

Big Science in Korea

KNU Workshop

June 20, 2003

Won Namkung

Pohang University of Science and Technology

(POSTECH)

Pohang, Korea

□ Big Science in Korea

- PLS - Light Source: 1988 – 1994**
- Hanaro - Research Reactor: 1988 - 1994**
- KSTAR - Fusion Tokamak: 1996 - 2004**
- KOMAC - Proton Linac : 2002 - 2008**

□ R&D Budget in Korea

□ Types of R&D Policy

PLS Overview

- ❑ **In 1987, POSTECH, a newly established university, proposed to construct a synchrotron light source on its campus:**
 - President H. Kim (accelerator physicist) and Dr. Y. Cho (ANL)
 - Y. Cho prepared the preliminary design report for PLS/PAL.
- ❑ **PLS is a 3rd generation synchrotron radiation source:**
 - 2 GeV injector linac and storage ring with upgrade option to 2.5-GeV.
- ❑ **Construction Project: April 1988 ~ December 1994**
 - **Funded by POSCO (60%) & Government (40%)**
- ❑ **Operation: funded by Government (80%) & POSCO (20%)**

Aerial View of PAL



LINAC

Gallery and Tunnel



Parameters

Beam energy (GeV)	2.5
No. of accelerating columns	44
Frequency (MHz)	2,856
Number of klystrons	12
Klystron power (MW)	80
SLED Gain	1.6
Total length (m)	~160

Storage Ring

Tunnel



Parameters

Beam Energy (GeV)	2.5
Emittance (nm-rad)	12.1
Beam Lifetime (Hours) (@ 170mA)	20
Number of Bunches	400
Beam Current (mA)	170

Hanaro Overview

Research Nuclear Reactor

- 30-MW open-tank-in-pool type
- 20% U₃Si-Al Fuel

National users' facility

- Intense neutron source for neutron science
- Medical & industrial application of Radioisotopes

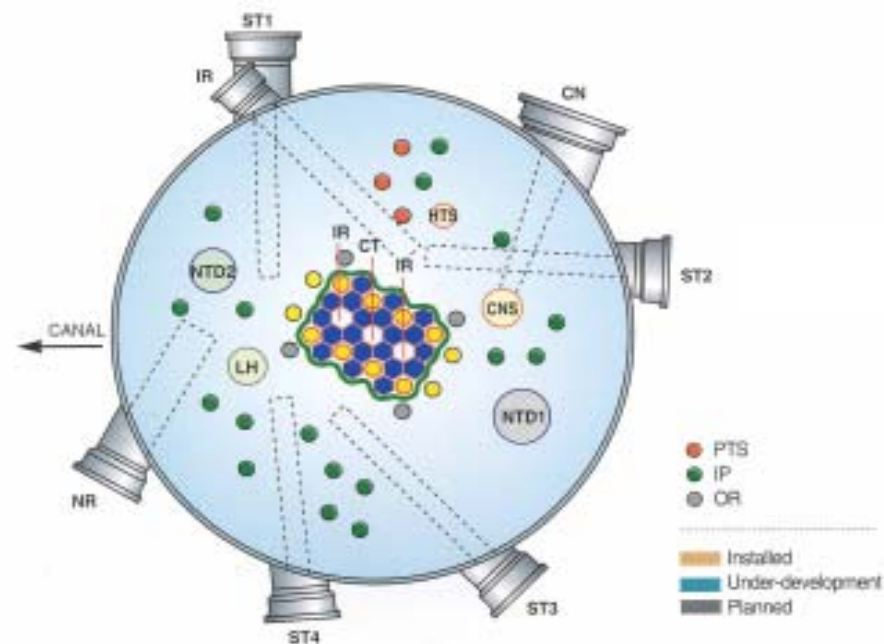
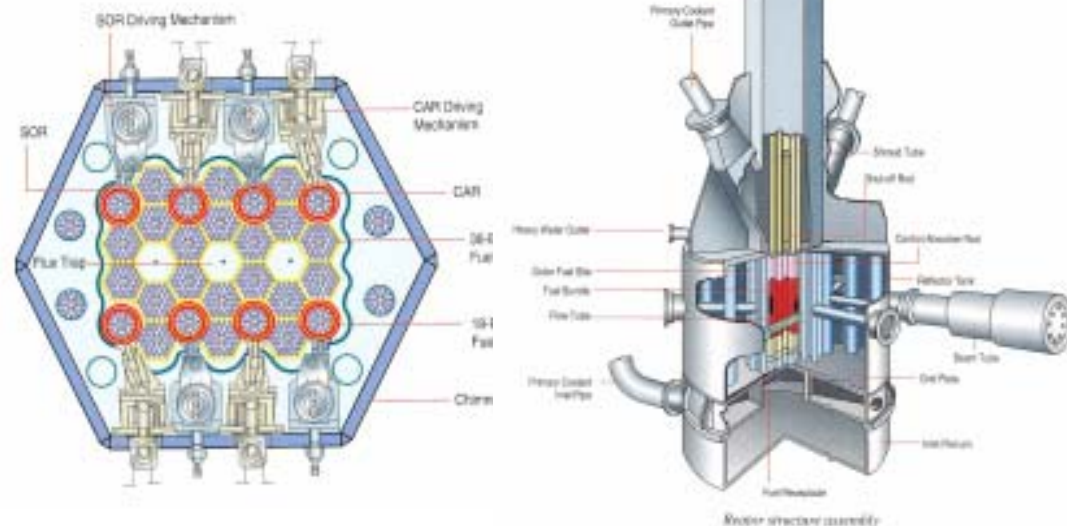
Construction period: Feb. 1988 ~ Dec. 1994

First Criticality Achieved: Feb. 1995

Construction & Operation:

Korea Atomic Energy Research Institute (KAERI)

Hanaro Reactor



Horizontal Experimental Tubes

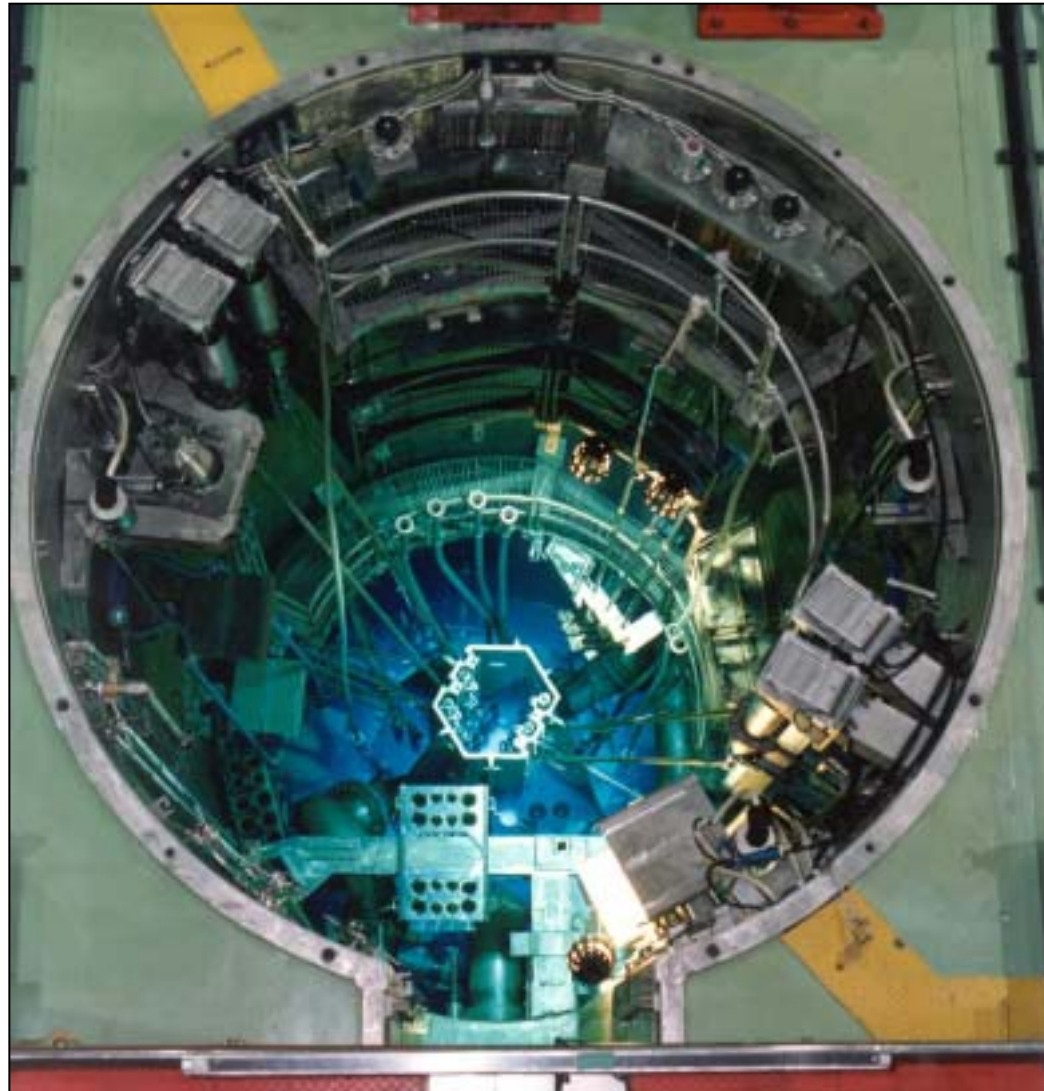
- ST1 : Polarized Neutron Spectrometer
- ST2 : High Resolution Powder Diffractometer / Four Circle Diffractometer
- ST3 : Neutron Reflectometer / Medium Resolution Powder Diffractometer
- ST4 : Triple Axis Spectrometer
- CN : Small Angle Neutron Spectrometer
- IR : Boron Neutron Capture Therapy Facility
- NR : Neutron Radiography Facility

Vertical Experimental Holes

- IR, CT : Capsule Irradiation Facility
- LH : Fuel Test Loop
- OR : Capsule Irradiation / RI Production
- IP : RI Production
- HTS : Hydraulic Transfer System for RI Production
- PTS : Pneumatic Transfer System for Neutron Activation Analysis
- NTD : Neutron Transmutation Doping of Silicon
- CNS : Cold Neutron Research Facility



Hanaro Reactor



KSTAR Overview

Fusion Research Tokamak

- All Super-conducting magnets
- Steady-state capable tokamak with a major radius of 1.8 m

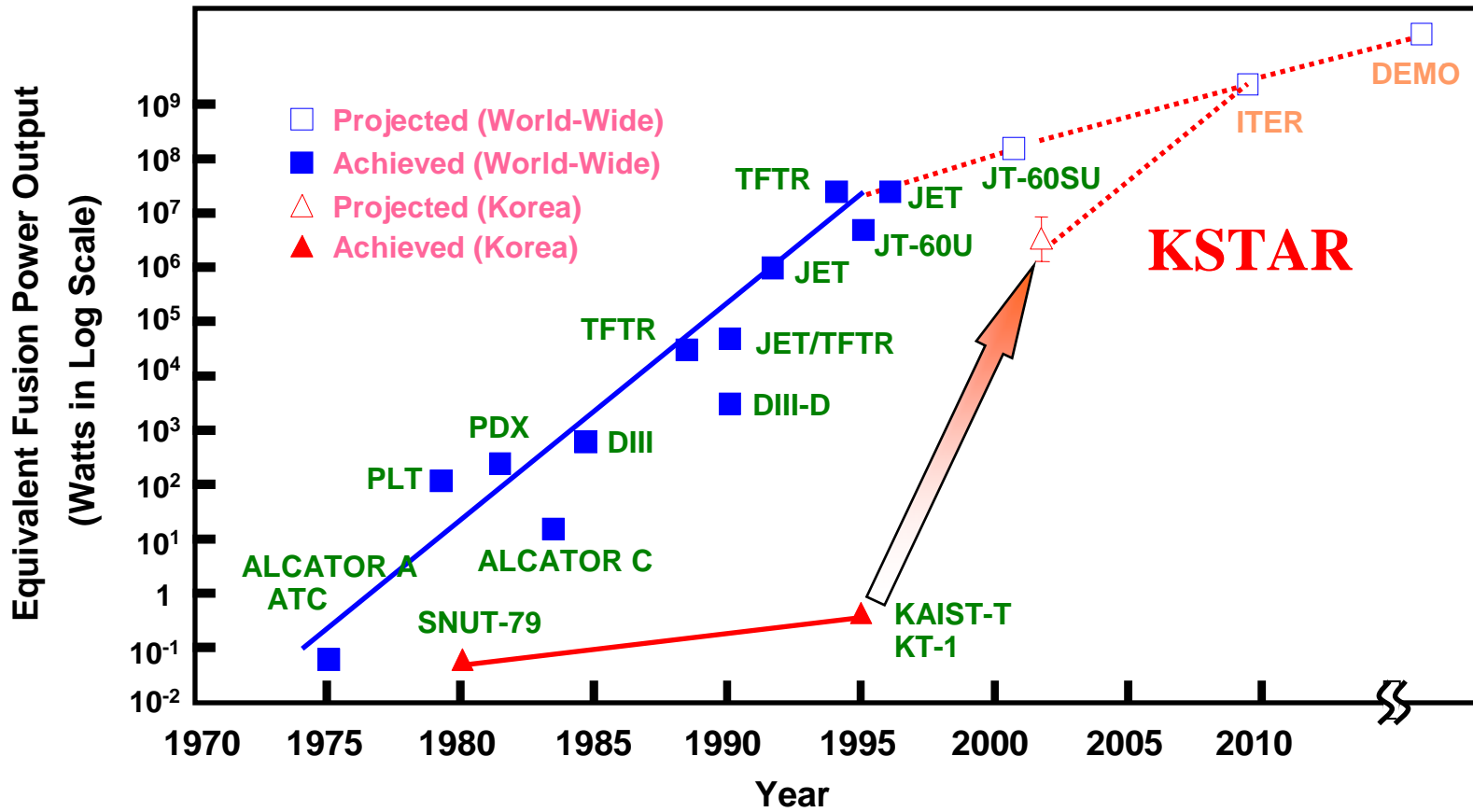
National users' facility

- Long-pulse tokamak plasma research
- Heating and current drive for steady-state operation

Project Period: Jan. 1996 - Dec. 2005

First Plasmas: June 2006 (*Plan*)

Construction & Operation: Korea Basic Science Institute (KBSI)



KSTAR Facility Construction Completed

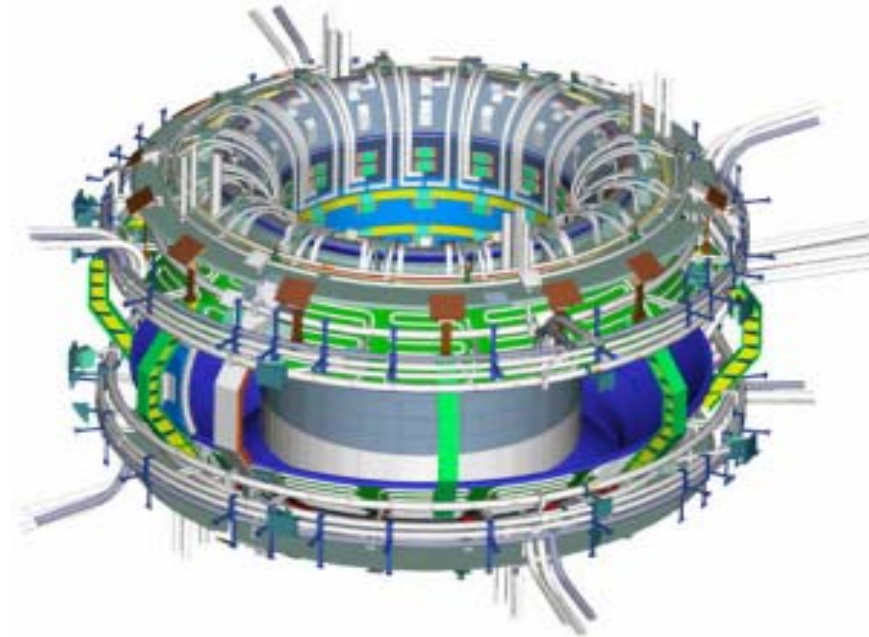
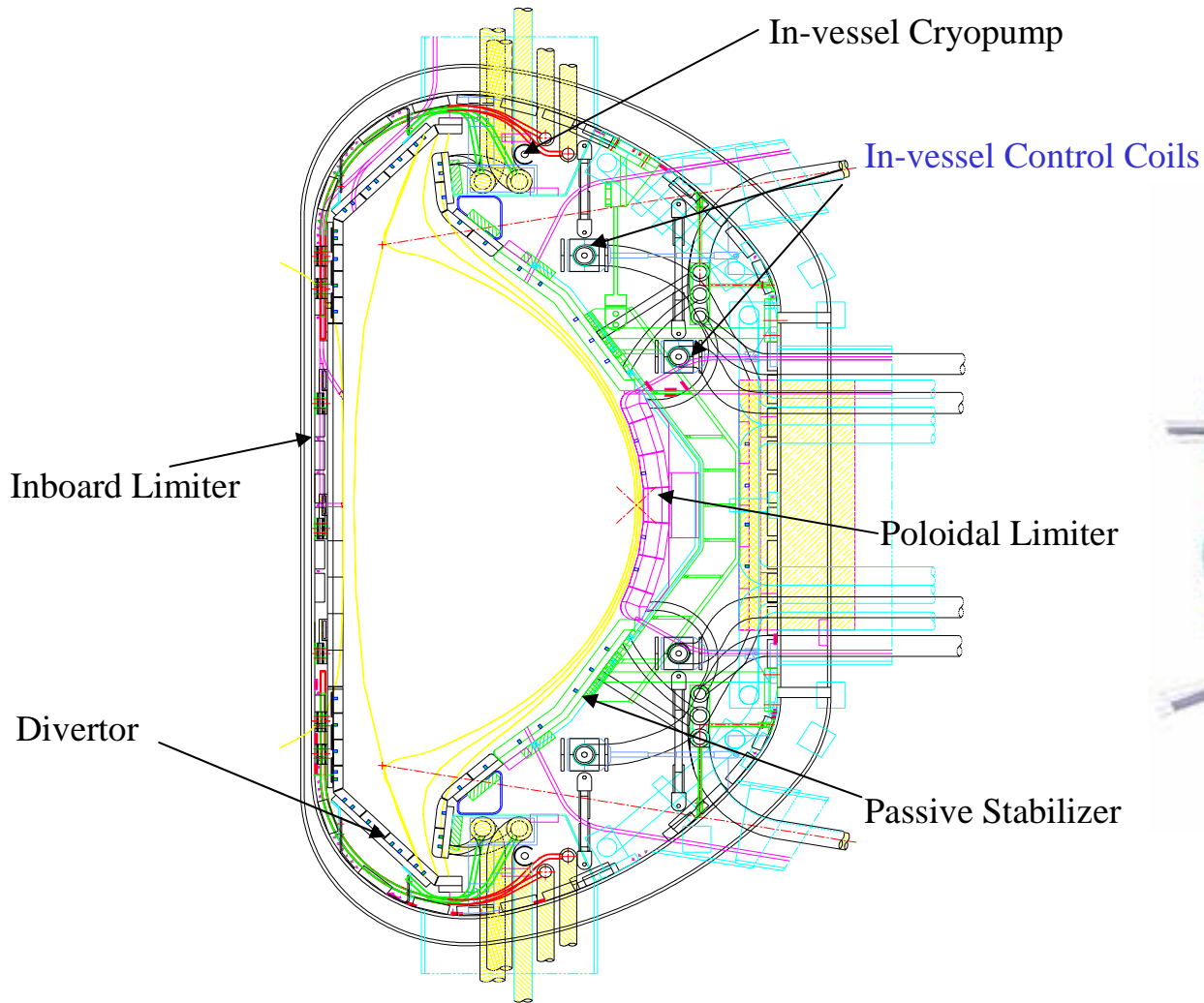
June 2002



KSTAR Experimental Hall Completed



KSTAR In-Vessel Components

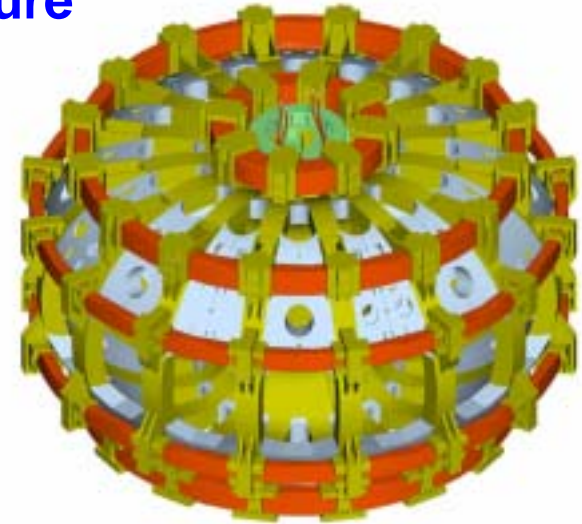


KSTAR Vacuum Vessel Fabrication

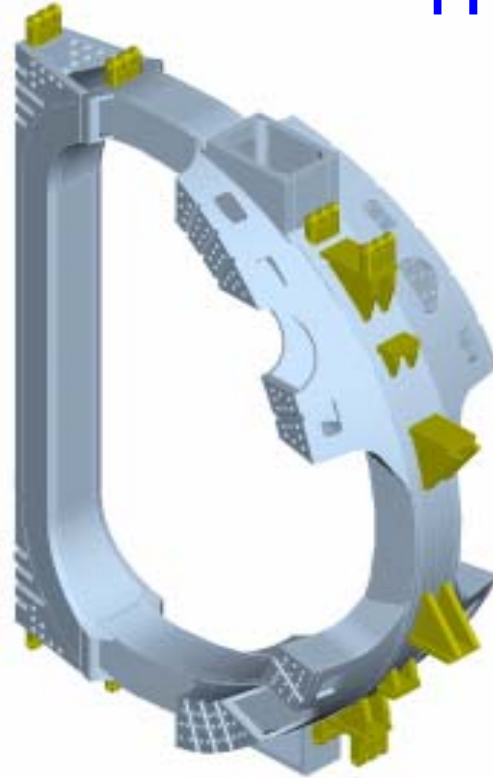


KSTAR SC Magnet Structure

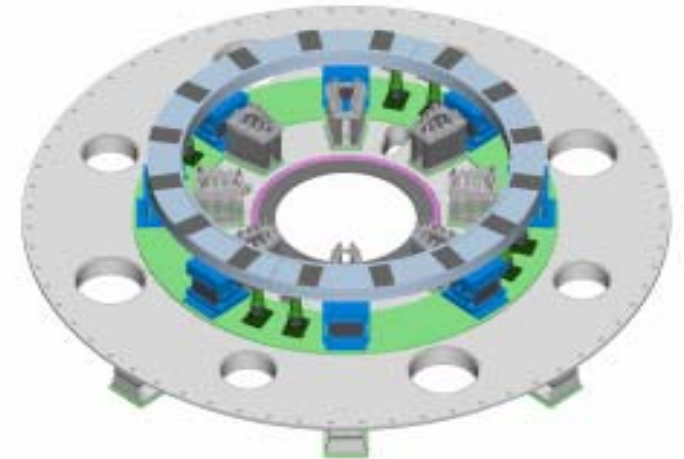
PF Structure



CS Structure

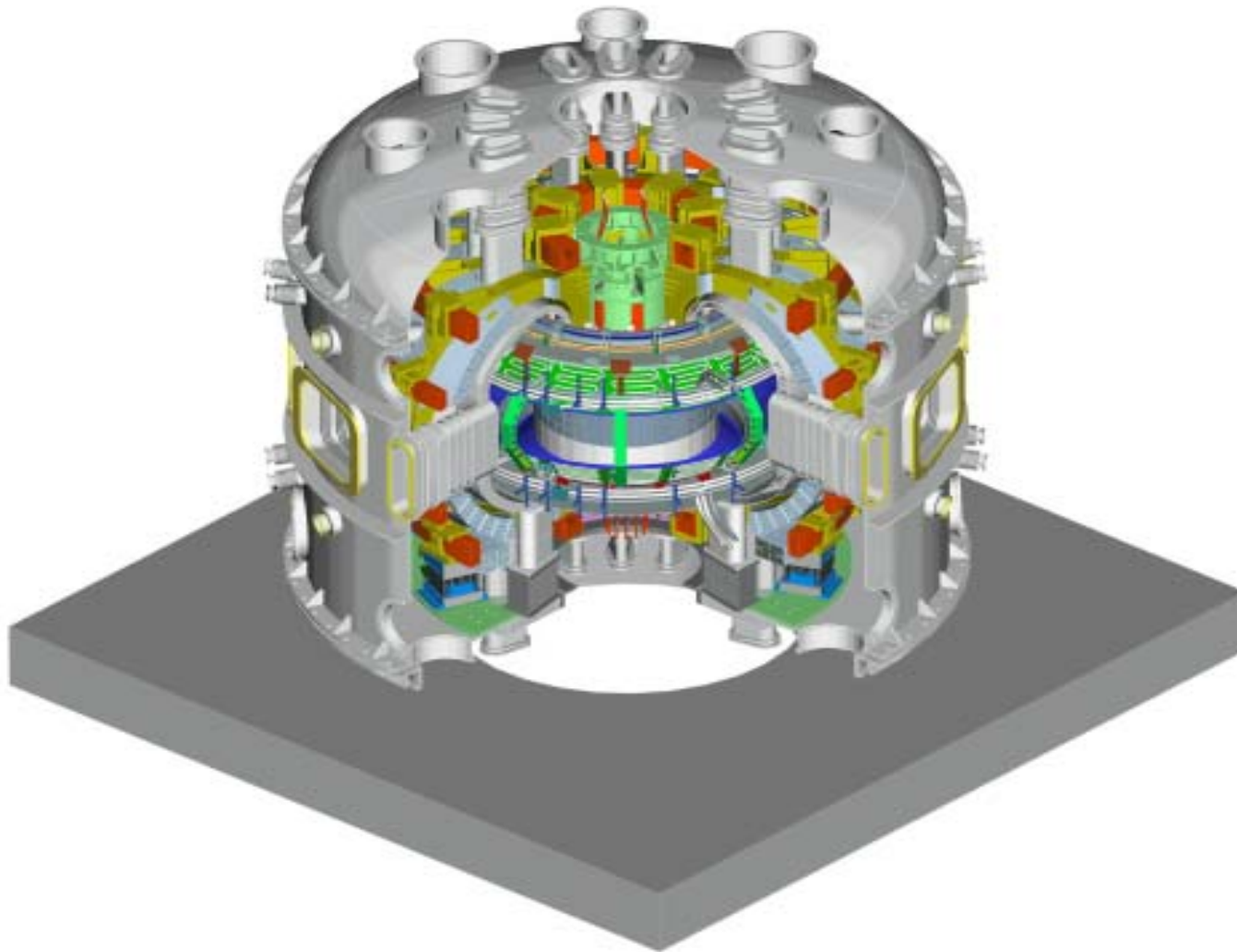


TF Structure



Gravity Support

KSTAR Tokamak



Presidential Visit to Washington (2003. 5. 14)



(ITER)

Joint Statement Between the United States of America and the Republic of Korea - Common Values, Principles, and Strategy

On May 14, 2003, President George W. Bush of the United States of America and President Roh Moo-hyun of the Republic of Korea held a summit meeting at the White House in Washington, D.C.

President Bush and President Roh highlighted the importance of increasing bilateral cooperation across a broad range of global issues. In this context, the two leaders welcomed U.S. and ROK cooperation in the International Thermonuclear Experimental Reactor (ITER) project, ...

Korea-EU Science Minister's Meeting (2003. 5. 16)



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KOMAC Overview

High-Power Proton Accelerator

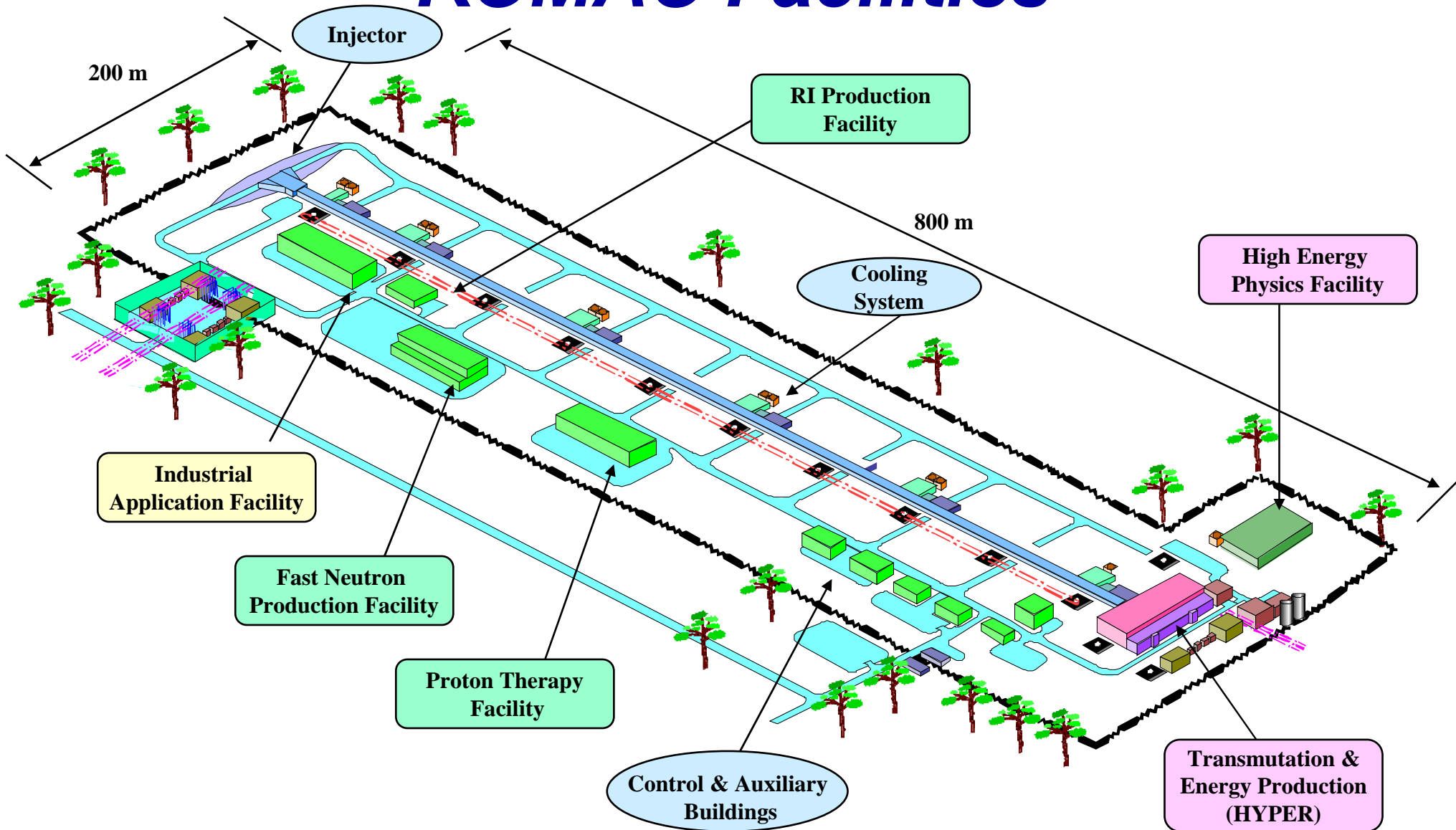
- o Staged construction of 1.0 GeV, 20 mA proton linac
 - 20 MeV: National Nuclear R&D Program (1997-2002)
 - 100 MeV: New Frontier Program (2002-2008)
 - 1.0 GeV: Under R&D Study

National users' facility

- o Intense neutron source for basic and applied science research

Lead Laboratory: Korea Atomic Energy Research Institute (KAERI)

Schematic Layout of KOMAC Facilities





장기비전 <양성자가속기 시설을 중심으로 한 과학기술단지 예시도>

Annual R&D Budget in Korea

	'95	'96	'97	'98	'99	'00	'01	'02	'03
Gov. R&D (Trillion Won)	1.8	2.4	2.9	3.1	3.1	3.5	4.5	5.2	5.5
Gov. Budget (Trillion Won)	51	58	64	76	83	87	100	106	111
GDP (Trillion Won)	377	418	453	444	484	518	544	N/A	N/A
GDP (Billion U\$)	490	523	482	317	407	457	421	N/A	N/A
GDP per capita (U\$)	10,900	11,400	10,500	6,900	8,700	9,628	8,957	N/A	N/A

*Note: Currency Ratio: 1 U\$ ~ 800 Won until 1997
~ 1,200 Won after 1998*

Basic Science & Strategic Technology Budget in Korea

(Billion Won)

	'01	'02	'03
Basic Science	737	941	1,035
6-Technologies (IT, BT, NT, ET, ST, CT)	1,085	1,483	1,633
R&D Budget	4,485	5,158	5,524



(Billion Won)

IT	492
BT	496
NT	197
ET	251
ST	184
CT	14

*Note: Currency Ratio: 1 US\$ ~ 800 Won until 1997
~ 1,200 Won after 1998*

Large-scale Facility Budget in Korea

(Billion Won)

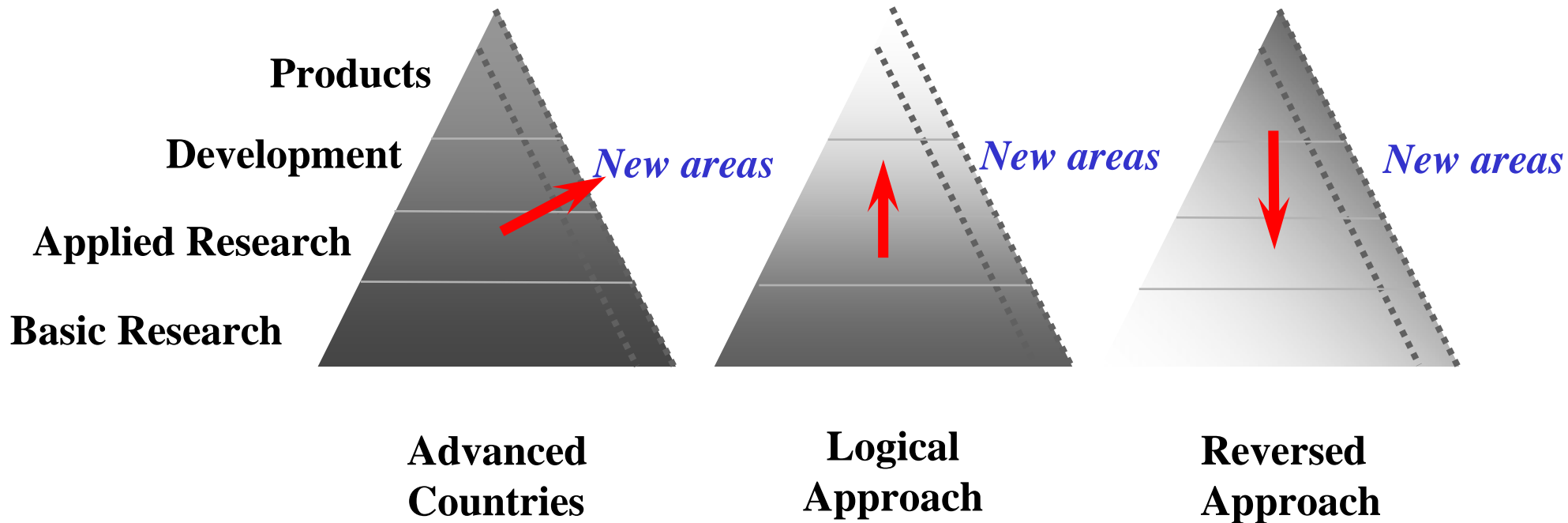
	'01	'02	'03
Basic Science	737	941	1,035
R&D Budget	4,485	5,158	5,524

Note: Currency Ratio: 1 US\$ ~ 800 Won until 1997
 ~ 1,200 Won after 1998

2003 budget (Billion Won)

PLS (Light Source)	22
KOMAC (Proton Linac)	~12
KSTAR (Tokamak)	45
Hanaro (Res. Reactor)	~15

Types of Science and Technology Policy



Open for Discussions

on

Experimental Particle Physics Research