nJenni Neutron Generator

The NeutronGate nJenni is a cutting-edge, lightweight neutron generator designed for high-intensity pulsed neutron generation. With customizable neutron intensity, energy, and time profiles, nJenni offers flexibility to meet diverse requirements. Built with active pumping, it assures long lifetime and effortless maintenance with low lifetime costs.

Features:

- **High neutron yield up to 1E10 n/s.**
- **High energy accelerator enabling use of various neutron production reactions**
- **Accelerator column enabling use of high accelerator energies >150keV.**
- **High current Pulsed operation**
- **High neutron flux.**
- **Convenient neutron production geometry on a tip of a drift tube allowing efficient experimental setup.**
- **Neutron flux stabilization <1% via feedback from the neutron counter.**
- **Reliable design and easy to use.**
- **Easy Maintenance and modular design**
- **Pumped system: long lifetime, easy maintenance of the radiation head and high neutron production rate.**

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Components

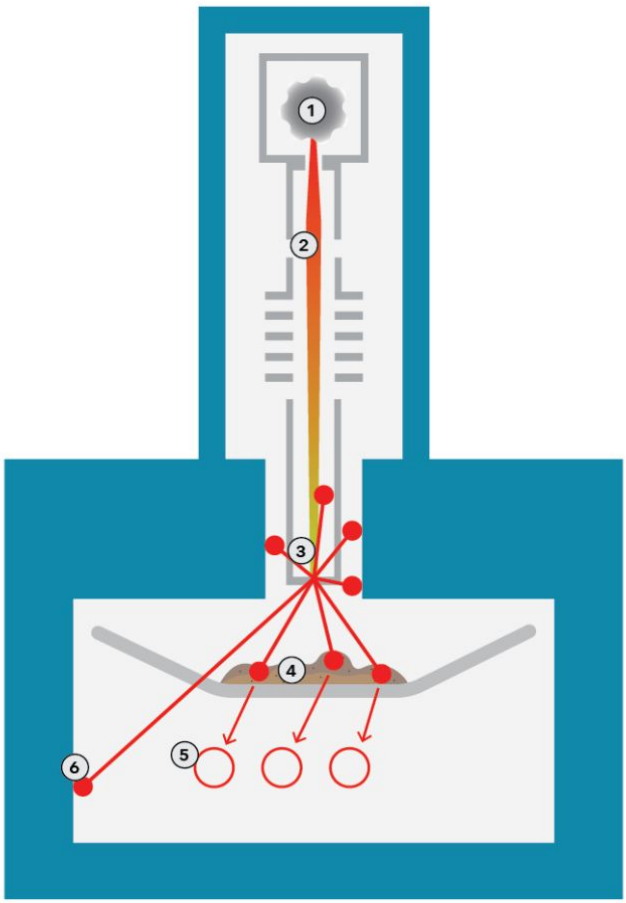
Main Components:

1. **Radiation Head:**
   - Employs an actively pumped accelerator system with a high-voltage target.
   - Features a modular design, facilitating modifications such as changing accelerator energy and nuclear reactions.
   - Supports both pulsed and continuous operations.
   - Ensured protection against environmental factors like temperature shifts, dust, and moisture.
   - Dedicated maintenance service available.
2. **Auxiliary Rack:**
   - Houses power supplies, oil cooler, control electronics, and a deuterium gas bottle.
3. **Chiller Unit:**
   - Regulates temperature for the rack and radiation head, independent of external conditions.
   - Manages varied thermal loads within the system.
   - Required if inhouse water cooling system is not available.

Radiation Head Application Note

One typical application for nJenni is the NeutronGate online elemental analyzer OreGate. Main components of such system are

1. **Ion source**
   a. Energy is fed in to low density gas that ionizes via electron collisions forms plasma
2. **Accelerator**
   a. eam is extracted from plasma focused and accelerated to beam target.
3. **Beam target**
   a. nuclei collide at the beam target forming neutrons via nuclear fusion DETECTION ARRAY Detector array detects the gammas coming from irradiated material. SHIELDING Remaining neutrons are shielded from the environment by radiation shielding
4. **Sample**
   a. mass on the conveyor is irradiated with neutrons.
5. **Detector system**
   a. Detector array detects the gammas coming from irradiated material.
6. **Radiation shielding**
   a. Remaining neutrons are shielded from the environment by radiation shielding



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Datasheet

Variable	[Unit] Note	Value	
		MIN	MAX
Operating temperature	C	-40	30
Operating Humidity	%	0	100
Pulse length	us	10	5000
Pulse period	us	50	100 000
Duty cycle	%0		100
Maximum Pulse amplitude	[n/s] High amplitude pulse operation might need extraction electrode kit to tune the beam optics from 100% duty cycle operation to high amplitude/ low duty cycle operation.	2E9	1E11
User interface			
hard error, warning	Binary signal 24V DC ON/OFF. (Radiation on, Major system errors)		
Safety Interlocks	24V DC Relay Closed/Open (Door, cover, collision, Jamming interlocks etc.)		
Data interface	See document "General Description of Instrumentation and Automation"		
Other			
Radiation safety	Public exposure class: E Occupational exposure class: 3 Radiation security class: Unclassified or C		
IP rating	Rack and radiation head up to IP66. Standard chiller IP30, IP44 with custom enclosure.		
Compliance	CE marking requirements. LVD, MD, EMC, EURATOM		

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Datasheet

Variable	[Unit] Note	Value	
		MIN	MAX
Model	nJenni		
Nuclear reaction D-Li			
time averaged neutron production yield	[n/s]		2E9
Neutron production reaction	d(Li,n)Be, d(Li,n+a) and d(d,n)He		
Neutron Energy	Peaked at 2.5MeV and 13MeV Continuum below 8MeV	Thermal	13 MeV
DD Reaction			
time averaged neutron production yield	[n/s]		1E10
Neutron production reaction	d(d,n)He		
Neutron Energy	Peaked at 2.5MeV	Thermal	2.5 MeV
Electrical			
Power	400VAC 3x230 VAC 32A		
Communication interface	Ethernet, PROFIBUS, custom		
Interlocks and binary signals	24V isolated relays, interlocks, hard errors		
Accelerator energy	Different accelerator configurations available, 150 kV, 225 kV and 300 kV	150 kV	300 kV
Mass			
Radiation head	Depends on selected pump	30 kg	90 kg
Chiller 13kW	Empty		350 kg
Utility rack		200 kg	300 kg

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Options

1. **-Accelerator Energy (Includes accelerator, high-voltage supplies, and cabling):**
    - Acc300kV200W: Features a 300kV power supply with a 200W accelerator beam power.
    - Acc225kV4kW: Equipped with a 225kV power supply and an accelerator beam power ranging from 2000-4000W.
    - Acc150kV1.8kW: Offers a 150kV power supply and an accelerator beam power between 500-1500W.
2. **-Target Material:**
    - Li: Lithium target yields discrete neutron energies of 2.5 and 13 MeV, and a continuum of 0-8MeV.
    - Ti: Titanium target initiates neutron production at 2.5MeV through the D(d,n)He reaction.
    - Al: Aluminum target facilitates the 2.5MeV D(d,n)He neutron production reaction. While it provides a lower neutron yield than the Ti target, it ensures more consistent and resilient neutron production.
3. **-Interface Options:**
    - Analog: Provides a basic analog data interface with binary 24V and 0-10V analog signals.
    - Profibus: Features a Profibus interface.
    - Modbus: Features a Modbus TCP/IP interface over Ethernet
    - TCPIP: Standard with the nJenni is a Fiber optic and Ethernet port interface, typically 10/100/1000 base SFB modules. Alternate fibers can be integrated via media adapters.
4. **-Pulser:**
    - A built-in pulser ensures the possibility of pulsed operations. Note: System optimised for Adjusting to an exceedingly high maximum pulse intensity beam current cannot be operated in low-current continuous operation mode. produce low may hinder low currents in current continuous operations.
5. **-Counter:**
    - A neutron counter cCan be incorporated to provide real-time feedback on neutron production rate. It also adjusts neutron production to stabilize the neutron count rate to within a <1% deviation. The data interface can be employed to introduce measurements that substitute the counter value.

Customization:

The nJenni system can be tailored to specific needs, including target material, beam spot size, pulse intensity, radiation shielding, cooling mechanisms, and more. For detailed customization inquiries, please contact NeutronGate reach out to discuss the precise requirements of your application.