

## THE ACCELERATOR

During 2004 the LNL XTU-Tandem accelerator delivered heavy ion beams in the three experimental halls for a total amount of  $\simeq 3600$  hours of beam on target (150 days). 21 days, corresponding to 14 % of the total, were used to inject beams into the ALPI post-accelerator.

The Tandem accelerator delivered heavy-ion beams at terminal voltages up to  $\simeq 15$  MV. However, problems of sparks at voltages above  $\simeq 14.2$  MV caused several tank openings during the first part the year. Various measurements were therefore shifted or could not even be performed.

Noteworthy was the extensive use of  $^{40,48}\text{Ca}$  beams for different experiments, which were delivered on targets with intensities in the range 1-5 pA. Also,  $^{18}\text{O}$  beams were used several times at intensities of  $\simeq 1\text{-}1.5\mu\text{A}$  for the trap experiment. Although limited by the problems with the Tandem accelerator, medium-heavy mass ions, namely  $^{64}\text{Ni}$ ,  $^{82}\text{Se}$  and  $^{90}\text{Zr}$  beams were successfully accelerated in ALPI and reached the target points at intensities of few pA.

## THE SET-UP'S AND THE EXPERIMENTS

In the 1<sup>st</sup> experimental hall the PRISMA magnetic spectrometer coupled to the new  $\gamma$ -array CLARA fully entered into operation and a first experimental campaign started in spring. With this combined set-up one can study reaction mechanism and nuclear structure of neutron-rich nuclei produced via multinucleon transfer reactions. In this first campaign ten beam-times were performed with heavy-ion beams ranging from  $^{24}\text{Mg}$  to  $^{90}\text{Zr}$ , involving physicists coming from different institutions.

Tests of the new equipment for the experiment EXOTIC were performed with  $^{17}\text{O}$ . In this experiment secondary beams are produced in a gas target for reaction mechanism studies.

The set-up for applied physics placed in the  $+70^0$  position continued operation with various heavy-ion beams and, together with the set-up for condensed matter physics installed at the  $+30^0$  beam line, covered about 17 % of the total available machine time.

In the 2<sup>nd</sup> experimental hall the PISOLO set-up was extensively used for measurements of sub-barrier fusion reactions on medium-mass systems. GASP restarted operation in late spring and beam times were performed

Set-up	Detector	Hall	% of beam-time
PRISMA+CLARA	magn. spectr.+ $\gamma$ array	I	43
Int. Physics	$+30^0, +70^0$	I	17
EXOTIC	part. det.	I	4
PISOLO	TOF spectr.	II	15
GASP	$\gamma$ -array	II	10
TRAPS	atom trap	II	9
GARFIELD	$4\pi$ det.	III	2

mainly using the Cologne Plunger for lifetime measurements.

The set-up for the production and transport of francium ions into a magneto-optical trap was upgraded with the installation of a Wien filter along the secondary beam-line. Radioactive Fr ions at energies of  $\simeq 3$  keV were sent into the trap with intensities of  $\simeq 10^5\text{-}10^6$  ions/sec.

In the 3<sup>rd</sup> experimental hall the GARFIELD apparatus for charged particle detection suffered from the problems of the accelerator complex and used a very limited amount of beam-time, mainly for detector tests.

The total number of experiments completed during 2004 was 20 ; of these, 11 had foreign users as spokespersons with participants coming from several institutions from outside Italy. Beams were accelerated to the different target points with a beam-time percentage listed above.

## THE PAC

The LNL Program Advisory Committee met twice during 2004 in order to evaluate the experimental proposals presented for the periods March-July 2004 and September 2004-March 2005. For the first (second) meeting, held in March (July), a total of 16 (24) proposals were submitted for experiments at the Tandem-ALPI accelerator, 2 (2) of which concerned applied physics and were evaluated by the User Selection Panel (USP). The total beam-time request for nuclear physics experiments for the 1<sup>st</sup> and 2<sup>nd</sup> semester was 91 (168) days, the number of approved proposals by the PAC was 9 (11) and the number of assigned days was 49 (64) respectively. The total number of days allotted for interdisciplinary physics was 13 (10) for the 1<sup>st</sup> (2<sup>nd</sup>) semester.