# Introduction

# Damping Ring Civil Design for Asian Region

# Introduction of the Presenter

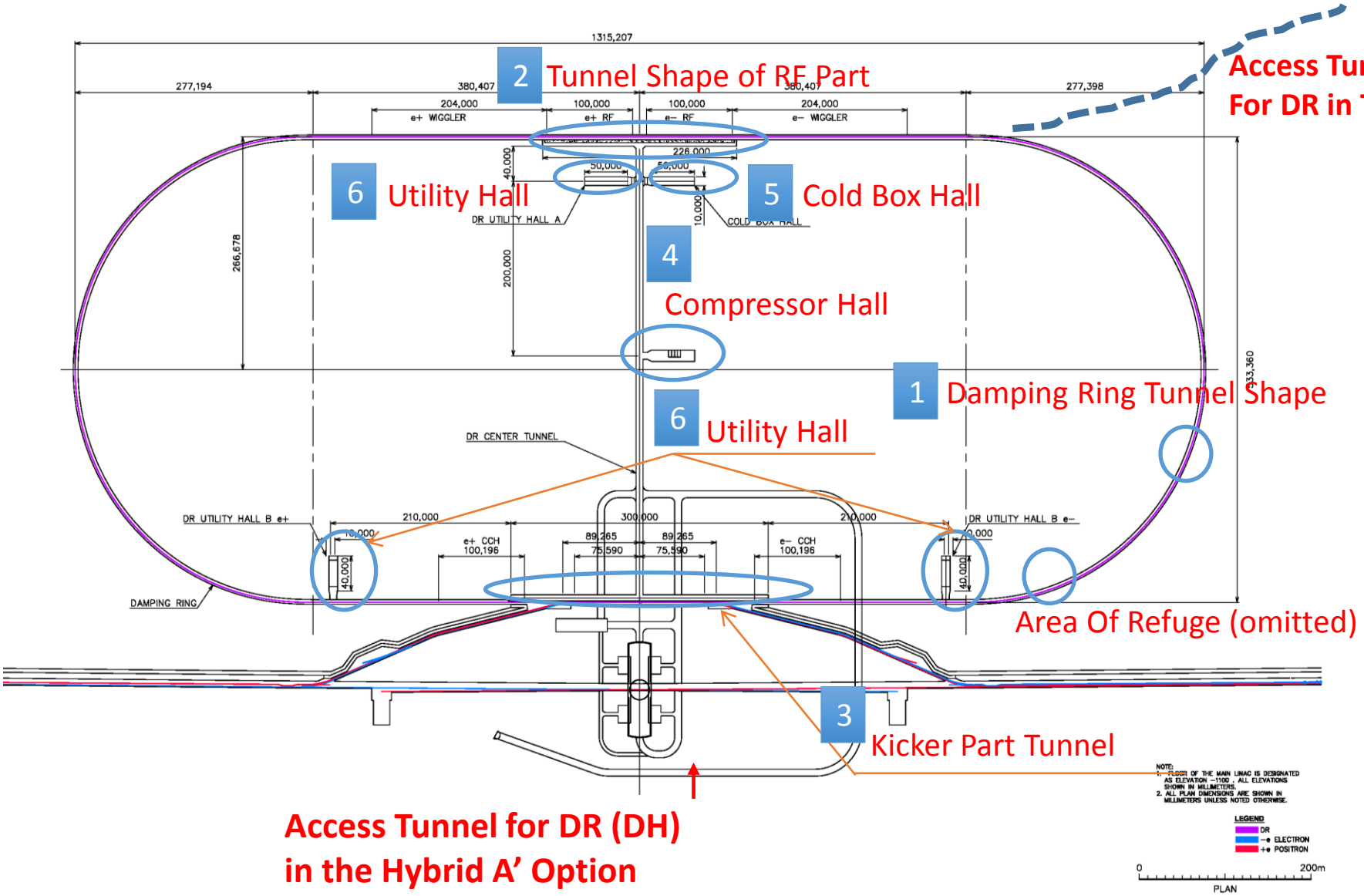
- *Presenter : Go ORUKAWA-san*
  - *Department of Civil Engineering in J-Power*

- *J-Power :*
  - *Originally J-Power was the National Policy Corporation of Japanese government.*
  - *It became a private company  now completely 10 years ago.*

# Contents

- Damping Ring Configuration in Asian Region
- Some considerations after TDR
- Utility Cavern including Cold Box yard
- Evacuation Simulation

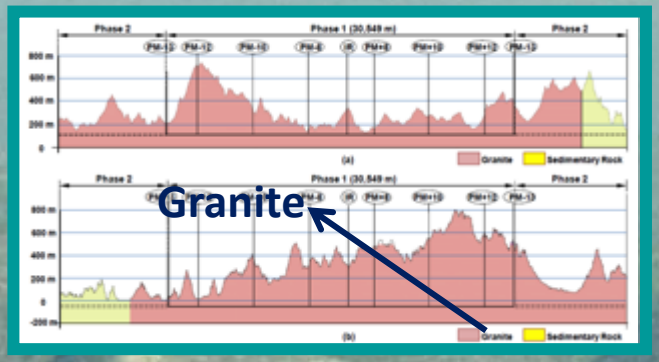
# Damping Ring Configuration for Asian Region in case of the Hybrid A' Option




**Access Tunnel for DR (DH) in the Hybrid A' Option**

# Asian Site Conventional Facility – Introduction

**(Site) Mountainous green field not far from big towns, accessible with existing roads.**
**(Facility) Smaller surface structures and underground structures.**

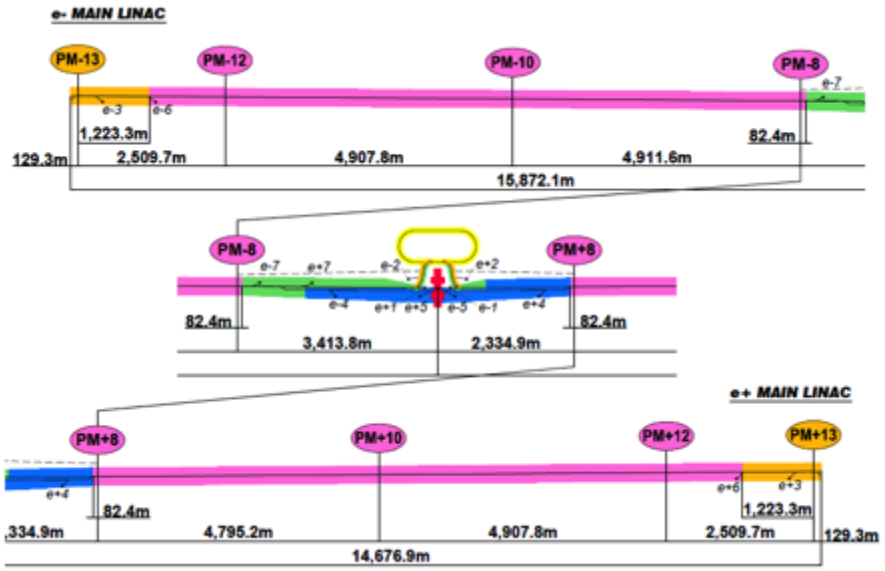



Damping Ring
Ring To Main Linac (RTML)
Detector Hall
PM-ab
PM+8
PM+10
PM+12
PM+13
e+ ML
e- Source
Surface Structures
Existing surface road
PM-12
PM-13
PM-10
PM-8
(Slope <7%)
e+ Source
PM-X
(Center Campus)
Access Tunnel
(Slope <10%)
Access Hall
e- Main Linac (ML)
Existing road
RTML turn-around

(The background photo shows a similar site image but does not show the real site.)

# WBS 1.7.1 Civil Engineering – (1) Project Scope

- Dimension
- Underground Volume
- Surface Area




**ACCESS TUNNELS AND CAVERNS**

| NAME | PM-13 | PM-12 | PM-10 | PM-8 | IR HALL | D.R. | PM+8 | PM+10 | PM+12 | PM-13 |
|---|---|---|---|---|---|---|---|---|---|---|
| ACCESS T ( W x H )m | 8 x 7.5 | 8 x 7.5 | 8 x 7.5 | 8 x 7.5 | 8 x 7.5<br>11 x 11<br>11 x 9 | 8 x 7.5<br>11 x 9 | 8 x 7.5 | 8 x 7.5 | 8 x 7.5 | 8 x 7.5 |
| CAVERN ( W x L x H )m | 15 x 41.3 x 15 | 20 x 180 x 13<br>15 x 41.3 x 15 | 20 x 180 x 13<br>15 x 41.3 x 15 | 20 x 180 x 13<br>15 x 41.3 x 15 | 25 x 142 x 41 | 10 x 68 x 8<br>10 x 40 x 8<br>13 x 50.3 x 12 | 20 x 180 x 13<br>15 x 41.3 x 15 | 20 x 180 x 13<br>15 x 41.3 x 15 | 20 x 180 x 13<br>15 x 41.3 x 15 | 15 x 41.3 x 15 |

**DUMPS**

| | | | |
|---|---|---|---|
| MPD | e-1 | SC TUNE UP DUMP | 311 KW** |
| MPD | e-2 | EDRX TUNE UP DUMP | 220 KW |
| MPD | e-3 | RTML TUNE UP DUMP | 220 KW |
| HPD | e-4 | BDS TUNE UP DUMP | 14 MW |
| HPD | e-5 | PRIMARY e-DUMP | 14 MW* |
| MPD | e-6 | RTML TUNE UP DUMP | 220 KW |
| MPD | e-7 | ELECTRON FAST ABORT DUMP | 250 KW |

| | | | |
|---|---|---|---|
| MPD | e+1 | SC TUNE UP DUMP | 311 KW** |
| MPD | e+2 | PDRX TUNE UP DUMP | 220 KW |
| MPD | e+3 | RTML TUNE UP DUMP | 220 KW |
| HPD | e+4 | BDS TUNE UP DUMP | 14 MW |
| HPD | e+5 | PRIMARY e+DUMP | 14 MW* |
| MPD | e+6 | RTML TUNE UP DUMP | 220 KW |
| MPD | e+7 | TARGET DUMP | 200 KW* |

**BEAM ABORT WIDENING ( )**

| POINT | SOURCES e-1, e+1, e-7 & e+7 | RTML, PLTR & ELTR e-2, e-3, e-6, e+2, e+3 & e+6 | BDS e+4, e-4, e+5 & e-5 |
|---|---|---|---|
| ( W x L )m | WITHIN TUNNEL | 10 x 32 | 20 x 42 |

**MUON WALL WIDENINGS**

| POINT | BDS |
|---|---|
| ( L x W )m | (4) WITHIN TUNNEL |

| SOURCE AREA | QTY | AREA (m2) | % AREA |
|---|---|---|---|
| e- Source | 0 | 0 | 0.0% |
| e+ Source | 0 | 0 | 0.0% |
| Damping Ring | 0 | 0 | 0.0% |
| RTML | 0 | 0 | 0.0% |
| Main Linac | 65 | 22,375 | 24.5% |
| BDS | 10 | 3,650 | 4.0% |
| ER | 28 | 65,250 | 71.5% |
| TOTAL | 103 | 91,275 | 100.0% |

**TUNNELS WIDTH (M)**

| AREA SYSTEM | e- INJECT. BDS & SERVICE | DAMPING RING | MAIN LINAC BEAM | e SOURCE RTML, PLTR & ELTR | e+ INJECT. BDS & SERVICE |
|---|---|---|---|---|---|
| AMERICA-width M | 4.5 SER. TUNNEL+ 4.5 x 4.5 W / WIDENED AREAS | 5.5 | 5.0 | 4.5 SER. TUNNEL+ 4.5 x 4.5 W / WIDENED AREAS | 4.5 SER. TUNNEL+ 5.0 W/ WIDENED AREAS |
| EUROPE-width M | - | - | - | - | - |
| ASIA-width x height M | 8.0 x 5.0 BDS TUNNEL + 4.5 x 4.0 SER. TUNNEL | 5.5 x 4.7 D.R. + 11.0 x 5.5 WIDENED AREA | 11.0 x 5.5, 8.0 x 5.0 M.L.+ 4.5 x 4.0 SER. TUNNEL | 11.0 x 5.5 RTML, PLTR & ELTR + 4.5 x 4.0 LOOP PART | 8.0 x 5.0 BDS TUNNEL + 4.5 x 4.0 SER. TUNNEL |

# WBS 1.7 – (1) Costing Base

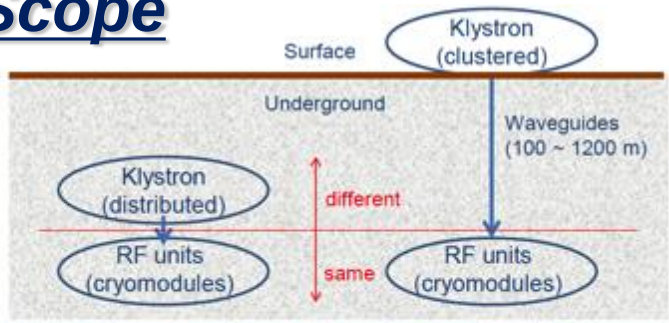
***Two Japanese design consultants have studied the ILC conventional facility and done the estimates except handling, survey and alignment. Tunnel cost estimates were guided by the Ministry Standard. The major civil costs were checked by the past project data. The electrical and mechanical costs were estimated on the basis of the past projects and by hearing the major equipment costs from the companies.***

| Cost Item | TDR Who estimated? | How estimated? | RDR Who? | How? |
|---|---|---|---|---|
| 1.7.1 Civil | **JPOWER**→GC (Nikken Sekkei→GCs) | **Ministry Standard used** for **Beam tunnels**, Project data for others | **Nikken**→GCs | **Past projects** (TBM/NATM) |
| 1.7.2 Electrical | Nikken | Project data, hearing. | Nikken (HV) Europe (Others) | Project data. |
| 1.7.3-5 Mechanical | Nikken | Project data, hearing. | Americas | |
| (1.7.6 Handling) | Europe | | Europe | |
| 1.7.7 Safety | Nikken | Project data. | Nikken | Project data. |
| (1.7.8 Survey & Alignment) | Europe | | Europe | |

→: Hearing GC: general contractor

# WBS 1.7.2 Asian Electric Cost – (1) Scope

- Power loads for DKS MLs and CFs
- TDR baseline (half beam power operation)




| | DKS | KCS |
|---|---|---|
| Klystron | 378 | 403 |
| RF units | 567 | 567 |

~6%

**DKS** Power Load in MW (TDR baseline - Low Power)

| Area System | RF Power | Racks | NC magnets | Cryo | Conventional | | Total |
|---|---|---|---|---|---|---|---|
| | | | | | Normal | Emerg | |
| e- sources | 1.28 | 0.09 | 0.73 | 0.80 | 1.47 | 0.50 | 4.87 |
| e+ sources | 1.39 | 0.09 | 4.94 | 0.59 | 1.83 | 0.48 | 9.32 |
| DR | 8.67 | | 2.97 | 1.45 | 1.93 | 0.70 | 15.72 |
| RTML | 4.76 | 0.32 | 1.26 | part of ML cryo | 1.19 | 0.87 | 8.40 |
| Main Linac | 52.13 | 4.66 | 0.91 | 32.00 | 12.10 | 4.30 | 106.10 |
| BDS | | | 10.43 | 0.41 | 1.34 | 0.20 | 12.38 |
| Dumps | | | | | 0.00 | 1.21 | 1.21 |
| IR | | | 1.16 | 2.65 | 0.90 | 0.96 | 5.67 |
| TOTALS | 68.2 | 5.2 | 22.4 | 37.9 | 20.8 | 9.2 | 164 |
| (Americas) | 74.2 MW | | | | 14.6 MW | 6.4 MW | **161 MW** |

# Mechanical Design – Asian Region (1)

- Heat loads for DKS MLs and CF s

**DKS** Thermal Loads in MW (TDR baseline - Low Power)

| Area System | load to LCW | load to Air | Conventional | Cryo (Water load) | Total |
|---|---|---|---|---|---|
| e- sources | 1.40 | 0.70 | 1.87 | 0.80 | 4.77 |
| e+ sources | 5.82 | 0.64 | 2.27 | 0.59 | 9.32 |
| DR | 10.92 | 0.73 | 2.69 | 1.45 | 15.79 |
| RTML | 4.16 | 0.76 | 2.02 | part of ML cryo | 6.94 |
| Main Linac | 42.17 | 5.57 | 16.89 | 32.00 | 96.63 |
| BDS | 9.20 | 1.23 | 1.68 | 0.41 | 12.52 |
| Dumps | 14.00 | | 1.12 | | 15.12 |
| IR | 0.40 | 0.76 | 1.79 | 2.65 | 5.60 |
| TOTALS | 88.1 | 10.4 | 30.3 | 37.9 | 167 |

(Americas) 13.5 MW 154 MW