Technical requirements for the GlueX TRD gas system

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Abstract

Short description of the detector is given and preliminary requirements for the TRD gas system are specified.

The future GlueX TRD detector will consist of three modules. Each module is a box of 1700x1700 mm^2 cross section, with two gas volumes - the main one filled with Xe/CO_2 gas mixture of 90/10% containing the drift and the amplification volumes, and the second one for the radiator filled with CO2. The thickness of the drift and amplification volume is 25 mm and 10 mm respectively. Thus, we estimate the Xe/CO_2 gas volume to be 100 l per module, or 300 l in total. For the CO_2 volume it has a thickness of 150 mm or 430 l per module and 1300 l total. For the Xe/CO_2 volume we aim to have 8 volume exchanges per day, i.e. 100 l/h. The CO_2 volume can be exchanged once per day or 55 l/h.

The entrance and exit gas windows will be made of 100 μm Mylar, possibly enforced with Rochacell material. The detector will allow operation with overpressure between 0.5 and 2 mbar. The two gas volumes will be separated by 50 μm Mylar, covered with 1 μm Al. To limit the variations of the drift field, we require the pressure difference between the two gas volumes to be less than 0.2 mbar.

Oxygen contamination and water vapor should be kept less than 50 ppm, to minimize the electron recombination in the drift volume. The Nitrogen contamination should be kept less than 0.5%.

The elements of the gas system that operate above 1 bar should be kept in a separate gas room, elevated approximately 7 m above the detector. They will be connected to the detector with gas lines of about 50 m length.

The parameters and requirements of the gas system are summarized in Table I.

item	requirement	comment
total Xe/CO_2 gas volume	300 l	
total CO_2 gas volume	1300 l	
Xe/CO_2 gas flow	100 l/h	
CO_2 gas flow	55 l/h	
Operating overpressure	$0.5 - 2$ mbar	
Pressure difference b/n two volumes	< 0.2 mbar	
Oxygen contamination	< 50 ppm	
water vapor	< 50 ppm	
Nitrogen contamination	$< 0.5\%$	

TABLE I: General parameters and requirements for the GlueX TRD gas system.