



Annual Users' Conference

**ADVANCING RADIATION SAFETY.
EMPOWERING PROGRESS.**

M Resort, Henderson, NV | June 15 – June 18



MIRION
TECHNOLOGIES

*Advancing Radiation Safety.
Empowering Progress.*

© 2026 Mirion Technologies. All rights reserved.

Tritium Monitoring & Sampling

Essentials for Better Accuracy

Loic PIERRE

Product Line Manager

Mirion Connect | Annual Users' Conference 2026

Henderson, NV

**Scan QR code to log your
attendance for today's
(Thursday, June 18th)
breakout session**



Agenda

- *Welcome and Introduction*
- *Tritium essentials: properties and behavior*
- *Monitoring and sampling: how to and our offering*
- *Use cases overview*
- *Q/A - Discussion*



About Premium Analyse

WHO WE ARE

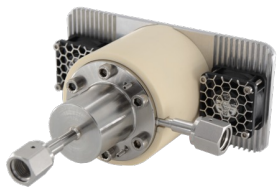
- *Designing and manufacturing tritium instrument for ~30 yrs*
- *Joined Mirion in 2019*
- *18-person team near Metz*
- *ISO 9001:2017 & 17025 certifications*



About Premium Analyse

WHAT WE DO

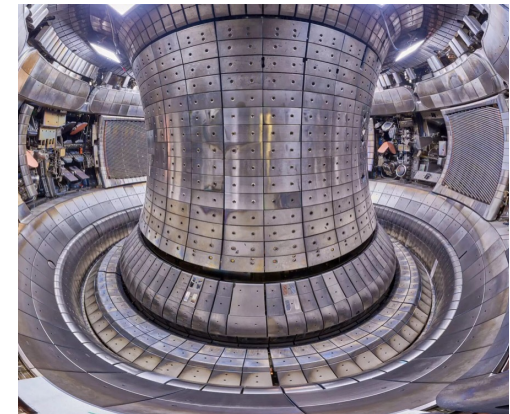
- Complete, customized tritium instrumentation
- Real-time monitors & samplers
- From radioprotection to process control
- Design, build, calibrate & service in-house



A global presence

WHAT WE DO

- *~2 000 monitoring systems installed in 20 countries*
- *Addressing the defense market, civil industry, medical industry and research facilities*
- *Complete mastery of the manufacturing channel inhouse*

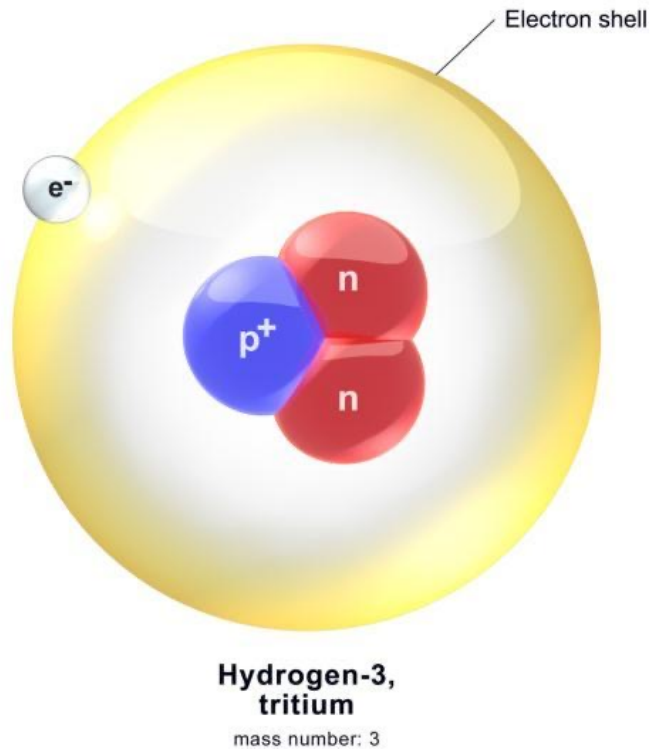


≈30 yrs
of experience

≈2,000
units installed

19+
countries

Tritium



- *Third isotope of hydrogen (^3H or T)*
- *Pure β^- emitter*
 - E_{max} 18.6 keV
 - E_{av} 5.7 keV
- *Half-life 12.32 years; decays to stable ^3He*
- *Chemically like hydrogen*
 - *Mobile*
 - *strong affinity for water*

Tritium

HTO · HT · OBT

- *HTO* — tritiated water / vapor; most abundant in nature
- *HT* — tritium gas; common in research processes
- *OBT* — organically bound; natural or molecule labelling

WHY THE FORM DRIVES DOSE

- *HTO* is readily taken up by the body; *HT* is largely exhaled
- *Form* — not just activity — sets the dose estimate
- So *HT/HTO* discrimination is central to accuracy

HTO is at least 10,000× more dose-significant than HT

Monitoring & Sampling

Mirion's solution



Two complementary approaches

REAL-TIME MONITORING

- Ionization chambers measure the gas concentration live, continuously

+

Immediate alarm
-> Ideal for
radioprotection &
process control

—

Reading impacted by
gamma rays and
other beta emitters
(noble gases)

INTEGRATED SAMPLING

- Bubblers trap tritium over hours to weeks for lab assay with LSC

+

More sensitive
Direct HT/HTO
separation
No impact from
gamma rays

—

No real time reading

Both methods often combined

Improving accuracy

REMOVE WHAT ISN'T TRITIUM

- *Differential measurement — a sealed compensation chamber subtracts background, and γ*
- *HT/HTO discrimination — membrane separation allows for HTO-only reading, the dose-driving form*

GET THE NUMBER RIGHT

- *Match the chamber volume to the activity range for the best MDA*
- *Low memory effect & baking capability*
- *Cutting-edge electronics*
- *Traceable calibration (ISO 17025) with type tested units*

The right monitor for the right use case

PLUG AND PLAY INSTRUMENTS

- *Portable monitors ready to bring on the field*
- *Mobile solution for specific use cases*
- *Installed all-in-one cabinets for continuous surveillance*

CUSTOM CHANNELS

- *Associate the right detector to meet the job requirement*
- *Hot-swappable items*
- *Specific use-case related functions (baking, high leak tightness, ...)*

Plug and Play Instruments

PORTABLE AND MOBILE



INSTALLED INSTRUMENTS



Plug and Play Instruments

PORTABLE MONITOR

- MDA from 20 kBq/m³ (0.5 µCi/m³)
- Running on battery, 6hrs autonomy
- Pump & detection assembly embedded.



MOBILE MONITOR

- MDA from 20 kBq/m³ (0.5 µCi/m³)
- HEPA filtration capability
- High flowrate



Plug and Play Instruments

INSTALLED MONITOR

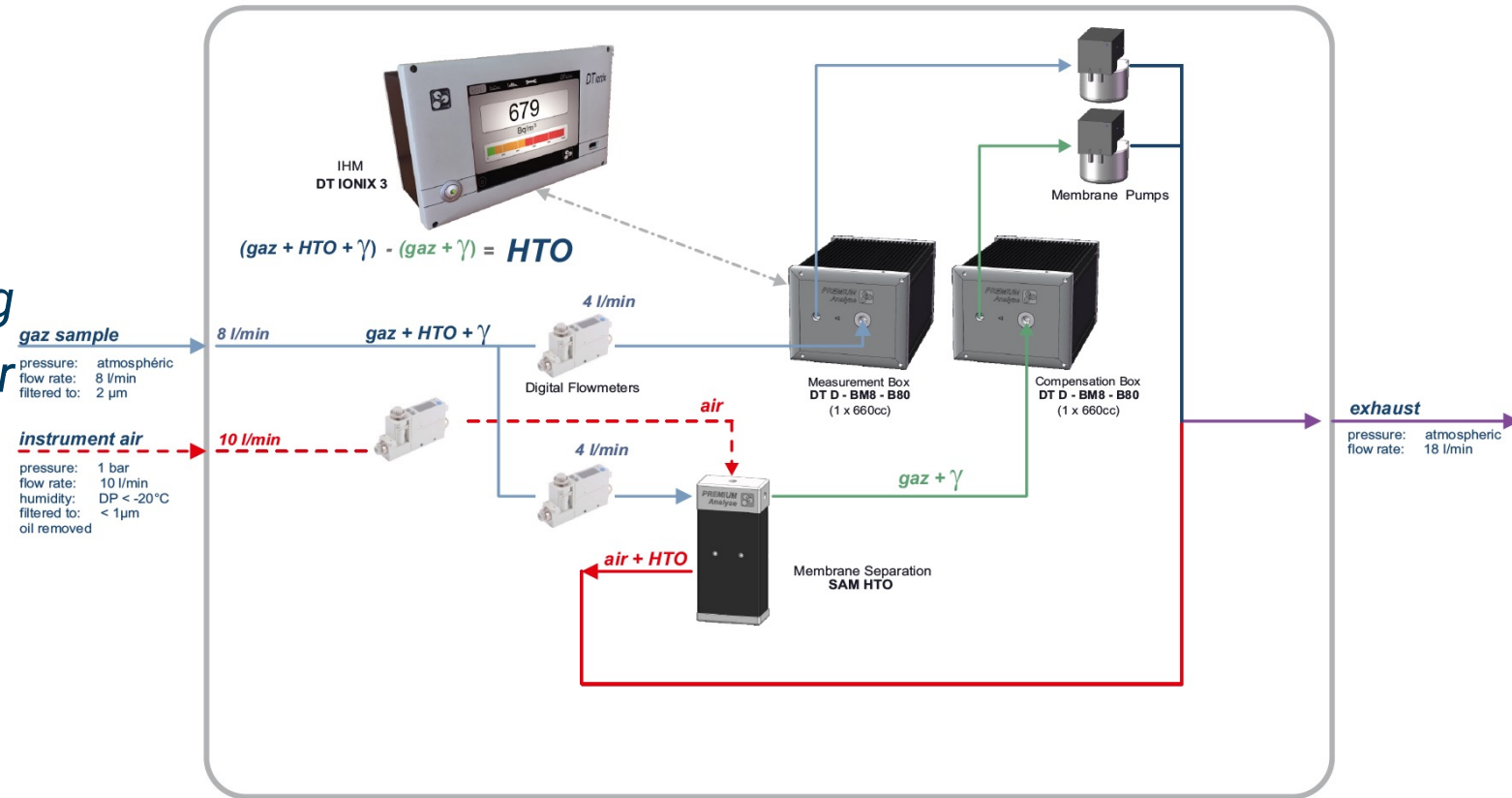
- *MDA from 10 kBq/m³ (0.27 µCi/m³)*
- *Versatile configuration for different types of measurements*
- *Modular inputs / outputs*



Innovation : C IONIX - HTO

MEASURING HTO REAL TIME

- MDA from 20 kBq/m³ (0.5 µCi/m³)
- Allows for HTO activity reading (dose-driving) in a field of other beta emitters (ex: noble gases)
- Reliable and maintenance-free



Building a channel

Every Premium Analyse channel turns a gas sample into a calibrated activity reading through the same four stages.



- *Ionization chamber* – the gas to analyze generates an ionization current
- *Preamplifier* – digitalizes and processes the femto-amp signal
- *DT IONIX* – applies the conversion coefficient and computes activity
- *Output* – volumetric activity in Bq/m^3 or Ci/m^3

IONIX 3 – The platform

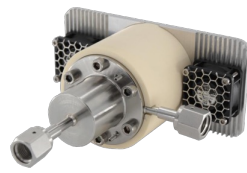


- *The shared brain of every Premium Analyse monitor*
- *Tactile, user-friendly display; the screen changes color on alarm*
- *Auto-scaling trend graph and customizable thresholds*
- *Data out:*
 - *Modbus TCP/IP, USB (all)*
 - *4–20 mA, 5 dry contacts (installed only)*

One platform for the full activity range

CHOOSE BY ACTIVITY AND USE CASE

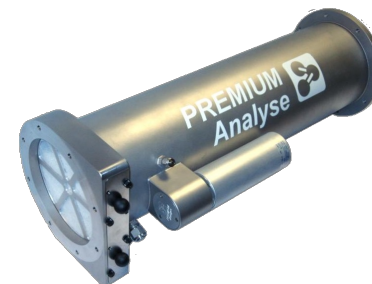
- High activity – MC10 (10 cc) / MLB (100 cc): process & gloveboxes; MDA from 1 MBq/m³ (27 µCi/m³)
- Wide range – BM8 (660 cc): radioprotection & stacks; MDA from 10 kBq/m³ (0.27 µCi/m³)
- High sensitivity – EXP40 (4 L) / XPR80 (8 L): environment; MDA from 10 kBq/m³ (0.27 µCi/m³)



MC10 · 10 cc



BM8 · 660 cc

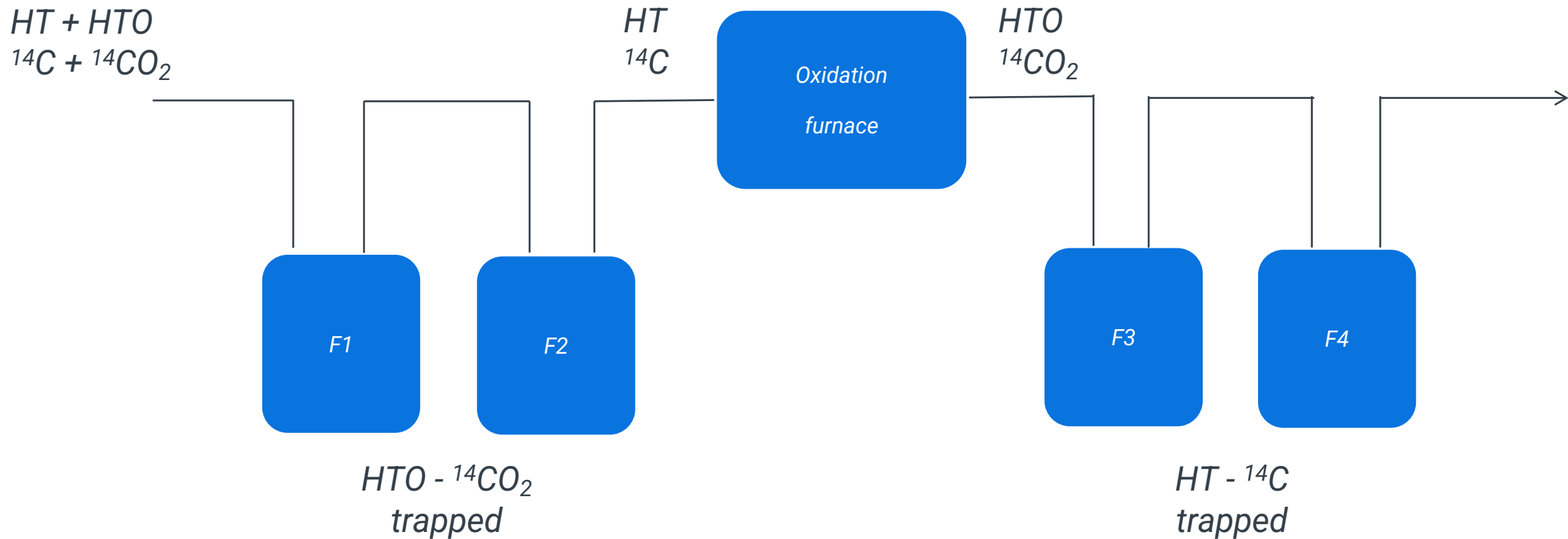


XPR80 · 8 L

ONE DT IONIX FOR ALL

- Same HMI, electronics & data interface for every chamber
- Swap detectors as your range changes – nothing new to learn
- Interchangeable, low-maintenance, field-proven designs

Samplers – Working principle



Hx IONIX – Samplers



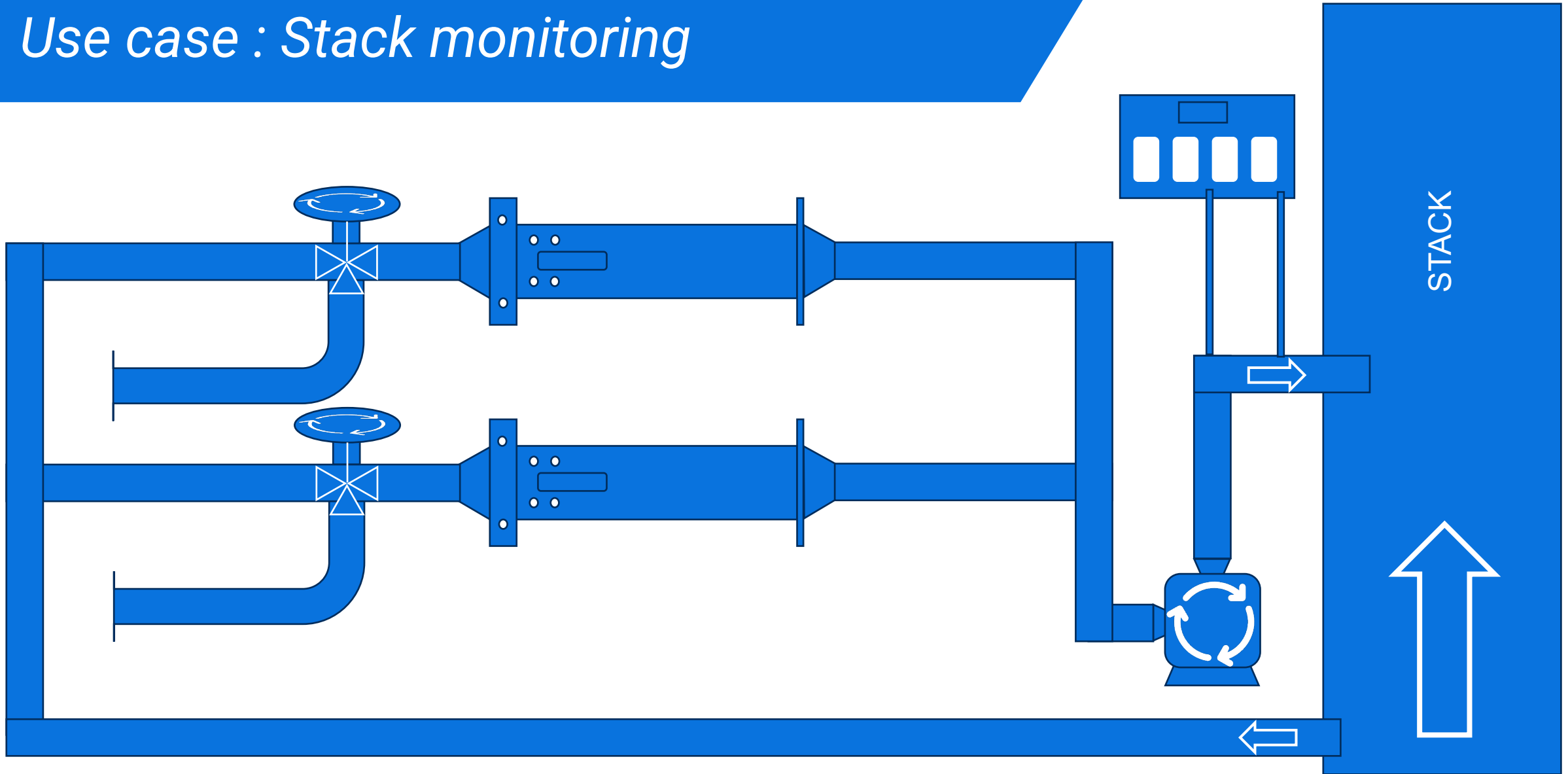
- *Trap tritium over hours up to one month for lab assay by LSC*
- *Separates HT & HTO (oxidation furnace + catalyst)*
- *>95% proven trapping efficiency*
- *2 or 4 bottle (whether HTO or HTO + HT sampling required)*
- *stainless circuit upstream the pump*
- *<15 kg for 4 bottles*

Hx IONIX – Samplers

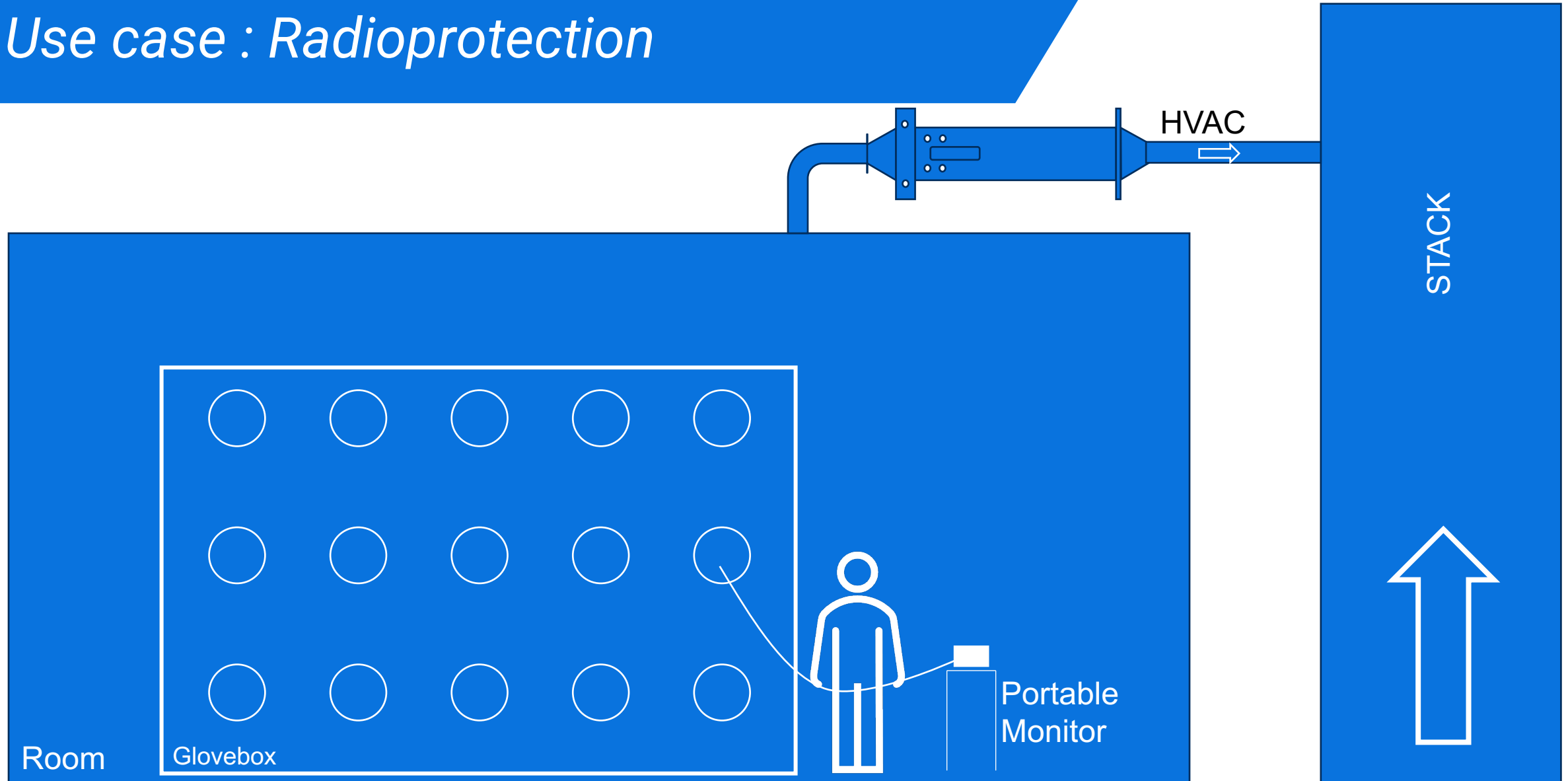


- Trap ^{14}C over hours up to one month for lab assay by LSC
- Separates $^{14}\text{CO}_2$ & ^{14}CO (oxidation furnace + catalyst)
- >95% proven trapping efficiency
- 2 or 4 bottle (whether $^{14}\text{CO}_2$ or $^{14}\text{CO}_2 + ^{14}\text{CO}$ sampling required)
- stainless circuit upstream the pump
- <15 kg for 4 bottles

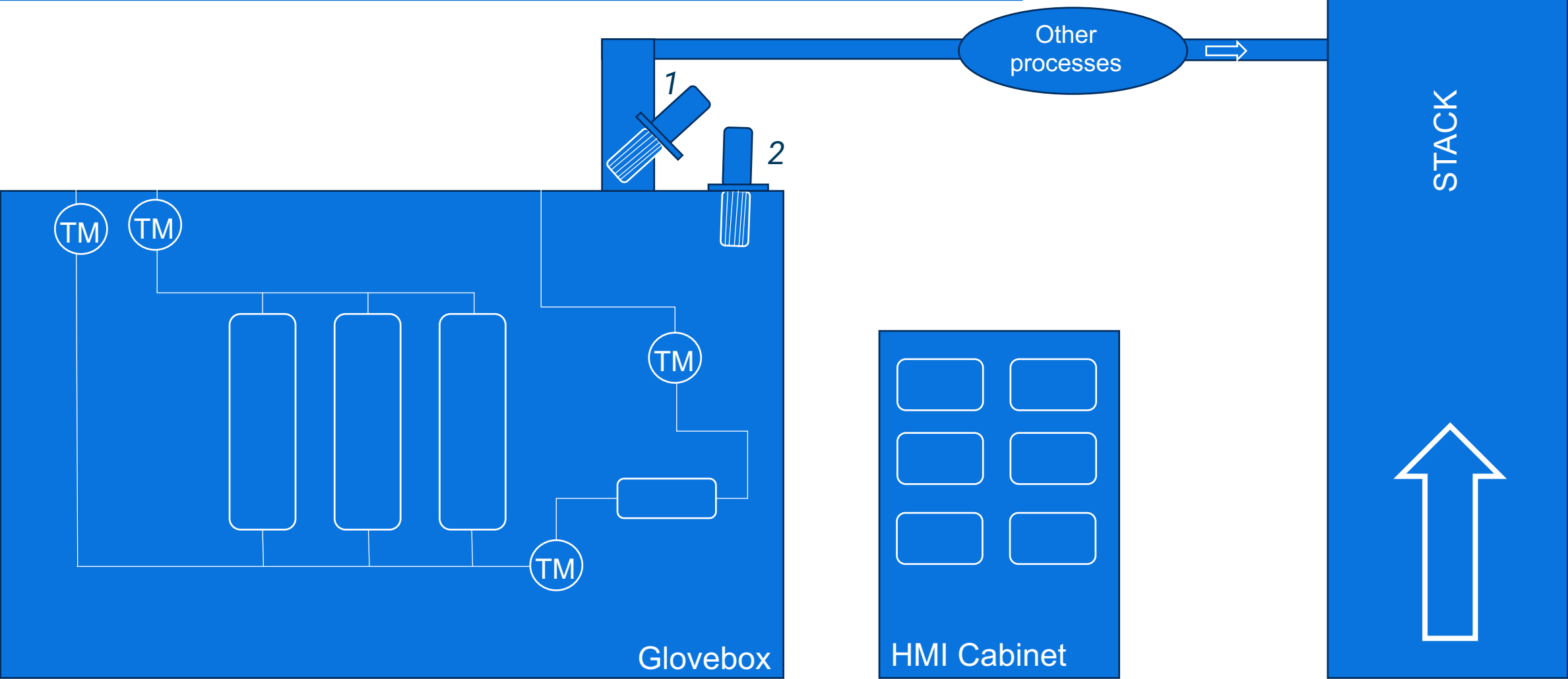
Use case : Stack monitoring



Use case : Radioprotection



Use case : Process Monitoring



Tritium Monitoring: Key Takeaways

WHAT IS REQUIRED

- *Appropriate monitor that meets the project's requirements*
- *Communication protocols to enable data acquisition*
- *Proven performance to international standards*

WHAT WE OFFER

- *Wide range of detectors with cutting edge electronics*
- *Instruments built from users feedback*
- *Unique and modern interface*
- *Calibration and testing facility*

Survey for:

Tritium Monitoring & Sampling: Essentials for Better Accuracy



*Please take a moment
to fill out a short survey
on this session.*

Thank you

