Novel Opportunities to study Dynamics @High Current Accelerator driven Neutron Sources

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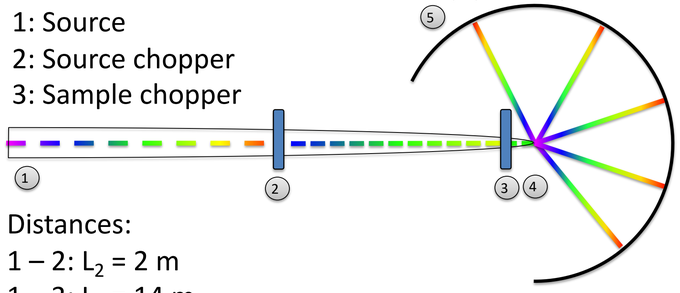
Direct geometry:
Cold monochromatic chopper spectromter

1: Source
2: Source chopper
3: Sample chopper



Distances:
1 – 2: L_2 = 2 m
1 – 3: L_3 = 14 m
3 – 4: L_{CS} = 1.5 m
4 – 5: L_{SD} = 3 m

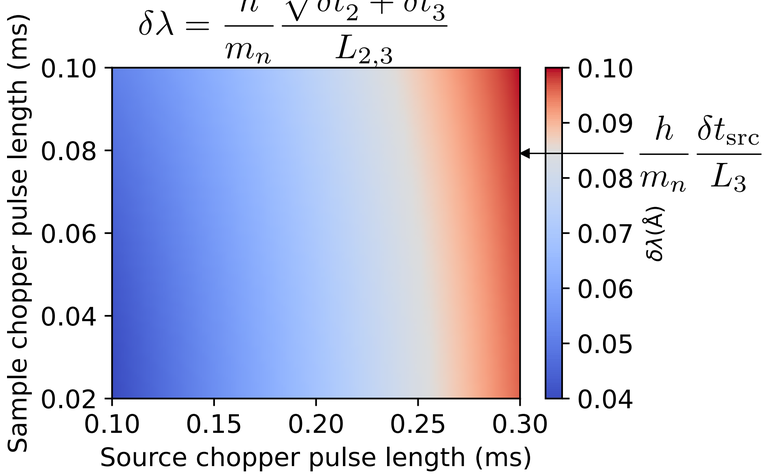
Secondary bandwidth

$$\Delta\lambda' = \frac{h}{m_n}\left(L_{\mathrm{SD}} f_3\right)^{-1} \approx 13.7\text{Å}$$

$$\text{for } L_{\mathrm{SD}} = 3 \text{ m and } f_3 = f_{\mathrm{src}}$$

High repetition rate provides reasonable secondary bandwidth
→ monochromatic illumination at 96 Hz
→ Sample flux 2x10^5 n cm^{-2}s^{-1}
@ λ= 5Å, 2º x2º collimation, $\Delta\hbar\omega_{\mathrm{elast}} = 100\mu\mathrm{eV}$
Chopper system: Sample chopper (3) controls λ' resolution
Source chopper (2) controls λ resolution
$\delta t_3 \ll \delta t_2$
Band width and frame overlap tbd.
Compact instrument for flexible resolution: $L_3 \approx$ 14 m

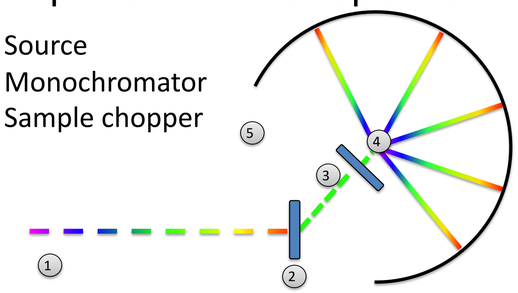
$$\delta\lambda = \frac{h}{m_n}\frac{\sqrt{\delta t_2^2 + \delta t_3^2}}{L_{2,3}}$$



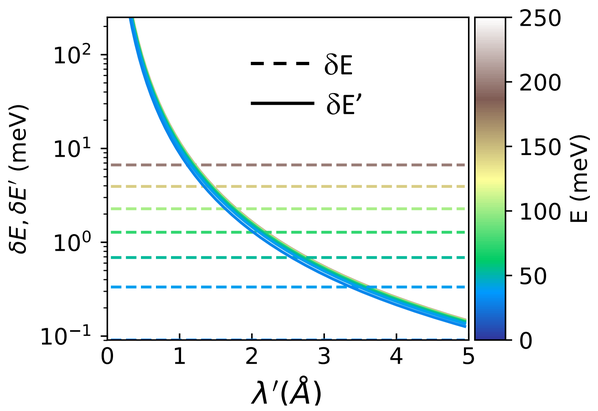
$$\frac{h}{m_n}\frac{\delta t_{\mathrm{src}}}{L_3}$$

Direct geometry:
Epithermal X-ToF spectrometer

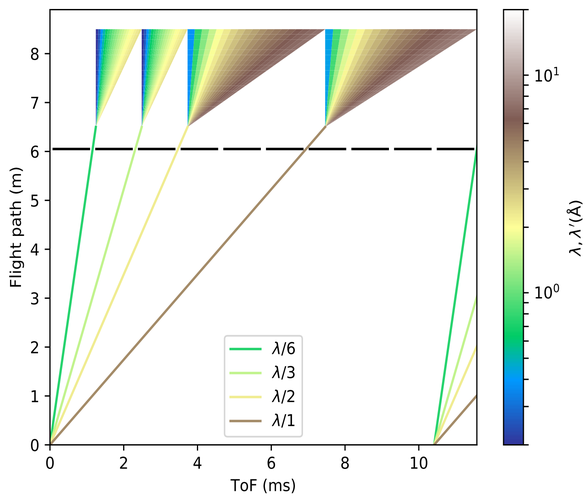
1: Source
2: Monochromator
3: Sample chopper



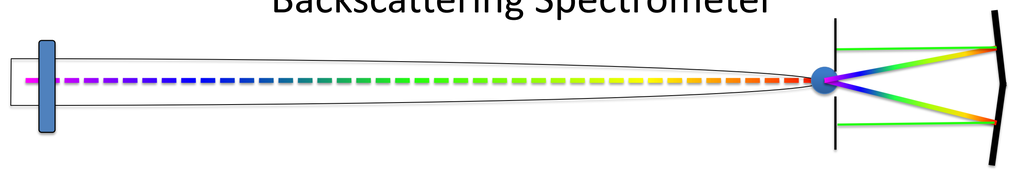
Optimize energy loss



Possible Multiplexing: $\frac{2d}{n}\sin\theta = \frac{h}{m_n}\frac{1}{L_c f_{src} m}$



Indirect geometry:
Backscattering Spectrometer



Design goals
Dynamic range $-150\mu\mathrm{eV} < \hbar\omega < 150\mu\mathrm{eV}$
Energy resolution $3\mu\mathrm{eV} < \Delta\hbar\omega < 20\mu\mathrm{eV}$
-> high repetition rate (96Hz) at distance ~ 70 m
-> Pulse shaping at distance ~ 2 m, pulse length ~ 50 µs for 2 µeV ΔE
Choice of analyzers:
Si_{111}
PG_{002} using FARO concept:
(R.Bewley , Rev. Mod. Inst **90**, 075106)
Pulse must be long enough to sweep time window over full dynamic range
Neutron pulse ~ 300 µs > Proton pulse = 208 µs

λ-time distribution for 96 Hz source, 208 µs proton pulse

Accepted λ-time distribution by Chopper @2m, providing ΔE =2 µeV at 70 m