



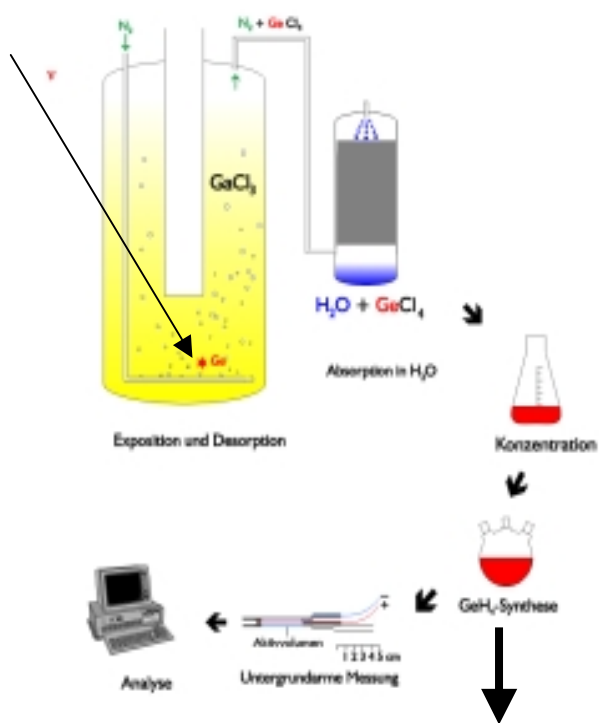
Development of a cryogenic detection concept for GNO

Outline

- GNO, a solar neutrino monitor
- Integration of LTDs in GNO
- ^{71}Ge Detection in 4π geometry
- UGL Garching – test facility for ‘cryoGNO’
- Summary

GNO (=Gallium Neutrino Observatory)

„A solar run“



Detection with LTDs:
Interface to GNO:
GeH₄ (Germane gas)

of GALLEX chemical detection:

1997 / seit April 1998 GNO

Laboratori Nazionali del Gran

100 m.w.e.) (CC-Reaktion mit $E_{thr} = 233$ keV)

neutrino-moderate (extra solar) ~ 4 weeks

part of the solar neutrino

(neutrinos !)

in time of the integral solar

$^{71}\text{Ge}^*$: X-Ray and γ -ray
160 eV to 1 MeV



→ Goal:
Reduction of systematic and statistical
uncertainties: CryoGNO



Motivation for 'CryoGNO'

Uncertainties in GNO:

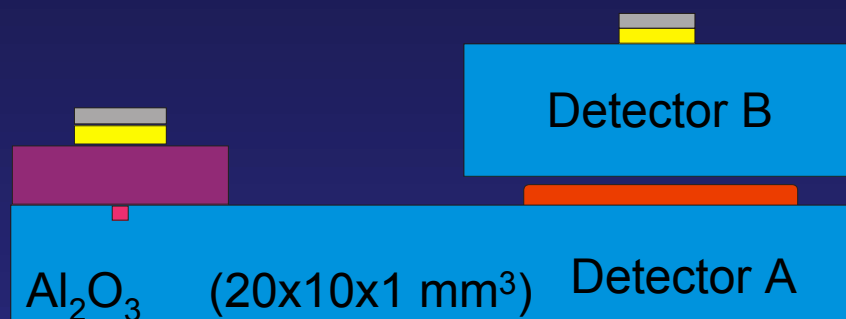
GNO's	Systematic error	Statistics	Statistical error
targetmass	0,8%		after 108 solar runs
Energy cuts	2,2%		65-75 % for miniaturized proportional counters
Pulseshape cuts	1,3%	65-75 % for miniaturized proportional counters	
other Cuts	0,6%		
Sidereactions	2,0%		
overall	4,3%	overall	6,4%

Neutrinos: a growing & powerful tool for astrophysics

- upper limit for CNO-cycle solar neutrino flux

Introduction of a highly efficient cryogenic detection system looks promising !

^{71}Ge detection in 4π geometry



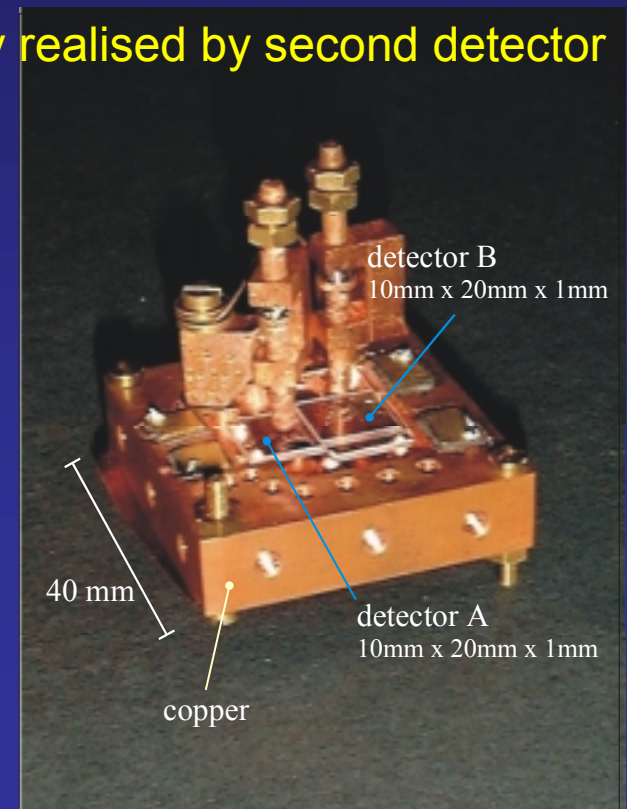
Thermal deposition of Germane-gas
via CVD (= Chemical Vapour Deposition)



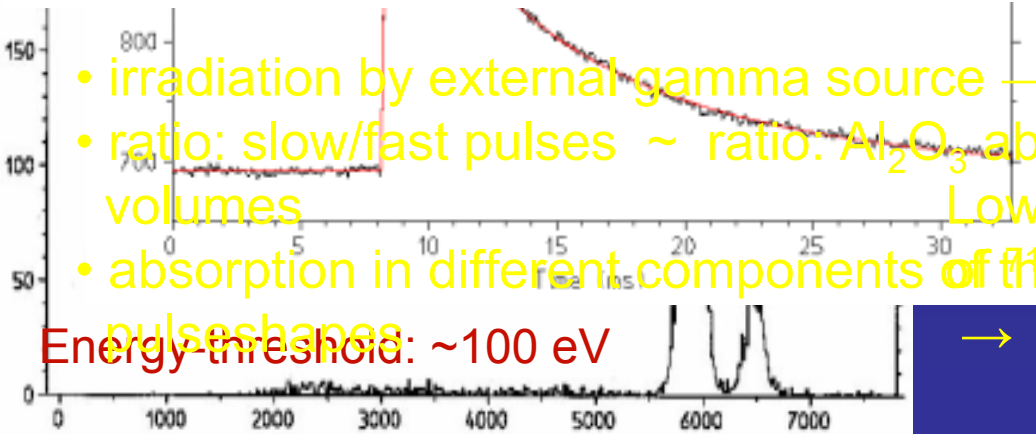
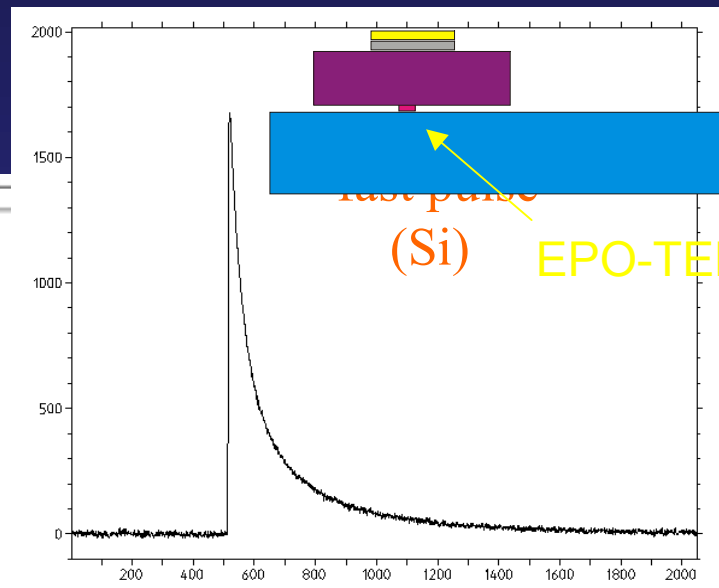
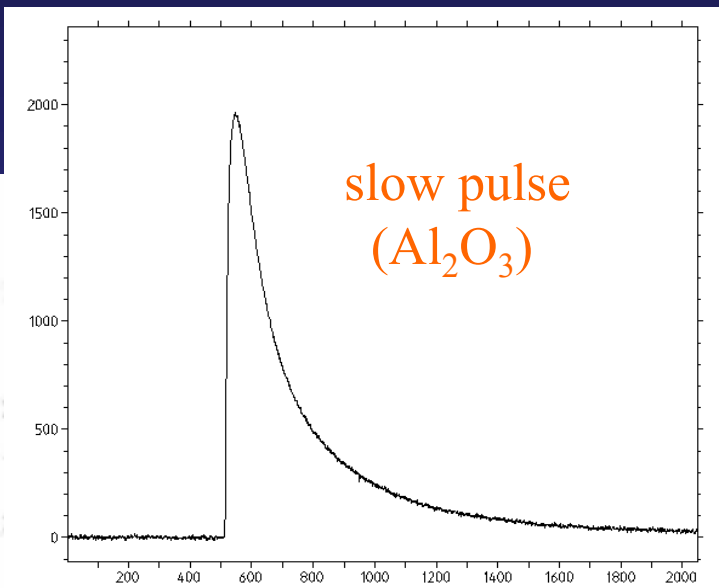
4π -geometry realised by second detector

- Prefabricated & tested Ir/Au Thermometer on Silicon
- Decoupling of deposition & detection avoids deterioration of Ir/Au bilayer due to high CVD Temperatures ($\sim 500^\circ\text{C}$)

- **Detection efficiency** 98-100 %
- **Low energy threshold** ~ 100 eV
- **Energy resolution** $\sim 6\%$
- **4π -detector understood**
- **GeH_4 interface to GNO**



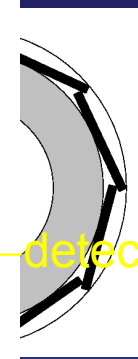
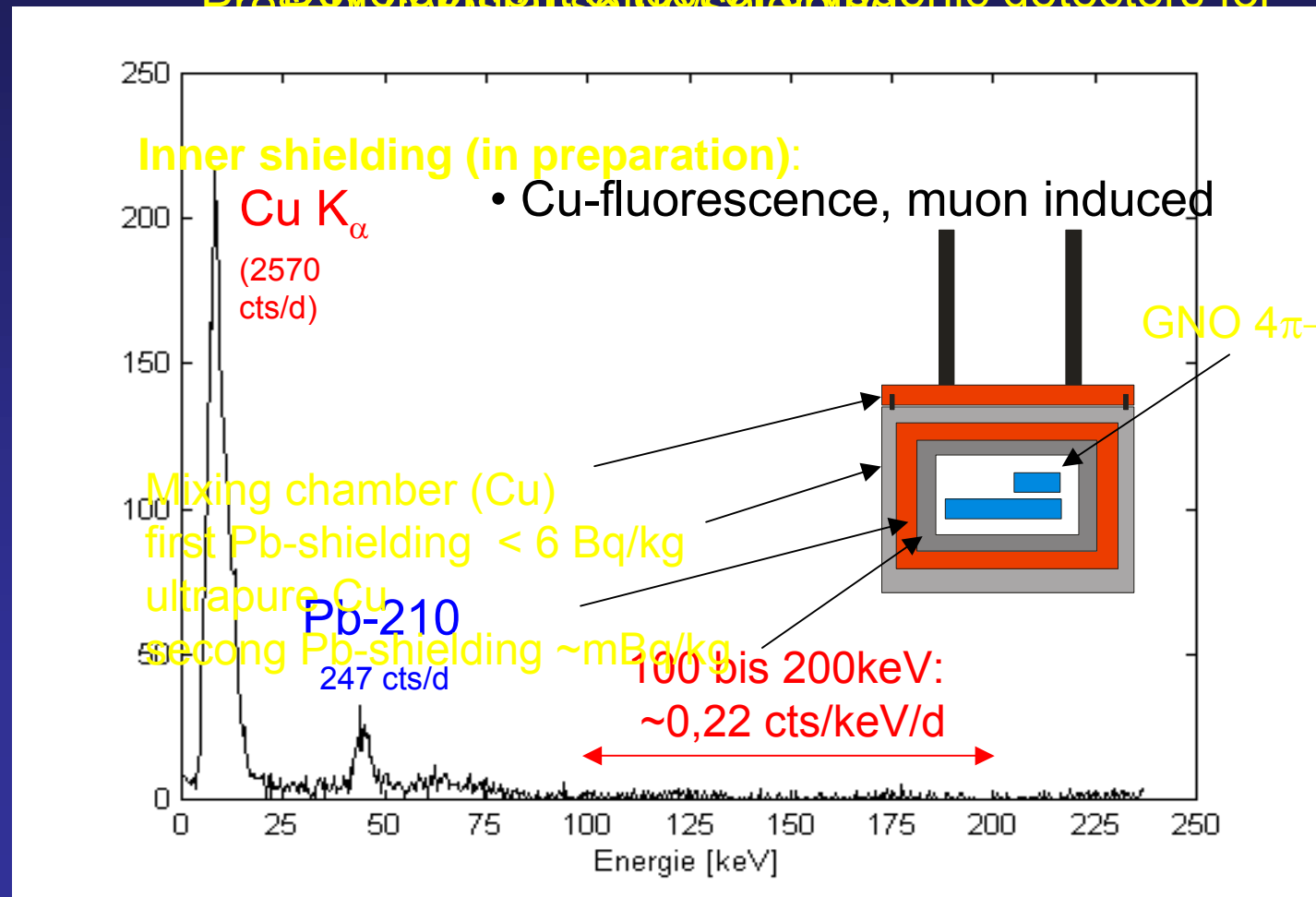
Decoupling CVD and detector: Si405_c



• irradiation by external gamma source → **two different pulse shapes**
 • ratio: slow/fast pulses ~ ratio: Al_2O_3 absorption / Si substrate volumes
 • absorption in different components of the detector leads to different pulse shapes
 → previously not possible with MPCs !

Underground Laboratory in Garching (15 m.w.e.)

Background spectrum:
 Development & test of cryogenic detectors for



Summary

- 4π efficient detection geometry realized
- highly efficient Ge-deposition tested successfully
(compatibility with GNO guaranteed, GeH_4 as interface)
- Detailed understanding of detector spectra
- decoupling of Ge-deposition and detection realized

- first steps towards longterm runs successful, further work necessary
- Present activity: analysis and suppression of background contributions

- Plan to prove feasibility of 'cryoGNO': longterm run with artificially activated ^{71}Ge