

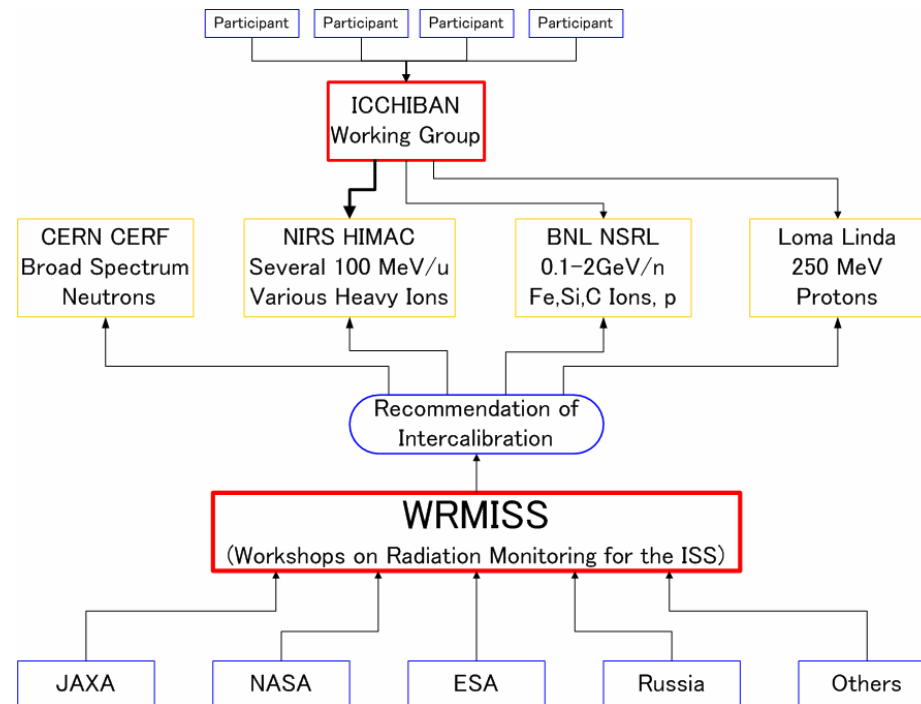
Status of ICCHIBAN-3 and -4 Intercomparison Experiments for Space Radiation Instruments

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Y.Uchihori, H.Kitamura, K.Fujitaka, N.Yasuda (NIRS, Japan)
and E. Benton (EriL Research Inc.)
on behalf of ICCHIBAN Working Group and Participants

ICCHIBAN Project

- Determine **the response of space radiation dosimeters** to heavy ions of charge and energy similar to that found in the galactic cosmic radiation (GCR) spectrum.
- **Compare response and sensitivity** of various space radiation monitoring instruments. Aid in **reconciling differences** in measurements made by various radiation instruments during space flight.
- Establish and characterize a heavy ion “**reference standard**” against which space radiation instruments can be calibrated.



Participants

Active Detectors

Institution	Investigators	Country
Kiel Univ.	R.Beaujean, S.Burmeister	Germany
IMBP	V.Bengin	Russia
LBNL	J.Miller, C.Zeitlin, L.Heilbronn, S.Guetersloh	USA
NASA-JSC	T.Shelfer, E.Semones, N.Zapp	USA
NIRS	Y.Uchihori, N.Yasuda, H.Kitamura	Japan
Prairie View A&M Univ.	R.Wilkins, B.Gersey, D.Woods	USA
STIL-BAS	Ts.Dachev	Bulgaria
Waseda Univ.	T.Doke, K.Terasawa, T.Fuse	Japan

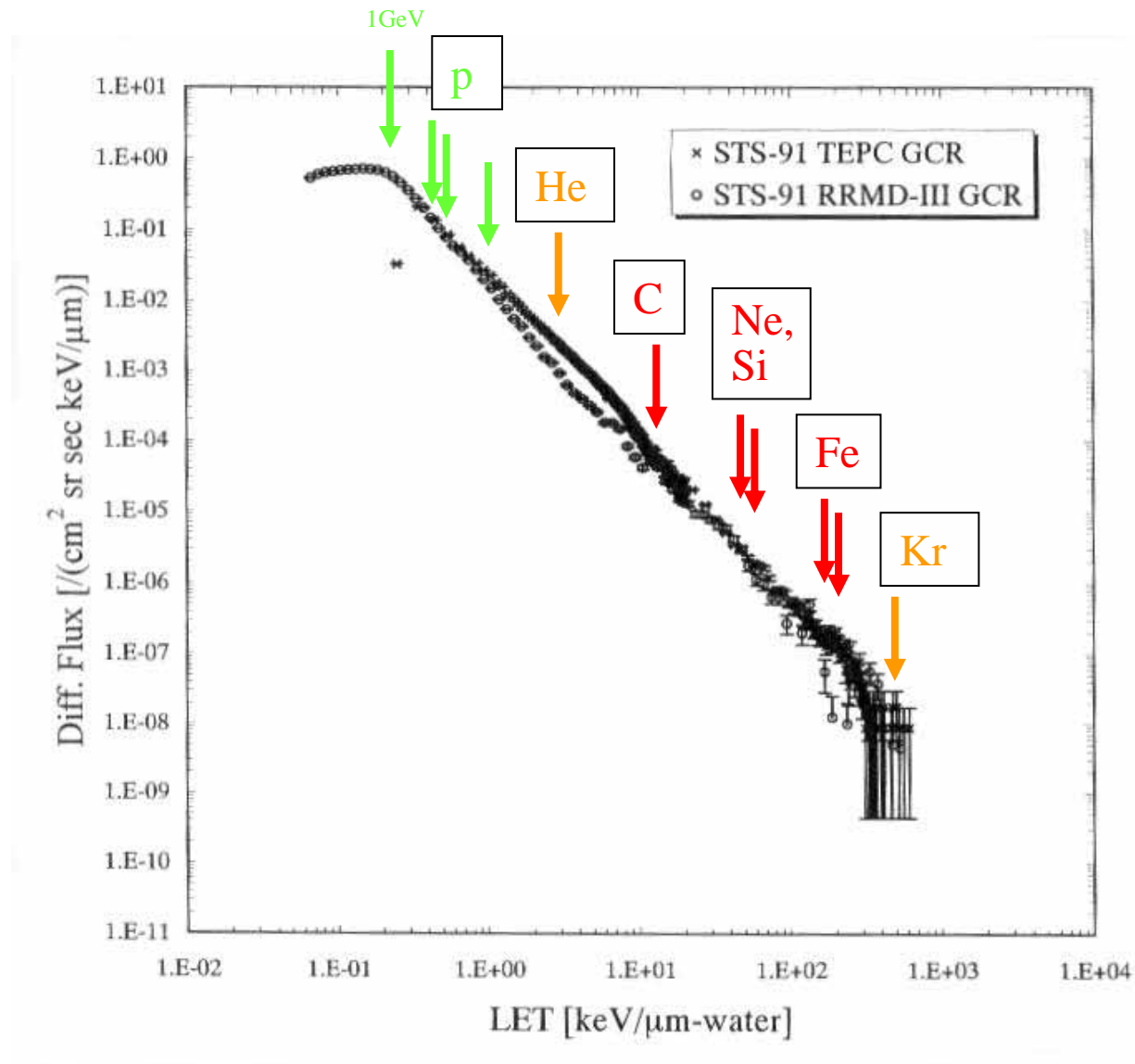
Passive Detectors

Institution	Investigators	Country
ATI	T. Berger, M. Hajek & N. Vana	Austria
DLR	G. Reitz, T.Berger	Germany
ERI	E. R. Benton, A. L. Frank & E. V. Benton	USA
IMBP	Yu. Akatov & V. Shurshakov	Russia
KFKI AEKI	S. Deme, I. Apathy, J. Palfalvi & T. Pazmandi	Hungary
INP	P. Bilski, P. Olko & T. Horwacik	Poland
NASA JSC	E. Semones	USA
NRPB	D. Bartlett & L. Hager	UK
NASDA & KEK	H. Tawara, A. Nagamatsu & M. Masukawa	Japan
NPI	F. Spurny & K. Turek	Czech Rep.
OSU	S.W.S. McKeever, R. Gaza, & E. G. Yukihara	USA

History of ICCHIBAN runs

Feb. 11-13, 2002	1 st ICCHIBAN Experiment (For Active Detectors)	C400, Fe400
May 23-28, 2002	2 nd ICCHIBAN Experiment (For Passive Detectors)	He150, C400, Si490, Fe500
Feb. 3-6, 2003	3 rd ICCHIBAN Experiment (For Active Detectors)	Si800, Fe500
May 19-30, 2003	4 th ICCHIBAN Experiment (For Passive Detectors)	He150, C400, Ne400, Fe500, ...
Sep. 6-7, 2003	1 st Proton ICCHIBAN Experiment (For All Detectors)	p70-250
Feb. 14-17, 2004	5 th ICCHIBAN Experiment (For Active Detectors)	He150
June 4-15, 2004	6 th ICCHIBAN Experiment (For Passive Detectors)	C135, Ar500, Kr400, ...
Sep. 24-26, 2004	1 st NSRL ICCHIBAN Experiment (For All Detectors)	p1000, O1000, Fe1000

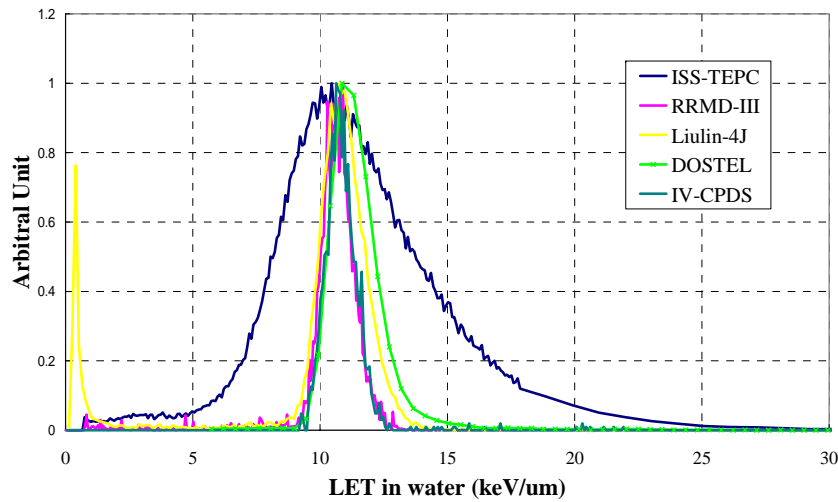
Covered LET Region in ICCHIBAN Exp.



T.Doke et al.,
Rad. Meas. 33
(2001) 373

Comparison for Carbon and Iron Runs in IC-1

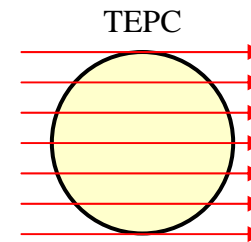
ICCHIBAN-1, Carbon 400MeV/u



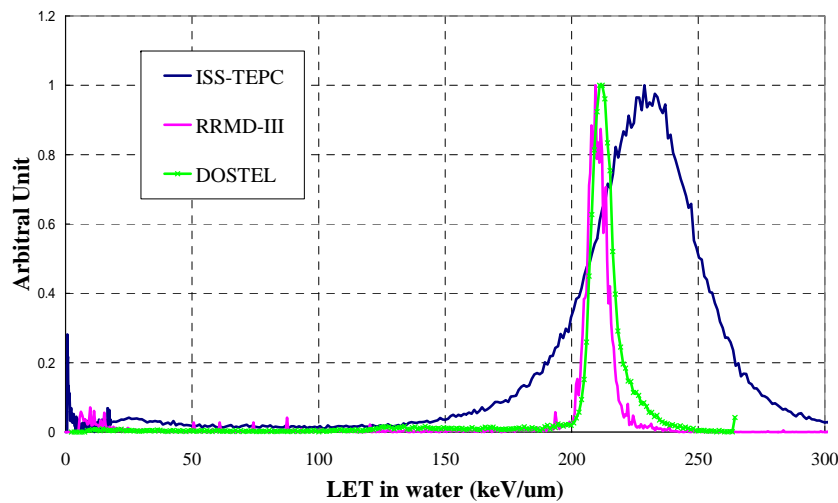
0 degree

Center

No Absorber



ICCHIBAN-1, Iron 400MeV/u



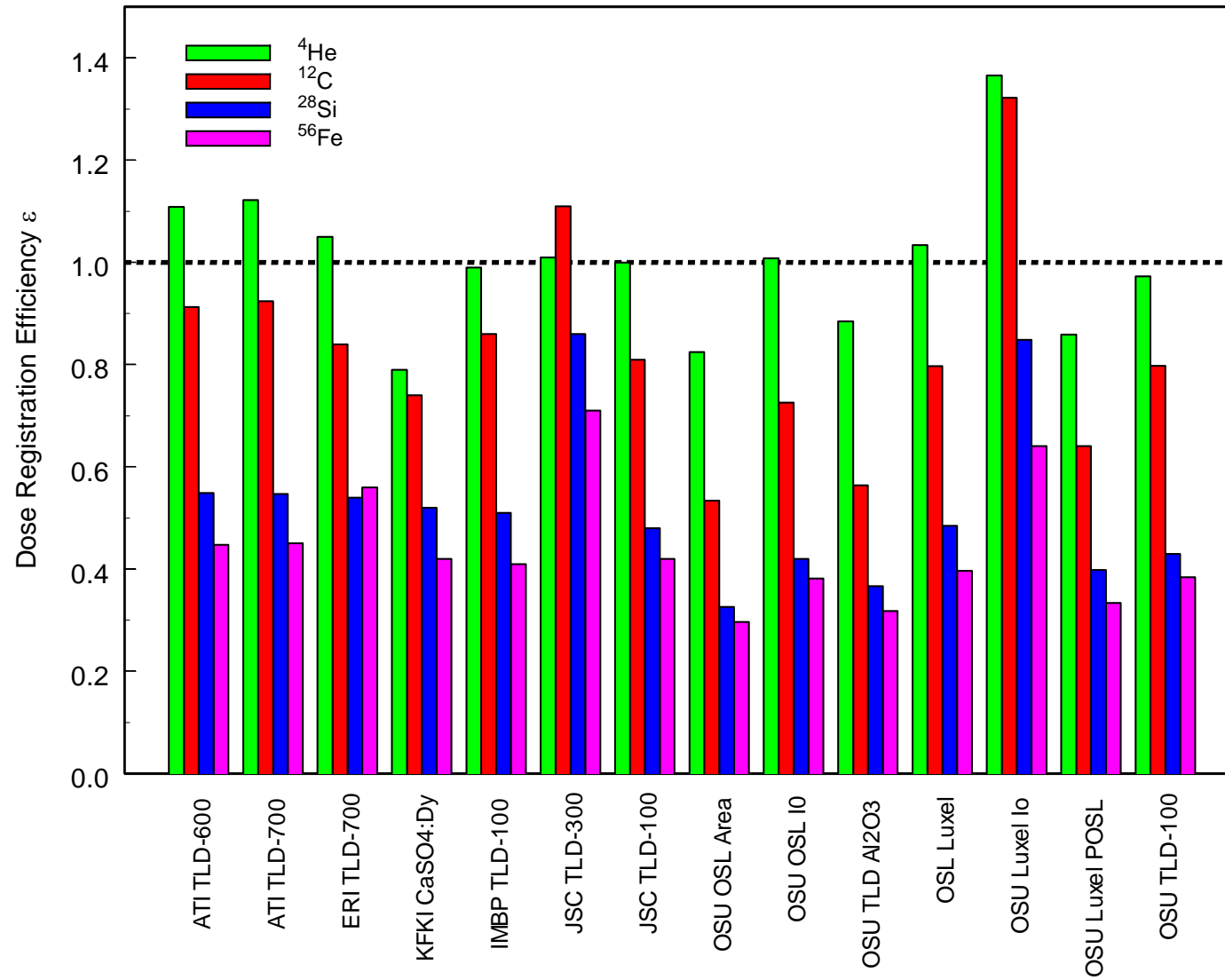
0 degree

Center

No Absorber

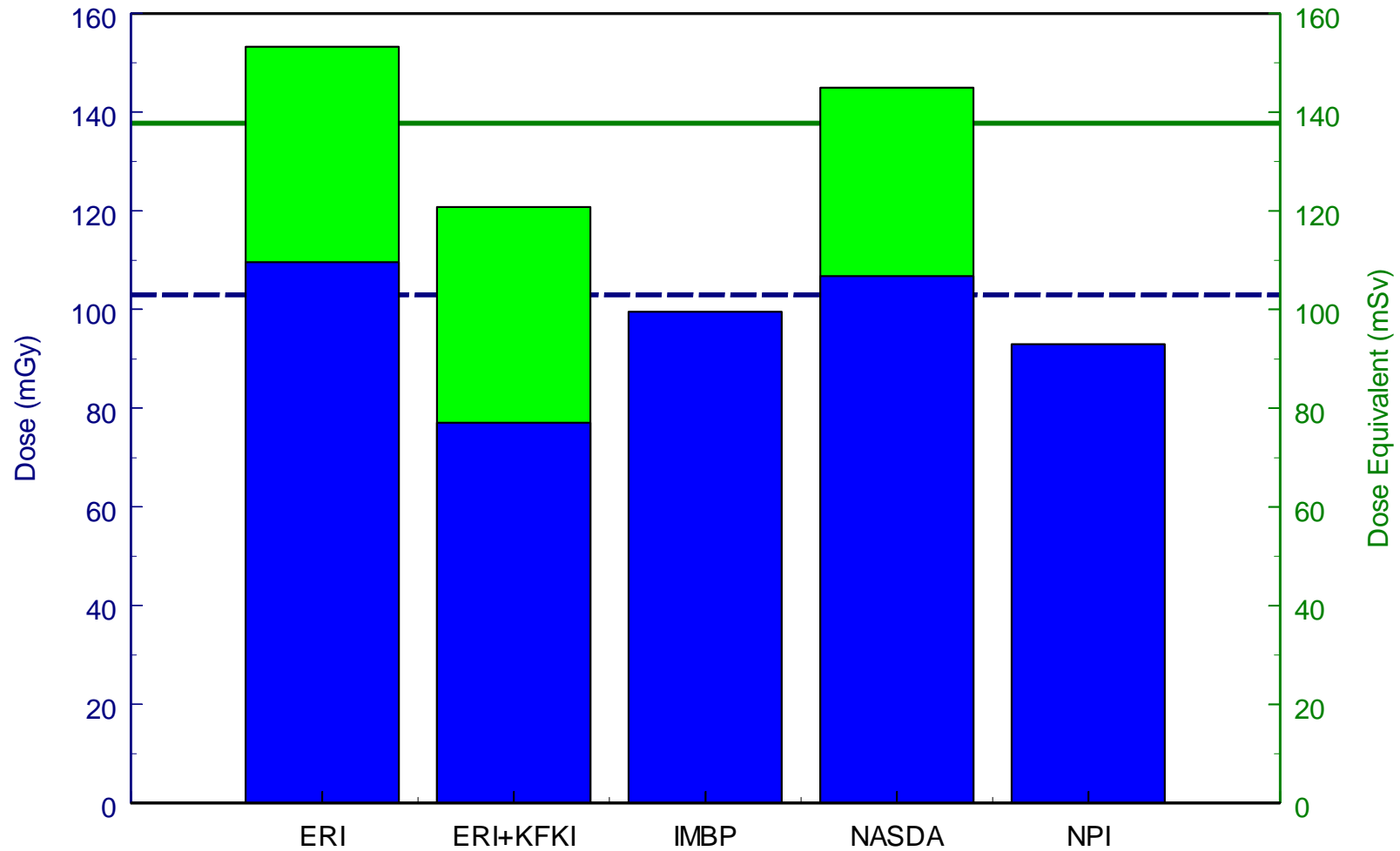
CPDS and
Liulin-4J have
no data.

ICCHIBAN-2: High-LET TLD Efficiency



ICCHIBAN-2: Blind No. 1 TLD+PNTD

Blind 1 "Space", Actual D: 103 mGy, Actual H: 137.7 mSv



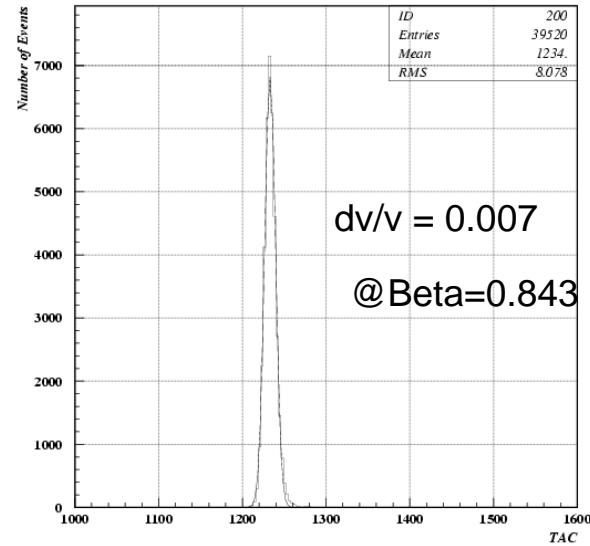
ICCHIBAN-3 & 5 Experiments

- ICCHIBAN-3
 - Using Si 800, C400 and Fe500 beams, ICCHIBAN-3 was performed on Feb, 2003.
 - ATI, ERI, Kiel Univ., LBNL, NASA-JSC, NIRS, Waseda Univ.&JAXA
 - Direct, inclined and fragment beams
- ICCHIBAN-5
 - Using wide, uniform He150 beams, ICCHIBAN-6 was performed on June, 2004.
 - ATI, DLR, IMBP, Kiel Univ., LBNL, NIRS, Waseda Univ.&JAXA
 - Direct, inclined and fragment beams with wide, uniform beam

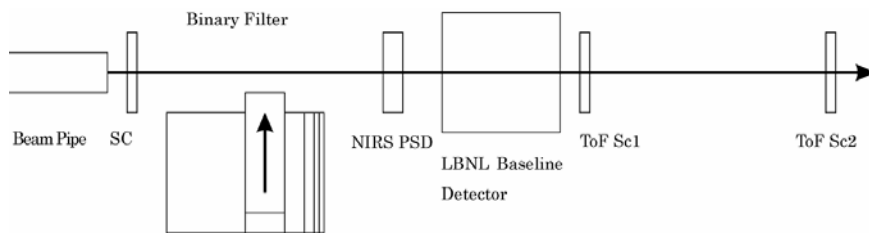
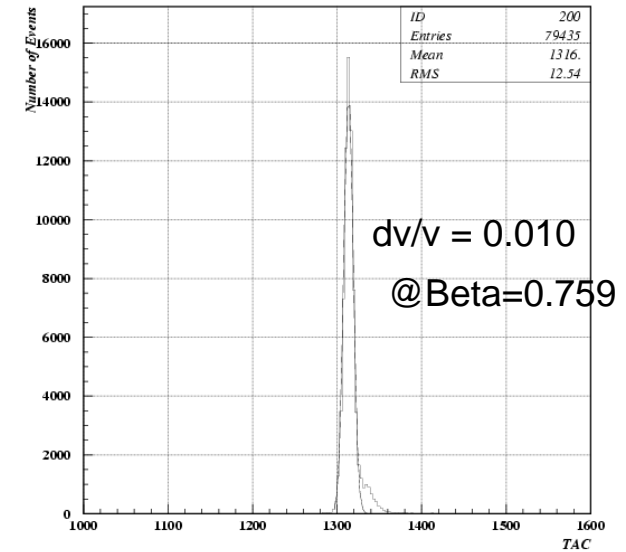
Reference Measurements using LBNL Detectors in ICCHIBAN-3

Time of Flight Measurements

IC-3, 030204, Si800

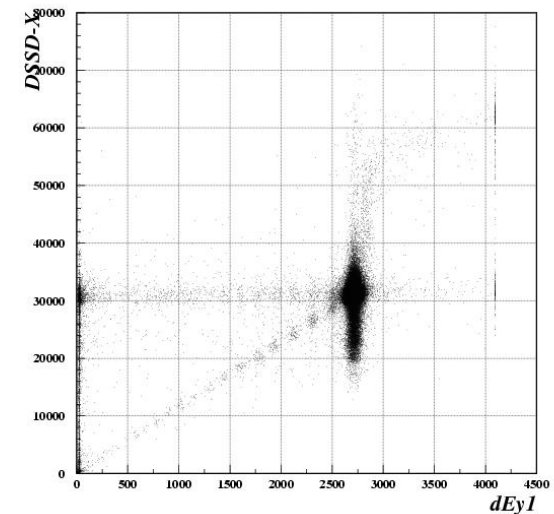


IC-3, 030205, Fe500

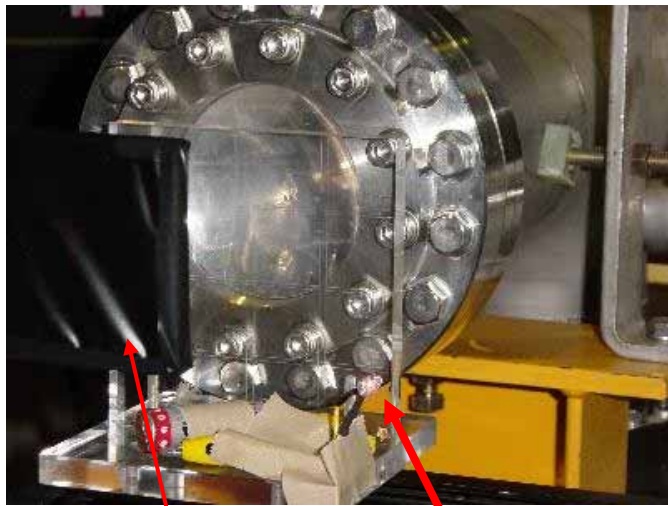


Fragmentation

IC-3, 030205, Fe500

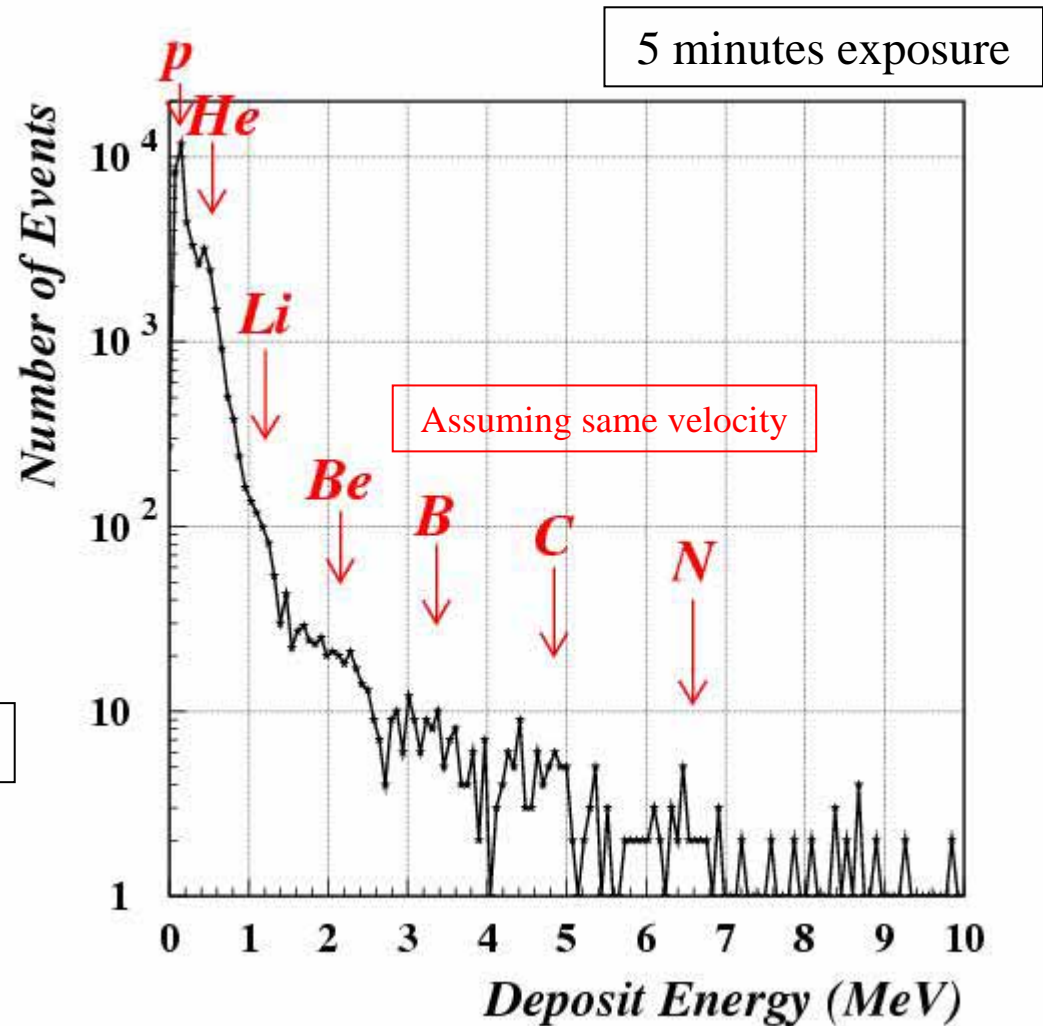


Fragments from Si(800) Beam (Liulin-4J data)

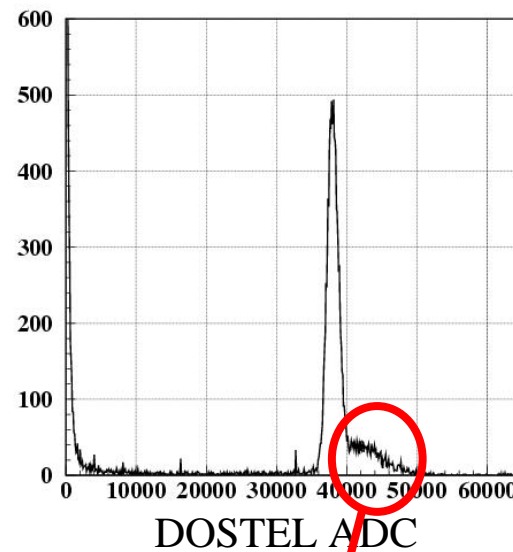
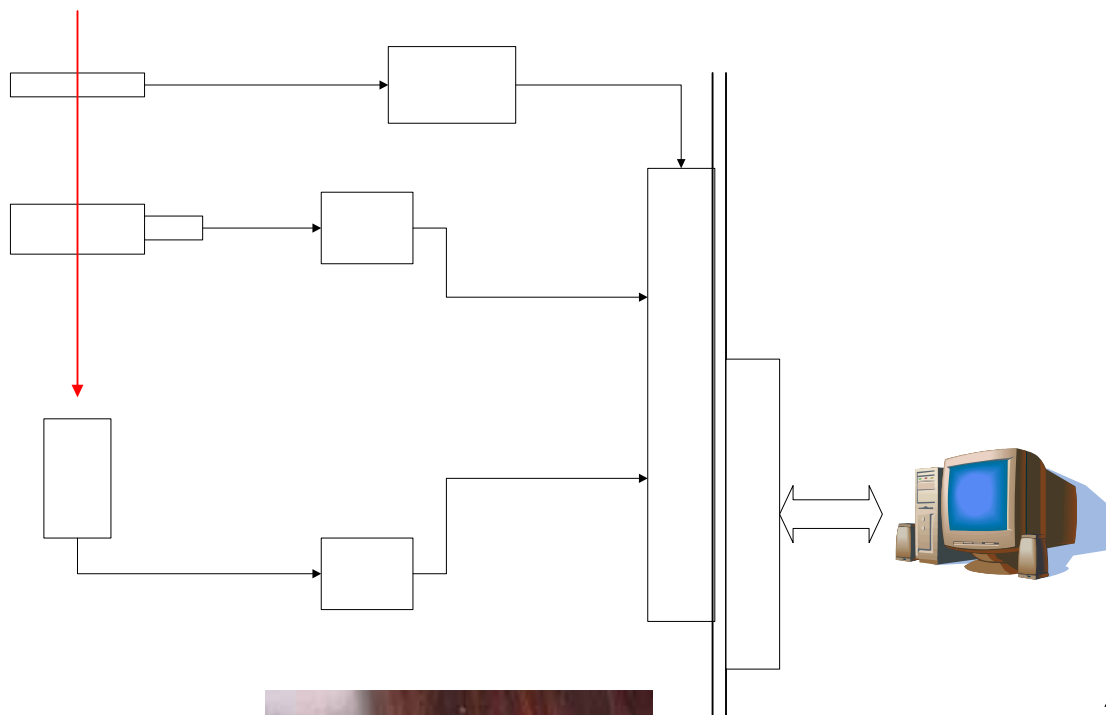


Plastic Scintillator
(50 μ m)

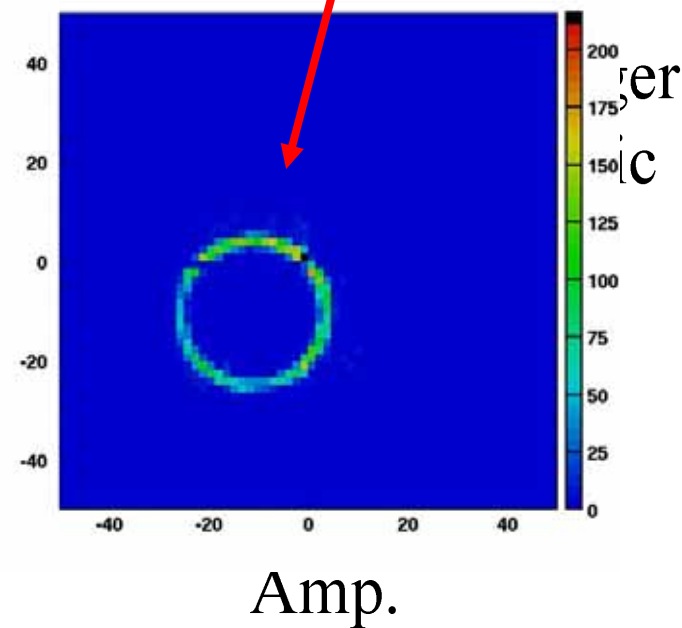
Acryl Target (1cmt)



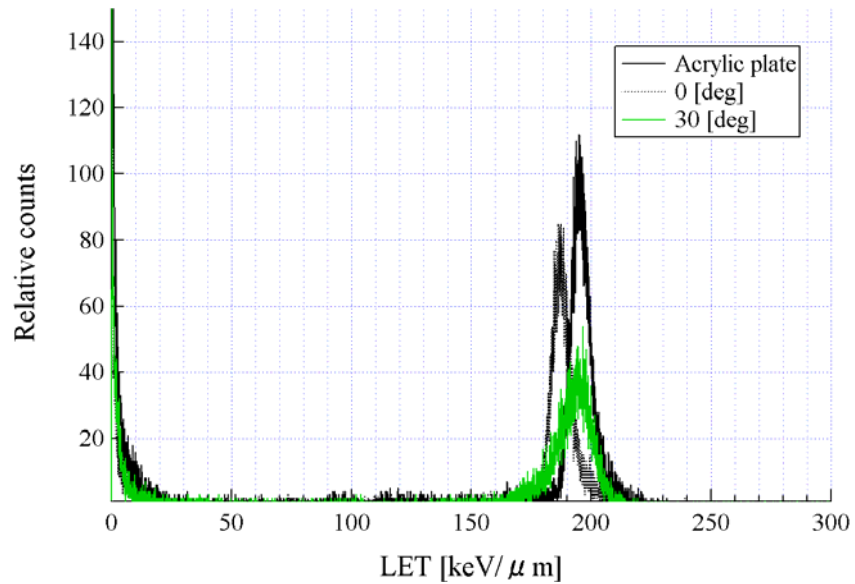
Position Sensitive Detector + Monitor



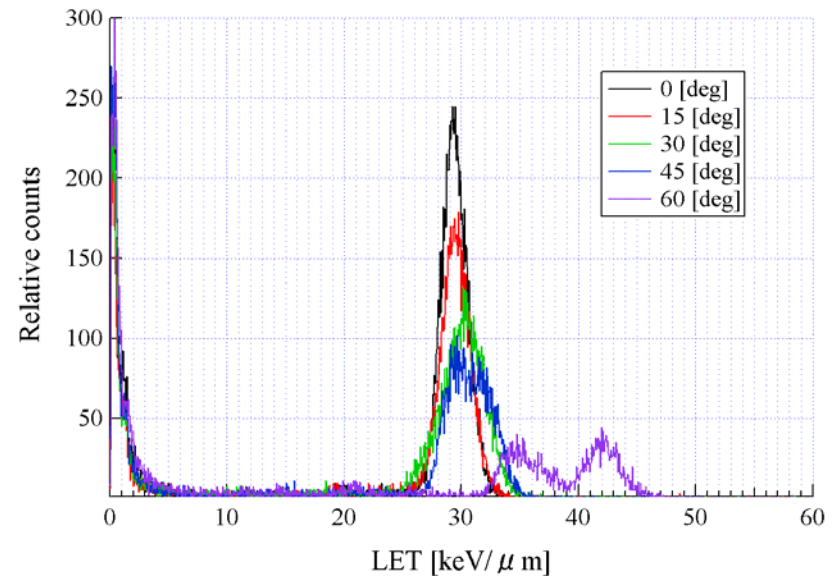
Trig. SC_{10cm}



Results from ICCHIBAN-3 (RRMD-III)



Iron Experiments



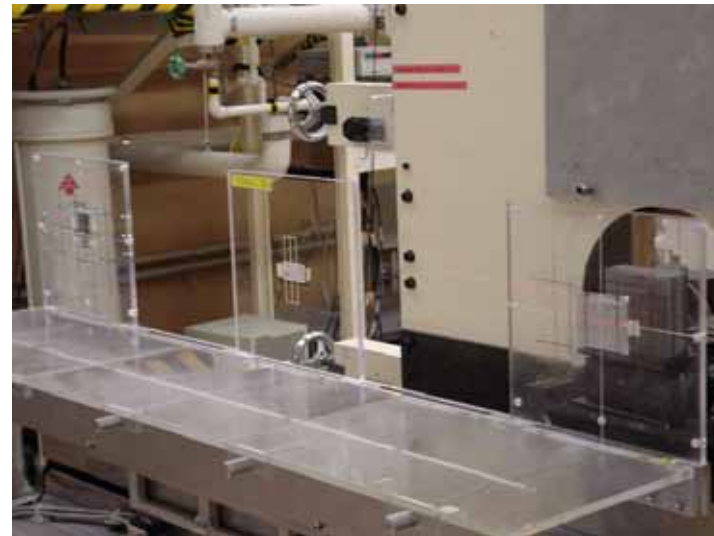
Neon Experiments

by Waseda Univ. and JAXA

ICCHIBAN-4 & 6 Experiments

- ICCHIBAN-4
 - Using He150, C400, Ne400, Fe500 beams and other low LET radiation, ICCHIBAN-4 was performed on May, 2003.
 - Dr. Y. Akatov, Dr. E. Benton, Ms. R. Gaza, Dr. B. Gersey, Dr. M. Hajek, Dr. R. Wilkins and Ms. D. Woods participated to experiments.
 - 12 institutions sent or brought their dosimeters for the experiments.
 - 16 ‘Know Exposure’ and 8 ‘Blind Exposure’ were performed
- ICCHIBAN-6
 - Using C135, Ar500, Kr400 beams and other low LET radiation, ICCHIBAN-6 was performed on June, 2004.
 - Dr. Y. Akatov, Dr. E. Benton, Dr. T. Berger and Dr. M. Hajek participated to experiments.
 - 12 institutions sent or brought their dosimeters for the experiments.
 - 6 ‘Know Exposure’ and 6 ‘Blind Exposure’ were performed

Preparation and Exposure of Passive Detectors (ICCHIBAN-4)



Conclusion (I)

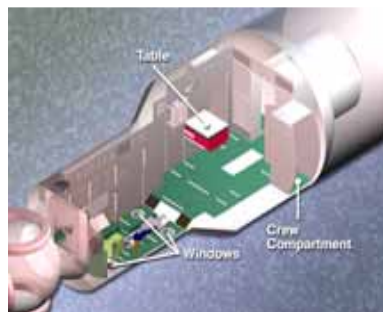
- 1st, 2nd, 3rd, 4th, 5th and 6th ICCHIBAN runs were carried out successfully at HIMAC in 2002, 2003 and 2004.
- We have compared the results and reports from ICCHIBAN-1 and 2 were published as HIMAC report in NIRS on April, 2004.
- We are preparing next reports from ICCHIBAN-3 and 4 and will be published in this year hopefully.
- Next ICCHIBAN experiments (ICCHIBAN- 7&8) will be performed on Sep. or Oct. in 1995.
- 1st Proton-ICCHIBAN experiment was performed on Sep. 6-8, 2003 at Loma Linda Synchrotron Facility. 30-250 MeV proton beams were exposed. We thank to Dr. G. Nelson and LLUMC group.

Conclusion (II)

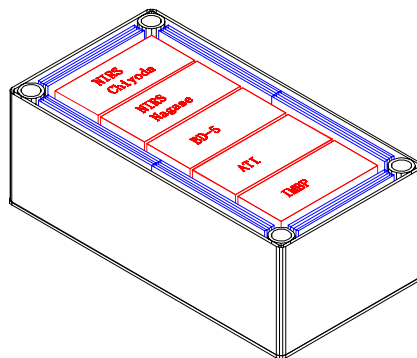
- **1st NSRL-ICCHIBAN** experiment will be performed on **Oct. 24-26, 2004**. We thank every effort by Drs. J. Miller, F. Cucinotta, M. Vazquez, B. Sutherland and BNL group. We welcome your participation to the NSRL-ICCHIBAN.
- Intercomparison experiment in space environment is expected to compare dosimeters. The **MATRHOSHKA** project (PI:Dr. Reitz) must be one of them. And, as another opportunity, **Space-ICCHIBAN** experiment will be performed with collaboration between IMBP and NIRS in near future. We thank to Drs. V. Petrov, V. Shurshakov and Y. Akatov. We welcome your participation to Space-ICCHIBAN, too.
- HIMAC-ICCHIBAN experiments were performed as a part of NIRS-HIMAC Research Project.

Intercomparison in Space Environment (BRADOS-Intercomparison/Space-ICCHIBAN-0)

Collaboration with IMBP, Russia and NIRS, Japan



Passive Dosimeters from four groups were on board in ISS Russian Service Module and they were exposed for three months at space environment from Jan. – Apr., 2004.



- NIRS, Japan (NIRS+Chiyoda, NIRS+Nagase)
- IMBP, Russia
- Eril Research Inc. & Oklahoma State Univ., USA
- Atominstute of the Austrian Universities, Austria