

Status update of TRIUMFs UCN program and neutron electric dipole moment search

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UBC, UNBC, SFU, University of Winnipeg, University of Manitoba

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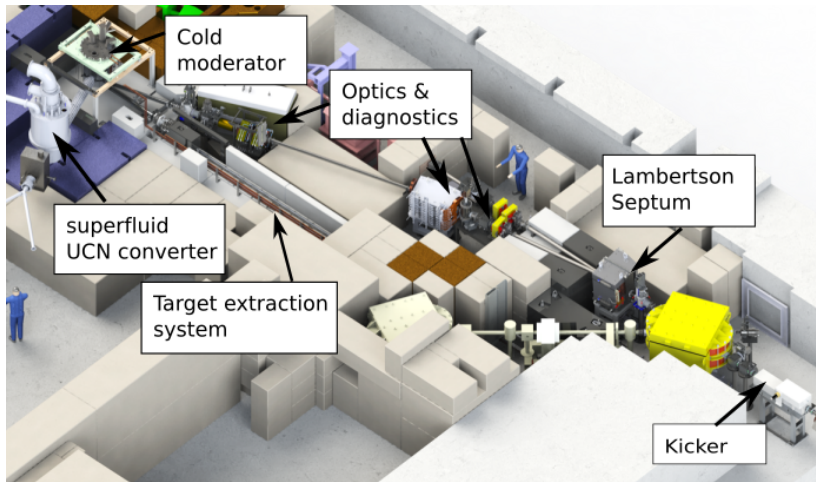
Overview in brief

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- Horizontal UCN converter cannot be installed now, rather 2019
- Spring 2017: install vertical UCN source & RCNP nEDM prototype
- Summer 2017: first UCN production on site and nEDM operation
- Funding application submitted for Next Generation nEDM apparatus, expected installment 2020, and upgrade of cold moderator from heavy ice to liquid Deuterium

Experimental site: Mesonhall



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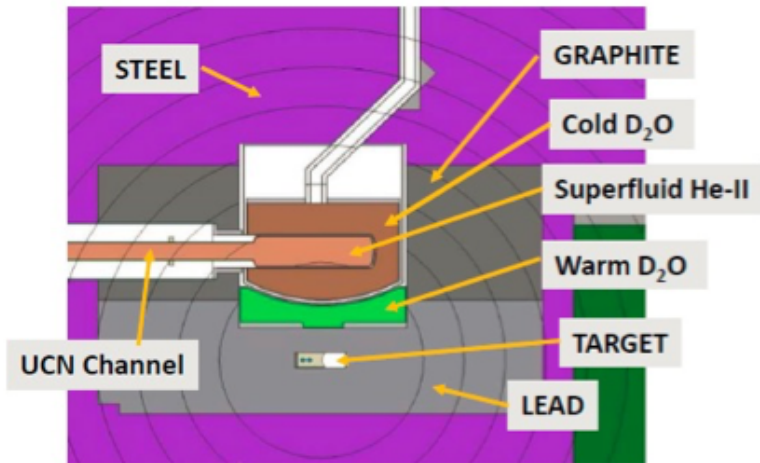
Beamline commissioning

- Start with $1\ \mu\text{A}$ of beam instead of $40\ \mu\text{A}$
- (Big difference between converter materials solid deuterium and superfluid helium used at TRIUMF:
UCN lifetime very different \Rightarrow deuterium short irradiation with high power, helium long irradiation with low power)
- Three stages:
 - Start with trickle beam of below $50\ \text{nA}$
 - Intermediate stage for optics and diagnostics elements,
 $< 200\ \text{nA}$
 - Operation with up to $1\ \mu\text{A}$, including neutron flux measurements

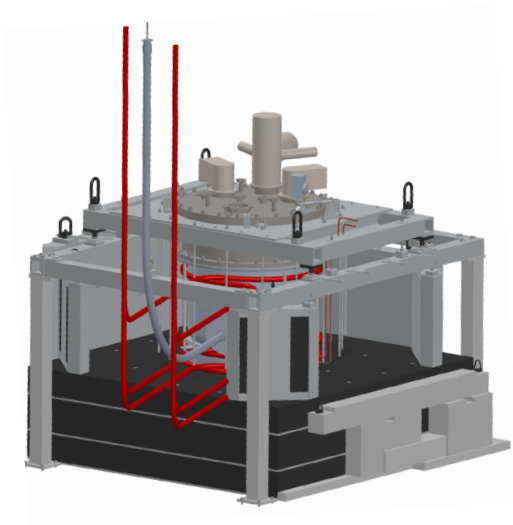
Thermal and cold neutron flux measurements

- Measure thermal flux via gold foil activation around moderator tank
- Measure cold neutron spectrum at converter position
- New technique: combination of activation in different materials (Au, Eu, Lu, Sc, Co) and apply unfolding methods
- Not all crosssections are known at sufficient precision \Rightarrow cold neutron beamtime application at JPARC

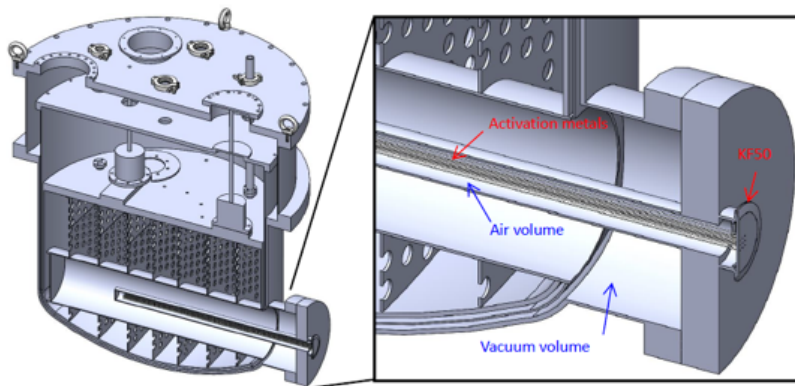
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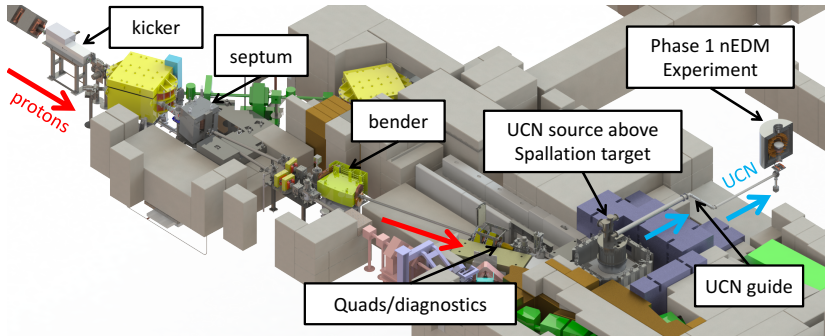
Plans for 2017

- Shutdown: remove cold moderator cryostat and install vertical UCN source
- Install RCNP prototype nEDM apparatus
- Prove UCN operation at TRIUMF by storing UCN
- Observe UCN precession via Ramsey method

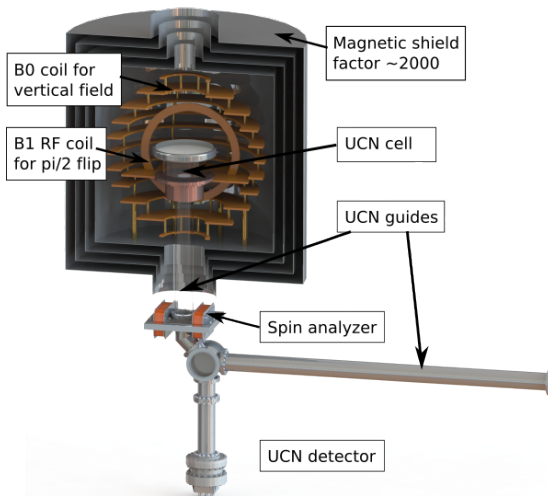
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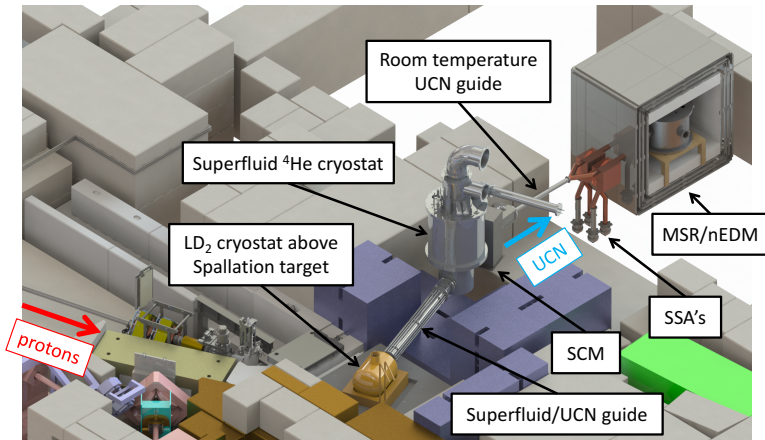
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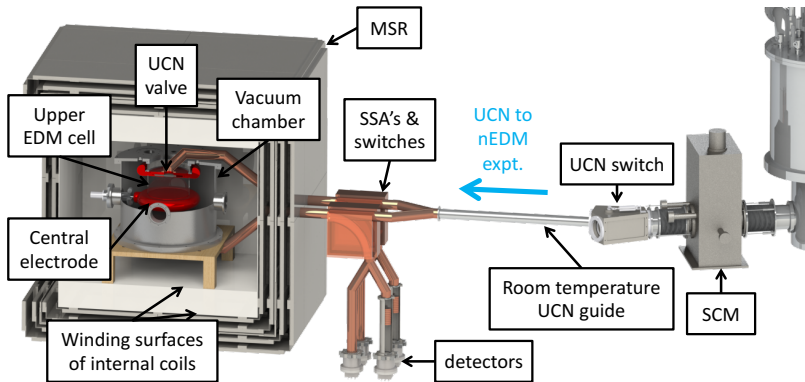
Plans for 2017



"Phase 2" nEDM apparatus \Rightarrow 2020



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Goals of TRIUMFs UCN program

- Operate world's strongest intensity UCN source
 - Milestone: first UCN production on-site in Summer 2017
 - Store them inside RCNP nEDM apparatus, apply Ramsey method of separated oscillatory fields
- Measure (or limit) nEDM to a precision of 10^{-27} ecm
- Establish UCN user facility with a second port & and attract international scientific community

Please have a look at Nick Christopher's poster about nEDM simulations (TRIUMF summer student)
Looking for a Bachelor's, Master's, PhD, or postdoc position in beautiful Vancouver? Let me know

Thank you for your attention!