Polarean 3777

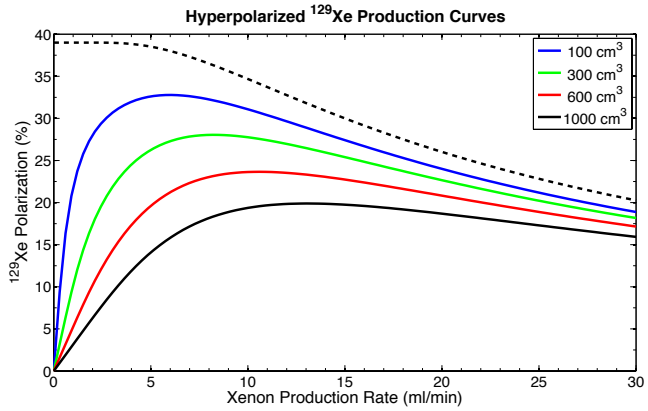
^{129}Xe Hyperpolarizer Upgrade Module

The 3777 upgrade module provides a straightforward means to enhance ^{129}Xe polarization on existing 9800 system by up to a factor of two. Such a doubling of high-purity, hyperpolarized ^{129}Xe polarization improves gas phase magnetic resonance studies by increasing imaging SNR, accelerating workflow or decreasing the volume of xenon required for a study.

The upgraded outlet manifold thaw path is designed to improve user control and maximize ^{129}Xe polarization retention during the thaw.

The upgrade package replaces a number of critical components in the standard 9800 system with higher performance designs to enable ^{129}Xe polarization levels in the range of 20–25% at typical production throughput.

This objective is achieved via a combination of enhancing xenon polarization within the optical cell using the existing laser source in 9800 system, and reducing polarization loss in cryogenic collection and recovery of hyperpolarized ^{129}Xe.



^{129}Xe polarization as a function of production rate after installing the 3777 upgrade module ^{129}Xe polarization levels in the range of 20-25% are achievable using the standard 60W laser installed on 9800 systems. The dashed line shows the ^{129}Xe polarization leaving the cell whereas the color-coded lines depict the collected xenon volume using an effective solid-state xenon relaxation time of one hour.

System Overview and Specifications

Operation of the upgraded polarizer remains identical to that of the standard 9800 system, while bringing key displays and valves to a more ergonomic location. The upgraded system continues operating as a Class 1 laser system, and thus requires no laser protective eyewear during normal operation.

The new central control unit replaces the conventional temperature/interlock controller. In addition to providing the legacy functions, it regulates the rubidium pre-saturator function and provides enhanced monitoring and control of laser light transmission.

POLAREAN
polarean.com

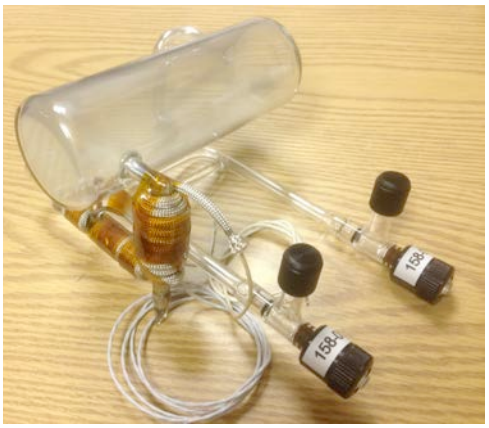
Polarean, Inc.
PO Box 14805
Research Triangle Park, NC 27709-4805
Phone: (919)-206-7900
Fax: (919)-206-7901
info@polarean.com

Upgrade Module Components

- Improved optical cell design with optimized flow geometry and a dedicated, high-purity silica-wick rubidium pre-saturator to enhance spin exchange efficiency.
- Expanded temperature controller functionality enables the rubidium pre-saturator and cell body temperatures to be independently controlled.
- Redesigned and streamlined polarized gas flow path optimized to eliminate polarization loss during collection and recovery.
- Improved magnetic holding field to increase polarization retention times and minimize polarization loss during xenon collection.
- Improved cryogenic trap to minimize xenon volume and polarization loss during collection and to accelerate thawing speed.
- Dedicated laser transmission monitoring module enables more accurate control of laser absorption.

The improved magnetic holding field minimizes polarization loss during xenon collection and recovery, and prolongs the polarization retention in solid-state xenon.

An integral part of the polarized xenon collection system is the enhanced cryogenic trap – the cold finger, featuring an optimized geometry to enhance xenon freezing pattern and retention. This new design leads to a higher ultimate polarization of xenon through a longer solid-state relaxation time and an accelerated thaw into gas state.



The new optical cell design incorporates a pair of optical quality flat windows, a reinforced rubidium pre-saturator and a dedicated heater. The cell body is now largely free from rubidium and operates at a lower temperature than the rubidium pre-saturator in order to maximize spin exchange efficiency.

Upgrade Features

- The upgrade module includes two days of installation and certification at the customer site.
- The upgrade module carries a one-year warranty.
- The system upgrade includes a full hyperpolarizer system checkup, calibration and optimization.
- No additional space or facility requirements are necessary for the system upgrade.

POLAREAN
polarean.com

Polarean, Inc.
PO Box 14805
Research Triangle Park, NC 27709-4805
Phone: (919)-206-7900
Fax: (919)-206-7901
info@polarean.com

Safety Features

- Designed and built to the standards of the 9800 ^{129}Xe hyperpolarizer, with CE Mark, UL and CSA approvals.
- DOT approved shipping of replacement optical cells.

Optional Add-On Equipment

- Dual source ^{129}Xe cylinder manifold upgrade module for real-time switching between natural abundance and enriched xenon mixes. This minimizes the risk of system contamination and downtime during frequent xenon cylinder changes.
- Heavy duty external purifier module with bypass function installed between the external gas manifold and the polarizer in order to further purify the gas mixes, protect the system against potential contamination and prolong the life of optical cells at their peak performance.

NOTE: *The 9800 Xenon Hyperpolarization System and the associated upgrades are designed for research use. When used to produce hyperpolarized xenon for human inhalation, all applicable institutional and federal approvals must be obtained.*

Polarean, Inc.
PO Box 14805
Research Triangle Park, NC 27709-4805
Phone: (919)-206-7900
Fax: (919)-206-7901
info@polarean.com