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# Development of Neutral Molecular Beam Injector for Two Dimensional Edge density measurement


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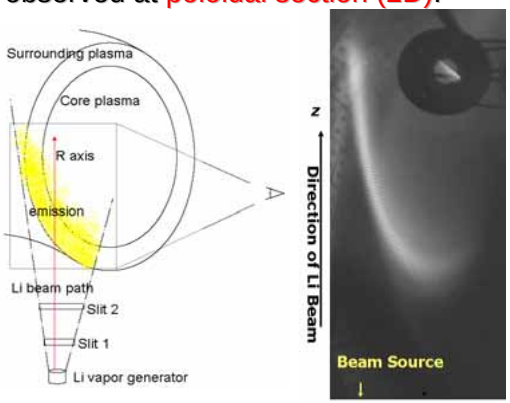
## 1.introductions

*edge plasma affects the overall energy and particle confinement in fusion test devices

*phenomena do not always appear symmetrically in toroidal and/or poloidal directions

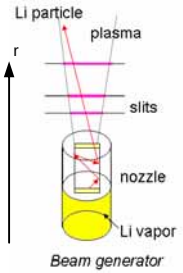
We propose "**Sheet-Shaped Thermal Lithium Beam Probe**", by which density profile and density fluctuation can be observed at poloidal section (2D).




## 2. Purpose

Development of the efficient beam injector to get the high intensity of emission by simulation of intensity of thermal lithium beam

## 3. 3D Thermal Li particle distribution code using monte-carlo method

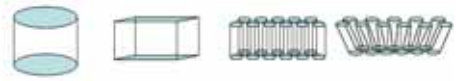



- Li particles generate at the under face of nozzle, fly with random angle
- No particle collision
- The particles which reach inner wall of nozzle hole can re-start with new random angle
- The particle which can not pass the slit is deemed as being lost

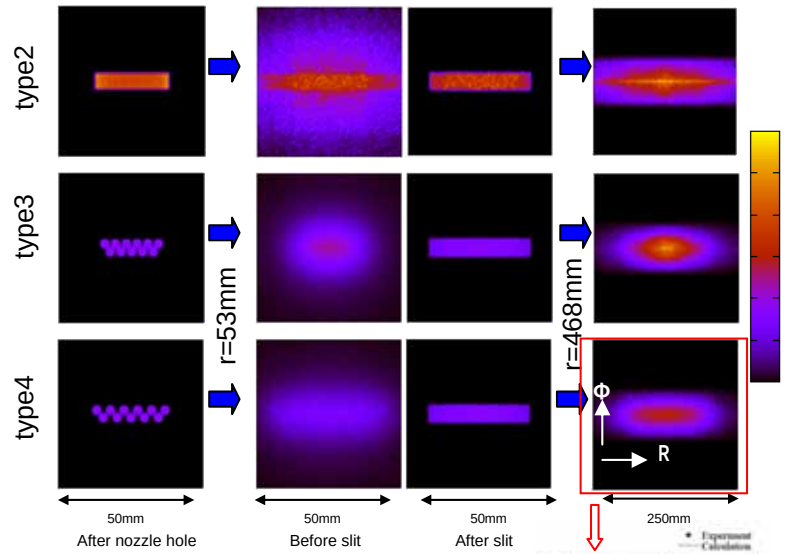
The particles which can pass the all slit can reach to plasma and form the sheet-shaped beam.

## 4. Effect of nozzle shape

The height of each nozzle is 20mm.
Only one slit is set, the size of the slit is 35mm×6mm,the length (*r*) from nozzle to slit is 53mm.
The number of generating particle is $1\times10^7$

| | Type1 | Type2 | Type3 | Type4 |
|---|---|---|---|---|
| Shape of nozzle hole |  | | | |
| | Φ 25mm | 25mm * 5mm | Φ 3mm × 11 | Φ 3mm × 11 |
| Area of nozzle hole | 490.9mm² | 125mm² | 77.8mm² | 77.8mm² |
| Rate of passing nozzle | 47.7% | 31.8% | 14.5% | 14.5% |
| Rate of passing slit | 3.8% | 8.6% | 16.0% | 13.6% |
| Max Intensity of beam | 1.00 | 1.49 | 1.38 | 1.07 |
| FWHM of sheet beam at minor axis | 240.0 | 43.75 | 38.5 | 37.4 |
| α : Power of number $n_0(r) = a\,r^{-\alpha}$ | 2.08 | 2.02 | 1.92 | 2.03 |

*Rate of passing nozzle in the table parameter is a ratio of the number of particles that go out of an upper nozzle to the number of generated particles.
*Rate of passing slit is a ratio of the number of the particles that pass over the slit to the number of particles that passed the nozzle.
*Max intensity of beam is a relative value based on type1 of the beam intensity in the point *r*=468mm.
* **α** is an appearance of attenuation to distance r.

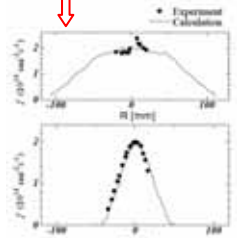



## 5. Adequacy of the calculation

Measurement of Li beam flux with a quartz micro balance

Beam made by type4 nozzle is examined.

Calculation result agree with Experimental data



## 6. Set up in LHD

Nozzle: type 3
Final slit : eccentric rectangel slit
r = 185mm Size=45mm*4mm
Center (⊿R,⊿Φ) = ( 10.5mm,0mm)
Target area : r=2980mm