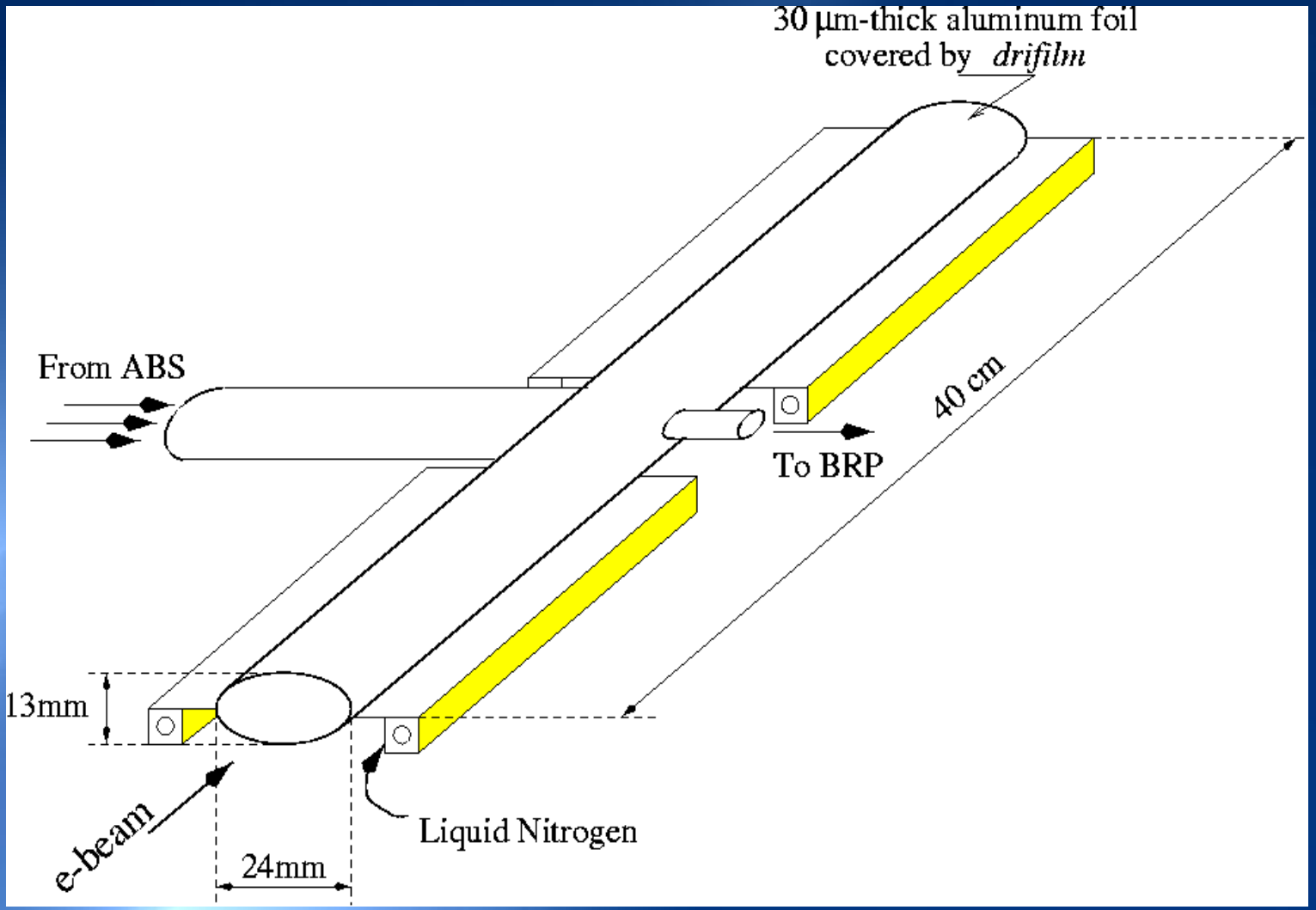
# *Efficiency of the injection of the atomic beam into the storage cell*

# Questions to be discussed

1. How effectively atomic beam could be injected into the cell when the pressure in the cell is increased
2. Is there fast saturation of the target thickness when the intensity of the beam from ABS is increased?
3. Intrabeam scattering – how to measure this effect?

# Geometry of the cell



# Attenuation of the injected beam

$$2*C*P = I_0 * \exp\{-\sigma*P*L/2kT\} + Q_{ext}$$

| R | = | A | + | C |
|---|---|---|---|---|

| I0 | Qext | P (mbar) | A | B | A+Q |
|---|---|---|---|---|---|
| 6,91097E+16 | 0 | 3,37E-04 | 4,99E+16 | 4,89E+16 | 4,99E+16 |
| 6,91097E+16 | 1,00E+16 | 3,95E-04 | 4,72E+16 | 5,74E+16 | 5,72E+16 |
| 6,91097E+16 | 2,00E+16 | 4,47E-04 | 4,49E+16 | 6,49E+16 | 6,49E+16 |
| 6,91097E+16 | 4,00E+16 | 5,50E-04 | 4,06E+16 | 7,99E+16 | 8,06E+16 |
| 6,91097E+16 | 6,00E+16 | 6,70E-04 | 3,62E+16 | 9,73E+16 | 9,62E+16 |
| 6,91097E+16 | 8,00E+16 | 8,00E-04 | 3,19E+16 | 1,16E+17 | 1,12E+17 |
| 6,91097E+16 | 1,00E+17 | 9,00E-04 | 2,90E+16 | 1,31E+17 | 1,29E+17 |
| 6,91097E+16 | 1,00E+18 | 7,00E-03 | 7,99E+13 | 1,02E+18 | 1,00E+18 |

$\sigma$

**Ext. flux**

**Decreasing of the intensity of the injected beam due to scattering in the injecting tube ( external source into the cell )**

σ

**Pressure reading in the compresion volume vs the external flux**

# TARGET THICKNESS VS BEAM INTENSITY

$I_{inj}=I_0*\exp(-n_0*\sigma*L/2)$

$n_0= I_{inj}/C_{cell} =I_0*\exp(-n_0*\sigma*L/2)/(3*6.5*10^4*d^3/L)$

d=1cm, target thick. $t = n_0*L$, $\sigma = 0.8*10^{-14}cm^2$ , $I_0=6.9*10^{16}$

$x = t*\sigma/2$ $\qquad$ $7*10^2*(d/L)^2*x = \exp(-x)$

Let (d/L) = 1/20 than $1.75*x = \exp(-x)$ $\quad x = 0.39$

for $1* I_0 = 6.9*10^{16}$ at/sec $\quad t = 9.6*10^{13}$ at/cm$^2$

| | |
|---|---|
| 2 | 15.1 |
| 4 | 22.4 |
| 6 | 27.6 |
| 10 | 34.5 |
| 20 | 45.0 |

# Atomic depolarization due to the wall collisions

$$t_t = (L/d)^2 \cdot t_b$$

$$P_t \propto e^{-\alpha(L/d)^2}$$

$$F = t_t \quad P^2$$

$$L/d = \sqrt{1/2\alpha}$$

$$\alpha \quad 0.001 \; L/d \quad 20$$