

Polarean 9820

^{129}Xe Hyperpolarizer

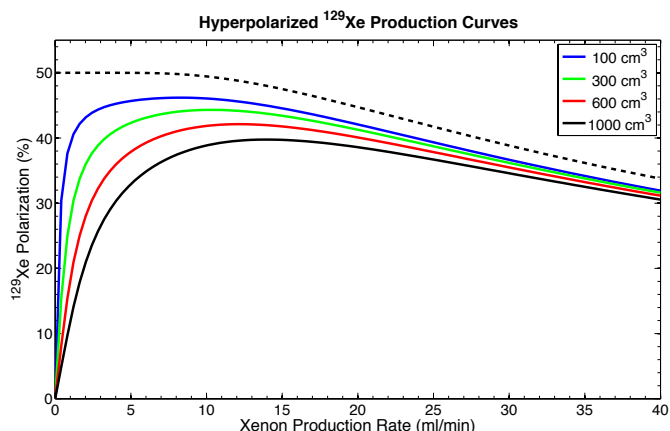
The 9820 ^{129}Xe hyperpolarizer provides a routine supply of high-purity, hyperpolarized ^{129}Xe for gas phase magnetic resonance studies. The polarizer is typically installed near the MRI/NMR suite and processes a custom mixture of ^{129}Xe , N_2 , and ^4He , into one or more doses of pure hyperpolarized ^{129}Xe that is available for magnetic resonance studies. There is no chemical change associated with hyperpolarization – only nuclear spin alignment and cryogenic extraction of pure xenon. The hyperpolarized ^{129}Xe is then thawed and dispensed into a container or bag. Once dispensed into an appropriate container, and maintained within a modest holding magnetic field, the polarization relaxes with a T_1 of 1–2 hr.



The new generation 9820 xenon polarizer features a tunable 200W water-cooled narrowed linewidth laser, an expanded oven to accommodate substantially larger volume cells, and a 4-coil electromagnetic field configuration to provide uniform coverage over the oven and polarized gas plumbing.

System Overview and Specifications

The 9820 Xenon Hyperpolarization system can be operated on site by personnel who have undergone appropriate training. Polarization levels range over 35–45% depending on the volume and throughput of produced xenon, typically at 1–3 L/h. The system operates as a Class 1 laser, and thus requires no laser protective eyewear during normal operation.



The 9820 xenon polarizer is capable of delivering ^{129}Xe polarization levels in the range of 35–45% as a function of production rate (1–3 L/h) when operating at the peak laser power. The dashed line shows the typical ^{129}Xe polarization leaving a 1.5-L cell whereas the color-coded lines depict the collected xenon volume using an effective solid-state xenon relaxation time of one hour.

Note: The 9820 Xenon Hyperpolarization system is designed for research use. If the system is used to produce hyperpolarized ^{129}Xe for human inhalation, all applicable institutional and federal approvals must be obtained.



The standard 9820 xenon polarizer configuration comes with a 1.5-L optical pumping cell, a triple-zone temperature control system, custom optics to deliver a highly uniform laser beam across the entire cell length, and a high efficiency cryogenic xenon collection system. The 9820 platform is designed with several expansion options to enhance performance and throughput as new components become available.

System Components

- Custom hyperpolarized ^{129}Xe compatible valves and tubing
- Hyperpolarized ^{129}Xe collection plumbing within the electromagnetic field
- Narrowed linewidth tunable 200W 795-nm optical pumping laser in Class 1 housing
- Circular polarizing and beam collimating optics
- Mass flow and pressure transducers
- Closed circuit water chiller for robust temperature control
- High-field high-capacity cryogenic accumulation area
- Vacuum pump and purge function to prepare delivery containers
- Shielded oven with dual-action active heating/cooling temperature control

- Flow-through optical cell installed in series with rubidium pre-saturator each with its own dedicated temperature control
- Laser transmission and spectral monitoring
- Safety interlocks
- Central power distribution

Safety Features

- Filtered power distribution
- Air flow switch
- Interlocked protective laser housing for Class 1 operation
- CE Mark, UL and CSA approvals
- DOT approved shipping of replacement optical cells.

Optional Equipment and Services

- Polarization measurement station with absolute calibration for ^3He and ^{129}Xe
- Dual source ^{129}Xe cylinder manifold 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 by-pass 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.
- Dose mixing syringes

Laboratory Space Requirements

- Controlled access space capable of temporary Class 4 laser operations
- Minimum room dimensions:
 - width 120" (3m)
 - depth 84" (2m)
 - height 84" (2m)
- Ferrous materials to be at least 3' (1m) away from the polarizer.
- Local ambient magnetic field preferably less than 1 Gauss

Polarizer Dimensions

170cm L x 60cm W x 160cm H
(65" L x 24" W x 60" H)

Electrical Requirements

- 3 phase 208 V, 47-63 Hz, 20 A per phase
- Power outlet: US NEMA L21-30R
- Lockable isolate box

Compressed Air

- 20 psig (1.5 bar) minimum pressure
- 4 standard cubic feet per minute (110 L/min) minimal flow
- 0.01% water maximal content

Environmental Requirements

- 5 kW/h maximal heat load (17,000 BTUH = 1.5 Ton)
- Room temperature between 68-75 °F (20-24 °C)
- Dedicated temperature control

Supplies and Consumables

- External ^{129}Xe - ^4He - N_2 tank
- External UHP N_2 tank
- External commercial N_2 tank
- Liquid nitrogen
- Dose delivery bags