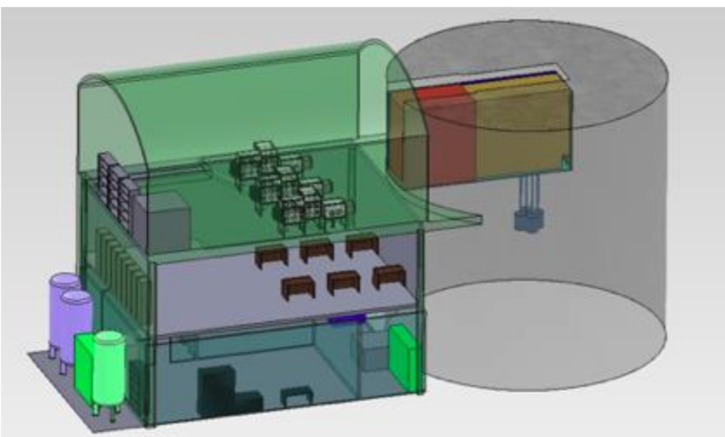
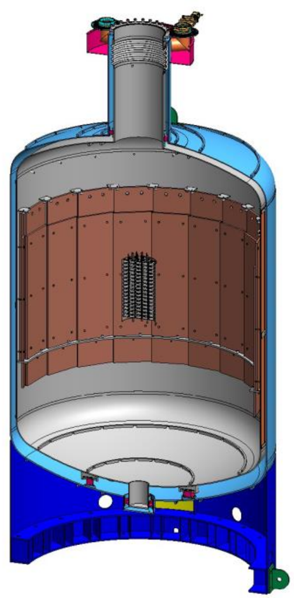
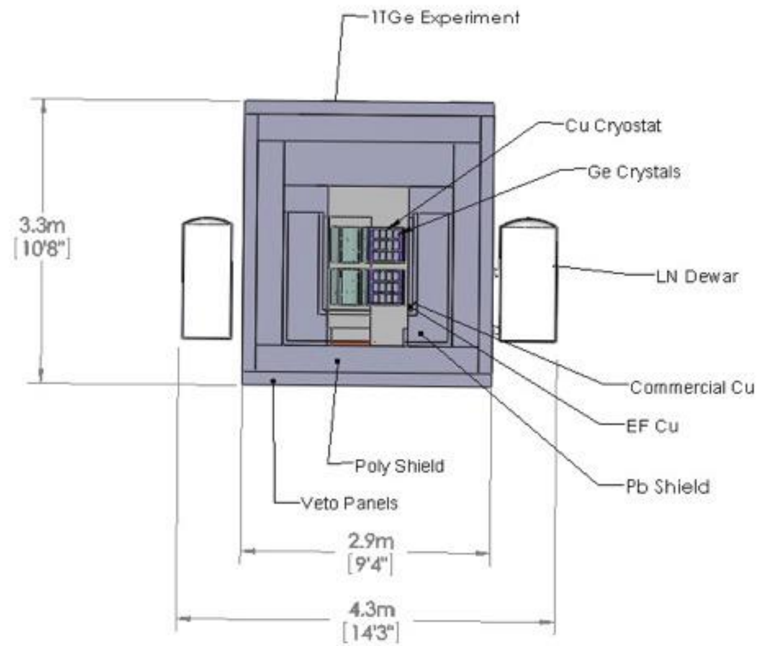
# Next generation 76Ge 0νββ-experiment: next steps and Work Breakdown Shedule

**B. Majorovits,**
MPI für Physik, München, Germany





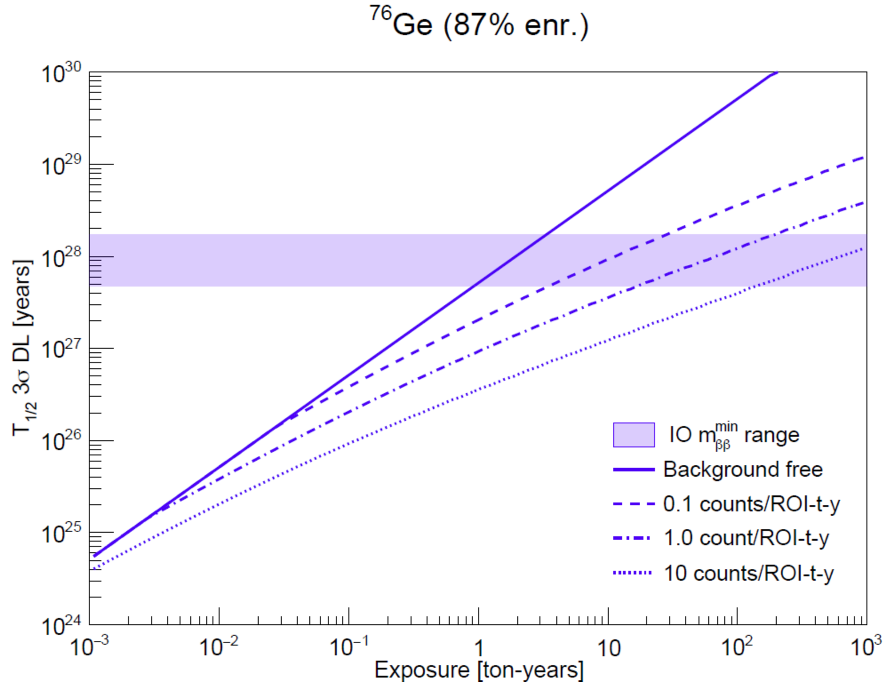


# Working assumption(s):

## Downselect of strategy for time planning:

$^{76}$Ge technology should remain at forefront of sensitivity of 0νββ decay experiments during preparation phase for next generation experiment.

Avoid gap (> 10 years?) without physics data taking after finishing MJ and GERDA!



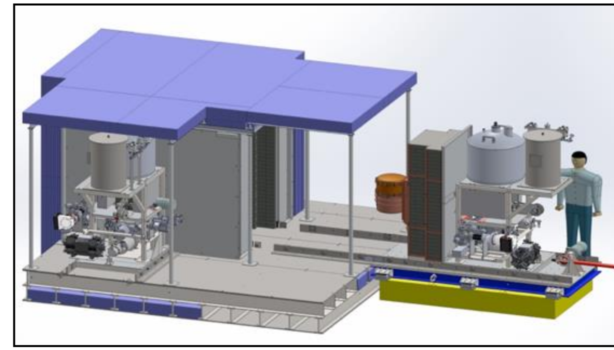

Preparation of infrastructure for final ton scale experiment needs to start as soon as possible, irrespective of the scenario

# Working assumption(s):

## Downselect of technology:

**Majorana like:**

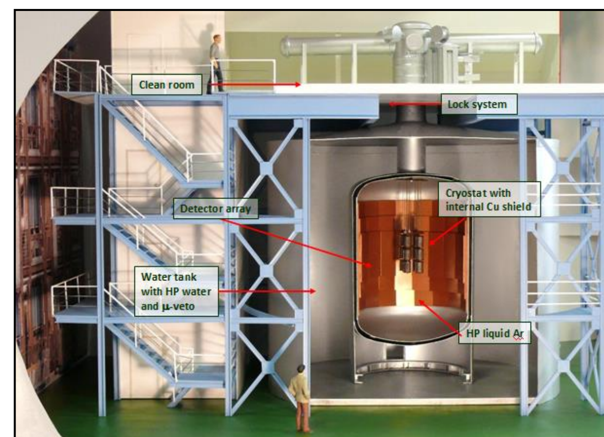
**Detailed investigation of high Z material in direct surrounding?**
**Turn around fast enough?**



**GERDA like:**

**Need to**
**a) advance passivation technology**
**b) solve $^{42}$K background issue**

$\infty$




**Hybrid solution (Ge encapsulated in LAr):**

**R&D for encapsulation technology that allows for efficient (LAr??) veto**

**Alternative solutions:**

**New ideas? New R&D? Time scales?**

# Possible scenarios:

**Use of GERDA infrastructure for existing diodes:**

Merge the existing detectors (~75 kg) and implement them inside the GERDA infrastructure with as little as possible additional hardware changes.

**Use GERDA infrastructure for 200kg experiment:**

Procure an additional ~120kg of detectors
Merge with existing detectors.
Implement inside the MJD/GERDA infrastructure
Massive reconstruction of lock system/arraying necessary

**Fast implementation of first step (200kg?) in final ton scale infrastructure.**

Time scale?
When can site be selected, when can infrastructure be available?
What is the dependence on site selection?

**→ Need to define down select strategy ASAP!**

# Work Packages independent of strategy:

**0) Evaluate all known challenges from MJD & GERDA**

a) Experiences we have with detectors from different manufacturers & technologies

b) Backgrounds now "testable" with MJD&GERDA:
$^{68}$Ge & $^{60}$Co, cosmic μ-induced neutrons,
Surface alphas, $^{42}$K on surface, etc.

c) Depth requirement

**1) Procurement of Detectors (independent of strategy):**

a) Isotope production

b) Purification

c) Crystal growth

d) detector R&D (BEGe/inverted coax/....)

e) Diode fabrication

f) Detector characterization

g) Surface treatment: passivation technology/LC/Alphas

h) Logistics (transport/shielding)

# Work Packages independent of strategy:

**2) Advanced materials:**
- a) R&D on new ideas (for example self vetoed solution PEN)
- b) Alloys, ...

**3) Detector Mounting (differ for different strategies):**
- a) Holders/Cryostats
- b) Detector array support and guiding of cables from Front end to DAQ
- c) Detector contacting
- d) Infrastructure for assembly → Clean mounting line!

**4) Detector Signal Readout:**
- a) Very front end: JFET/GeFro, alternatives
- c) Cables & feedthroughs, new concepts,...
- b) DAQ and online signal processing

# Work Packages independent of strategy:

**5) Active Veto:**

a) SiPM solution
b) PMT solution
c) Alternatives

**6) Cryostat/Shielding:**

**7) Muon veto:**

**8) Infrastructure ton scale site:**

a) Definition of requirements (Electricity, cryogenics, etc.)
b) Choice of site:
boundary conditions for Underground lab vs. available alternataives
c) Labs and Clean room for detector module assembly

# Work Packages independent of strategy:

**9) Screening**
- a) HPGe
- b) Radon emanation
- c) ICPMS/GDMS/SIMS
- d) NAA
- e) advanced assay techniques

**10) Simulations:**
- a) MC of different designs
- b) Ge Surface events (alphas/n+)
- c) Myon induced background

**11) Analysis techniques/Pulse Shape Discrimination**
- a) Surface characterization n+/p+/passivation layers
- b) Dead layers
- c) Filtering algorithms
- d) .....

# Work Packages related to first step:

## Preparations to use of existing experimental infrastructure
## assumption: use of GERDA cryostat

| | | | |
|---|---|---|---|
| detectors | groove LC | investigate physics/chemistry | 2 years |
| | SAGe type | check PSD | 1 year |
| cryo infrastr. | larger diameter | design+production | 2 years |
| feed through | new design? | more compact | 1 yr |
| cables in chain | coax/flex/?? | smaller cables | 2 yr |
| chain | too small, too thin | different design? | 2 yr |
| electronics in LAr | too noisy | | 1-3 yr |
| cables det-amp | too radioactive | depends on electronics | |
| detector holder | too large | | 1 yr |
| | | | |
| $^{42}$K bkg | reduce bkg | study with enriched $^{42}$Ar | 3 yr |
| test stand | string test | | 1 yr |
| Ge screening | <20 uBq/kg sensitivity | | 1 yr |
| Cu,PTFE,... | clean material | procure | >1 yr |

# (?) Time schedule (?):

2016

- Form Proto-collaboration

2017

- Order additional enriched germanium for first step

2020

- Refurbrishment of existing infrastructure

2022

- Start first step experiment in refurbrished infrastructure

2025

- Install first detectors in ton scale infrastructure

20??

MJD & GERDA data taking

Techn. down-select

Downselect and preparation of site

Prepare infrastructure for first stage

Measure in re-furbrished infrastructure

First mesaurements in ton scale infrastructure

# Further reduction of background required:

**Cleanliness conditions:**

**Major disciplinary effort:**

**Training**

**Well defined sequences**

**Plan with additional time for keeping surrounding clean!**