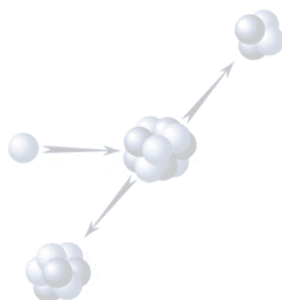


INTERNATIONAL SYMPOSIUM ON BORON NEUTRON CAPTURE THERAPY

July 7 - 9, 2004, Novosibirsk, Russia



Editor

Sergey TASKAEV

*Budker Institute of Nuclear Physics,
Novosibirsk, Russia*

PREFACE

Early in the 90s, Japanese scientists showed that boron neutron capture therapy (BNCT) allows treating brain glioblastoma multiforme and melanoma, that are resistant to other methods of treatment. Glioblastoma multiforme afflicts approximately one of 20,000 people every year. The disease is always fatal, usually within six months of onset. Surgery and conventional radiation therapies may prolong life for as much as a year but do not stop the spread of tumors throughout the brain. This event in the early 90s gave a good intensification in study boron neutron capture therapy. In 1994 BNCT irradiation was re-initiated in the US. Glioblastoma multiforme patients have been treated at Massachusetts Institute of Technology Research Reactor and Brookhaven Medical Research Reactor. In 1997, clinical trials began in Petten, the Netherlands, as a result of joint effort of the European Community. In June 1999 clinical trials began in Finland, in 2000 – in Czech Republic, 2002 – Sweden and Italy, 2003 – Argentina, in the near future clinical testing in Australia and Korea will be started. All these studies are conducted at specially constructed or adapted nuclear reactors. Progress in BNCT at clinical trials at reactors and prospects of the technique led to intensive discussion of development and construction of neutron source based on compact and inexpensive accelerator available for every oncologic hospital. Now, works are carried out at accelerators available at the number of scientific centers, and pilot accelerator based source of epithermal neutrons is under construction at the Budker Institute of Nuclear Physics.

The International Symposium on Boron Neutron Capture Therapy was held in Novosibirsk, July 7-9, 2004. It was organized by the Budker Institute of Nuclear Physics, Novosibirsk, with support of the International Science and Technology Center.

The main objectives of the Symposium were to serve as a review of the progress in the development of accelerators for BNCT irradiation systems, as well as review clinical aspects. The program of Symposium included review lectures, invited papers, contributed papers, round-table discussion, and ISTC seminar. The main topics of the papers were following: accelerator based neutron source; medical physics; treatment planning; clinical aspects. This meeting allowed to coordinate efforts of Russian investigating groups, some of which are supported by International Science and Technology Center.

S. Taskaev

Editor

Novosibirsk, July 21, 2004

Program Schedule

Wednesday, July 7, 2004

- 8:00 - 9:00** Registration
9:00 - 9:10 Opening of the Symposium
9:10 - 11:00 ISTC seminar
- | | | |
|-------|---------------|---|
| 9:10 | E. Kruglyakov | Plasma Neutron Source Based on Gas Dynamic Trap (ISTC projects # 050 and 492) |
| 9:30 | I. Koop | Electron-Positron Storage Ring (ISTC project # 1928) |
| 9:50 | P. Logachev | Accelerator Ion Source (ISTC project # 2257) |
| 10:10 | M. Tiunov | High-Efficiency, High-Power Accelerator Development (ISTC project # 2250) |
| 10:30 | G. Malyshkin | Development of a Treatment Planning System for the Snezhinsk Neutron Therapy Center (ISTC project # 2145) |
| 10:50 | A. Ivanov | Accelerator Based Neutron Source for Boron Neutron Capture Therapy (ISTC projects # 1484 and 2569) |
- 11:10 - 11:30** coffee break
11:30 - 13:00 Poster section
13:00 - 14:00 Lunch
14:30 - 22:00 Ship tour and barbecue

Thursday, July 8, 2004

- 10:20 - 13:00**
- | | | |
|-------|----------------|--|
| 10:20 | Yu. Belchenko | Study of cw negative ion source for BNCT tandem accelerator |
| 10:35 | A. Kudryavtsev | Channel of beam transporting |
| 10:50 | I. Kandaurov | Test experiments for ion beam injection at the prototype of electrostatic tandem accelerator |
- 11:15 - 11:35** coffee break
- | | | |
|-------|-------------------|--|
| 11:35 | I. Sorokin | Status of high-current tandem accelerator for the neutron therapy facility |
| 11:50 | P. Nemytov | High voltage rectifier for accelerator based neutron source |
| 12:05 | V. Davydenko | Stripping target for 10 mA 1 MeV negative ion beam |
| 12:20 | S. Taskaev | Optimization of lithium target for epithermal neutrons generation |
| 12:35 | T. Vsevolozhskaya | Temperature regime in neutron production target for BNCT |
- 13:00 - 14:00** Lunch
14:00 - 18:00
- | | | |
|-------|---------------|---|
| 14:00 | V. Kanygin | Recent methods of brain malignant tumor diagnostics and therapy |
| 14:25 | A. Manannikov | Radiotherapy in Russia |
| 14:45 | I. Ostanina | Recent aspects of medicamental treatment of tumor |
| 15:00 | V. Lisin | Fast neutrons therapy |
| 15:20 | V. Bregadze | Synthesis of boronated chemicals for BNCT |
- 15:55 - 16:15** coffee break
- | | | |
|-------|------------|---|
| 16:15 | V. Kononov | Accelerator based neutron source for medicine |
| 16:35 | O. Kononov | Accelerator based epithermal neutron source for NCT |
| 16:50 | G. Krainov | High frequency compact generator of accelerating voltage on 500 kV, 10 kW |
| 17:05 | G. Dimov | Dc tandem surface-plasma source of H ⁻ with current up to 100 mA |
| 17:25 | I. Sheino | Neutron capture therapy at the MEPHI reactor |
- 19:00 - 22:00** Symposium dinner

Friday, July 9, 2004

- 9:00 - 11:10** Round-table discussion on BNCT
11:10 - 11:30 coffee break
11:30 - 12:30
- | | | |
|-------|--------------|---|
| 11:30 | T. Kobayashi | Small accelerators for the next generation of BNCT irradiation systems |
| 11:50 | A. Ivanov | Accelerator based neutron source for boron neutron capture therapy |
| 12:10 | I. Gulidov | Fast reactor neutrons in the treatment of malignancies and perspectives of NCT and NCT enhanced fast neutron therapy in Obninsk, Russia |
- 12:30 - 12:50** Symposium closing
13:00 - 14:00 Lunch
14:00 - 16:00 Excursions to experimental facilities of Budker Institute of Nuclear Physics
16:00 - 19:00 Optional excursions to Novosibirsk and Akademgorodok

CONTENTS

| | |
|---|-----------|
| Small accelerators for the next generation of BNCT irradiation systems | 1 |
| T. Kobayashi, K. Tanaka, G. Bengua, M. Hoshi, Y. Nakagawa | |
| Accelerator based neutron source for neutron capture therapy | 7 |
| B. Bayanov, Yu. Belchenko, V. Belov, V. Davydenko, A. Donin, A. Dranichnikov, A. Ivanov, I. Kandaurov, G. Kraynov, A. Krivenko, A. Kudryavtsev, N. Kuksanov, R. Salimov, V. Savkin, V. Shirokov, I. Sorokin, S. Taskaev, M. Tiunov | |
| Development and study of cw H^- source for BNCT | 10 |
| Yu. Belchenko, A. Khilchenko, A. Kryuchkov, V. Savkin, I. Ivanov, I. Piunov | |
| Coupling H^- ions beam line for tandem accelerator | 19 |
| S. Konstantinov, A. Krjutchkov, A. Kudryavtsev, O. Myskin, I. Sorokin, M. Tiunov | |
| Test experiments for ion beam injection at the prototype of electrostatic tandem accelerator | 23 |
| V. Davydenko, A. Ivanov, I. Kandaurov, O. Myskin, M. Tiunov | |
| Status of high-current tandem accelerator for the neutron therapy facility | 26 |
| V. Dolgushin, G. Kraynov, E. Pokhlebenin, V. Shirokov, I. Sorokin | |
| Source of the accelerating voltage in the high-voltage tandem accelerator for neutron capture therapy | 31 |
| M. Veis, N. Kuksanov, P. Nemytov, V. Prudnikov, R. Salimov, S. Fadeev | |
| Stripping target for a 10 mA, 1 MeV negative-hydrogen ion beam | 36 |
| V. Davydenko, A. Krivenko | |
| Optimization of lithium target for epithermal neutrons generation | 39 |
| B. Bayanov, V. Belov, V. Kindyuk, S. Taskaev | |
| Temperature regime in neutron production target for BNCT | 46 |
| T. Vsevolozhskaya | |
| Accelerator based epithermal neutron source for NCT | 50 |
| V. Kononov, O. Kononov, N. Soloviev, M. Bokhovko | |
| Accelerator based neutron sources for medicine | 62 |
| V. Kononov, M. Bokhovko, O. Kononov | |
| The high frequency compact generator of accelerating voltage on 500 kV, 10 kW | 66 |
| A. Babkin, P. Bykov, G. Krainov, G. Sil'vestrov, V. Shirokov, Yu. Tokarev | |

| | |
|---|------------|
| Dc tandem surface-plasma source of H⁻ ions with current up to 100 mA | 70 |
| G. Dimov | |
| Tape high power neutron producing target for NCT | 76 |
| V. Kononov, G. Smirnov, S. Taskaev | |
| Recent methods of brain malignant tumor diagnostics and therapy | 79 |
| V. Kanygin | |
| NCT at the MEPHl reactor | 82 |
| K. Zaitsev, A. Portnov, V. Sakharov, V. Troshin, V. Savkin, V. Kvasov, O. Mishcherina, V. Kulakov, V. Khokhlov, I. Sheino, V. Meshcherikova, V. Mitin, N. Kozlovskaya, I. Shikunova | |
| Estimation of neutron kerma in biological tissue containing boron and gadolinium compounds for neutron capture therapy | 99 |
| I. Sheino, V. Khokhlov, V. Kulakov, K. Zaitsev | |
| Fast reactor neutrons in the treatment of malignancies and perspectives of NCT and NCT enhanced fast neutron therapy in Obninsk, Russia | 111 |
| I. Gulidov, A. Sysoev, Yu. Mardynsky, S. Ulianenko, S. Kapchigashev, V. Kononov, B. Fursov | |