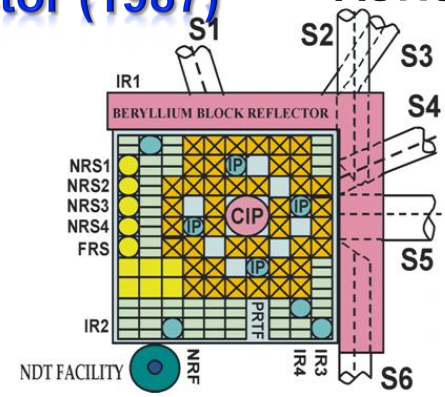
SANS Facilities in BATAN Serpong Indonesia

Edy Giri Rachman Putra

Neutron Scattering Laboratory
National Nuclear Energy Agency of Indonesia (BATAN)
Kawasan Puspiptek Serpong, Tangerang, Indonesia

AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

The G.A. Siwabessy Reactor (1987)



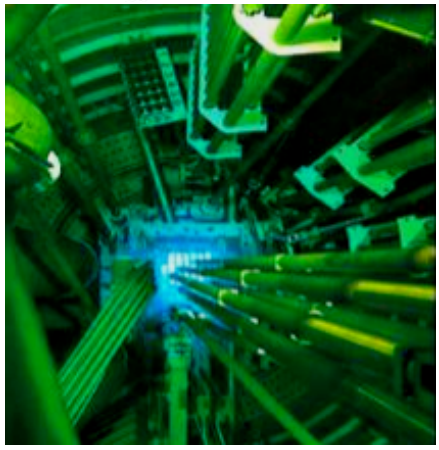
Descriptive parameters of RSG – GAS

Power : **30MW (15MW)**
Neutron flux at core : **2.5 x 10^{14} cm^{-2} s^{-1} (~ 1 x 10^{14})**

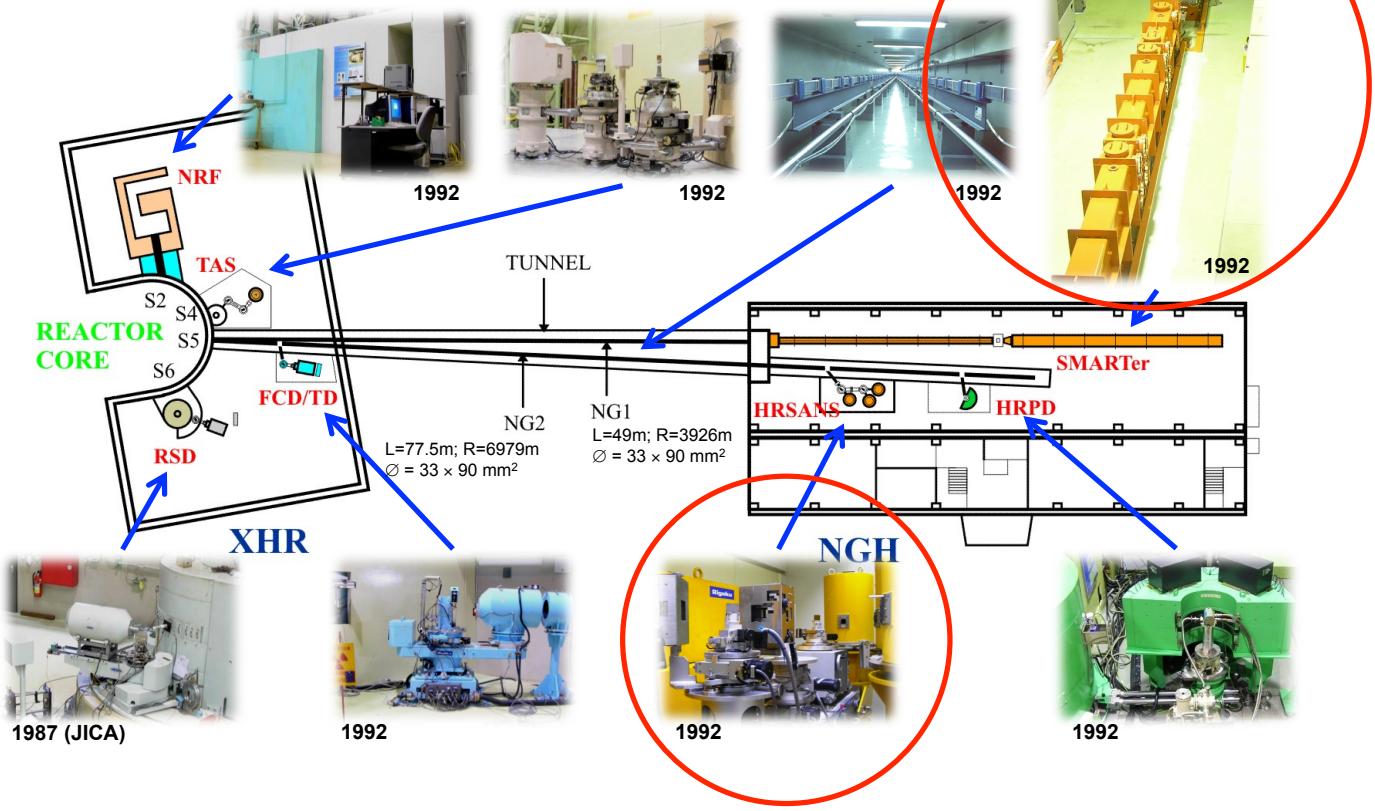
Core

Active core volume (dm^3)	: 180
Active core height (cm)	: 60
Loading (Kg ^{235}U)	: 8.675
Number of fuel elements	: 40
Number of control elements	: 8
Fuel type	: U_3SiAl - MTR
^{235}U enriched (%)	: 19.75
^{235}U density (g cm^{-3})	: 2.96
Moderator / coolant	: H_2O (thermal neutron)

Neutron beam ports : **6 (2 Tangential & 4 Radial)**



BATAN's Neutron Scattering Facility



AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

36m SANS BATAN Spectrometer (SMARTer)

Status : Running**

Edy Giri Rachman Putra
giri@batan.go.id

Mode :

- Conventional pinhole and focusing SANS (52 MgF_2 lenses)
- Neutron wavelength ~ 3 – 6 Å (10 – 20%)
- Maximum neutron flux ~ 7 x 10^6 cm^{-2} s^{-1} (λ = 3.2 Å)
- Effective Q range 0.005 – 0.3 $Å^{-1}$
- RIS∅ : 2D-PSD (1.3 – 18 m & 0.1 m)
- GRAPS, Igor NIST, SASfit, ATSAS.

Equipments :

- Small heater; external electromagnet 1 tesla

Development :

- New motor control system (motion control) & data acquisition system
- Automatic sample changer & refrigerated /heated oil circulator
- Stopped-flow cell for kinetic studies (time-resolved SANS)*
- New time-to-digital converter (TDC)*

Utilization :

- Soft and hard matters, i.e. colloids, polymers, ceramics, alloys, magnetic materials, micellar solutions, protein solutions & virus.

1996 - 1997

2003 (2005 - 2007)
2008 - 2009

High-Resolution SANS

Alan Maulana
alan@batan.go.id

Status : Running

Mode :

- Preset time measurement
- Monochromator PG (004)
- Take-off angle 60°
- Neutron wavelength λ = 1.667 Å ; FWHM = 0.451°
- Double perfect crystals Si(311)
- Smallest step (0.0001°)
- Neutron flux before monochromator ~ 6.5 × 10^7 cm^{-2} s^{-1}
- Neutron flux (sample) ~ 10^3 cm^{-2} s^{-1}

Development :

- Background reduction

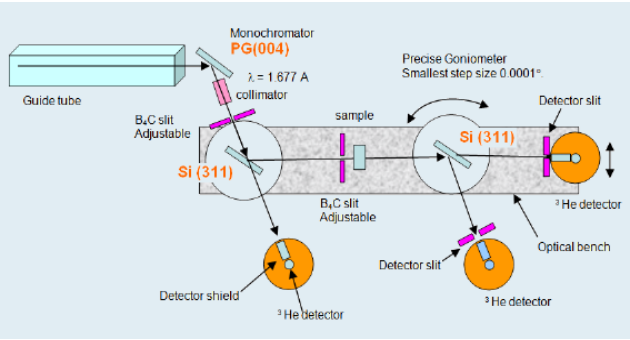
Utilization :

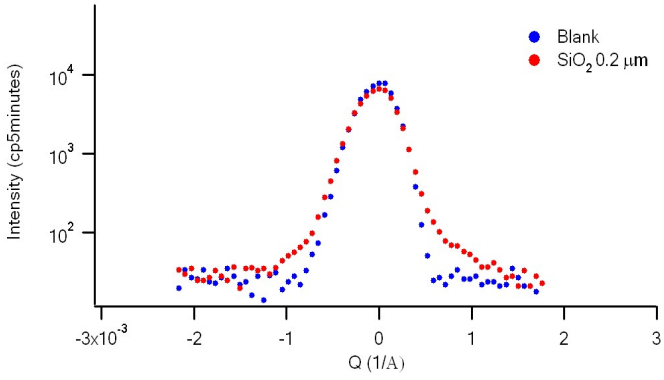
- Testing & calibration (optimization)

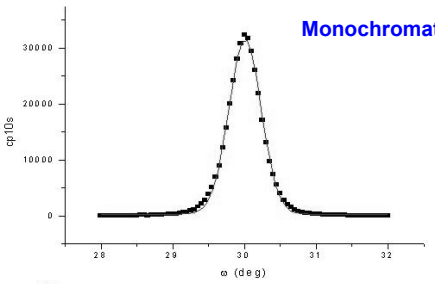
2000 (2008 – 2009)

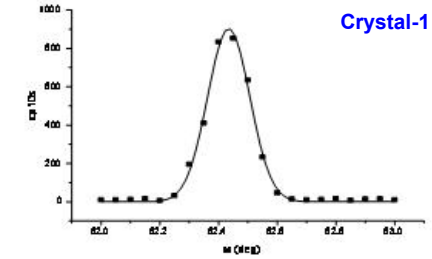
AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

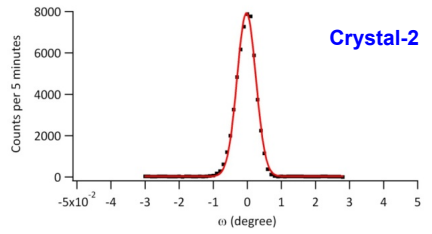
Schematic Diagram & The Results



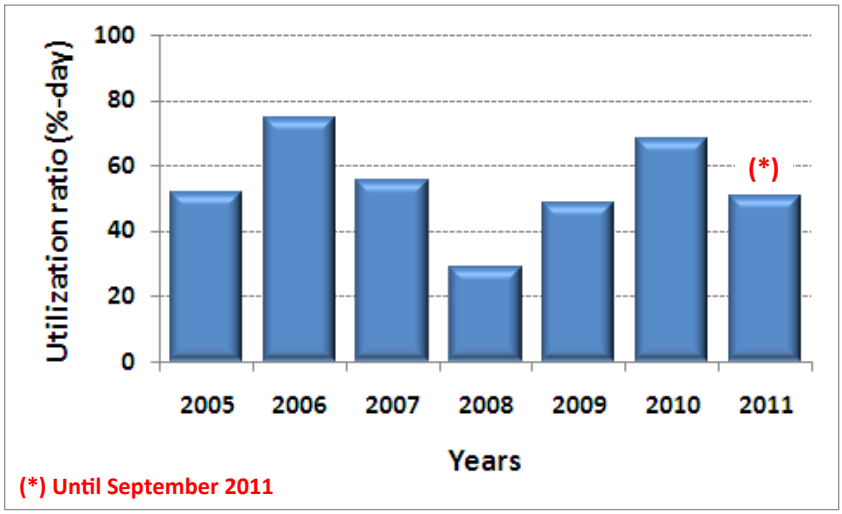








The Utilization – Users of SMARTer



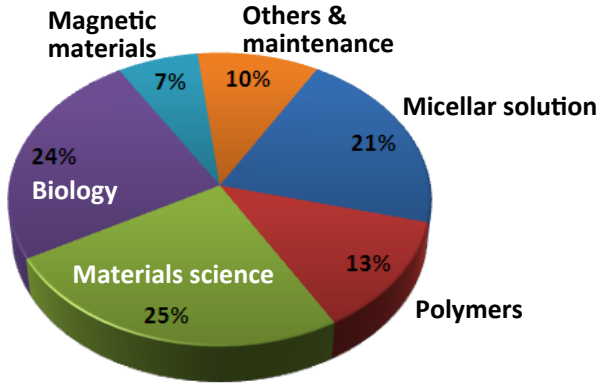
Total beam time ~ 160 – 170 days (15 MW)

Operation mode : (3 x 4 days) + (1 x 11 days)
Friday night – Tuesday afternoon
Established since 2004

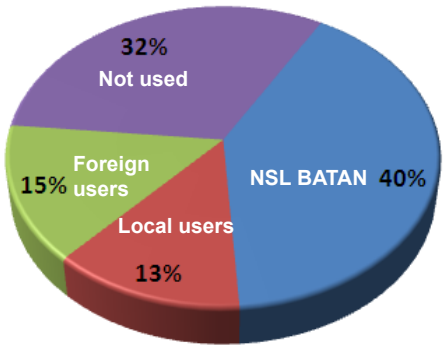
AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

The Utilization – Users of SMARTer

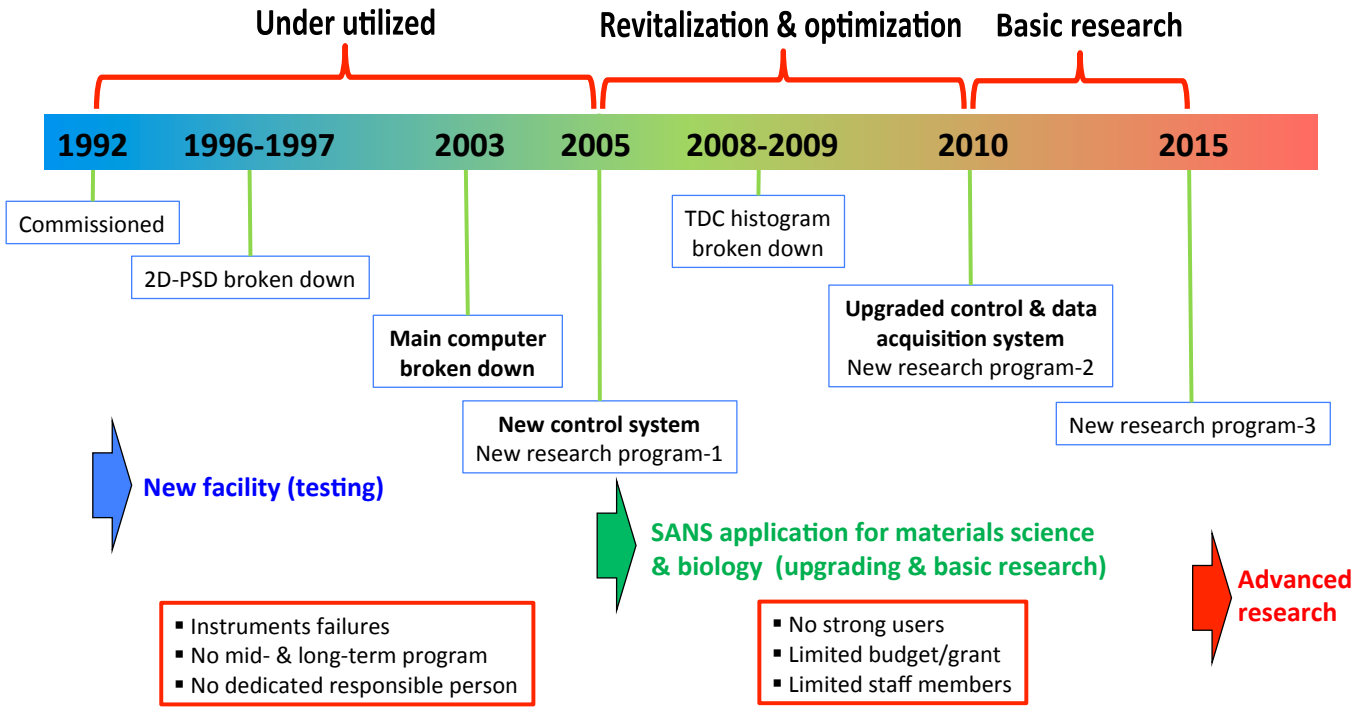
Research Area (2005-2011)



User distribution (2010)

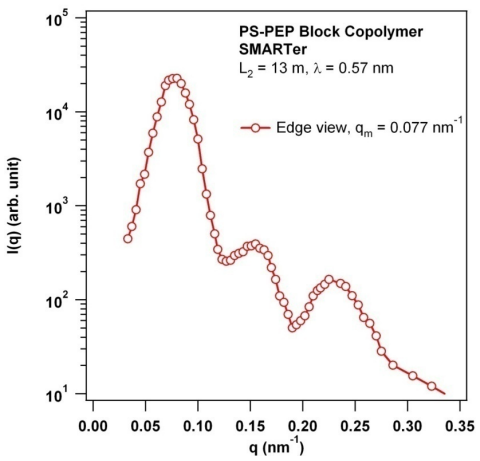


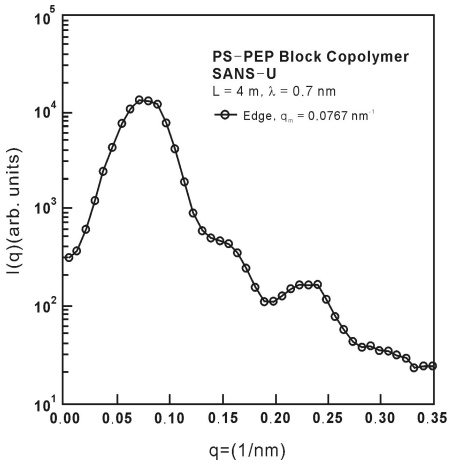
The time-line of SMARTer

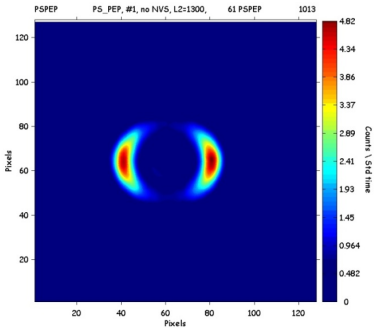


AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

Inter-laboratory Comparison



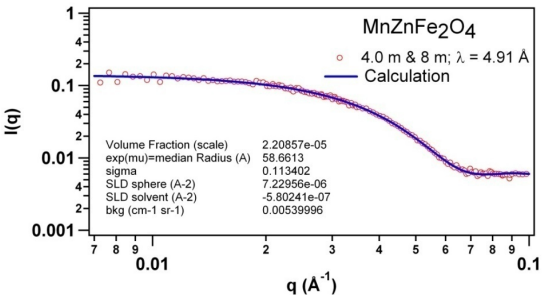


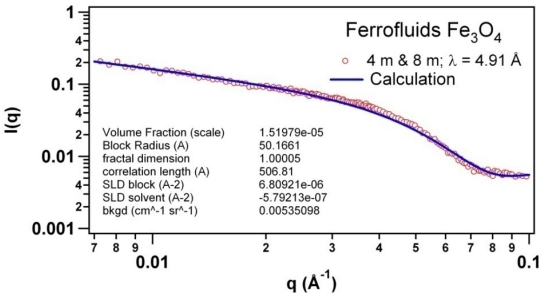


The data was taken using SMARTer
May & December 2006

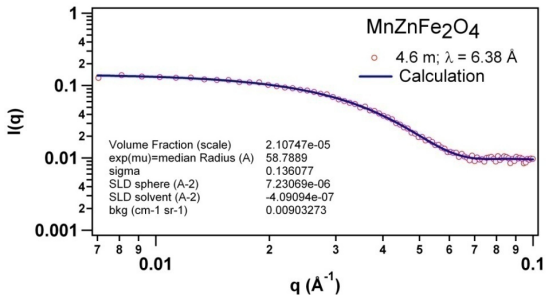
Inter-laboratory Comparison

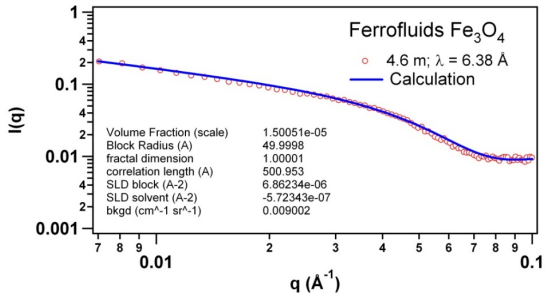
SANS BATAN





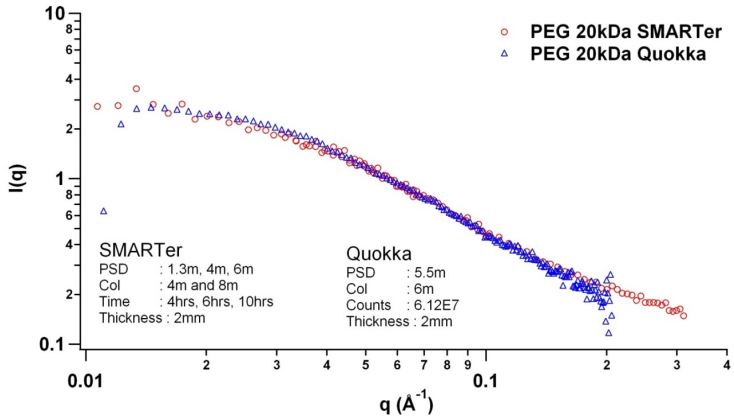
8m - HANARO SANS, Korea

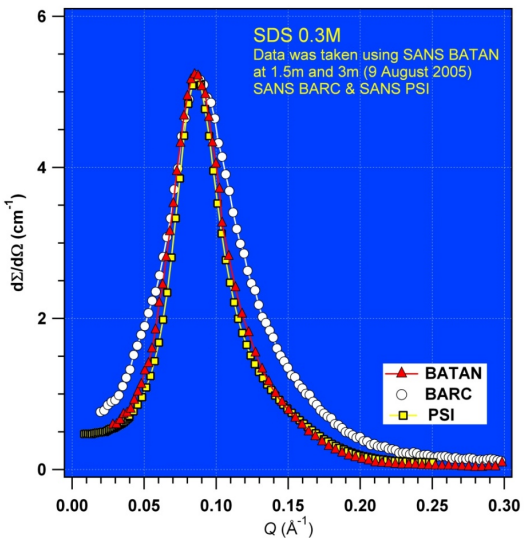




AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

Inter-laboratory Comparison





Mid- & Long-term Research on Nanostructure Studies

Prof. Pratap Bahadur
Dept. of Chemistry
South Gujarat University,
India

Drug delivery

Prof. Shahidan Radiman
Dept. of Physics
Univ. Kebangsaan Malaysia

Magnetics

Prof. Darminto
Dept. of Physics
Institute of Technology Sepuluh November, Surabaya, Indonesia

Soft matters

Biology

Materials Science

Hard matters

Ceramics

Dr. Abdul Aziz Mohamed Megat Harun Al-Rashid
Nuclear Malaysia Agency

Virus

Dr. Arief Budi Witarto
Biotechnology Center
Indonesian Institute of Sciences

SMARTer
(nano structure)

AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

Mid- & Long-term Research on Nanostructure Studies

"Stop-flow cell"

Drug delivery

"Cryo-magnet"

Magnetics

Soft matters

Biology

Materials Science

Hard matters

Virus

"Cooled/heated circulator"

SMARTer
(nano structure)

"Furnace"

Ceramics

Mid- & Long-term Research on Nanostructure Studies

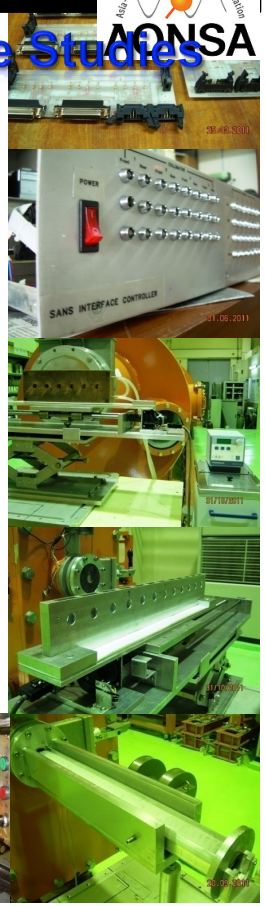
Dr. Ananda Putra
JAEA - Japan

Arum Patriati
Young staff at NSL - BATAN

Aminah Oemar
PhD Student, KAIST - Korea

Potential strong users for SMARTer

Prof. Gulam Roshan Deen
National Inst. Education - Singapore



AONSA - Instrument Scientist Workshop, Tsukuba, 20 November 2011

The "Road-map" of Biology Research by SMARTer

ab initio calculation

MD simulation

Simple geometry

Macromolecule structure
Kinetic studies
Three phases
Two phases

1 Micelles / microemulsions

Conventional SANS

Ultra-structure virus
Complex protein structures
Self-assembly proteins
Folding-unfolding
Globular structure

2 Protein solution

Focusing SANS
MgF_2 focusing lenses

Time-resolved SANS
Stop-flow cell

3 Virus structure

Publications

Available online at www.sciencedirect.com

Advances in Applied Ceramics 2009 VOL 108 NO 4 199

XIV International Conference on Small-Angle Scattering (SAS09)
Journal of Physics: Confer

IOP Publishing

Canadian Journal of Chemistry

Available online at www.sciencedirect.com
ScienceDirect
Procedia Chemistry 00 (2011) 000–000

Procedia Chemistry
www.elsevier.com/locate/procedia

Structural Organization of Poly(vinyl alcohol) Hydrogels Obtained by Freezing/Thawing and γ-Irradiation Processes: A Small-Angle Neutron Scattering (SANS) Study

T. Puspitasari[a], K.M.L. Raja[a], D.S. Pangerteni[a], A. Patriati[b], E.G.R. Putra[b,*]

[a]Radiation Process Division, Center for Application of Isotope and Radiation Technology National Nuclear Energy Agency of Indonesia (BATAN), Jalan Cinere Pasar Jum'at, Jakarta, Indonesia

[b]Neutron Scattering Laboratory, Center for Technology of Nuclear Industrial Materials, National Nuclear Energy Agency of Indonesia (BATAN), Kawasan Puspiptek Serpong, Tangerang 15314, Indonesia

Abstract

The structural organization of poly(vinil alcohol) (PVA) hydrogels obtained by repeatedly freezing/thawing and γ-irradiation processes of 15%-w/w PVA solution in D_2O has been revealed by small-angle neutron scattering (SANS) technique. The opaque sample is due two separated phases which composed by polymer-rich and polymer-poor regions occurred from freezing/thawing samples, while transparent sample formed from irradiated PVA hydrogels sample. It has been pointed out from SANS experimental data that the cross-linking in the gels formed by freezing/thawing process are crystallites as the scattering intensity $I(Q)$ decreases with Q according to the -4^{th} power law (Porod's law) in the high Q range region. From SANS data analysis, the radius of the crystallite size is about 30 - 35 Å and its distributed inhomogeneously with the average distance of 150 - 170 Å in the polymer-rich phase that consisted by crystalline PVA aggregates and swollen amorphous PVA. In opposite, the irradiated PVA hydrogels with the irradiation dose of 40 kGy did not show a -4^{th} power law scattering due to in absence of crystalline and amorphous PVA phases in the polymer-rich region.

© 2011 Published by Elsevier Ltd.

IAEA TC Projects (2012 – 2014)

IAEA.org International Atomic Energy Agency

Contact Us | Help | Site Index | Signup for News

17 November 2011 | About IAEA | Our Work | News Centre | Publications | Data Centre | FONT SIZE A + A –

You are in : TC Home » TC Programme

TC Home | About TC | TC Programme | Participation | TC Publications | TC Strategy

TC Programme
TC activities in the regions
National projects
Regional projects
Interregional projects
Projects by field

The Technical Cooperation Programme

To see the **list of recipient countries and territories in each region**, please click here. To view projects from specific regions, select a region below.

The Agency's Technical Cooperation Programme is developed jointly by the Secretariat and the Member States. It is based on an assessment of the development priorities and conditions in each specific country or region, the project requests received from Member States, the application of appropriate criteria for project formulation, appraisal and formal approval by the IAEA Board of Governors. The programme also includes regional and interregional projects that are developed to improve the efficiency of implementation or to better utilize the collective experience and resources of multiple Member States.

The TC Programme is prepared, appraised, implemented and evaluated in accordance with the provisions of the Agency's Statute, the Technical Cooperation Strategy (GOV/INF/824) and the Revised Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the Agency (INFCIRC/267), and in accordance with relevant directives of the General Conference and the Board of Governors.

The TC Programme comprises

- national projects (also known as country projects),
- regional projects, and
- interregional projects.

Projects may comprise one or more of the following components: experts, equipment and materials, fellowships and scientific visits, training courses, meetings/workshops and sub-contracts.

Department of TECHNICAL COOPERATION

TC Feedback | TC Glossary

Project information

TC activities in the regions
Africa
Asia and the Pacific
Europe
Latin America

Upgrading BATAN's Research Reactor Facilities

Objective

To upgrade, revitalise and rejuvenate BATAN's research reactor facilities.

Budget

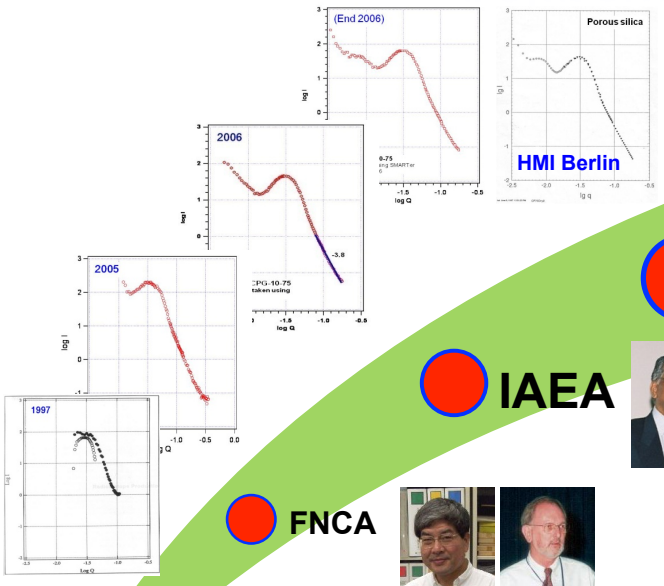
80% budget for Neutron Scattering Lab.

- Expert Mission
- Training
- Scientific visit
- **Procurement(*)**

Conclusions

1. SMARTer is in operation/running.
2. Comparable with other SANS spectrometers.
3. We have ~ 170 day of beam time annually.
4. Useful for preliminary or medium level scientific research.
5. Need expertise, especially for HRSANS. (*Knowledge, experience, confidence*)
6. Open for "**formal**" research collaboration
   - **Under IAEA; RCA; RAS**
   - **Under FNCA(*)**
7. Sharing the modalities to support the **ASEAN** neutron users.

Acknowledgment



MEXT, IAEA, AONSA, Others

RCA - KAERI

2007 - 2008

IAEA

2005 - 2007

FNCA

~ 1998 - 2003

STA-JAERI

~ 1994 - 1998