The progress of CARR's neutron imaging facilities

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China Advanced Research Reactor (CARR)

Key Parameters

- 60 MW
- Max undisturbed thermal neutron flux ($n \cdot cm^{-2} \cdot s^{-1}$)
  - $1x10^{15}$ (at reactor core)
  - $8x10^{14}$ (at heavy-water reflector)
- 19.75 wt% U^{235} enrichment


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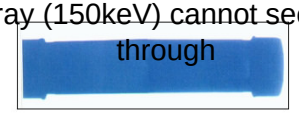
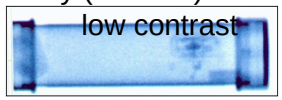
Some examples of neutron imaging applications

visible light sees only the

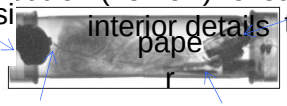
X-ray (150keV) cannot see through

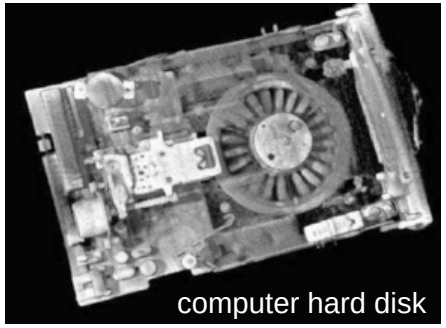


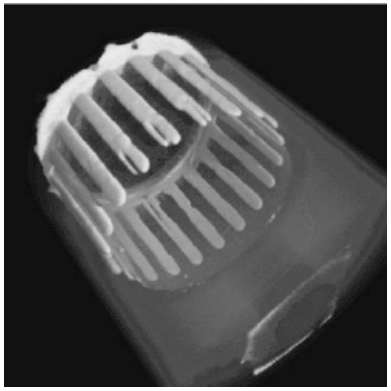
Gamma-ray (1.2MeV) shows too low contrast



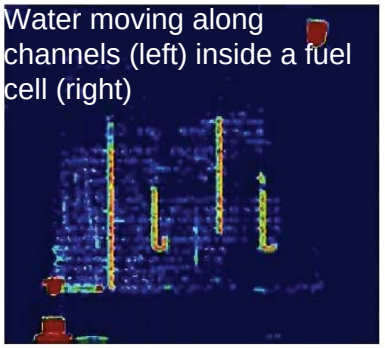
Neutron (25meV) reveals interior details

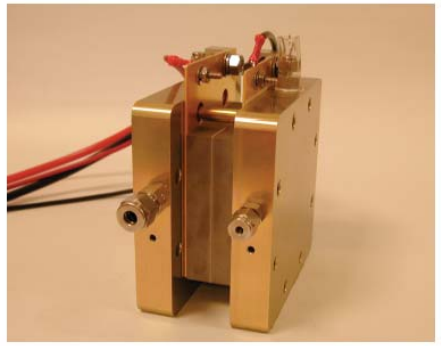




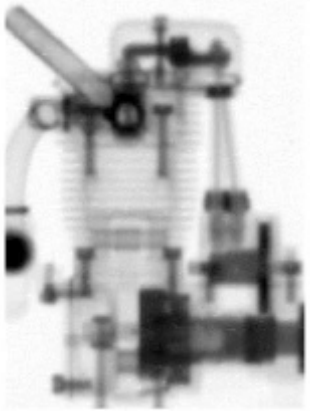


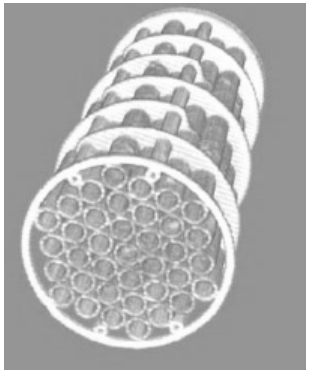
Neutron imaging reveals the rubber o-ring and adhesive inside metallic body





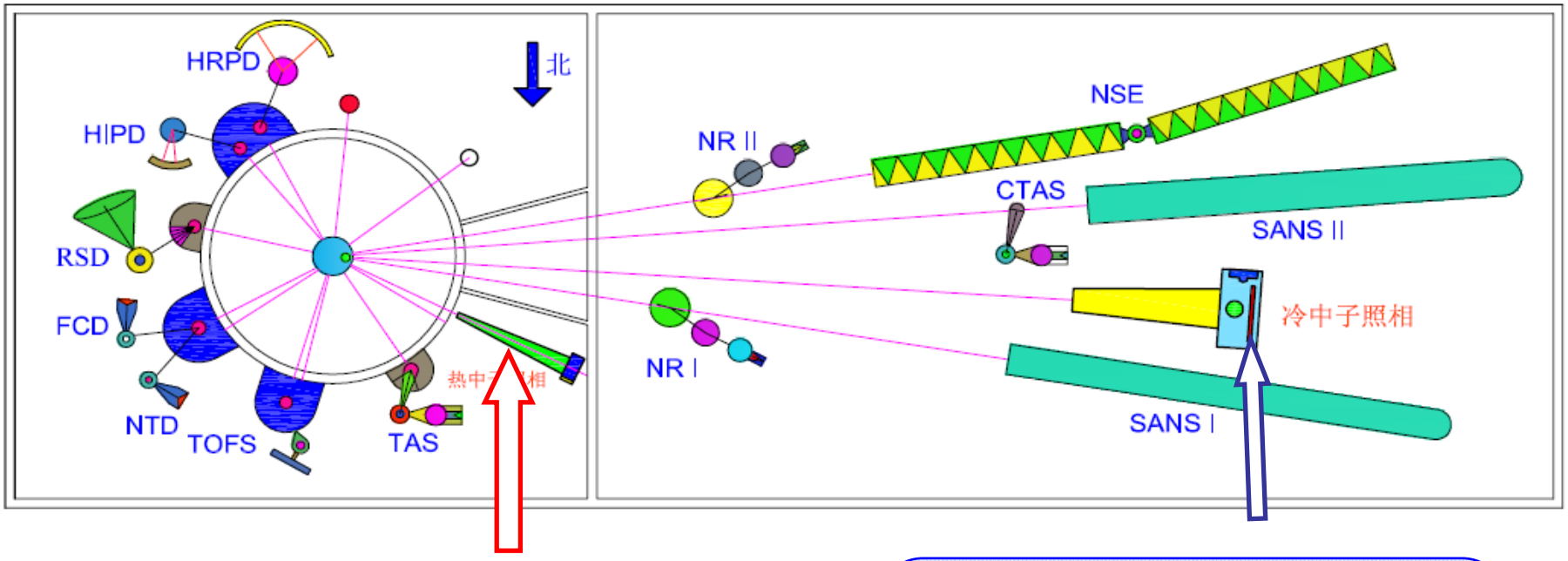
Neutron Tomography





interior heat conductor

Thermal and Cold Neutron Imaging Facility Location

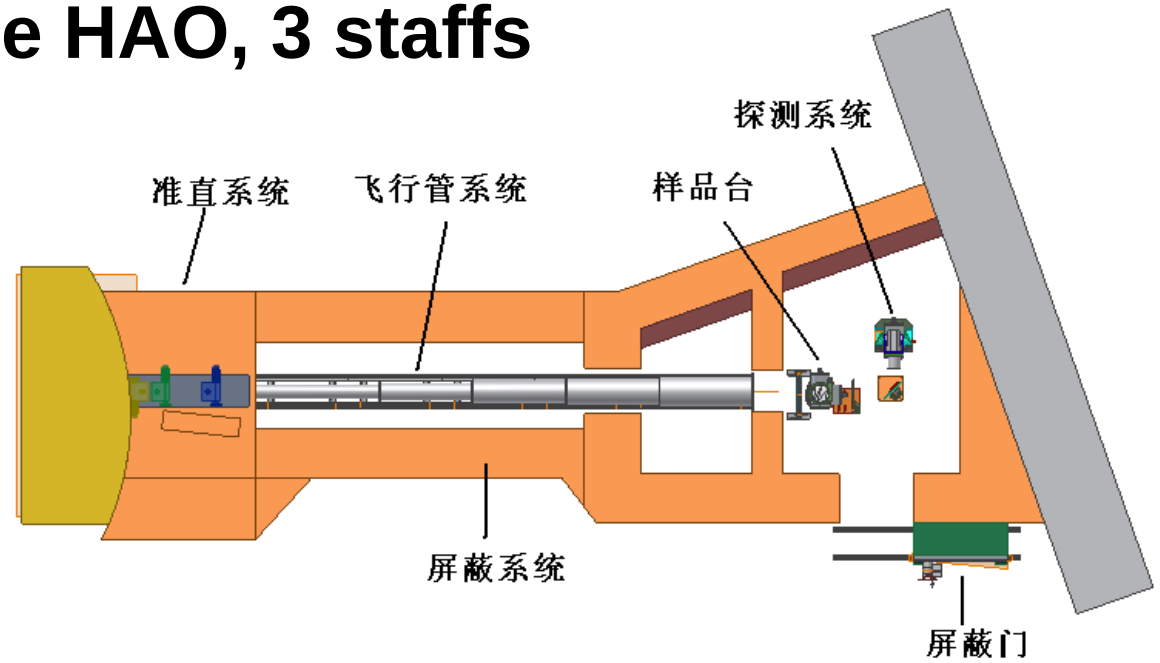


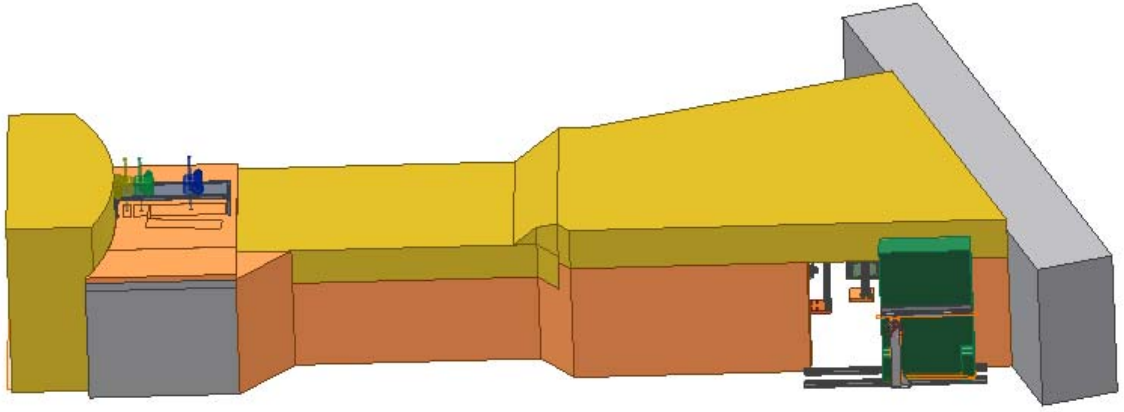
Thermal Neutron Imaging Facility

Cold Neutron Imaging Facility

Thermal Neutron Imaging Facility

Dr. Lijie HAO, 3 staffs





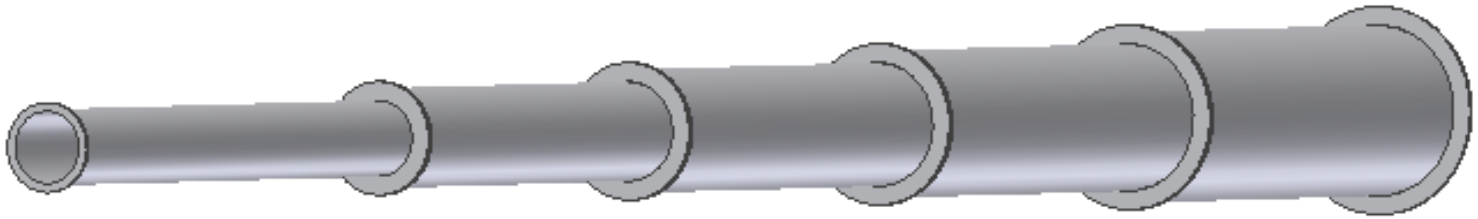
Design Parameters of Thermal Neutron Imaging Facility

- **CARR reactor: 60 MW**
- **Maximum of thermal neutron flux at sample :3xl0^{8}n cm^{-2}·s^{-1}**
- **Source-object distance: 10 m**
- **Measurement position (L): 3m, 6m, 9m**
- **L/D: 50～9000**
- **Cd-ratio : >100**
- **n/γ : >1.0×10^{6} n cm^{-2}·mR^{-1}**
- **Beam size at sample position : 250 mm x 250 mm**
- **Desired resolution :0.15mm,**

The parameters of Thermal Neutron Imaging Facility

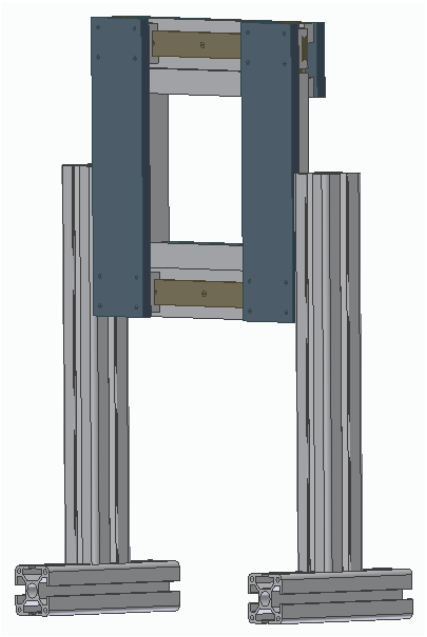
D （cm）	L (cm)	L/D	Neutron flux at sample （n cm-2·S-1）	Cd-ratio
6	900	150	2.3×10^{8}	>100
	600	100		
	300	50		
4	900	225	1.0×10^{8}	>100
	600	150		
	300	75		
2	900	450	2.5×10^{7}	>100
	600	300		
	300	150		
1	900	900	6.3×10^{6}	>100
	600	600		
	300	300		
0.1	900	9000	6.3×10^{4}	>100
	600	6000		
	300	3000		

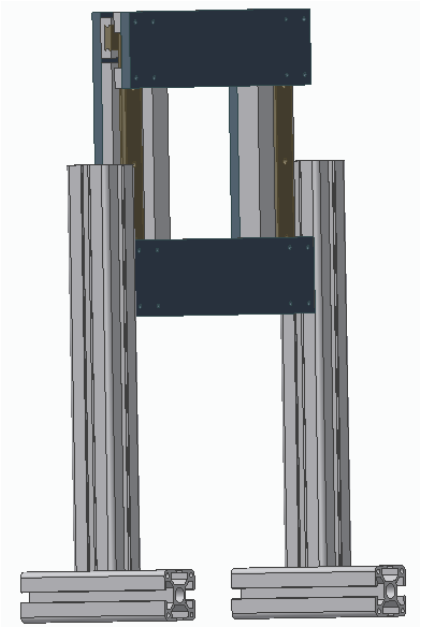
Flight Tube System



Beam Limiter

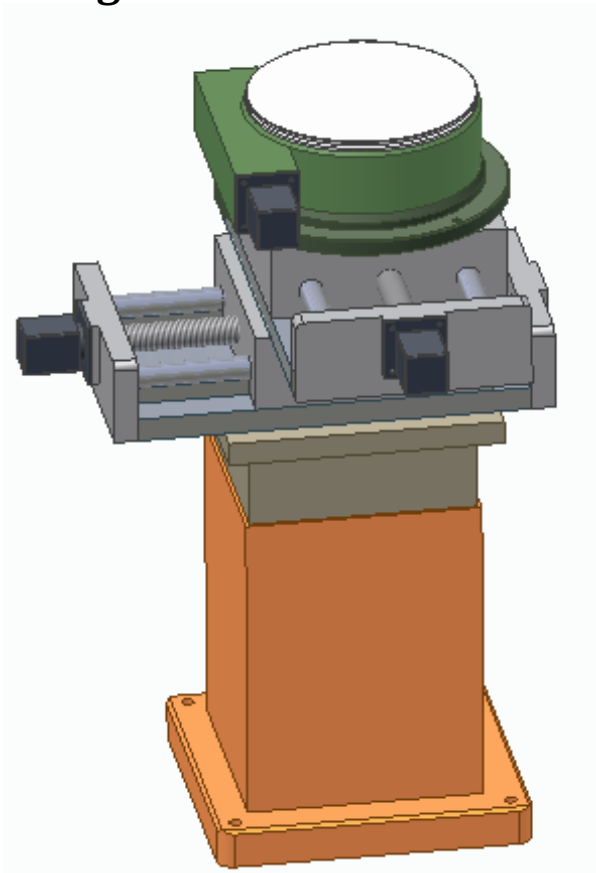
The beam limiter is installed at the end of the flight tube. It consists of four boral aluminum plates that can be driven independently into the neutron beam



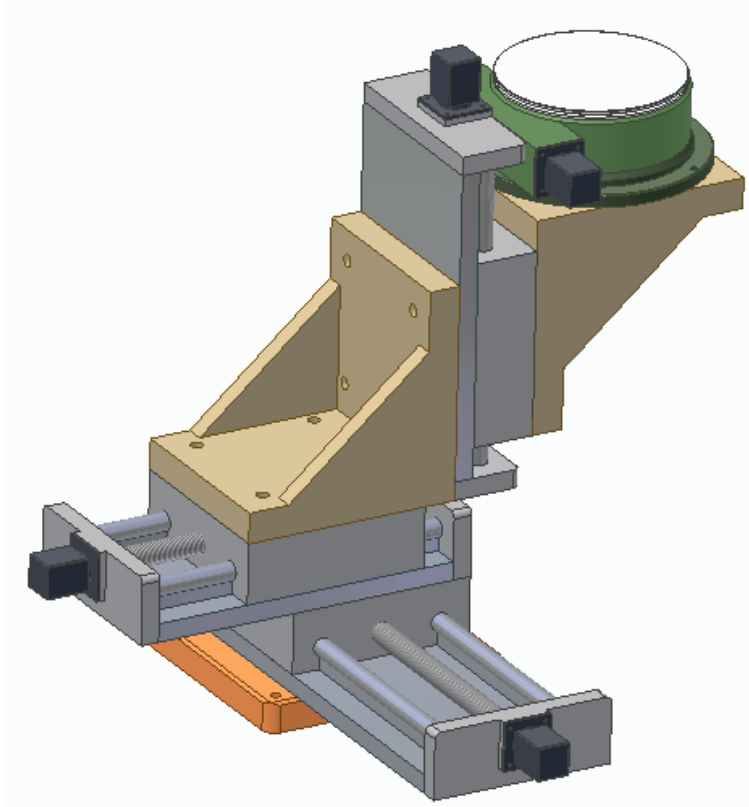


Sample tables

The large rotation table

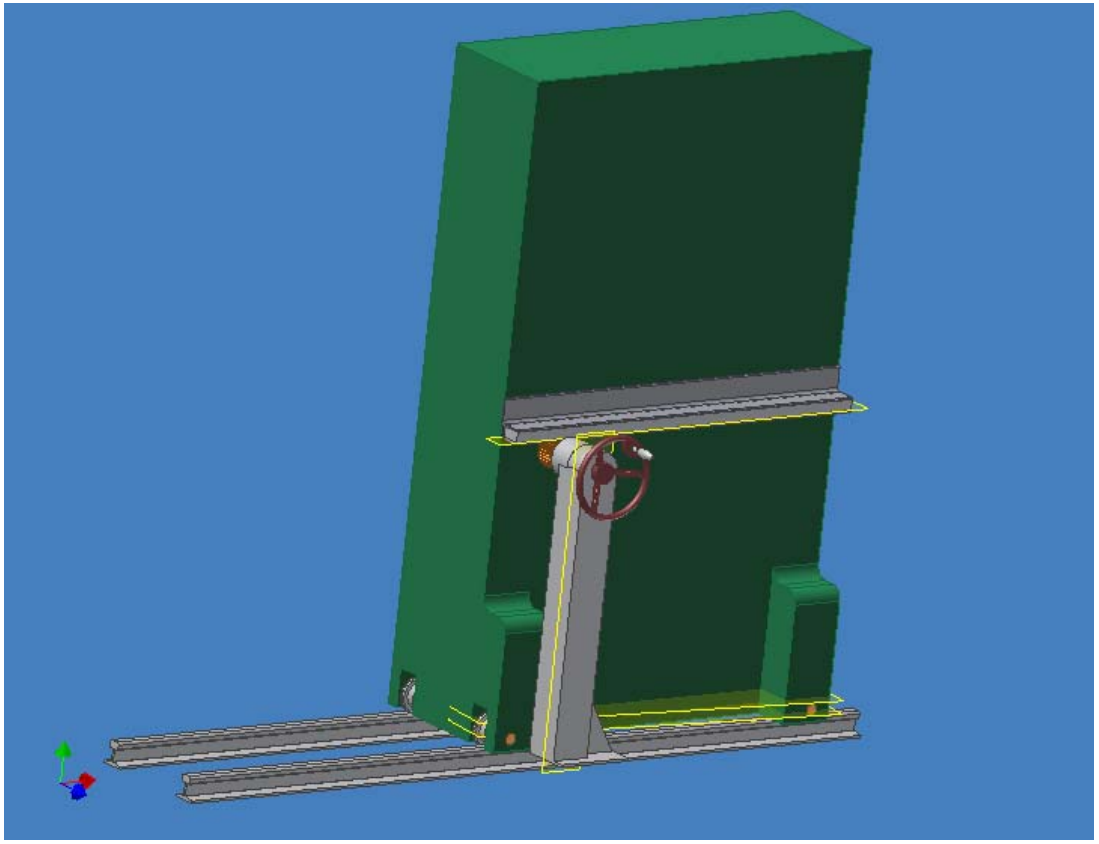


The small rotation table



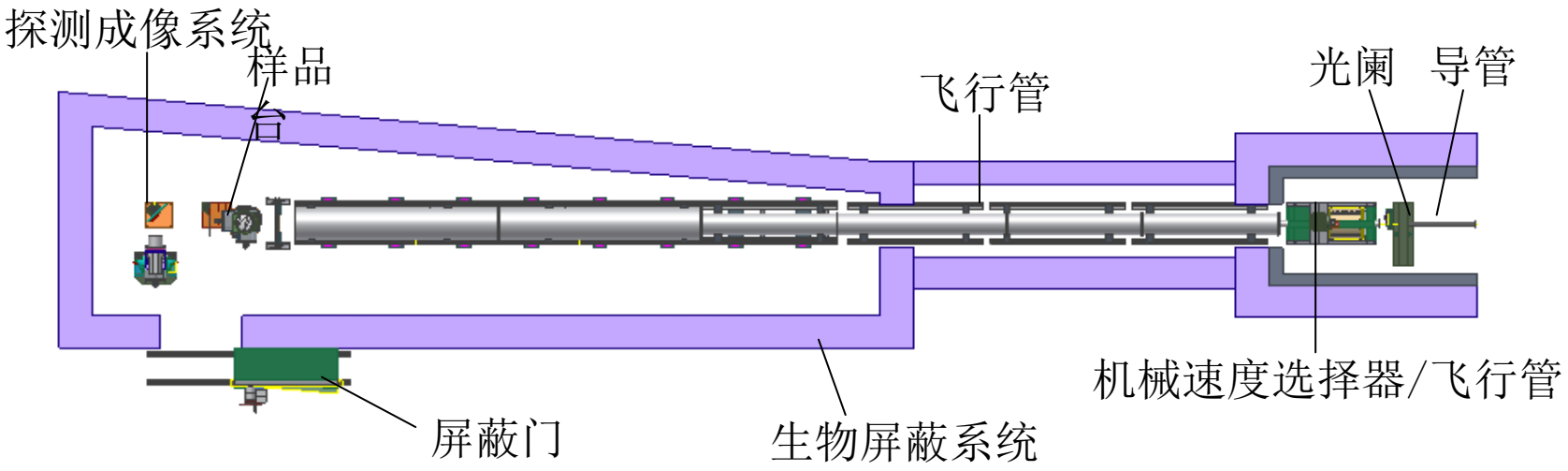
CCD Camera

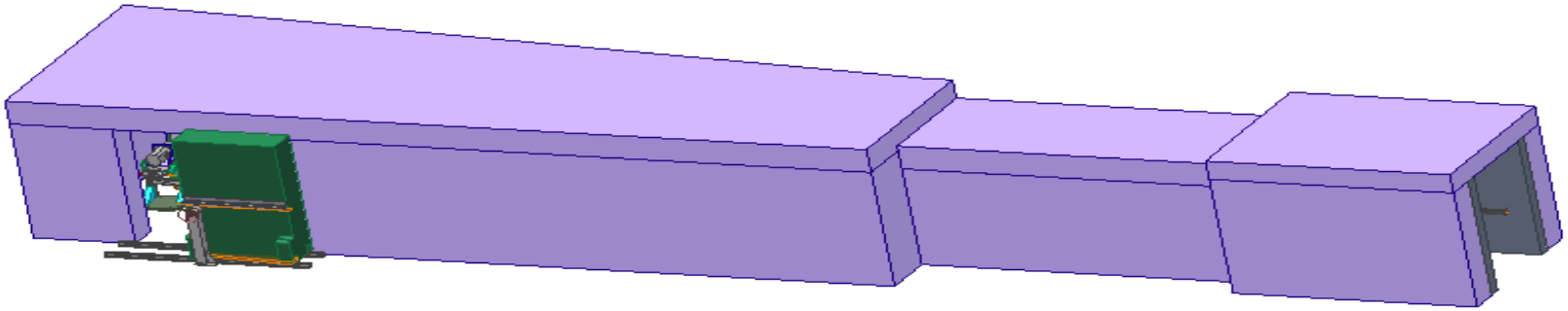
Shielding Gate



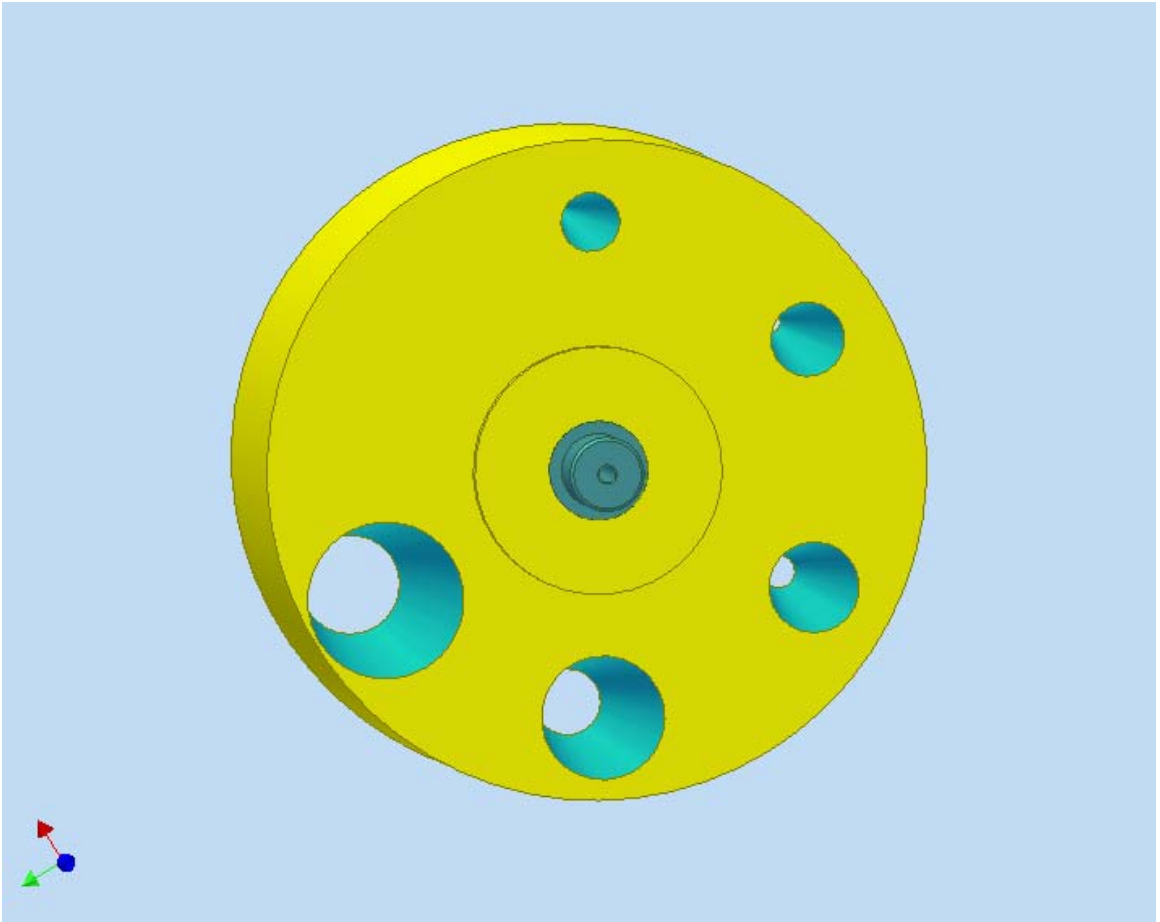
Cold Neutron Imaging Facility

Dr. Meimei WU, 3 staffs

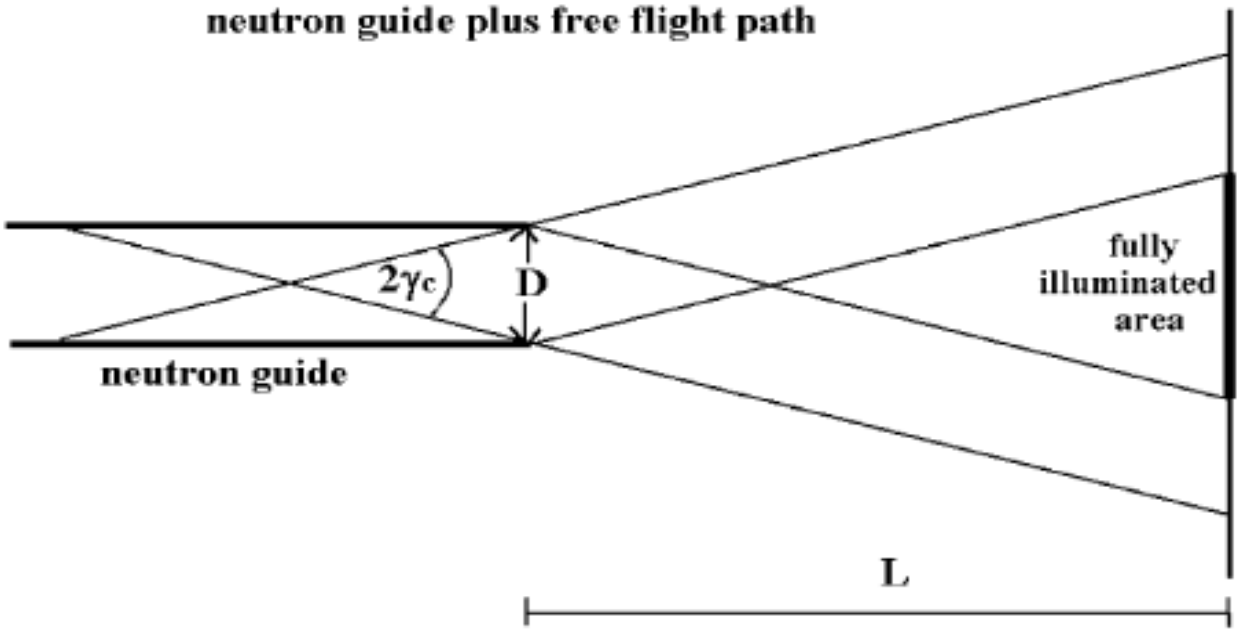


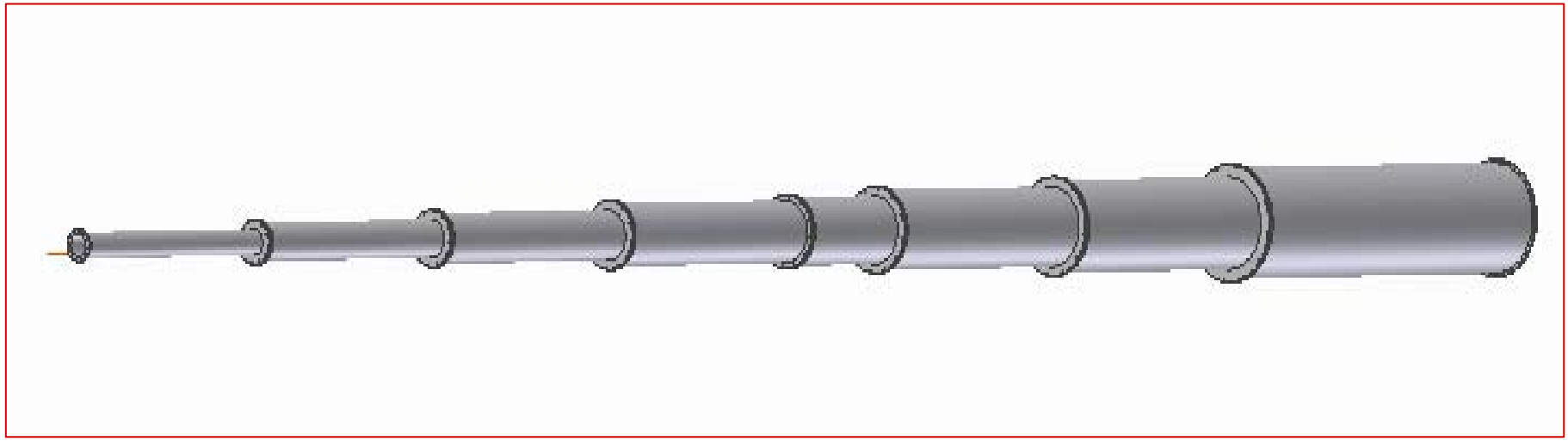


Diaphragm



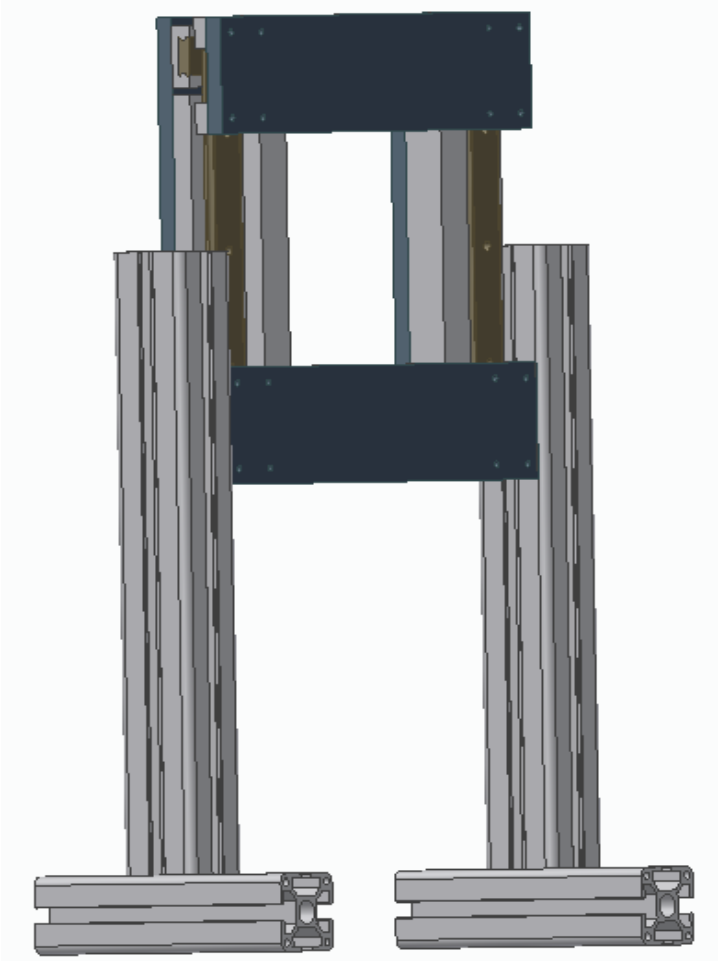
Flight tube


neutron guide plus free flight path
2γc
D
fully
illuminated
area
neutron guide
L



flight tube

Beam limiter



Build a tight cooperation in the near future!

Thank you for your attention !