TG10 Status report

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Gerda Collaboration Meeting, Geel

June 11th-13th, 2007

MaGe meeting in Munich

A joint **Gerda-Majorana** **MaGe meeting** was held at MPI, Munich on Feb 15th-16th, 2007 (after Ringberg Castle)

thanks to Kevin and local organizers!

Very successful: **25 participants** (6 from US), 14 talks

http://indico.mppmu.mpg.de/indico/categoryDisplay.py?categId=5

MaGe meeting in Munich

Discussion about the status of MaGe and about the future developments.

Meeting very useful to review the present situation and to **coordinate future actions**

→ bi-weekly joint phone conferences

Goal: **improve MaGe general visibility**

Necessary to have a **logo**

present candidate (proposed by Werner)

→

General paper describing MaGe structure and concept is in preparation (joint Gerda-Majorana)

(to be submitted to IEEE-TNS within a few months)

Documentation

The structure and the flexibility of MaGe allows it to be used also by non-MC people via **macro commands** (→ connections with TG11)

A detailed and clear **"user manual"** is necessary, both for the MaGe installation and for its use. Also sections for developers (class structure, etc.)

It is *work in progress* (sections incomplete or missing). Latest version available at the TG10 page of **GerdaWiki**

MaGe - the GERDA/MAJORANA Monte Carlo framework

A user's and developer's guide for GERDA members

Macros that are available with the MaGe code have been revised and "cleaned-up". They can be used by new users to see the main features of MaGe

MaGe meeting

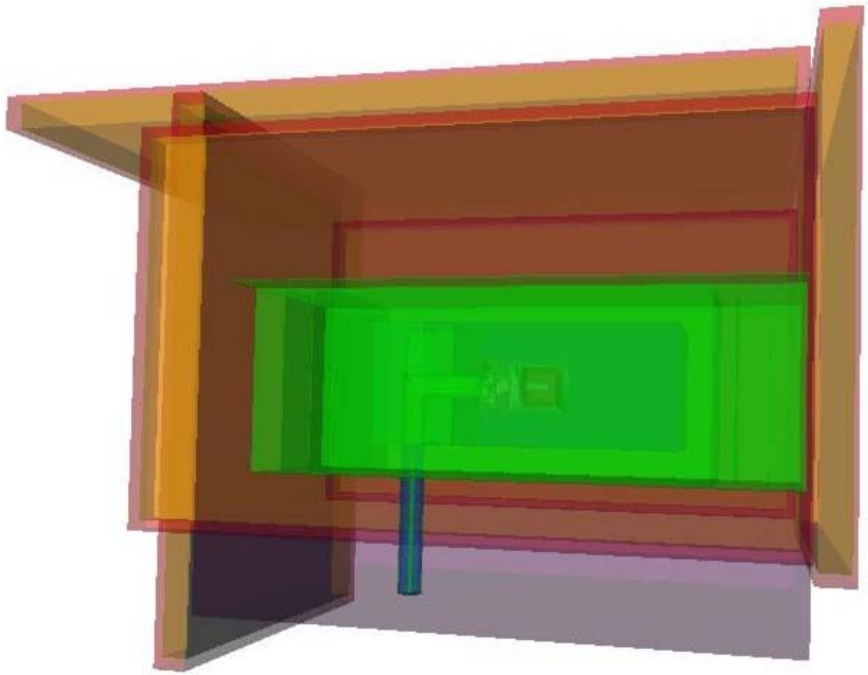
Some **present issues** identified and discussed during the MaGe meeting at MPI-Munich:

- Pulse shape simulation software. It should be possibly interfaced with MaGe
- **Validation** of MaGe, both for neutrons and γ-rays
  - ➡ Benchmarks in a MaGe testing suite
  - ➡ Investigation of known (and unkown) problems of Geant4, e.g. metastable states after neutron capture
  - ➡ Comparison of simulations with test stand data (gamma and neutron sources)
- Version control of MaGe (date-based for now)
- Keep an eye on results with 32- and 64-bit machines

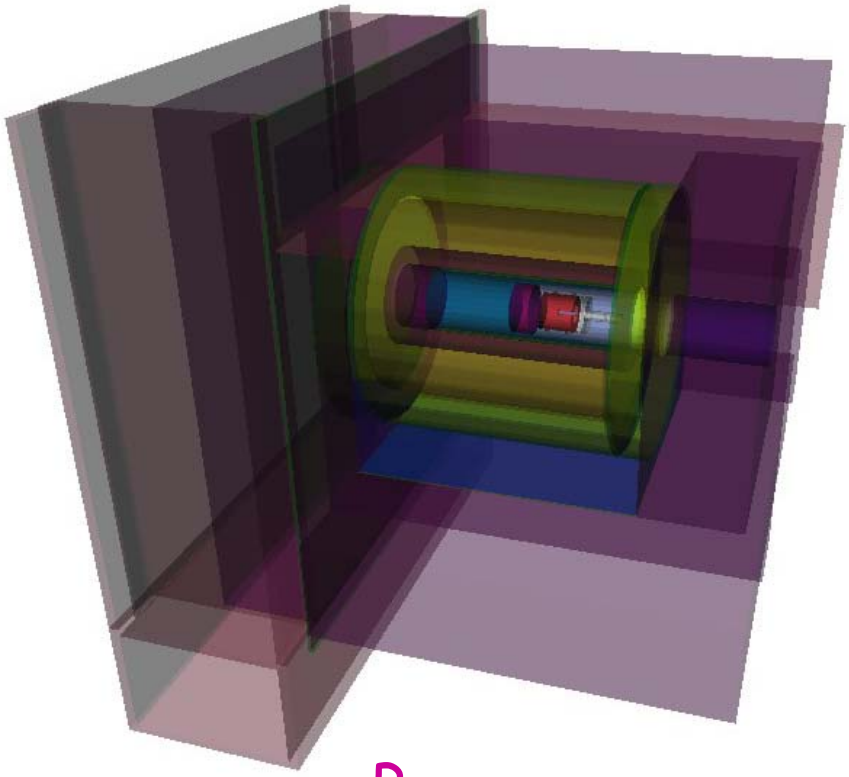
Coordination with TG11

MaGe is being used by the Heidelberg group for the efficiency calculation of Ge detectors (material screening)

3 detectors from Heidelberg have been modeled within MaGe



Corrado



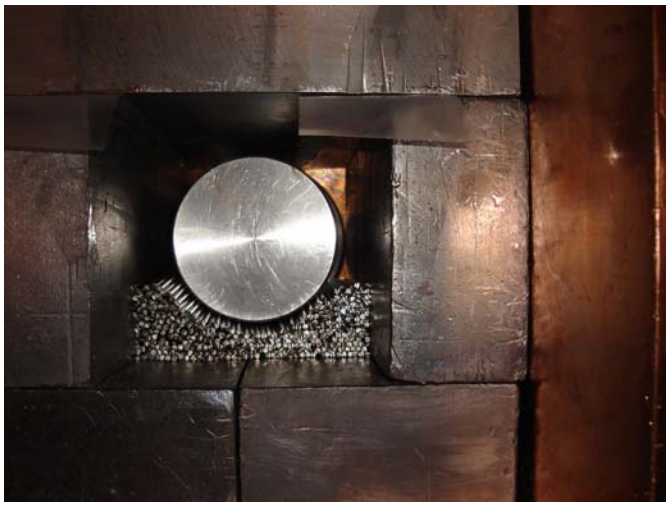
Bruno

Data for validation and **user feedback** can be provided

MaGe in γ-ray screening

Example of measured sample

- welding rods for GERDA cryostat
- measured in Dario detector in Dec 2006



Efficiency estimate using MaGe

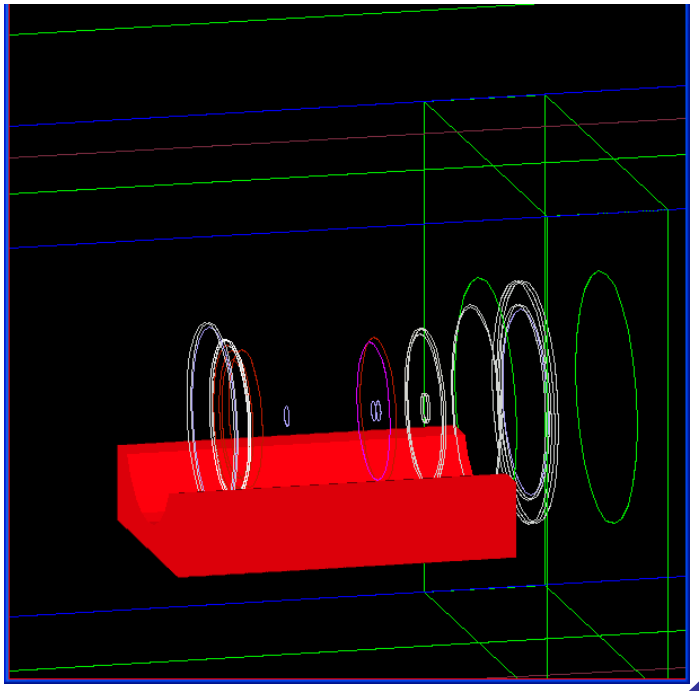
- Creating a model of the sample

  approximate shape and position inside the detector, material and average density

- Simulating decays of each radioactive isotope found in the sample

  For sufficient statistics usually ~10^6 decays are needed for each isotope, randomly distributed in the sample. Simulated isotopes : ^{208}Tl, ^{212}Pb, ^{214}Bi, ^{214}Pb, ^{228}Ac, ^{40}K, ^{54}Mn, ^{60}Co

- (One possible) output from MaGe: energy spectrum deposited in the detector, in 1-keV bins. From this spectrum efficiency for the required γ-lines can be calculated.



New simulation campaigns

Since (semi-) definitive drawings of the GERDA setup are being made available (water tank, cryostat, etc) we are getting ready to **run a new full MC campaign** for the background evaluation

Especially important for **external γ-ray background** (structures, holders, cables). Contributions from internal contamination, muons and neutrons could also be re-evaluated

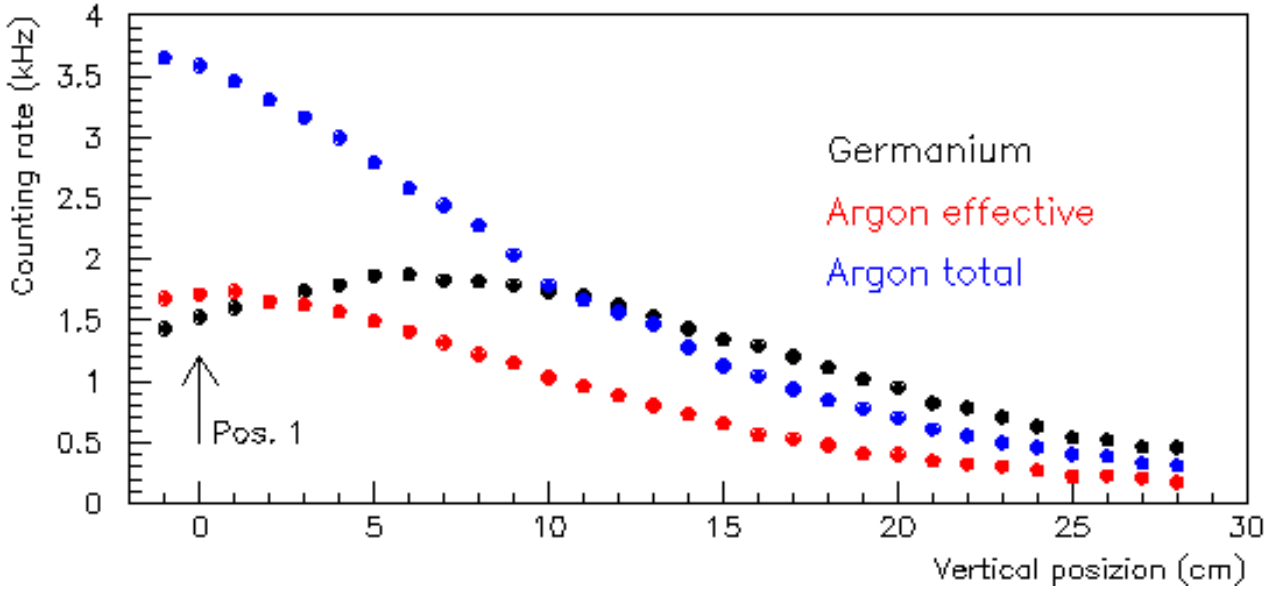
The **GERDA geometry** implemented in MaGe is being updated according to the present drawings

Validation work with test stand data is also going on in Munich (→ material also for MaGe paper)

Simulations of GDL stands

Simulations of the **stands** at the **GDL**, to help with the interpretation of data (e.g. issue of the crystal leakage current under irradiation)

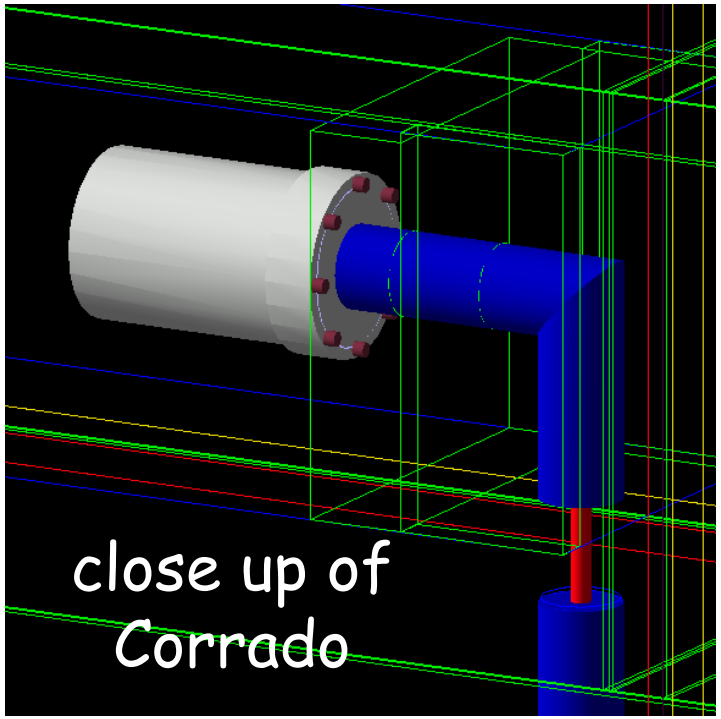
Activity within this topic also by the Russian group (→ Igor's talk at TG1)



The stand (simplified) geometry is simulated in MaGe using the **"external file" approach** (no C++ coding)

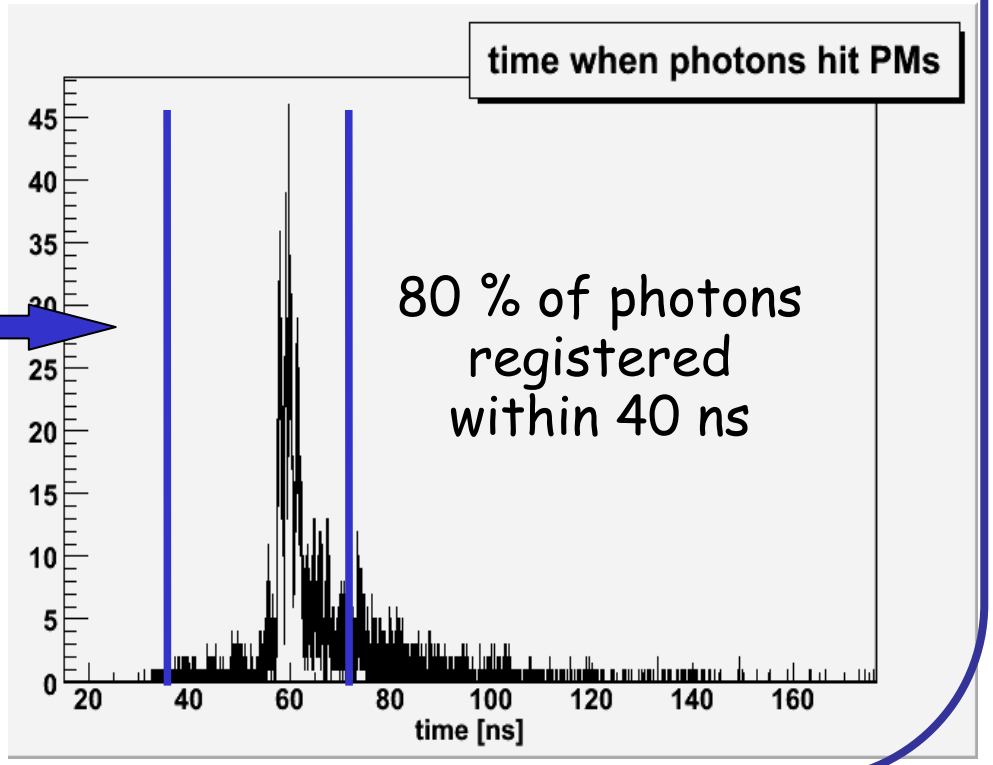
The geometry of the LArGe setup and shielding at the GDL is **being updated** within MaGe.

Other activities



Background studies for Phase I and Phase II and other test stands. Verified that angular correlation of ^{60}Co (neglected in first simulations) has **no effect** on GERDA (GSTR-07-004)

Simulation of Cherenkov light in the muon veto (→ TG7 report)



Goal: to have all stands and setups that are interesting for GERDA **implemented in MaGe**

Pulse shape simulation effort

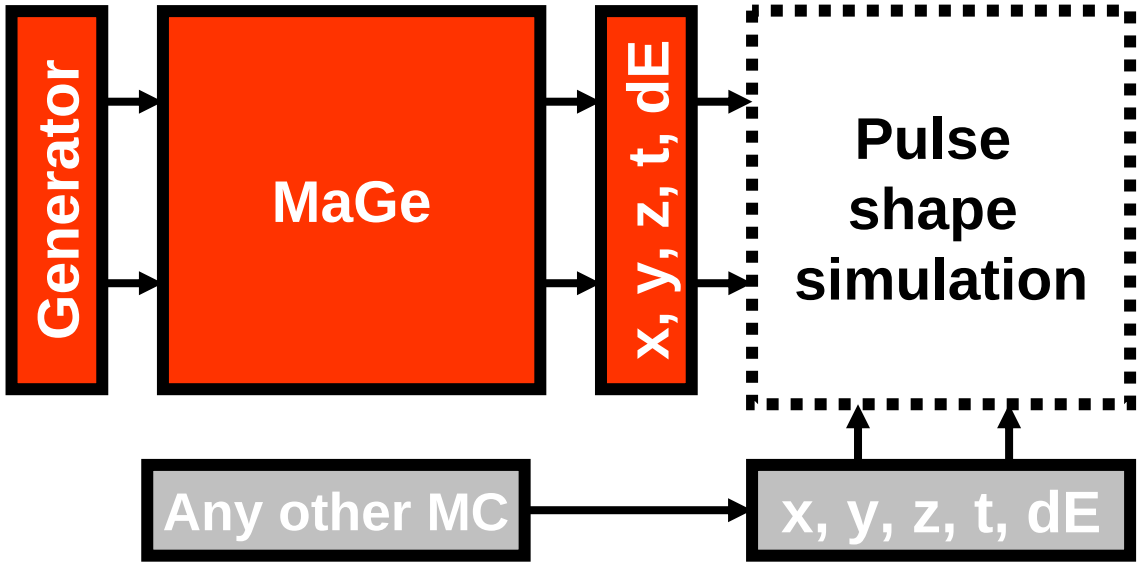
- Help in the interpretation of **pulse shape data** (e.g. spatial distribution of energy)
- Support and test pulse shape **analysis algorithms** (e.g. efficiencies)
- **Complement data** (e.g. libraries of SSE/MSE, border events, spatial distribution/position sensitivity, etc.) → AGATA approach

Technical implementation:

- **Jointly** coordinated and developed by the Majorana and GERDA Monte Carlo groups (excellent experiences from MaGe project)
- Pulse shape simulation will become part of the **MaGe framework** (same CVS repository)

Pulse shape simulation effort

- Use **independently** by the Monte Carlo code (e.g. from file)
- Use in conjunction with MaGe Monte Carlo providing the **whole chain** from event generation, propagation to pulse shape simulation
- Advantages of running with MaGe is the flexibility and existing software infrastructure (e.g. geometry, I/O)



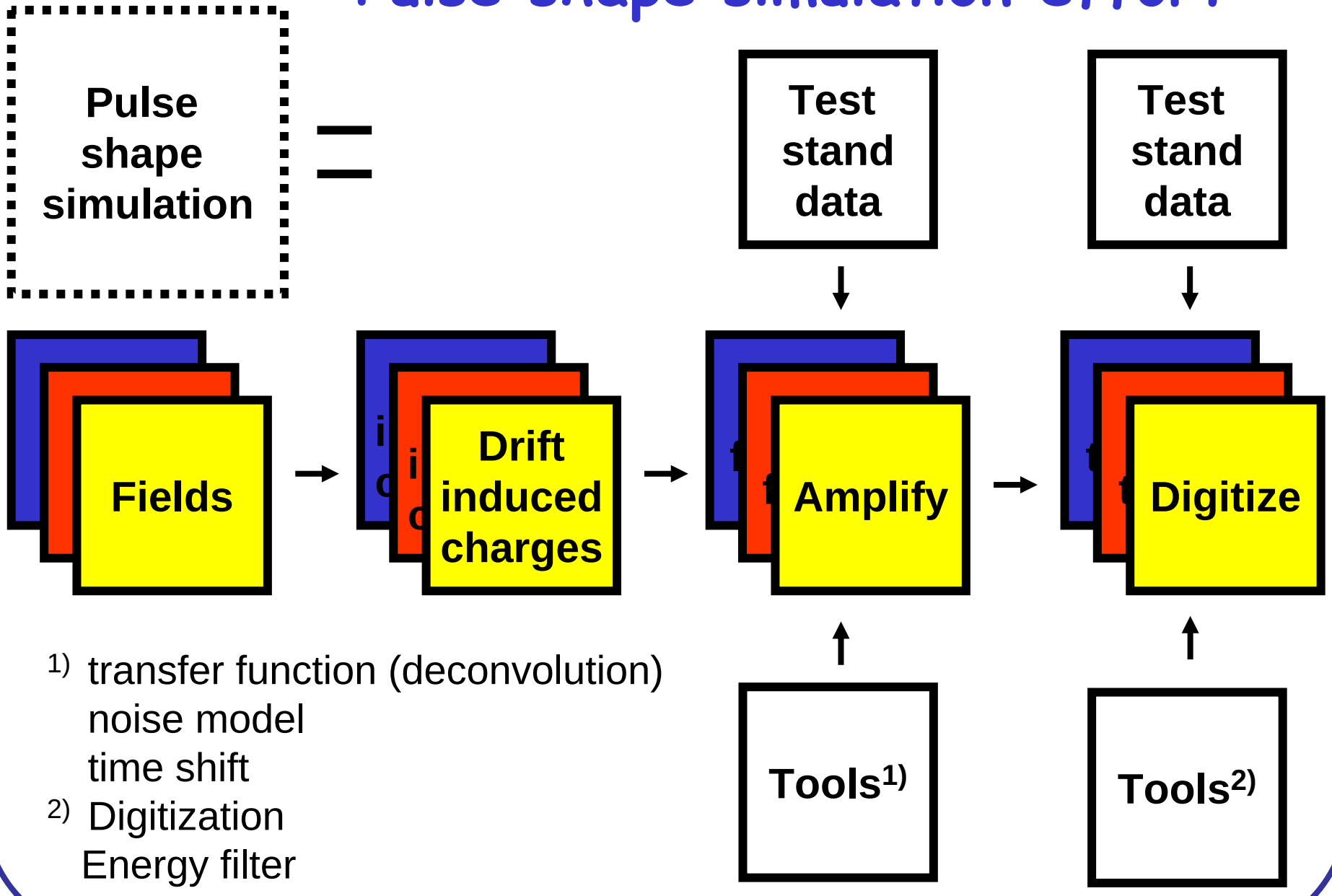
Pulse shape simulation effort

Modular approach:

- Field solver
- Drift model
- Induced charge calculation
- Pre-amplifier / electronics
- DAQ

- Independent **work on modules** (Majorana, Gerda, test stands, etc.):
- Wrap existing (free) code and compare (GRETINA, AGATA, PNNL, home made, etc.)
- Provide "objects" for secondary tools and analysis software (e.g. PSA algorithms, electronic models, DAQ models)

Pulse shape simulation effort



1) transfer function (deconvolution)
noise model
time shift
2) Digitization
Energy filter

Present activities

Background studies:

- Update of the GERDA and LArGe geometries in MaGe
- Study of stands in Munich, GDL and Heidelberg detectors

Validation of MaGe:

- Investigation of Geant4 problems
- Benchmark of MaGe with test stand data (neutrons and γ's)

Pulse shape simulation:

- Build basic objects ✓
- Incorporate basic functionality into MaGe (ongoing)
- Build modules and secondary tools (to be done)

Documentation of MaGe (user manual, general paper)

Conclusions

The **activity** of the Monte Carlo Working Group continues **regularly** (MPI, Tueb., LNGS, Hd, Russia). Coordination with other WGs (TG1 and TG11)

Good communication and coordination with the Majorana side (phone conferences, MaGe workshop). Internal communication with non-MaGe Monte Carlo users can be improved

A major **MC campaign** is going to start to evaluate the GERDA background in the final geometry. Also activity on Munich and GDL stands

Activity for the development of **pulse shape simulation** has started. The idea is to interface it with MaGe, to have the full simulation chain