

# qNMR

Quantitative Analysis by NMR



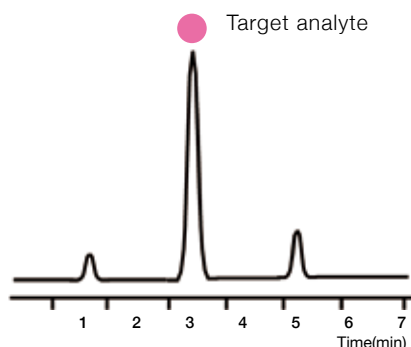
# What is quantitative analysis using NMR(qNMR)?

Quick and accurate quantitative analysis is possible without using a reference material that is the same as the target analyte.

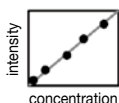
## Comparison of Chromatography and NMR analysis Procedures

### Chromatography

#### Chromatogram

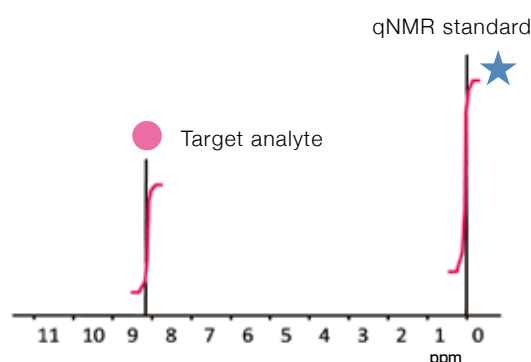


1. Prepare a set of solutions of known concentrations of the compound to be quantified
2. Preparation of instrument for measurement condition
3. Make a **calibration curve**
4. Perform chromatographic analysis of target analyte
5. Calculate result



### NMR

#### <sup>1</sup>H NMR Spectrum



1. Choose **qNMR standard**
2. Prepare sample by mixing the qNMR standard, target analyte and solvent
3. Set instrument and run NMR measurement
4. Calculate result

Quick Analysis

## Features of qNMR

1. **Versatility** —→ **Target analyte are typical organic compounds**  
\* Quantitative analysis of a compounds is possible, although its standard sample may not be available.
2. **Efficiency** —→ **The qNMR standard that is the same as the target analyte is not necessary.**  
\* One qNMR standard can be used for unlimited number of target analyte.
3. **Speed** —→ **Calibration curve is not required --> With qNMR it is possible to perform absolute quantification.**  
\* Usually, a few milligrams of sample is required.
4. **Reliability** —→ **SI (The International system of units) traceable analysis is possible.**



### Why purity analysis by NMR is attracting attention

#### Improved reliability of quantitative analysis

If the purity of the qNMR standard used in quantitative analysis is not known, qNMR can be used to determine the purity. By incorporating the absolute purity value into quantitative analysis calculation, it is possible to improve on the reliability of quantitative analysis obtained by chromatographic methods.

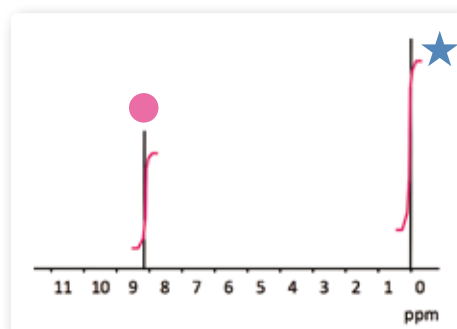
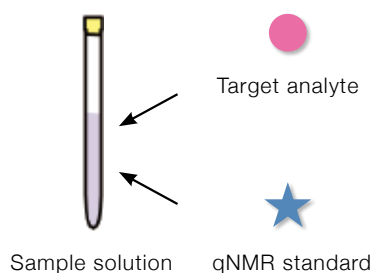
# Variety of qNMR methods\*1

There are two methods of quantitative analysis using NMR mainly.

## Internal Standard Method

The presence of standards in the sample solution minimizes various factors that can lead to errors and allows for precision. This method is utilized for purity analysis.

### One sample (comparison within a spectrum)



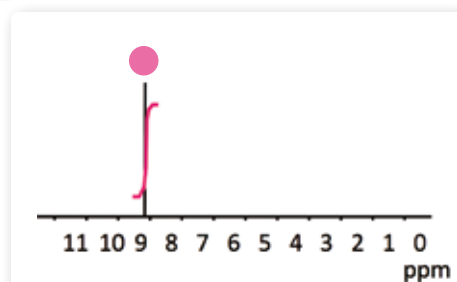
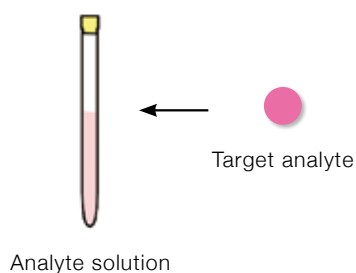
NMR spectrum of internal standard method

## External Standard Method : PULCON\*2

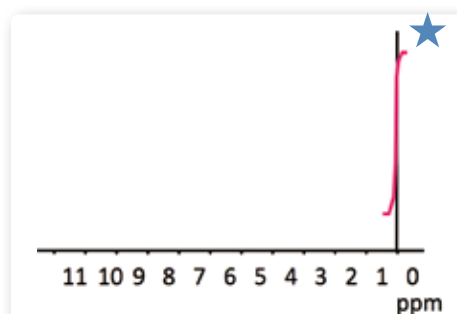
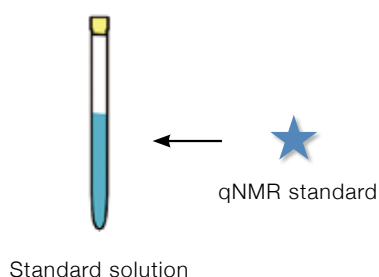
A standard solution is prepared and used separately from the sample solution, so that the contamination into the target analyte is minimized.

Various methods have been reported.

### Two samples (comparison between 2 spectra)



Target analyte NMR spectra of external standard method



qNMR standard NMR spectrum of external standard method

\*1 There are two basic quantitative method by NMR : the relative and absolute quantification. However, we only introduce the absolute quantification of analyte here.

\*2 Pulse Length-based CONcentration measurement. A quantitative analysis method measurement of involving measurement of the standard and analyte sample separately and then comparing the signal areas.

# qNMR workflow of internal standard method

Quantitative methods for the accurate determination of the purity or content of organic compounds.

qNMR is SI-traceable and accurate quantitative values.

Quantitative NMR analysis is possible by means of either internal or external standard method. The choice of these methods depends on the purpose of analysis.

Among the internal standard methods, a qNMR analysis that can quantitatively express the reliability of the analytical results and qualifies in principle as a primary standard measurement method is possible.

If reliability is the most important factor, e.g. purity, the

internal standard method is strongly recommended. In official methods such as Japanese Pharmacopoeia, the qNMR with SI-traceability applied qNMR method is used as a quantitative method to accurately determine purity and content,<sup>\*3</sup> and are used for evaluation of certified reference materials.<sup>\*4</sup>

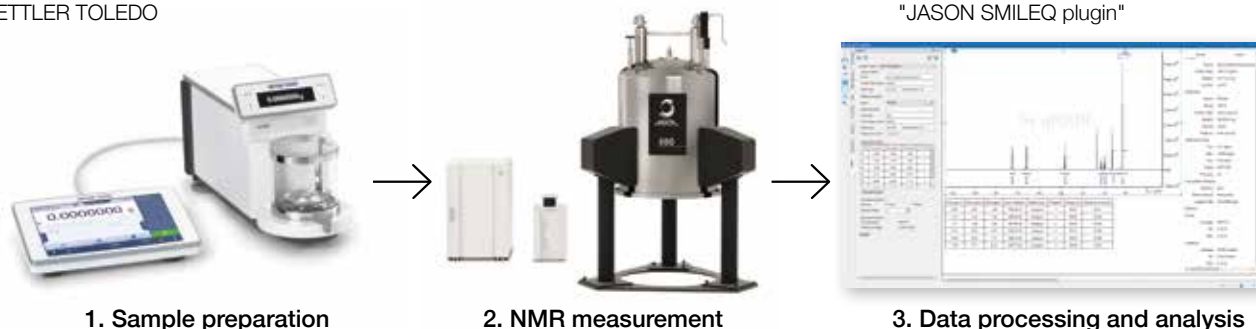
The internal standard method is employed by JEOL in the analysis operation from sample preparation to calculation.

## Procedure

Ultra Micro balance XPR2U  
: METTLER TOLEDO

NMR spectrometer ECZ Luminous™

NMR analysis software for qNMR  
"JASON SMILEQ plugin"



## Ensure reliability

The absolute value of the amount of the material can be obtained by measurements verified by the International System of Units(SI). This measurement method is called the primary standard measurement method, and NMR is one of them,<sup>\*4</sup>

At qNMR analysis, certified standard material with SI traceability of reference materials (Certified reference material, CRM) can be used, enabling SI-traceable purity evaluations.

## ISO standardization of qNMR method <sup>\*5</sup>

Contributes to improved reliability in the quantitative analysis of organic compounds such as pharmaceuticals, reagents and food ingredients.

International standard for the quantitative purity determination of organic compounds using nuclear magnetic resonance (NMR) has now been adopted by ISO 24583, Quantitative nuclear magnetic resonance spectroscopy - Purity determination of organic compounds used for foods and food products -General requirements for <sup>1</sup>H NMR internal reference methods.-

The qNMR (quantitative NMR) method is an analysis method that enhances reliability. This international standard defines the measurement procedures for the qNMR method, which is a "quantitative analysis" method using NMR, and improves the reliability of the purity determination of organic compounds around the world. This will further promote the implementation of the qNMR method in society and contribute to the realization of a comfortable, safe and secure society.

The international standard was published by ISO on 19 December 2022.

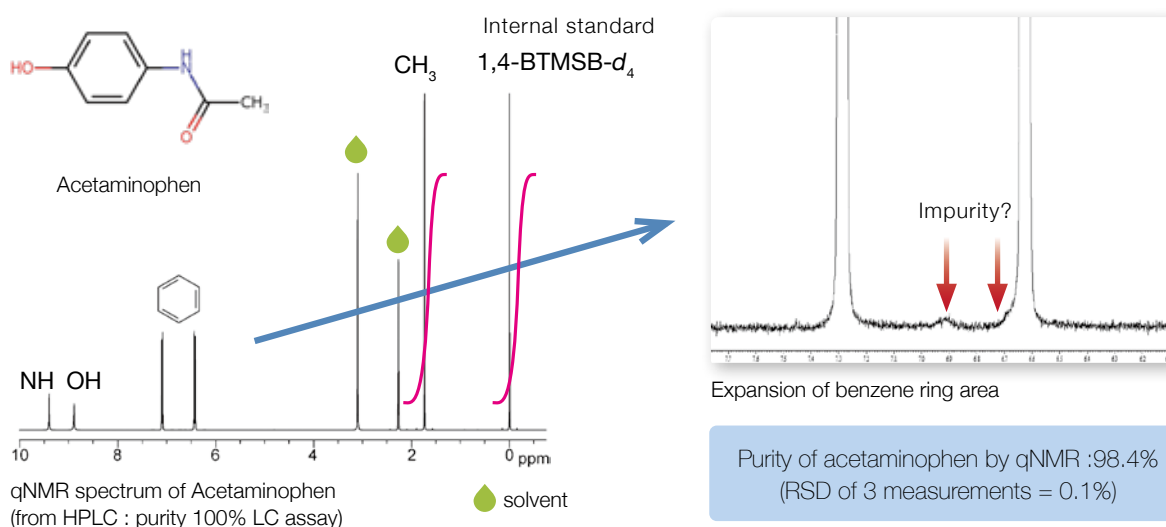
<sup>\*3</sup> THE JAPANESE PHARMACOPOEIA EIGHTEEN EDITION (THE MINISTRY OF HEALTH, LABOUR AND WELFARE)

<sup>\*4</sup> T.Ihara, T.Saito, JEOL News Vol47, No.1, 2012 - Realization of an Innovative Metrological Traceability using the Quantitative NMR Method

<sup>\*5</sup> ISO 24583 : <https://webdesk.jsa.or.jp/books/W11M0070/index> English page is available.

# Example of qNMR internal standard method

## Purity Analysis of Acetaminophen



The result of the purity of acetaminophen reagent is shown here. 1,4-bis(trimethylsilyl)benzen- $d_4$  (1,4-BTMSB- $d_4$ ) was used as the internal standard material. <sup>\*6</sup>

We decided to use the  $^1\text{H}$  signal of the  $\text{CH}_3$  group and the calculation was made according to the

formula(1) to determine a purity of 98.4%.

As such, qNMR enables purity analysis and confirmation of impurities simultaneously. In addition, it is possible to obtain information on changes of the sample over a period of time and it can be used in product quality control.

$$\text{Formula (1)} \quad P_{\text{sample}} = \frac{I_{\text{sample}}}{I_{\text{std}}} \times \frac{H_{\text{std}}}{H_{\text{sample}}} \times \frac{m_{\text{std}}}{m_{\text{sample}}} \times \frac{M_{\text{sample}}}{M_{\text{std}}} \times P_{\text{std}}$$

$I$  = signal intensity(integral value),  $H$  = number of protons(number of hydrogen atoms in the functional group),  $m$  = mass(weight),  $M$  = Molar Mass,  $P$  = purity(%)

### Introduction of qNMR related reagents

Code No.	Product	Grade	Package size
024-17031 020-17033	1,4-BTMSB- $d_4$ Reference Material [CRM]	TraceSure®	50 mg 50 mg×4
044-31671 040-31673	DSS- $d_6$ Reference Material [CRM]	TraceSure®	50 mg 50 mg×4
048-33271	Dimethyl Sulfone Reference Material [CRM]	TraceSure®	100 mg
135-17951	Maleic Acid Reference Material [CRM]	TraceSure®	100 mg
093-06731	4 Internal Standard Set for Quantitative NMR [CRM]	for qNMR	1 set
634-29181	3,5-Bis(trifluoromethyl)benzoic Acid for Quantitative NMR ( $^1\text{H}$ , $^{19}\text{F}$ )	NMIJ CRM 4601-c	200 mg
639-44151	1,4-Bis(trimethylsilyl)-2,3,5,6-tetrafluorobenzene for Quantitative NMR ( $^1\text{H}$ , $^{19}\text{F}$ )	NMIJ CRM 4602-a	100 mg
161-24661	Potassium Hydrogen Phthalate [CRM]	TraceSure®	50 g
041-33641	DSS- $d_6$ Standard Solution (500 mg/L Deuterium Oxide Solution)	for qNMR	1 mL×5 A

Please find the details <https://labchem-wako.fujifilm.com/us/category/analysis/nmr/qnmr/index.html>

\*6 1,4-BTMSB- $d_4$  : Code No. 024-17031, 020-17033 Fujifilm Wako Pure Chemical Corporation



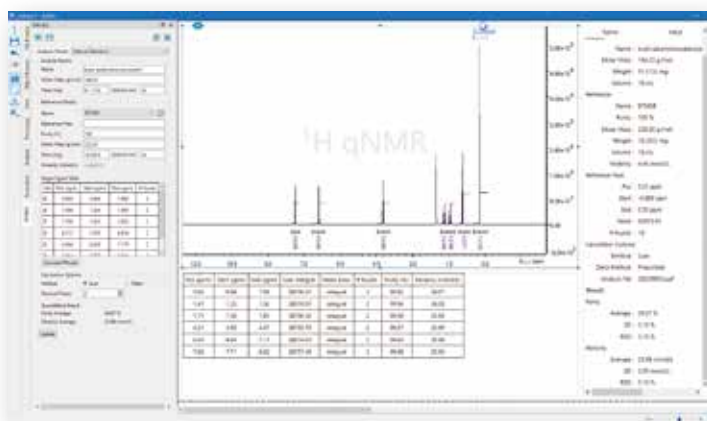
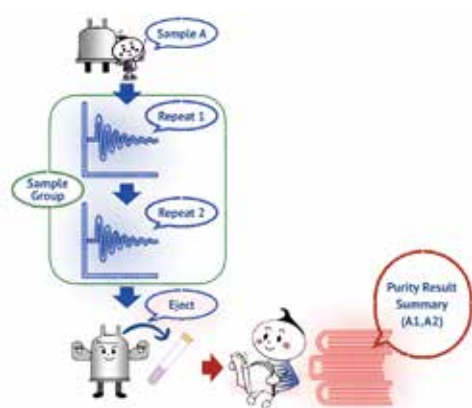
# Information of qNMR Analysis System

JEOL NMR Systems offer both internal and external standard method

## Data Analysis Tool

### JASON SMILEQ

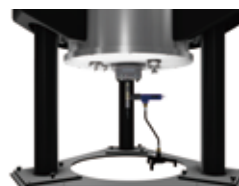
SMILEQ(Spectral Management Interface Launching Engine for qNMR) is an automated qNMR analysis system provided by JASON(JEOL Analytical Software Network). (p.8)



## Optional

### Long Time Low Temperature Unit Compressor Type

This long time low temperature unit a vortex tube. The achievable temperature of sample depends on the specification of the compressor used, but the ability to easily reach a temperature of approx. 25 degrees C below room temperature. It is suitable for long measurement of samples requiring low temperature.



### Auto Sample Changers

Sample tubes of various diameters and special sample tubes can be transported safely. The JackBean type does not require the use of stairs when changing NMR sample. Pre-Cool and Pre-Heat types are also available for users who need to keep samples cool or pre-heat them.



ASC24



ASC30



ASC100

Type	Option
ASC24	
ASC30 (JackBean)	Pre-Cool Pre-Heat
ASC64 (JackBean)	
ASC100 (JackBean)	



## Installation Case about qNMR and our support

### FUJIFILM Wako Pure Chemical Corporation Tokyo plant

FUJIFILM Wako Pure Chemical Corporation has started production of certified reference material (CRM) using ISO 24584 (qNMR), first in the world. <sup>\*1</sup>

The qNMR (quantitative NMR) method has been stipulated in Japanese Industrial Standards (JIS), and an International Organization for Standardization (ISO) method for sample analysis. The ISO method for qNMR was established through collaborative research by multiple organizations including FUJIFILM Wako Pure Chemical Corporation and JEOL Ltd.

<sup>\*1</sup> As of October 30th, 2023

qNMR can be used for purity assay even without a reference material identical to the target analyte, and has the advantage that the analysis time is shorter than other methods. This means that qNMR can also be applied for analyte for which a reference material has not yet been, such as new drugs.

FUJIFILM Wako Pure Chemical Corporation is a supplier of reference material and certified reference material (RMs/CRMs) for qNMR. These reference materials will be standards for quantitative analysis when measuring together with the target analyte. As another feature of qNMR is that a single reference material can be used for a number of analytes.

FUJIFILM Wako Chemical Corporation has contributed to the standardization of qNMR and has introduced qNMR into their quality control processes. They have a plan to provide a sufficient number of RMs/CRMs for general analysis and are preparing to meet the diverse demands of users. Through these efforts, they are working to disseminate qNMR and support its users.



JNM-ECZL400

FUJIFILM Wako Pure Chemical Corporation currently uses three JEOL NMR systems, one of which is the latest JNM-ECZL400S, which can be used for automated qNMR, in order to analyse many analytes quickly and efficiently. We also carry out regular inspections to ensure stable operation of the NMR system. (Interview, November 2023)

You can find out more details on our website.

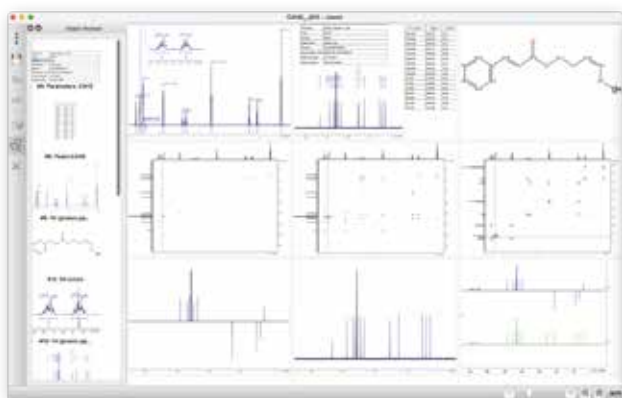
[https://www.jeol.co.jp/products/technology\\_cases/cases/nmr\\_12.html](https://www.jeol.co.jp/products/technology_cases/cases/nmr_12.html)

JASON(JEOL Analytical Software Network)is next-generation NMR analysis software focused on the automated processing,analysis and reporting of NMR data.

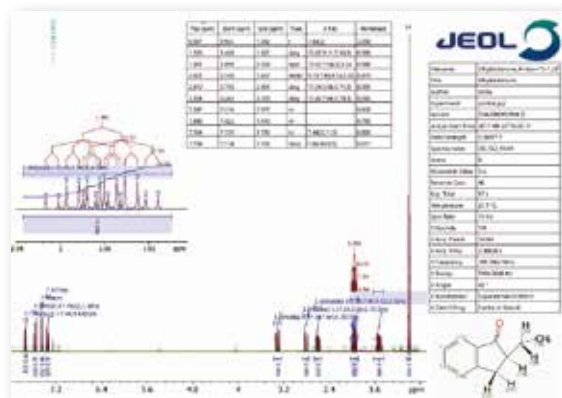
Highly flexible interface and extensive analysis functions

JASON's intuitive interface facilitates a variety of NMR analyses. In addition to basic 1D/2D-NMR data processing, JASON offers versatile functions such as multiplet analysis, peak deconvolution,  $^1\text{H}$ ,  $^{13}\text{C}$  chemical shift prediction, automatic attribution and spin simulation.

One of JASON's special features is its canvas. Each NMR data set can be linked to each other using the object link function, providing seamless support from spectral analysis to report generation.



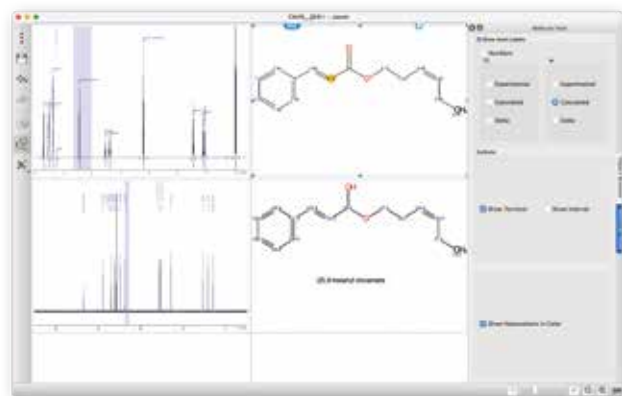
## JASON Canvas



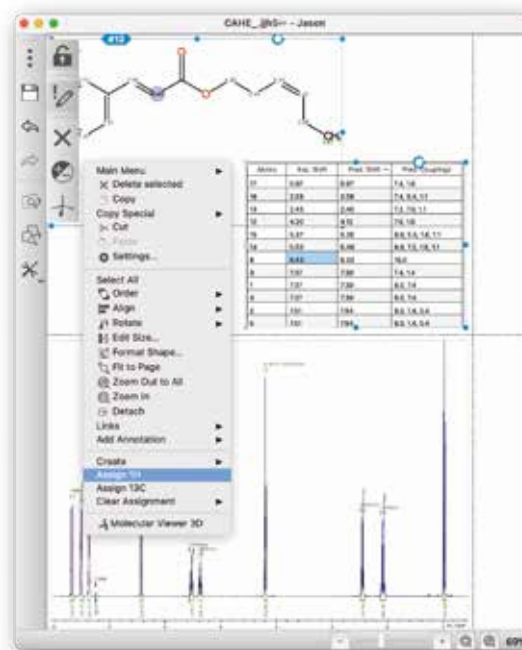
### Example for report of J-coupling patterns

## <sup>1</sup>H, <sup>13</sup>C Chemical shift prediction

JASON can predict chemical shifts for input chemical structures. Using the predicted  $^1\text{H}$  and  $^{13}\text{C}$  chemical shifts, the structural formula and the actual NMR spectra can be compared with each other. Furthermore, NMR spectra can be automatically assigned from the predicted chemical shift information. Easily chose Auto assignment [ $^1\text{H}$ ] or [ $^{13}\text{C}$ ] from the menu and the signal assignment results are displayed on the NMR spectrum.



## <sup>1</sup>H and <sup>13</sup>C Chemical shift prediction



The result of automatic assignment for  $^1\text{H}$  NMR spectrum





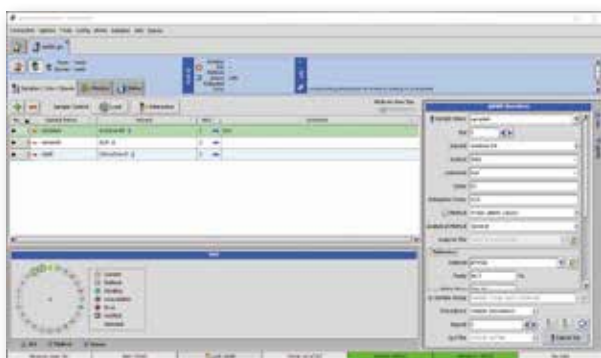
smileq



SMILEQ (Spectral Management Interface Launching Engine for Q-NMR) is an automated qNMR measurement and analysis system, where measurements with the NMR software Delta and qNMR analysis with JASON are carried out seamlessly and automatically in an integrated manner.

## Measurement & Analysis in one Step

All qNMR measurements, data processing and reporting for the internal standard method are performed automatically. qNMR measurement conditions and FID data measured with Delta are properly data processed via JASON's SMILEQ plug-in, and quantitative values are calculated and reported automatically.

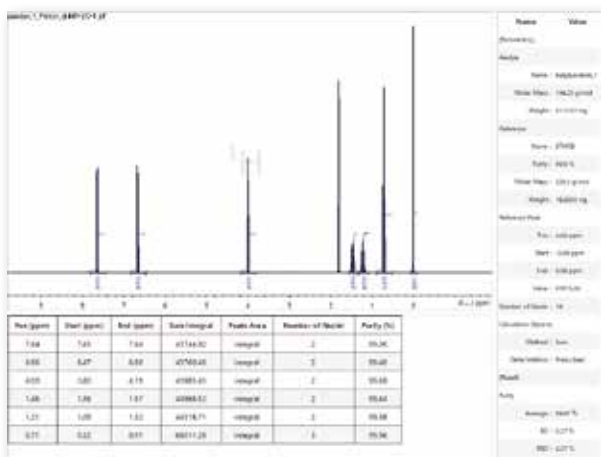


Setting for experimental condition : Delta

The conditions for qNMR analysis can be managed centrally using the Delta qNMR seamless tool, while the SMILEQ system enables user-independent, automated and optimised qNMR analysis.

- ☒ The measurement conditions, analysis conditions and sample information can be specified on one screen
- ☒ Analysis templates and a reference material library are available
- ☒ Repeated, sequential or non-sequential measurement sequences can be defined

## Data management



Example of report

- ☒ Easy-to-understand reports with qNMR analysis results and measurement conditions at a same time
- ☒ Management of FID, pdf file and JASON format file created for each measurement
- ☒ If re-analysis is required, individual analysis is possible with the SMILEQ plugin
- ☒ Statistical results (average, SD, RSD) for all results can be created as a summary report in the case of multiple samples or repeated measurements (p.9)



## Optimization for SOP development

SMILEQ is an automated analysis system that can manage all qNMR analyses via the Delta qNMR seamless tool. Standard Operating Procedures (SOP) support is also available, making SMILEQ ideal for quality control and other work environments with a large number of analysis samples.

Supported versions  
 -Delta 6.1 or later  
 -JASON 1.3 or later  
 SMILEQ\_plugin 1.0 or later

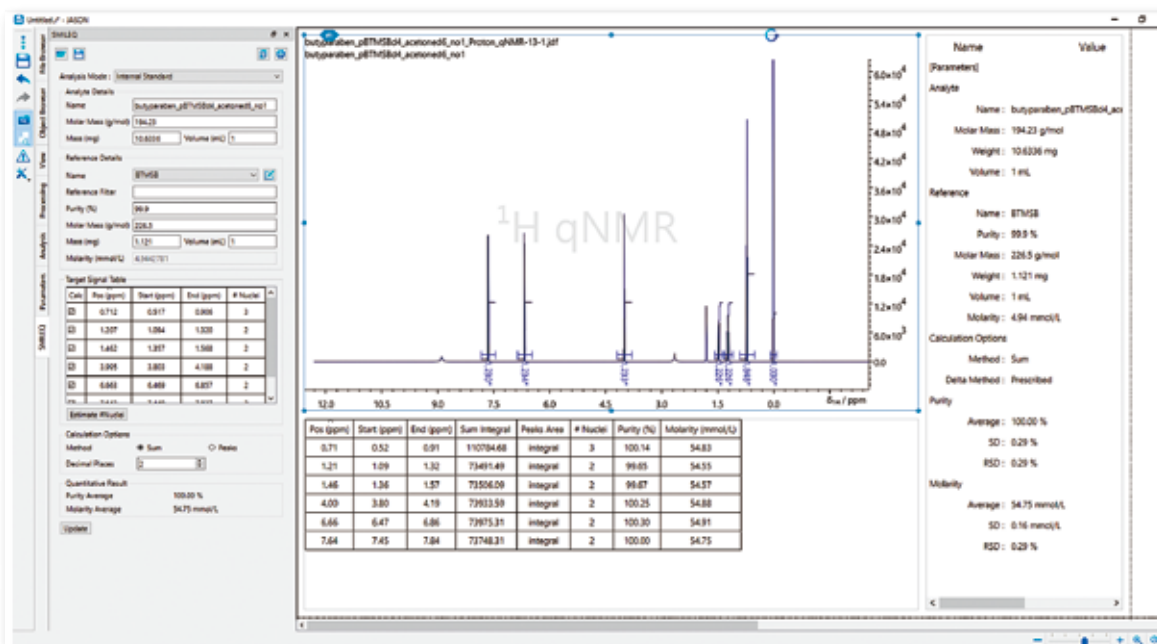
\* The qNMR seamless tool is available in Smart Mode of Delta

# Reporting functionality of the SMILEQ plug-in

The measurement data can also be processed and analysed for qNMR on your own PC. Statistical results from measurements of multiple samples and repeated measurements, as well as ISO 24583 reports, can also be generated automatically.

Internal standard and external standard analysis

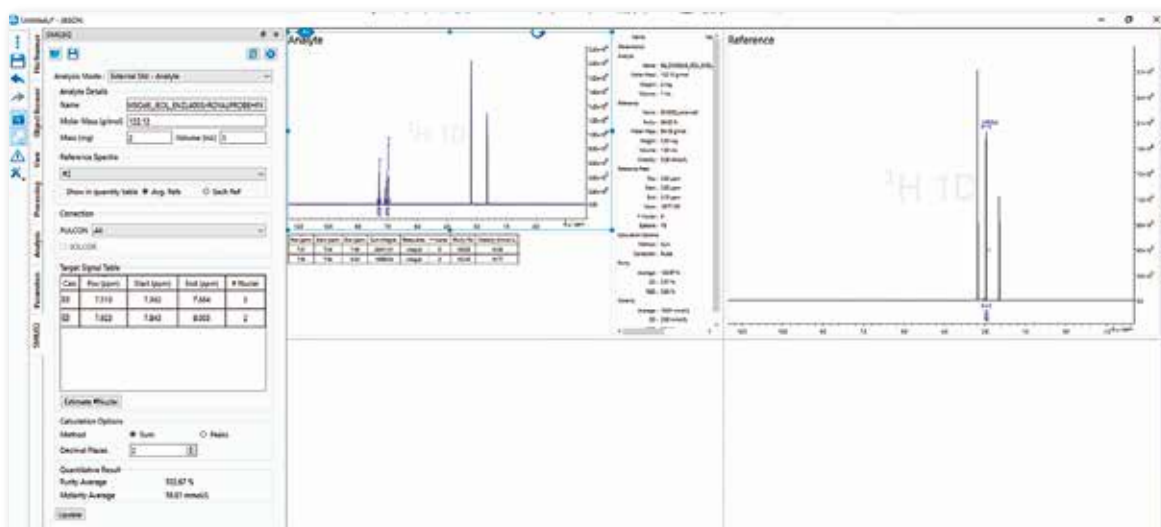
## Perform internal standard qNMR analysis



Example of individual report

Internal reference: Enter reference and analyte details all one panel for simple qNMR analysis. Multiplet NMR standard signals can be used for analysis.

## Perform external standard qNMR analysis



Example of individual report

SMILEQ can use external standards allowing routine qNMR analyses across different samples. PULCON and SOLCOR corrections can be applied to obtain accurate concentrations. The use of multiple reference spectra is also supported.

## Summary reports of multiple samples and repeat measurements.

### Summary Report (Purity)

Sample name	Pur (%)	Run 1 (%)	Run 2 (%)	Run 3 (%)	Ave (%)	SD (%)	ASD (%)	Ave (%)	SD (%)
butyl parahydroxybenzoate1	7.86	99.48	99.57	99.95	99.67	0.25	0.25	99.76	0.19
	6.90	99.63	99.56	99.88	99.69	0.17	0.17		
	1.71	99.58	99.59	100.02	99.73	0.25	0.25		
	1.41	99.94	99.99	100.02	99.99	0.04	0.04		
	0.86	99.82	99.70	99.82	99.78	0.07	0.07		
butyl parahydroxybenzoate2	4.21	99.57	99.58	99.95	99.70	0.21	0.21		
	7.86	99.93	99.59	99.28	99.60	0.33	0.33	99.72	0.25
	6.90	99.79	99.55	99.43	99.59	0.18	0.18		
	1.71	100.03	99.75	99.35	99.71	0.34	0.34		
	1.41	100.00	99.94	99.84	99.92	0.08	0.08		
butyl parahydroxybenzoate3	0.86	99.82	99.78	99.65	99.75	0.09	0.09		
	4.21	100.13	99.73	99.37	99.74	0.38	0.39		
	7.86	99.65	99.36	99.21	99.41	0.22	0.23	99.62	0.20
	6.90	99.61	99.55	99.32	99.49	0.15	0.15		
	1.71	99.83	99.53	99.48	99.61	0.19	0.19		
	1.41	99.85	99.88	99.94	99.89	0.05	0.05		
	0.86	99.73	99.74	99.74	99.74	0.00	0.00		
	4.21	99.70	99.61	99.45	99.58	0.13	0.13		

Example of summary report

The JASON summary report shows the average purity and standard deviation per signal used in the quantification calculations for the each qNMR results. The average purity and standard deviation for each sample group is also displayed.

The table on the left shows the results of triplicate measurements for each of the three Butylparaben samples. The results of the quantification calculations for each repeat measurement and the average purity and standard deviation for each sample can be seen.

## ISO 24583 qNMR analysis Report \*7

### Uncertainty of the Purity (according to ISO 24583)

Sample name	Pur (%)	Run 1 (%)	Run 2 (%)	Run 3 (%)	Ave (%)	SD (%)	Ave (%)	SD (%)
butyl parahydroxybenzoate1	7.86	99.48	99.57	99.78	99.62	0.18	99.72	0.14
	6.90	99.63	99.56	99.79	99.66	0.12		
	1.71	99.58	99.59	99.83	99.67	0.14		
	1.41	99.95	99.99	100.00	99.98	0.03		
	0.86	99.82	99.70	99.79	99.77	0.06		
butyl parahydroxybenzoate2	4.21	99.58	99.58	99.77	99.64	0.13	99.73	0.12
	7.86	99.91	99.65	99.30	99.62	0.31		
	6.90	99.78	99.58	99.44	99.60	0.17		
	1.71	100.01	99.83	99.58	99.74	0.19		
	1.41	99.98	99.94	99.84	99.93	0.08		
butyl parahydroxybenzoate3	0.86	99.82	99.79	99.61	99.76	0.09		
	4.21	100.12	99.80	99.38	99.77	0.38		
	7.86	99.65	99.35	99.17	99.36	0.25	99.59	0.19
	6.90	99.61	99.50	99.31	99.47	0.15		
	1.71	99.83	99.41	99.44	99.56	0.23		

Example of the qNMR analysis report accordance with ISO 24583

### Uncertainty Budget (according to ISO 24583)

Source of uncertainty	Unit	Value	Standard uncertainty	Uncertainty coefficient	Relative standard uncertainty
NMR experiments	Measurement repeatability	%	99.77	0.30	0.30
	Variations from different signals selected	%	99.53	0.18	0.18
	Variations from qNMR sample solution preparations	%	99.68	0.08	0.08
Purity of standard	The purity of the internal standard used	%	100.00	0.1	0.10
Combined standard uncertainty (%)					0.49
Coverage factor					2
Expanded uncertainty (%)					0.97

Report output according to ISO 24583 is available for quantitative calculations, which describes the uncertainty in repeated measurements, the uncertainty in the signal used for the calculation and the uncertainty in the conditioned sample. For qNMR analysis results, the range of quantitation values obtained can be more clearly evaluated.

### Automatic batch analysis of multiple data set

No.	File Name	Processing File Name	Analysis File Name	Analyte Name	Analyte Mol/ass (g/mol)	Analyte Mass (mg)	Analyte Volume (mL)	Reference Mass (mg)	Reference Volume (mL)	Reference Purity (%)	Reference Molarity (mmol/L)
#1	butyl parahydroxybenzoate1_Protein.qNMR-2-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate1	194.23	91.1133	18	18.2003	18	100	4.45402
#2	butyl parahydroxybenzoate1_Protein.qNMR-3-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate1	194.23	91.1133	18	18.2003	18	100	4.45402
#3	butyl parahydroxybenzoate1_Protein.qNMR-1-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate1	194.23	91.1133	18	18.2003	18	100	4.45402
#4	butyl parahydroxybenzoate2_Protein.qNMR-2-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate2	194.23	91.1133	18	18.2003	18	100	4.45402
#5	butyl parahydroxybenzoate2_Protein.qNMR-3-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate2	194.23	91.1133	18	18.2003	18	100	4.45402
#6	butyl parahydroxybenzoate2_Protein.qNMR-1-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate2	194.23	91.1133	18	18.2003	18	100	4.45402
#7	butyl parahydroxybenzoate3_Protein.qNMR-2-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate3	194.23	91.1133	18	18.2003	18	100	4.45402
#8	butyl parahydroxybenzoate3_Protein.qNMR-3-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate3	194.23	91.1133	18	18.2003	18	100	4.45402
#9	butyl parahydroxybenzoate3_Protein.qNMR-1-1.jaf	20230905.jaf	20230905.jaf	butyl parahydroxybenzoate3	194.23	91.1133	18	18.2003	18	100	4.45402

Data processing, generating of summary reports and ISO reports for multiple data can be managed together in the 'MultiSpectrum SMILEQ' window. Simply select the Reports menu and reports for multiple data are automatically generated.

\*7 Supported version is JASON 3.1 and later, SMILEQ-plugin 2.0 and later

**ARGENTINA**  
COASIN S.A.C.IyF.  
Virrey del Pino 4071,  
C1430CAM-Buenos Aires  
Argentina  
Tel. 54-11-4552-3185  
Fax. 54-11-4552-3321

**AUSTRALIA & NEW ZEALAND**  
JEOL (AUSTRALASIA) Pty.Ltd.  
Suite 1, L2 18 Aquatic Drive  
- Frenchs Forest NSW 2086  
Australia  
Tel. 61-2-9451-3855  
Fax. 61-2-9451-3822

**AUSTRIA**  
JEOL (GERMANY) GmbH  
Gute Aenger 30  
85356 Freising, Germany  
Tel. 49-8161-9845-0  
Fax. 49-8161-9845-100

**BANGLADESH**  
A.Q. CHOWDHURY SCIENCE & SYNERGY PVT. LTD.  
87, Suhrawardy Avenue, Floor 2  
Baridhara, Dhaka1212  
Bangladesh  
Tel. 88-02-22262272  
Fax. 88-02-22264428

**BELGIUM**  
JEOL (EUROPE) B.V.  
Planet II, Gebouw B  
Leuvenessesteenweg 542,  
B-1930 Zaventem  
Belgium  
Tel.32-2-720-0560  
Fax.32-2-720-6134

**BRAZIL**  
JEOL Brasil Instrumentos Cientificos Ltda.  
Av. Jabaquara, 2958 5° andar conjunto 52 ;  
04046-500 Sao Paulo, SP  
Brazil  
Tel. 55-11-5070 4000  
Fax. 55-11-5070 4010

**CANADA**  
JEOL CANADA, INC.  
3275 1ere Rue, Local #8  
St-Hubert, QC J3Y-8Y6, Canada  
Tel. 1-450-676-6776  
Fax. 1-450-676-6694

**CHINA**  
JEOL (BEIJING) CO., LTD.  
Zhongkeziyuan Building South Tower 2F,  
Zhongguancun Nanshanje Street No. 6,  
Haidian District, Beijing, P.R.China  
Tel. 86-10-6804-6321  
Fax. 86-10-6804-6324

JEOL (BEIJING) CO., LTD., SHANGHAI BRANCH  
2F-BC Room, Building A, Mingji Business Plaza,  
No.207 Songhong Road, Changning District,  
Shanghai 200335, P.R.China  
Tel. 86-21-6246-4487  
Tel. 86-21-5836-6350  
Fax. 86-21-5836-3668

JEOL (BEIJING) CO., LTD., GUANGZHOU BRANCH  
Rm.3501, OnelinkCenter, 230 Tianhe Road, Tianhe District,  
Guangzhou, Guangdong Prov., 510620, China  
Tel. 86-20-8779-7848  
Fax. 86-20-8778-4268

JEOL (BEIJING) CO., LTD., WUHAN BRANCH  
Room A2118, Zhongshang Plaza Office Bldg.,  
No. 7 Zhongnan Road, Wuhan,  
Hubei, 430070, P.R.China  
Tel. 86-27-8713-2567  
Fax. 86-27-8713-2567

JEOL LTD. (BEIJING) CO., LTD., CHENGDU BRANCH  
1807A Zongfu Building,  
NO. 35 Zhongfu Road, Chengdu, Sichuan, 610016  
P.R. China  
Tel. 86-28-86622554  
Fax. 86-28-86622564

**EGYPT**  
JEOL SERVICE BUREAU  
3rd Fl. Nile Center Bldg., Nawal Street,  
Dokki, (Cairo), Egypt  
Tel. 20-2-3335-7220  
Fax. 20-2-3338-4186

**FRANCE**  
JEOL (EUROPE) SAS  
Espace Claude Monet, 1 Allée de Giverny  
78290, Croissy-sur-Seine, France  
Tel. 33-13015-3737  
Fax. 33-13015-3747

**GERMANY**  
JEOL (GERMANY) GmbH  
Gute Aenger 30  
85356 Freising, Germany  
Tel. 49-8161-9845-0  
Fax. 49-8161-9845-100

**GREAT BRITAIN & IRELAND**  
JEOL (U.K.) LTD.  
Sliver Court, Watchmead,  
Welwyn Garden City, Hertfordshire AL7 1LT, U.K.  
Tel. 44-1707-377117  
Fax. 44-1707-373254

**GREECE**  
N. ASTERIAS S.A.  
56-58,S. Trikoupi Str. P.O. Box 26140  
GR-10222, Athens, Greece  
Tel. 30-1-823-5383  
Fax. 30-1-823-9567

**HONG KONG**  
FARMING LTD.  
Unit No. 1009, 10/F., Prosperity  
603 King's Road, North Point, Hong Kong  
Tel. 852-2815-7289  
Fax. 852-2581-4635

**INDIA**  
JEOL INDIA PVT. LTD.  
Unit No.305, 3rd Floor,  
ABW Elegance Tower,  
Jasola District Centre,  
New Delhi 110 025, India  
Tel. 91-11-4595-8000  
Tel. 91-11-4595-8005  
Tel. 91-11-4595-8017

JEOL INDIA PVT. LTD. Mumbai Office  
214 E Square, Subhash Road,  
Vile Parle (EAST),  
Mumbai 400 057, India  
Tel. 91-22-2612-9387

JEOL INDIA PVT. LTD. Bangalore Office  
125, Brigade Road,  
Unit No.402, Level 4, Palms Square,  
Bangalore-560025, India  
Tel. 91-80-4375-3351

JEOL INDIA PVT. LTD. Kolkata Office  
Regus, The Legacy, 25 / A,  
Shakespeare Sarani,  
Kolkata - 700017, India  
Tel. 91-98-3023-0484

JEOL INDIA PVT. LTD. Hyderabad Office  
422, Regus Solitaire Business centre  
1-10-39 to 44, Level 4, Gumidelli Towers, Old Airport Road,  
Begumpet, Hyderabad - 500016, India  
Tel. 91-40-6704-3708

**INDONESIA**  
PT. TEKNO LABindo Penta Perkasa  
Komplek Gading Bukit Indah Blok I/11  
Jl. Bukit Gading Raya Kelapa Gading Permai,  
Jakarta 14240, Indonesia  
Tel. 62-21-45947057/58  
Fax. 62-21-45942729

**ITALY**  
JEOL (ITALIA) S.p.A.  
Palazzo Pacinotti - Milano 3 City,  
Via Ludovico il Moro, 8/A  
20079 Basiglio(MI) Italy  
Tel. 39-02-9041431  
Fax. 39-02-90414343

**KOREA**  
JEOL KOREA LTD.  
Dongwoo Bldg., 7F, 1443, Yangjae Daero,  
Gangdong-Gu, Seoul, 05355, Korea  
Tel. 82-2-511-5501  
Fax. 82-2-511-2635

**KUWAIT**  
Ashraf & CO. Ltd.  
P.O.Box 3555 Safat 13036, Kuwait  
Tel. 965-1805151  
Fax. 965-24335373

**MALAYSIA**  
JEOL (MALAYSIA) SDN.BHD.  
508, Block A, Level 5,  
Kalana Business Center,  
97, Jalan SS 7/2, Kalana Jaya,  
47301 Petaling Jaya, Selangor, Malaysia  
Tel. 60-3-7492-7722  
Fax. 60-3-7492-7723

**MEXICO**  
JEOL DE MEXICO S.A. DE C.V.  
Arkansas 11 Piso 2  
Colonia Naples  
Delegacion Benito Juarez, C.P. 03810  
Mexico D.F., Mexico  
Tel. 52-5-556-211-4511  
Fax. 52-5-55-211-0720

**Middle East**  
JEOL GULF FCZO  
P.O. Box No. 371107  
Dubai Airport Free Trade Zone West Wing SWA No. G12,  
Dubai, UAE  
Tel. 971-4-609-1497  
Fax. 971-4-609-1498

**PAKISTAN (Karachi)**  
ANALYTICAL MEASURING SYSTEM (PVT) LTD. (AMS LTD.)  
14-C Main Sehar Commercial Avenue Lane 4,  
Khayaban-e-Sehar,  
D.H.A-VII, Karachi-75500, Pakistan  
Tel. 92-21-35345681/35340747  
Fax. 92-21-35345582

**PANAMA**  
PROMED S.A.  
Parque Industrial Costa del Este  
Urbanizacion Costa del Este  
Apartado 0816-01755, Panama, Panama  
Tel. 507-303-3100  
Fax. 507-303-3115

**PHILIPPINES**  
JATEC Philippines Corporation  
28 Floor, The Enterprise Center Tower 2,  
Ayala Avenue corner Paseo de Roxas,  
Ermita, San Lorenzo, Makati City, 1226 Philippines  
Tel. 632-8645-3804

**PORTUGAL**  
Izasa Portugal Lda.  
R. do Proletariado, 1  
2790-138 CARNAXIDE, Portugal  
Tel. 351-21-424-73-00  
Fax. 351-21-418-60-20

**QATAR**  
Mannai Trading Company W.L.L.  
AlJ Enadi Complex,  
Salwa Road P.O.Box 76, Doha, Qatar  
Tel. +974 4455-8216  
Fax. +974 4455-8214

**RUSSIA**  
JEOL (RUS) LLC  
Office 351, floor 3, 23,  
Novoslobodskaya St,  
Moscow 127055, Russia  
Tel. 7-495-748-7791/7792  
Fax. 7-495-748-7793

**SAUDI ARABIA**  
ABDULREHMAN ALGOSAIBI G.T.C. (Riyadh)  
Algosaii Bulking-Old Airport Road  
P.O. Box 215, Riyadh-11411, Saudi Arabia  
Tel. 966-11-272-5899

**SCANDINAVIA**  
SWEDEN  
JEOL (Nordic) AB  
Hammarbacken 6A, Box 716, 191 27 Sollentuna  
Sweden  
Tel. 46-8-28-2800  
Fax. 46-8-29-1647

**SINGAPORE**  
JEOL ASIA PTE.LTD.  
2 Corporation Road  
#01-12 Corporation Place  
Singapore 618494  
Tel. 65-6565-9989  
Fax. 65-6565-7552

**SOUTH AFRICA**  
ANGSTROM Scientific (Pty) Ltd.  
370 Angus Crescent, Northlands Business Park  
29 Newmarket Road  
Northriding, Randburg 2169 South Africa  
Tel. +27 11 462 1347

▼ Local office



Certain products in this brochure are controlled under the "Foreign Exchange and Foreign Trade Law" of Japan in compliance with international security export control. JEOL Ltd. must provide the Japanese Government with "End-user's Statement of Assurance" and "End-use Certificate" in order to obtain the export license needed for export from Japan. If the product to be exported is in this category, the end user will be asked to fill in these certificate forms.