

## AUTOMATED IRRADIATION SYSTEMS FOR USE IN CYCLOTRONS

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There are two cyclotrons in operation at IPEN-CNEN/SP: one model *CV-28*, capable of accelerating p, d,  $^3\text{He}^{++}$  and  $\alpha$ , with energies of 24, 14, 36 and 28MeV, respectively, and beam currents up to  $30\mu\text{A}$ ; the other one, model *Cyclone 30*, accelerates protons with energy of 30MeV and currents up to  $350\mu\text{A}$ . Both have the objective of irradiating targets for radioisotope production for use in Nuclear Medicine, such as  $^{67}\text{Ga}$ ,  $^{201}\text{Tl}$ ,  $^{111}\text{In}$ ,  $^{123}\text{I}$ ,  $^{18}\text{F}$  and general research [1,2].

The objective of this work was the development of irradiating systems completely automatized, always aiming to reduce the radiation exposition dose to the workers and to increase the reliability of use of these systems, because very high activities are expected in these processes.

In the automation, a Programmable Logical Controller (PLC) was used connected to a feedback network, to manage all the variables involved in the irradiation processes. The program of the PLC was developed using *SIMATIC STEP SEVEN (S7)*, software from *SIEMENS*, where all the steps are supervised in screens at a microcomputer. The assembling and sequence of leading were developed using the software from *UNISOFT*, that keeps the operator informed about the work being carried out, at any time .

The supervisory screens for the liquid, solid and gaseous targets can be seen in figures 1, 2 and 3.

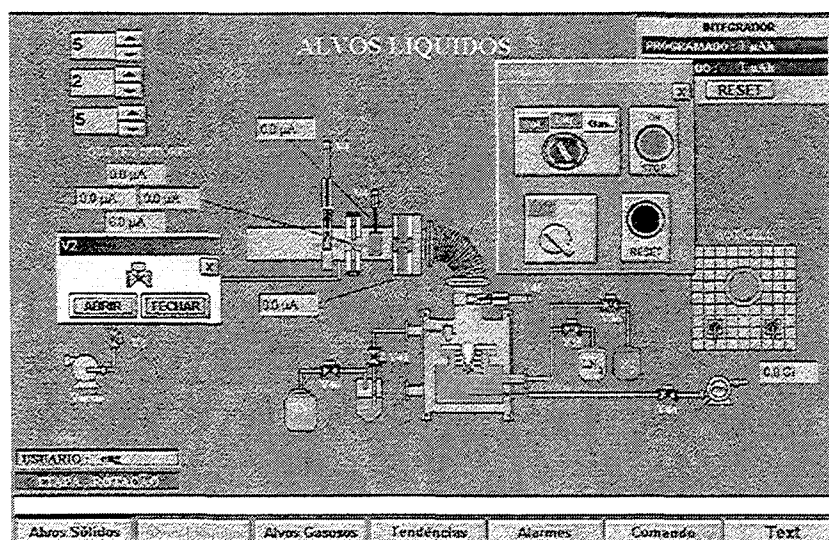


FIG. 1. Supervisory screen for liquid target.

\*This Work was supported by FAPESP.

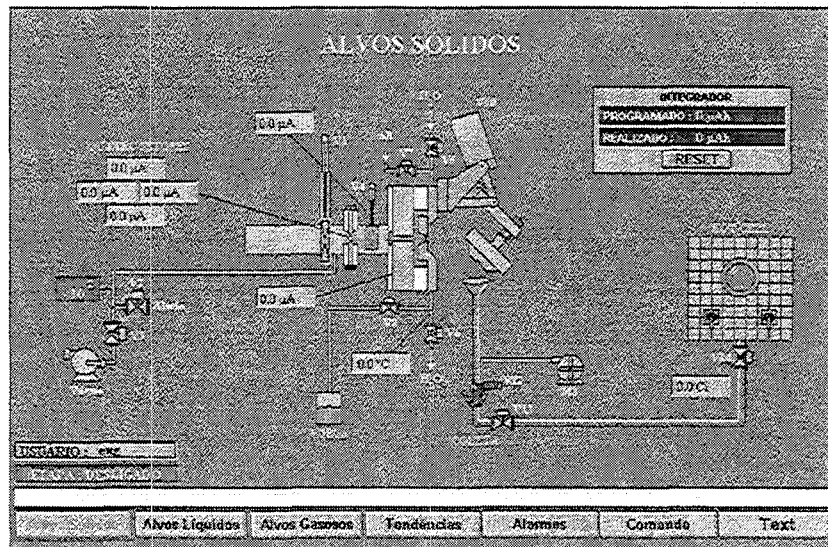


FIG. 2. Supervisory screen for the solid target.

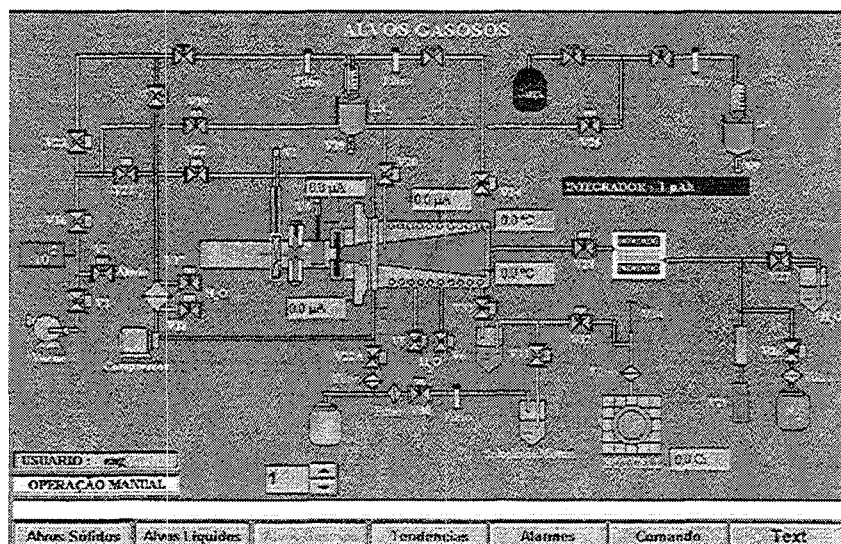


FIG. 3. Supervisory screen for the gas target.

The system is being tested at the CV-28 Cyclotron of IPEN through the irradiations with 24MeV protons and currents up to 10µA in targets of:

- a- Solid:  $^{nat}\text{Zn}$  electroplated onto a nickelated Cu plate for the production of  $^{67}\text{Ga}$ .
- b- Gas:  $^{nat}\text{Kr}$  for the production of the generator  $^{81}\text{Rb}$ - $^{81m}\text{Kr}$ .
- c- Liquid: natural water for the production of  $^{18}\text{F}$ .

#### REFERENCES

- [1] ARAUJO, S.G., Dissertação (Mestrado), Instituto de Pesquisas Energéticas e Nucleares. São Paulo, SP, 1996.
- [2] QAIM, S. M., Nucl. Inst. Meth in Phys. Res. 41 (10-11), 1989, p.289-295.