

Status of NEXT

J.J. Gómez-Cadenas
Instituto de Física Corpuscular (CSIC & UVEG)

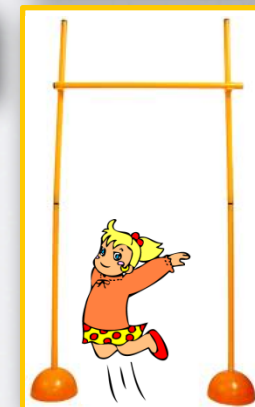
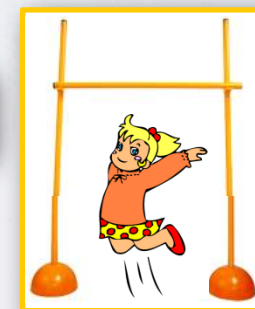
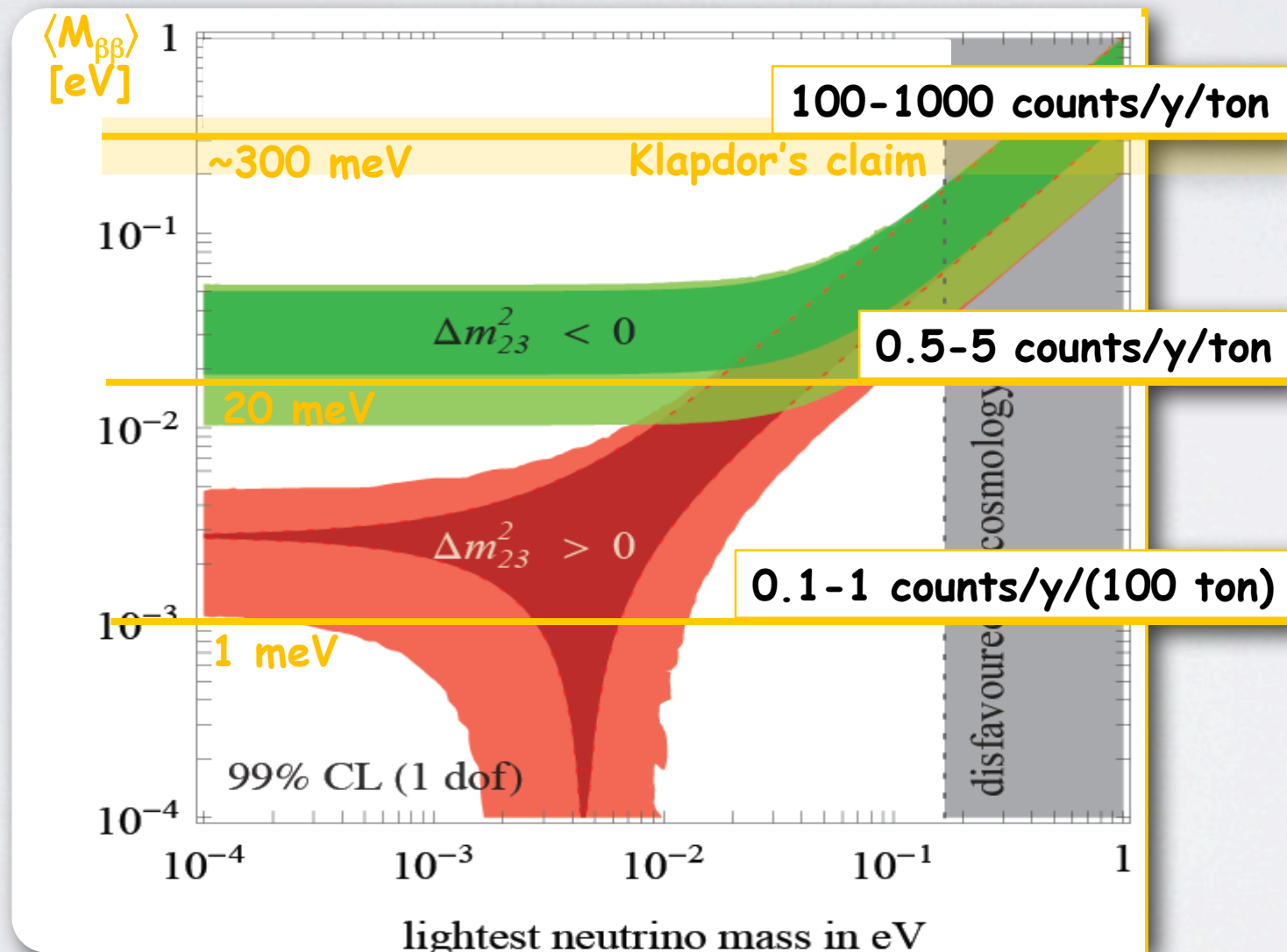
November, 2012

OUTLINE

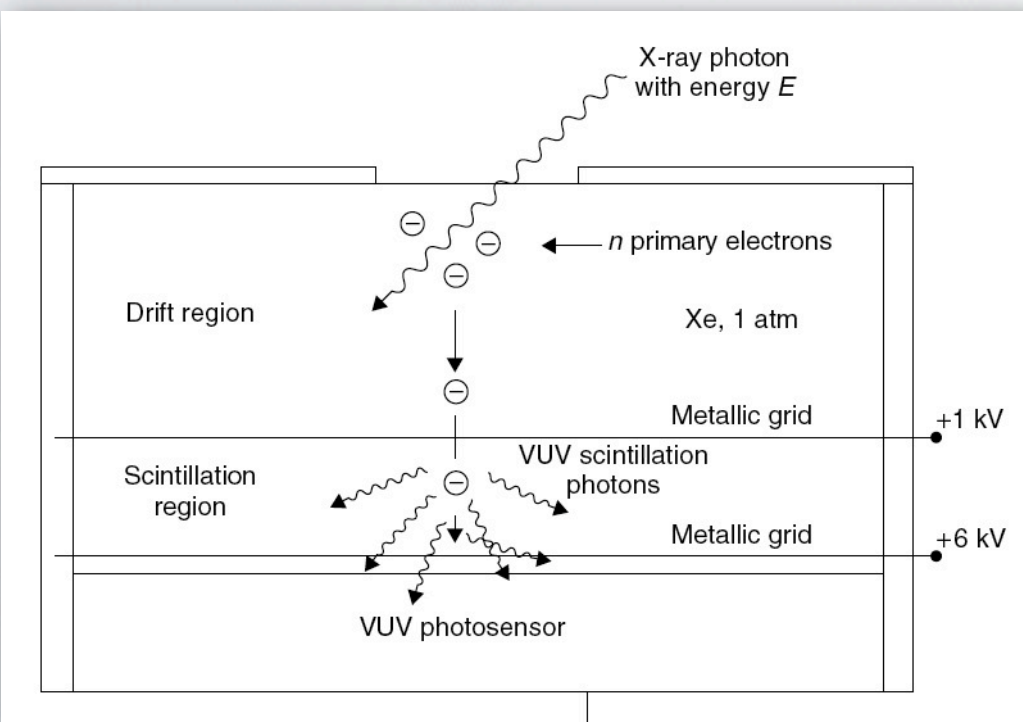
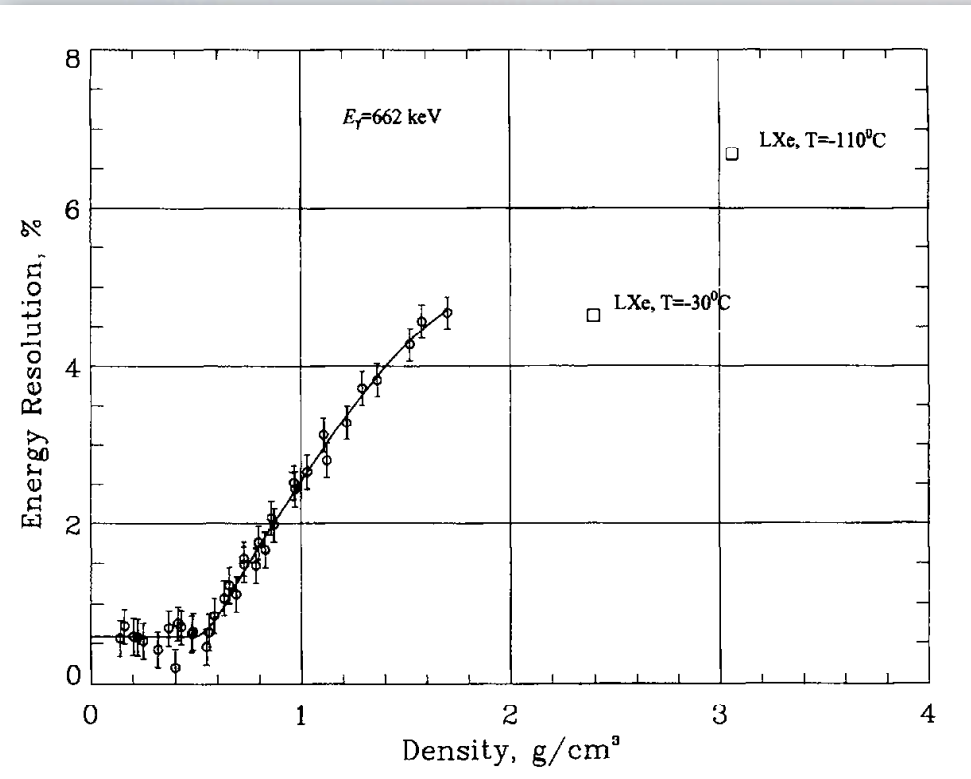
- NEXT physics case
- News from Madrid.
- News from USA
- Schedule
- The next six months.
- Beyond

Experimental challenges

$$(T_{1/2}^{0\nu})^{-1} = \boxed{G^{0\nu}(Q, Z)} \boxed{|M^{0\nu}|^2} m_{\beta\beta}^2$$

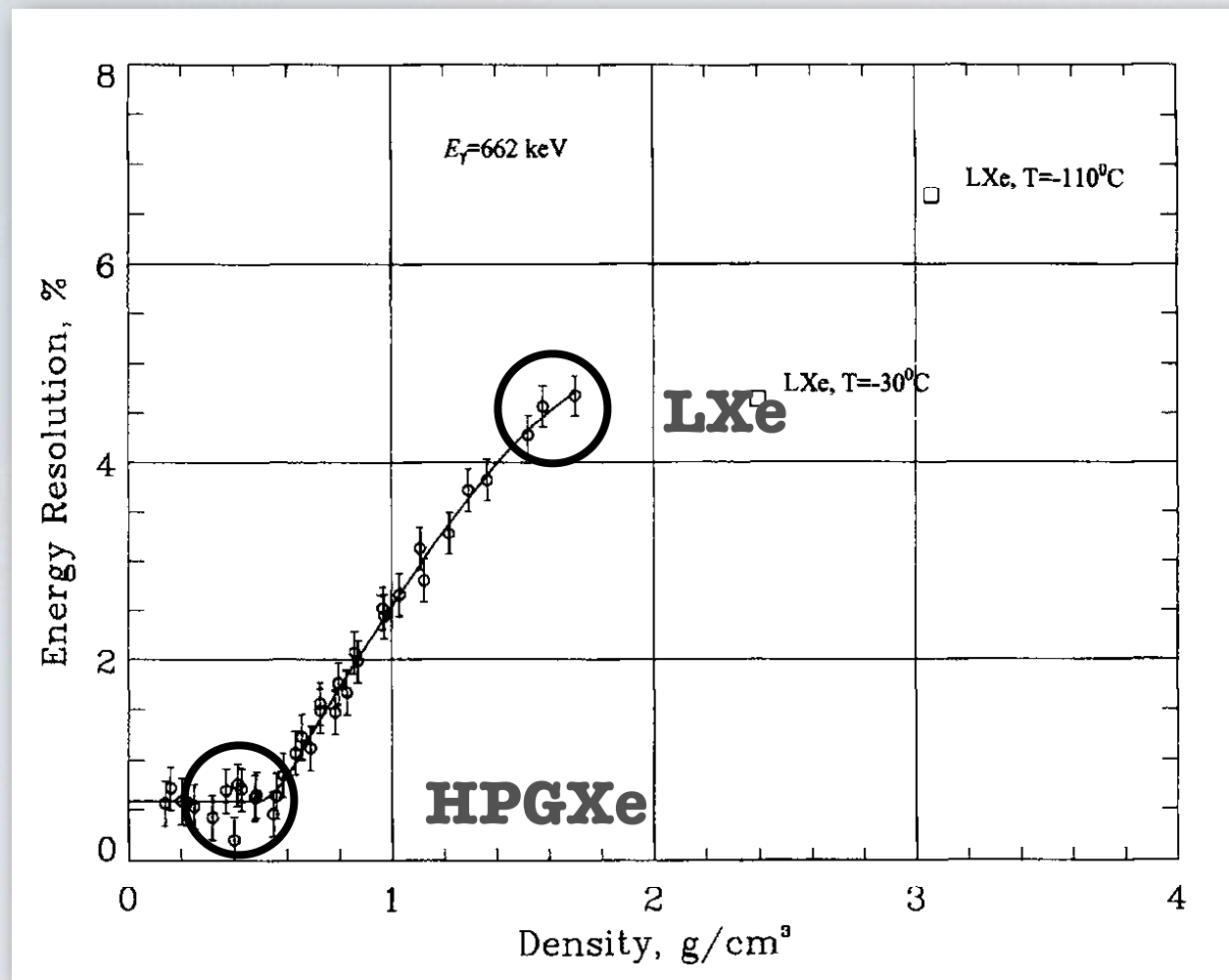


NEXT: A HPGXe

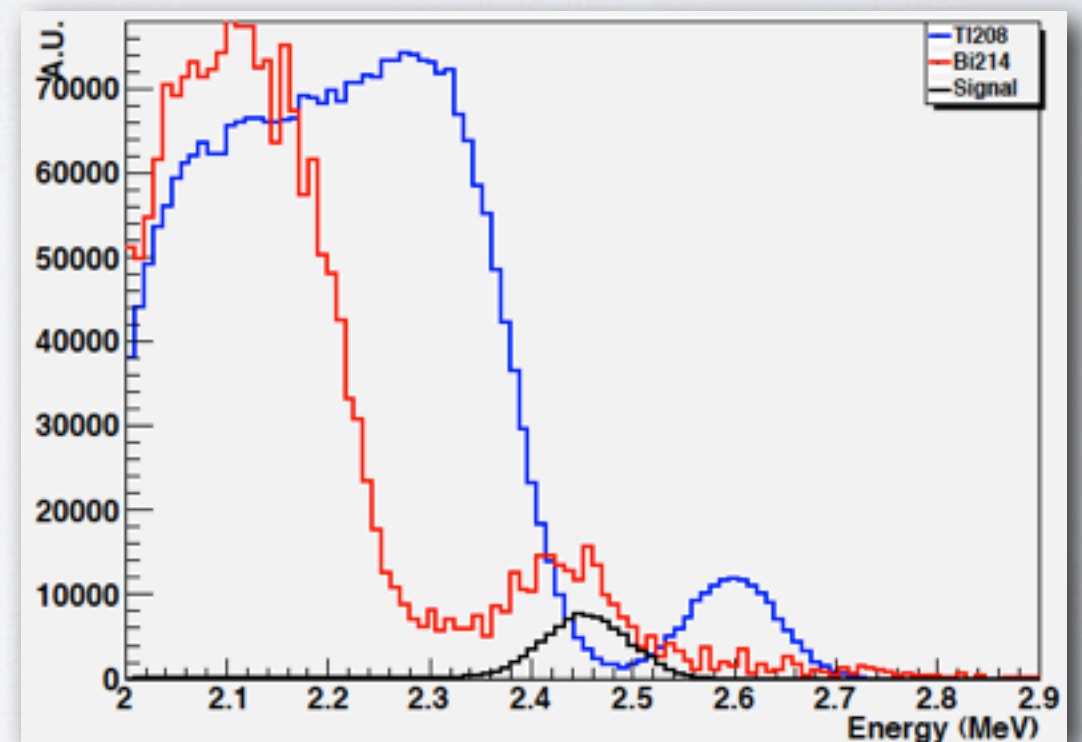
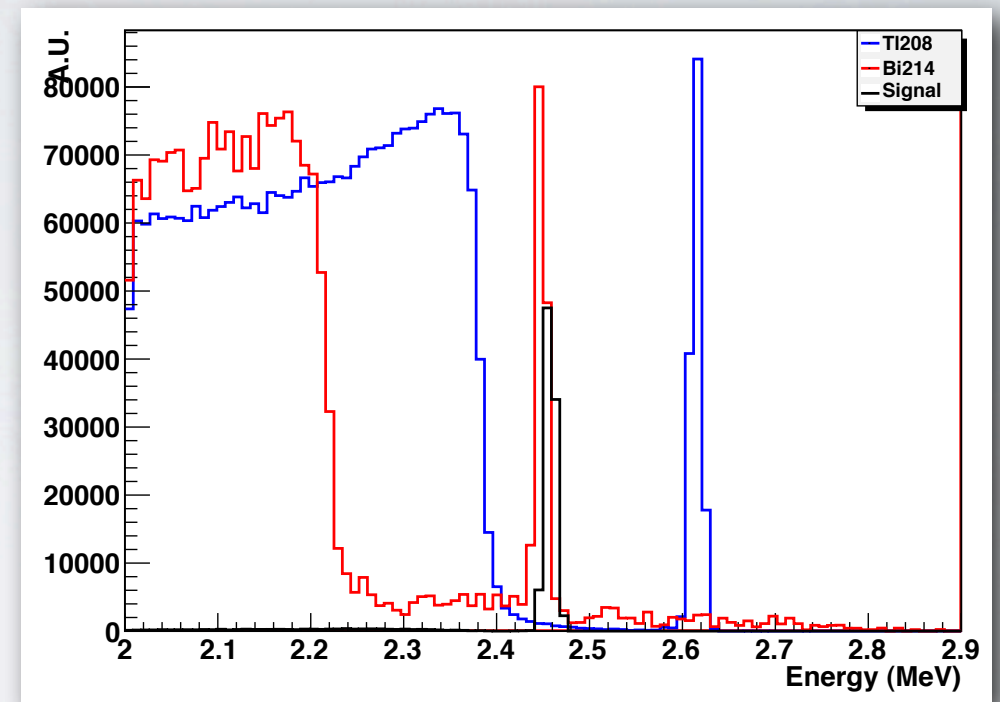


- **Principle 1:** Resolution in a HPGXe is much better than in LXe, and can get close to that of Ge detectors. NEXT-DBDM has measured a resolution that extrapolates to **0.5% FWHM** at Qbb.
- **Principle 2:** Achieving a resolution equal or better than 1% FWHM at Qbb requires lineal amplification of charge. Use **electroluminescence**.
- **Principle 3:** Separate the energy and the tracking function (optimize sensor type) (**SOFT**)

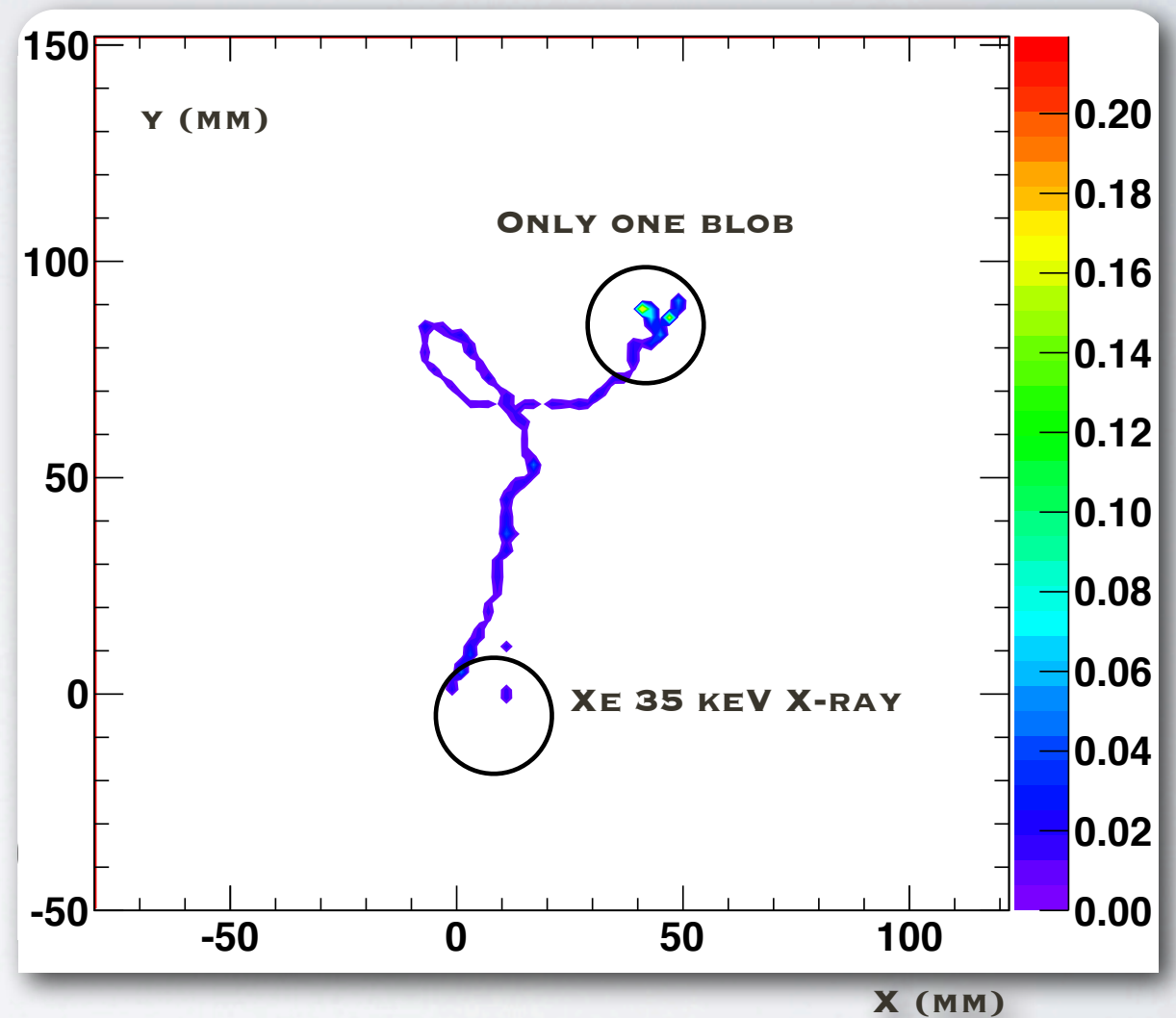
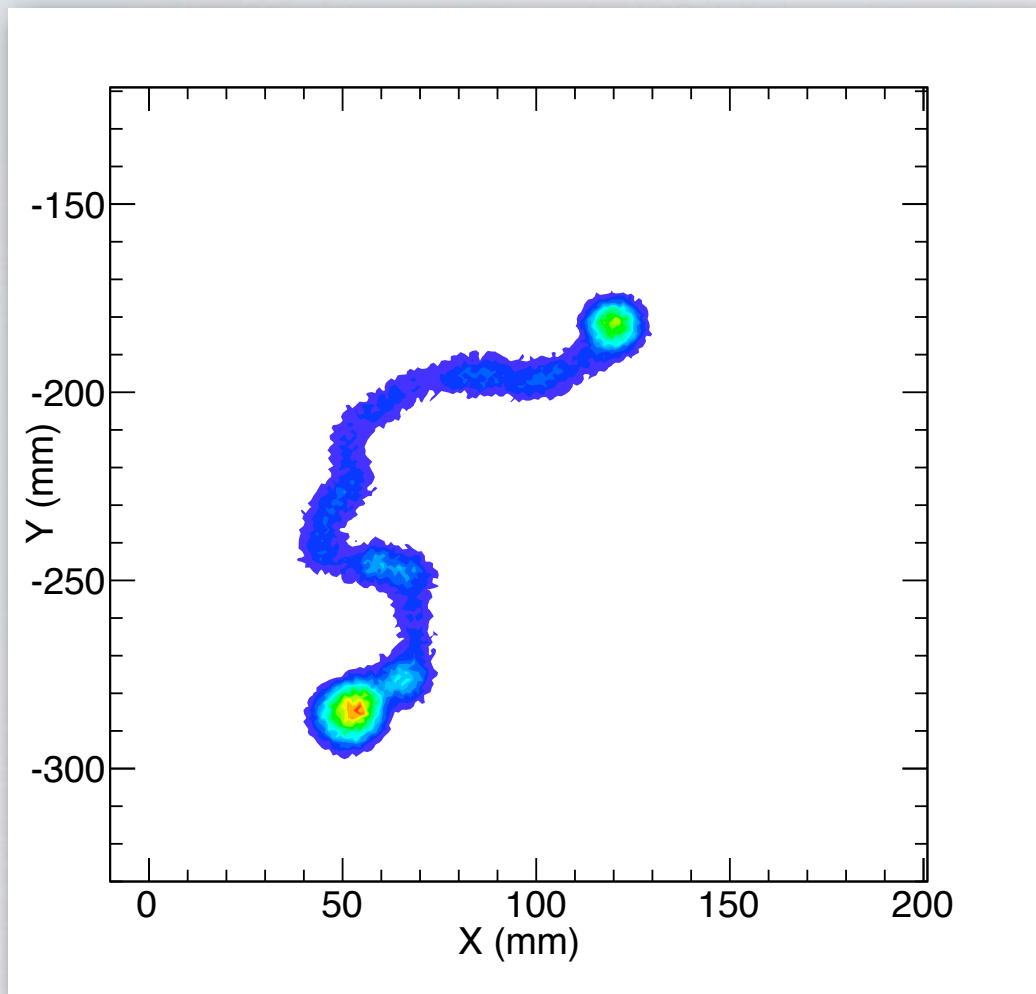
HPGXe vs LXe



- HPGXe can achieve a resolution 5 to 10 better than LXe. Essential!



HPGXe has a topological signature (extra handle)



The law of diminished returns in $bb0\nu$

$$m_{\beta\beta} = K \sqrt{1/\varepsilon} \left(\frac{b \Delta E}{Mt} \right)^{1/4}$$

Today: ≈ 200 meV. Inverse: ≈ 20 meV

Need to Improve by 10^4 !!! HOW??

EXO: Mass could improve by 10^2 (30 kg y to 3 ton y).

Resolution is fixed by the technology: Thus, a LXe detector needs to reduce background rate by 10^2 (from 10^{-3} ckky to 10^{-5} ckky)

VERY DIFFICULT

NEXT vs EXO

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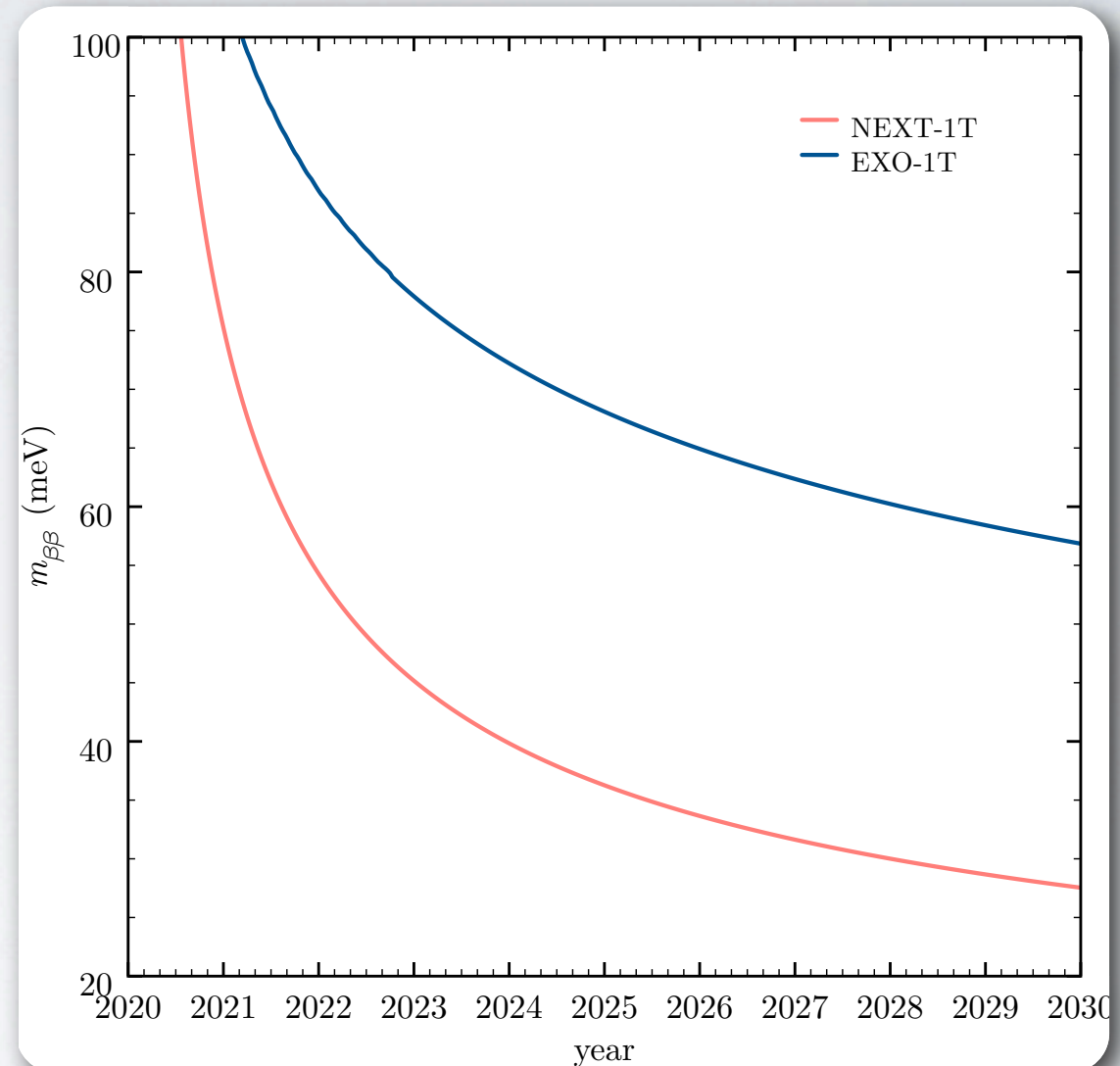
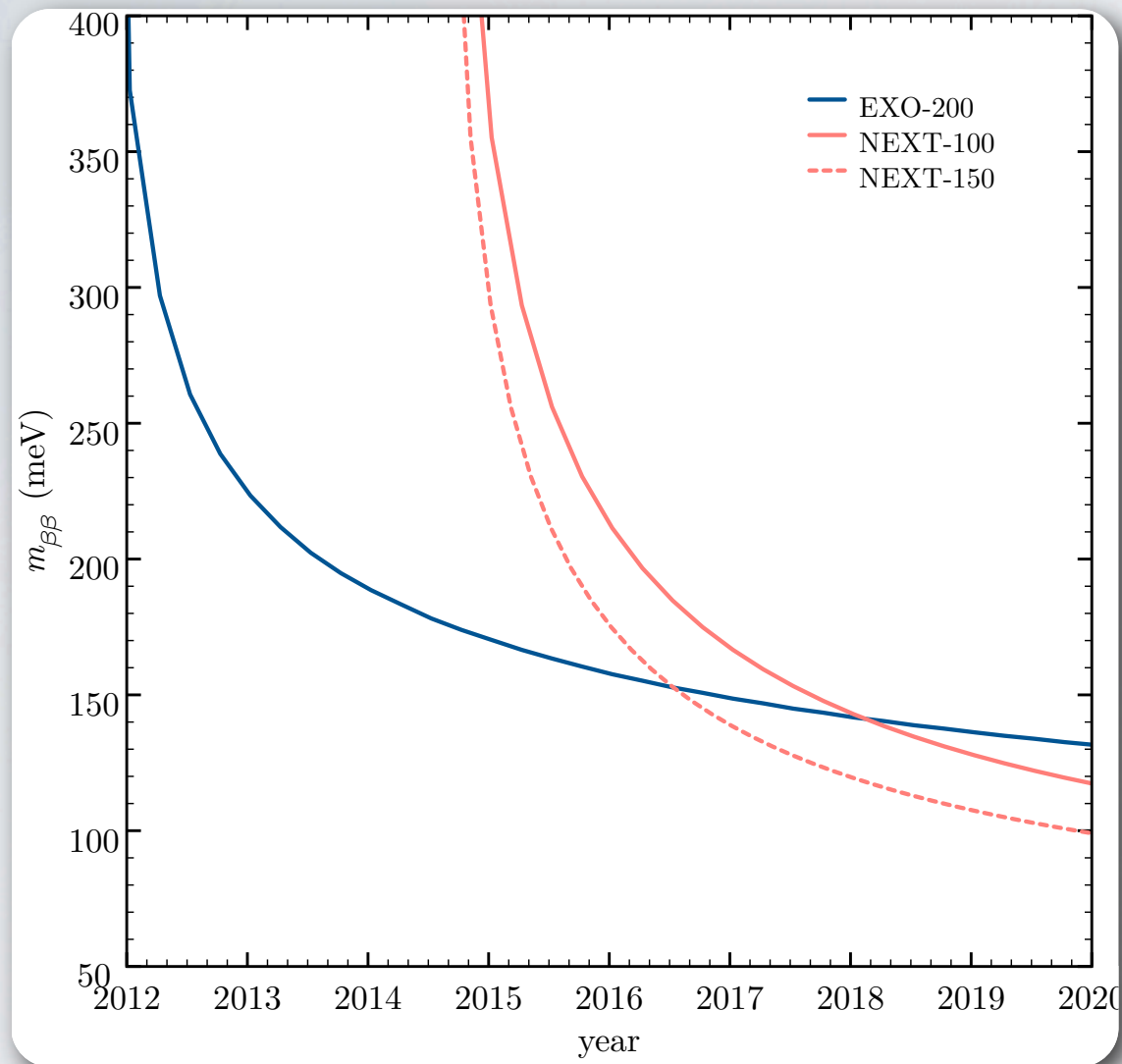
NEXT: Mass to 1 ton (thus reach 3 ton y).

Resolution can be a factor 10 that of EXO

background rate can be a factor 10 that of EXO (from 10^{-3} ctky to 10^{-4} ctky)

DIFFICULT TOO but not So difficult

NEXT vs EXO



Notice: NEXT-100 has a clear physics case.
But NEXT-1ton has the potential of covering the inverse hierarchy! Therefore, NEXT-100 is also the prototype of NEXT-1ton

NEWS FROM MADRID

- Submitted coordinated project (IFIC, UAM, UPV)
- Obtained circa 500 k€ for two years.
- Asked for a redress (alegaciones). No news yet.
- Objective criticism from committee: Not enough publications (energy resolution, topological signature, radiopurity) and no secured funds from international collaboration.
- Need to present a new proposal in January 2014.
- To succeed: a) papers, b) advance detector as much as possible, c) secure extra funds.

NEWS FROM USA

- New interest in NEXT from FNAL and ANL.
- Met at FNAL (LBNL, Iowa, Texas, FNAL, ANL, UNM + IFIC).
- USA side of the collaboration strongly reinforced by the addition of new groups (major national labs)
- Proposal to DOE to be submitted before the end of the year (tbc).
- Proposed responsibilities: Energy plane, field cage, electronics for the SiPMs.
- Clyde Robson (Stockholm) + UNM will do Slow control

SCHEDULE

- Assuming USA request is submitted before the end of 2012, approval may arrive by summer 2013.
- Field cage may be ready before the end of 2013
- Energy plane may be ready first quarter of 2014.
- SiPM electronics may be ready before summer 2014.
- Therefore, tracking plane needs to be ready first quarter of 2014.

SCHEDULE (2013)

- Complete infrastructures: pedestal, castle, PV and gas system.
- Test PV + Gladys for leaks & pressure.
- Complete DAQ prototype (PMT side?)
- Circulate gas and perhaps read scintillation signals with radioactive sources.
- Get all certificates.
- Install and test FC, grids and HVFT.

SCHEDULE 2013

- Complete radiopurity campaign, including measurements of PMTs.
- Complete and publish analysis of prototype data, including NEXT-DEMO++.
- Fully define tracking plane protocols, prepare for production (end of 2013?)

SCHEDULE 2014

- Install energy plane and tracking plane.
- Complete DAQ, Slow Control.
- SiPMs electronics.
- Run with depleted xenon for at least 3 months.

SCHEDULE

- All the above is tentative.
- Dates of foreseen deliverables must be provided (readjusted) to project manager asap (next few days).
- GC to be redone this week and final schedule to emerge.

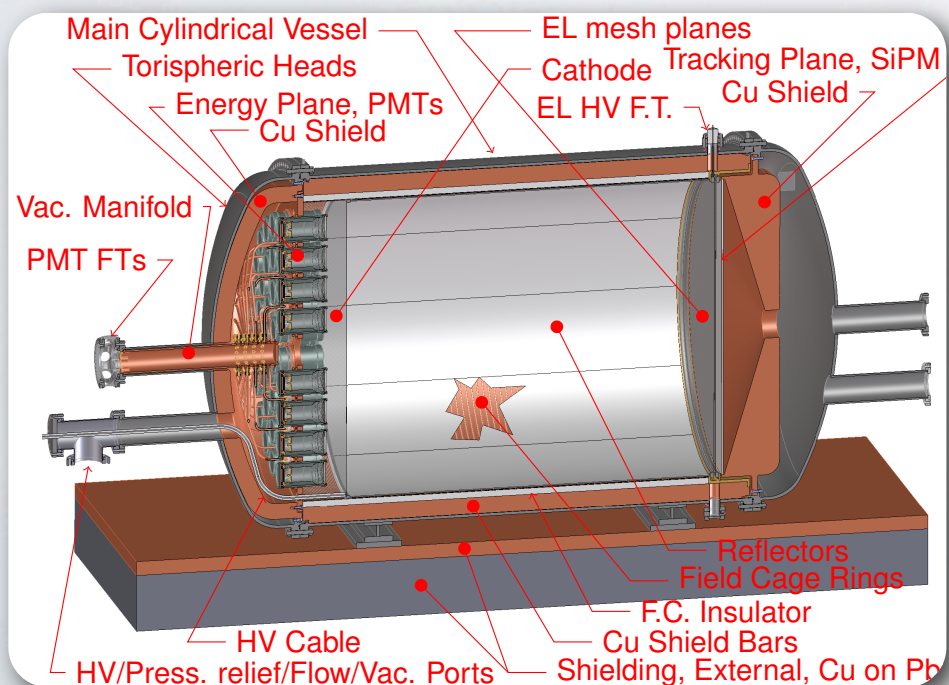
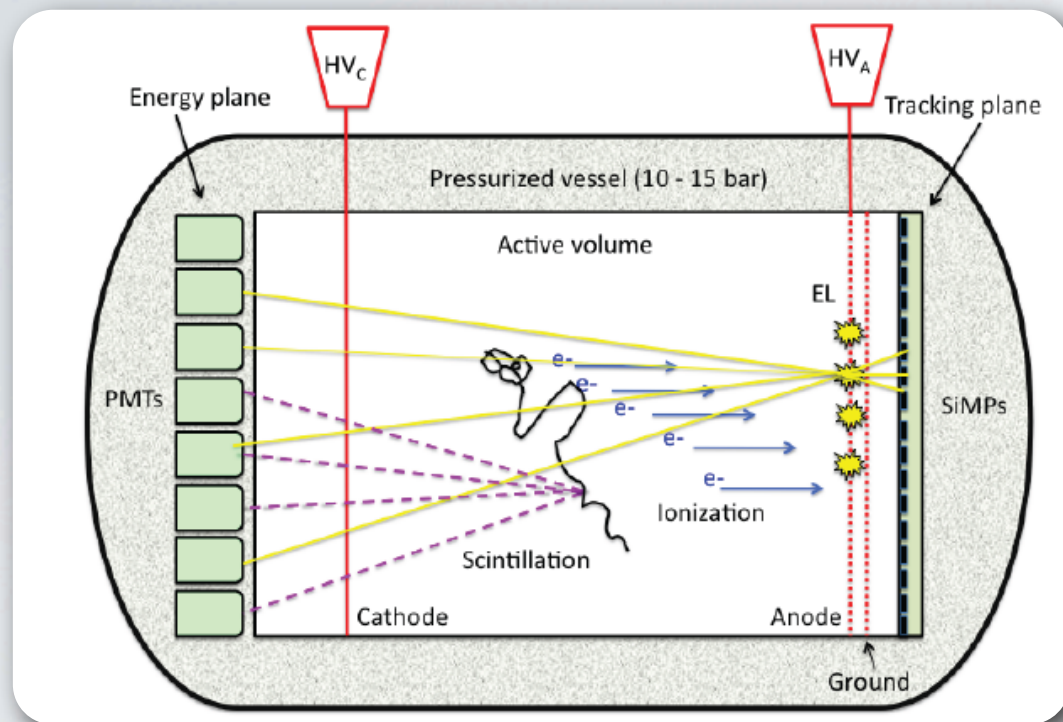
THE MONEY SITUATION

- Assuming that the USA contribution comes through...
- With the help of LSC (lead needed...)
- The remaining of Consollider money...
- And any cash you may find... (lotteries, etc.)
- THE BASIC DETECTOR CAN BE PAYED.
- Therefore, good chances that ministry is convinced of feasibility of project in 2014 and provides enough funds for final gas system, shielding and operation.

ASSESSMENT

- Complex situation.
- Unavoidable delays wrt schedule (due to lack of funds, thus self-fulfilled prophecy by spanish science officers).
- Not impossible.

NEXT-100 program

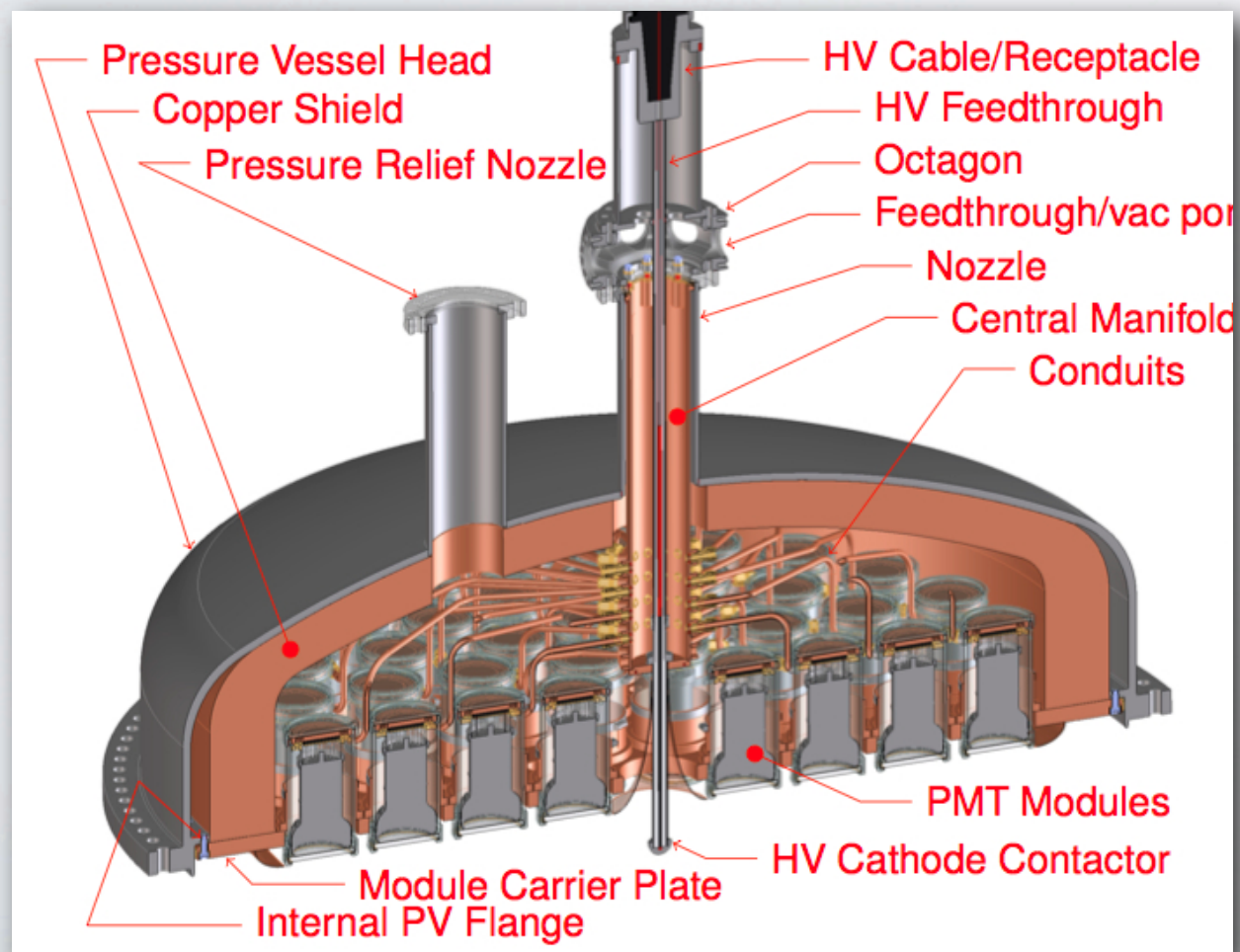
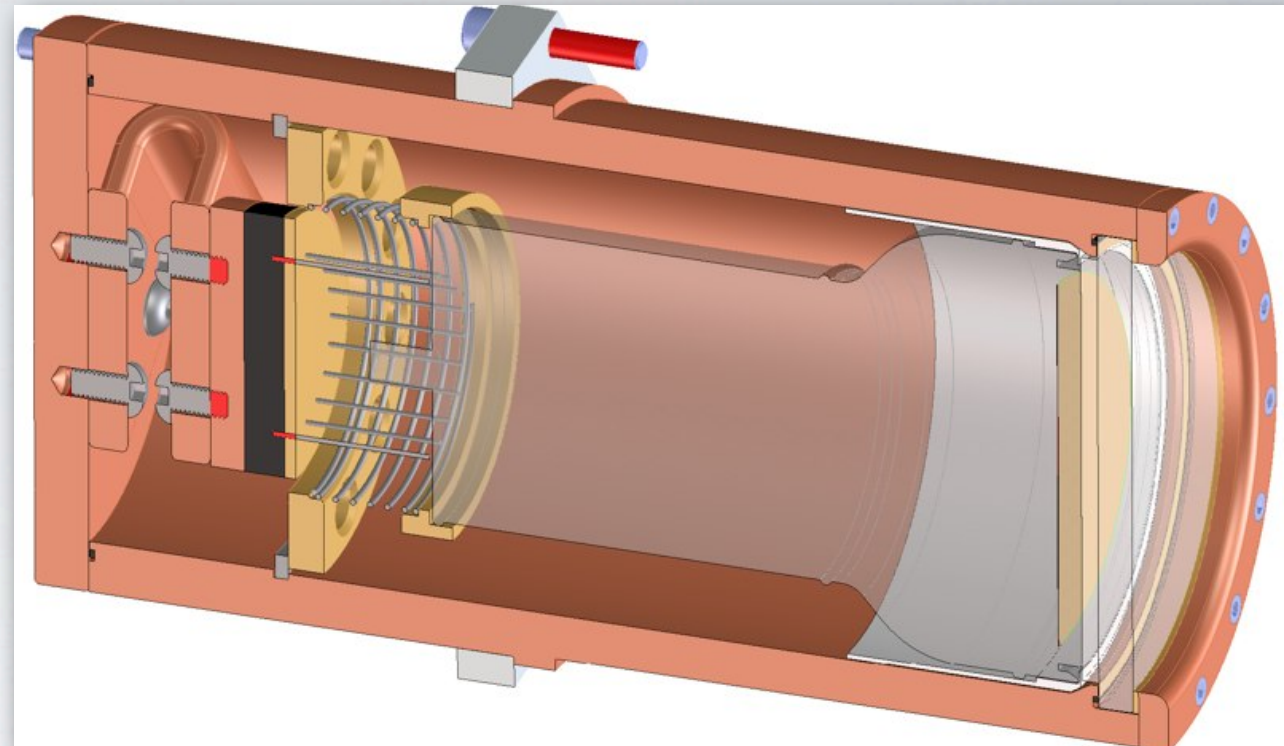
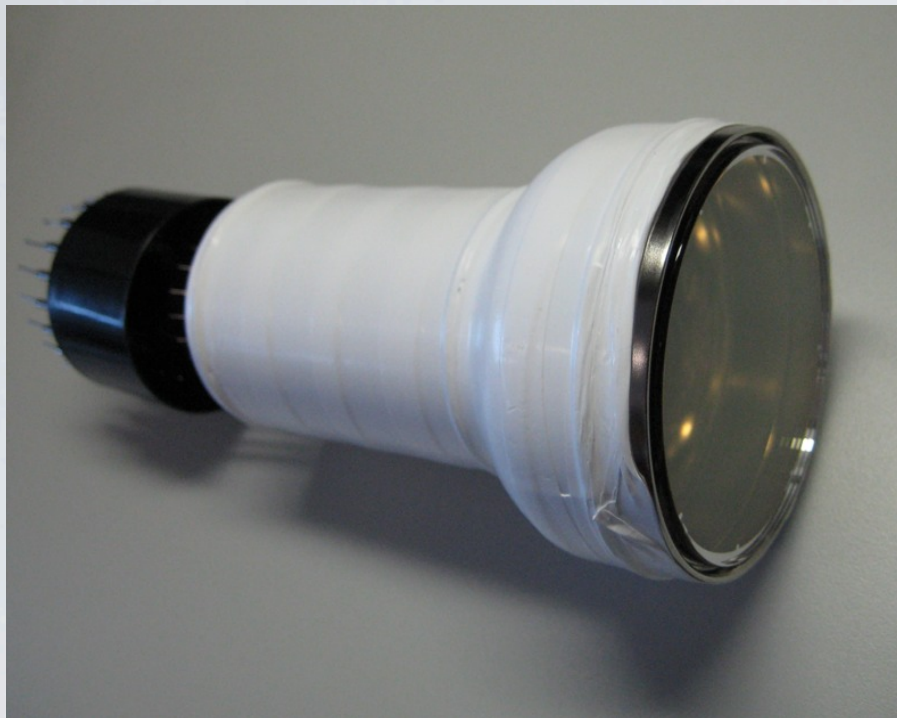


- **Stage 1 (2014)**: Run with depleted Xenon. Demonstrate a resolution better than **1.0% FWHM** at Q_{bb}. Measure backgrounds from the data themselves.
- **Stage 2 (2015-2016)**: Physics run with EXe (100/150 kg). Reach or improve EXO.
- **Stage 3 (2017-2018)**: Demonstrate NEXT-1ton. TMA, SAINT, Improvements in tracking. Aim for resolution of **0.5% FWHM** at Q_{bb}. Physics run with improved detector.

NEXT DEMO



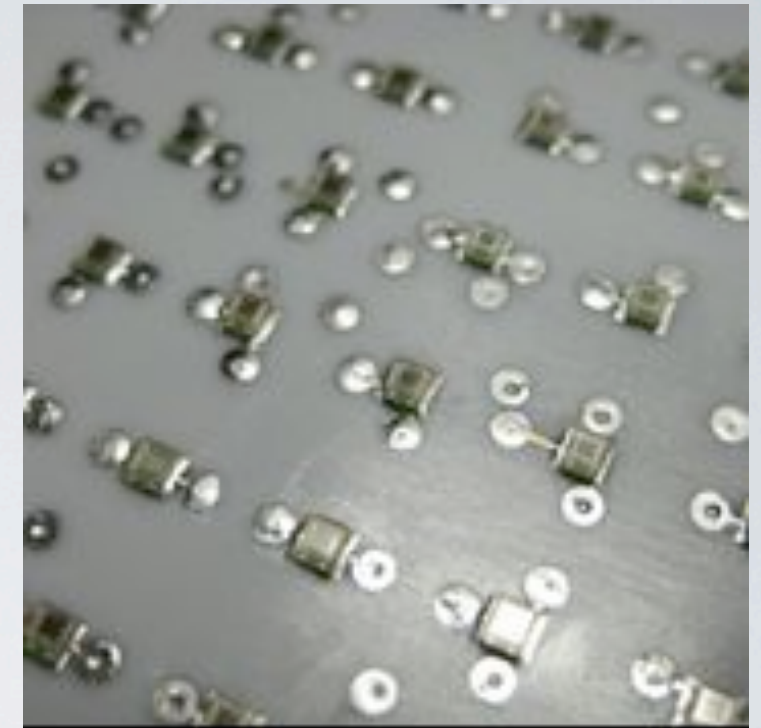
- Roughly a scale 1/20 NEXT-100
- Can be upgraded with new field cage, PMTs in cans, new tracking plane.
- NO NEED FOR MORE PROTOTYPES.



- Energy plane: 60 radiopure PMTs from Hamamatsu (3" diameter, 1-3 mBq/PMT)
- PMTs already purchased
- Complete design of cans and energy plane: LBNL + ANL



- New field cage (prototype for DEMO) asap
- We may need new coating oven

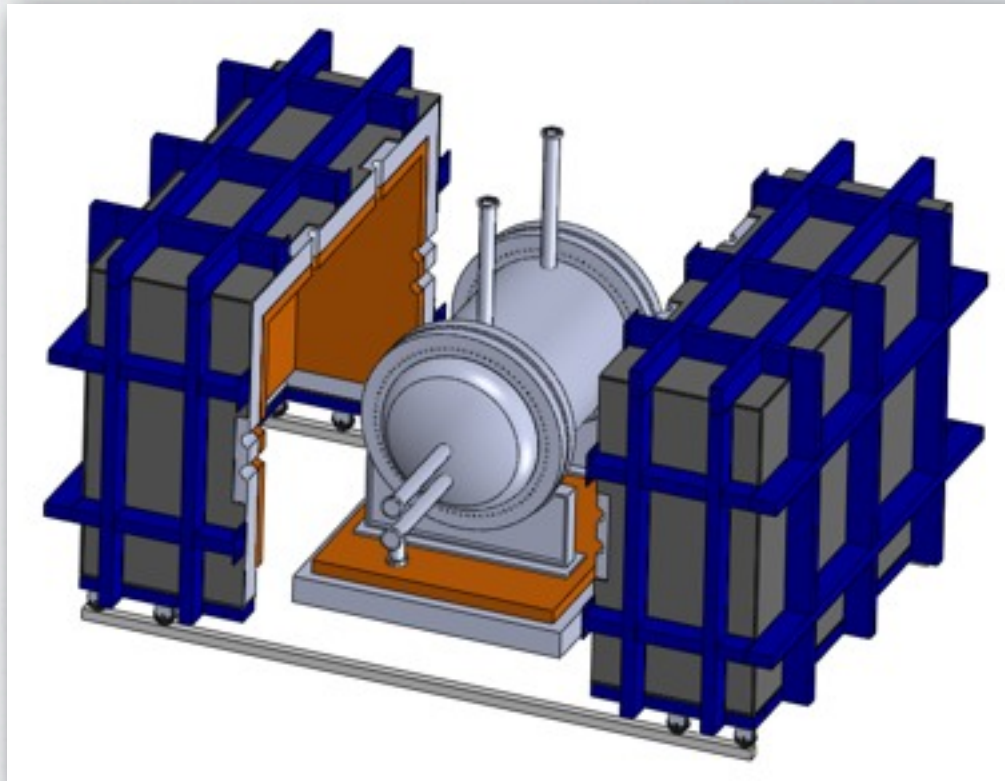


- New Tracking plane made with “Dice Boards” (DB) of SiPMs, 1mm² size, coated with TPB
- About 110 DBs, (~7000 SiPms), each DB is an array of 8x8 SiPMs at a pitch of 1cm in NEXT-100
- Design to be refined (since we have extra time). Production to be launched in late 2013 or early 2014.

NEXT: Construction



- Infrastructures to be built asap
- Should be ready by summer 2013.



NEXT ROUND OF PAPERS

- Papers on prototypes: almost ready: NEXT-DBDM, NEXT-DEMO (Na22), NEXT-DEMO (alphas).
- Paper on radiopurity essentially completed.
- Paper on PMT calibration with scintillation light completed.
- These five papers must be uploaded to arXives by 14th November, if needed with a “bula” from src.
- Final version of papers in arXives + journal before Xmass.

Summary

- NEXT may have the best physics case of all $bb0\nu$ experiments of its generation.
- It may be the only experiment that can extrapolate to 1 ton.
- Schedule is still OK
- Project still plausible.

<http://next.ific.uv.es/>



■ **THANKS FOR YOUR ATTENTION**