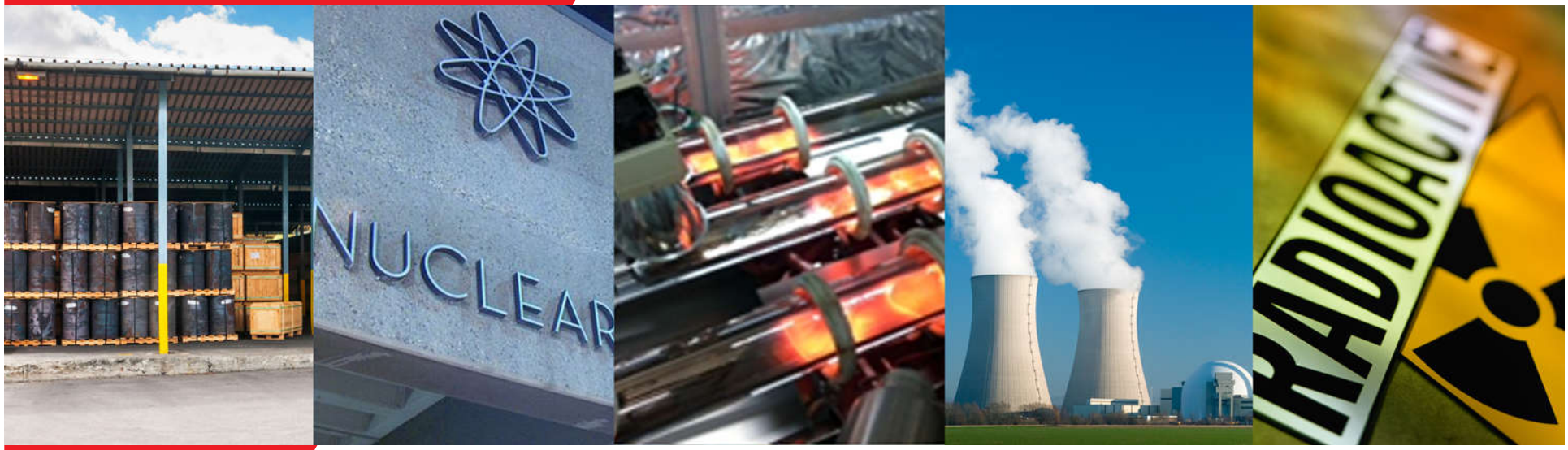
ORTEC®

AMETEK®



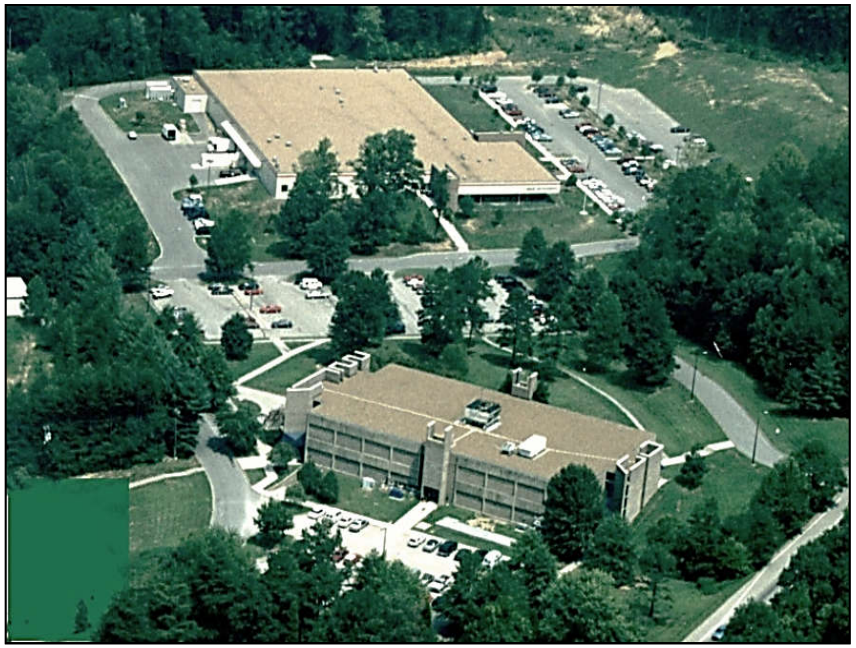

# DAVIDE SACCHI

# ORTEC Overview

ORTEC®

ORTEC was founded in 1960 by researchers from Oak Ridge National Labs to commercialize charged particle detectors

- **Headquarters:** Oak Ridge, TN with global sales and service offices
- **Employees:** 300+ worldwide
- **Core focus:** Ionizing radiation detection, identification and analysis instruments and systems
- **Ownership:** AMETEK, Inc., a leading global manufacturer of electronic instruments and electromechanical devices with 2015 sales of $4.0 billion



# ORTEC Core Competencies

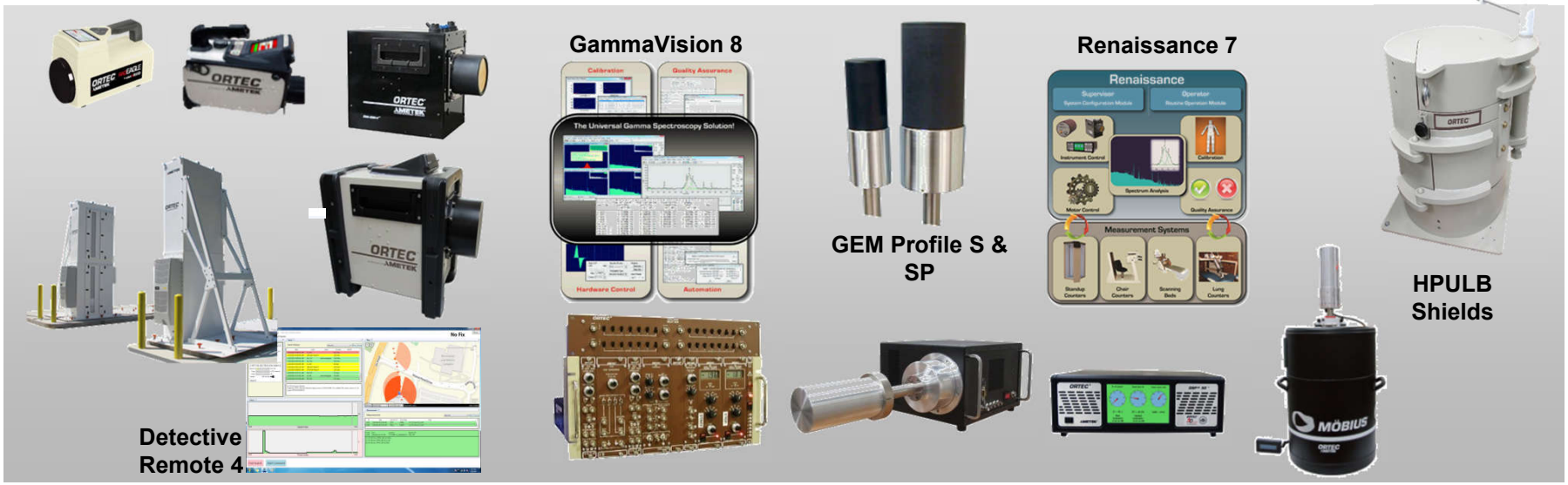
ORTEC®

- **High Purity Germanium Crystal Mfg.**
  - *Purest industrial substance in the world*
  - *~ 1x10$^{10}$ atoms/cc of impurity or better (out of about 1.2x10$^{23}$ atoms/cc total)*
- **Cryocooling Technologies**
  - *Vertically intergraded design and manufacturing of Stirling coolers*
- **Specialized Electronics**
  - *Highly specialized for nuclear, corrosion and materials analysis*
- **Analysis Software**
  - *Comprehensive offerings for integrated hardware control, data analysis and visual display*
- **Integrated System Applications**
  - *Focused expertise to assess and configure or customize targeted solutions to meet your needs*


# ORTEC Served Markets

ORTEC®

| Nuclear Security & Safeguards | Radiochemistry, Health Physics, Nuclear Power, Research and Education |
|---|---|



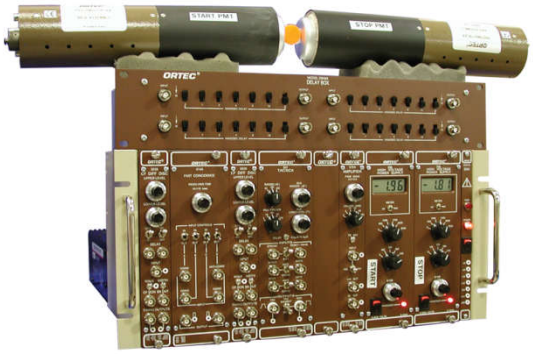

| | | |
|---|---|---|
| • Scintillation based detection and ID<br>• Enhanced mobile search software | • Integrated gamma spec. software<br>• High resolution, wide energy HPGe | • Advanced whole body cntg. software<br>• Ultra-low background lead shielding |

# **Key Technology:** HPGe Detector LN2 and Electromechanical Cooling Systems

# Key Technology: Electronic Products

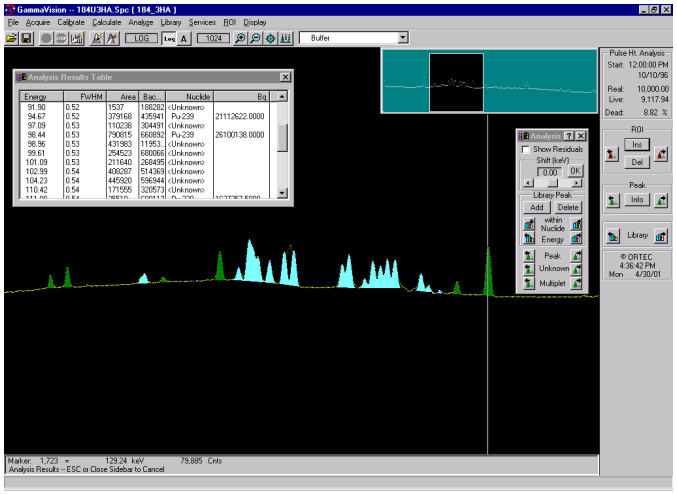
## Signal processing electronics for radiation detector systems and fast timing systems

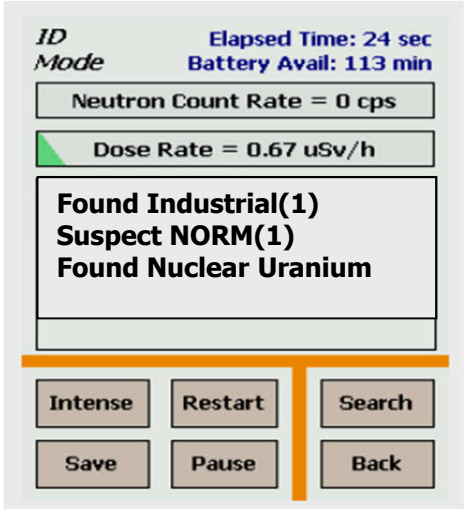


# Key Technology: Software

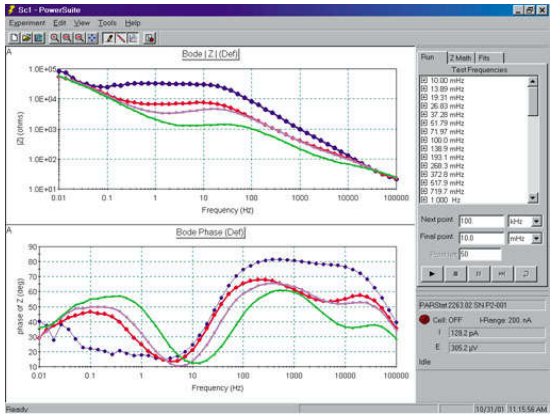
**High degree of collaboration with national laboratories for state of the art analysis methods.**






**ORTEC Analysis Software for :**

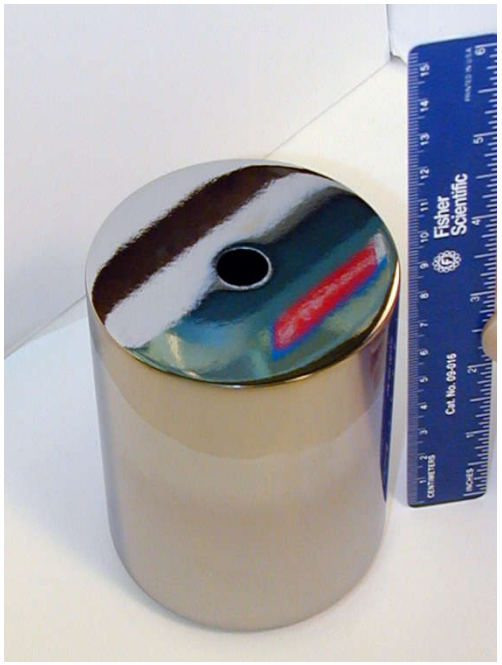
- Gamma Spectroscopy
- Alpha Spectroscopy
- Waste Assay
- Safeguards
- Whole Body Counting
- Homeland Security

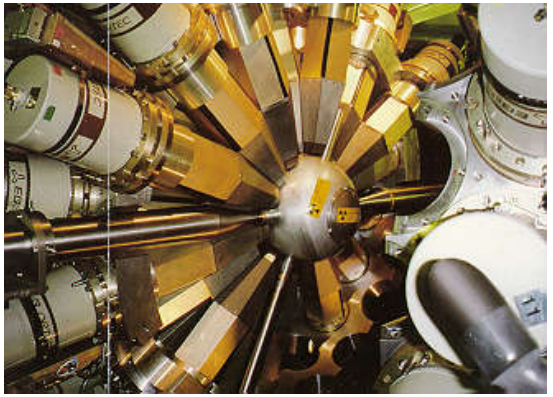


# Key Technology: HPGe Crystals for Detectors

**ORTEC** is a world leader in nuclear instrumentation, including both growing HPGe crystals and fabricating detectors.

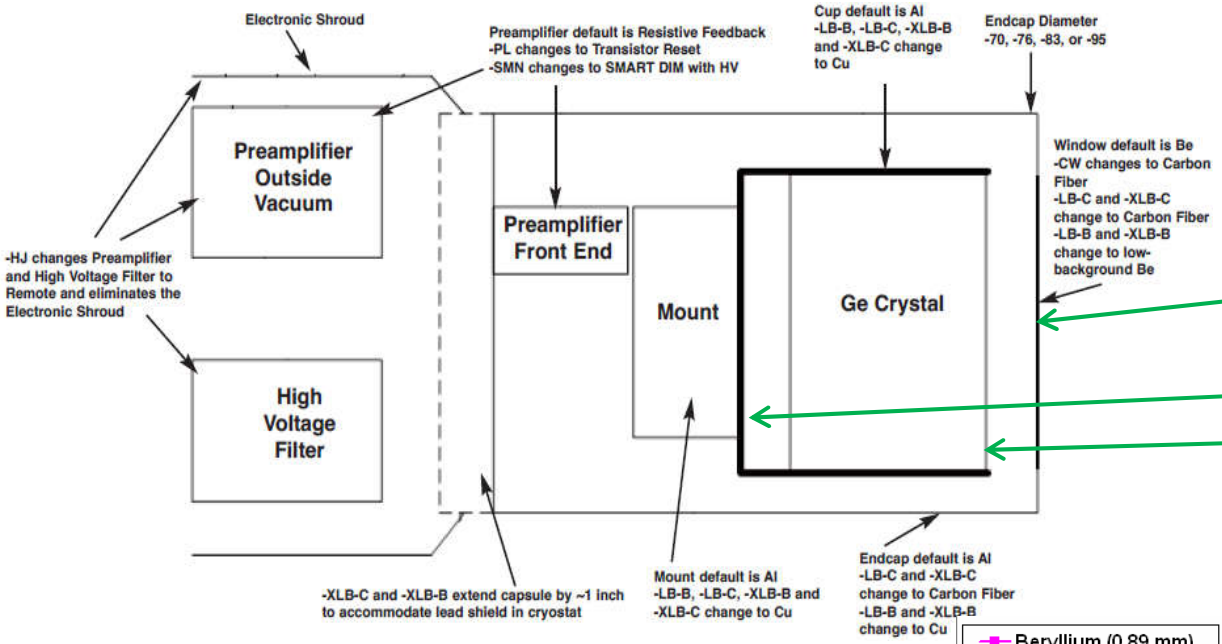
**ORTEC** has significant experience in large scale production of HPGe detectors for a variety of projects.



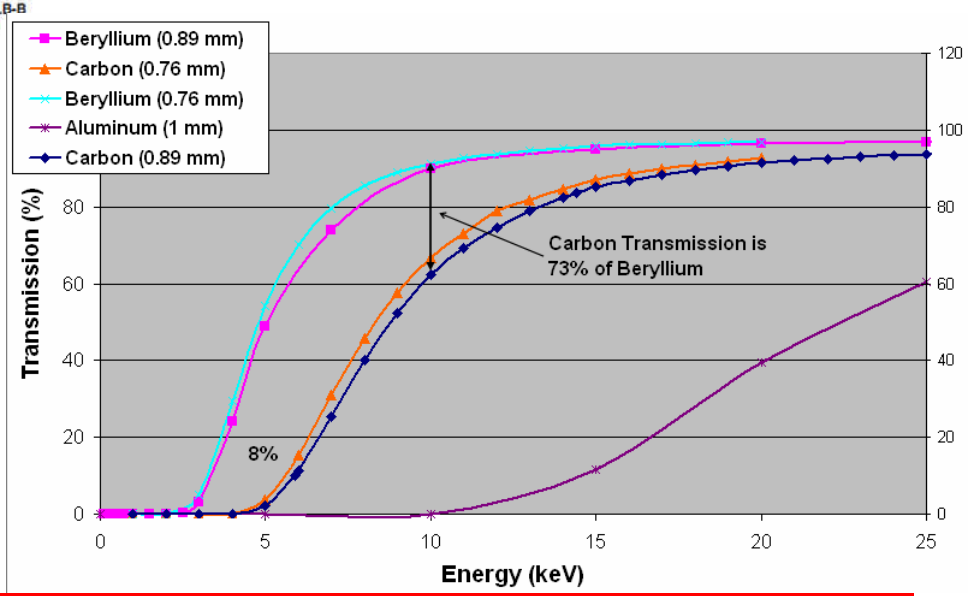
# Detector Efficiency

ORTEC®




Components affecting efficiency:

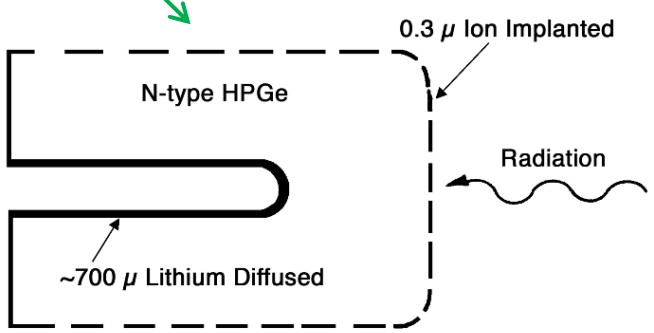
- Front and sides of the endcap
- Crystal holder
- Crystal contact

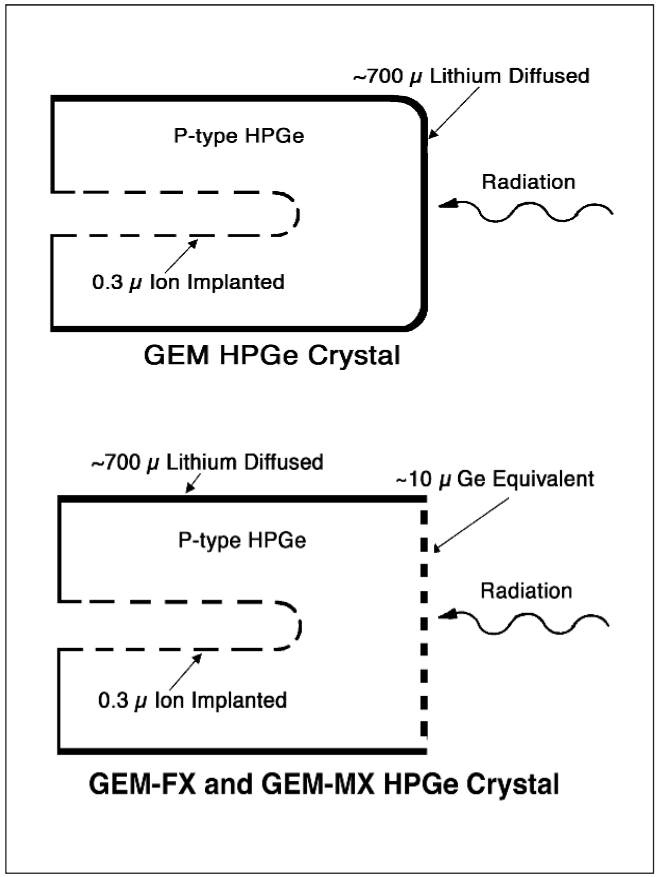


# P-type vs N-type HPGe detectors

ORTEC®

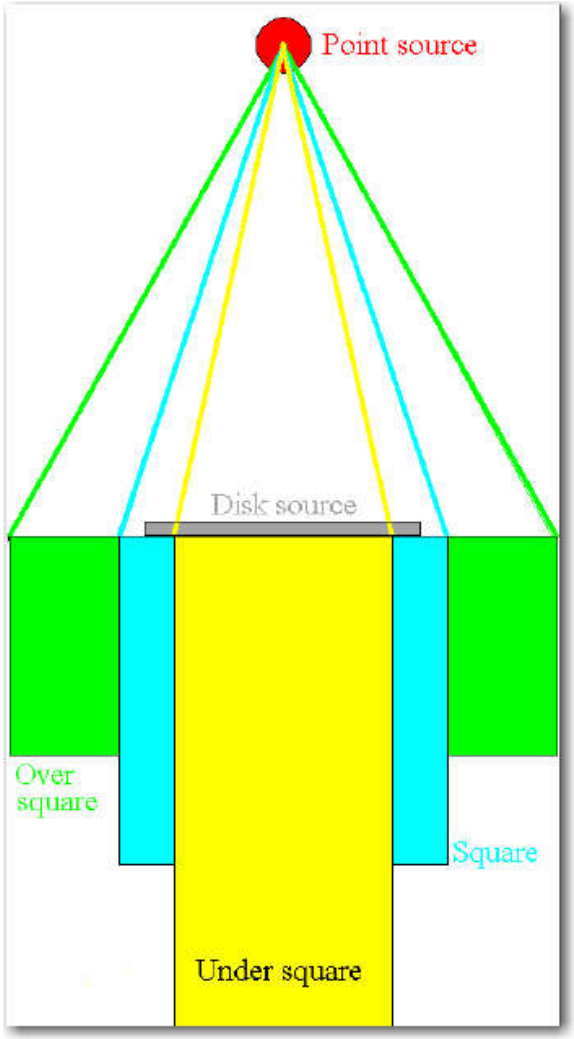
- P-type (GEM, Profile):
  - Better resolution
  - Ruggedness
  - Lower price
- N-type (GMX):
  - Better lower energy efficiency from sides
  - Neutron/proton damage resistivity



# HpGe serie GEM Profile

ORTEC®

# 2011... GEM Profile MX & FX

ORTEC®

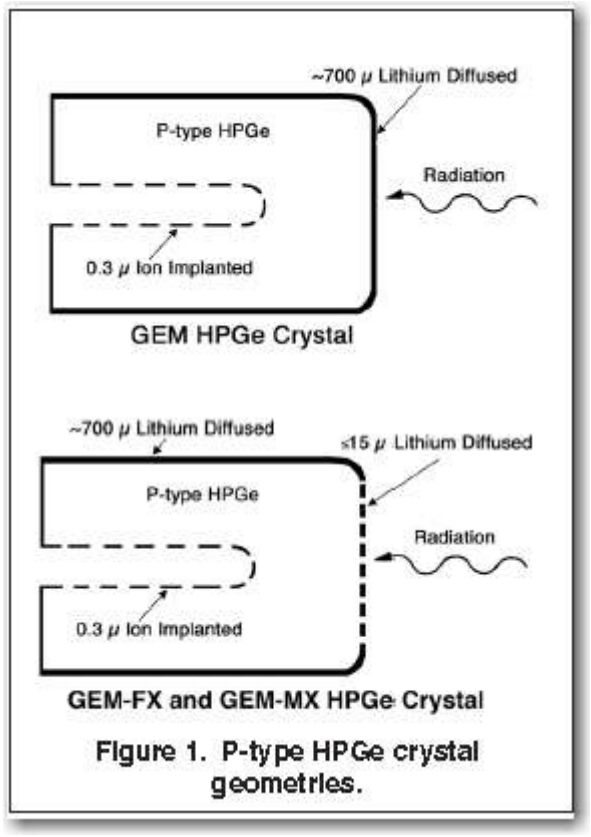
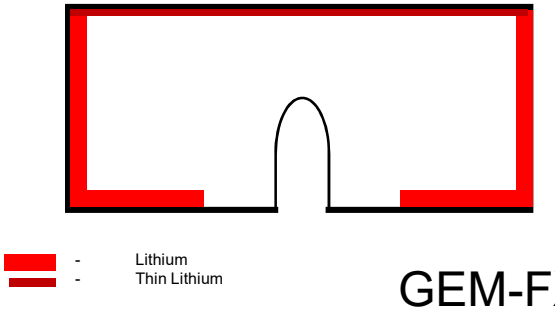
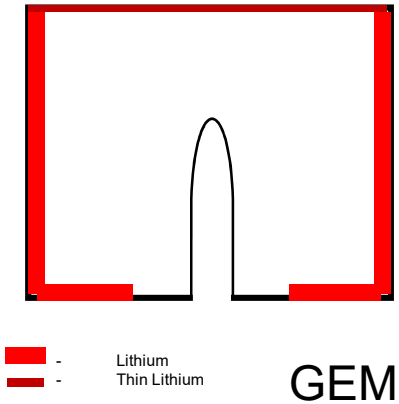



Figure 1. P-type HPGe crystal geometries.



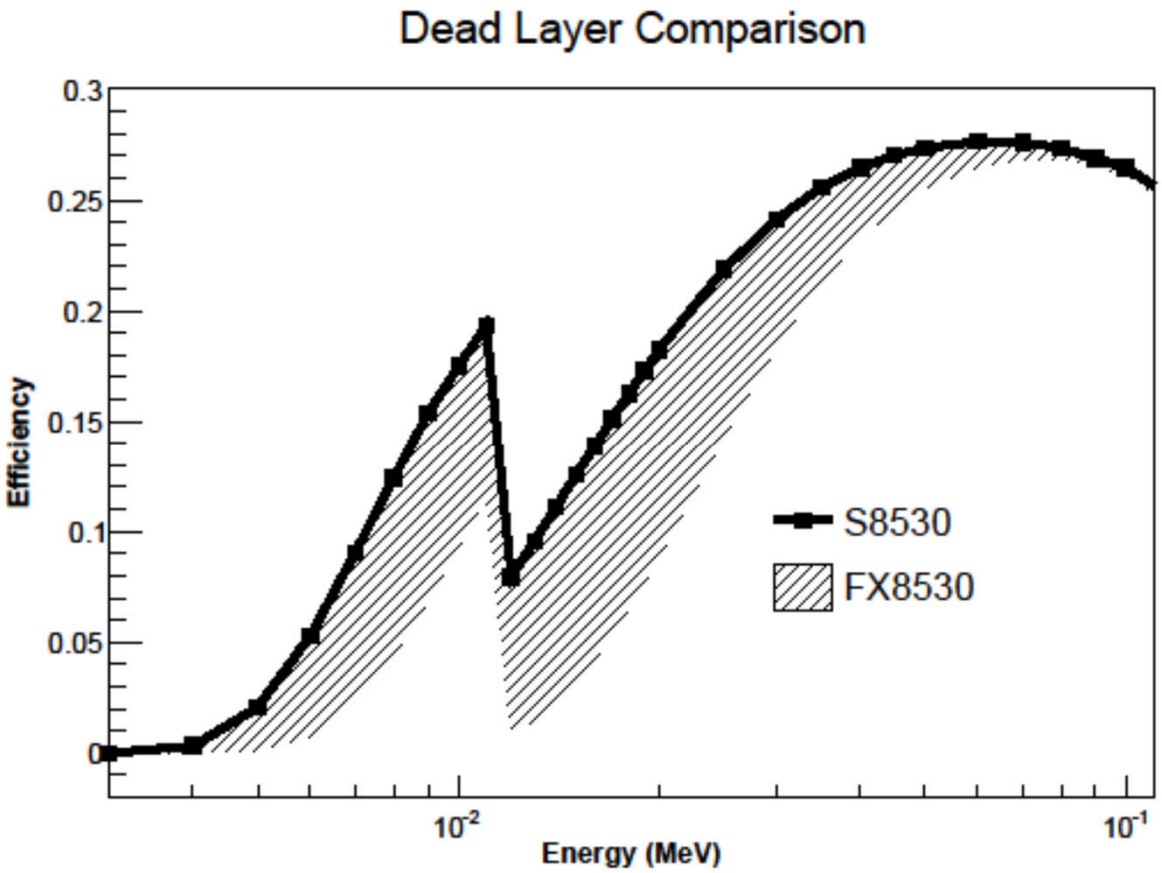

GEM-FX




GEM-MX

# 2014…STFC vs Old Contact

ORTEC®

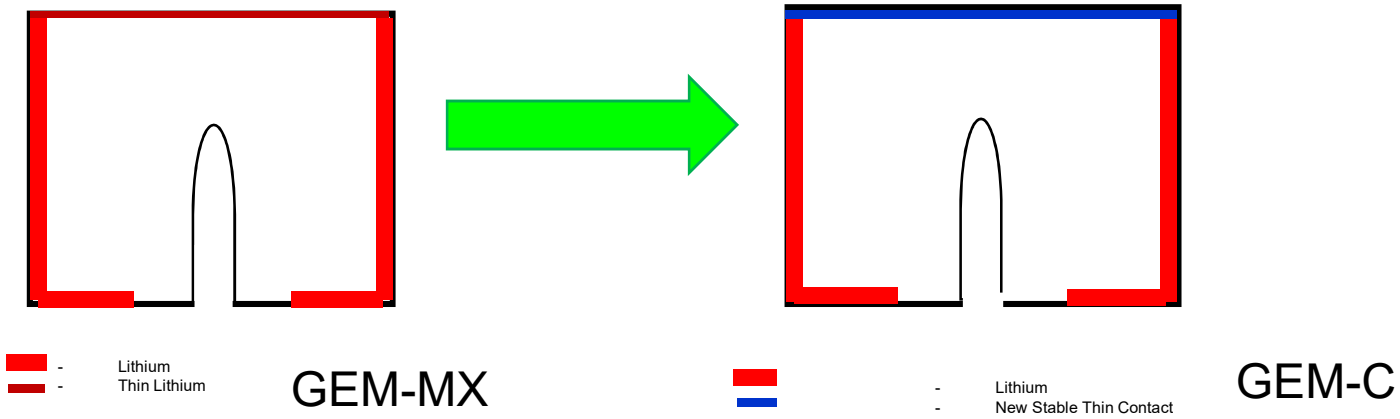



**Improvements:**

Profile S with STFC shows improvement in efficiencies over former Profile FX detector for energies below 100 keV.

- *Stable Thin Front Contact (STFC) presented at the IEEE NSS/MIC, November 2014 in Seattle, Washington – Kyle T. Schmitt, Gregor G. Geurkov, Elaine. G. Roth, Timothy R. Twomey, and Teresa Underwood "Improved Efficiency at Low Energies with P-Type High Purity Germanium Detectors".*

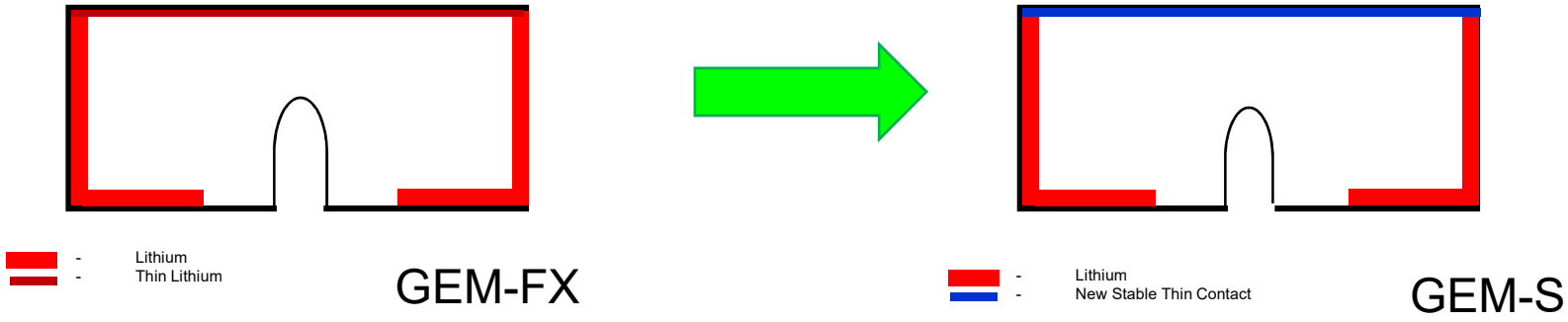
# Profile MX → Profile C (Coaxial)




**Change:**

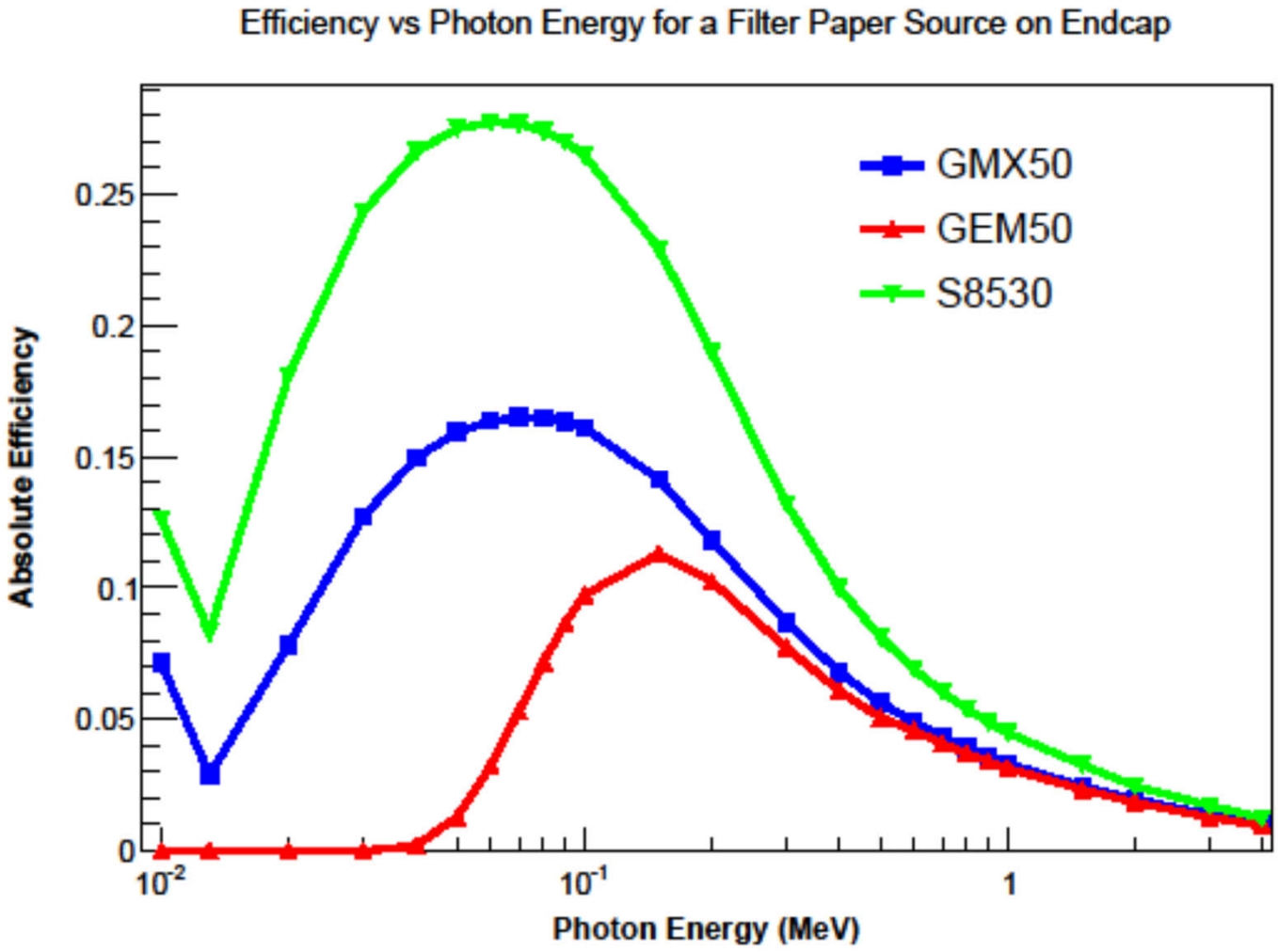
- ❑ Front contact is replaced by a stable thinner proprietary contact

# Profile FX → Profile S (Semiplanar)



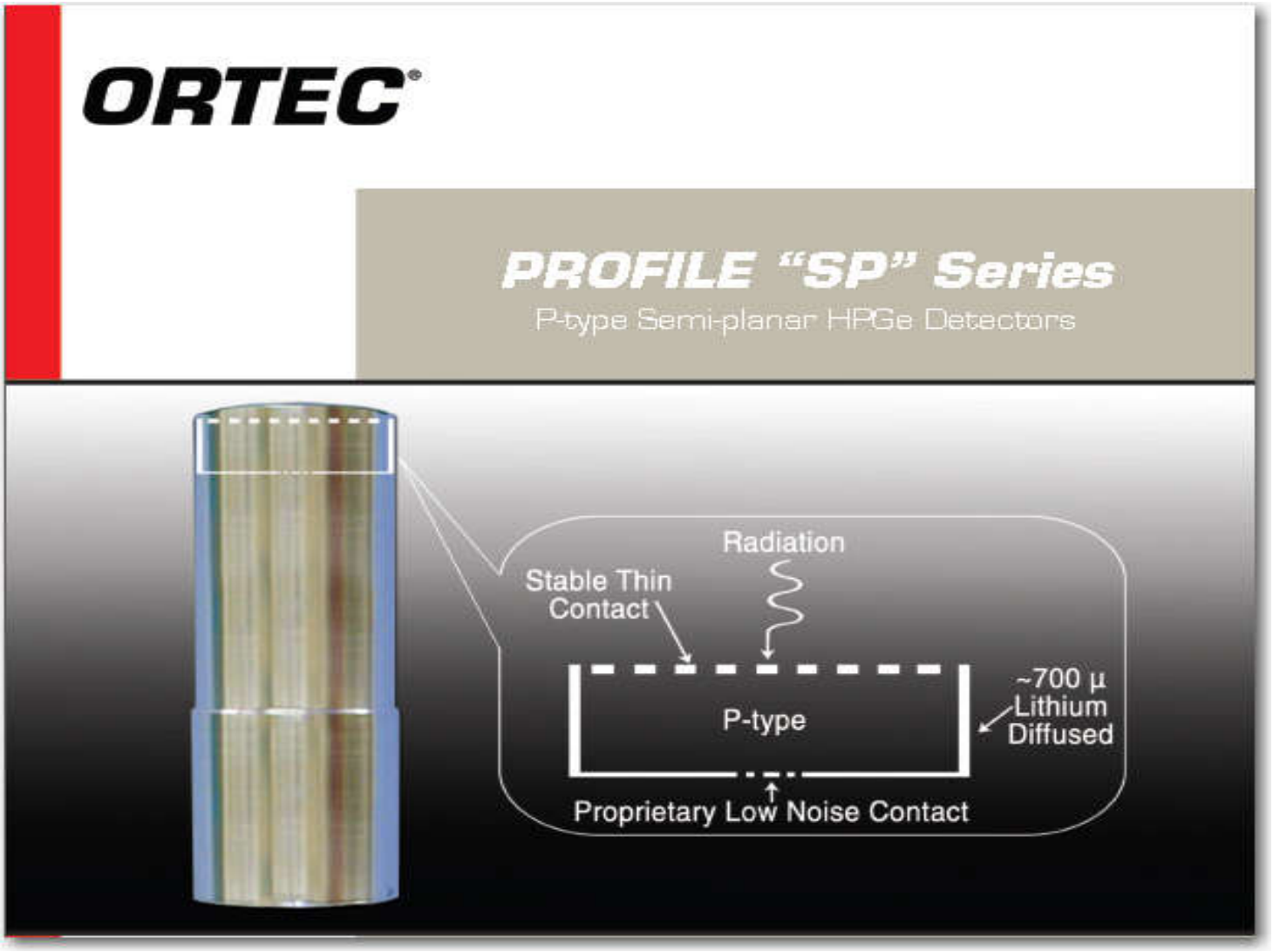

**Change:**

- Front contact is replaced by a stable thinner proprietary contact


Efficiency vs Photon Energy for a Filter Paper Source on Endcap
GMX50
GEM50
S8530
Absolute Efficiency
0.25
0.2
0.15
0.1
0.05
0
$10^{-2}$
$10^{-1}$
1
Photon Energy (MeV)

# 2015... Profile SP

ORTEC®



# 2015... Profile SP

ORTEC®

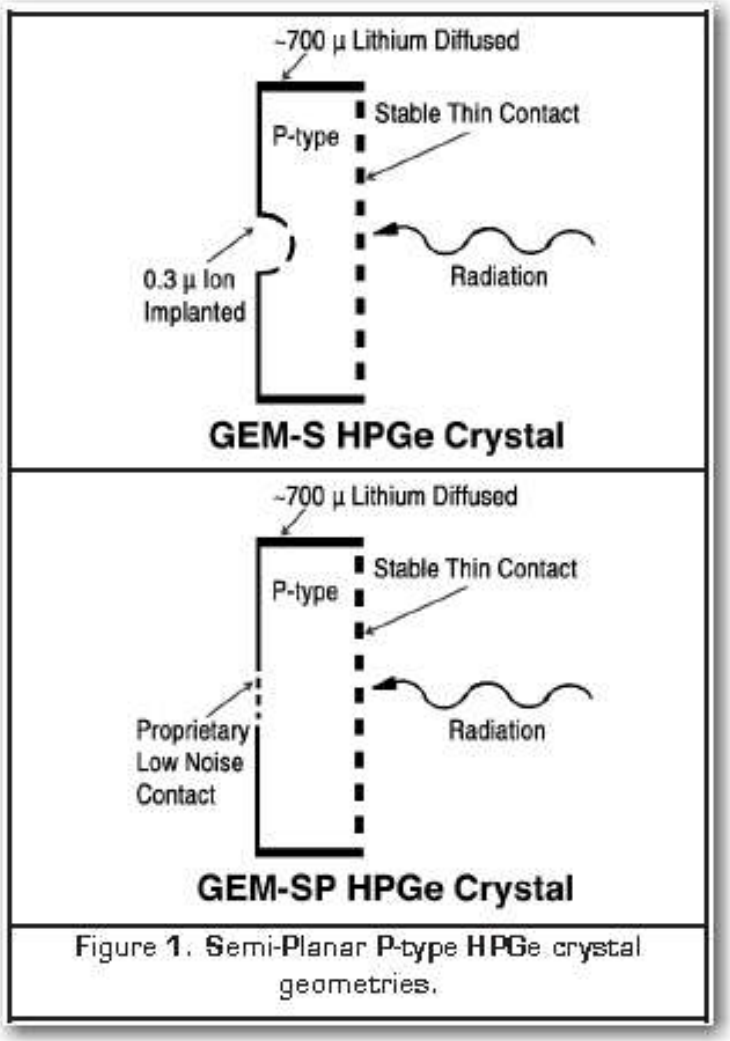



Figure 1. Semi-Planar P-type HPGe crystal geometries.

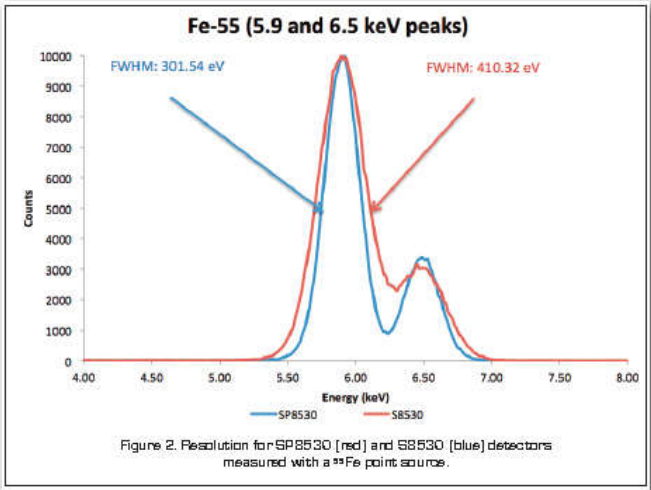



Figure 2. Resolution for SP8530 [red] and S8530 [blue] detectors measured with a $^{55}$Fe point source.

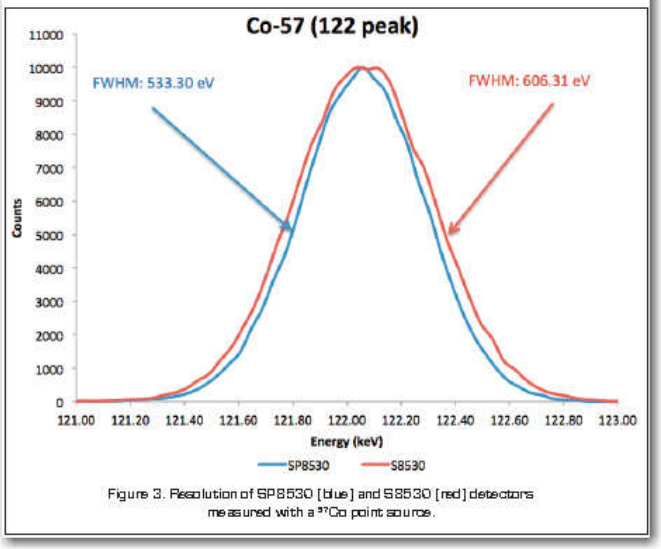
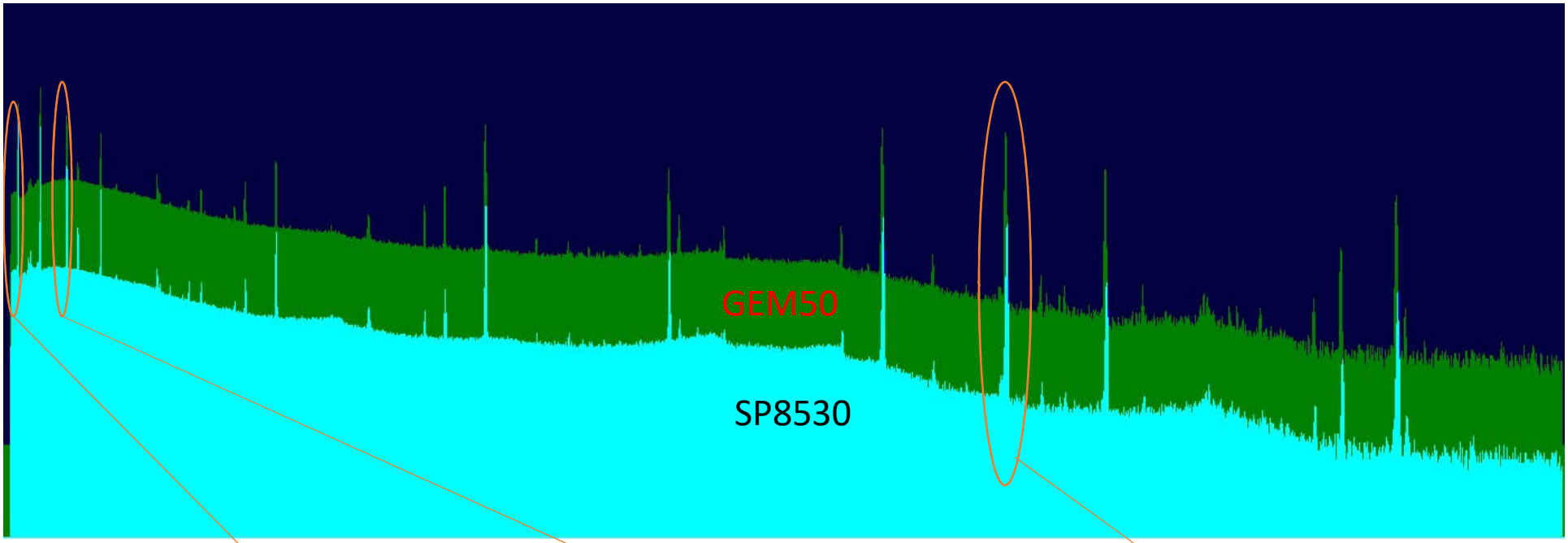
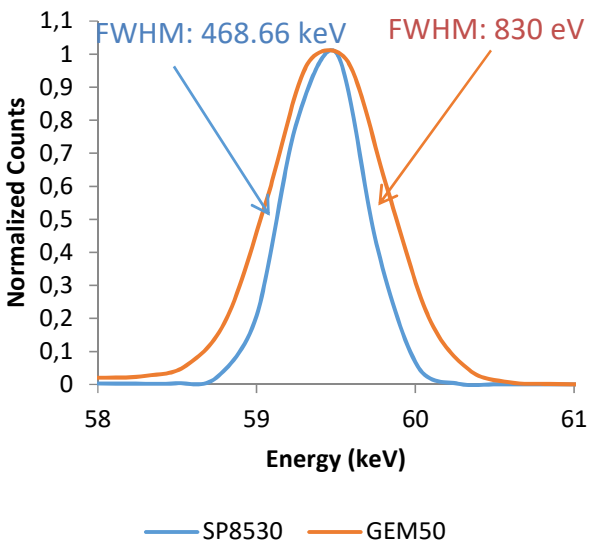


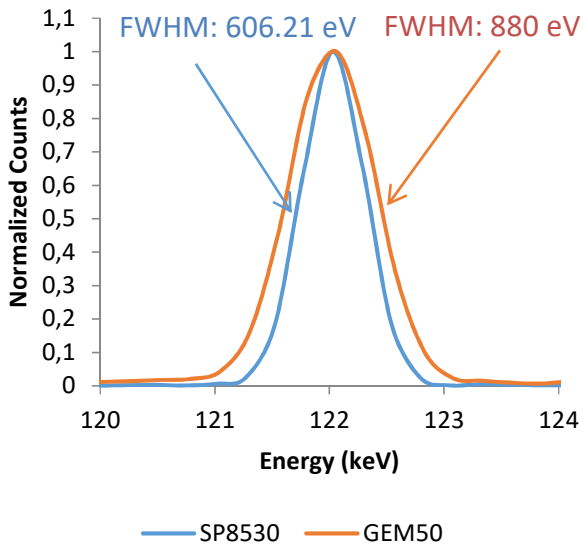

Figure 3. Resolution of SP8530 [blue] and S8530 [red] detectors measured with a $^{57}$Co point source.



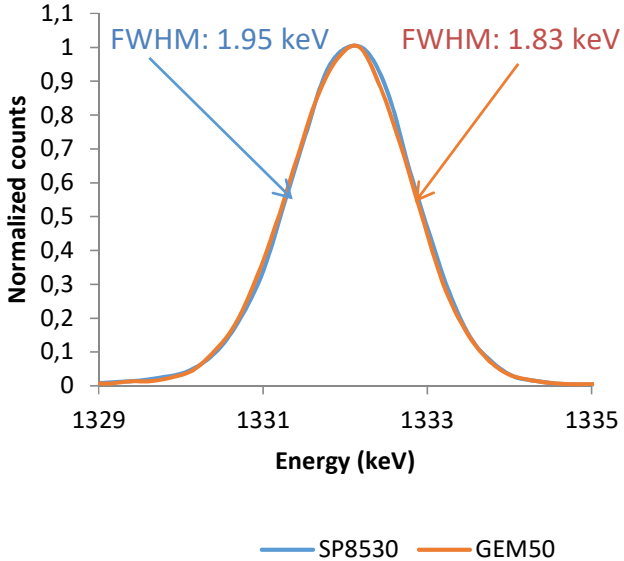

## Am-241 (59.5 keV peak)




## Co-57 (122keV peak)




## Co-60 (1332keV peak)



# Cooling Overview

ORTEC®

- Using Liquid Nitrogen as cooling method has significant drawbacks:
  - It is a hazardous material.
  - It is costly both in terms of man-hours used in filling operations and the actual cost of the $LN_2$.
  - Detector performance is degraded during filling
  - It is not always available, thus limiting the applications for HPGe detectors

AMETEK SUNPOWER ® ORTEC®

# Portable Coolers

ORTEC®

- Micro-trans-Spec/ Micro-UF6
  - *13% efficiency P-type detector, weighs 7kg*
- Trans-Spec-DX-100T
  - *45% efficiency P-type detector, weighs 11kg*
- Trans-Spec-N **(New)**
  - *50% efficiency N-type detector, weighs 11kg*
- IDM-200-V **(New)**
  - *50% efficiency P-type large area detector, weighs 18kg*



# Stationary/Transportable Coolers

ORTEC®

- X-COOLER-III
  - *Pop-Top compatibility*
  - *All attitude detector/cold-head*
- LDM-1
  - *Complete Spectrometry Solution*
  - *All attitude operation / includes stand*
- MOBIUS **(released July 2013)**
  - *$LN_2$ recycler*
  - *> 2 years between $LN_2$ fills*
- ICS
  **(Vacuum Hardened released September 2014)**
  **(PopTop released November 2016)**
  - *Integrated Stirling cooler*
  - *All attitude operation*
  - *$LN_2$ equivalent energy resolution above 100 keV*




# Möbius® $LN_2$ Recycler

ORTEC®

## *Industry leading $LN_2$ recycling cooling system for HPGe detectors*


### Key Drivers

- $LN_2$ cryocooling for premium HPGe detector resolution and simultaneously minimizing the cost and hazards associated with frequent refilling.

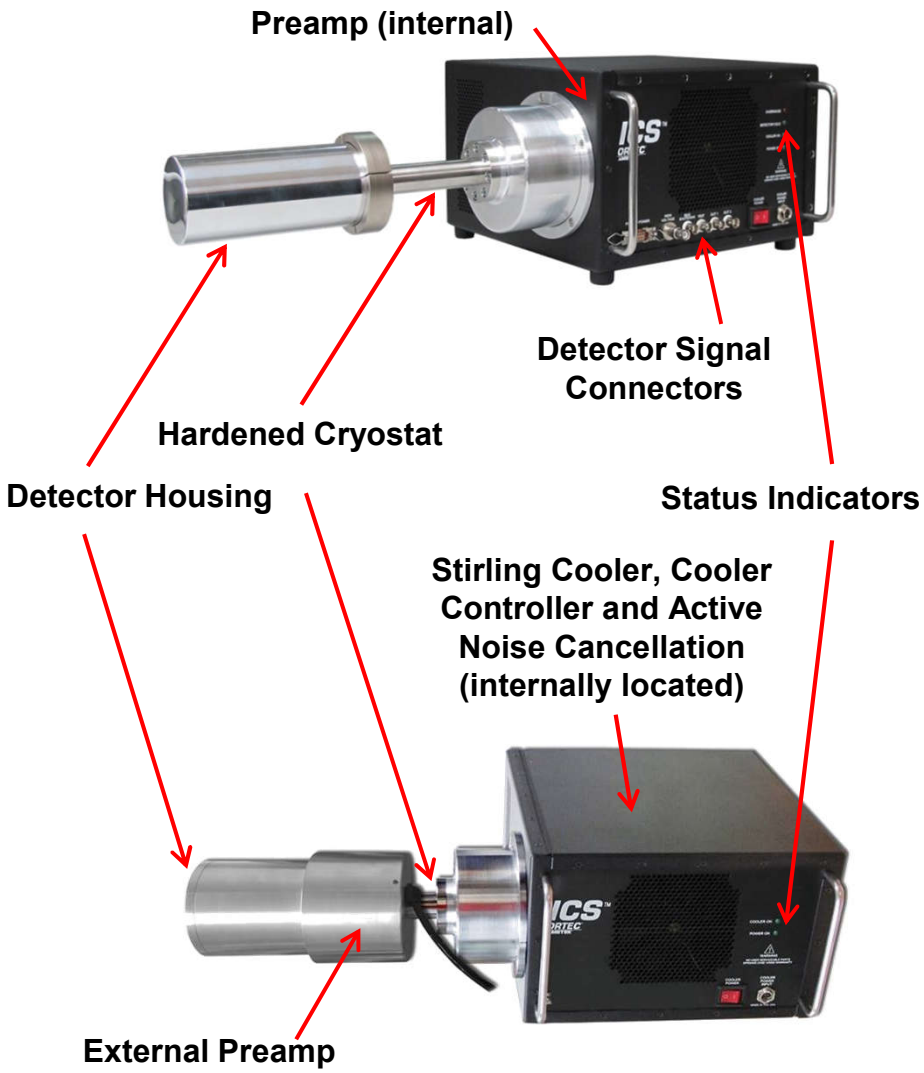
### Technology / Product Implementation and Solution

- Integrated dewar and electrical cryocooler that recondenses $LN_2$ vapor
  - *Up to two or more years without the need for LN2 refills under normal operating conditions*
- Sunpower CryoTel® GT Stirling cooler
  - *High reliability 200,000 hour MTTF cryocooler*
  - *Low power consumption, < 50% of alternatives*
- 28 liter dewar provides extended run-time
  - *7 to 10 days holding time upon power loss with full dewar*
- System monitoring and diagnostic tools

# ICS® Integrated Cryocooling System

ORTEC®

## *Superior electro-mechanical cooling system for HPGe detectors*




### Key Drivers

- Premium, $LN_2$ like resolution performance without using $LN_2$, with improved operational ease-of-use, application flexibility, and superior system uptime

### Technology / Product Implementation and Solution

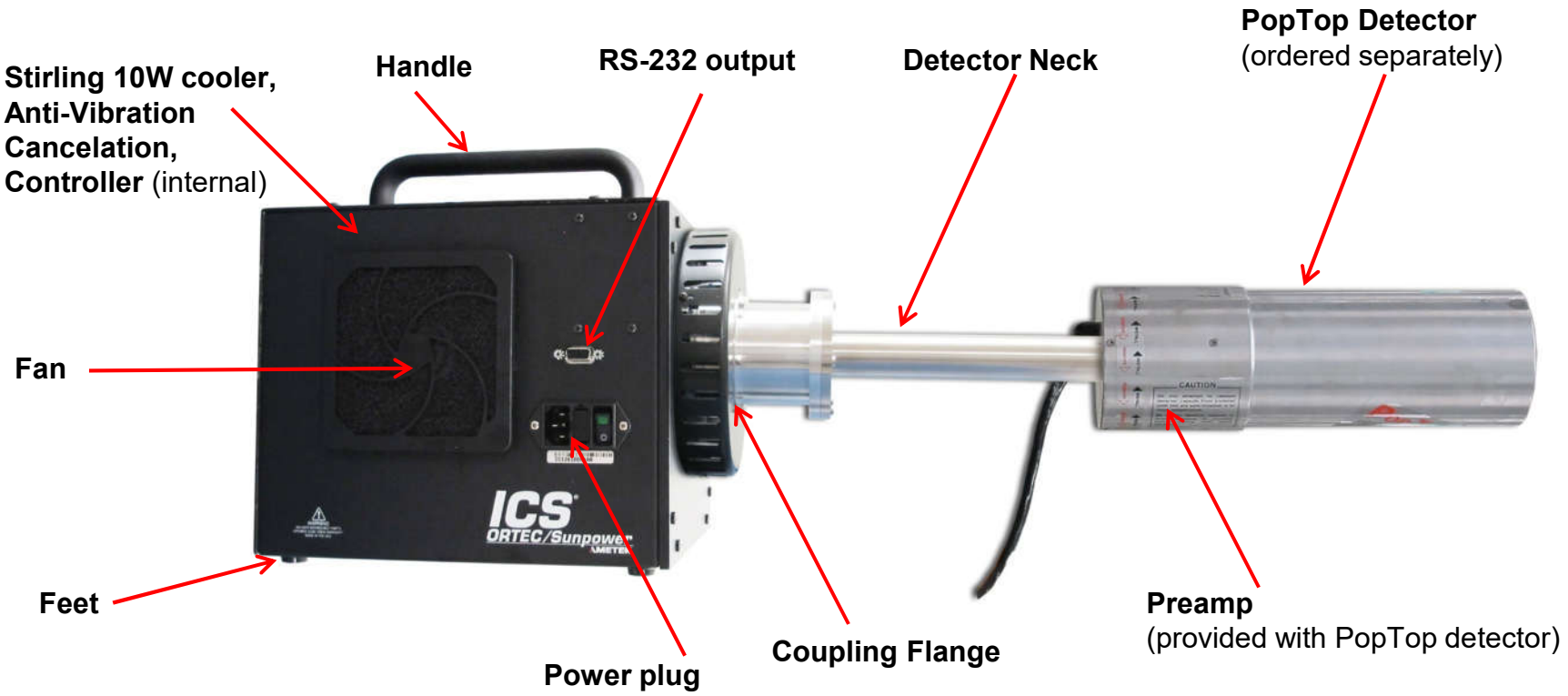
- Delivers $LN_2$ like resolution for a variety of HPGe detector models
- Fully integrated Sunpower Stirling cryocooler incorporates Active Vibration Cancellation technology and provides excellent cooler MTTF
- Vacuum hardened cryostat for superior vacuum integrity and no thermal cycling
- Ultra-quite design in a small, compact, single unit footprint provides installation flexibility

# PopTop® -ICS® (ICS-P4)

ORTEC®

## Key Differences From Vacuum Hardened version

- Conventional cryostat
- Field Upgradable
- Higher power consumption
- Lower weight



# RADEAGLE Update

ORTEC®


## High Performance Low-Medium resolution RIID

# RADEAGLE Key Advantages

ORTEC®

***RADEAGLE is the fastest, most accurate, and lightest handheld radioisotope identification device in its class with the fewest false alarms.***

Combining a large(1), high sensitivity(2,3), NaI(Tl) crystal with an intelligent algorithm, RADEAGLE can correctly ID up to six isotopes simultaneously, even in complex shielded or masked scenarios in under 30 seconds.

At ~2500g, the RADEAGLE is the lightest of all NaI(Tl), high performance RIIDs, and incorporates a simple touchpad user interface and intuitive, multi-functional software. The RADEAGLE's simplistic operation enables even novice users to be fully capable of performing sophisticated ID measurements.


(1) 3.0" (76.2mm) x 1.0" (25.4mm)

(2) > 2500 cps per uSv/h @ 662keV $^{137}$Cs

(3) < 7.2% FWHM @ 662keV $^{137}$Cs



AMETEK®

# RADEAGLE Life Cycle Costs

ORTEC®

## Total Life Cycle Costs Include:

- *Upfront Capital Costs*
- *Calibration Costs*
  - *No Calibration Costs with RadEagle (saves $3-4K /yr or every two years).*
- *Maintenance Costs*
  - *Minimal maintenance costs and ability to repair units in house*
- *False Alarm Costs*
  - *False Positives require costly responses from multiple government agencies*
  - *False Negative cost would be inconceivable.*

***RadEagle is lowest Total Life Cycle Cost Option***

# RADEAGLE – capabilities update

ORTEC®



**WI-FI Dongle**

- System can be connected to any WI-FI network
- System can open a Access-Point, so devices (PC, Mobile phone, Ipad, …) can be connected easily
- Load Spectra, create report, change settings and etc. via Web-Interface

**USB to Ethernet adapter**

- System can be connected to any local Ethernet
- Load Spectra, create report, change settings and etc. via Web-Interface

**USB – Stick**

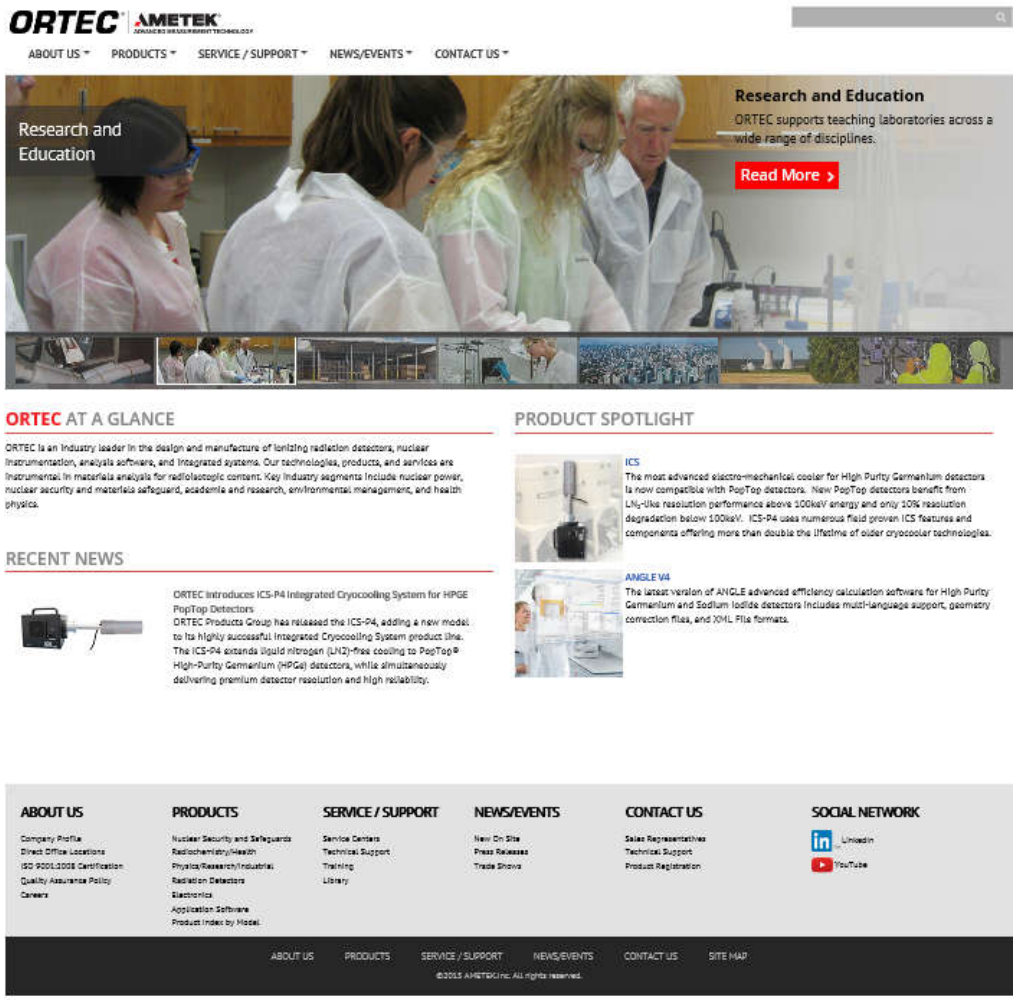
- Spectra data can be copied to the data stick
- Easy data exchange between System and PC

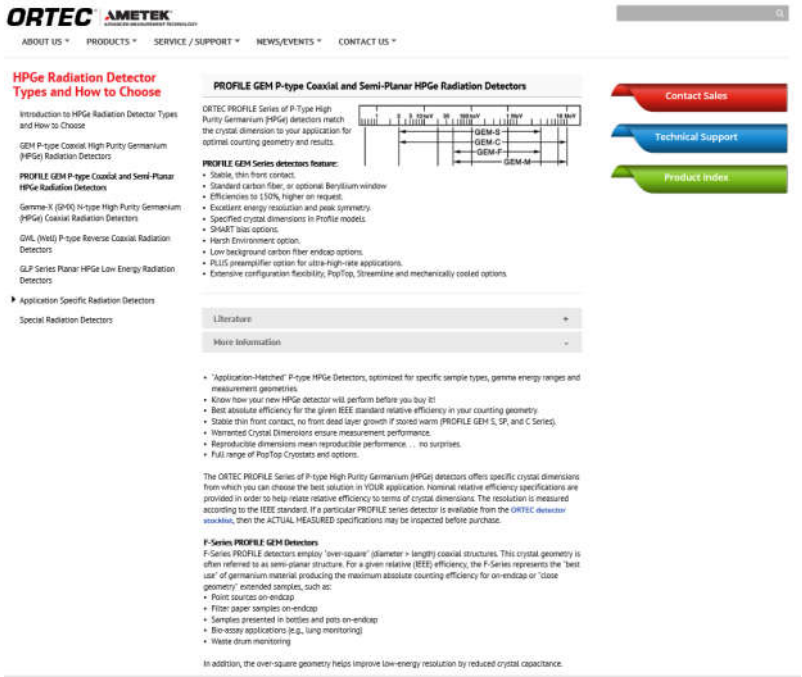
**USB cable to PC**

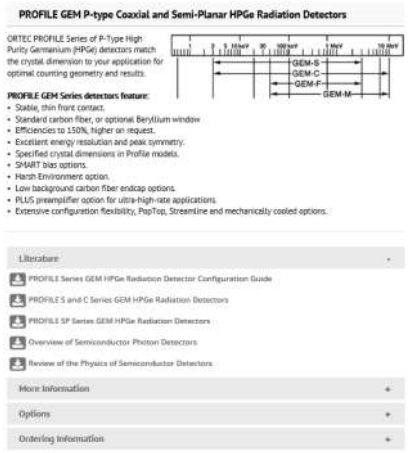
- Direct connection to Web-Interface on the PC
- Easy data exchange
- Live data

# And finally – our New Website

ORTEC®




Suggestions and feedback on the new website will be appreciated

AMETEK®

# Thanks for your attention !