

# Summary of Benchmarking Session

Methods: **Monte Carlo** and other methods

Physics Model

Data: Barion and/or Meson interactions in nucleon

: Parameterization

Nuclear data

Inter-comparison among codes

$\Lambda_0$  problem

Requirement for the secondary particle yield from  
small target

# Microscopic Benchmarking

IAEA activity : [www-nds.iaea.org/spallations](http://www-nds.iaea.org/spallations)

Advanced Workshop on Model Codes for Spallation Reactions ( Feb. 10, 2010)

Double Differential Cross section (DDX): CEA-Saclay

Isotopic Distribution Cross section (IDX): GSI

Light Charged Particle Production (LCPP)

: NSC, LANL, COSY..

etc.

GSI activity

Isotopic Distribution Cross section (IDX): GSI

CERN experiment: Secondary particle production

# Macroscopic (Integral) Benchmarking

## Proton accelerators

RCNP experiment: Deep penetration (forward)

FNAL experiment (JASMIN):

Deep penetration (lateral)

Muon interaction

BNL experiment: Deep penetration (lateral)

## Heavy ion accelerators

RIKEN experiment : Secondary neutron production

# References

# Macroscopic (Integral) Benchmarking at SATIF2

## 1. Thick Target Neutron Yields

- Thick Target Neutron Yields for 256 MeV Protons at LANL by Meier
- Photoproduction of High-Energy Neutrons in Thick Targets by Electrons in the Energy Range 150 to 270 MeV by H. J. von Eyss, et al.
- Thick Target Neutron Yield for 710-MeV Alpha Particles by R. A. Cecil, et al.

## 2. Shielding Experiments

- Transmission Through Shielding Materials of Neutrons Generated by 52- and 65-MeV Protons by Uwamino and Shin, et al.
- Saturated Activities in Iron Beam Stop Bombarded by 500 MeV Proton Beam at KEK by Ban, et al.

# Macroscopic (Integral) Benchmarking at SATIF3

1. Transmission of Quasi-monoenergetic Neutrons Generated by 43- and 68-MeV Protons Through Iron and Concrete Shields at TIARA by Nakao and Nakashima, et al.
2. Neutron fluxes in and around iron Beam Stop Irradiated by 500 MeV Protons at KEK by Arakita and Ban, et al.
3. Reaction Rate Distributions Inside Thick Concrete Shield Irradiated by 6.2 GeV protons at Berkeley by A. B. Smith, et al.
4. Neutron and Hadron Fluxes Inside Iron Beam Dump Irradiated by 24 GeV Protons at CERN by A. Fasso, et al.

# *SINBAD*

## *Accelerator Shielding (23)*

- RCNP experiments (Deep penetration, medium energy)
- TIARA experiments (Deep penetration, medium energy)
- AGS experiments: Radioactivity induced by GeV-Protons
- ROESTI I, II and III (CERN)
- CERF experiments
- CERN 200 and 400 GeV/c protons activation experiments
- RIKEN Quasi-monoenergetic Neutron Field in 70-210 MeV Energy Range
- KENS p-500 MeV shielding experiment using 4m Concrete
- HIMAC experiments (TTY and deep penetration, heavy ion accelerator)
- BEVALAC Experiment with Nb Ions on Nb & Al Targets
- MSU experiment with He & C ions on Al target
- Neutron Spectra Generated by 590-MeV Protons on a Thick Pb Target
- ISIS Deep-Penetration Neutrons through Concrete and Iron Shields using p-800 MeV