# BEGe project: chronology/crystal pulling/plans

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# Goal of $^{depl}$Ge BEGe projects

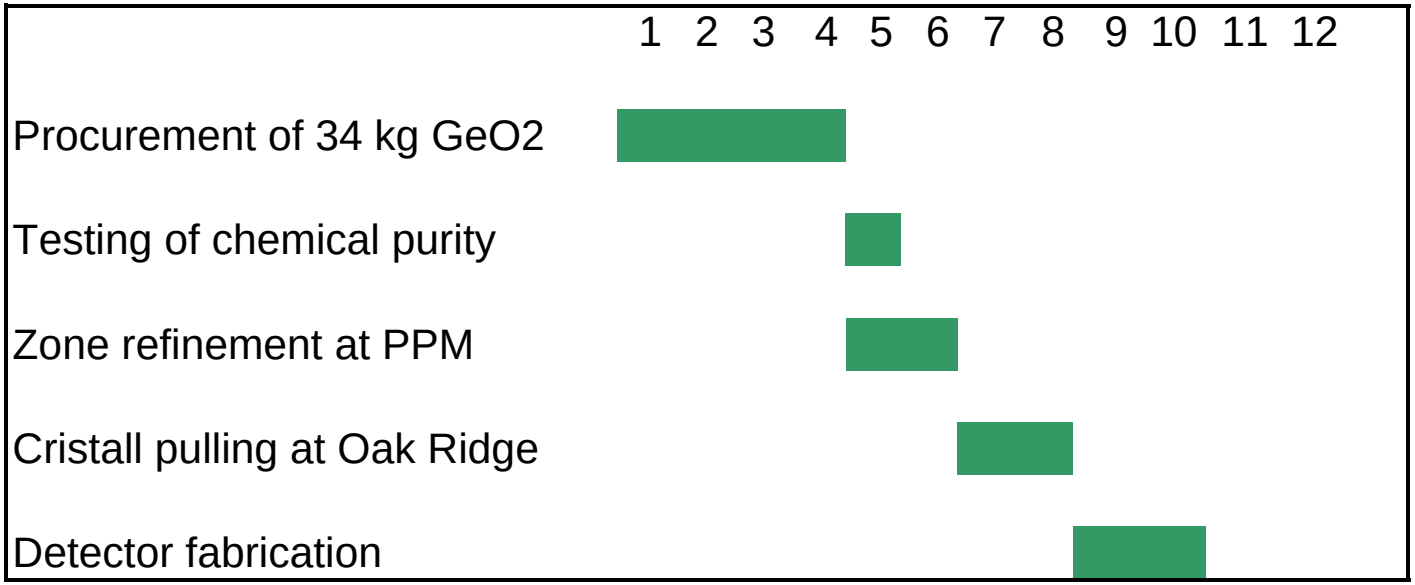
- Show that working BEGe detectors can be produced based on material supply chain ($^{dep/enr}$Ge from ECP; reduction and purification to 6N at PPM; crystal pulling at Oak Ridge; diode fabrication at Olen)
- Test production scheme to maximize detector yield from 37.5 kg $^{enr}$Ge using 20 kg of $^{dep}$Ge

# project distribution

| | prototype | depl. Ge | purification | crystal pulling | detector fabr. | testing |
|---|---|---|---|---|---|---|
| **Tuebingen** | | x | | x | (x) | x |
| **Dresden** | | | x | | | x |
| **Zuerich** | | | | x | x | x |
| **INFN** | x | | | x | x | x |
| **IRMM** | x | | | | x | x |
| **MPIK** | x | | | (x) | | x |

- procurement support by INR
- zone refinement support by MPI Munich

# Schedule as of early 2009



# Chronology

| | |
|---|---|
| **Jan 28 09:** | order of 34 kg dep-Ge-oxide by Tuebingen |
| **Apr 6/7 09:** | Oak Ridge/Meriden – C.Cattadori, A. Garfagnini, St.S. |
| **Apr 30 09:** | arrival of dep-Ge in Tuebingen |
| **May 5 09:** | ICPMS results from LNGS |
| **May 12 09:** | start of reduction and purification at PPM |
| **Jun 22 09:** | zone refined bars arrived at MPIK (21.4 kg / 91% yield) |
| **Jul 8 09:** | 21.4 kg material arrived at Oak Ridge as 'temporary imported goods' |
| **Jul 17 09:** | zone refinement completed; cutting each bar in 4 slices |
| **Aug 4 09:** | 1st crystal pulled (#4 piece) |
| **Aug 27 09:** | 2nd crystal pulled (#3 piece) |
| **Sep 30 09:** | re-growth of #3 |

1 month contamin. 2 months by economical crisis!

**Plan:**

| | |
|---|---|
| Until 30. Oct.: | #2,#1, re-growth of #4 (tbd) |
| Nov: | meeting at Oak Ridge to discuss selection of slices |
| | shipment of dep-Ge to MPIK => Olen |
| Dec: | start of detector production |
| Jan/Feb '10: | first BEGe from depl-Ge available |

# Results from crystal growth

**# 4 piece (tail end) – Aug 4:**

- top 20% of the ingot is p-type with and net impurity level <1E10, which however is too pure for BEGe's
- residual 80% is n-type
- acceptor impurity is probable Al; donor impurity probable Phosphor;
- ingot was pulled with In-doping for compensation;
- amount of In doping was chosen based on a precursor experiment done by Canberra using their regular material and cutting the zone refined bars in 4 slices (instead of their usual 3 slices).
- crystal can be regrown with and increased In doping with a good chance to achieve BEGe detector quality;
- **Milestone: PPM material (after zone refinement at Oak Ridge) suitable for BEGe detector production**

**#3 piece – Aug 27:**

- Net impurity (p-type) level 4E10 – too high for BEGe's
- Al contamination in process identified and removed
- Regrowing Sep 30 - results: Oct. 2

# Preparing the acceptance testing of depleted BEGe's

- 4-5 detectors, above ground at LNGS, Struck FADC from HD
- HV curve, energy resolution, peak tails, active volume and dead layer measurements (241-Am and 60-Co), full PSD performance test with 228-Th
- stability measurement? near electrode sensitivity loss test?
- establish common PSD analysis procedure

People: Dusan, Assunta, Matteo, Alberto, Enrico, ……

# Operation in LAr

N.B: Detector technology same as p-type semi-coax detector

- dismount BEGe crystal from cryostat (80 mm, 70 mm ?)
- test in GDL test stands/LArGe
- Optimized FE electronics for BEGe: CSA77 with separate JFET, PZ0, commercial CMOS, other?
- Time slot: Nov/Dec ?