



NRS-5000/7000

Laser Raman Spectrometer

The New NRS-5000/7000 Dispersive Laser Raman



NRS-5500/5600
High-End Model

NRS-7500/7600
Flagship Model



The performance and functions expected on a micro-Raman spectrometer are all provided with the NRS-5000/7000 series Raman systems, assuring consistent performance for rapid acquisition of high quality data with automated system control and minimal optical adjustments.

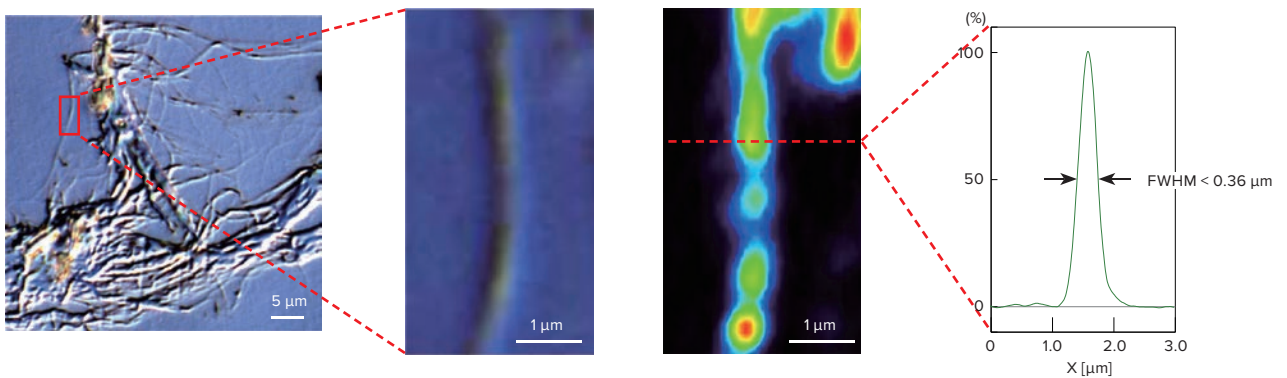
For application expansion, an automated multi-grating turret, up to 2 detectors and a maximum of 8 lasers ranging from the UV through the NIR are capable of integration with the instrument system, all optical components are PC controlled for maximum flexibility with minimum user interaction.

NRS-5000/7000 Series features

- Research-grade model assuring high spectral quality
- Exceptional wavenumber accuracy with a high-precision rotary-encoder direct drive mechanism
- Low wavenumber measurement
- Auto-alignment of microscope laser introduction optics and Raman scattering light path
- Wavenumber calibration using an integrated Ne lamp
- Unique Dual Spatial Filter (DSF) for higher spatial resolution than conventional confocal optics
- Patented Spatial Resolution Image (SRI) function for simultaneous observation of sample image, laser spot and aperture image
- Full range of options including macro-Raman measurement unit and fiber probes

High Spatial resolution by optimum confocal design

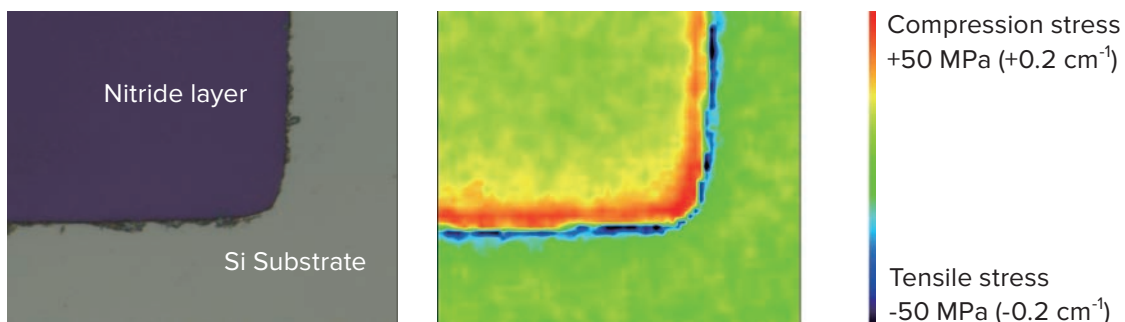
Beam spot size of laser Raman spectroscopy is below $1\mu\text{m}$, and besides, our optimum confocal design DSF makes it possible to meet maximum level spatial resolution and high accurate analysis.



Raman measurement of Carbon nano tube
 Left: Observation view (by using differential interference observation unit)
 Right: Raman image and spatial spectrum

Imaging measurement with high wavenumber resolution

In stress measurement which needs to detect slight peak shift, high wave number resolution is a key factor. NRS-5000/7000 series has well designed robust body, which can keep high stability and performance even for severe stress analysis with high accuracy.



Stress change of nitride layer on the Si substrate
 Left: Observation view (by using x100 objective lens)
 Right: Color-coded image of peak shift

$$\text{Stress} = \text{approx. } 250 \text{ MPa} \times \Delta\nu (\text{cm}^{-1})$$

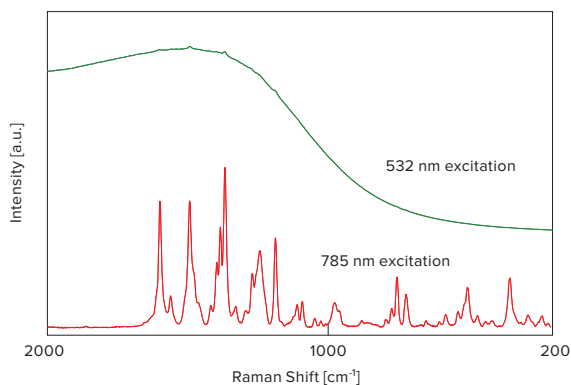
Flexibility design for your demand

Capability for multi-lasers system

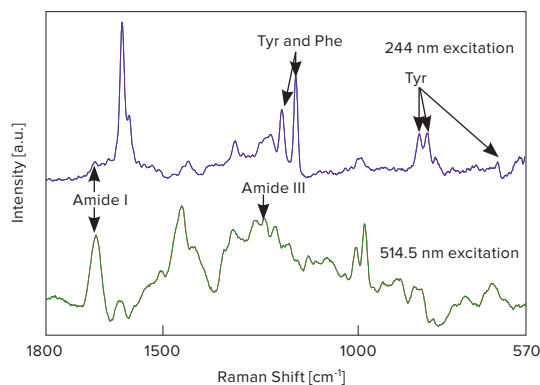
The choice of the laser is very important to get the usable Raman data.

Generally, 532 nm excitation laser is familiar to Raman application because the energy of the 532 nm excitation is high. For reducing the fluorescence influence, the longer wavelength excitation lasers (785 nm excitation etc.) are used. In addition, in the case that the sample is bio material (protein, DNA and so on), UV excitation laser is powerful tool using the "resonance Raman effect".

NRS-5000/7000 has the capability to mount a maximum of 8 lasers ranging from the UV through the NIR, and can switch the lasers by software.



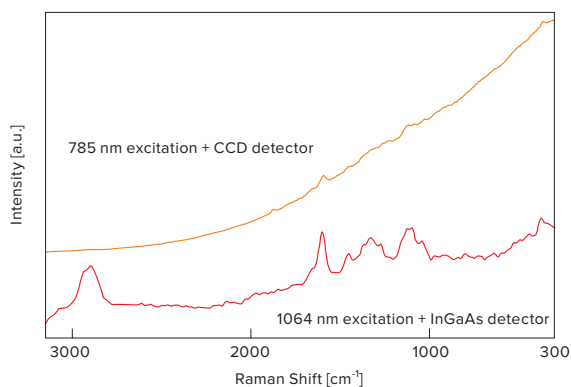
Raman spectrum of the paint



Resonance Raman spectrum of the enzyme (Ribonuclease A) by using UV or Vis excitation lasers

InGaAs detector options for fluorescence free measurements

Combination of 1064 nm excitation laser and InGaAs detector is the effective for the fluorescence rejection. JASCO offers the dual detector switching mechanism for NRS-5000/7000, which can provide the various data by using 1064 nm excitation laser and the other excitation laser.

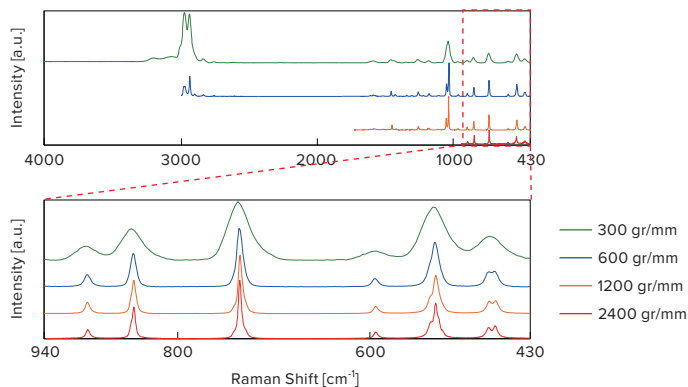


Raman spectrum of the wood (lignin)

Auto switching mechanism of gratings up to 4

Auto grating switching mechanism up to 4 difference gratings.

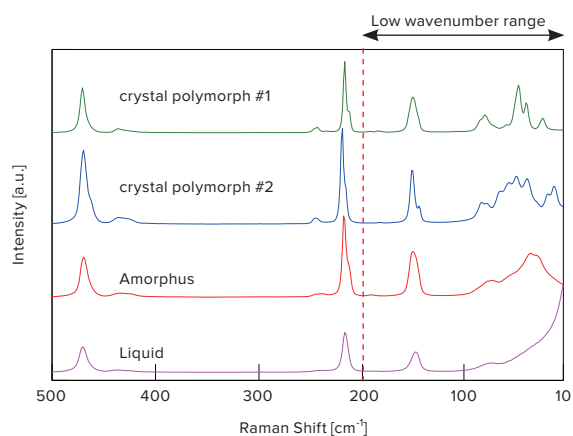
By using this automated grating mechanism, suitable grating can be selected depending on purpose of measurement and measurement condition as Ex wave number etc.



Measurement example of each gratings (sample: taurine)

Very low wavenumber measurement

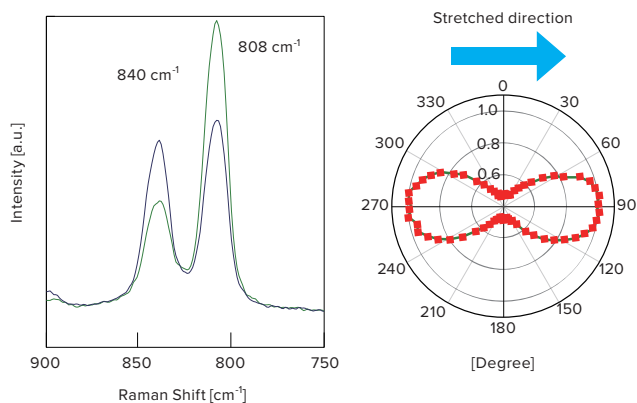
JASCO newly developed the mountable mechanism inside of instrument for the very low-wavenumber measurement filters, which makes it possible to meet local upgrade with ease. By using this mechanism, the NRS-5000/7000 can measure in very low-wavenumber region down to 10 cm^{-1} .



Raman spectrum of the sulfur

Polarized Raman measurement

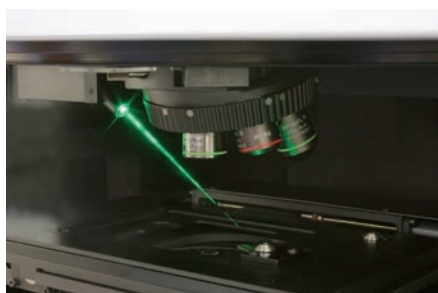
Polarized Raman measurement is useful to get the various information of crystal structure and molecular orientation. NRS-5000/7000 has optional accessories as a half wave plate unit or the polarized measurement unit for these purpose.



Orientation evaluation example of OPP film
(Ratio of 808 cm^{-1} and 840 cm^{-1})

Macro Raman measurement

Macro measurement unit irradiates the sample with the laser (laser beam diameter: $50 - 100\ \mu\text{m}$), and can provide the average information of the sample.



Fiber probe measurement

Fiber probe measurement unit is suitable to in situ measurement and the reaction monitoring.



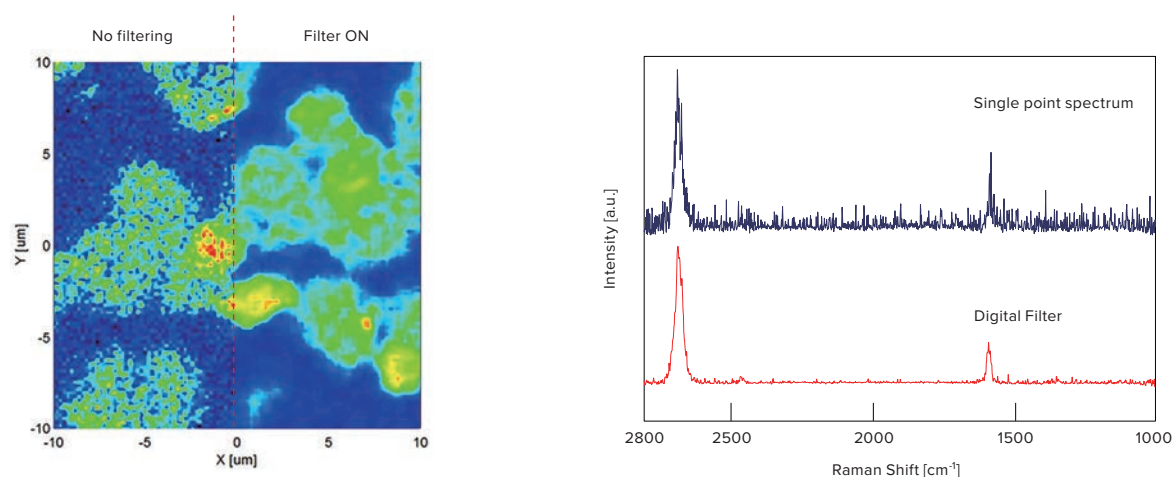
High Speed imaging Raman system - QRI and SPRIntS

QRI High speed imaging system

QRI is our new technology that consists of High speed/high accurate stage and high speed data process in CCD detector. QRI makes it possible wide area imaging in quick as few seconds for several thousand measurement, and can cover various size of samples from mm order to sub micron order.

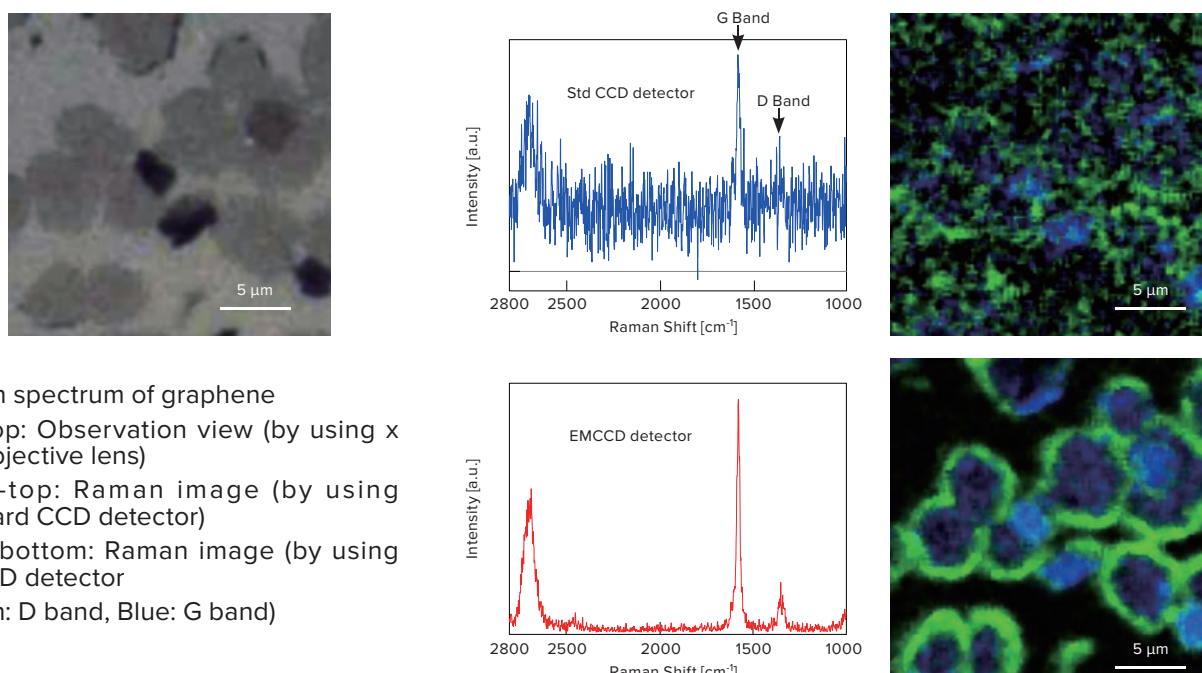
Improvement with Digital Filter

JASCO added the digital filter function, which can improve the S/N on the spectrum.



EMCCD detector option

JASCO offers the EMCCD detector, which has the feature of multiplying the electron. Therefore, NRS-5000/7000 with EMCCD detector can perform the Raman measurement with high S/N ratio.



Raman spectrum of graphene

Left-top: Observation view (by using x 100 objective lens)

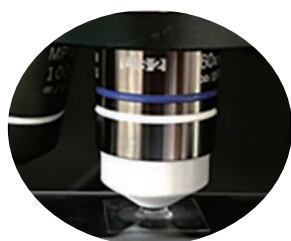
Right-top: Raman image (by using standard CCD detector)

Right-bottom: Raman image (by using EMCCD detector)

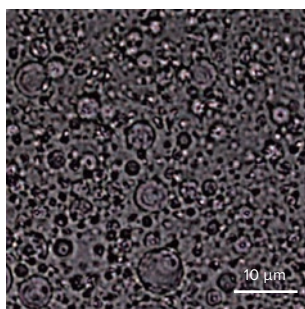
(Green: D band, Blue: G band)

SPRIntS High Speed Imaging system ("SPRIntS": Software Programmable Raman Integration Speed)

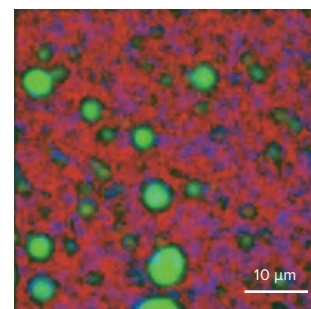
SPRIntS imaging is a laser scanning function which supports high speed measurements by scanning the laser excitation beam using individual scan mirrors (VertiScan) to irradiate the sample while collecting data from a high-speed CCD detector at a minimum of every 5 milliseconds. The VertiScan function also supports a 3-D imaging function by utilizing the Z-autostage and the confocal capability of the instrument system. The VertiScan system is unlike other laser scanning functions because the sample is illuminated with a vertical laser beam every y time to retain measurement confocality and obtain a high quality, undistorted Raman image.



Water immersion objective lens



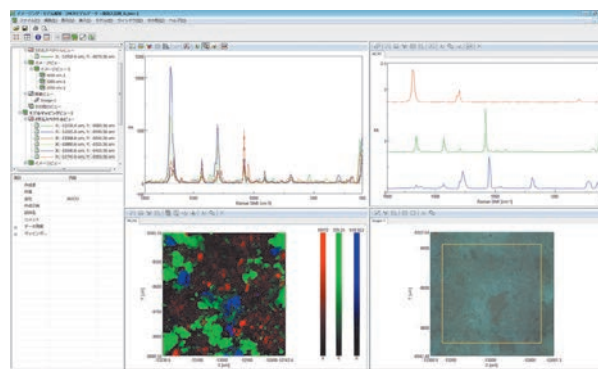
Raman image of butter



Left: Observation view (by using x 60 water immersion objective lens)
Right: Color-coded diagram (Red: oil, Green: water, Blue: fat acid)

Imaging Model Analysis Program

“Image Model Analysis” is a function to make a relative concentration distribution by extracting the principal components automatically from the measured spectra. Therefore, the imaging plot can be obtained in a short time without neglecting the components contained in the sample. It is also possible to identify the components by searching the spectrum of principal components in the database.



Specification

	NRS-5500	NRS-5600	NRS-7500	NRS-7600
Spectrograph				
Spectrograph (Focal length)	Aberration-corrected Czerny-Turner monochromator (f = 300 mm)		Aberration-corrected Czerny-Turner monochromator (f = 500 mm)	
Scanning mechanism	High-precision direct drive			
Wavenumber range (Raman shift, 532 nm excitation)	50 - 8000 cm ⁻¹ 10 - 8000 cm ⁻¹ (using option)	10 - 8000 cm ⁻¹	50 - 8000 cm ⁻¹ 10 - 8000 cm ⁻¹ (using option)	5 - 8000 cm ⁻¹
Maximum resolution	1 cm ⁻¹ /pixel (532 nm excitation, 1800 gr/mm, 1024 pixel CCD) 0.4 cm ⁻¹ /pixel optional (532 nm excitation, 2400 gr/mm, 2048 pixel CCD)		0.7 cm ⁻¹ /pixel (532 nm excitation, 1800 gr/mm, 1024 pixel CCD) 0.3 cm ⁻¹ /pixel optional (532nm excitation, 2400 gr/mm, 2048 pixel CCD)	
Grating	1800 gr/mm (Option: 3600, 2400, 1200, 600, 300, 150 gr/mm), Up to 4 gratings can be mounted.			
Rejection filter	Notch filter, Edge filter, Rejection filter for very low-wavenumber measurement			
Rejection filter switching	Manual exchange (Option: automated 8-position switching mechanism)			
Detector				
Standard detector	4-stage Peltier cooled CCD detector (UV-NIR range, 1024 × 255 pixel)			
Optional detectors	4-stage Peltier cooled CCD detector (high-resolution, 2048 × 512 pixel), Liquid-nitrogen-cooled InGaAs detector (for 1064 nm excitation laser, 512 or 1024 pixel)			
Dual detector switching	Factory option (required when using 2 detectors)			
Laser				
Laser	532 nm, 50 mW (Option: 244, 266, 325 355, 442, 488, 514.5, 633, 660, 785, 1064 nm) Internal: Max. 2, External: Max. 6 (VIS-NIR laser: Max. 3, UV laser: Max. 3), Total: Max. 8 lasers, 9 wavelengths			
Microscope				
Microscopic observation	Standard:High-resolution built-in CMOS camera (3 million pixel) Option:binocular, trinocular, polarization observation, differential interference, transmission illumination			
Confocal optics	Standard			
DSF (Dual Spatial Filter)	Standard *Not available for UV upgraded model			
SRI (Spatial Resolution Image)	Standard *Not available for UV upgraded model			
Objectives	5×, 20×, 100× objectives (Option: Long working distance type, UV type, NIR type)			
Standard sample stage	XY autostage with joystick accessory (travel range X:100, Y:70 mm, 0.04 μm step), Z autostage (travel range Z:30 mm, 0.1 μm step)			
QRI high speed imaging	Factory option			
SPRIntS imaging	Factory option (including VertiScan, high-speed data import, 3D imaging measurement, Z autostage, autofocus function)			
Autostage imaging	Standard (including imaging measurement, 3D imaging measurement, XYZ autostage, autofocus function)			
Macro measurement unit	Factory option (SPRIntS imaging system and the Macro measurement unit cannot be provided simultaneously)			
Auto-alignment feature	Laser beam auto-alignment, Raman scattering auto-alignment			
SGL (slit guide image)	Standard			
Neon lamp	Standard (for wavenumber correction)			
Safety feature	Integrated sample chamber laser interlock, laser light-path protection (Class 1 compliance)			
Software				
Standard function	Point measurement, wide spectral-band measurement, basic spectral data processing functions, search/functional group analysis (Sadtler KnowItAll), cosmicray removal, auto-fluorescence-correction, wavenumber correction, sensitivity correction, JASCO canvas (printing function), validation, user help function			
Imaging function	Omnifocal image, Real-time display of spectrum, chemical image and current measurement point, multi-image map, auto-focus (supporting both sample image contrast and laser focus algorithms), imaging analysis (including Peak height (ratio), Peak area (ratio), Peak shift, PWHH), PCA mapping, 3-D imaging (including 3-D Raman image display, 3-D image slice display)			
Optional programs	High-throughput screening measurement, interval measurement analysis, stress analysis, carbon analysis, polysilicon crystallinity evaluation, 2D correlation			
Anti-vibration table	Option (air source for anti-vibration table: nitrogen gas or air source, secondary pressure 0.25 - 0.3 MPa)			
Dimensions & Weight (Main unit only)	880(W) × 890(D) × 670(H) mm About 200 kg	1360(W) × 890(D) × 670(H) mm About 240 kg	1060(W) × 1220(D) × 670(H) mm About 230 kg	1540(W) × 122 (D) × 670(H) mm About 270 kg
Power requirement	AC100 V ±10 V, 200 V ±20 V, 200 VA			



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