

Eastern Health – Newfoundland & Labrador Centre for Molecular Imaging and Research

Date form last updated: 2016 May 30

Completed by: Julio Panama, Cyclotron Engineer

1. Cyclotron Facility – Contact info

Institute (name/address):	Eastern Health – Newfoundland & Labrador Centre for Molecular Imaging and Research 300 Prince Phillip Drive, St. John's, NL A1B3V6
Institution URL:	www.easternhealth.ca
Person in charge (name/ph#/email):	Dr. Douglas Abrams doug.abrams@easternhealth.ca
Position/title:	Manager Cyclotron/Pharmacy/QA
Cyclotron manager/engineer (name/ph#/email)	Julio Panama julio.panama@easternhealth.ca
QA manager (name/ph#/email)	TBD
QC manager	TBD
Other senior staff (titles/name/ph#/email):	Dr. Bassem Elshahat bassemelshahat@hotmail.com Dr. Edward Kendall Edward.kendall@mun.ca Dr. Jeffery Flemming Jeffery.flemming@easternhealth.ca

2. Cyclotron characteristics

Cyclotron manufacturer/model	IBA Cyclone HC 18/18
Cyclotron installation date (Year):	2016
Dual beam?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes
Any upgrades?	<input type="checkbox"/> No <input type="checkbox"/> Yes, Describe:
Particles:	<input checked="" type="checkbox"/> ¹ H <input type="checkbox"/> ² H <input type="checkbox"/> ³ He <input type="checkbox"/> ⁴ He
Particle energy, or range (MeV):	<u>18</u> ¹ H <u> </u> ² H <u> </u> ³ He <u> </u> ⁴ He
Max particle current (uA):	<u>150</u> ¹ H <u> </u> ² H <u> </u> ³ He <u> </u> ⁴ He
Typical particle current (uA):	<u> </u> ¹ H <u> </u> ² H <u> </u> ³ He <u> </u> ⁴ He

3. Cyclotron Operation Prefer not to answer

Planned operating days per week:	<input checked="" type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input checked="" type="checkbox"/> 4 <input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7
Number of planned maintenance days/month:	TBD
Number of planned shutdown weeks per year:	TBD
Total operating hours (h)/week:	TBD
h/week for radionuclide production:	
h/week for research:	
h/week for maintenance:	
h/week for applications:	

4. Is the cyclotron used to produce Prefer not to answer

Calibration sources? (specify which & quantity)	<input type="checkbox"/> No <input type="checkbox"/> Yes
Mossbauer sources? (specify which & quantity)	<input type="checkbox"/> No <input type="checkbox"/> Yes
X-ray sources? (specify which & quantity)	<input type="checkbox"/> No <input type="checkbox"/> Yes
Intense neutron beam? (specify average $E_n = ?$)	<input type="checkbox"/> No <input type="checkbox"/> Yes

5. Application questions Prefer not to answer

Are pre-clinical studies using cyclotron radiopharmaceuticals carried out on-site?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, types of radiotracers and name(s) and email(s) of PIs): Dr. Edward Kendall edward.kendall@mun.ca Dr. Bassem Elshahat bassemelshahat@hotmail.com
Are clinical studies using cyclotron radiopharmaceuticals carried out on-site?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, types of radiotracers and name(s) and email(s) of PIs): Dr. Jeffery Flemming Jeffery.flemming@easternhealth.ca
Are cyclotron radionuclides/labelled compounds used or planned to be used for agricultural applications such as plant biochemistry/research?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, types of radiotracers and name(s) and email(s) of PIs):
Is the cyclotron used for nuclear reaction cross-section measurements?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for targetry development?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, types of isotopes, and name(s) and email(s) of PIs):
Is the cyclotron used for materials science?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for radiography?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for radiobiology?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for physics research?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for activation analysis?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for proton therapy?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Is the cyclotron used for neutron therapy?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):
Other (specify)	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):

6. Types of imaging equipment N/A, Prefer not to answer

Single photon (specify if gamma camera, SPECT, or SPECT-CT):	
Number of clinical scanners:	6
Number of pre-clinical scanners:	1 (anticipated 2017)
Number of plant biochemistry scanners:	
PET (specify if PET, PET/CT, or PET/MR):	
Number of clinical scanners:	1
Number of pre-clinical scanners:	2 (anticipated 2017)
Number of plant biochemistry scanners:	

7. Do you supply radionuclide(s), radiotracer(s), or radiopharmaceutical(s) to other institutions? (No/ Yes/ Prefer not to answer). If yes, and if available, please provide the name of product, institution, and supply frequency:

Product	Institution	Frequency

8. Cyclotron/radionuclide/radiochemistry/radiopharmacy training

Is the cyclotron used for education and training in nuclear sciences, health physics, etc?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, name(s) and email(s) of PIs): Dr. Douglas Abrams doug.abrams@easternhealth.ca
Does your institute participate in trainee exchange (for production):	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, name(s) and email(s) of PIs): Dr. Douglas Abrams doug.abrams@easternhealth.ca
Does your institute participate in trainee exchange (for research):	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, name(s) and email(s) of PIs): Dr. Douglas Abrams doug.abrams@easternhealth.ca
Does your institute accept IAEA research fellows for training/experience:	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if available, name(s) and email(s) of PIs): Dr. Douglas Abrams doug.abrams@easternhealth.ca
Other training opportunities (specify):	<input type="checkbox"/> No <input type="checkbox"/> Yes (if available, name(s) and email(s) of PIs):

9. Radionuclide production – ^{18}F (F) N/A, Prefer not to answer

Reaction	<input type="checkbox"/> $^{18}\text{O}(\text{p},\text{n})^{18}\text{F}$; <input type="checkbox"/> $^{16}\text{O}(\text{}^3\text{He},\text{p})^{18}\text{F}$; <input type="checkbox"/> $^{20}\text{Ne}(\text{d},\gamma)^{18}\text{F}$; <input type="checkbox"/> $^{16}\text{O}(\alpha,\text{d})^{18}\text{F}$
Typical current (μA):	
Typical energy (MeV):	
Typical yield (GBq):	
Typical target pressure (psi):	

Is target He cooled?	<input type="checkbox"/> No <input type="checkbox"/> Yes
Typical beam time (min):	
Typical Y_{sat} if known (GBq/ μA)	
% Isotopic enrichment ^{18}O	
^{18}O supplier(s)	
Target volume [^{18}O]H ₂ O (mL)	
Usage per year [^{18}O]H ₂ O (mL)	
Do you recycle [^{18}O]H ₂ O?	<input type="checkbox"/> No <input type="checkbox"/> Yes (if “yes”, <input type="checkbox"/> in-house <input type="checkbox"/> return to supplier)

10. Radionuclide production – ^{11}C ($[^{11}\text{C}]\text{CH}_4$) N/A, Prefer not to answer

Typical current (μA):	
Typical energy (MeV):	
Typical yield (GBq):	
Typical target pressure (psi):	
Typical beam time (min):	
Typical Y_{sat} if known (GBq/ μA):	
Gas mixture:	
Target volume:	
$[^{11}\text{C}]\text{CH}_3\text{I}$ production ASU model:	
Typical yield (GBq):	
Typical yield (% d.c.):	

11. Radionuclide production – ^{11}C ($[^{11}\text{C}]\text{CO}_2$) N/A, Prefer not to answer

Typical current (μA):	
Typical energy (MeV):	
Typical yield (GBq):	
Typical target pressure (psi):	
Typical beam time (min):	
Typical Y_{sat} if known (GBq/ μA):	
Gas mixture:	
Target volume:	
$[^{11}\text{C}]\text{CH}_3\text{I}$ production ASU model:	
Typical yield (GBq):	
Typical yield (% d.c.):	

12. Other radionuclides produced N/A, Prefer not to answer

Product	Yield on batch (GBq)	Irradiation parameters (MeV/ $\mu\text{A}/\text{min}$)	Typical target mass/material	Extraction method	Used on site?	Distribution/sales?
^{13}N					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
^{15}O					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
$^{18}\text{F}\text{-F}_2$					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes

⁴⁴ Sc					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
⁶⁴ Cu					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
⁶⁷ Ga					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
⁸⁶ Y					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
⁸⁹ Zr					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
^{94m} Tc					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
^{99m} Tc					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
¹⁰³ Pd					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
¹¹¹ In					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
¹²³ I					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
¹²⁴ I					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
²⁰¹ Tl					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
²¹¹ At					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
Other:					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
					<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes

13. Radiopharmaceutical production – ¹⁸F(FDG) N/A, Prefer not to answer

Production frequency (batches/week)	
Used on site	<input type="checkbox"/> No <input type="checkbox"/> Yes
Distribution/sales	<input type="checkbox"/> No <input type="checkbox"/> Yes
ASU model	
Typical yield (GBq):	
Typical yield (% , decay corrected):	_____ <input type="checkbox"/> pre/post dose-cal; or <input type="checkbox"/> indirectly via ASU
ASU model	<input type="checkbox"/> N/A
Typical yield (GBq):	
Typical yield (% , decay corrected):	_____ <input type="checkbox"/> pre/post dose-cal; or <input type="checkbox"/> indirectly via ASU
ASU model	<input type="checkbox"/> N/A
Typical yield (GBq):	
Typical yield (% , decay corrected):	_____ <input type="checkbox"/> pre/post dose-cal; or <input type="checkbox"/> indirectly via ASU

14. Radiopharmaceutical production – Other Products (please copy table for as many products as desired)

N/A, Prefer not to answer

Product:	
Production frequency (batches/week)	
Stage:	<input type="checkbox"/> R&D <input type="checkbox"/> Pre-clinical <input type="checkbox"/> Clinical
Used on site	<input type="checkbox"/> No <input type="checkbox"/> Yes
Distribution/sales	<input type="checkbox"/> No <input type="checkbox"/> Yes
ASU model	

Typical yield (GBq):	
Typical yield (% , decay corrected):	_____ <input type="checkbox"/> pre/post dose-cal; or <input type="checkbox"/> indirectly via ASU
ASU model	<input type="checkbox"/> N/A
Typical yield (GBq):	
Typical yield (% , decay corrected):	_____ <input type="checkbox"/> pre/post dose-cal; or <input type="checkbox"/> indirectly via ASU

15. Radionuclides and radiopharmaceuticals planned to be produced in the next 1-3 years (specify)

N/A, Prefer not to answer

Product:	Application:
F18	
C11	
N13	
I123	
I124	
Ga68	
Tc99m	

16. Additional comments: N/A

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