TOPIK RISET KELOMPOK NUKLIR ITB

Kelompok Peneliti Nuklir ITB
Koordinator: Prof. Dr. Zaki Su'ud

PROGRAM SECARA GARIS BESAR

1. Pengembangan SDM Nuklir untuk persiapan PLTN
2. Penyiapan teknologi yang optimal untuk situasi dan kondisi di Indonesia
3. Mengembangkan riset perancangan dan keselamatan PLTN maju khususnya dari GENERATION IV
4. Mengembangkan sistem analisis bagi PLTN termasuk PLTN GEN IV: Analisa Netronik, Analisa Thermal Hydraulic, Analisa Safety, juga disain dan analisis Pengungkung
5. Penyiapan skenario penanganan limbah nuklir baik dengan penyimpanan maupun daur ulang

Pengembangan SDM

- Program S1, S2 dan S3 di dalam negeri dan kerjasama dengan PT di luar negeri untuk S3
- Meliputi Bidang Fisika Reaktor dan Keselamatan reaktor (Fisika ITB), Bidang Analisa (Mesin), Instrumentasi (Fisika, teknik Fisika, Elektro, Mesin), dll
- Kerjasama dengan Bapeten, BATAN, dll. Dalam penyelenggaraan S2 dan S3 khusus
- Pengembangan pelatihan khusus baik untuk SDM inti maupun sosialisasi

SISTEMATIKA RISET NUKLIR DI ITB

1. SPINNORs
2. MODIFIED CANDLE
3. Th Cycle Based Long Life Thermal Reactors
4. Ship Based Reactors
5. Code Development
6. Nuclear Data
7. Riset Analisa Thermal

SPINNORs

Long Life Pb-Bi Cooled Fast Reactors

SMALL SIZE Pb-Bi COOLED NUCLEAR POWER REACTORS

- Power Range 25MWe ~ 100MWe
- Long life operation without refueling
- Ideal for remote area (islands): especially outside Java-Bali Area
- Current status : Final Optimization especially in safety, thermal system, etc.
- Inherent safety
- Non proliferation
- Fissile self sustain

Very Small Size Pb-Bi COOLED NUCLEAR POWER REACTORS

- Power Range 5MWe ~ 25MWe
- Long life operation without refueling
- Ideal for remote area (islands): especially outside Java-Bali Area, special purpose
- Current status : Final Optimization especially in safety
- Inherent safety
- Non proliferation
- Fissile self sustain

Medium & Large Size Pb-Bi COOLED NUCLEAR POWER REACTORS

- Power Range 100MWe ~ 2000MWe
- Few years operation without refueling
- Ideal for Java-Bali Area, special purpose:Hydrogen Production
- Current status : Optimization in Neutronic design , safety and thermal system
- Inherent safety
- Non proliferation
- Breeding
- Economical
- Load follower
- Cogeneration

ADS (Accelerator Driven System)

- Power range : 100KWe~50MWe
- Fast and thermal
- High safety performance
- Optimization of neutron source design and configuration
- Optimization of thermal system
- Safety analysis

Pb-Bi Corrosion Investigation

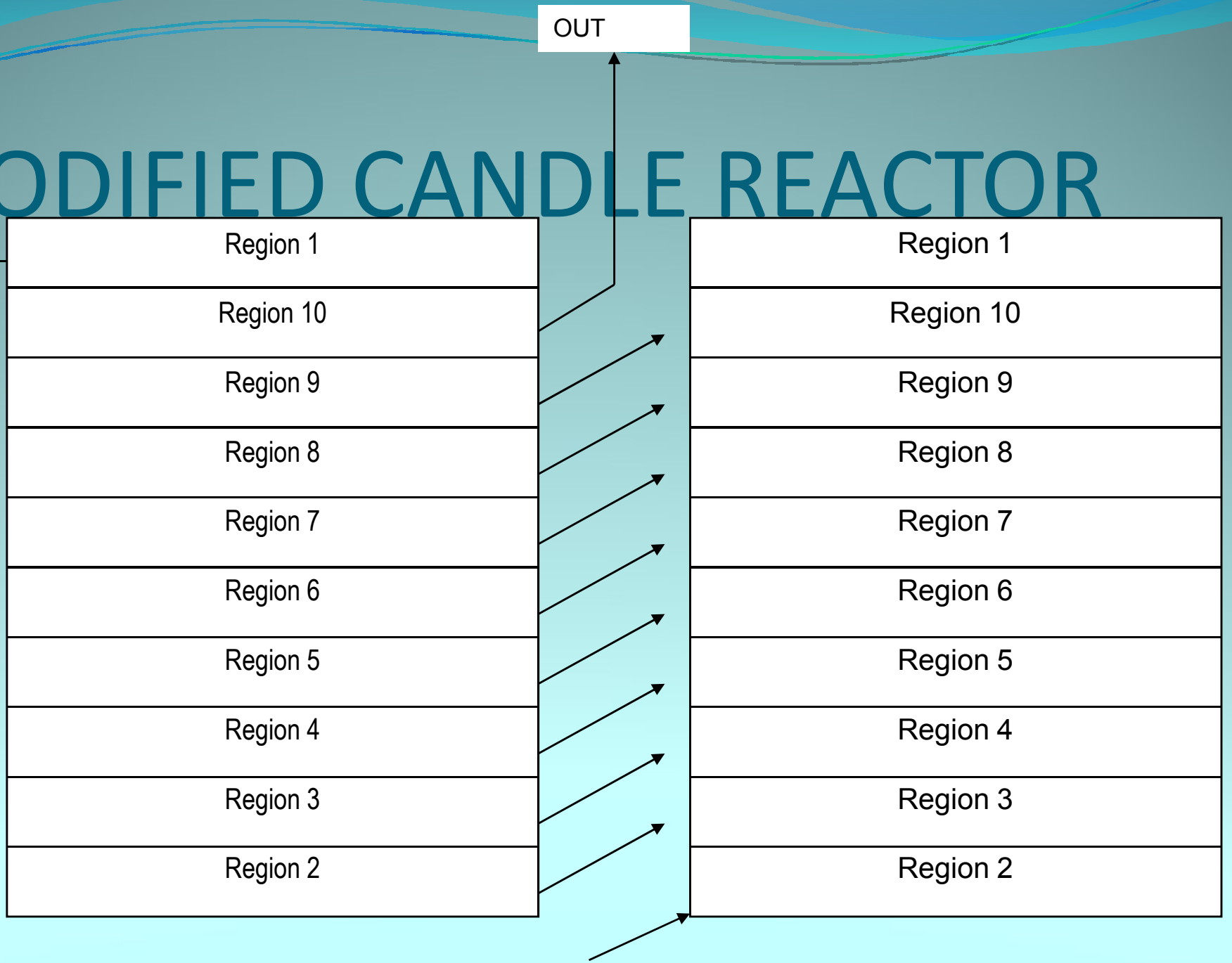
- Clasical and Quantum Mechanical Based simulation
- Based on Ab initio Model
- Comparation with existing experimental data
- Searching for better fit structural material

Hydrogen Production reactors

- Fast: Pb-Bi Cooled, Thermal : HTGR Based
- Selection of Best chemical mechanism
- Thermal configuration optimization
- Material feasibility
- Simulation system

MODIFIED CANDLE

MODIFIED CANDLE REACTOR

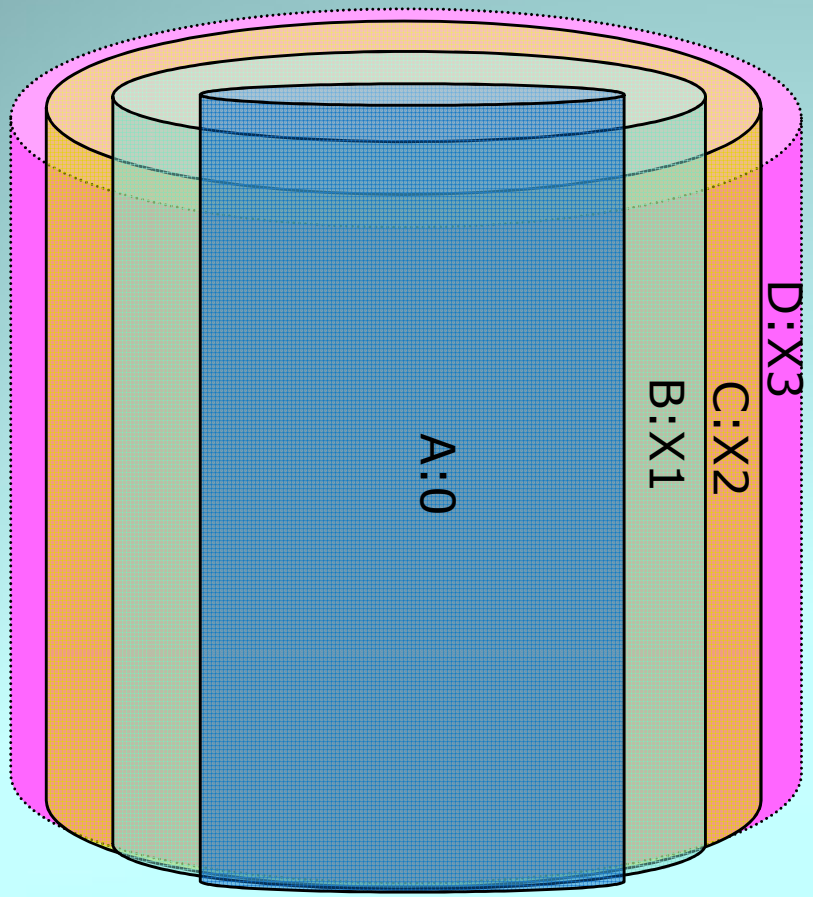


Modified Candle Reactors

- In this study conceptual design study of Pb-Bi cooled fast reactors which fuel cycle need only natural uranium input has been performed. In this case CANDLE burn-up strategy is slightly modified by introducing discreet regions.
- In this design the reactor cores are subdivided into several parts with the same volume in the axial directions.
- The natural uranium is initially put in region 1, after one cycle of 10 years of burn-up it is shifted to region 2 and the region 1 is filled by fresh natural uranium fuel.
- This concept is basically applied to all regions, i.e. shifted the core of I'th region into I+1 region after the end of 10 years burn-up cycle .

Long Life Reactor With Natural Uranium as Fuel Cycle input

BOC



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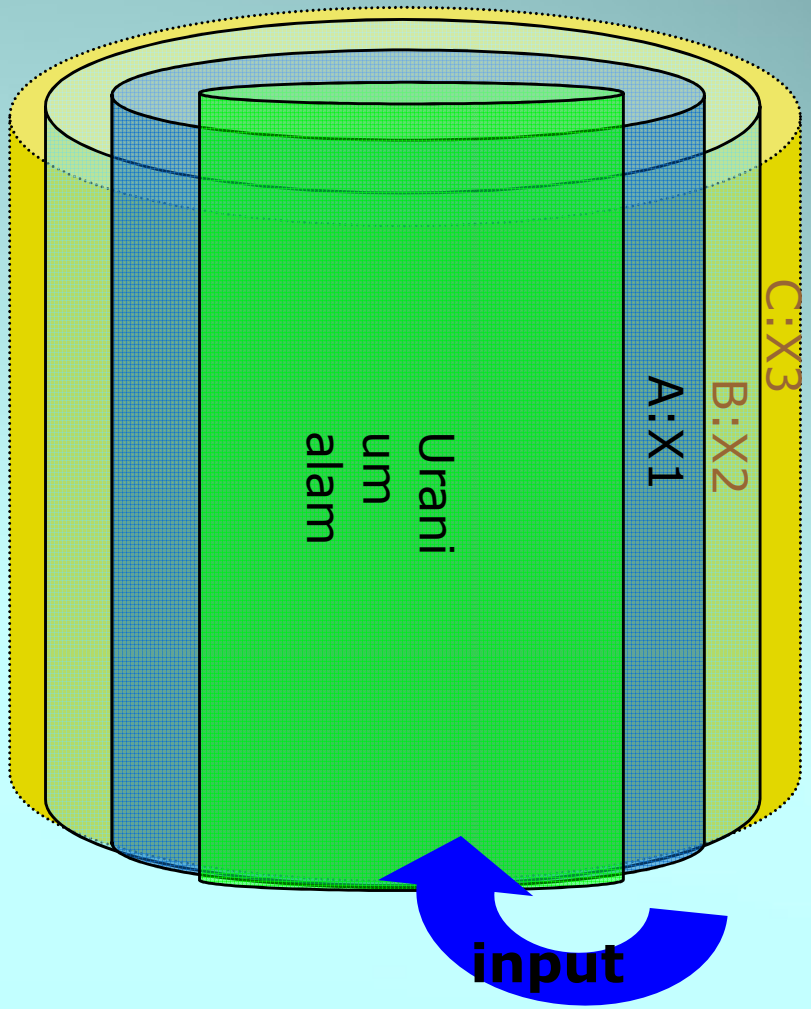
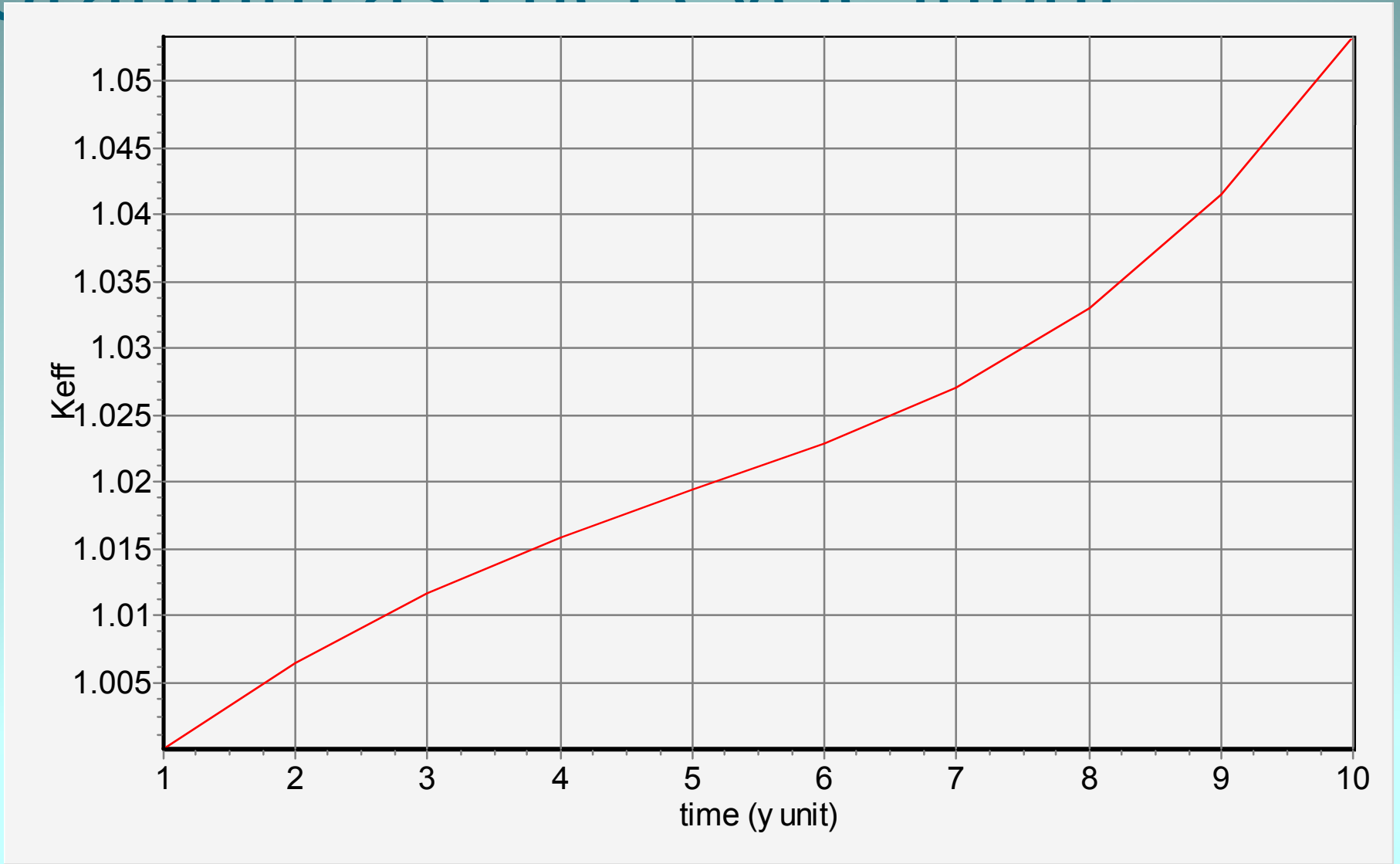
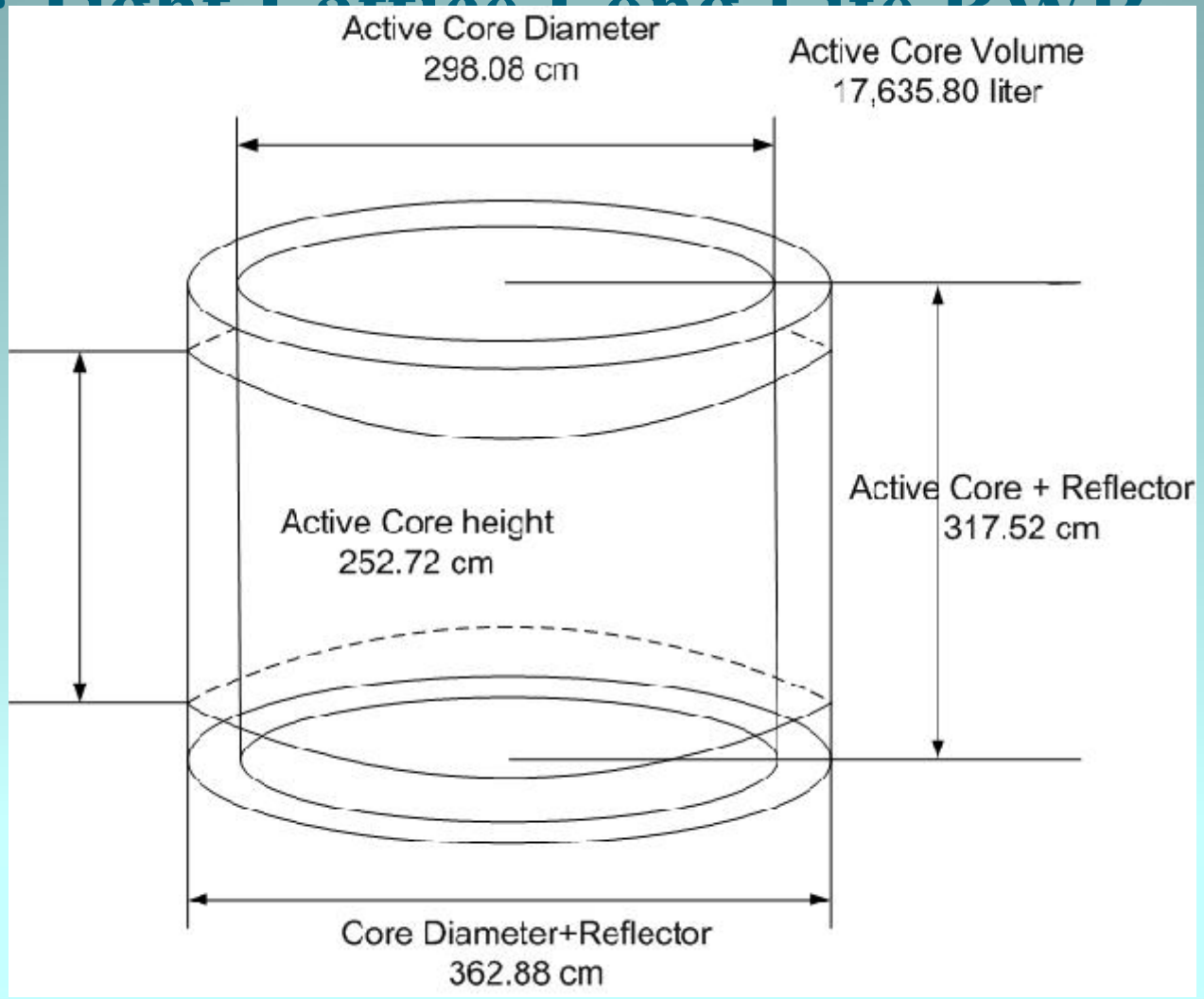


Long Life Reactor With Natural Uranium as Fuel Cycle input

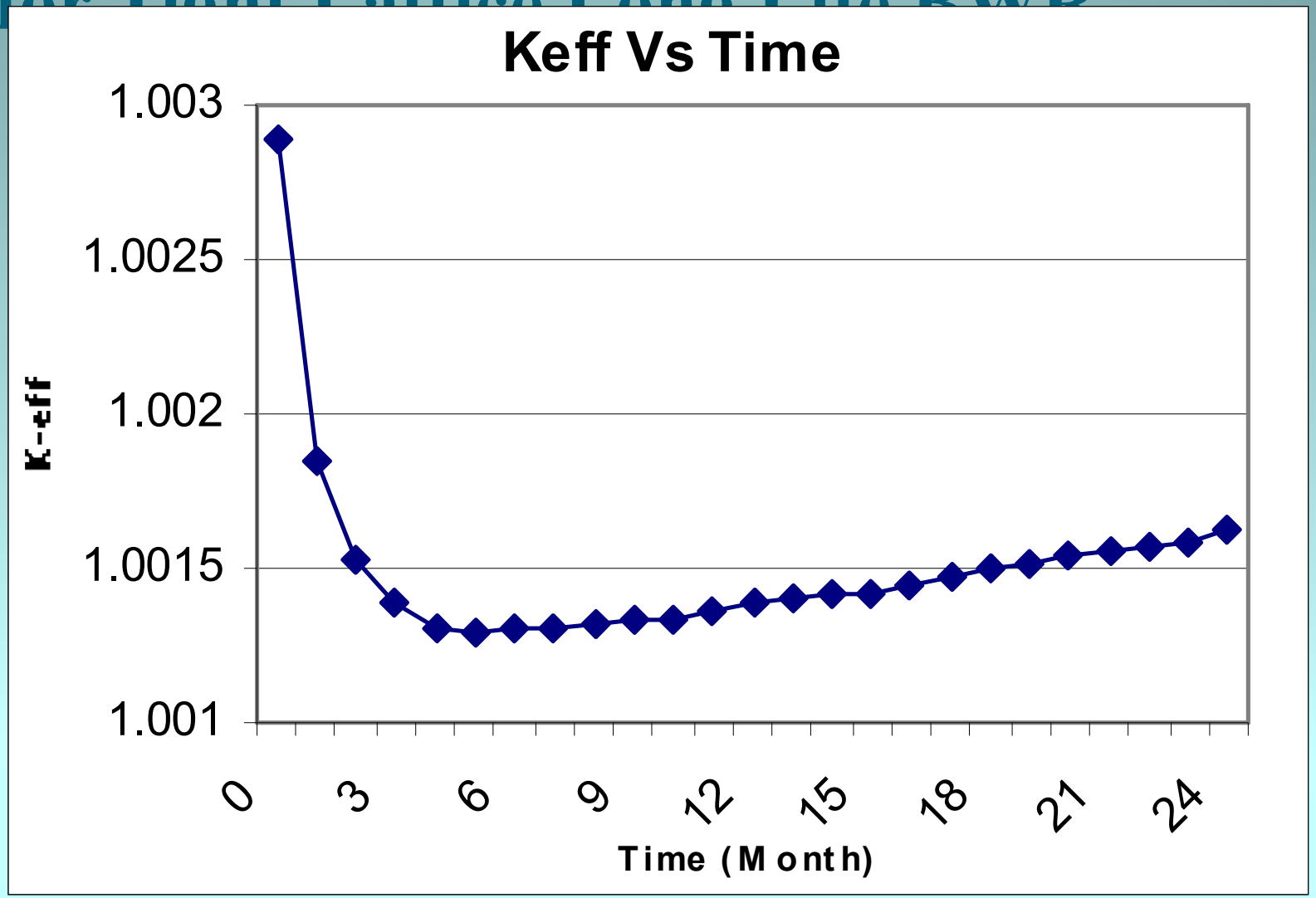


Th Cycle Based long Life Thermal Reactors

Thorium(Th) and Protactinium (231Pa) Based Fuel for Tight Lattice Long Life PWR



Thorium(Th) and Protactinium (231Pa) Based Fuel for Tight Lattice Long Life BWR



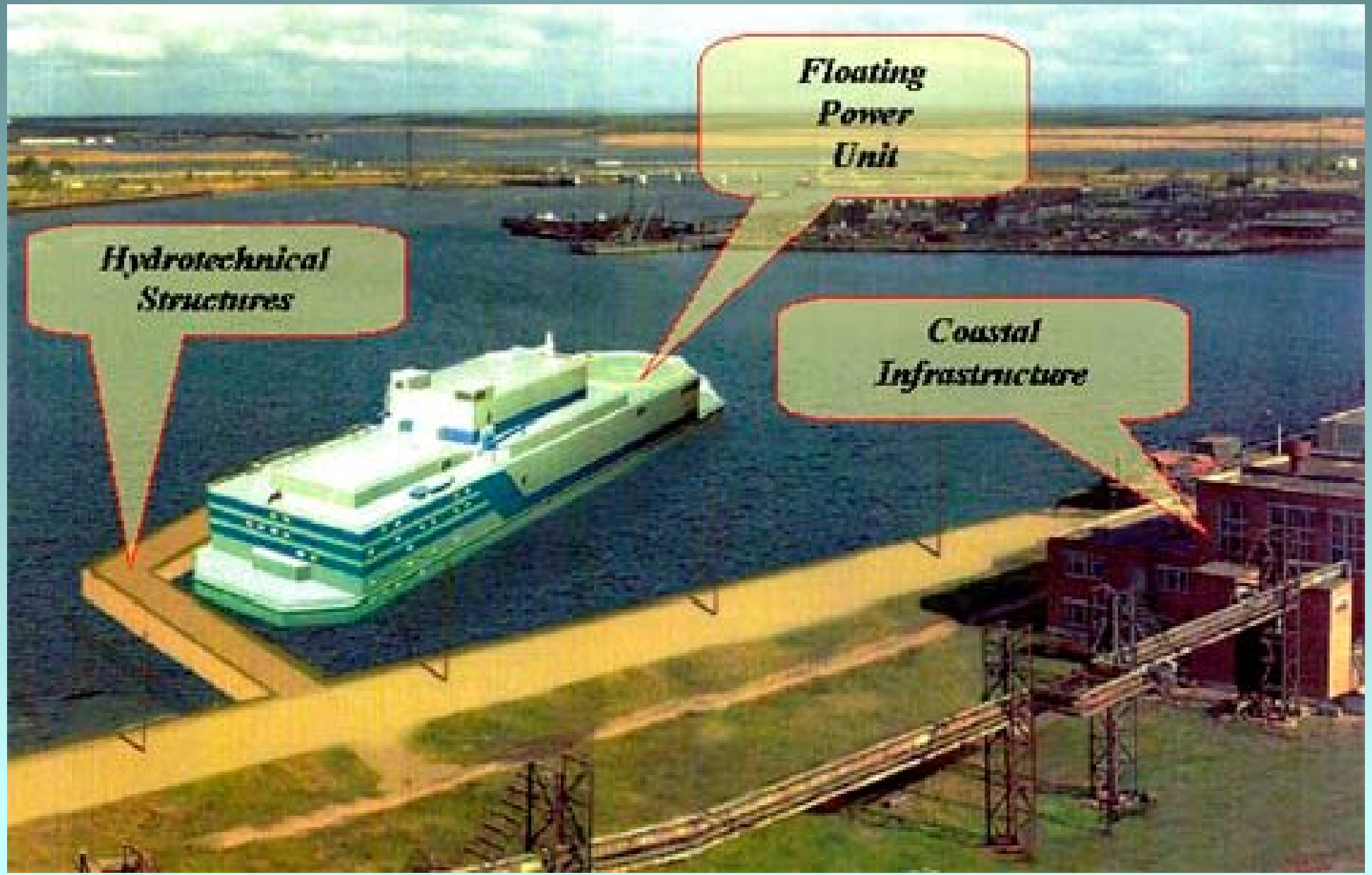
Thorium(Th) and Protactinium (231Pa) Based Fuel for Tight Lattice Long Life BWR

Active Core Volume(minus reflector)	17635.8 Liter
Thermal Power	620 Mwatt
Average Power Density	35.2 Watt/cc
Enrichment Uranium-233	8.1% and 11%
Percentage Protactinium-231	6.7%dan12.5%
Reactor operation time	30 year
Excess-reactivity	0.384%

Ship Based Reactors

SHIP BASED NUCLEAR POWER REACTOR

- Pb-Bi Based and Water cooled based
- Small and very small sized
- Ideal for remote area, emergency and temporary development
- Status: Final optimization and safety analysis


Floating
Power
Unit
Hydrotechnical
Structures
Coastal
Infrastructure

CODE DEVELOPMENT

Group Contant Processing

- Fast group constant : general geometry
- Thermal system: implementation & toward general geometry
- Interface to other code
- Paralel computation

Neutronic Design

- Three dimensional system analysis
- Additional feature
- Better user interface
- Transport analysis
- Special investigation

Safety Analysis

- Three dimensional model
- Local blockage analysis
- Other Hypothetical accident analysis
- ADS safety analysis
- Paralel Computation

Monte Carlo Simulation

- For shielding and neutronic calculation
- Development of generic subroutine
- Paralel Computation

Paralel Computation

- Based on ehternet and dedicated system
- Based on Socket programming or specially developped system
- Development of new algorithm better fit to paralel computation

TOPIK BESAR: INTEGRATED SYSTEM ANALYSIS CODE

- TAHAP I :

1. CELL HOMOGENIZATION CODE
2. MULTI GROUP DIFFUSION CALCULATION
3. BURNUP ANALYSIS

Analisa Thermal

- Riset fundamental analisa thermal dengan sampel PLTN
- Riset Terapan untuk analisa thermal hydraulic dan safety PLTN
- Analisa untuk disain dan kehandalan pengungkung

Sosialisasi Nuklir

- Pengembangan sistem simulasi khusus
- Pelatihan ke Pelajar dan masyarakat
- Sosialisasi melalui media massa dan seminar

Anggota TIM

- Prof. Dr Zaki Su'ud
- Prof. Dr Aryadi S
- Dr. Abdul Waris
- Dr. Ari Darmawan P
- Dr. Rijal K.
- Dr. Khairul Basar
- Drs. Novitrian MS
- Dr. Nathanael
- Dll. Total sekitar 15