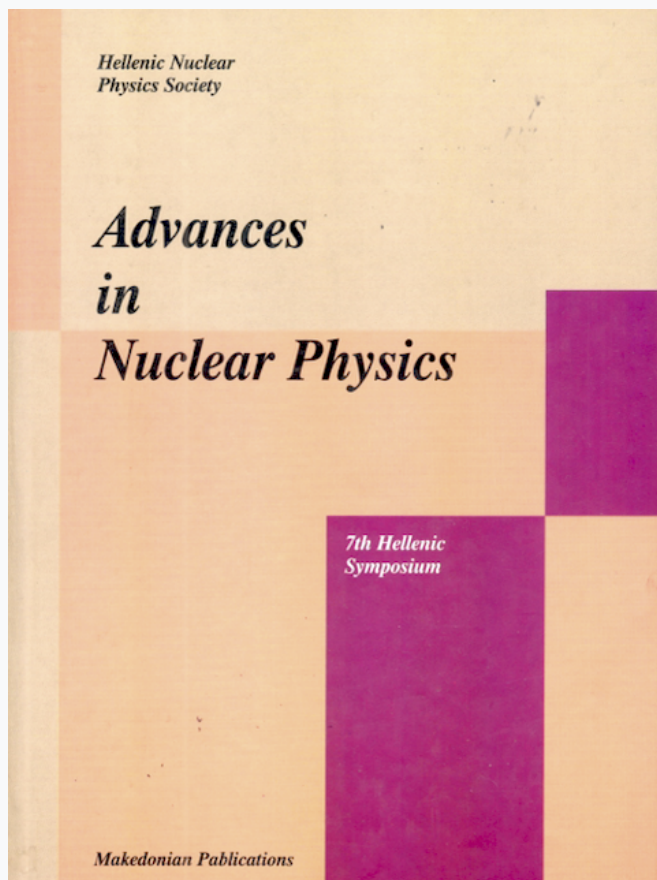


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The IASA Racetrack Microtron Facility

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Abstract

The Institute of Accelerating Systems and Applications (IASA) is pursuing research and facilitates postgraduate studies in traditional and cross-disciplinary areas where accelerators play an important role. The first major facility of IASA, now under construction, is a 246 MeV two-stage CW Cascade microtron. The planned experimental programs and facilities include nuclear and particle physics, nuclear medicine, archeometry and material science.

1 Institutional Framework

The Institute for Accelerator Systems and Applications (IASA) is a research institute operating under the auspices of the Ministry of Education in Greece. It is affiliated with six departments of the National and Capodistrian University of Athens (NCUA) and the National Technical University of Athens (NTUA). It is open to researchers from the international community and access is determined purely on scientific merit.

2 The IASA Racetrack Microtron Accelerator

The IASA CW Racetrack Microtron (IASA-RTM) is being constructed largely out of the components of the NBS/LANL CW Racetrack Microtron and the University of Illinois R&D RTM project [1]. The design is now based on a cascade (2 stage) microtron [2] (see Table). This choice was made based upon an evaluation [3], presented at the PAC-95 Conference. The cascade scheme

described below has been adopted, following the review and recommendation of an international review panel.

RTM parameters	NBS/LANL	IASA-1	IASA-2
Injection Energy (MeV)	5	6.5	42.3
Gain per Turn (MeV)	12	1.43	8.5
Number of recirculations	15	25	24
Max. output energy (MeV)	185	42.3	246.7
Maximum current (μA)	550	100	100
Duty factor (%)	100	100	100
Frequency (MHz)	2380	2380	2380
Incremental # ν	2	1	1
Magnet field (T)	1.	0.2379	1.414
Linac RF losses (kW)	305	30	143
Asymptotic phase angle ϕ (deg)	0	18	18
End magnets spacing (m)	12.5	3.25	8.6

Table 1
NBS/LANL and the IASA RTM parameters

The accelerator comprises of the 6.5 MeV injector followed by the first stage (IASA-1) 42 MeV RTM and the second stage (IASA-2) 246 MeV RTM. The design for the injector includes two electron guns: a thermionic 100 keV electron gun and a polarized electron source using a mode-locked laser [4]; they are followed by a pre-accelerating section to 6.5 MeV [5]. A detailed description of the optics of the IASA CW racetrack microtron is given in [6]. The availability and use of two pairs of identical end magnets allows for the realisation of the cascade scheme. Also the choice of $\nu = 1$ leads to a more simplified tuning and operation of the accelerator, and to a decrease in RF power consumption. Calculated values of sensitivity factors and longitudinal and normalised transverse acceptances suggest a clear improvement [3] over the values of the original $\nu = 2$, NBS/LANL design.

3 Layout of the Facility

A preliminary schematic view of the cascade scheme and layout of the IASA Laboratory is given in below. In this figure the accelerator vault and the first three experimental halls are shown. The installation and operation of the machine will be completed in two phases. In Phase-1, the injector will be fully

operational and all the necessary tests will be performed in experimental hall 1. The construction of the RTM IASA-1 will proceed while operating the 6.5 MeV injector by separating the RTM from the injector with temporary shielding. Experimental halls 2 and 3 will then house the experimental instrumentation for the applied research program. In Phase-2, the installation of the second stage of the microtron IASA-2 will begin without substantially affecting the applied research program. The complex allows for possible expansion so as to accommodate future expansions including a third stage and/or a FEL facility.

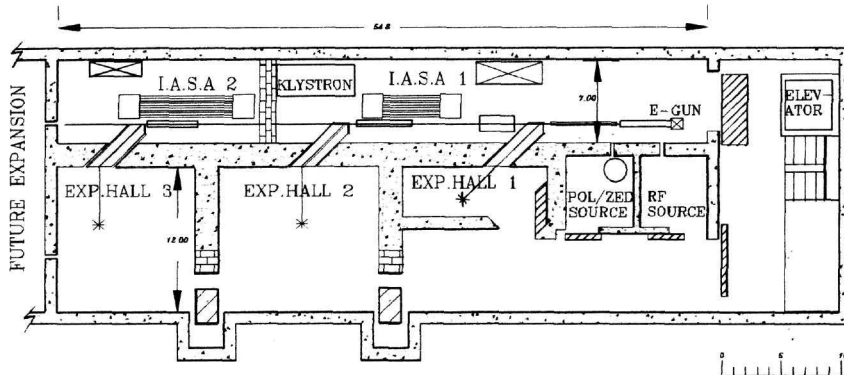


Fig.1 Layout of the IASA RTM facility

4 Present Status – The Maquette Projects

During the on going period of construction of the accelerator vault and associated experimental areas of the IASA RTM Laboratory, a staging area has been set up which provides adequate space and supporting facilities for the installation and operation of three important projects for the realization of the accelerator described above: (a) the injector maquette, (b) the RF maquette and (c) the magnet maquette. All three projects are being developed during the period of construction of the accelerator vault. We have begun construction of the 100 keV injector line. We expect to get the 100 keV DC electron beam later this year, and a chopped/bunched beam by the beginning of 1997. A completely new control system is being implemented in our accelerator based on the EPICS control system [7]. The RF maquette project concerns the modification from US to European voltage standards and testing needed for the HV power supply of the 500 kW klystron and its power supply. The magnet maquette project is dealing with the final scheme and the construction of a mapping system for small magnets as well as for the large 4 end magnets. Two as well as three dimensions codes are being used for magnetic field calculations.

5 The Research Program

IASA is charged with the responsibility of conducting research and aiding postgraduate studies. Its planned research activities include research in accelerator physics and engineering, instrumentation, control, nuclear and particle physics, cancer treatment by radiotherapy, angiography, archeometry, material sciences and food preservation [8]. Our RTM facility will be capable of producing high intensity, high quality polarized electron and photon beams. A theory group also operates under the auspices of IASA. This group is addressing theoretical issues connected with the experimental program carried by IASA experimentalists within the Institute and abroad.

6 Conclusions

The first major facility of IASA will be a CW RTM reaching 246 MeV capable of providing intense polarized electron and photon beams. The adopted cascade scheme offers the advantage of reaching up to 42 MeV max output energy (in increments of approx. 1.4 MeV), with a current of $100\mu A$ in Phase-1. The beam will be used in many areas of our applied research program. Also, an electron beam up to 246 MeV (in increments of 8.5 MeV) will be produced from the second stage to match the needs of our pure research program. This scheme meets our requirements for simplicity, stability of the operation of the machines, economy as well as the benefit of an early start of our research program.

References

- [1] S. Penner et al., *IEEE Trans. on Nucl. Sci.* Vol. NS-32 (1985) 2669-2671
L.S.Cardman, *IEEE Trans. on Nucl. Sci.* Vol. NS-30 (1983) 3267-3273
- [2] H. Herminghaus et al., *Nucl. Instr. Meth.* **138** (1976) 1
- [3] A.V. Tiunov et al., *PAC95*, Dallas USA
V.G. Gevorgyan et al., *VINITIN*, 183-B89, Moscow 1989
- [4] H. Avramopoulos et al., Compact, Mode-Locked, Semiconductor Diode Laser for Polarized Electron Sources, *SPIN96*, Amsterdam, Holland 1996
- [5] H. Herminghaus, *private communication*, 1995
L.S. Cardman, *private communication*

- [6] A.V. Filippas et al., Optics for the Athens cw RTM, *EPAC96*, Sitges, SPAIN, 1996
- [7] E. Stiliaris et al., Control System Implementation for the IASA Microtron, *EPAC96*, Sitges, SPAIN, 1996
- [8] 1st International Cross Disciplinary Symposium on Accelerators and Applications, Athens, May 26–28, 1994.