TG10 Status Report – Summary of the MaGe workshop

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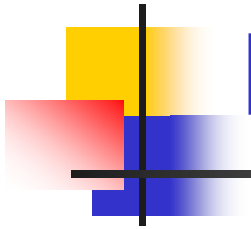
MaGe workshop

- Third general MaGe workshop, Munich-MPI, 18th-20th January 2010
  - "meeting zero" in 2004 at LNGS (when MaGe was born)
  - Meeting in Munich, February 2007
- Slides, list of particicipants and other details available at
  http://wwwgerda.mppmu.mpg.de/meetings/MaGe_Munich2010/index.html
- 23 registered participants, 4 from the US side (including Reyco Henning and Jason Detwiler)

Scope and goals

- Three years are past since the I MaGe meeting in Munich (and >5 since the meeting 0 at LNGS)
  - The development "burst" calmed down and a fairly stable version of MaGe is available
  - The burst now is on MGDO and pulse shape simulation software → **coordinate** the effort
  - "*Minimize double work while making sure that work done is redundant enough to ensure connection to reality*"
- Majo and Gerda are going to start data taking
  - Need reliable/validated MC also for data **interpretation**
- Open road towards a common 1-ton effort
  - Need new background studies
  - New scenarions for MC, need MaGe to be scalable

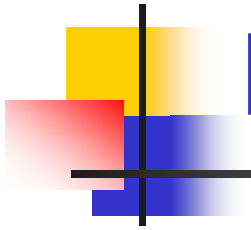


MGDO

- Meant to be a common format (with tools) to help the interface between Monte Carlo and real data (exp. pulse shapes) → discussion this morning
  - It was extensively developed in the past ~2 years
- Includes:
  - Containers ("objects") to treat and manage physical quantities, as waveforms, electric fields, geometry data
  - Interface to MaGe MC simulations via the hits (→ MaGe depends on MGDO, not vice versa)
  - General-purpose tools for data treatment and analysis (FT, filters, calculations) → useful also for **real** data
- A comprehensive manual not available up to now
  - This did not help newcomers to use MGDO interfaces and tools
  - Things going better, **documentation on TWiki**

Pulse shape simulations

- Software for pulse shape simulation is under **very active development** both in Gerda and Majorana.
- Validation with real data also ongoing, **good results**
- A least 3 independent codes developed up to now (although optimized/targeted to different types of detectors) → GERDA + Majorana
  - Advisable that results are cross-checked for a few easy cases (= benchmarks)
  - All codes should be integrated or have an interface to MGDO, to allow the re-use of common tools (not to re-invent the wheel)
- It is important to upgrade the Munich code (developed & tested for true coax detectors) to make it work for other types of detectors (BEGe, not true coax)



Benchmarks - 1

- Agreement to have a comprehensive set of test to benchmark MaGe simulations and pulse shape calculations with simple use cases
- Check for volume overlaps or other (unpredictable) problems in the MaGe geometries
  - Run for new Geant4 versions, main changes in MaGe, compiler upgrades, etc.
  - Test a few “easy” geometries but **tricky enough** that problems may show up
  - Test a **sub-set of real geometries**, that are critical for GERDA and Majorana

Benchmarks– 2

- Compare results obtained by the Pulse Shape codes for two test cases (for which **data** will be made **available**)
  - Munich segmented detector (true coax)
  - Majorana BEGe
- Comparisons step-by-step
  - Check E fields and V_W on a crystals → profiles to be compared quantitatively (χ^2 ?)
  - Check final pulses (rather than trajectories) for ~10 test points distributed in the detectors (especially where one may expect problems)
  - Then validation with exp. data

Pulse shape calculations

- Simulated E-fields and pulse shapes for the BEGe detectors (LNGS and Hd)
  - tuning/debug of the analysis codes
  - evaluation of the cut efficiencies
- Comparison with experimental measurements for validation and cross-check
- See Matteo's talk
- Similar work performed in Munich with segmented detectors
  - electric field and pulse shape calculations
  - comparison with experimental data

1-ton effort (1)

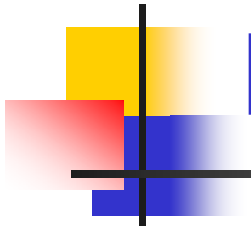
- Need to simulate extremely rare events, goal is **10^{-4}** counts/(keV kg y)
- Monte Carlo job at the moment:
  - Check that there are no **clear show-stoppers**
  - Provide information to the engineers
  - Identify areas where R&D is required
  - Critical items likely to be close parts (e.g. insulators, electronics → irreducible) and surface contamination
  - Probably need a deeper & larger laboratory
- At this point, **manpower** for the 1-ton MC effort is a limiting issue

1-ton effort (2)

- Challenge from the Monte Carlo point of view:
  - Codes to be optimized for speed, need to simulate 10^{12}'s Events
  - Optimized generators
  - Advisable to **benchmark** neutron tracking algorithms (e.g. MaGe/G4 vs. MCNP) with use cases that are easy enough (simple shielding)
- Open discussion whether we want **MaGe** to be **publicly available**, as a *general tool* for the community
  - Consensus not reached. Surely, we distribute(d) the code to individuals who ask it
  - In any case, we don't have manpower (nor will) to provide any support

Background model(s)

- Both Majorana and Gerda are developing independently tools for **book-keeping** of jobs in large simulation campaigns (**NEST** for us)
  - Identify, store and retrieve the parameters of interest
    - File names, material properties, etc.
  - Could be done via a database (in GERDA it is a human-readable XML file)
  - Also tools for spectral fit will be useful
- **Consensus** that the needs of the two experiments are different for this → **no common development** of book-keeping tools
  - Good to have redundancy in some cases



Databases

- No doubt that **we need database(s)** to keep track of data and info
  - calibration, real, MC, slow control, logbook, etc.
- Good to have one single database (not different formats/locations).
- **Maintainance** going to be an issue
- Majorana tried and reported about **CouchDB**
  - Phyton link between MGDO, CouchDB and ROOT
- Database discussion in GERDA is still at a very preliminary (= conceptual) stage
  - To be agreed within the Collaboration

MaGe paper

- Paper originally submitted to IEEE-TNS on February, 2008
  - preprint on arXiv:0802.0860
  - Mixed reviews: ok for one referee, **14** (!) pages of comments from the other
- Paper underwent major revision and rewriting
  - Added new original material
  - Meets some of the recommendations from the 14 pages
- Ready to go again through the Editorial Boards of GERDA and Majorana
  - journal still TBD