

# MultiSyn

compact multi-synthesis radiosynthesizer



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TECHNOLOGIES

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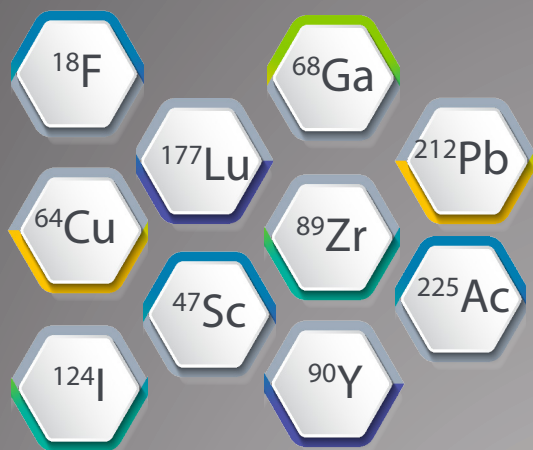


The MultiSyn is an affordable multi-purpose, multi-chemistry compact disposable cassette radiosynthesizer



# Multi-Isotope

One synthesizer for all your radiochemistry needs



Standardize and simplify your labs radiochemistry requirements with one versatile synthesizer.

By simply changing the hardware cassette, you can easily switch to another radiosynthesis without any cross-contamination.

## Typical Synthesis

The MultiSyn can perform the following synthetic steps, or you can setup your own by simply modifying the non-proprietary hardware cassette and graphically generating a new synthesis recipe method using our open software interface.

### Step 1A

Elution of the isotope to the MultiSyn

### Step 2 (optional)

With or without pre-purification of the eluted / delivered isotope

### Step 3

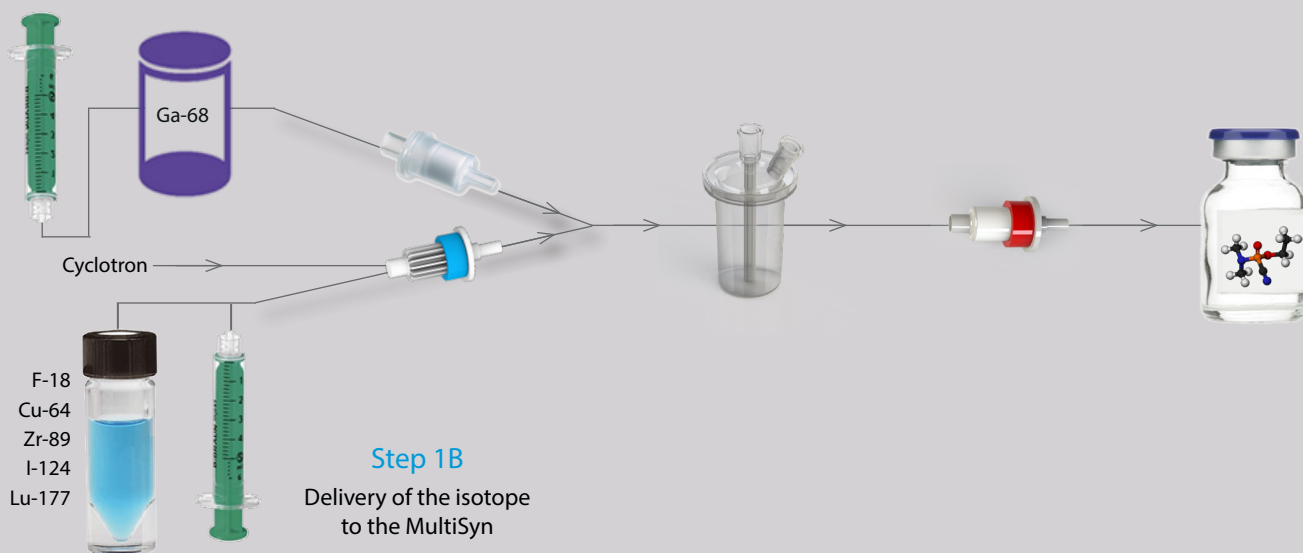
Labelling reaction

### Step 4

S.P.E. purification and reformulation of the labelled product

### Step 5

Final Injectable Radiotracer



# Low cost Disposable Cassette & Reagents

## Disposable Cassettes

The sterile disposable synthesis cassette and reagent set helps avoid cross-contamination and ensures reproducible results.

This enables you to effortlessly meet the most stringent quality control GMP compliance standards.

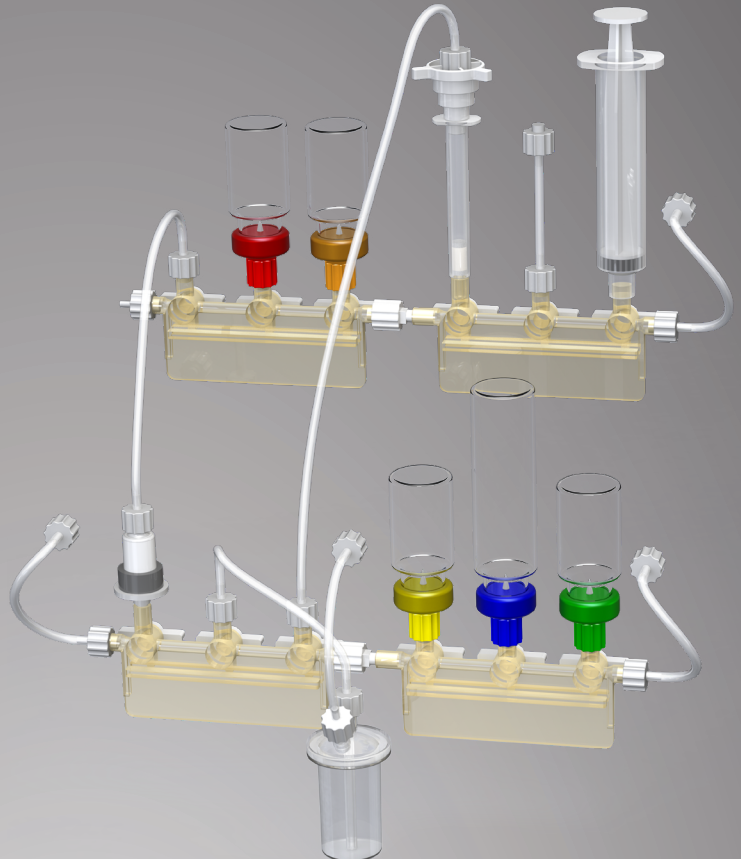
By using non-proprietary components, the user can modify and develop their own cassettes.

Low metal contaminant materials are used throughout the cassette and reagents.

Manufactured in Australian GMP clean rooms and gamma sterilized.

Hardware cassettes are purchased from iPHASE technologies.

Significantly lower your labs consumables costs.



## Reagent Sets

Reagent sets purchased from iPHASE technologies manufactured by Huyai or ABX.

Each batch of reagents comes with Certificate of Analysis.



# Optimized synthesis recipes

$^{68}\text{Ga}$ PSMA 81%	$^{68}\text{Ga}$ DOTATATE 75%	$^{68}\text{Ga}$ FAPI 66%	$^{177}\text{Lu}$ PSMA >95%	$^{177}\text{Lu}$ DOTATATE >95%	$^{89}\text{Zr}$ Durvalumab 75%	$^{89}\text{Zr}$ Cremirimilab Berdoxam 76%	$^{64}, ^{67}\text{Cu}$ SARTATE 65%
$^{18}\text{F}$ FDG 72%	$^{18}\text{F}$ NaF 96%	$^{18}\text{F}$ PSMA 60%	$^{18}\text{F}$ FAPI 25%	$^{161}\text{Tb}$ PSMA-I&T >95%	$^{225}\text{Ac}$ PSMA-I&T >95%	$^{225}\text{Ac}$ HA-DOTATATE >95%	$^{124}\text{I}$ Peptide 65%

Uncorrected radiochemical yield

Need a compound that is not listed? Contact our team and we can explore the development of custom cassettes and reagent sets.

## Routine production of $^{18}\text{F}$ compounds



Setup for  $^{18}\text{F}$ -FDG radiolabelling

### $^{18}\text{F}$ compounds

The MultiSyn can be used for an ever growing number of  $^{18}\text{F}$  compounds that do not require HPLC purification.

### $^{18}\text{F}$ -FDG

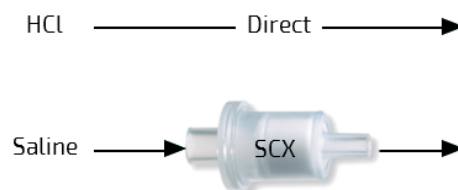
The MultiSyn is also ideal for the low cost radiosynthesis of  $^{18}\text{F}$ -FDG.

Cassette has been currently tested with up to 480 GBq (13 Ci) of starting  $^{18}\text{F}$  resulting in a 66% uncorrected radiochemical yield.



# Compatible with all $^{68}\text{Ga}$ generators

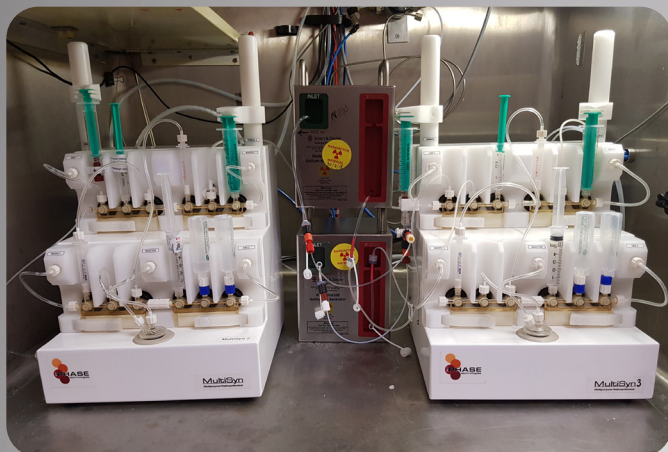
The MultiSyn is compatible with all  $^{68}\text{Ga}$  generators. It has a built-in force limiting syringe drive for either direct generator elution or pre-purification of the generators eluate.



## Direct Elution

The simplest  $^{68}\text{Ga}$  synthesis method involves direct labelling of the generators eluate.

This method reduces synthesis time and simplifies system setup.



## Pre-purification

Certain compounds and generators require reduction of the acid concentration of the generator eluate and/or purification of metal impurities from the generators eluate to improve labelling yields.

This is easily accomplished with generator pre-purification and involves trapping the generator eluate onto a purification cartridge and subsequent elution to the reactor with a >99% trap and release efficiency of  $^{68}\text{Ga}$ .



## Multiple Generator Elution

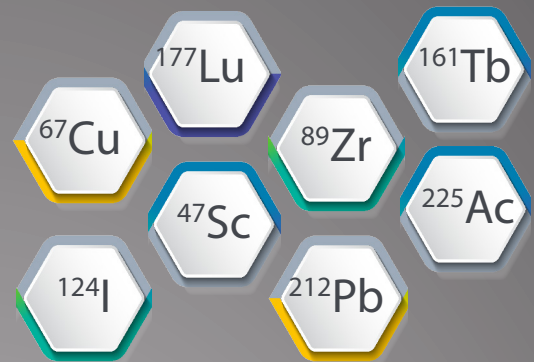
The MultiSyn can be used to elute multiple generators to increase final radiotracer activity.

The process is automated. No need to rotate any taps manually

# Theranostic capabilities



Setup for  $^{177}\text{Lu}$ -PSMA &  $^{177}\text{Lu}$ -DOTATATE radiolabelling.



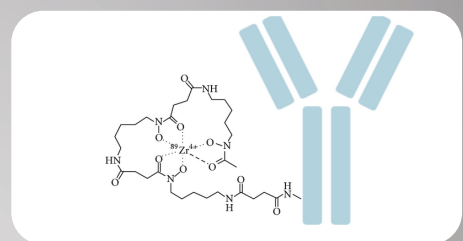
## Theranostics

The MultiSyn enables the radiochemist to easily synthesize theranostic compounds using isotopes such as  $^{177}\text{Lu}$ ,  $^{225}\text{Ac}$ ,  $^{161}\text{Tb}$ ,  $^{124}\text{I}$ ,  $^{212}\text{Pb}$  &  $^{64,67}\text{Cu}$ .

## Zirconium-89 Monoclonal antibody radiolabelling



Setup for  $^{89}\text{Zr}$  radiolabelling.



## $^{89}\text{Zr}$ Antibody Labelling

Fully automate  $^{89}\text{Zr}$  monoclonal antibody radiolabelling using the MultiSyn. Typical fully automated synthesis process involves:

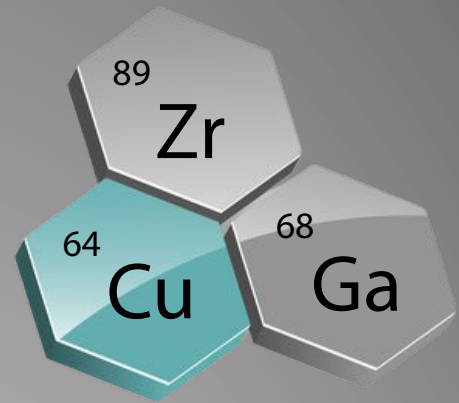
1. Automated cartridge conditioning.
2.  $^{89}\text{Zr}$  Neutralization.
3. Radiolabelling.
4. Purification using PD-10 cartridge.



# Solid Target Dissolution & Purification

The MultiSyn solid target dissolution expansion module enables the MultiSyn to:

Be a complete system for the closed-circuit dissolution of coin based solid targets ( $^{64}\text{Cu}$ ,  $^{89}\text{Zr}$  &  $^{68}\text{Ga}$ ) and purification of the dissolved isotope on the MultiSyn's disposable cassette



## Coin based Solid Target Dissolution & Purification Process:

### Target Dissolution:

1. MultiSyn pressure tests expansion module's fluidic circuit.
2. MultiSyn transfers reagents to expansion module.
3. Drop irradiated coin (24mm dia) into funnel
4. Clamp coin to seal target face
5. Peristaltic pump circulates heated acid to dissolve target

### Target Purification:

6. MultiSyn transfers dissolved target from Expansion Module
7. Cartridge purification of dissolved target on MultiSyn's disposable cassette



MultiSyn Solid Target Dissolution Expansion Module





Setup for dissolution & purification of  $^{64}\text{Cu}$

## Location for Expansion module:

The expansion module is located next to the MultiSyn in the same hotcell. This setup requires a transport system for the irradiated coin to the hotcell.

or

The expansion module is located underneath solid target in the cyclotron bunker for direct dropping of coin into expansion module's receiving funnel. This setup does not require a transport system and only one 1/16" tube connection between the purification MultiSyn and Expansion Module is required.



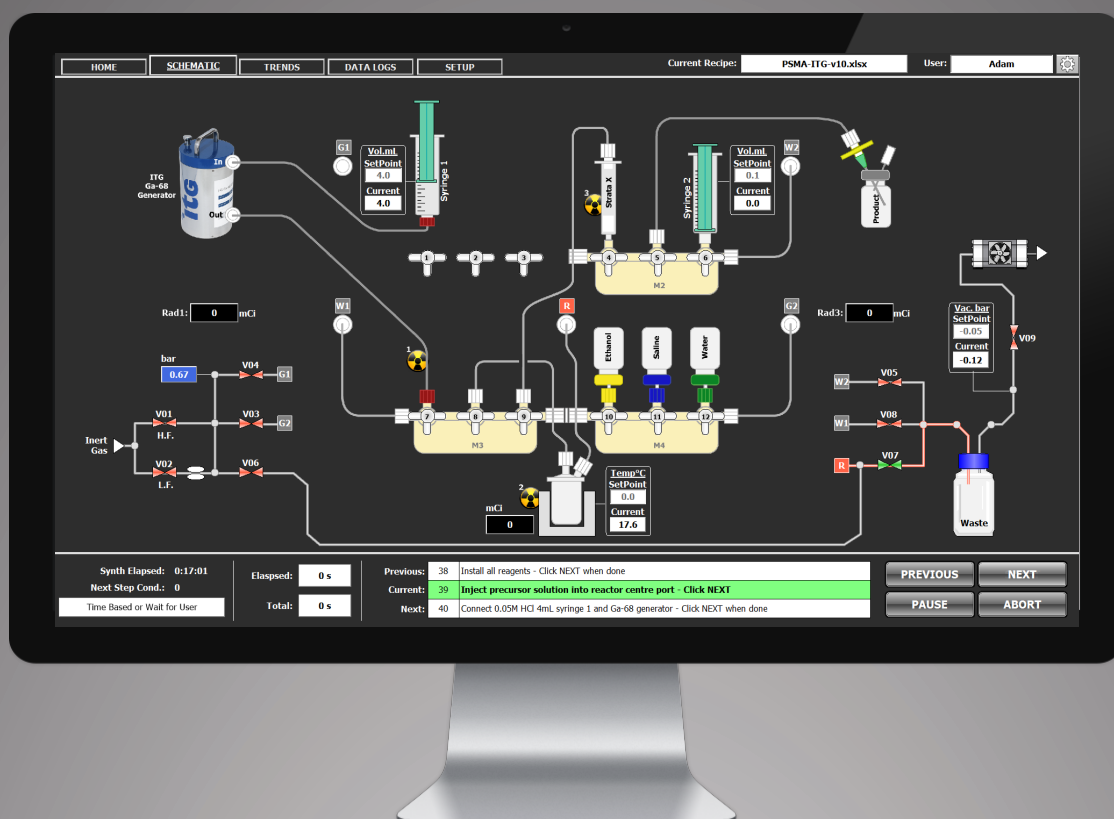
## Radiation detector monitoring:

1 x Radiation Detector located in the Expansion Module to monitor dissolved solution radioactivity.

3 x Radiation Detectors in the MultiSyn for purification process monitoring.

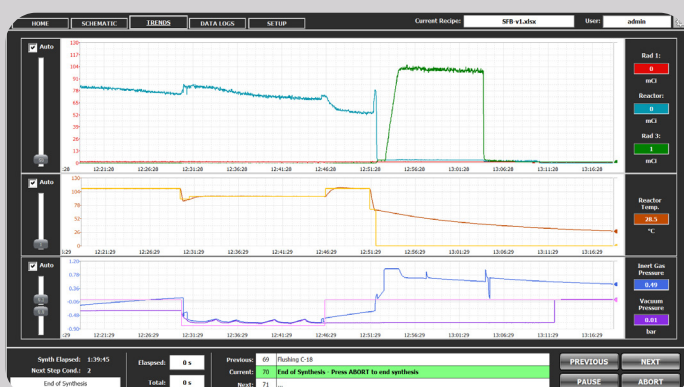
# Open User Interface

System control & visual synthesis recipe development all in one platform



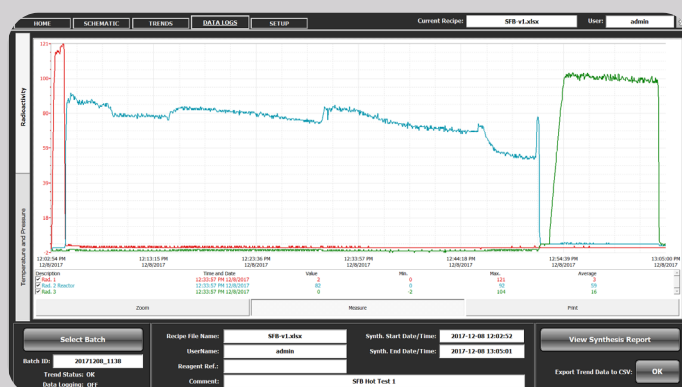
- ✓ Easy to use open software interface for easy tracer development
- ✓ Guides you step-by-step during the synthesis
- ✓ Can be installed on multiple computers for remote synthesis development

- ✓ Recording of all process variables and report generation (21 CFR Part 11 & GMP compliant)
- ✓ Traditional PC or Touch Screen Tablet Control
- ✓ Built-in remote diagnostics enabling simplified troubleshooting



Real-Time Sensor Trends

All sensor information can be displayed graphically in real-time trends.



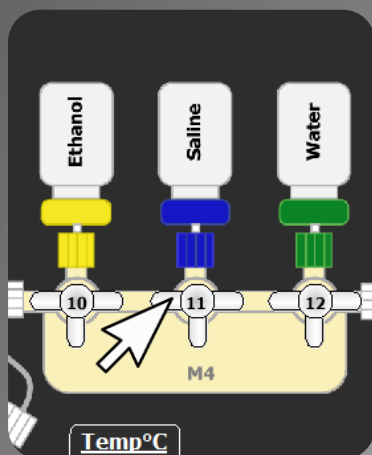
Historical Data Review

Review previous synthesis results as trend graphs with data analysis functions.



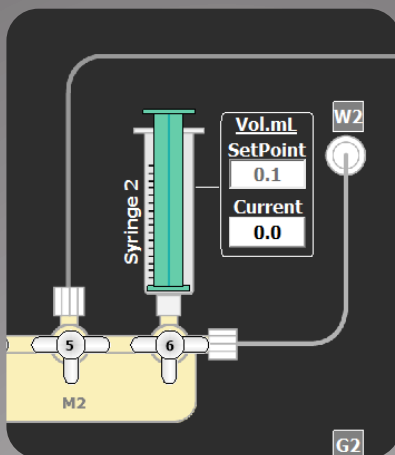
# Graphical **Synthesis Recipe** Development

Click • Define • Save



## 1. Click a schematic

Click a schematic element such as solenoid valves and rotary actuators to turn them on/off or to set positions.



## 2. Define a parameter

Define parameters such as reactor temperatures, syringe volumes & step parameters (description, time, condition).

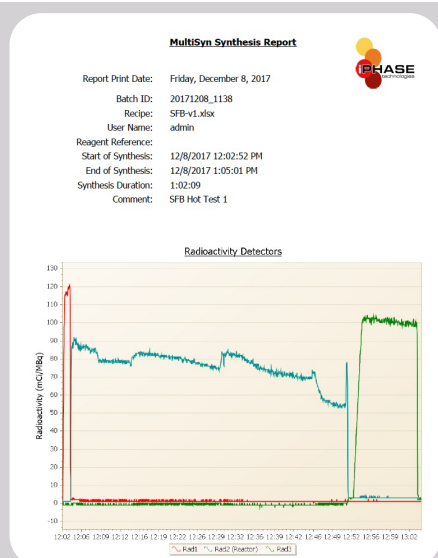


## 3. Save Step

Click the Save Step button and the software will automatically fill-in the Excel® recipe step list automatically.

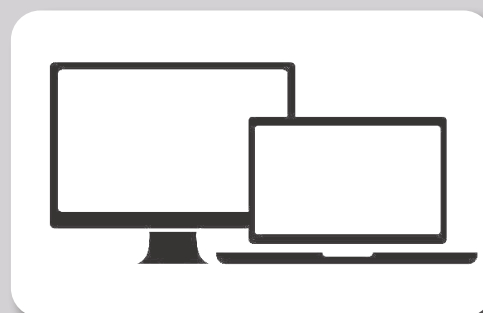
			(sec)	Manifold Rotary Tap Position (0=off, 1=left, 2=right)												(mL)	(mL)	Process Valve (0=off, 1=on)								(0-255 °C)	(-1.0-0.0 bar)				
Step	Step Message	Step Condition	Step Time	RT1	RT2	RT3	RT4	RT5	RT6	RT7	RT8	RT9	RT10	RT11	RT12	Syringe 1 Position	Syringe 2 Position	V01	V02	V03	V04	V05	V06	V07	V08	Reactor Temp	Vacuum Setpoint	PO 1	PO 2	PO 3	
61	Eluting generator to reactor	0	5	0	0	0	0	0	0	2	1	0	0	0	0	0.5	0.0	0	0	0	0	0	0	1	0	0	0.0	0	0	0	
62	Eluting generator to reactor	42	30	0	0	0	0	0	0	2	1	0	0	0	0	0.0	0.0	0	0	0	0	0	0	1	0	0	0.0	0	0	0	
63	Eluting generator to reactor	0	10	0	0	0	0	0	0	2	1	0	0	0	0	0.0	0.0	0	0	0	0	0	0	1	0	0	0.0	0	0	0	
64	Flushing HCL to reactor	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	1	1	1	0	0	1	0	0	0.0	0	0	0	
65	Flushing HCL to reactor	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0.0	0.0	0	1	1	1	0	0	1	0	0	0.0	0	0	0	
66	Labelling reaction - Heat up phase	11	360	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0	0	120	0.0	0	0	0	
67	Labelling reaction - Heat up phase	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0	0	120	0.0	0	0	0	
68	Labelling reaction - Cool to reaction temp	15	360	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0	0	95	0.0	0	0	0	

Synthesis recipes are stored as easily editable Excel® step list files.



## Synthesis Reports

Generate and print synthesis reports to satisfy your labs documentation and GMP requirements.



Install on Multiple Computers

Develop the synthesis recipe in your office and test the recipe in the lab.

# Technical Specifications

Hardware	
Reactor	<ul style="list-style-type: none"> <li>• 10mL low metal contaminant Topas COC reactor or 10mL glass reactors</li> <li>• Heating to 150°C when using a Topas COC reactor and 220°C when using glass reactors</li> <li>• Contained compressed air cooling to ambient temperatures (all exhaust compressed air can be piped outside of the hotcell to eliminate contamination or pressurizing of the hotcell environment by the compressed air used to cool the reactor)</li> <li>• Optional Vortex Tube compressed air cooling to approx. 8°C</li> </ul>
Stopcock Actuators	<ul style="list-style-type: none"> <li>• 12 x 3-position electric servo actuators</li> <li>• Can rotate all the disposable manifold stopcocks to 3 positions: left, right and off</li> </ul>
Manifold Clamps	<ul style="list-style-type: none"> <li>• Unique magnetically locking latches for disposable stopcock manifold clamping</li> </ul>
Syringe Drives	<ul style="list-style-type: none"> <li>• 2 x electrically actuated syringe drives</li> <li>• Multi-syringe size capable: 1mL, 5mL, &amp; 10mL sizes</li> <li>• Force limiting drive control circuit stops driving the syringes plunger if the back-pressure is too high, and automatically resumes drive once the back pressure is reduced. This specialized circuit is especially usefully when eluting <sup>68</sup>Ga generators with high back pressures and delivers smooth &amp; reliable generator elutions.</li> </ul>
Vacuum Pump	<ul style="list-style-type: none"> <li>• Built-in chemically resistant vacuum pump, dual head</li> <li>• Max vacuum -0.95bar</li> </ul>
Automation	<ul style="list-style-type: none"> <li>• Industrial PLC (Programmable Logic Controller) with wired or wireless communications to the interface laptop or tablet PC</li> <li>• PLC is housed in an external compact enclosure which is located outside of the hotcell to eliminate radiation damage to the electronics. This ensures reliable operation even in high radiation fields.</li> <li>• Synthesizer is connected to the PLC enclosure via 2 multi-pin electrical cables</li> </ul>
Sensors	
Radioactivity	<ul style="list-style-type: none"> <li>• 3 tungsten collimated linear CsI(Tl) crystal PIN diode radioactivity detectors</li> </ul>
Pressure	<ul style="list-style-type: none"> <li>• 2 x pressure sensors for vacuum and inert gas pressure monitoring</li> </ul>
Temperature	<ul style="list-style-type: none"> <li>• PT100 sensor for reactor temperatures</li> </ul>
Software	
Graphical Interface	<ul style="list-style-type: none"> <li>• Easy to use open platform operator interface, with sensor trends, historical data logging &amp; analysis, synthesis reports, multi-level password protected user access, CFR 21 CFR Part 11 &amp; GMP compliant</li> </ul>
Synthesis Recipes	<ul style="list-style-type: none"> <li>• Easily generated using unique Click-&amp;Save graphical recipe development technology and stored as Excel® step lists</li> </ul>
Utilities and Dimensions	
Compressed Air	<ul style="list-style-type: none"> <li>• 6-8 bar (87-116 psi), 4mm O.D. push-in tube connection</li> </ul>
Inert Gas	<ul style="list-style-type: none"> <li>• Helium, Nitrogen or Argon; 2-8 bar (29-116 psi), 1/8" O.D. tube connection</li> </ul>
Case	<ul style="list-style-type: none"> <li>• Compact solvent resistant powder coated case</li> </ul>
Dimensions	<ul style="list-style-type: none"> <li>• 275 mm x 270/397 mm x 240 mm (WxHxD)</li> </ul>

