

The Mirion Spectroscopic Stack Monitor

WOSMIP Remote
June 2020
Jim Zickefoose



MIRION
TECHNOLOGIES

Outline

- System overview
- System performance
- System upgrades

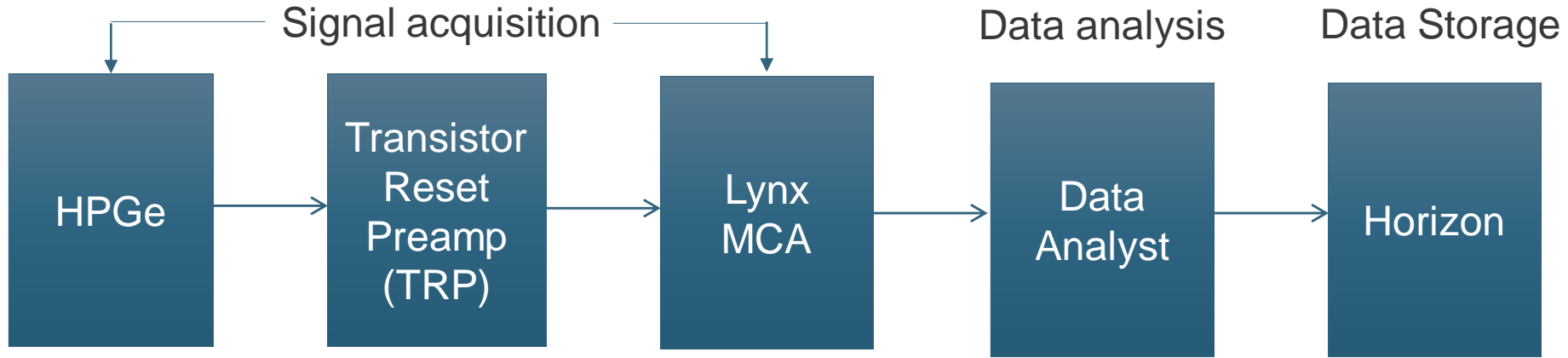


System Overview

- Designed to measure stack releases of noble gases e.g.:
 - Xe-131m
 - Xe-133
 - Xe-133m
 - Xe-135
 - Xe-135m
- Designed specifically for the STAX project
- Uses existing Canberra/Mirion standard products
- 3 systems running at different installations
 - IRE – 2.5 years
 - ANSTO – 1.5 years
 - ORNL – 0.5 years



System overview - Signal Chain



- The system is built with Mirion standard products – limits downtime during maintenance
- Large dynamic range is possible with TRP/Lynx signal chain
- Automated acquisition and analysis with the Data Analyst
- Horizon provides permanent local storage of data and data review interface

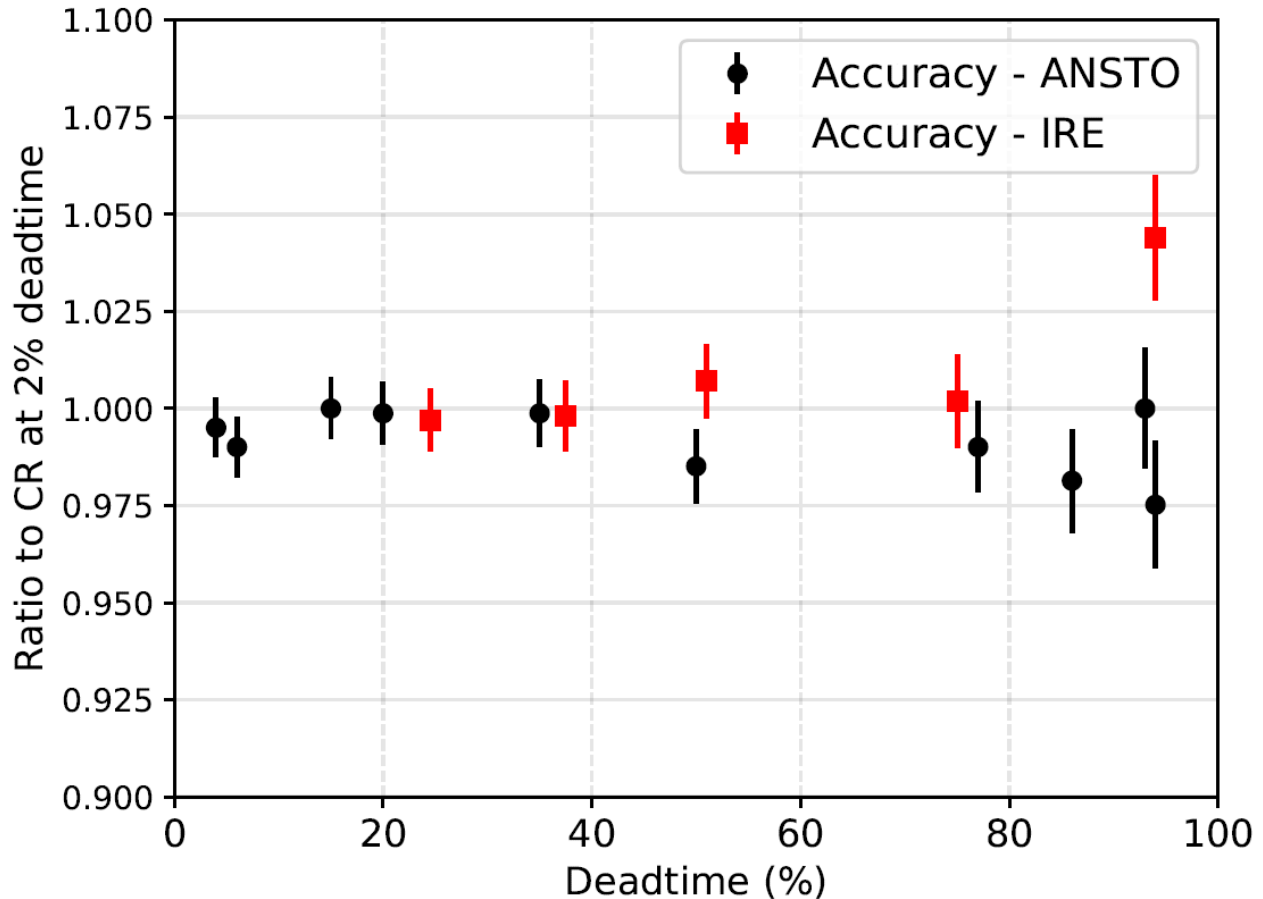
System Performance - MDC

- Using the simple Currie formalism at the 95% confidence level
- MDC for 600s averaging time (short workflow)
- BKGD rates for closed shield in ~100 nSv ambient field

Nuclide	Key line (keV)	Yield (gamma/dis)	Efficiency (cts/gamma)	ROI BKGD Rate (cps)	MDC (Bq/m³)
Kr-85	514	0.00434	4.06E-03	9.59E-03	6.91E+04
Kr-85m	151.2	0.7519	9.77E-03	1.25E-02	1.85E+02
I-131	364.5	0.8122	5.44E-03	5.35E-03	2.20E+02
Xe-131m	163.9	0.01953	9.59E-03	1.31E-02	7.41E+03
Xe-133	80.99	0.3699	6.45E-03	1.27E-02	5.74E+02
Xe-133m	233.2	0.1013	7.86E-03	1.01E-02	1.56E+03
Xe-135	249.8	0.8999	7.46E-03	1.03E-02	1.87E+02
Xe-135m	526.6	0.808	3.99E-03	3.06E-03	2.46E+02

System Performance – High count rates

- The Lynx deadtime correction was tested with a dual source method
- Less than 5% error at 500,000 cps
- Actual deadtime is dependent on shaping parameters
- System specified top end count rate is 500,000 cps but will measure well beyond that



System Performance – Measurement range

- Measurable concentration range (Xe-133)
 10^2 to 6.3×10^9 Bq/m³
- Assuming 90,000 m³/h stack flow rate
- Measurable release rate range (Xe-133)
 9×10^6 to 5.7×10^{14} Bq/h

Possible System Updates



QA workflow (near future)

- Automatically track efficiency, energy, and shape calibrations as well as state of health information
- Automatically provide feedback if conditions are beyond the desired confidence level

Relay outputs

- Provide remote indications when user defined criteria are met
- Nuclide alarms, count rate alarms, fault indication, power failure

Horizon UI updates (near future)

- Compare nuclide activity time series plots against each other
- New look and feel – more user friendly and more responsive

Sampling skid AC

- Limit the temperature exposure of the detector and detector cooler

Thank you!