CTU Prague RD50 Group

GaAs PAD detector

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Contents

Motivation

The structure of detector on SI GaAs substrate was created using:

- MOCVD epitaxy of PN junctions

- TiAu contact on P+ side

- alloyed AuGeNi contact on N+ side

This technology was developed to compare obtained results with the diffused type of the precedent detectors

Structure of the detectors

SI GaAs substrate , thick. ~250 um

MOCVD epi layer P+ (C) thickn. 0,3 um, ~8x10E18 cm^{-3}
MOCVD epi layer N+ (Si) – back side, 0,4 um, ~8x10E18 cm^{-3}

Metallization of P+ : TiAu (10 + 200) nm

Metallization of N+ : AuGeNi (200+100+100) nm, alloyed at 400°C in forming gas

Technology for GaAs detectors

MOCVD type with guard ring

deposition of MOCVD epi layer (P+ , dot. C)

back side deposition of MOCVD epi layer (N+, dot. Si)

making a ohmic contacts on P+ and N+ side of structure

- P+ side metallization : TiAu
- N+ side metallization : AuGeNi

etching of the metallization to designed pattern following etching of GaAs (patterned metallization serves as etching mask) to form MESA structure without need of additional passivation

Structure of the detectors

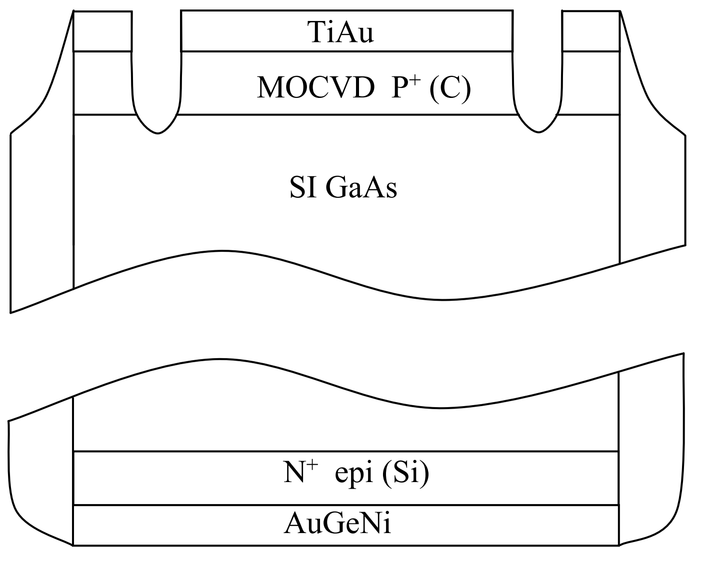


Fig.1: Vertical structure of detector with guard ring - MOCVD epi type of structure

Results

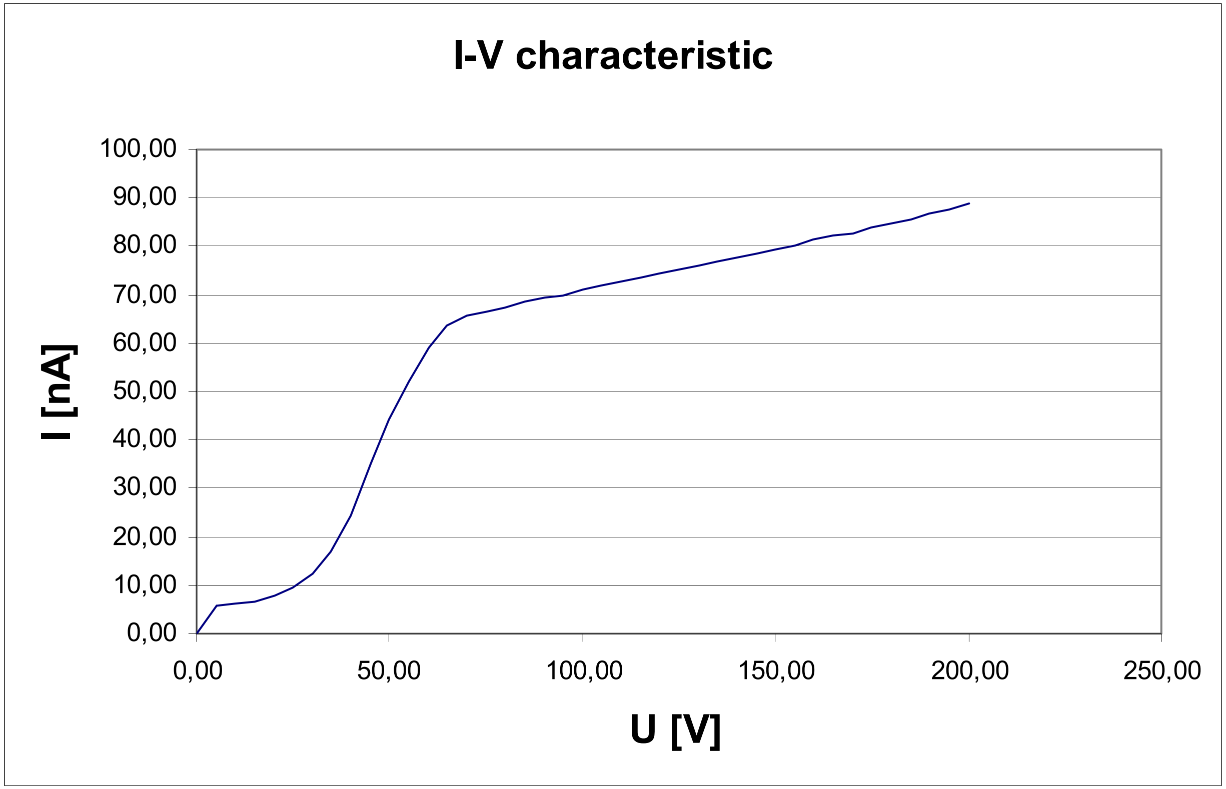


Fig. 2: I-V characteristic of GaAs PAD (MOCVD)

Results

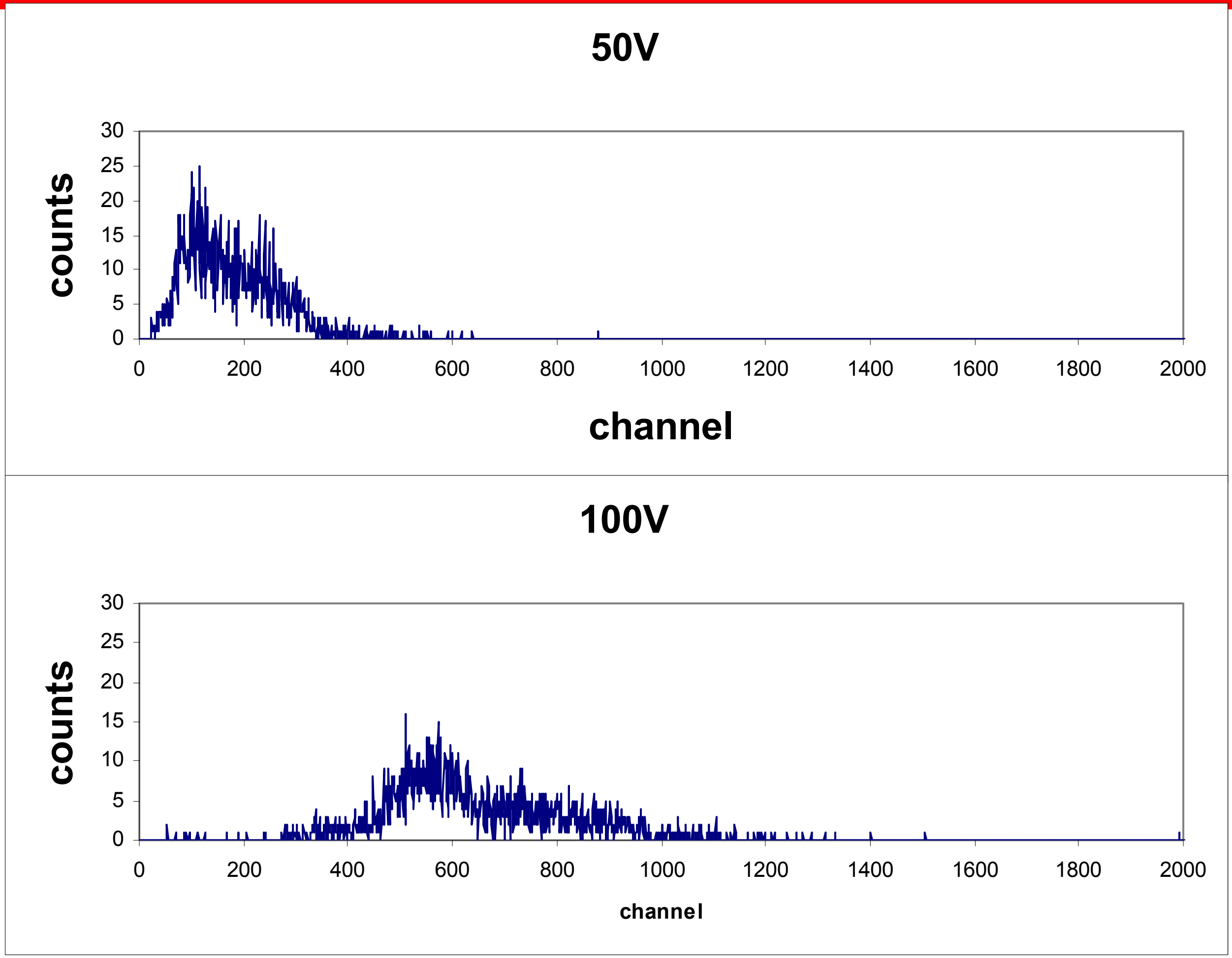
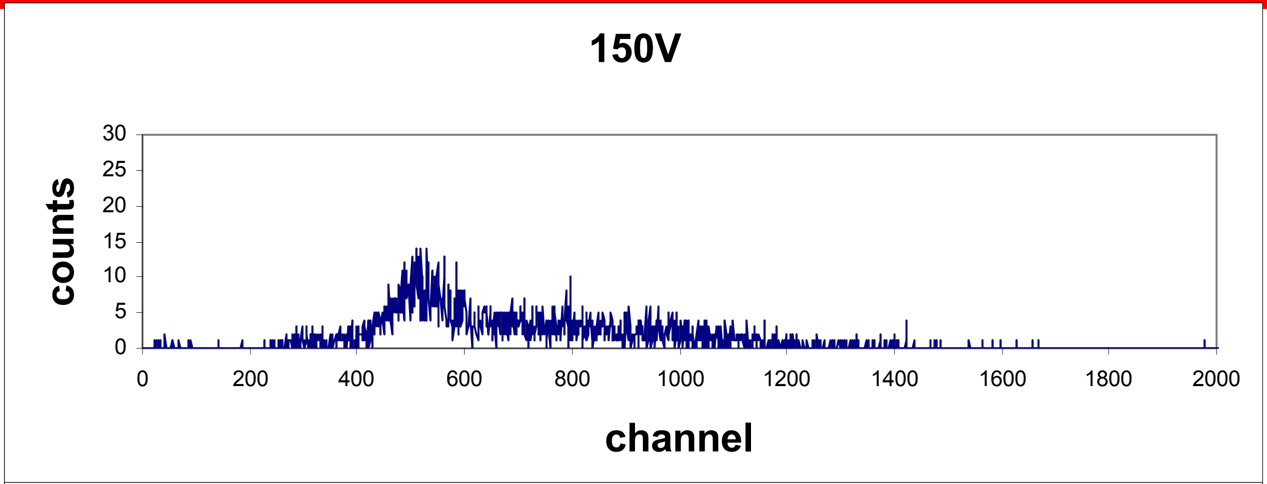


Fig. 3: Alpha response

Results



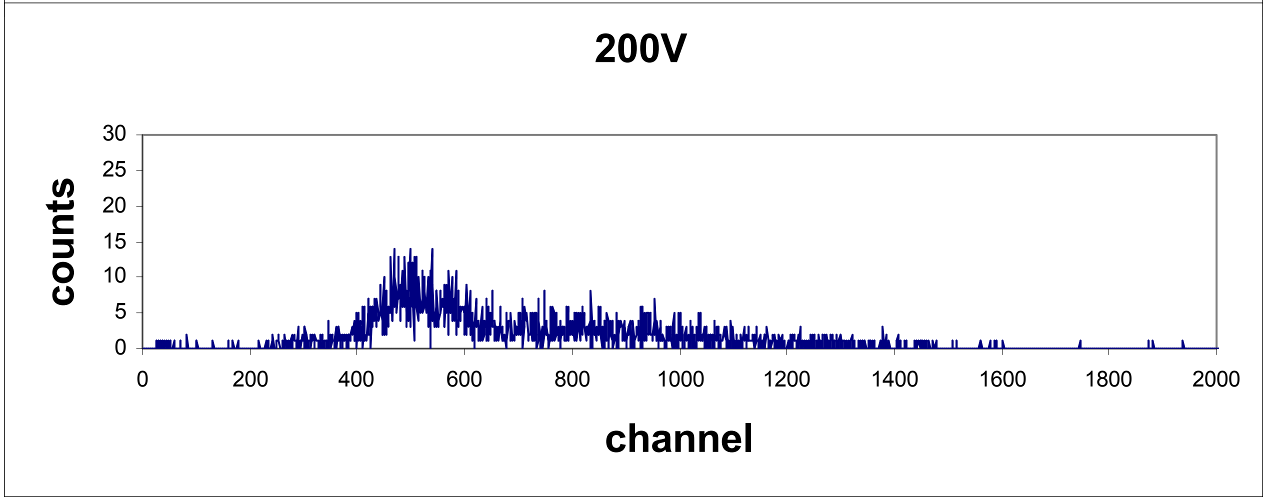


Fig.: 4 - continuation (All presented spectra were measured using alpha-particle source $Am^{241}Pu^{239}$)

Results

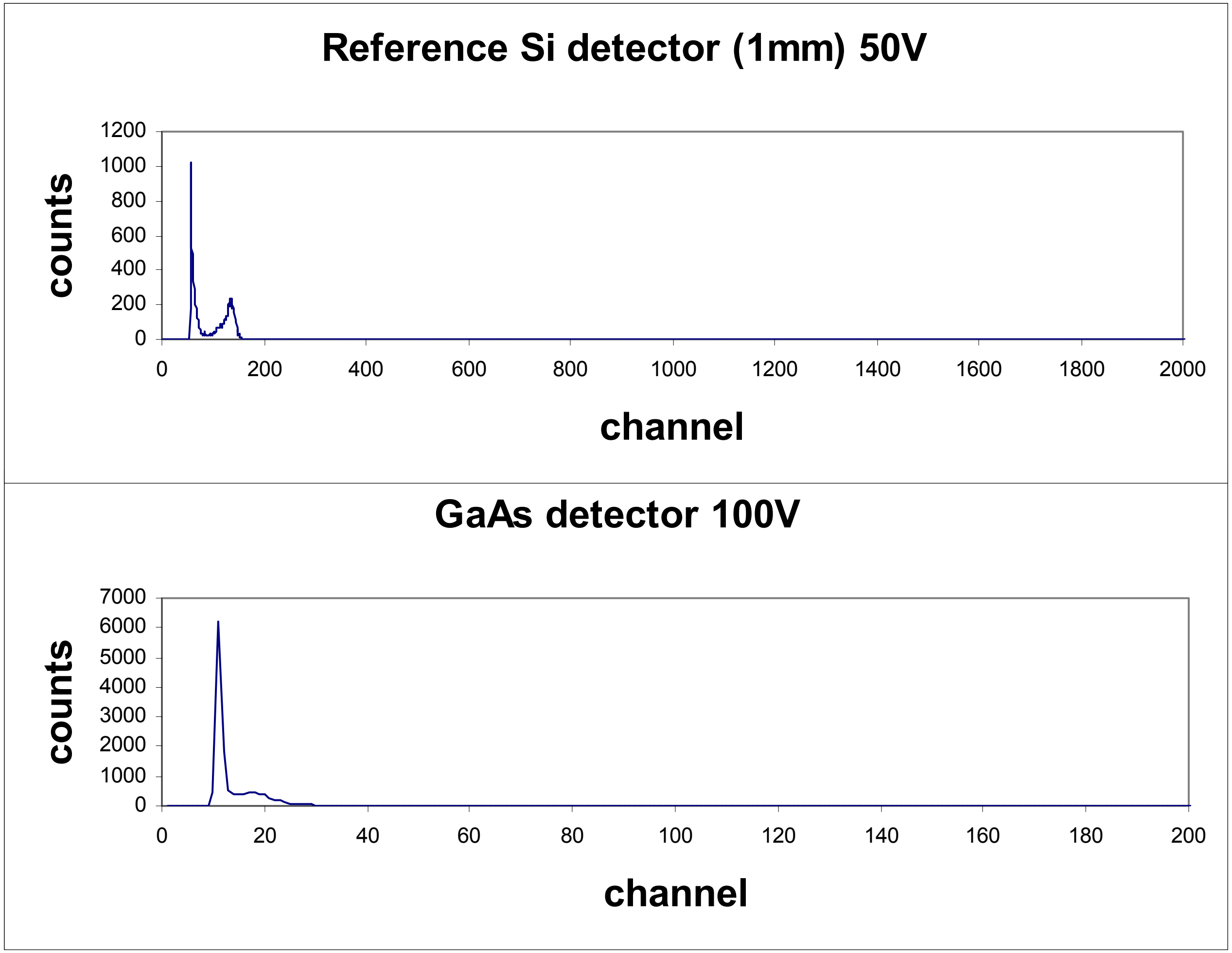


Fig. 5: Gamma response

Results

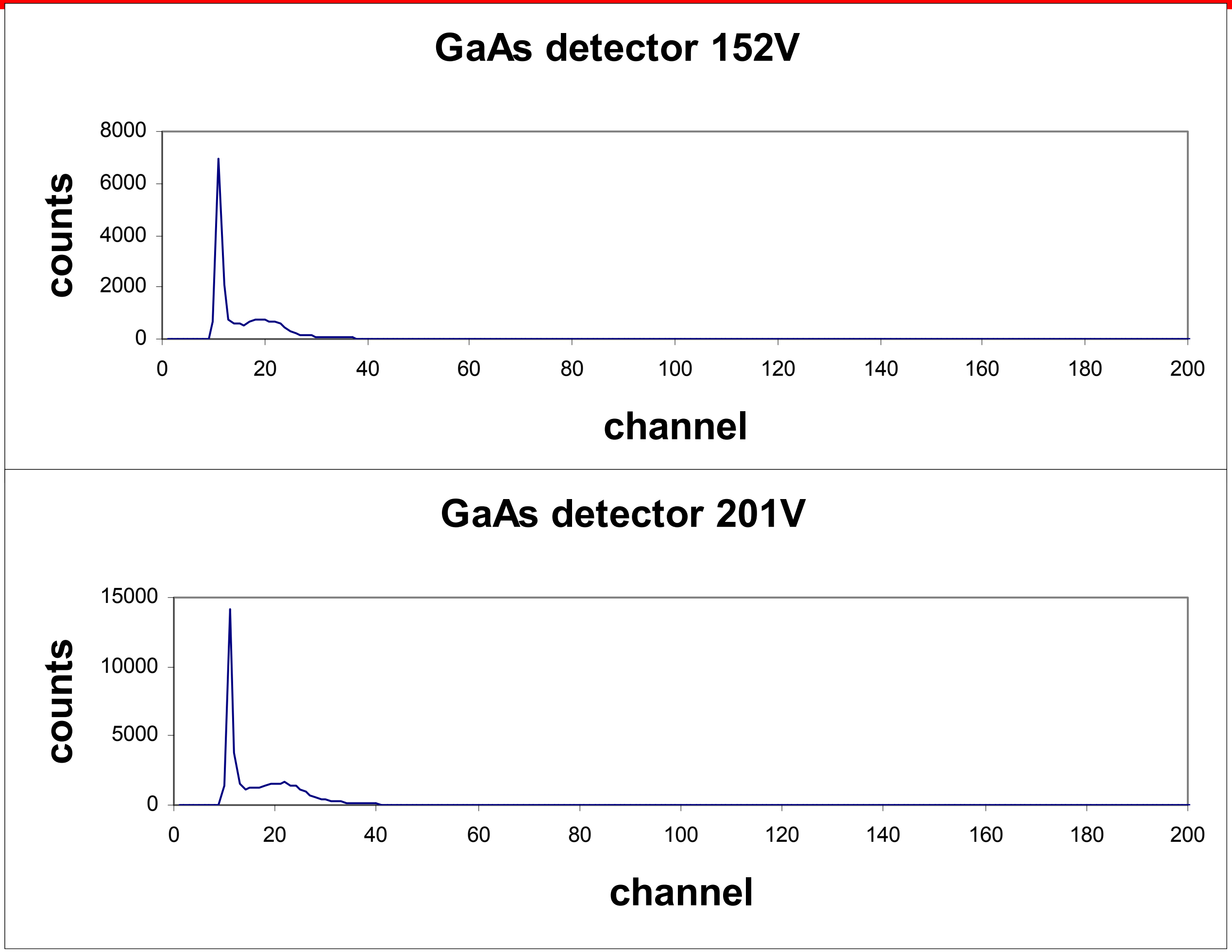


Fig. 6: Gamma response - continuation

Results

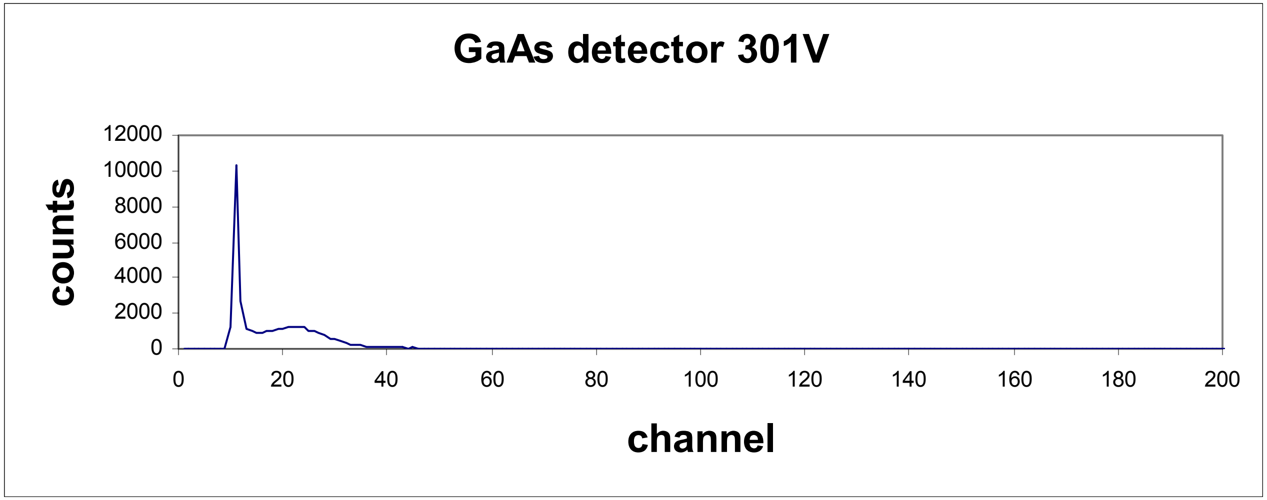


Fig. 7: Gamma response - continuation

Conclusions

•Experiments show the ability of described technology to prepare functional detectors on GaAs

•The CCE is lower in comparison with the Si type

•The GaAs detectors show better sensitivity for photons

•In near future will be measured the response for X- rays

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Thank you for your attention