TG-10 status report

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on behalf of the TG-10

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Overview

• Completed projects
• Ongoing projects
• Future projects
• Majorana / GERDA Joint Monte Carlo Workshop
• Your input is needed
Recently completed projects

- Placement of PMTs for the muon veto  
  Tübingen
- Validation of MaGe with test stand data (gammas)  
  Munich
- Studies of the angular correlation between gammas in Co-60  
  Munich
- Installation of MaGe in Heidelberg  
  Heidelberg
<table>
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<tr>
<th>Ongoing projects</th>
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<td>(GERDA) MaGe update</td>
<td>all</td>
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<td>Validation of MaGe with test stand data (neutrons)</td>
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<td>Easy geometry implementation</td>
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<td>MaGe documentation</td>
<td>Washington/Munich</td>
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<td>Bench mark processes</td>
<td>Washington/Munich</td>
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Ongoing projects: MaGe Update

• Geometry:
  • Infrastructure → Beams, clean room, lock, ...
  • Water tank → final geometry needed
  • Cryostat → final geometry needed
  • Detectors → Phase I detector geometries needed (database?)
    → Define reference arrays (Phase I and II)
    → Drawings accessible to TG 10?
    → Materials (and thus activities) fixed yet?

• Physics lists, technical details

• Documentation:
  • MaGe user's and developer's guide
Ongoing projects: Validation with test stand data (neutrons)

- Data taken with an 18-fold segmented detector and an AmBe source
- Identification of lines is ongoing
- MC plus background describes most of the features in the spectrum
- Some lines are not described in GEANT4 (meta-stable states)
- Work with neutron data also performed by Majorana
Ongoing projects: MaGe reference publication

- **Aim:** MaGe reference
- Together with Majorana MC group
- GERDA participation: Tübingen, LNGS, Munich
- **Topics:**
  - Scope (double-beta decay and related)
  - Structure of MaGe (flexibility)
  - Physics validation
- Journal: IEEE
Ongoing projects: Easy geometry implementation

- Triggered by material screening group
- New feature: define materials and (simple) geometries from external file, i.e. no re-compiling necessary.
- New feature: new output scheme for detector efficiency calculation
- Manual and test macros available (CVS)
- Test of GDML (more general database) planned
- Further details in the MaGe Workshop
Ongoing projects: Muon veto efficiency

- Calculation of the muon veto efficiency ongoing
- Efficiency of 98.9% obtained with Cherencov detector and scintillator
- Data base of dangerous muons is being build up
- Geometry of scintillator plates to be updated during general MaGe update
Ongoing projects: Calculation of radioactivity limits for Phase I

- Calculation of background from suspension and crystals for Phase I
- Assumptions: 9 Phase I crystals
  - liquid Argon
  - Anti-coincidence analysis
- Allowed activities $A$ for $10^{-3}$ counts/(kg·keV·y):

<table>
<thead>
<tr>
<th>Part</th>
<th>Mass [kg]</th>
<th>$A^{(238\text{U})}$ [μBq/kg]</th>
<th>$A^{(228\text{Th})}$ [μBq/kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystals</td>
<td>18.0</td>
<td>0.13</td>
<td>0.4</td>
</tr>
<tr>
<td>Argon</td>
<td>88605.0</td>
<td>1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Holder</td>
<td>1.1</td>
<td>55.6</td>
<td>10.1</td>
</tr>
<tr>
<td>Electronics</td>
<td>0.6</td>
<td>$\approx 8000$</td>
<td>$\approx 500$</td>
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Planned projects

• Monte Carlo campaign with updated geometry:
  • Estimate of expected background
  • Signal efficiencies for physics processes (0νββ, 2νββ, ...)
  → Major effort in the next months
  → Create reference background table for GERDA

• Pulse shape simulation:
  • Extra software package with interface to MaGe
  • Development together with Majorana MC group

• Simulation of test stands and auxiliary experiments:
  • Monte Carlo validation
MaGe Workshop

- Joint Majorana / GERDA Monte Carlo Workshop on MaGe
  - Majorana and Gerda participation (about 25 participants)
  - Monte Carlo validation – Data to Monte Carlo comparisons
  - Technical issues (code design and development, organization, release policy, ...) and documentation
  - User’s input
  - Discussion of development of pulse shape simulation
  - MaGe ↔ GEANT4 ↔ ILIAS connections
Your input is needed

- If you did work related to Monte Carlo please let TG-10 know.
  - Communication is improvable, please help

- We would like to have input from users:
  - Do you have problems running MaGe, let us know.
  - Are there features which you’d like to see in MaGe, let us know.
  - Are there any changes in the hardware design, let us know.
  - Is there data which does/does not agree with MC, let us know.