Multi-Grid High-Pressure Gas Proportional Scintillation Counter
A New Approach

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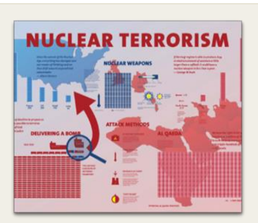
Introduction

The Ph.D thesis proposal presents the development of an alternative method for developing hard X-ray and gamma-ray detectors based on electroluminescence (EL).

The method has several interesting characteristics that make it a potential solution for the development of X and gamma-ray spectrometers:

- Small statistical fluctuations;
- Does not require the use of PMT's or other additional photosensors;
- Microphonic effects are highly suppressed;
- Reduction of space charge effects;

As well as a wide range of possible applications, which includes:



Homeland Security


Geological Prospection


Experimental Physics


Medical Applications

Multi-Grid High-Pressure Gas Proportional Scintillation Counter

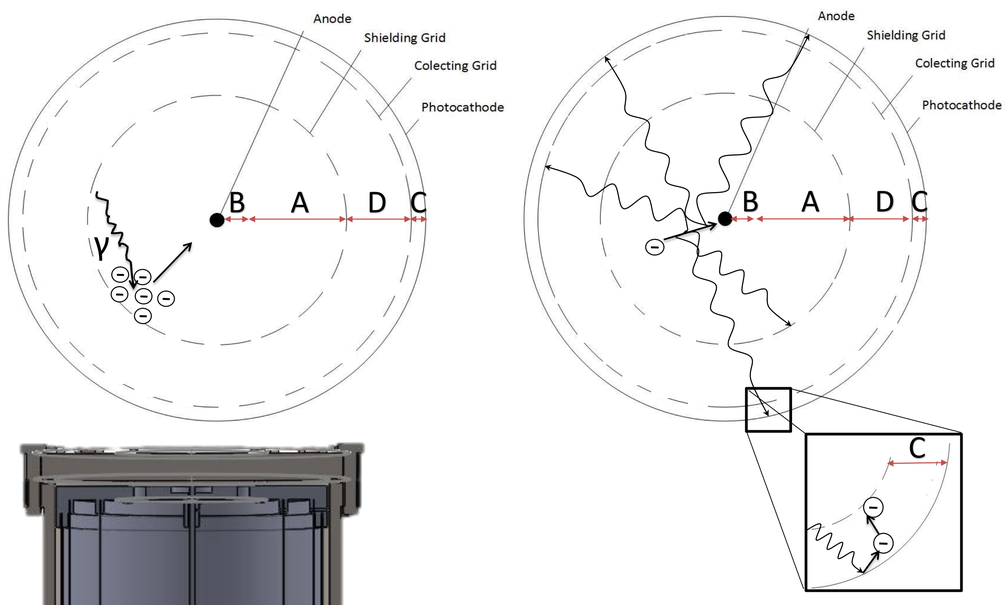
Detector

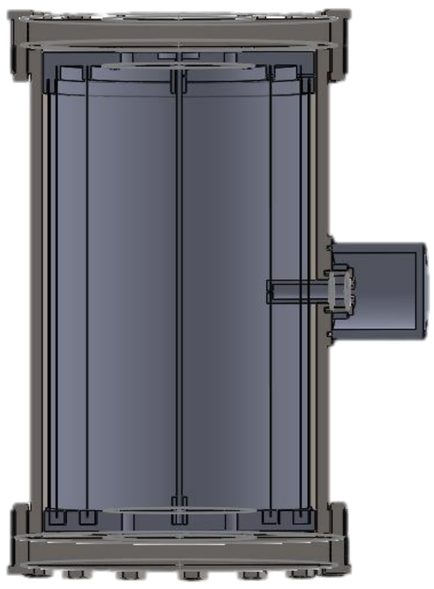
The new detector consists of a multi-grid high-pressure xenon based gas proportional scintillation counter (MGHP-GPSC) which relies on the secondary scintillation of gas atoms as the amplification stage.

This new detector consists of four distinct regions:

- Absorption/Drift Region (A);
- Secondary Scintillation Region (B);
- Photoelectron Collection Region (C);
- Electric Field Barrier Region (D);

Working Principle



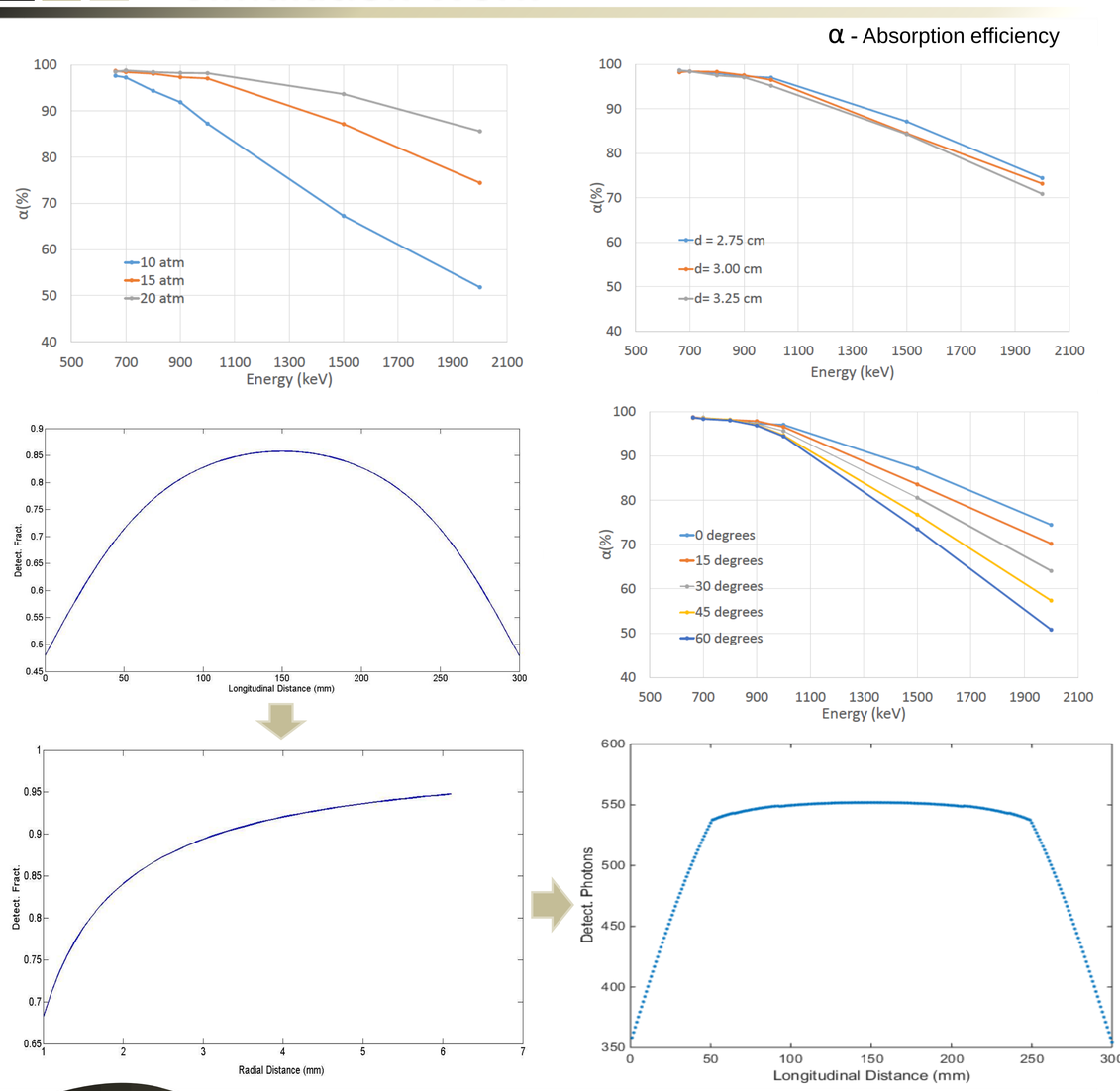


Regions	E/p ($V.cm^{-1}.Torr^{-1}$)	Length
Absorption/Drift	0,03 < 1	5,5 cm
Scintillation	1 - 6	0,5 cm
Electric field barrier	<1	2,0 cm
Photoelectron collection	<1	0,5 cm

Previous Work

- Study of charge transport properties in gases of interest (Xe-N_2, Ar-CO_2, Ne-CO_2, Ar-CH_4, Ar-C_2H_6)
- Study of the best detector geometry.
- Design of the MGHP-GPSC.
- Simulation studies for optimization of the detector performance.
- Correction of solid angle effects using different techniques (curved grids or non uniform photocathodes).

Simulation Work



MGHP-GPSC Characterization

- Pressure range: 5-20 atm
- Detecting Efficiency (662 keV @15 atm): higher than 25%
- Solid angle ($\Omega/4\pi$): 0,50-0,85
- Detector Active Volume: 3369 cm^3
- Detector gain: 20-30 phe^-/e^- (photoelectrons per primary electron)

Future Work

- Construction and assembly of the detector in progress.
- Evaluation of the system integrity (hydrostatic test, leak detection and electrical isolation).
- Evaluation of the system overall performance (proof concept, gain, energy resolution, acoustic and vibrational tests).

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