HIDEX

Ari Lehmusvuori, PhD

29.4.2021

Liquid Scintillation Counters

Hidex
600 SL

Hidex
300 SL

Hidex
Triathler

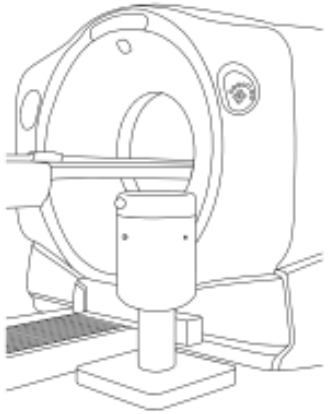
Microplate Reader

Hidex Sense
Beta

Gamma Counter

Hidex Automatic
Gamma Counter

Radiowater generator



Sample preparation instruments

Hidex
600 OX Oxidizer

Hidex
Q-ARE 100

HIDEX

Sample preparation

600 OX Oxidizer

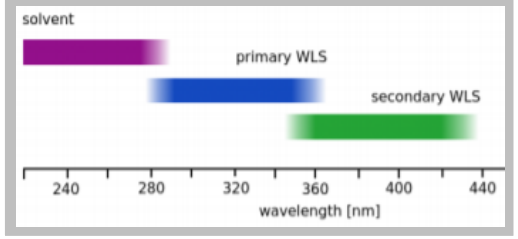
Q-ARE 100plus

Sample preparation

GOOD SAMPLE PREPARATION

NO/BAD SAMPLE PREPARATION

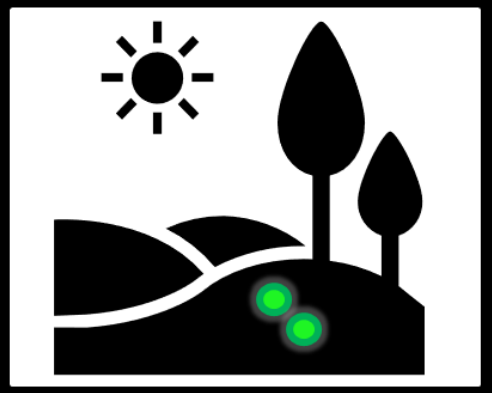
LIQUID SCINTILLATION ANALYSIS



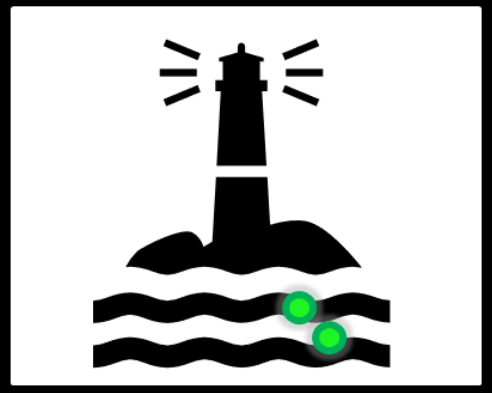
ACCURATE RESULTS

INCORRECT RESULTS

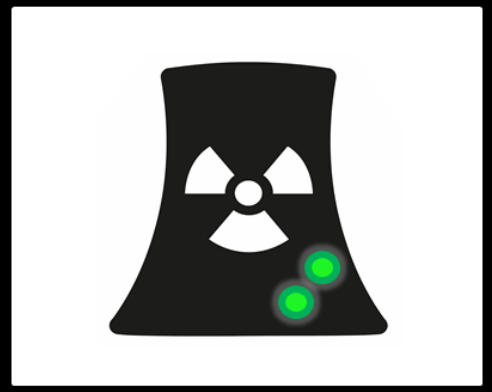
Sample



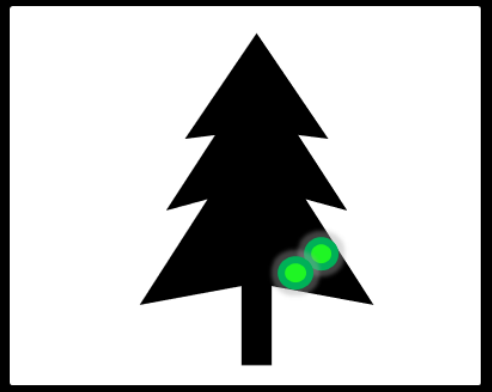
soil



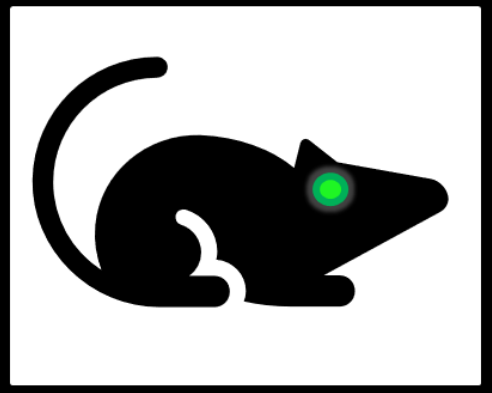
water



Nuclear power plant decommissioning



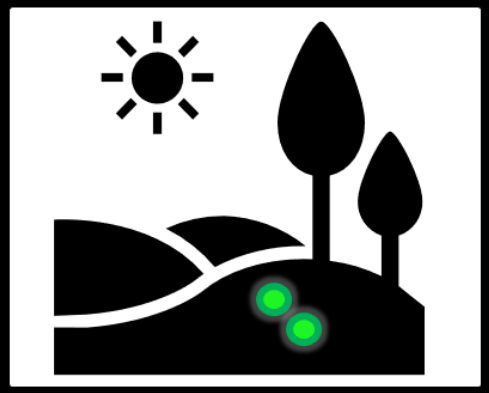
plant



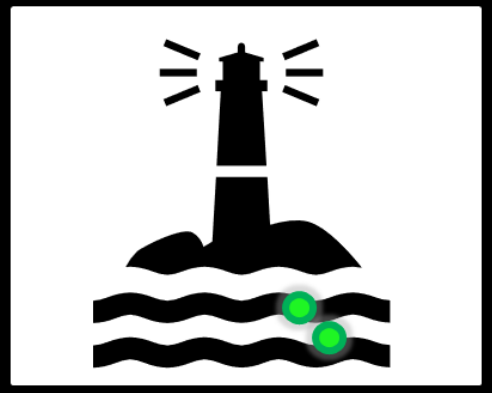
tissue

● = radioisotope

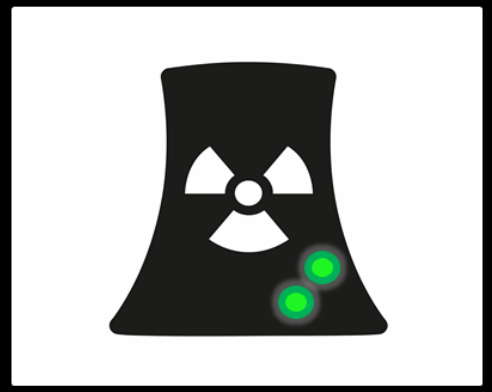
Sample



soil



water



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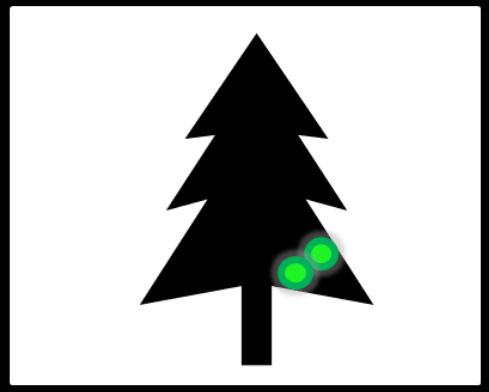
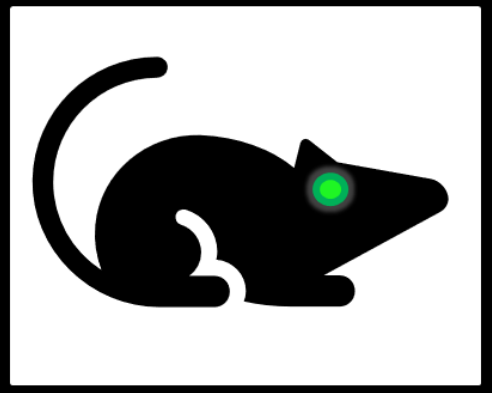


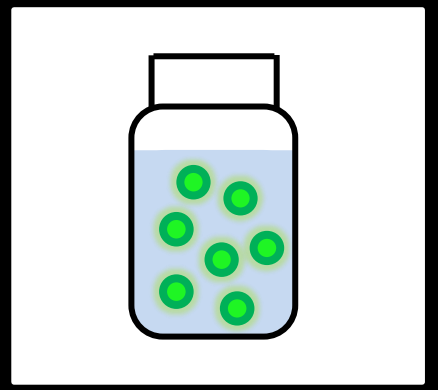
plant



tissue

● = radioisotope

After sample prep



Homogenous and clear liquid sample for Liquid Scintillation Counting

Why sample preparation?

- Solid sample transformation into homogenous liquid solution for LSC measurement
- Removal of impurities to decrease quenching and luminescence background
- Concentration of the target radionuclide
- Isolation of the target radionuclide from mixture of several different radionuclides

Hidex Q-ARE

QUICK

AUTOMATED

RADIONUCLIDE

EXTRACTION

Extraction chromatography

Extraction chromatography (EXC) combines the selectivity of liquid-liquid extraction with ease-of-use of the solid phase extraction (SPE) chromatography

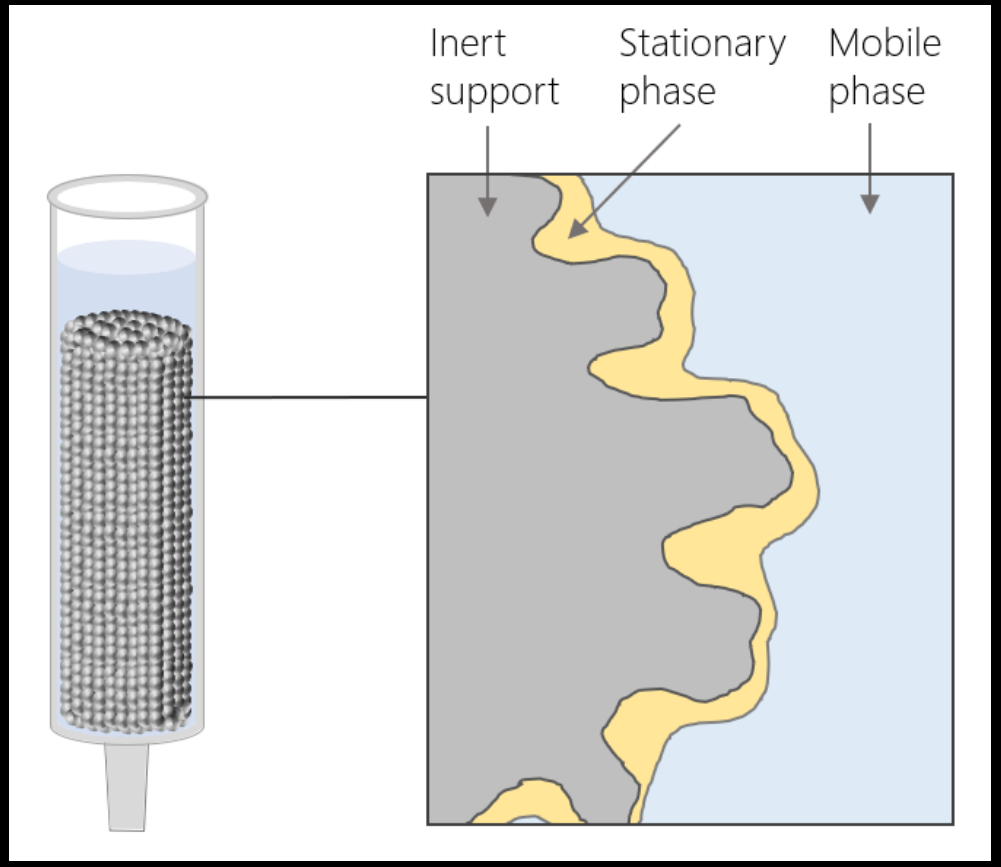
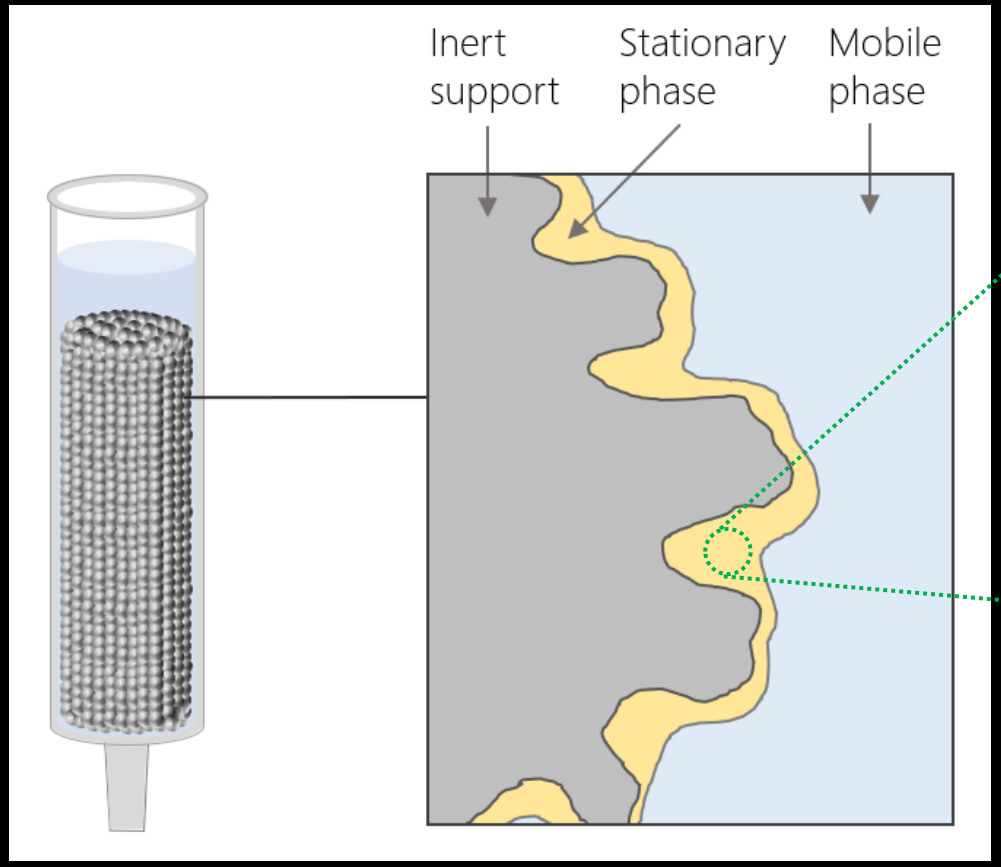


Figure 1. Extraction chromatography resin structure. The stationary phase that contains liquid extractant compound specific to the target radionuclide is impregnated on the inert support.

Extraction chromatography

Extraction chromatography (EXC) combines the selectivity of liquid-liquid extraction with ease-of-use of the solid phase extraction (SPE) chromatography



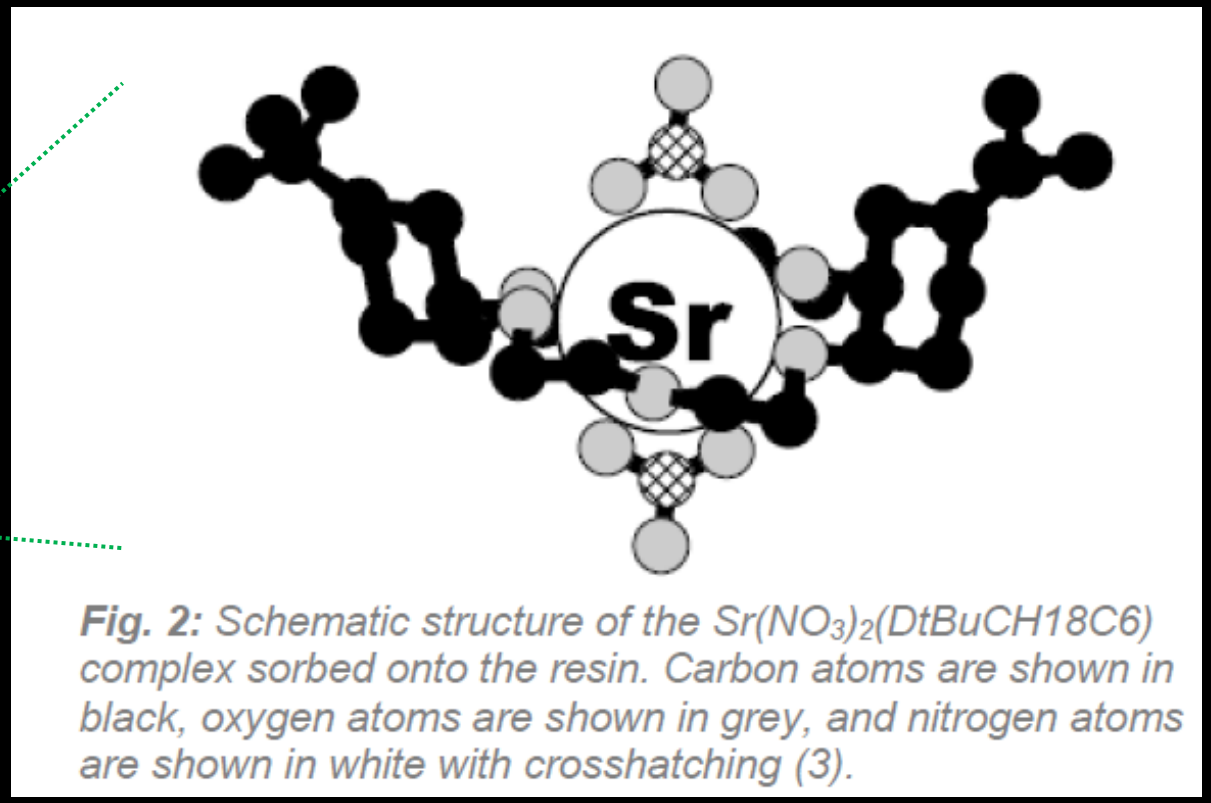


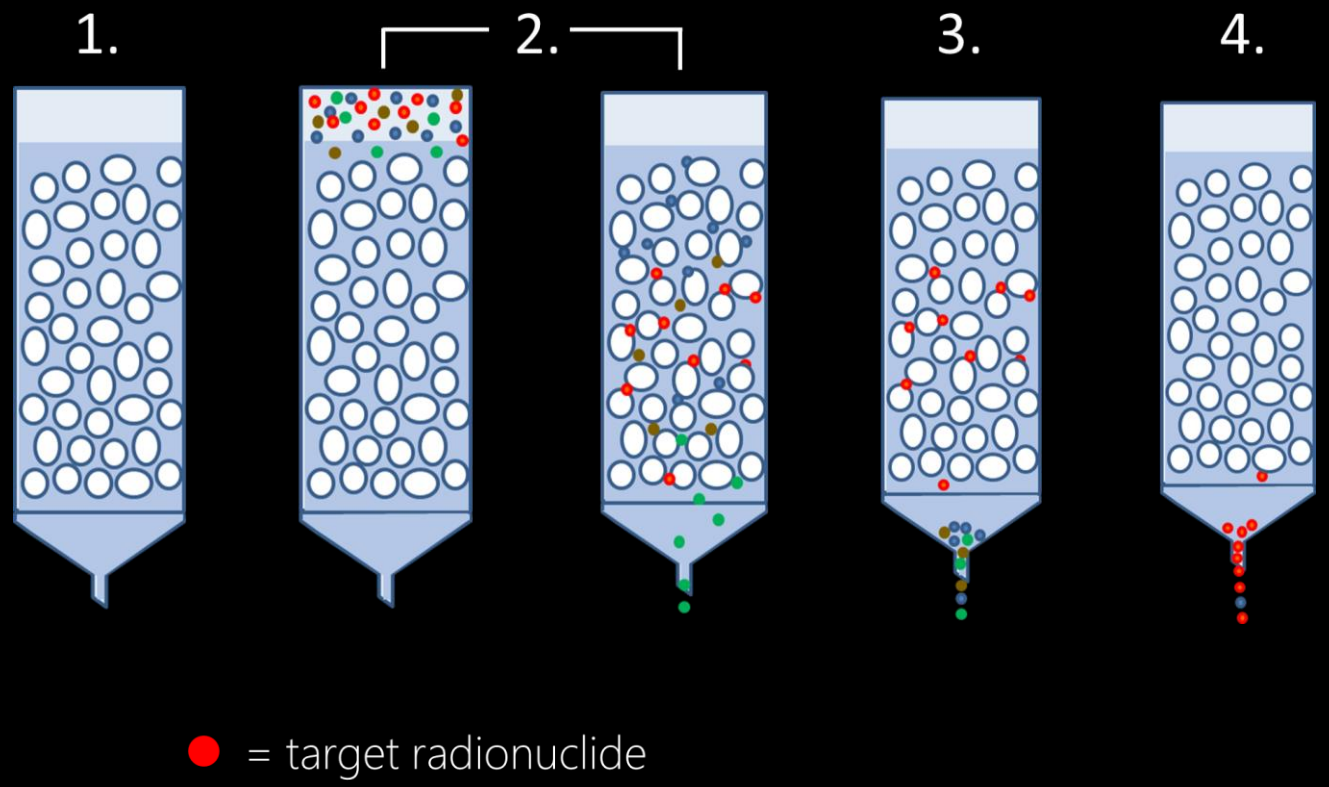
Fig. 2: *Schematic structure of the $Sr(NO_3)_2(DtBuCH18C6)$ complex sorbed onto the resin. Carbon atoms are shown in black, oxygen atoms are shown in grey, and nitrogen atoms are shown in white with crosshatching (3).*

Figure 1. Extraction chromatography resin structure. The stationary phase that contains liquid extractant compound specific to the target radionuclide is impregnated on the inert support.

Extraction chromatography

Steps:

1. Conditioning
   - Strong acid for activation of the resin
2. Sample loading
   - Sample is applied and the target radionuclides are caught by the resin
3. Washing
   - Impurities are washed away by acid
4. Elution
   - Radionuclide is eluted and collected



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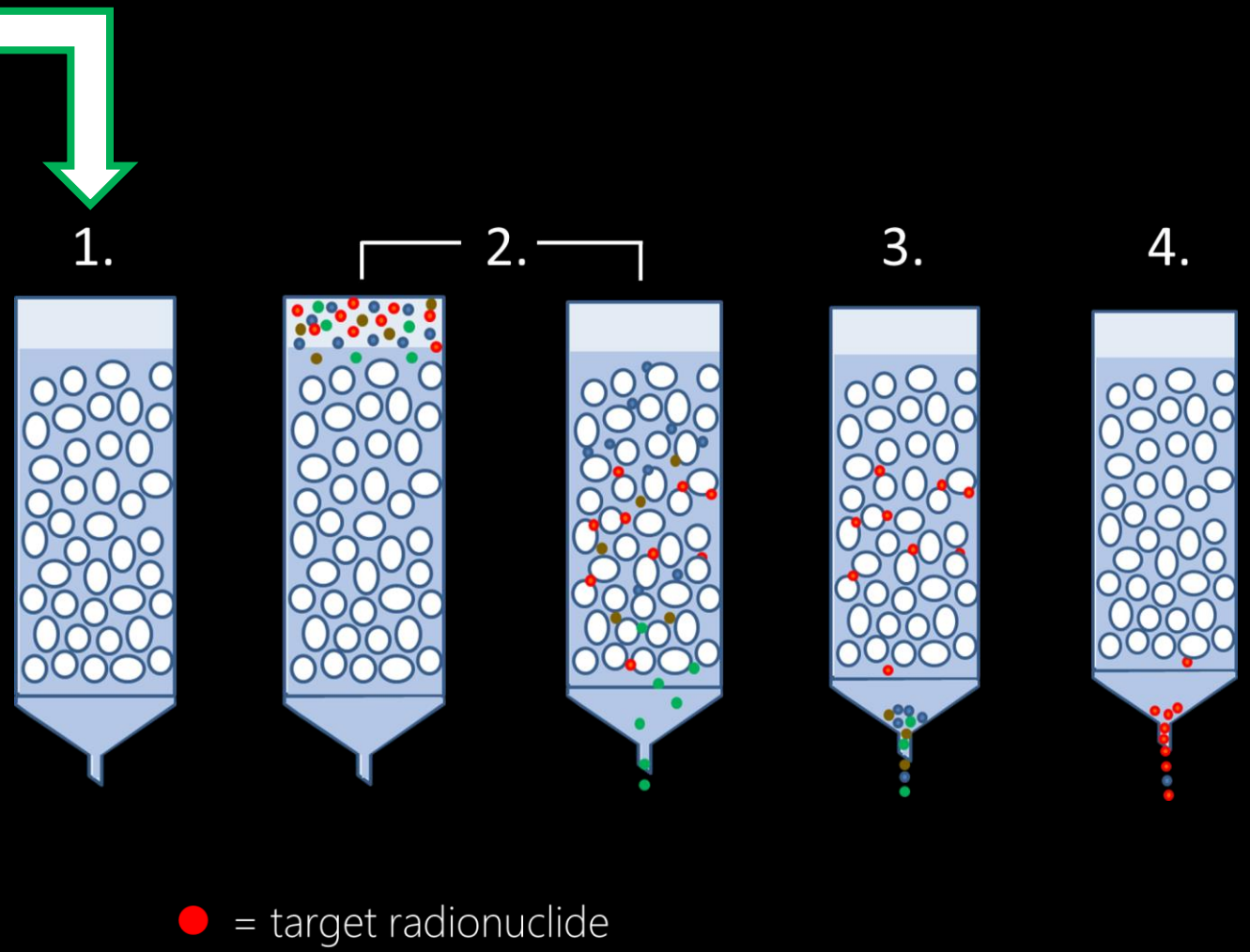

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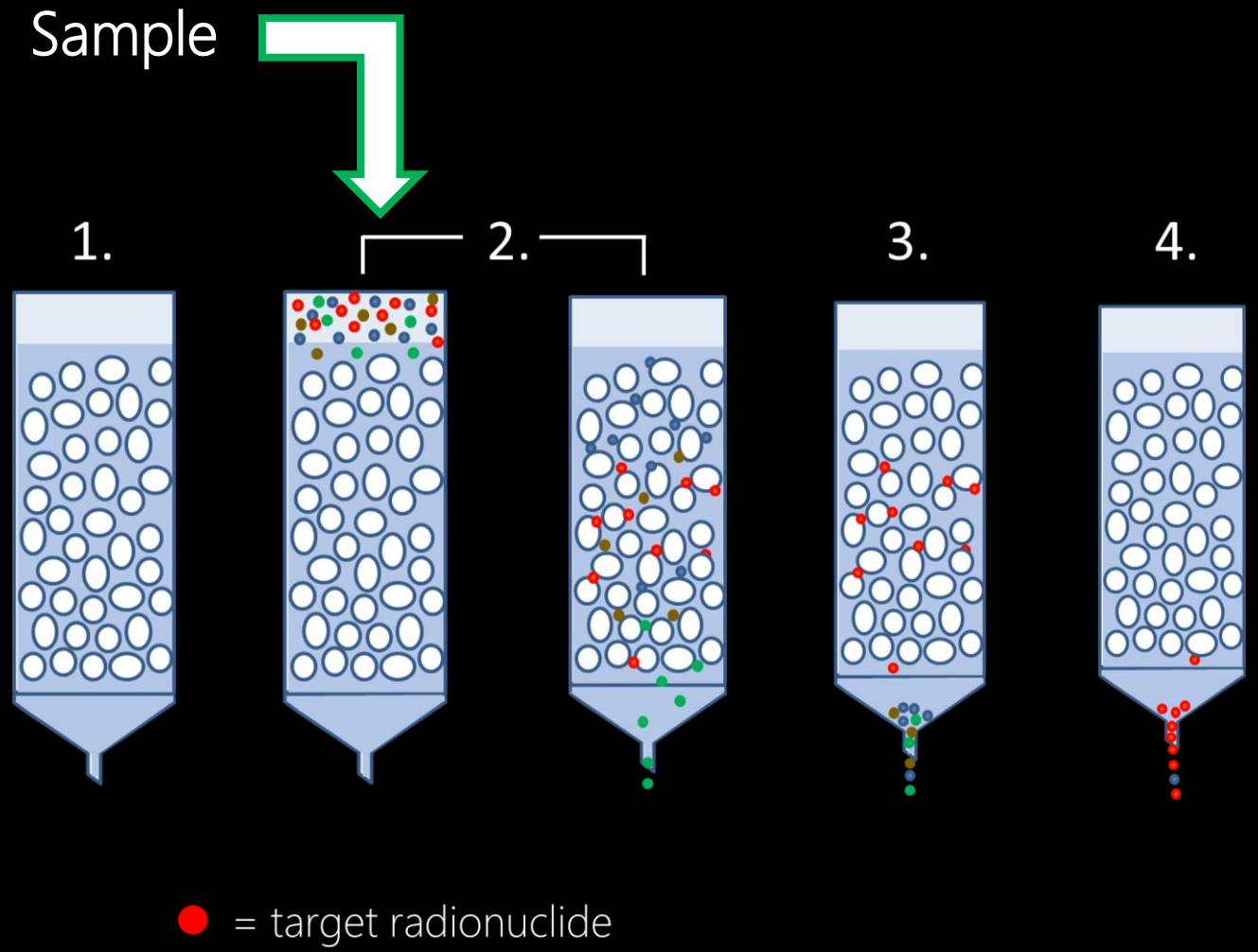

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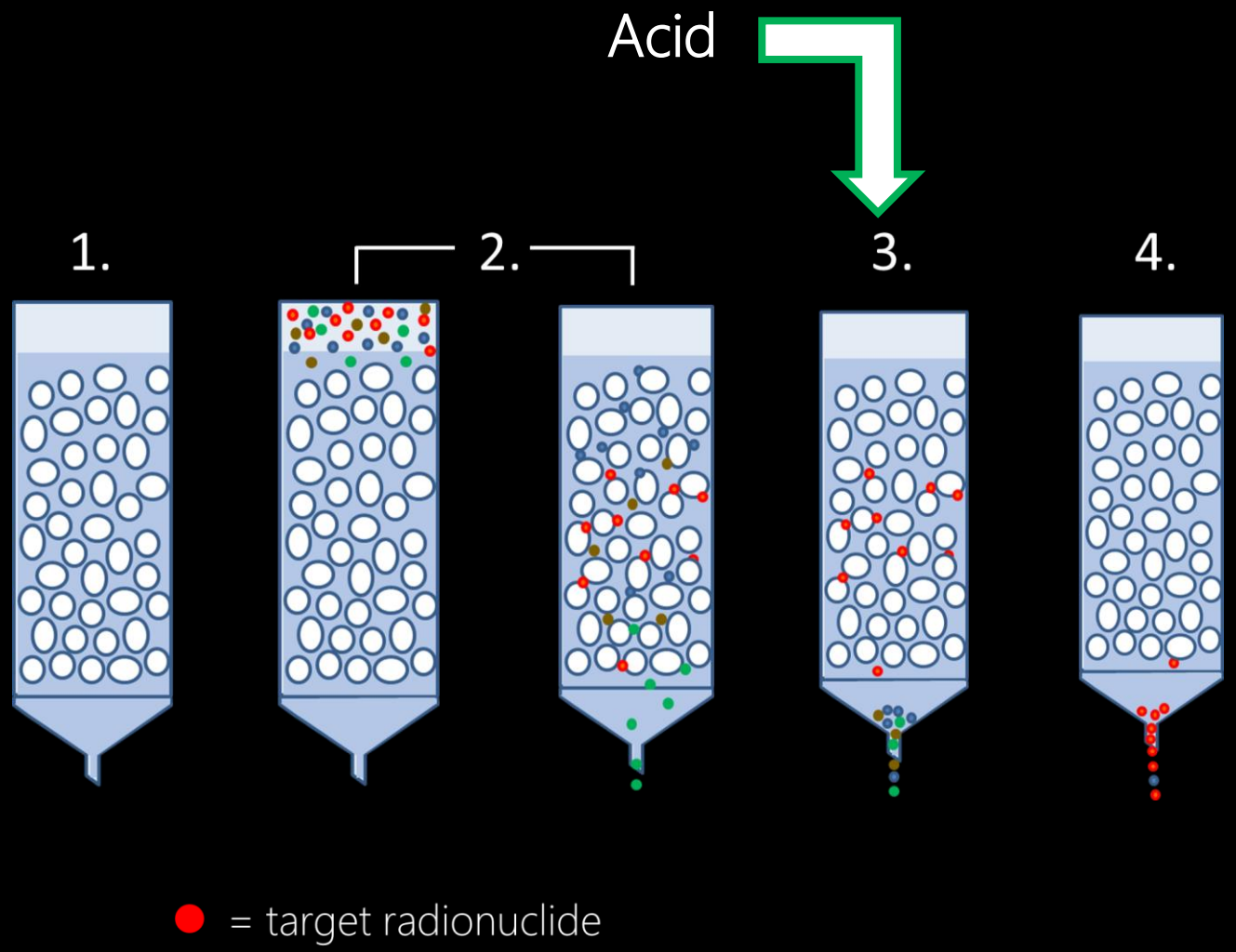
4. Elution
   - Radionuclide is eluted and collected



Extraction chromatography

Steps:

1. Conditioning
   - Strong acid for activation of the resin
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3. Washing
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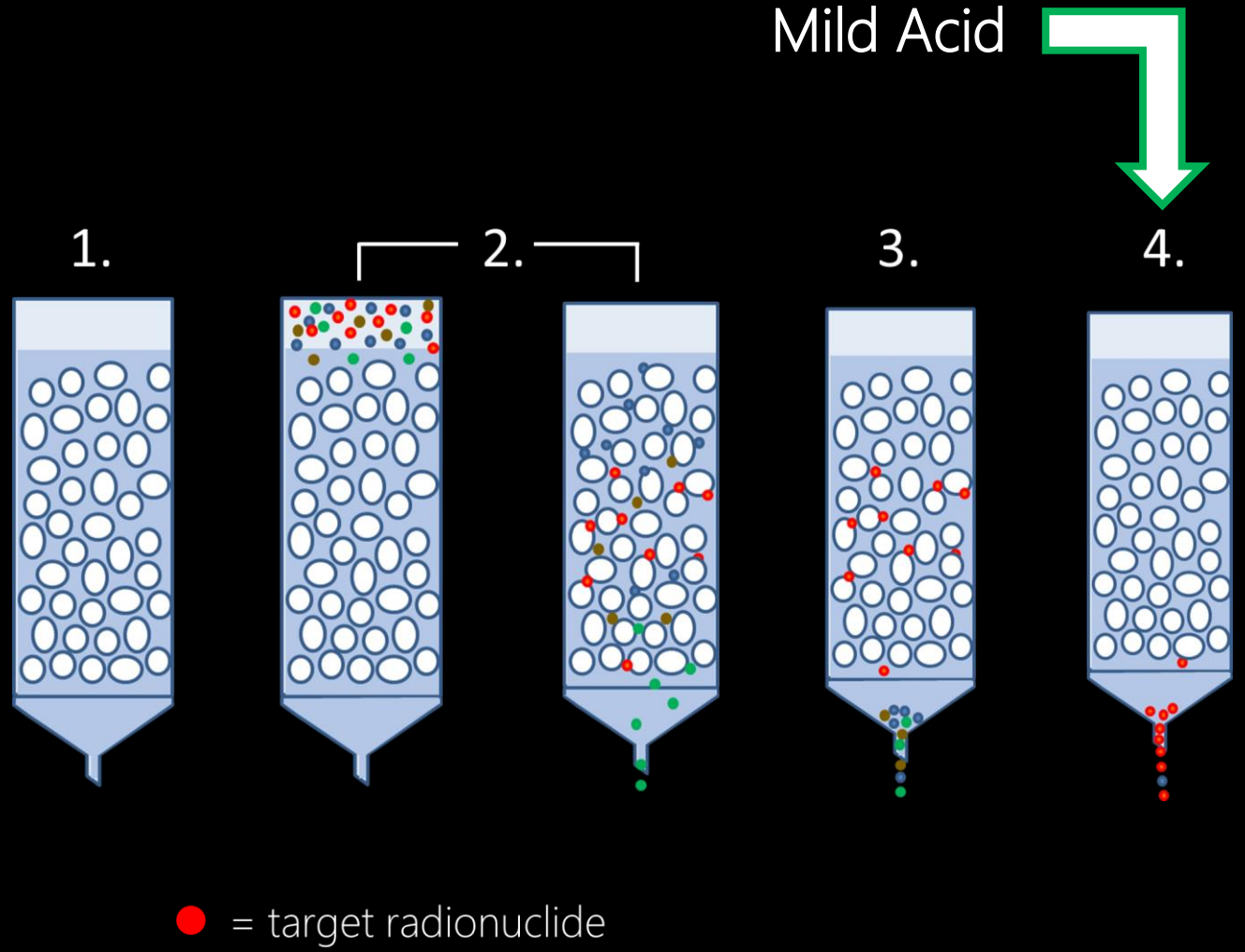
4. Elution
   - Radionuclide is eluted and collected



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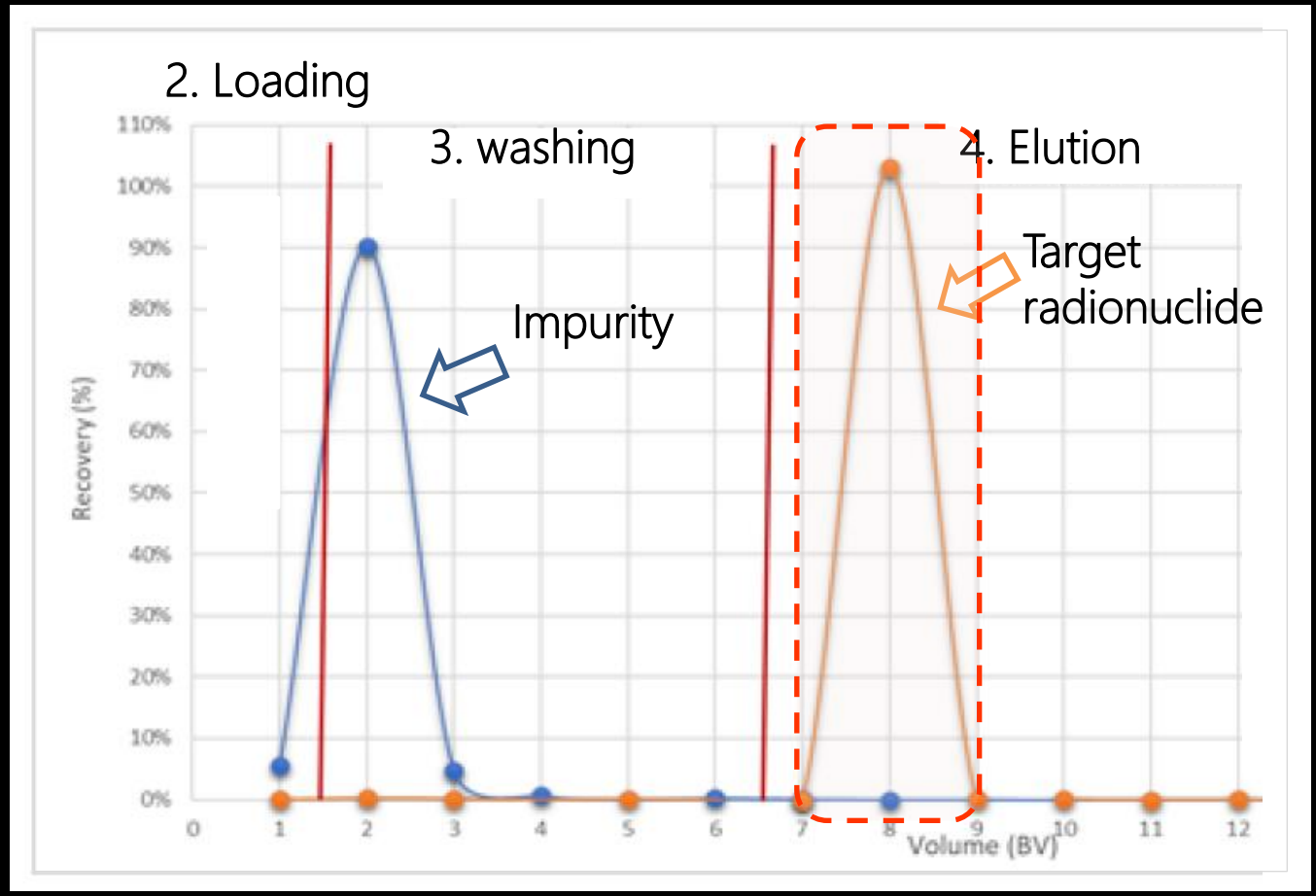


Traditional way. Manual Extraction chromatography

Traditional way. Manual Extraction chromatography

Traditional way. Manual Extraction chromatography

Traditional way. Manual Extraction chromatography

Automated Extraction chromatography

Q-ARE 100plus

60 cm

78 cm

55 cm

Weight
60 kg

Q-ARE 100plus

12 Reagent solutions

8 Samples

Elution fraction collection bottles (total 20)

1 pump for each sample

8 extraction chromatography columns

Q-ARE 100plus

12 Reagent solutions

8 Samples

Elution fraction collection bottles (total 20)

1 pump for each sample

8 extraction chromatography columns

Q-ARE 100plus

12 Reagent solutions

8 Samples

Elution fraction collection bottles (total 20)

1 pump for each sample

8 extraction chromatography columns

Q-ARE 100plus

12 Reagent solutions
6 + 6

8 Samples

Elution fraction collection bottles (total 20)

1 pump for each sample

8 extraction chromatography columns

Q-ARE 100plus

12 Reagent solutions

8 Samples

Elution fraction collection bottles (total 20)

1 pump for each sample

8 extraction chromatography columns

Q-ARE 100plus

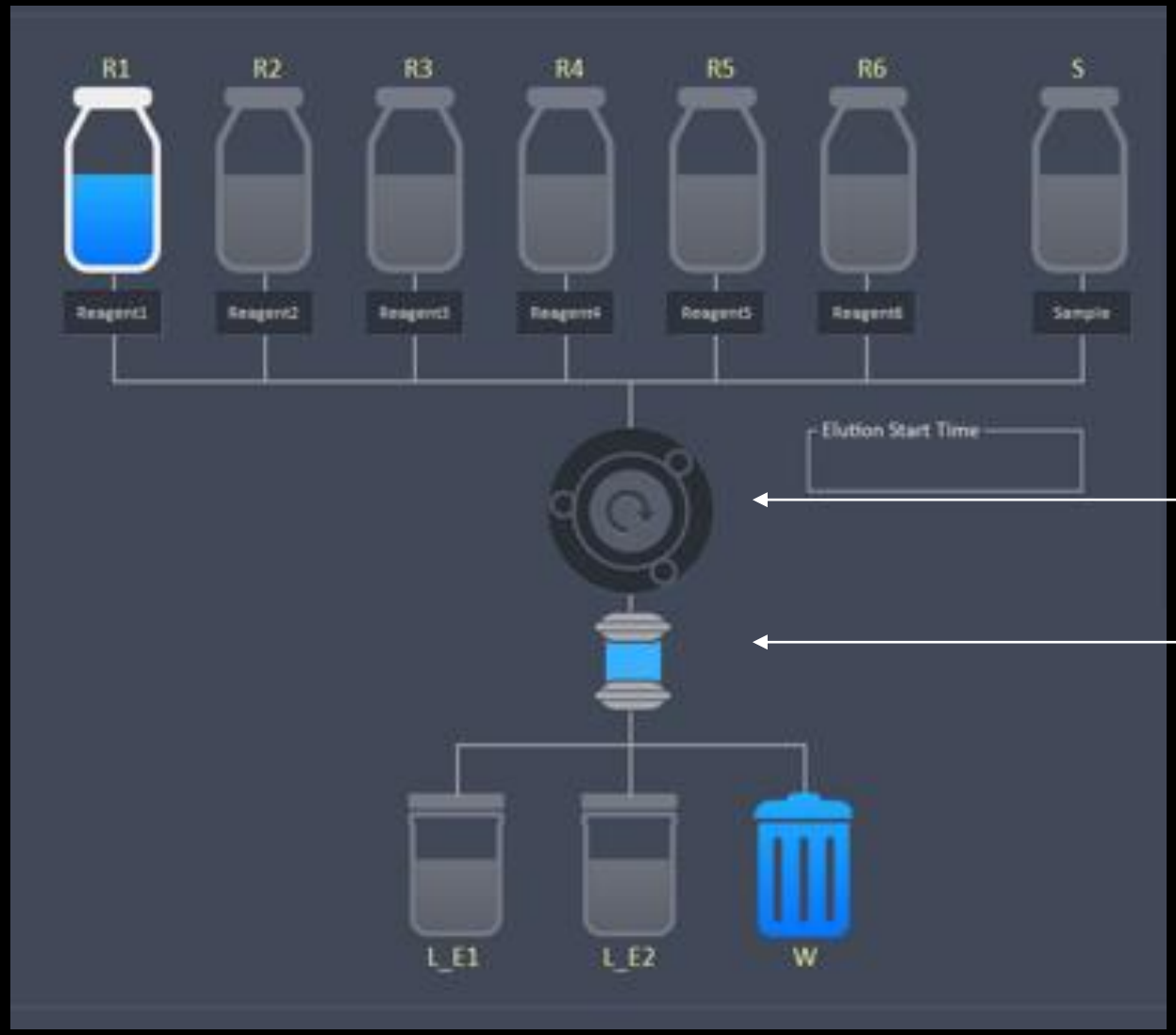
Acid resistant and fume hood free design

Acid resistant pumps, valves, tubing and fittings (PEEK, PTFE)

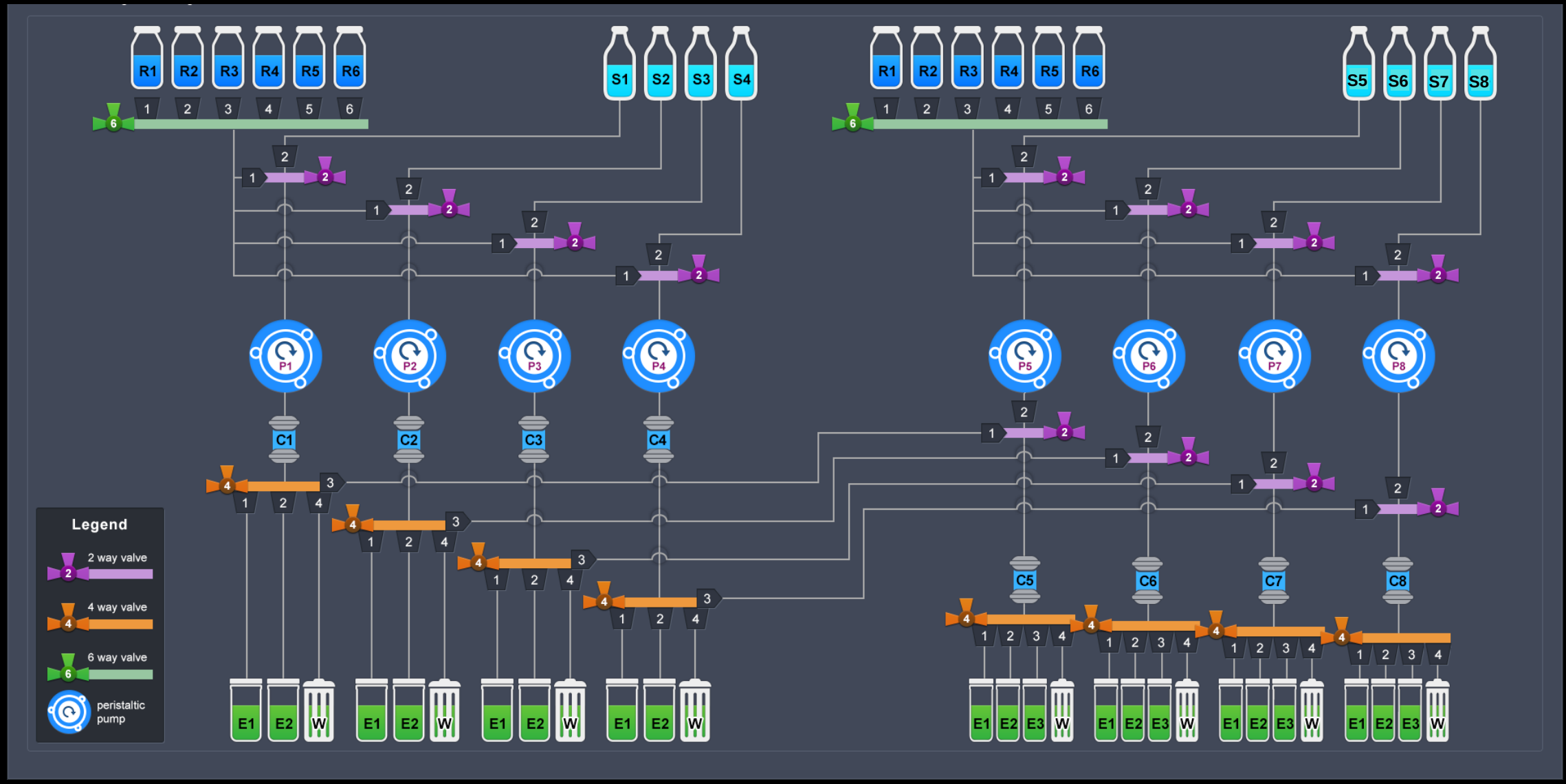
Acrylic doors covering the pumps and columns

Hidex Q-ARE liquid handling

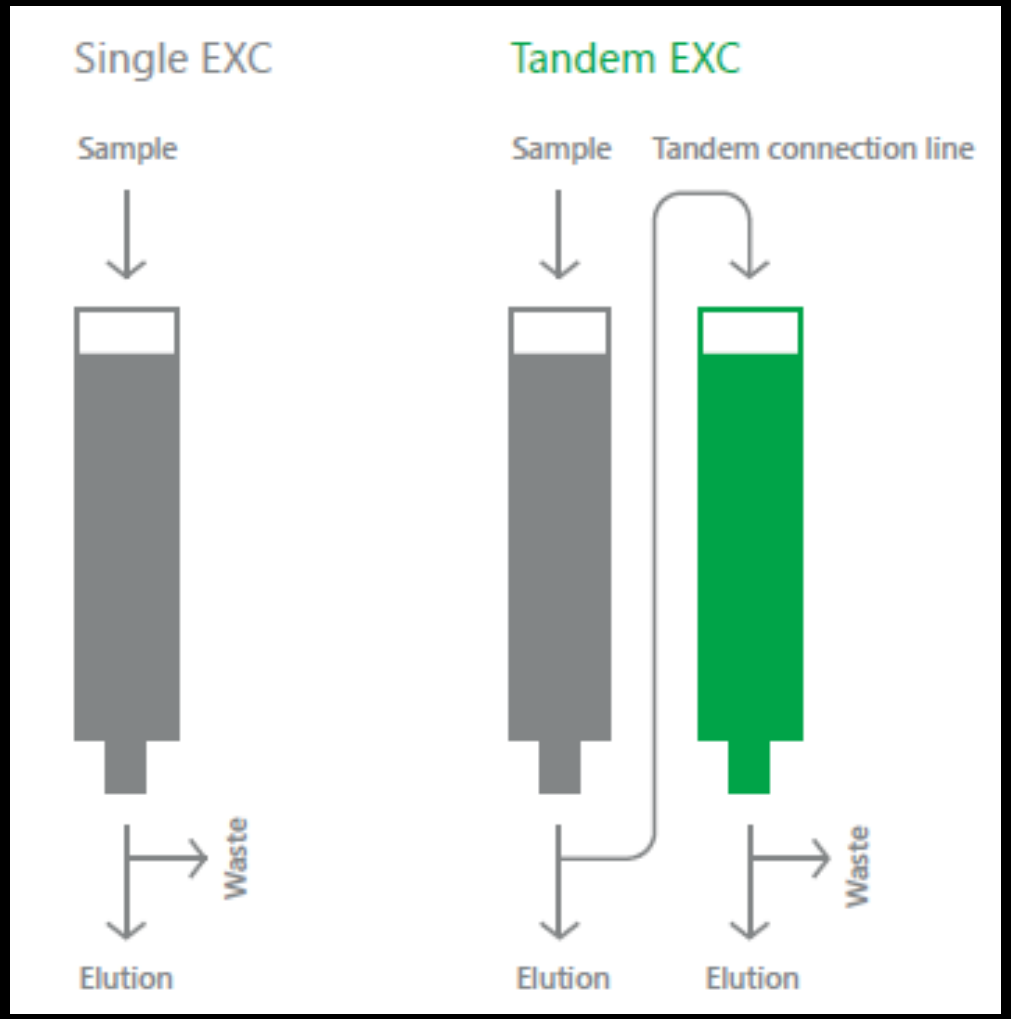
Basic view



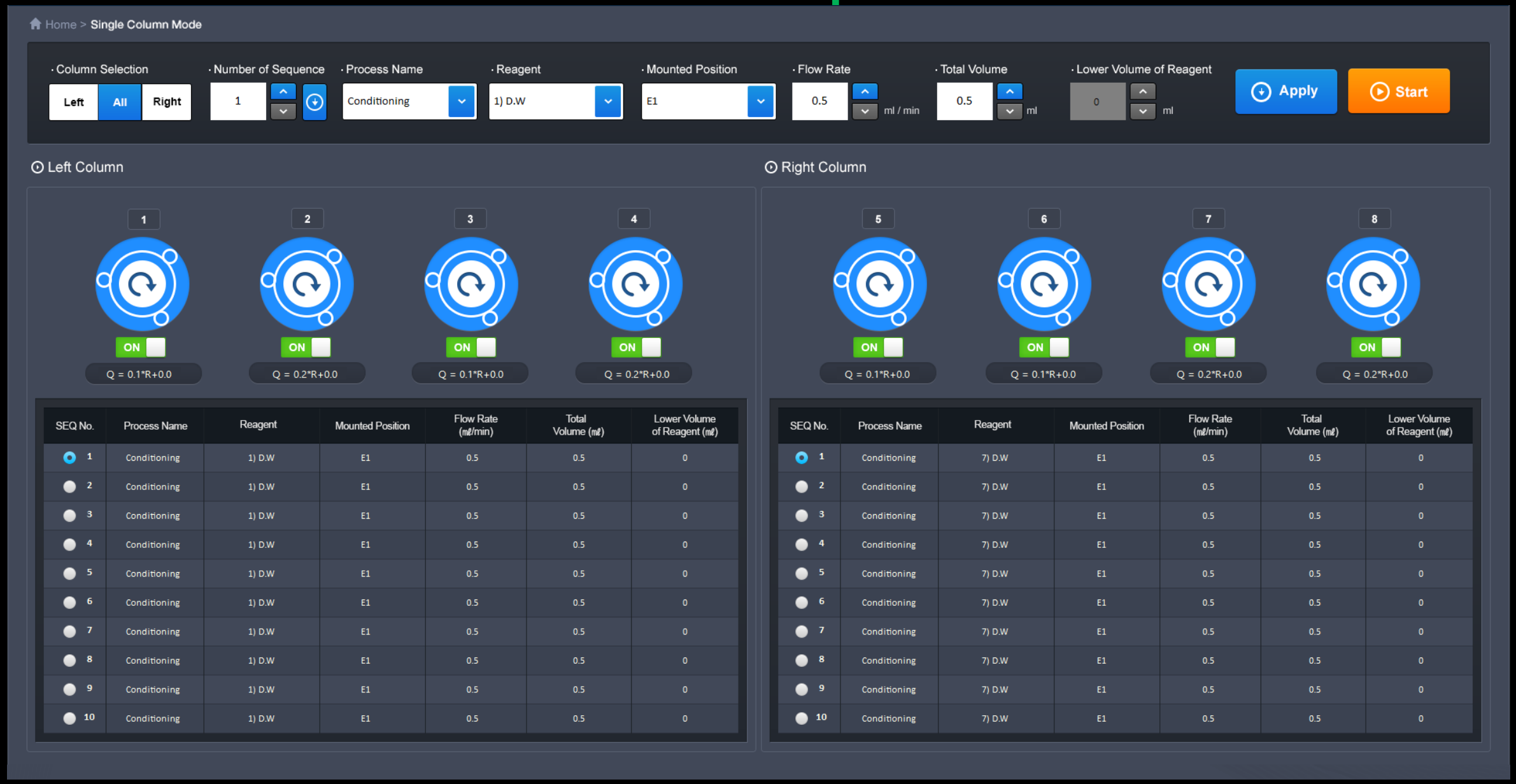
Hidex Q-ARE 100plus liquid handling



Automated Tandem chromatography



Hidex Q-ARE 100plus software



SEQ No.	Process Name	Reagent	Mounted Position	Flow Rate (mℓ/min)	Total Volume (mℓ)	Lower Volume of Reagent (mℓ)
1	Conditioning	1) D.W	E1	0.5	0.5	0
2	Conditioning	1) D.W	E1	0.5	0.5	0
3	Conditioning	1) D.W	E1	0.5	0.5	0
4	Conditioning	1) D.W	E1	0.5	0.5	0
5	Conditioning	1) D.W	E1	0.5	0.5	0
6	Conditioning	1) D.W	E1	0.5	0.5	0
7	Conditioning	1) D.W	E1	0.5	0.5	0
8	Conditioning	1) D.W	E1	0.5	0.5	0
9	Conditioning	1) D.W	E1	0.5	0.5	0
10	Conditioning	1) D.W	E1	0.5	0.5	0

SEQ No.	Process Name	Reagent	Mounted Position	Flow Rate (mℓ/min)	Total Volume (mℓ)	Lower Volume of Reagent (mℓ)
1	Conditioning	7) D.W	E1	0.5	0.5	0
2	Conditioning	7) D.W	E1	0.5	0.5	0
3	Conditioning	7) D.W	E1	0.5	0.5	0
4	Conditioning	7) D.W	E1	0.5	0.5	0
5	Conditioning	7) D.W	E1	0.5	0.5	0
6	Conditioning	7) D.W	E1	0.5	0.5	0
7	Conditioning	7) D.W	E1	0.5	0.5	0
8	Conditioning	7) D.W	E1	0.5	0.5	0
9	Conditioning	7) D.W	E1	0.5	0.5	0
10	Conditioning	7) D.W	E1	0.5	0.5	0

Columns & Resins

- Column size 1 – 20 ml
- Prepacked and self-packed columns
- Eichrom resins and cartridges

Product Name	Applications		
Actinide Resin	Group actinide separations/gross alpha measurements	Technical Info	Part Numbers
Cl Resin	Cl, I	Technical Info	Part Numbers
Cs Resins	Cs	Technical Info	
Cu Resin	Cu	Technical Info	Part Numbers
DGA Resins	Actinides, Lanthanides, Y, Ra	Technical Info	Part Numbers
Ion Exchange Resins	Analytical grade cation and anion exchange resins	Technical Info	Part Numbers
Ln Resins	Lanthanides, Ra-228	Technical Info	Part Numbers
MnO2 Resin	Ra	Technical Info	Part Numbers
Nickel Resin	Ni	Technical Info	Part Numbers
Pb Resin	Pb	Technical Info	Part Numbers
Pre-filter Resin	Organics removal	Technical Info	Part Numbers
RE Resin	Th, U, Np, Pu, Am, Cm, rare earth elements	Technical Info	Part Numbers
Sr Resin	Sr, Pb	Technical Info	Part Numbers
TEVA® Resin	Tc, Th, Np,Pu, Am/lanthanides	Technical Info	Part Numbers
Tritium Column	^{3}H	Technical Info	Part Numbers
TRU Resin	Fe,Th, Pa, U, Np,Pu, Am, Cm	Technical Info	Part Numbers
UTEVA® Resin	Th,U,Np, Pu	Technical Info	Part Numbers

Hidex Q-ARE

Q-ARE 100plus

- 8 samples simultaneous processing
- 8 pumps and 8 columns

Q-ARE 50

- 4 samples simultaneous processing
- 4 pumps and 4 columns

Automated sample preparation

✓ Reduced worker exposure to radioactivity and hazardous chemicals > Improved user safety

✓ Improved reliability

✓ Higher throughput

✓ Lower overall costs

- higher throughput with less man-hours

✓ Shorter analysis time

HIDEX

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