Atomic Physics with Accelerators:
Projectile Electron Spectroscopy
Work Package 6: Electronics/DAQ

Electronics: Design and Implementation

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1 Computer Systems

The main computational systems used in the APAPES project are two identical PCs called the Lab Computer and the Analysis Computer. For both cases, the basic characteristics of the computers are as follows:

- Windows 7^{TM}Ultimate Edition 64-bit
- Additional software MS Office^{TM}2007/2010 or later
- At least quad-core processor with minimum nominal speed 3.4 GHz
- 16 GB of RAM with capability of an extension up to 32 GB.
- Primary drive: An SSD type of hard drive for the operating system with minimum size 256 GB.
- Secondary drive: Hard disk with minimum size of 1 TB.
- LED-type monitor, at least 21".
- Autonomous graphics card with at least 1 GB RAM.
- Network connectivity.
- Two additional RAM modules of 8 GB each extending total RAM to 32 GB.

One of the two computers also needed to have an extra Ethernet port, since by the time of the tender, it was a known necessity.
The first tender for the computer equipment ended unsuccessfully in January 2014, when a 2^{nd} was publicised immediately. After the completion of the 2^{nd} tender in February 2014, the PC assigned for the lab was bought, which allowed for further progress on the Control and DAQ work flow. The rest of the computer equipment were obtained a bit later.

2 Micro-Channel Plates

One of the first necessities of the program was the storage of the Micro-Channel Plates (MCPs) used in the position sensitive detector (PSD). To date, the MCPs used were the same ones used with the spectrometer when it was operating at Kansas State University (KSU). These were stored in a desiccator and were found to work satisfactorily. A new larger desiccator was ordered by January 2014. On February 2014 a tender for replacement MCPs was announced, and by the end of April 2014, it was completed. The MCPs were bought from PHOTONIS and have not been needed yet. They are safely stored in the new desiccator.

Figure 1: HMI and Tennelec HVPSs assigned for the voltage on the V_2 electrode and the hot wire electron gun respectively.

3 High Voltage Power Supplies

The are three categories of HVPS:

HMI The HMIs are high precision HVPS provided by the Hahn-Meitner-Institut[1] with fixed predefined polarity and the lowest ripple even at higher voltages among the three types of HVPS used.

Tennelec The Tennelec HVPS[2] have invertible polarity, however they need to shut down before any polarity change. Although not comparable to the HMI's, they exhibit sufficient stability for the high resolution spectroscopy and were placed on electrodes that rarely require polarity changes.

Applied Kilovolts The Applied KiloVolts HVPSs can digitally reverse their polarity but at the cost of 1 bit. This drops there internal DAC's resolution to 15 bits. Taking all that into consideration they were connected to specific voltages of the apparatus. They are integrated inside the rack mountable unit provided by Fasmatech. Specifically, inside the Fasmatech unit there are:

(a) 3 Applied KiloVolts model HP010RAA025[3] with a ± 10 kV range.

(b) 1 Applied KiloVolts model LS005RIP010[4] with a ± 5 kV range.

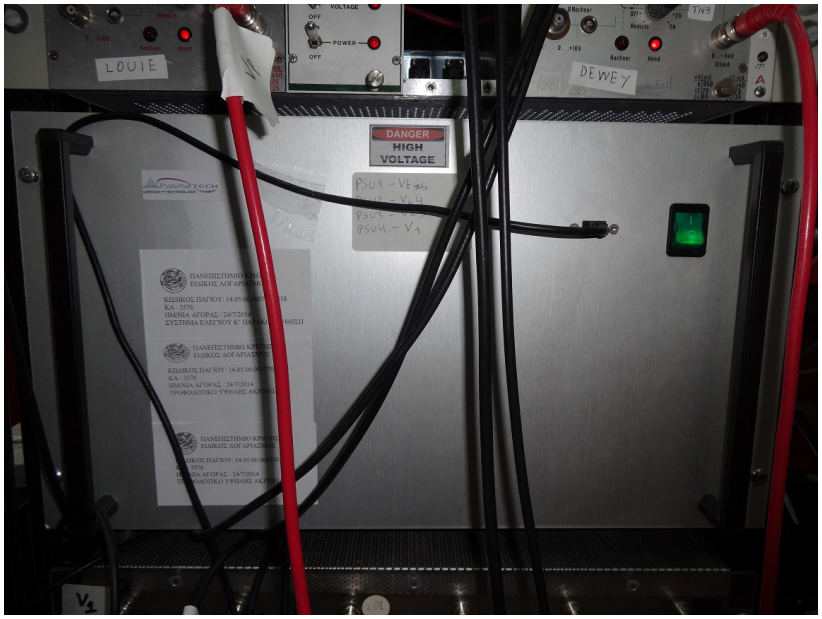

Figure 2: Fasmatech Rack-mount Unit.

Since the Tennelec HVPS came with the chamber and the analyser, they were available early enough for testing. On December 2013 some early tests were conducted to ensure proper functionality. From January 2013 the study of the system began for the proper choice of HVPS in terms of accuracy, noise and ripple. Also, research was done for the suitable floating HVPS for the MCPs and channeltron detector.
On February 2014 all HVPSs were bought, including the custom-made HMIs and the Fasmatech all-in-one rack-mount unit. For the floating HVPS the 3 kV floating HP 6515A unit was chosen which had also been used with success in Kansas. By March 2014, all additional purchases were made including a NIM crate[5], and a 4-channel 200MHz TDS200C digital storage oscilloscope.

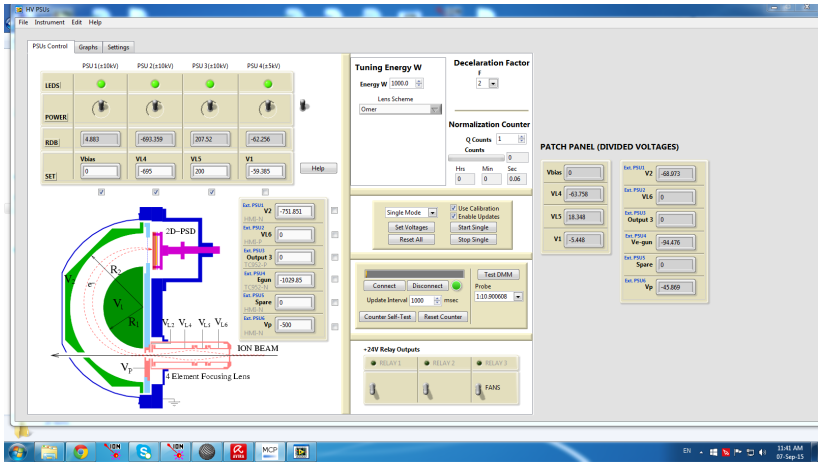

Figure 3: The Fasmatech Labview^{TM}. All parameters are updated automatically and all the information needed for the user are integrated into one screen.

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[4] http://apapes.physics.uoc.gr/equipment/documentation/Applied_kV_LS Iss3.pdf

[5] http://apapes.physics.uoc.gr/electronics/UEP20.pdf