SRs and XFELs in Asia-Oceania

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SR Sources in Asia-Oceania

Australia
- Australian Synchrotron (Clayton)

China
- Beijing SR Facility (Beijing)
- Shanghai SR Facility (Shanghai)
- National SR Laboratory (Heifei)
- HEPS (Beijing)
- HALS (Heifei)
- Wuhan
- Xian
- Dongguan

India
- INDUS-II (Indore)
- Kolkata

Japan
- Photon Factory (Tsukuba)
- PF-AR (Tsukuba)
- UVSOR (Okazaki)
- AICHI SR (Seto)
- RITUMEI SRC (Kusatsu)
- SPring-8 (Harima)
- SPring-8-II (Harima)
- NEW SUBARU (Harima)
- HiSOR (Hiroshima)
- Kyushu SR (Tosu)
- SLiT-J (Sendai)

Korea
- PLS-II (Pohang)

Singapore
- SSLS

Taiwan
- TLS (Hsinchu)
- TPS (Hsinchu)

Thailand
- SPS (Nakhon Ratchasima)
- SPS-II

2nd generation,
3rd generation
In construction/planning

Council Report 2018

AOFSRR workshop 2018 @ Taipei International Convention Center

AOFSRR 2018 Council meeting @ Grand Hyatt Hotel Taipei

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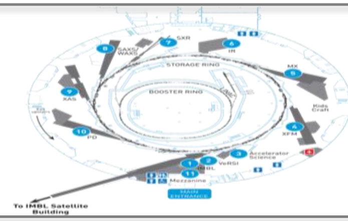
Australian Synchrotron – 2018 Progress

Australian Government

The Australian Synchrotron operates 10 beamlines:

> 99% beam availability; 5000 hours User Operations
> 6,500 registered users from over 80 research organisations
> 3,000 Students and Early Career Researchers
> 13% of users from international institutions
A wide range of Australian and international companies



New beamlines – part of the BRIGHT Program

Micro Computed Tomography (MCT)* (*Commenced construction)
Medium Energy XAS (MEX1 & MEX2)*
Biological Small Angle X-ray Scattering (BioSAXS)*
Advanced Diffraction & Scattering (ADS1 & ADS2)
High Performance MX (MX3)
X-ray Fluorescence Nanoprobe (Nanoprobe)
Micro Materials Characterisation (MMC)

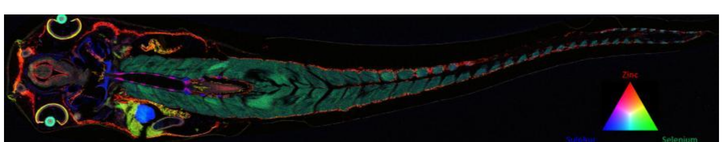
Excellent Scientific Output from 2017

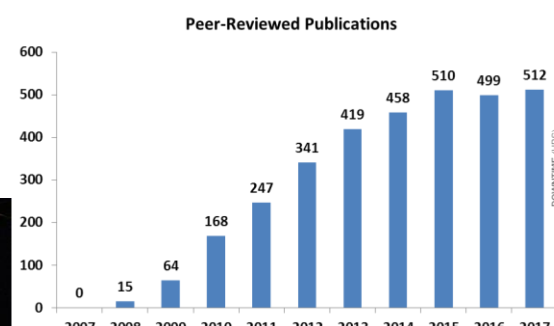
512 journal articles
20% of articles in high impact journals (IF > 7)
5177 researcher visits
~1000 experiments
< 30 unplanned downtimes

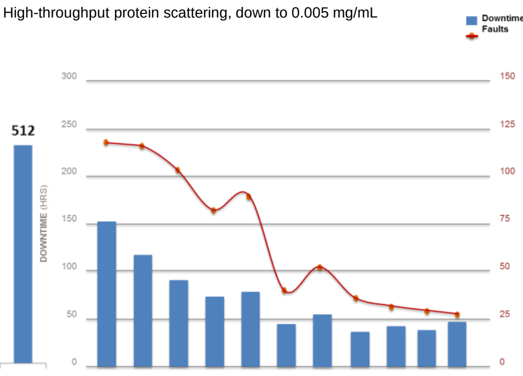
Beamline and Capability Developments

- ASCI High Performance Computing Cluster
  - MX structure solution; CT reconstruction & rendering; XFM analysis,…
- MX2 detector (EIGER 16M); MX1/MX2 sample robot upgrades
  - Average cycle time reduced from several minutes to ~35 s.
- XFM fast scanning stages; Maia detector upgrade; Eiger X 1M
  - Simultaneous Milliprobe & Microprobe operation; ptychography
- Toroidal Analyser ARPES
  - High-throughput NEXAFS
- IRM Focal Plane Array detector; Macro-ATR sample stages
  - Rapid, micron resolution IR maps of soft matter
- SAXS/WAXS endstation & detector upgrade; Co-Flow + SEC
  - High-throughput protein scattering, down to 0.005 mg/mL
- IMBL Large Animal & Patient Position Systems
  - Phase contrast in vivo imaging & CT; ~80 kg & ~1 m high
- PD robotic sample changing & auto-alignment; battery carousel
  - High-throughput protein scattering, down to 0.005 mg/mL

Chris Clarkson, *et al.*, *Nature*, **547**, 306 (2017).

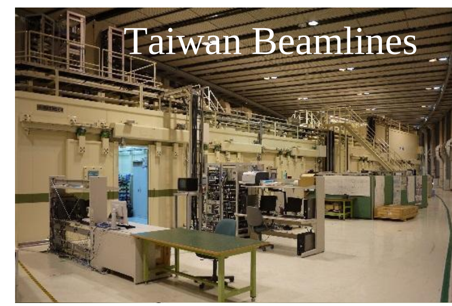


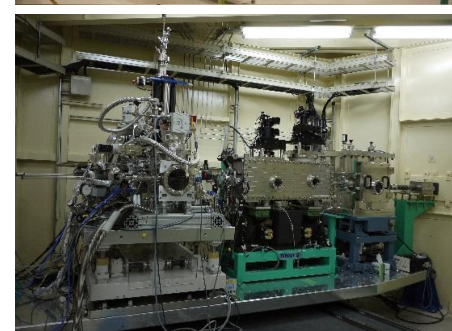


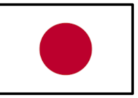


NSRRC User Facilities

Neutron Facility SIKA	台灣光子源 (Taiwan Photon Source)	台灣光源 (Taiwan Light Source)	SPring-8 Taiwan BLs







Accelerator-based Light Sources (still) in operation and to be constructed in Japan

MEXT	*: Academic to S&T*
Government	*: Central to Local*
Application	*: Basic to Applied*
Users	*: Universities to Industries*

1982 Photon Factory, IMSS, KEK	MEXT (Academic)	SX, HX	Top-up	to be upgraded again
1983 UVSOR, IMS	MEXT (Academic)	UV, SX	Top-up	upgraded to UVSOR III in 2012
1987 PF-AR, IMSS, KEK	MEXT (Academic)	HX	Top-up	upgraded in 2002
1996 HiSOR, Hiroshima Univ.	MEXT (Academic)	UV, SX		
1996 Ritsumeikan SR	Ritsumeikan Univ.	UV, SX		
1997 SPring-8, RIKEN	MEXT (S&T)	HX	Top-up	to be upgraded to SPring-8 II
1998 NewSUBARU	Hyogo Prefecture	UV, SX	(Top-up)	
2006 SAGA Light Source	Saga Prefecture	SX, HX		
2012 SACLA (XFELs), RIKEN	MEXT (S&T)	HX		
2013 Aichi SR	Aichi Prefecture	SX, HX	Top-up	
2023? SLiT-J (3GeV), QST	MEXT (S&T)	SX, HX	Top-up	

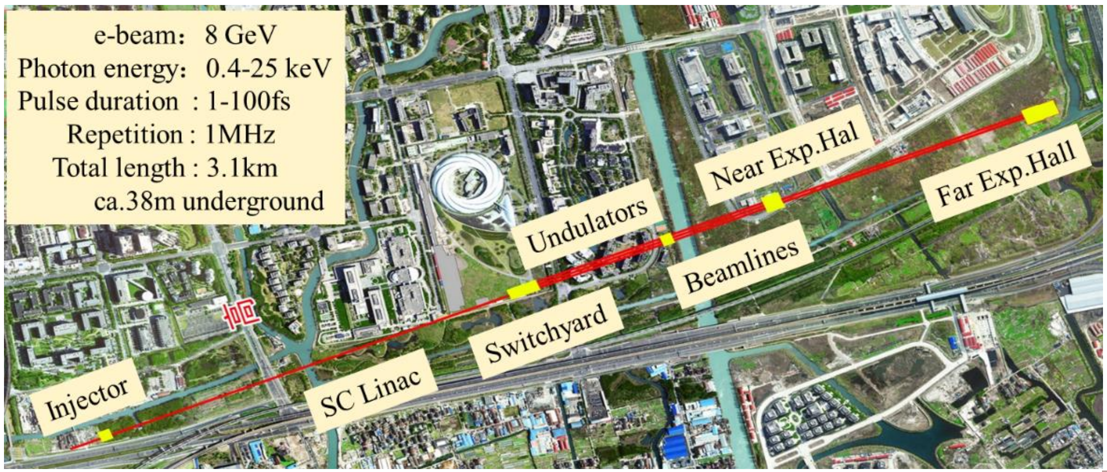
+ regional associations in Tohoku
(industries, prefecture, city, universities)

We hope MEXT(S&T) will soon (before the end of this June) approve the partnership between QST and the Tohoku team!


PAL-XFEL

SSRF, SXFEL and SCLF (Shanghai)

- **A Soft X-ray FEL based on 1.5GeV C-band linac is under phased construction and commissioning**
- **A Hard X-ray FEL based on 8GeV SRF linac started its construction in April 2018**



- **3.5GeV SR facility**
- **3.9nm·rad emmitance**
- **432m storage ring**

SSRF Phase-II Beamline
Project with 16 new beamlines started in 2016 and will last for 6 years.

HEPS (Beijing)

- **6GeV SR facility**
- **0.06nm·rad emittance**
- **1360m storage ring**

- A R&D project (HEPS-TF) with 50MUSD started in 2016.
- The project of HEPS has been approved by central government.
- Construction will start by end of 2018, and its commissioning is expected in 2024.

HALS (Hefei)

2.4GeV SR facility
0.03nm·rad emittance
672m storage ring

- A R&D Project for HALS was launched with 50M USD in December 2017.
- This project will be listed in the national big scientific infrastructure plan from 2021 to 2025.
- Its construction is expected to start in 2021.

Synchrotron Light Research Institute

1. Infrastructure

- Number of beamlines: **10** (operations) and **1** (under construction)
- New beamline for XAS using 3.5 T SMPW (designed and constructed by NSRRC) will be in operation in 2019.
- Full injection for storage ring is in operation.

2. Statistics

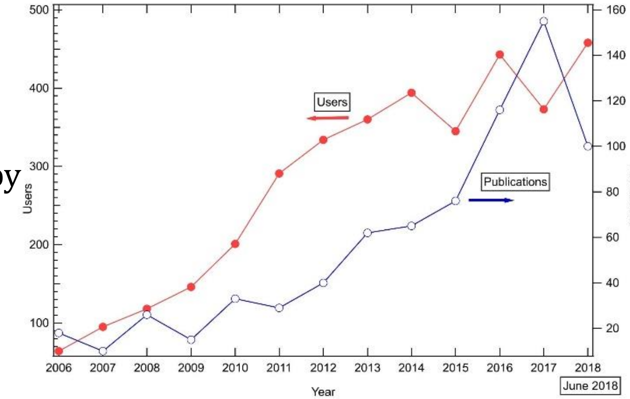
- Number of proposal nearly **400** in 2017 and more than 450 in 2018
- Number of publications more than **150 papers** in 2017.
- Number of International users is about 10% (**40 proposals**)

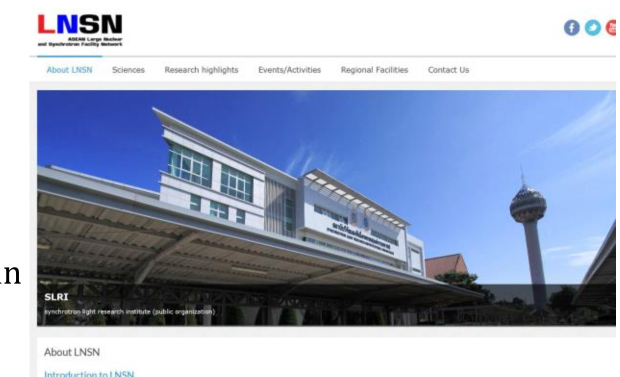
3. Other activities

- An ASEAN network 'ASEAN Large Nuclear and Synchrotron facilities Network (LNSN) has been established.
- Collaboration with other synchrotrons (NSRRC, AS, Diamond, etc.)

4. Plan

- Proposal for the 3rd generation synchrotron facility will be submitted in 2018.





SPS-II parameters	
Store beam energy	3.0 GeV
Beam current	300 mA
Emittance	0.97 nm-rad
Lattice structure	DTBA
Superperiods	14
Circumference	321.3 m
Long straight section length	5.02 m x 14
Short straight section length	3.10 m x 14

Concluding Remarks

SR Sources

- An MBA upgrade is planned for SPring-8
- Greenfield construction for MBA is underway at many facilities:
  - SLiT-J (Japan), HEPS (China), HALS (China), Wuhan (China), Xian (China), Dongguan (China), SPS-II (Thailand), Kolkata (India)
  - Japanese SLiT-J relies on funding from industry; Chinese facilities are funded partly by local governments.

XFELs

- 3 RT linac-based XFELs (SACLA, PAL-XFEL, SXFEL). An SC linac-based XFEL is planned in Shanghai (SCLF).
- Japan is exploring the possibility of making a 10 kHz machine using RT technology

RT Linac may Reach 10 kHz Repetition Rate

PHYSICAL REVIEW ACCELERATORS AND BEAMS **19,** 011302 (2016)

Dielectric assist accelerating structure

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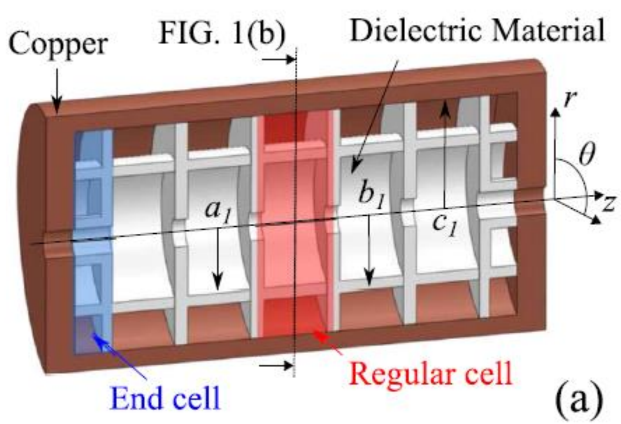
A higher-order TM_{02n} mode accelerating structure is proposed based on a novel concept of dielectric loaded rf cavities. This accelerating structure consists of ultralow-loss dielectric cylinders and disks with irises which are periodically arranged in a metallic enclosure. Unlike conventional dielectric loaded accelerating structures, most of the rf power is stored in the vacuum space near the beam axis, leading to a significant reduction of the wall loss, much lower than that of conventional normal-conducting linac structures. This allows us to realize an extremely high quality factor and a very high shunt impedance at room temperature. A simulation of a 5 cell prototype design with an existing alumina ceramic indicates an unloaded quality factor of the accelerating mode over 120 000 and a shunt impedance exceeding 650 MΩ/m at room temperature.



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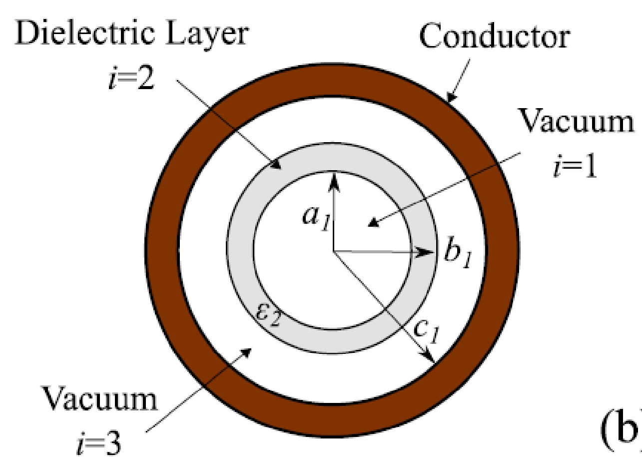

(b)