



GPC Streamliner

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Special features:

- WinGPC Unity Compact Edition only available in USA
- F.Y.I. Comparative Overview of Light Scattering Detectors

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PSS Achieves Unity in GPC-SEC

In this issue we will show our comprehensive approach to provide you with a united front toward efficient cutting-edge GPC-SEC.

Unity is the newest triumph of WinGPC software. WINGPC Unity is a data system that merges all available methods applied for size exclusion chromatography. The software **integrates** all detectors into one environment, independently of

brand, to provide you with every piece of information within a single injection. WinGPC Unity is the only program that integrates all light scattering detectors, (LS), viscometry detectors, and conventional detection (UV, RI, ELSD) simultaneously, in one run!

With WinGPC Unity (and the appropriate modules), you measure your sample now and decide afterwards what data is

relevant to this sample and how you want to analyze it. In one injection you can process results via LS, universal, or conventional calibration. You will not have to repeat the run when the evaluation assumptions were wrong (e.g., LS molecular weights are below 5,000 D). There are no restrictions to reprocess raw data once it has been collected.

More on UNITY, page2

PSS Quest for Integration with DAWN@LAN /WinGPC UNITY LS Connection with Wyatt Light Scattering Instruments

Here it is! PSS has another solution to embrace instrument diversity and empower the scientific world to capitalize on their investment by truly integrating all the analytical elements. This hardware product, the DAWN@LAN, enables the hook-up of Wyatt LS Detectors into the network and integrates them into an environment that is compatible with modern laboratory data management requirements. *You would need WINGPC Unity with WinGPC MALLS module to use the LAN Interface.*

Going beyond the simplicity of local data acquisition and stand-alone operation, the modern bottom line dictates that

computers are integrated into company-wide networks and digital data travel instantaneously. While Wyatt's Light Scattering detectors currently provide highly searched information, they demand setups of isolated islands, which are difficult to control, maintain and administer. Wyatt's instrumentation was not conducive to incorporation into modern laboratory infrastructure, until PSS launched the DAWN@LAN and WinGPC UNITY MALLS Module

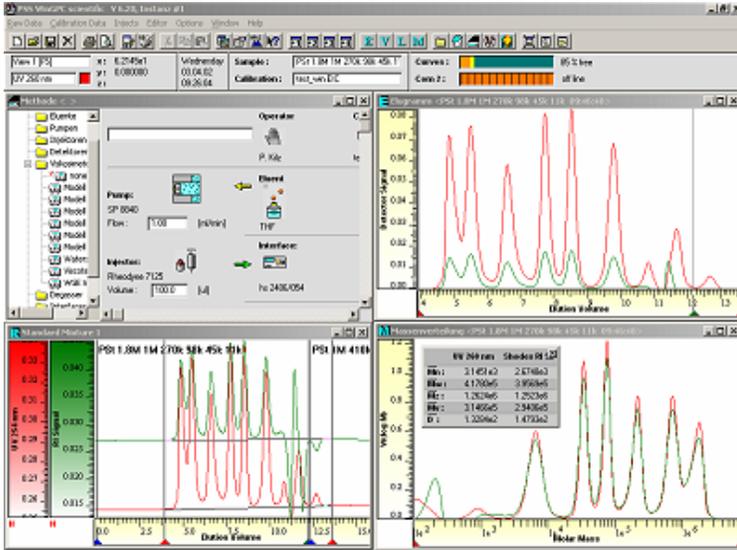
What is so great about DAWN@LAN?

First and foremost, it supports all DAWN protocol features: laser

on/off, Inject trigger, AUX channels, etc.

This connector (for LAN/WAN hookups of Wyatt LS Detectors) is crucial to integrate every Wyatt light scattering detector into the network. Using the hook up you can access the instrument remotely over the LAN; Capture data from any accessible LAN/WAN point within intranet and extranet; Prevent data loss through an integrated intelligent data buffer and; meet security requirements easily by separating users from potentially hazardous environments. It ships complete with network cable and power supply

Software Solutions: WinGPC UNITY, Compact Edition



“Bird-eye-view lets you always see what goes on. Always is up to date.”

WinGPC UNITY is a Software Data System for liquid chromatography of polymers with focus on Gel Permeation / Size Exclusion Chromatography.

The WinGPC Unity Compact Edition, an entry-level product of unparalleled value, is ideal for a single instrument installation performing conventional GPC analysis with 1 to 3 detectors on a single PC.

Unity’s market-wide compatibility allows the use of any detector RI, UV, ELSD, IR, etc, regardless of brand. The software will manage the data acquisition, data processing, documentation and results presentation to provide: Molecular Weight Distribution (MWD), Mw, Mp, Mn, and Poly-

dispersity D. Unity will convert any HPLC instrument into a GPC instrument when you switch to appropriate columns and standards. WinGPC Unity salient features include a friendly interface in the Windows operating system, which allows the view of raw data, chromatograms and calculated molecular weight distributions simultaneously; Powerful chromatogram and molar mass overlays provide application versatility; the video strip chart feature lets you monitor multiple injections; Unity’s underlying database design provides powerful and secure data storage and retrieval capabilities that allow re-calibration or data re-processing; Automated GPC processes include: internal standard, calibration, recalibration, and reporting.

The optional WINGPC Report Designer Module enables you to create custom individual reports where you control the content (graphics, results/result tables, text entries etc.) in a word processing environment with formatting, calculations and number rounding capabilities.

Upgrade the WINGPC Unity Compact Edition. Add modules to fit your changing needs, whether they are to add complex measurement capabilities to one instrument or to expand from a single instrument to large SEC installations with true client-server networks. Case specific configurations will be discussed and quoted upon request.

WINGPC UNITY MODULES

ISO, DIN, GLP COMPLIANCE AND COMPLETE SOFTWARE VALIDATION

Client Server: Allows various instruments to be accessible to many users simultaneously, via network	
Triple PLUS detection: multiple angles for Light scattering, viscosity and concentration detector(s).	Light Scattering: LS- One angle measurement of absolute molar mass (LALS, RALS) and/or MALLS- multiple angles for absolute molar mass branching and radius of gyration. (MALS, TALLS)
Viscosity: (1, 2, 3 and 4 capillary bridge designs) Intrinsic viscosity and Mark-Houwink coefficients & branching	
2-Dimensional Chromatography: Molar mass and composition distribution:- GPC-HPLC; LC/CAP- GPC, RPIC-NPLC, TREF-GPC, IC-GPC, GPC-GC, GPC-CE, and GPC-SFC	Heparins and End-group Analysis
Multi Instrument Acquisition	Copolymer: Average chemical composition
	Chemical Heterogeneity: HPLC-type separations
Report Designer: Produce eye-catching graphs and documentation for reports and presentations.	
UNITY SEC-GPC: Molar Mass averages and distributions Mw, Mp, Mn, D	

System Requirements:

- Pentium, Windows 2000 or XP
- 40 GB Hard disk
- 256 or better RAM
- RS-232 Com Port
- 17 in or larger monitor.

- Part Number:**
- WinGPC-com1
- WinGPC-com2
- WinGPC-com3
- WinGPCRD

Description:

- Data acquisition and processing from 1 detector
- Data acquisition and processing from 2 detectors
- Data acquisition and processing from 3 detectors
- Report Designer Module

- Price:**
- \$4,995
- \$5,495
- \$5,995
- \$1,295

F.Y.I. *Not all Light Scattering Detectors are created equal!*

Comparative Overview by Peter Kilz

The evolution of customer demands and laboratory requirements calls for instrumentation that provides cost effective high performance, specifically to meet the needs of the ever-evolving field of biopolymer applications. A review of measuring principles of Light Scattering (LS) Detectors is included here to equip the user with decision-making facts to select instrumentation. The following LS detectors are included: Low Angle LS (LALLS); Right Angle LS (RALLS); Two/three Angle LS (TALLS) and Multi Angle LS (MALLS).

Gel Permeation Chromatography (GPC a.k.a. SEC or GFC) is used to characterize macromolecules: molecular weight distribution, structure distribution, end group and branching distributions. [1] When coupled with LS detectors, more extensive structure information (branching and density) is possible even without calibration with reference materials. [2a,b,c]. Depending on the type of LS instrument used, various qualitative and quantitative properties can be determined:

- Radius of gyration (Rg)
- Degree of branching (long chain branching)
- Changes of the molecular structure
- Aggregation-/agglomeration behavior
- Aging/storage processes.

Basic Measuring Principles

Low Angle Laser Light Scattering (LALLS)

Due to its construction LALLS has a complicated optical setup [3a,b] that often results in signal interference impulses ("Spikes") when small air bubbles or particles get into the measuring cell (Fig. 1). The cell needs to be cleaned frequently from sediments that affects the optical behavior and creates external scatterings. LALLS does not deliver values like branching degree (an angle-dependent measurement). The LALLS advantage is the exact measurement of high molecular weights (> 10 Million. g/mol) free from angle extrapolation errors [4].

Right Angle Laser Light Scattering (RALLS)

The construction of the LS with one scattering signal at 90° RALLS is very simple and sturdy. Its signal occurs usually with minimum interference, but RALLS produces correct results only for relatively small molecular weights: about 200-kg/mol or molecule sizes smaller than 10 nm without additional structural information. For measurements of higher molecular weight samples the LS signal has to be corrected with a viscosity detector [5], thus requiring assumptions, which cannot easily be verified.

Two-Angle Laser Light Scattering (TALLS)

From PSS experience the use of

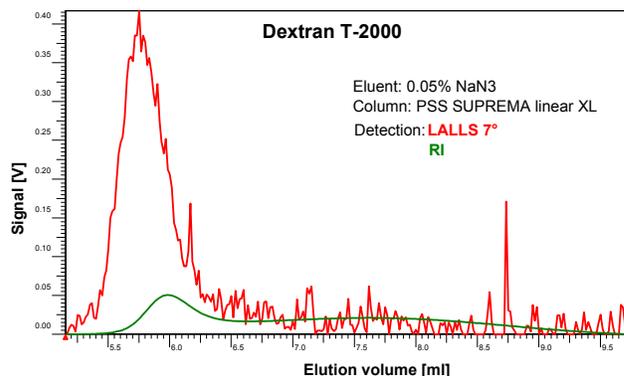


Fig 1 See the interference of the 7° LALLS-signals (red) compared to the excellent signal/noise ratio of the RI signal (green)

two- or three angles LS instruments does not considerably improve the situations mentioned above. The two-angle LS instruments operating at 15° and 90° often present both disadvantages of LALLS- and RALLS instruments [6]: use assumptions and small angle signal presents interference, like those shown on **Figure 2**.

The range of angles offered by the available three-angle instruments is too small

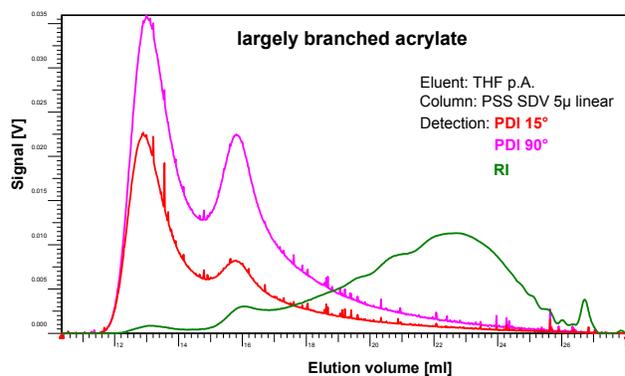


Figure 2: View of Raw Data of a Two-Angle Light Scattering Instrument; It shows the lower share of signal interferences in THF (with a largely branched PMMA); the different structures can be differentiated in terms of quality, but not easily in quantity with the TALLS procedure.

Comparative Overview (continued)

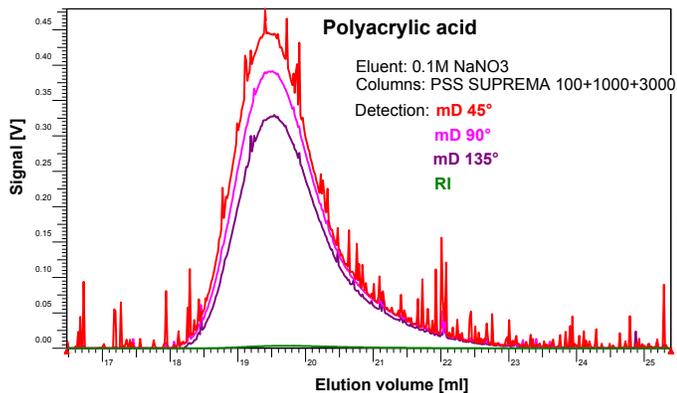


Figure 3: Light Scattering and RI Signal of a High-Molecular Polyacrylate measured with a Three-Angle LS Instrument Here the susceptibility to interferences of the LS-signals at small angles is compared with the wider-angle scattering (RI signal not visible very well in this graph).

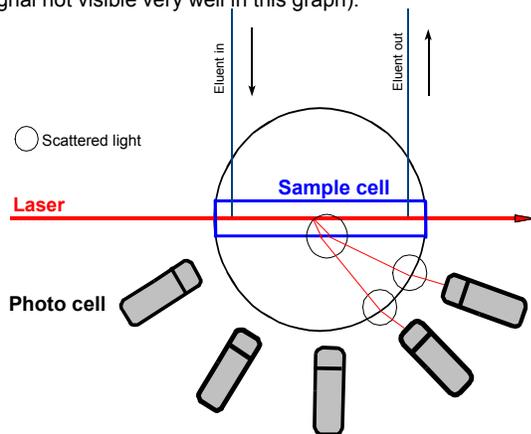


Figure 4: Schematic setup of commercial MALLS light scattering cell; shows the light path from the photo cell angle that deviates from the scattering angle.

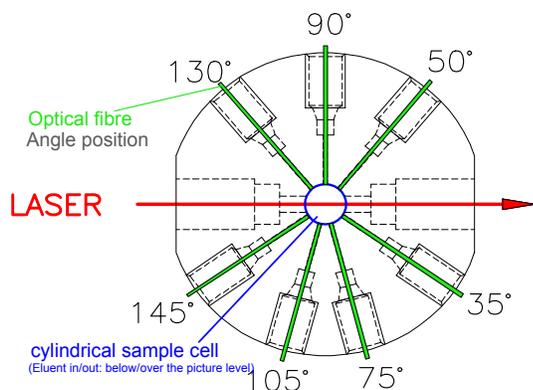


Figure 5: Setup of the Cylindrical Light Scattering Cell [8b] of the scattering light instrument PSS SLD 7000 MALLS. A 90° phase transition leads to a significantly better signal quality (see Fig. 6)

(realistically about 50° to 120°) to be able to deliver independent information about the structure over an extensive molecular weight range. These small angle instruments usually yield good quality signals with interferences comparable to those of wide-angle scattering see **Figure 3**. For small molecules (isotropic scattering) TALLS can be used with similar results to those of the much less expensive RALLS detector.

Multi Angle Laser Light Scattering (MALLS)

The available MALLS instruments overcome the limitations of LALS and offer the best use of LS [7]. The range of angles available typically 30° to 150° is more important, than the number of angles. To obtain an exact description of most scattering functions seven angles are sufficient more angles become redundant carrying unnecessary increases in capital and operation costs

Quality and stability of the signals highly depend on the construction of the measuring cell. One MALLS detector uses a glass bloc with a longitudinal bore.

Figure 4 shows the light path from the photocell angle that deviates from the scattering angle. This design requires mathematical corrections to account for the refraction caused by phase transition solution-glass, glass-air, at angles other than 90°. This effect is notorious in small angle

signals, which are subject to interferences or even rendered useless for measuring purposes.

Improvement of the MALLS Technique

A seven angle LS instrument has traditional cylindrical-cell geometry is depicted in **Figure 5**. The optical fibers are built in the cell wall at 90° angle. The right angle phase transition leads to a great signal quality, better than the previous design. The right angle prevents light refraction effects and minimizes the share of external light [8], leading to high signal/noise ratios and excellent signal forms. This self-venting, cylindrical cell has small dead volume and high-pressure stability (35 bar).

The GPC analysis of a paint binding agent system with the light scattering Instrument PSS SLD 7000 is shown in **Fig. 6**. It presents a direct comparison of the raw signals at 35°, 90° and 145° and the concentration detector signal. The multi-modal paint-binding agent covers a wide molecular weight range (10 million up to 1000 g/mol). The black curve shows a reliable measurement of the molecular weight even for the relatively small concentration and molecular weight. In the high-molecular range the quality of the raw signals is very good, below about 10 kg/mol a slight noise can be detected. This is due to the used measuring principle since the strength of the LS signal is proportional to the concentration and the molecular weight. When both factors are small their product is very small and therefore the signal/noise ratio will naturally

Comparative Overview (continued)

Conclusions

The light scattering detection in GPC can lead to considerably more information when various angles are measured. Therefore MALLS provide a more complete approach to maximizing the information. Seven simultaneous angles measured with minimum interference, maximum sensitivity and reliability place the PSS SLD 7000 in a leading position within the market. The high performance PSS SLD 7000 instrument operates with the PSS WinGPC, an efficient flexibly and expandable software solution that smoothly fits into the existing laboratory environment and delivers fast and sound answers on actual questions about natural, synthetic and (bio) polymers.

References:

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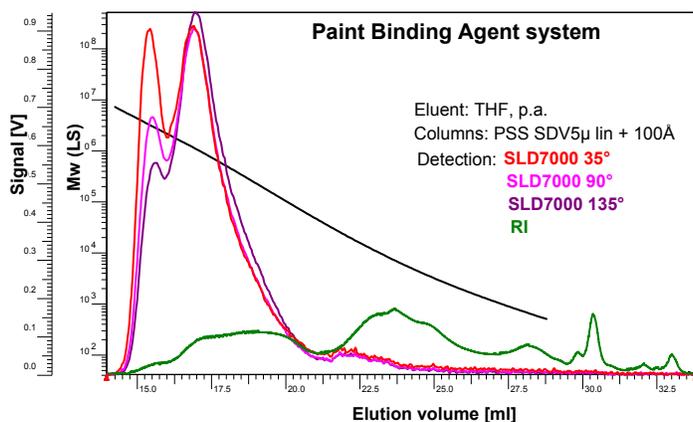


Fig 6: GPC-Analysis of a Paint Binding Agent System with the Light Scattering Instrument PSS SLD 7000 in THF



*New instrumentation
provides you choices
Best Value in the
Market!!*

PSS SLD7000 Instrument features

Relevance: simultaneous measurement of seven angles between 35° and 145°.

Reliability: by optimized flowing paths and separated optics/electronics: self-venting, cylindrical measuring cell with index matching, small dead volume and high-pressure stability (35 bar).

Sensitivity: ultra-sensitive CCD

detector and the optical fiber technique.

Accuracy and precision: resulting from extremely small scattering volume (20 µl) low noise and minimal scattered light.

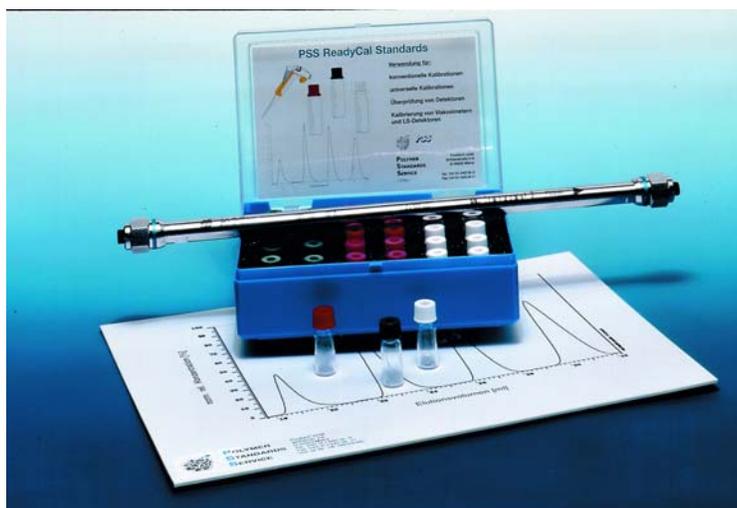
High signal quality: small cell volume (50 µl) prevents band broadening and other artifacts; USB data transfer.

Easy handling: plug and play operation: seamless WinGPC Unity integration with multiple systems and detectors (e.g. viscosity).

Flexibility: can be used as detector or as a stand-alone LS instrument.

Compact design: optimized instrument design taking advantage of all known miniaturizing concepts.

ReadyCal™ Kits



This product allows you to prepare a 12-point calibration curve within minutes, without the mess of weighing. Just add solvent to three vials, one of each color; let it stand for two hours, shake gently and load into your auto-sampler for analysis. Each kit contains 30 auto sampler vials that are color coded for your convenience (10 calibration curves). The kit comes with a quality certificate with all information you need. Available in two auto-sampler vial sizes: 4ml and 1.5ml - same price - just specify size when ordering

“12 point calibration curve in 3 injections”

The Following ReadyCal Kits are available:

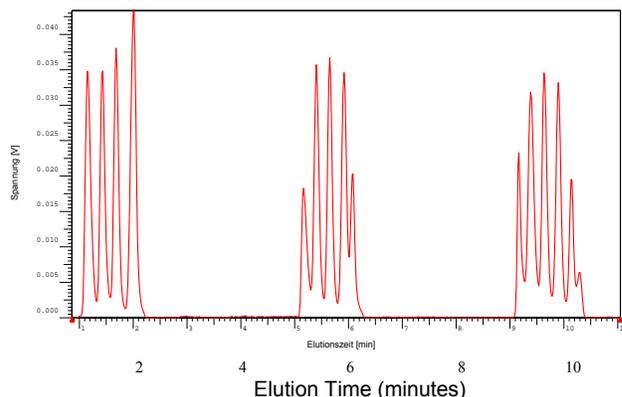
Description	MW Range (D)	Content	Part Number	Price
Poly(styrene) ReadyCal 1.5ml	400 - 3,000,000	10x3 vials	PSS-pskitr1	\$ 375
Poly(styrene) ReadyCal 1.5 Low	162 - 70,000	10x3 vials	PSS-pskitr1l	\$ 450
Poly(styrene) ReadyCal 1.5 High	1,500 - 6,500,000	10x3 vials	PSS-pskitr1h	\$ 450
PMMA ReadyCal1.5	500 - 3,000,000	10x3 vials	PSS-mmkitr1	\$ 425
PEO/PEG ReadyCal	200 - 1,200,000	10x3 vials	PSS-peokitr1	\$ 425

HighSpeed Columns

The PSS **HighSpeed** family of columns permits dramatic reductions in GPC analysis time for polymers > 2000D, without loss in resolution, accuracy or reproducibility. PSS HighSpeed columns (**20mmx50mm**) have a larger diameter and a shorter length than their typical analytical counterparts (8mm x 300mm), and the ability to operate at optimum flow rates of 6.25 ml/min while keeping same linear flow, equal resolution and polymer information: Mw, Mn, Mp and PDI. They have unparalleled ability to produce a 12 point calibration curve in just

ten minutes; (Polystyrene 374 to 2.3Million D shown below). Optimum column design helps expedite product screening, process control, and rapid sample throughput.

These columns can substitute the analytical columns without modifications to your LC system, as long as your pump and detectors can accommodate 6.25 ml/min. At this flow rate, you will use the same amount of solvent you currently use, but your elution occurs quicker. Our claim is not that you will save eluent, but that you will save precious time.



Real Time Calibration Curve with Polystyrene ReadyCal Standards on a SDV HighSpeed column

Detector UV Flow rate 6.25ml/min (THF)

HighSpeed Columns

GRAL/GRAM
MCX 10µm or 20µm
NOVEMA
PFG 7µm,
POLEFIN
SDV HR 3µm
SDV 5µm
SDV 10µm or 20µm
SUPREMA 10 or 20µm

Applicability Example

PMMA, Dextran, Cellulose nitrate
Sulfonates Apple juice
Polycations, Proteins PolyDADMAC
Polyethylene-terephthalate, Nylon
Polyolefin's
Oligomers
Organic soluble polymers PS, PMMA
Organic soluble polymers PS, PMMA
Gelatin, Bio-polymers, Dextrans

Eluent

DMF, DMAc, NMP, DMSO
Aqueous
Aqueous
HFIP
TCB
THF, Toluene, CHCl3
THF, Toluene, CHCl3
T HF, Toluene, CHCl3
Aqueous

Mw Range

2000 to 1Million
2000 to 5Million
2000 to 5Million
2000 to 10Million
< 8 Million
2000 to 1Million
2000 to 10Million
2000 to 50 Million
2000 to >100 million

PSS Product Selection Overview

Our comprehensive product line includes:

- Reference Polymer Standards and Calibration Kits that support the highest standards of quality: ISO, DIN, EN, ASTM, GLP, Organic or aqueous.
- GPC/SEC Columns and Specialty Gels.
- PSS HighSpeed columns that increase your sample throughput up to ten fold.
- WinGPC UNITY, a GPC Data System that integrates all your LC instrumentation into one environment, works well with all brands and grows with your needs
- GPC Instruments, Viscometry and Light Scattering Detectors
- Contract Laboratory Services.
- Method Development
- Consulting and Training
- Solutions for custom made polymers; custom stationary phases and/or software



PSS-USA 10th Year Anniversary Offer

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We're on the Web!
See us at:
www.polymer.de

We are celebrating our 10th year Anniversary with a wonderful 10% discount on all our High Throughput items. So try our HighSpeed products to enhance your GPC.

PSS will continue to work with you side by side providing high quality products, cutting edge expertise, up-to date equipment, instrumentation and methods development; whatever it takes to help you succeed with macro molecular characterization.

10% off High throughput items Anniversary Offer

One coupon per customer – expires 8/31/04 AD#UE41

Polystyrene and PMMA ReadyCal standards; add solvent to ready made mixtures and obtain a 12 point calibration curve in three injections

High Speed GPC Columns; complete analysis in 3 minutes

WinGPC Unity software is easy to use; highly automated; overlaid injections increases sample throughput by as much as 50%; works with all instruments and detectors.

Special pricing on **SLD7000** Light Scattering Detector and **ETA2010** Viscometer. Mention this add.

Call NOW 1-888-477-7872 to take advantage.

GPC/SEC Training Workshops at ACS Fall Meeting in Philadelphia, PA

You are cordially invited to participate in the GPC/SEC workshops that will be offered in the upcoming ACS Fall National Meeting & Exposition on August 23-25, 2004, in Philadelphia, PA. Dr. Martina Adler & Dr. Gunter Reinhold will offer an **"Introduction to Size Exclusion Chromatography,"** ideal for beginner or intermediate practitioners. This workshop will have emphasis on column selection, conventional calibration, molar mass sensitive detectors, light scattering, viscometry and high-throughput methods. For the more seasoned person, Dr. Martina Adler and Dr. M. Nazeem Jahed will offer the workshop titled **"Recent Advances in GPC/SEC and 2-Dimensional Chromatography"** that will focus on method development and recent applications of 2-D Chromatography (LACCC-GPC, HPLC-GPC). Those interested may register or request further information on time, date, and location, via email (pssusa@polymer.de). Late registrations will be entertained in the PSS Booth 319-321, contingent upon space available.

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