Development of Ultracold neutron Accelerator for Time focusing of pulsed neutrons

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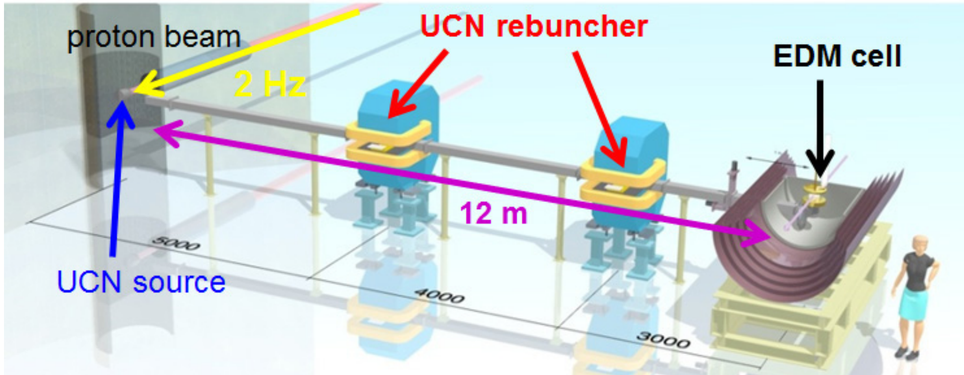
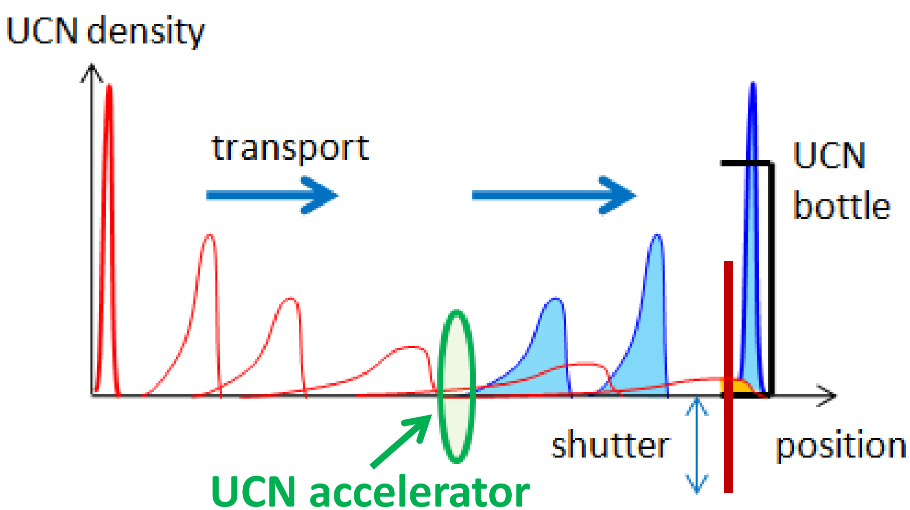
EDM experiment with pulsed source

EDM experiments with pulsed source

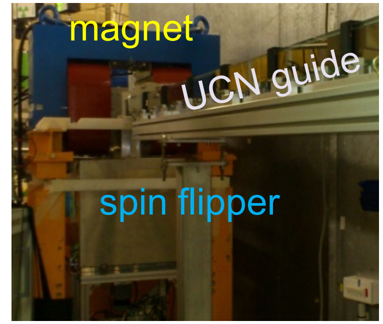


J-PARC P33

Time focusing

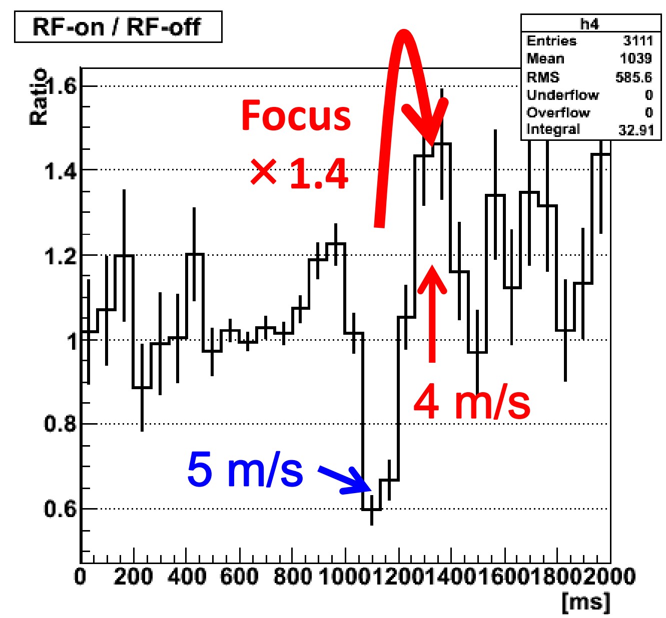


- UCN Accelerator



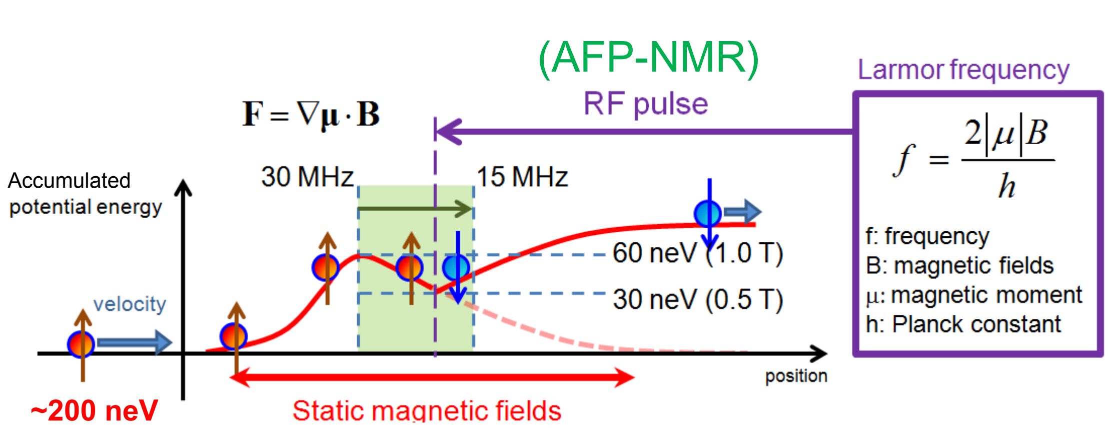
Demonstrated at ILL in 2011.

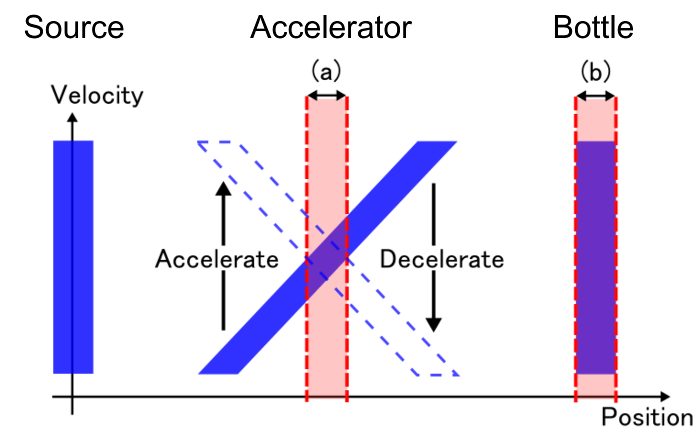
We succeeded in focusing UCN.



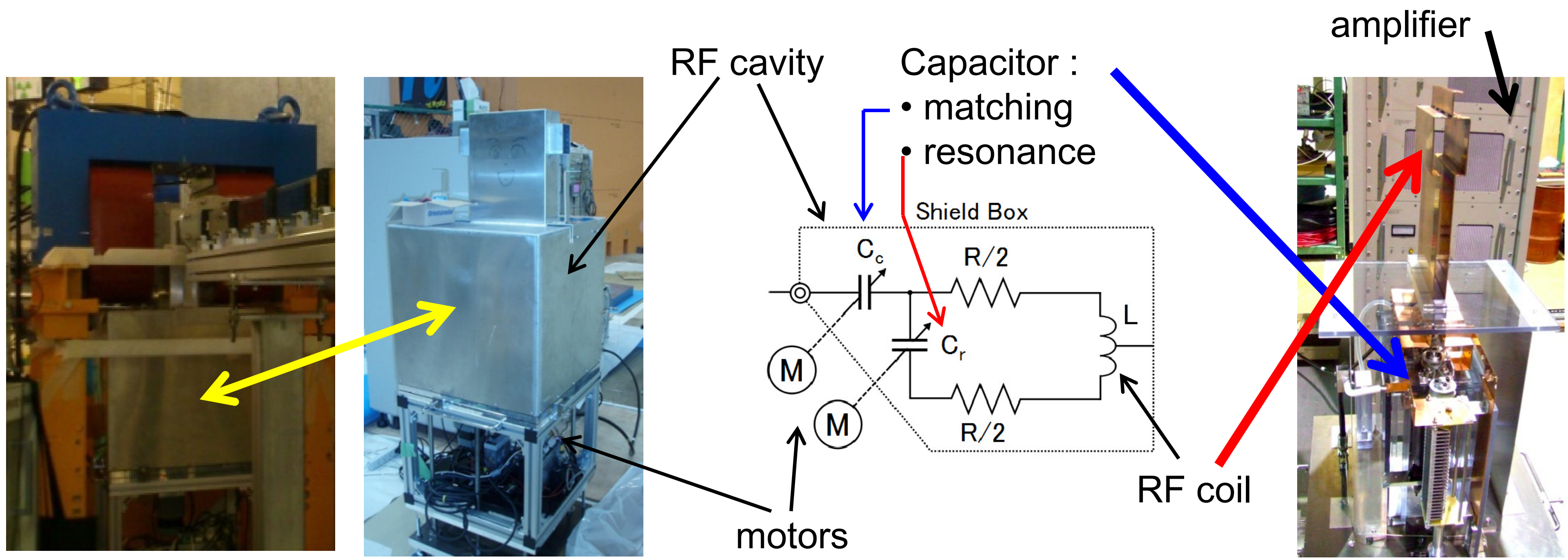
Phys. Rev. A **86**, 023843 (2012)

The Mechanism of UCN Accelerator





UCN accelerator named "UCN Rebuncher"



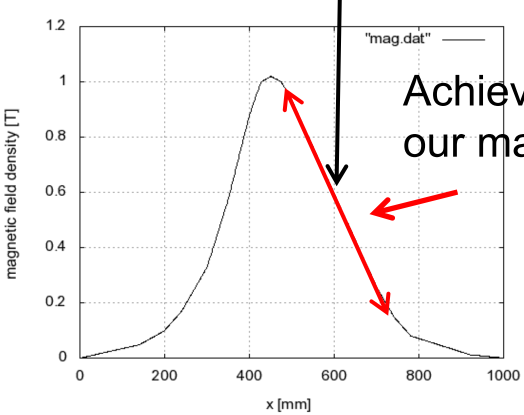
Adiabatic Fast Passage - NMR

Adiabatic condition

$$k = \frac{\omega_L}{\omega_B} \geq \frac{-\gamma_n B_1^{\,2}}{dB_0/dt} = \frac{-\gamma_n B_1^{\,2}}{v\, dB_0/dx} \gg 1$$

v : a neutron velocity
B_0 : static magnetic flux density
B_1 : rotating magnetic field strength
x : propagating direction of a neutron
γ_n : gyromagnetic ratio of a neutron

Field gradient **~ 3.2 T/m**



Achieved with our magnet.

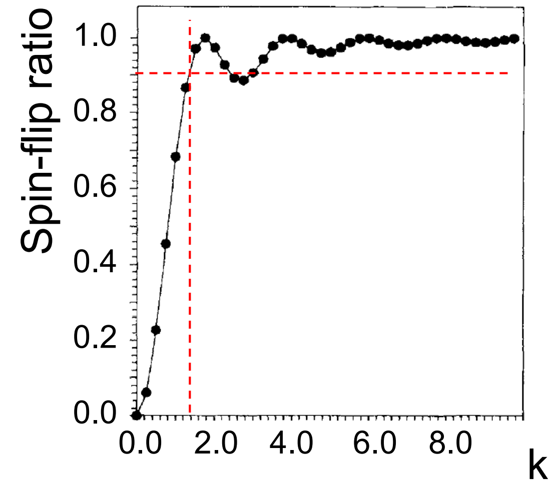
Physica Procedia **17**, 20-29 (2011)

IEEE Trans. Appl. Supercond. **22**, 4500704

Spin flipping ratio
> 0.9

Adiabatic parameter
k > 1.4

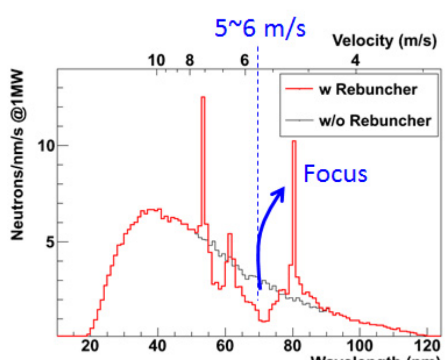
B_1 > 0.35 mT
(v = 5 m/s)

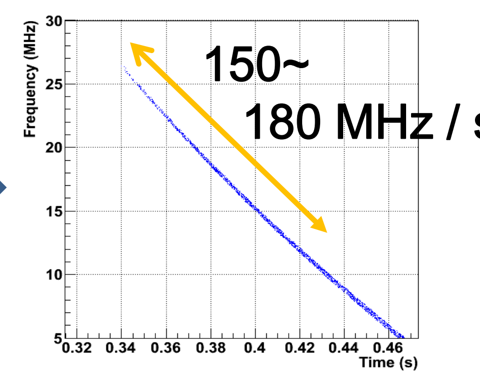


Nucl. Instr. Meth. Phys. Res. A **384**, 451-456 (1997)

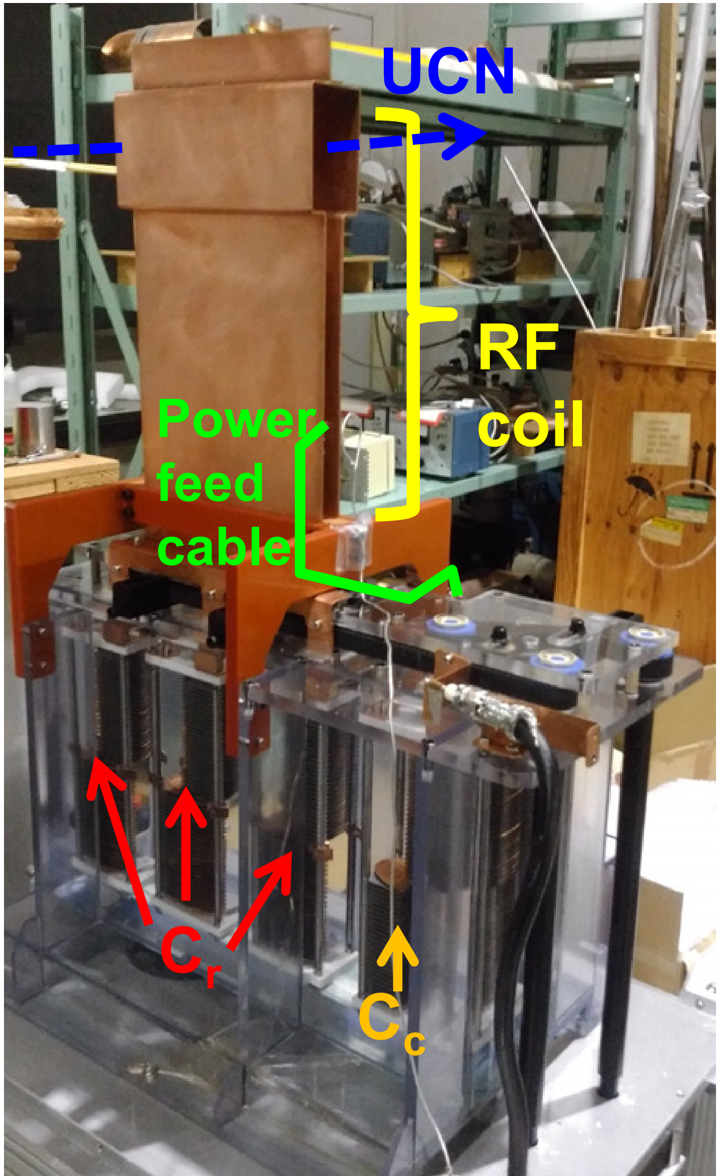
Frequency
1st : 17.5 ~ 28.6 MHz (±70~114 neV)
Goal : 6 ~ 30 MHz (±24~120 neV)

Spin-flip ratio
1st : ~ 0.5
Goal : ~ 1

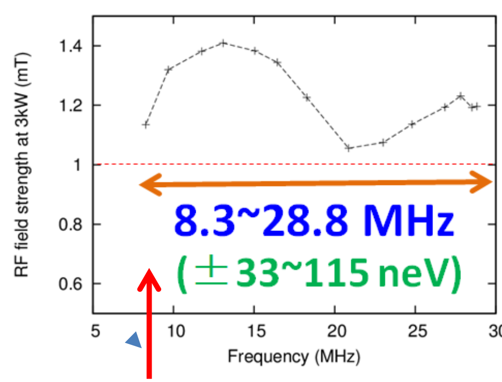


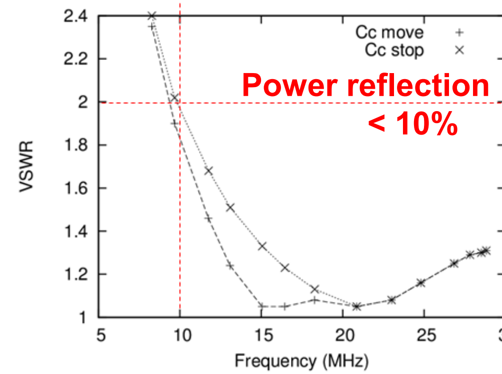


Present status of the 2nd rebuncher

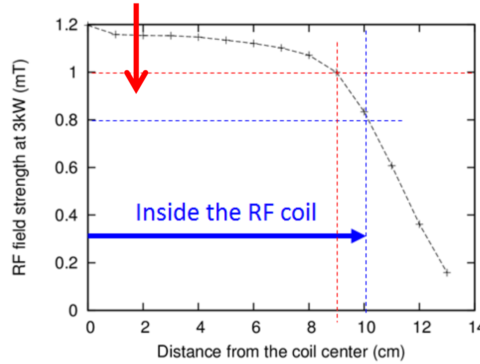


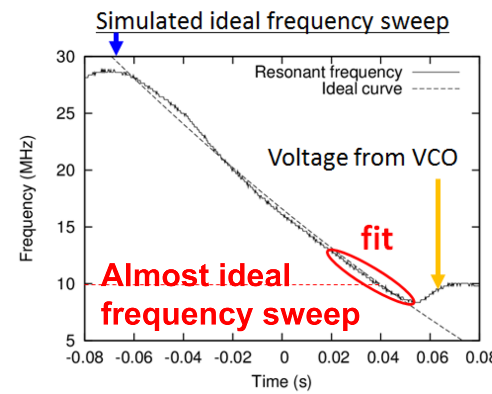
Result of 0.4 W power supply test





RF magnetic field > 1 mT
(Scaled up to 3 kW)





The second rebuncher is near completion!

MOPRC001