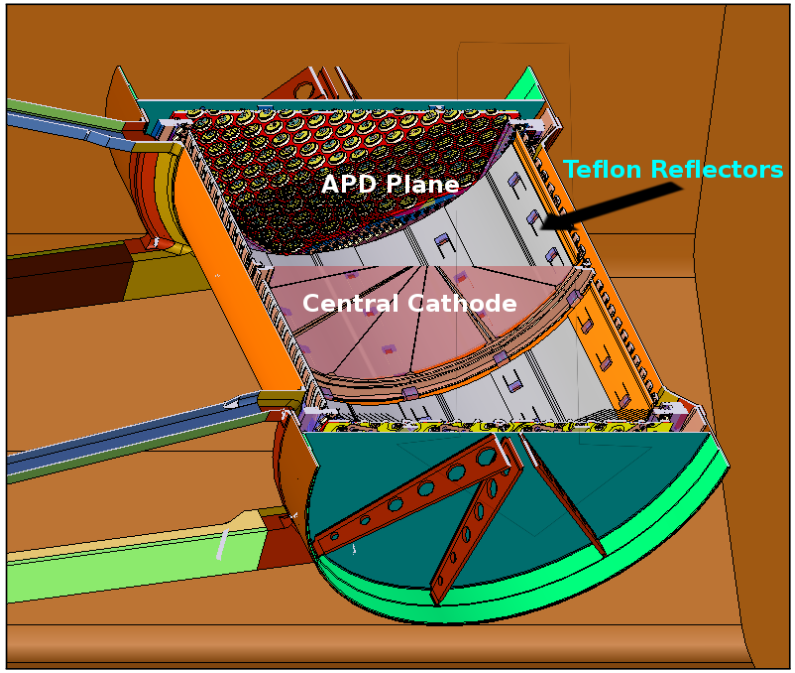
EXO-200 SENSITIVITIES

Case	Mass (ton)	Eff. (%)	Run Time (yr)	σ_E/E @2.5 MeV (%)	Radioactive BG (events)	$T^{0\nu}_{1/2}$ (yr) 90%CL	Majorana Mass (meV) QRPA[1]	NSM[2]
EXO200	0.2	70	2	1.6	40	6.4×10^{25}	133	186

1) Rodin, et. al., Nucl. Phys. A 793 (2007) 213-215 2) Caurier, et. al., arXiv:0709.2137v1

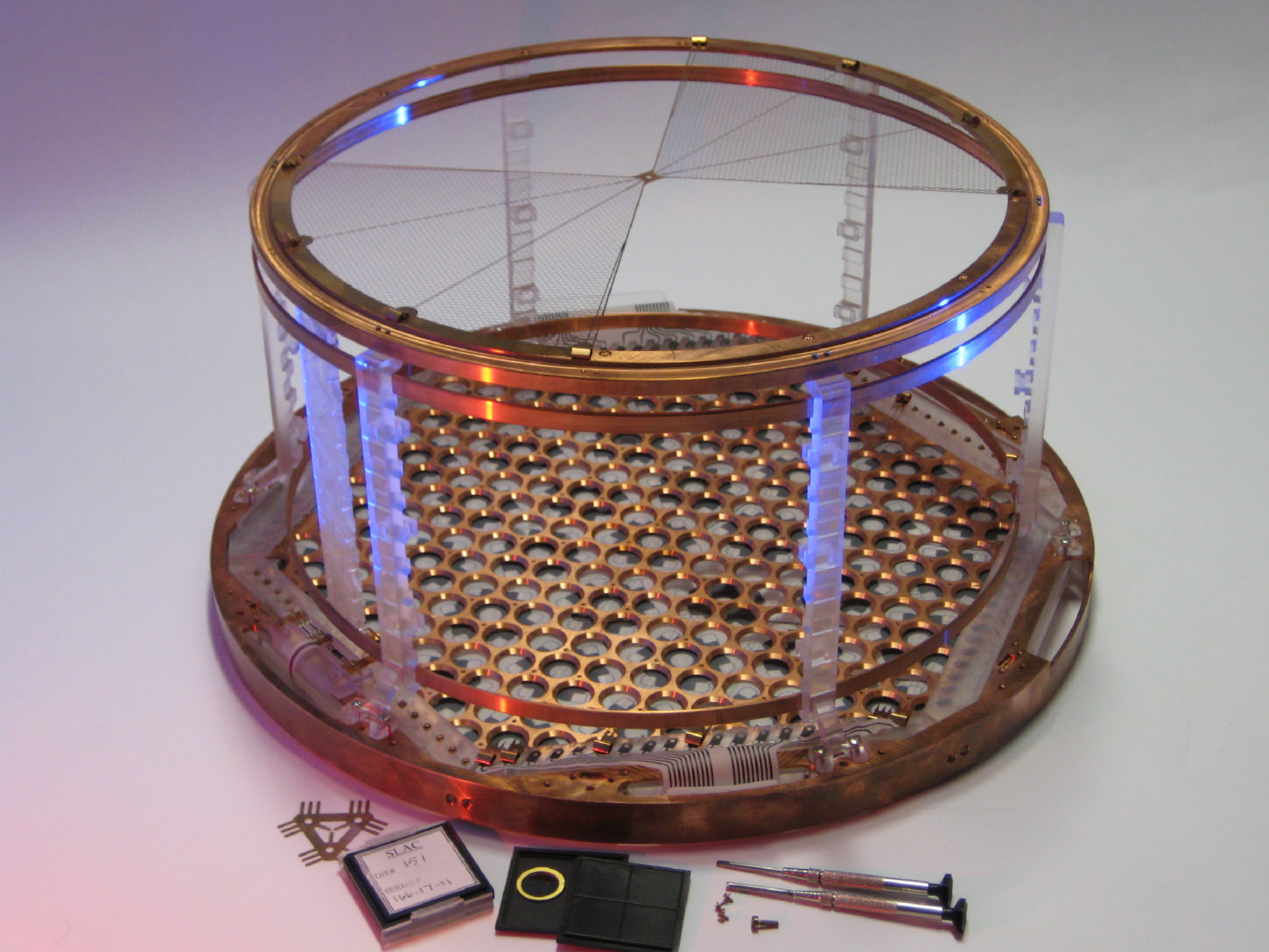
CRYOSTAT DESIGN





Massive Effort on Materials Qualification - Database of ∼330 Entries

D. S. Leonard *et al.*, arXiv:0709.4524 (NIM A)


SLAC
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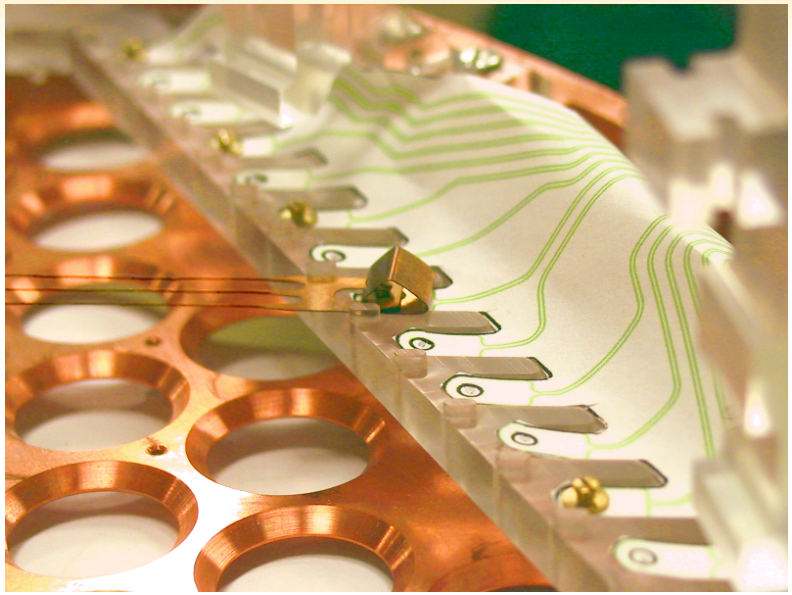
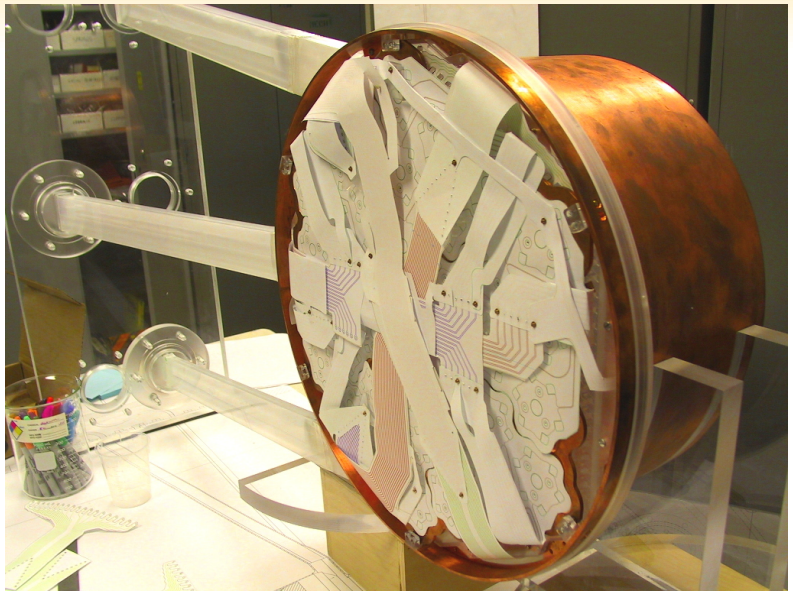
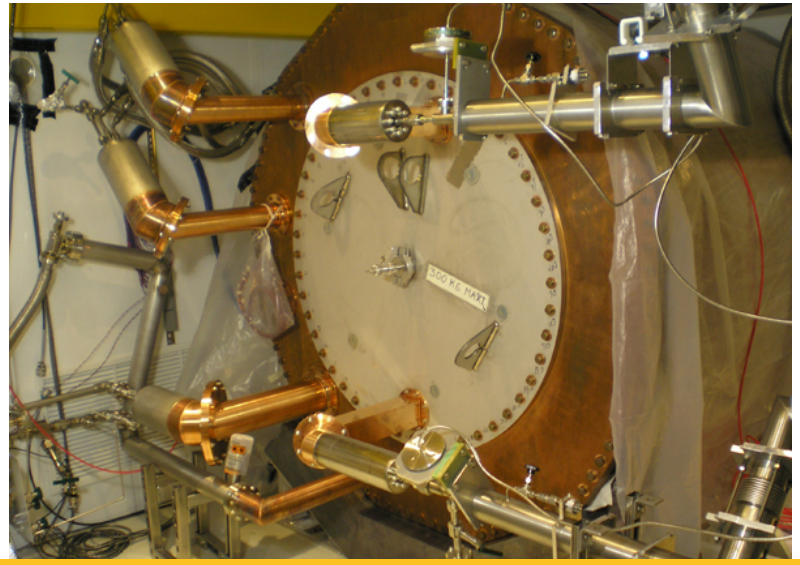
TPC CONSTRUCTION

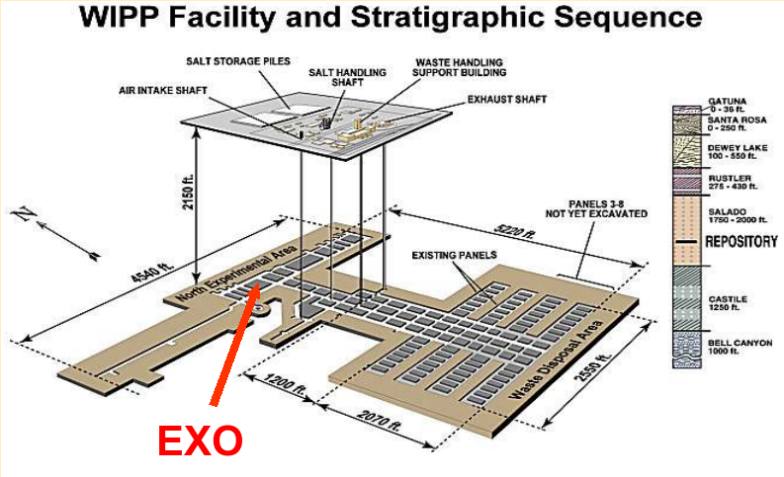




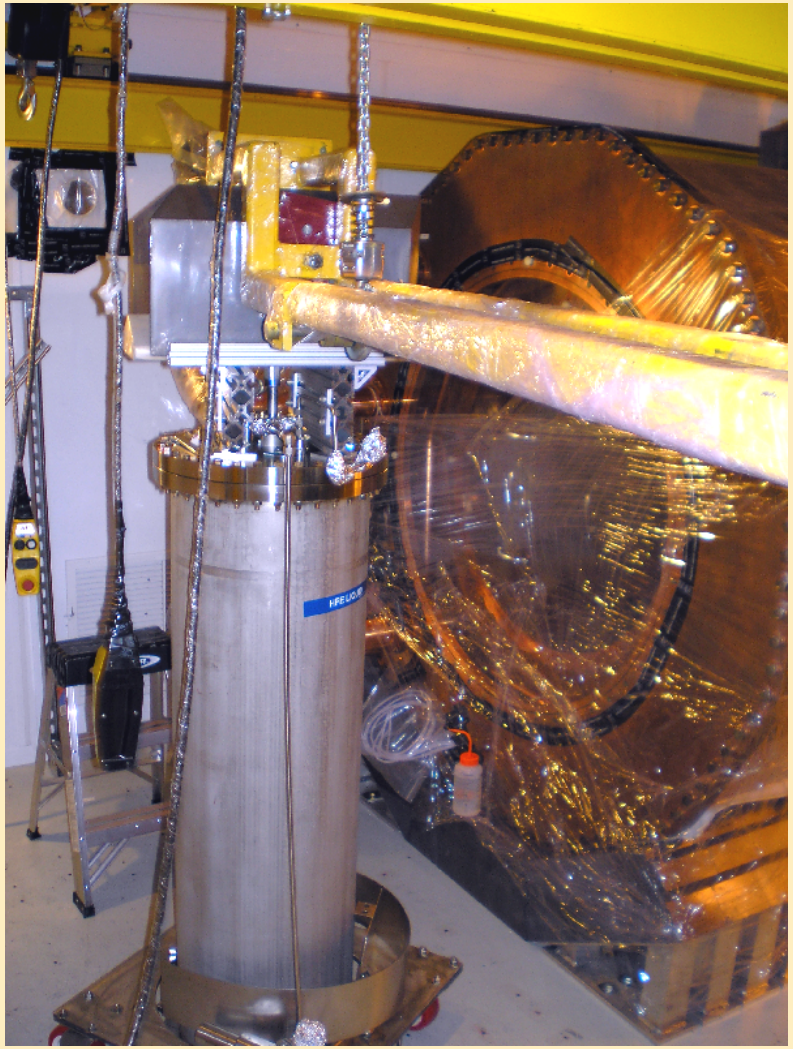


INSTALLATION AT WIPP

THE MINE



MODULE 1



EXO SENSITIVITIES

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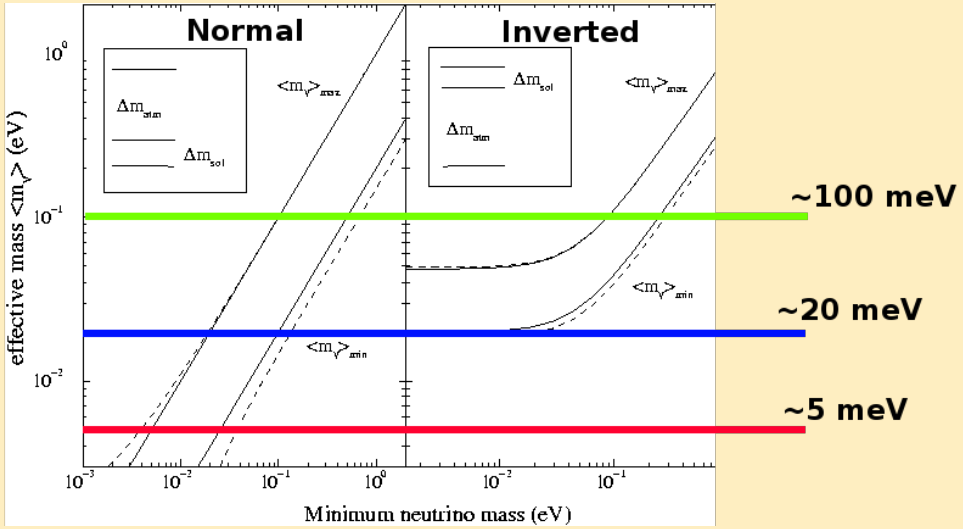
Case	Mass (ton)	Eff. (%)	Run Time (yr)	σ_E/E @2.5MeV (%)	$2\nu\beta\beta$ BG (events)	$T^{0\nu}_{1/2}$ (yr) 90%CL	Majorana Mass (meV) QRPA[1]	NSM[2]
Conservative	1	70	5	1.6	0.5 (use 1)	2×10^{27}	24	33
Aggressive	10	70	10	1	0.7 (use 1)	4.1×10^{28}	5.3	7.3

1) Rodin, et. al., Nucl. Phys. A 793 (2007) 213-215 2) Caurier, et. al., arXiv:0709.2137v1

RESTRAINING MIXING HIERARCHY

$\langle m_{\beta\beta}\rangle$



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