

冷中性子ディスクチョッパー型分光器 AMATERAS

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A Cold-Neutron Disk-Chopper Spectrometer AMATERAS

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AMATERAS Over View

AMATERAS: By combination of high-peak intensity from a H₂-coupled moderator & newly developed fast disk-choppers for pulse shaping and monochromating, AMATERAS realizes both high-resolution ($\Delta E/E_1 > 1\% @ E_1 = 20 \text{ meV}$) and high-intensity.

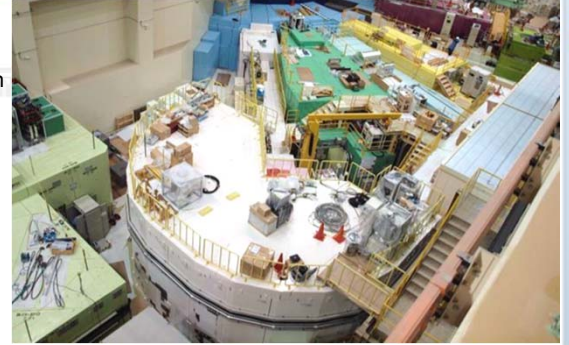
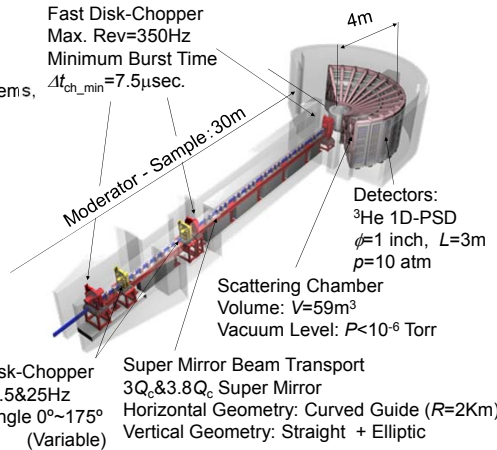
- ▶ Commissioning: from May, 2009
- ▶ User program: from Dec. '09

Items which have been already installed.

- ▶ Scattering Chamber, Shieldings, Chopper Systems, Beam Transport
- ▶ 4K Refrigerator: Bottom Loading Type
- ▶ Main Detectors
- ▶ 266 tubes installed (60% of full installation).
Covering Angle: Horizontal 4.7° ~ 111.7°
Vertical -16° ~ 22°
- ▶ 2 Beam Harrowers
- ▶ Oscillating Radial Collimator
- ▶ Crane

Items which have not yet installed.

- ▶ Main Detectors (Remaining 182 Tubes)
- ▶ Beam Monitors
- ▶ Polarization Options
- ▶ etc.



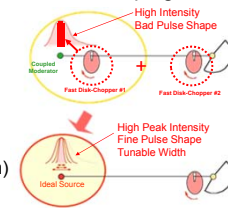
Pulse Shaping & Couple Moderator

By using pulse shaping chopper, we can cut put the peak of the pulse from high intensity coupled moderator.

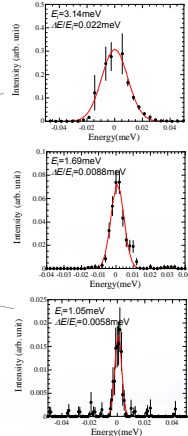
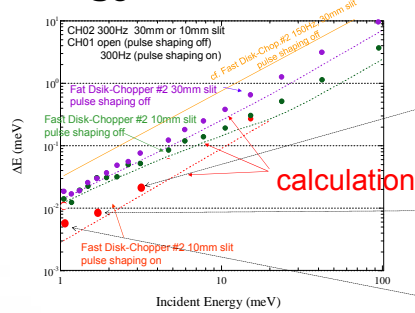
Enjoy high peak intensity without degrading of the resolution.

By tuning shaping width, we can optimize the intensity and the resolution.

cf. CNCS@SNS, LET@ISIS TS-2



Energy Resolution



- ▶ By using the pulse shaping chopper, we can obtain the energy resolution of less than 10 μeV at lower E_1 s.
- ▶ In actual experiments, most of users prefer low speed operation of chopper ($f=150\text{Hz}$) with the resolution of a few hundred μeV ~ a few meV.

Multiple- E_i Measurements

Multiple- E_i measurement utilizing repetition rate multiplication¹⁾ was demonstrated on 4SEASONS²⁾ and is becoming an ordinal (usual) measuring mode of chopper spectrometers at MLF.

- 1) M. Russina and F. Mezei, Nucl. Instrum. Methods Phys. Res. A 604 (2009) 624
- 2) M. Nakamura et al., J. Phys. Soc. Jpn. 78 (2009) 093002

Power of multiple- E_i measurement

▶ Zoom-in & zoom-out operation by using a single measurement data.

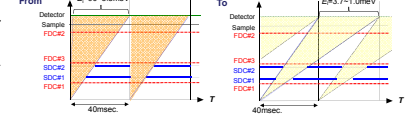
▶ Taking Different resolution (time-scale) data by a single measurement

Dynamics contains different time-scales (liquids, polymers, biomaterials...) can be measured effectively and precisely.

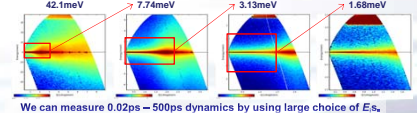
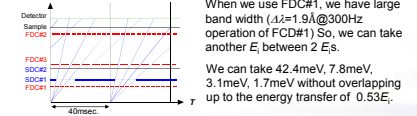
AMATERAS is potentially able to perform measurements in the range of 10 μeV ~ several 10meV (nearly 5 orders).

Effort to Expand Possible Dynamic Range

Previously: We can choose only 1 frame width → narrow range



New Choice: More than 1 frame width



Activities in JFY 2013

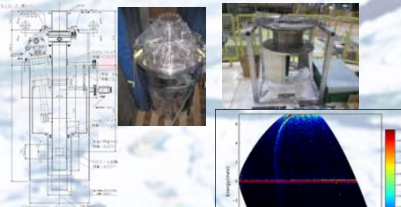
User Program in JFY 2013

- 2013A
- General Use Proposals: Accepted 9 (61 days), Reserved 4 (23 days) (# of submitted prop.: 22)
 - Project Use Proposals: 2 (25 days)
 - Elementary Strategic Use: 1 (3 days)
- * Due to the accident at Hadron Fac., user program for JFY 2013 was quited in the end of May. 4.5 general proposals and 1.5 project use proposal has been carried out.

- 2013B
- General Use Proposals: Accepted 4 (22 days), Reserved 2 (10 days) (# of submitted prop.: 18)
 - Elementary Strategic Use: 1 (3 days)

Commissioning in JFY 2013

- Fixing of beam transport section
- Commissioning on SE
- Replacement of a gas-leaked detector
- Preparation of beam monitors & attenuators
- Background reduction
- etc.



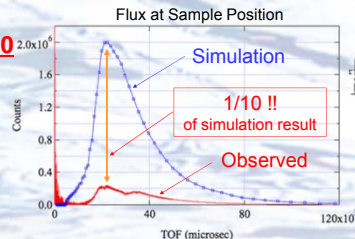
Fixing of Beam Transport

Low Neutron Flux at the Sample Position

The neutron flux at the sample position is turned out to be **1/10** of that of expected value.

▶ At the exit of biological shield (before the curved section), the measured flux is OK. Therefore, the source of problem is in the curved section or later of that.

- ▶ Miss-alignment in the curved section is found.
- ▶ Part of mirror show bad reflectivity.



Replacement (8.6m) and re-alignment (full-section) of guide mirror have been carried out.

AMATERAS will have **x10 higher intensity** from the next round???

Statistics of AMATERAS

Commissioning started from: May 2009
User program started from: December 2009

Number of proposals carried out:

- General Use Proposals: 43
- Urgent Proposals: 1
- Project Use Proposals: 6 (or 15 prop.-term.)

Beam time provided to user program:

- General Use Proposals: 210 days
- Urgent Proposals: 4 days
- Project Use Proposals: 95 days

Publications (except technical (instrumental) out-comes)

- Papers: 13 (published & accepted)
- Presentations in scientific meetings: more than 60

Proposals for 2014A

- General Use Proposals: 22
- Project Use Proposals: 2
- Instrumental Proposal: 1

