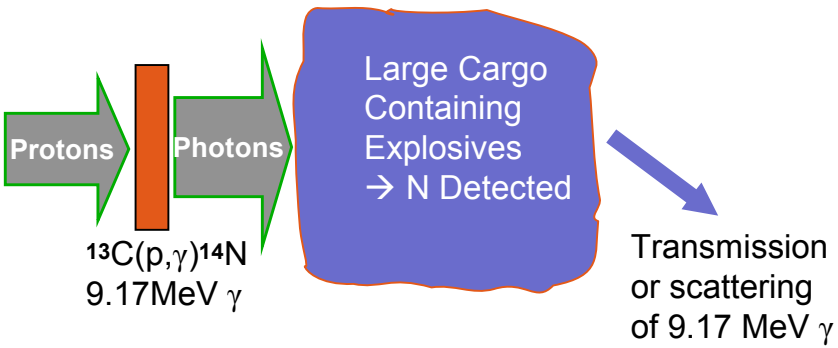
Detection Simulation: Photo-Resonance Data for Explosives Detection

CSEWG-USNDP Meeting: Nuclear Data for Homeland Security, Nov 6, 2003

Unclassified

Gamma Resonance Technology



Technical Principle

Compact 1.75 MeV proton accelerator produces 9.17 MeV resonance photons via $^{13}C(p,\gamma)^{14}N$ reaction.

These photons irradiate large sample, nitrogen is identified by detecting resonance photon transmission or scattering.

Problem: Actual design of detection system and optimization of overall setup represents a challenge.

Objective

Develop source and detection system to scan large cargoes, identify nitrogen (-->explosives), via photo-resonance interaction of 9.17 MeV photons on ^{14}N.

Perform extensive Monte Carlo simulation calculations, using new evaluated nuclear data.

Problem: Photo-resonance data for ^{14}N not available.

Funding: LDRD project, Energy Sciences & Technology Department, BNL

Status

Photo-resonance data for ^{14}N (focusing on 9.17 MeV γ-rays) were developed by the National Nuclear Data Center, BNL.

Data were put into ENDF-6 format (LANL) and processed using code NJOY to prepare input for Monte Carlo code MCNP.

Extensive Monte Carlo simulations are underway for numerous configurations along with sensitivity studies (BNL).

Data needs: Photo-resonance data needed for other nuclei such as ^{16}O and ^{35}Cl.

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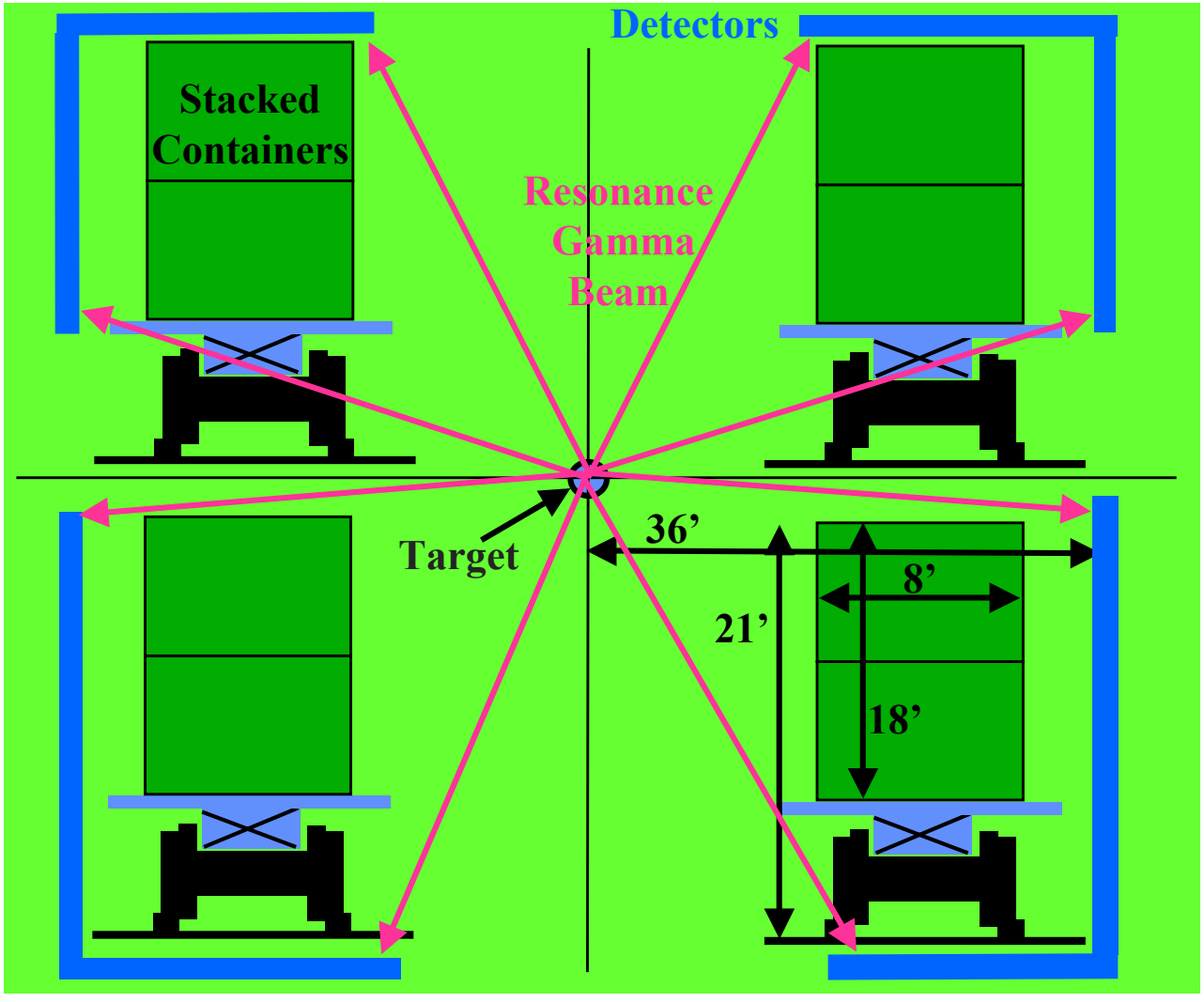
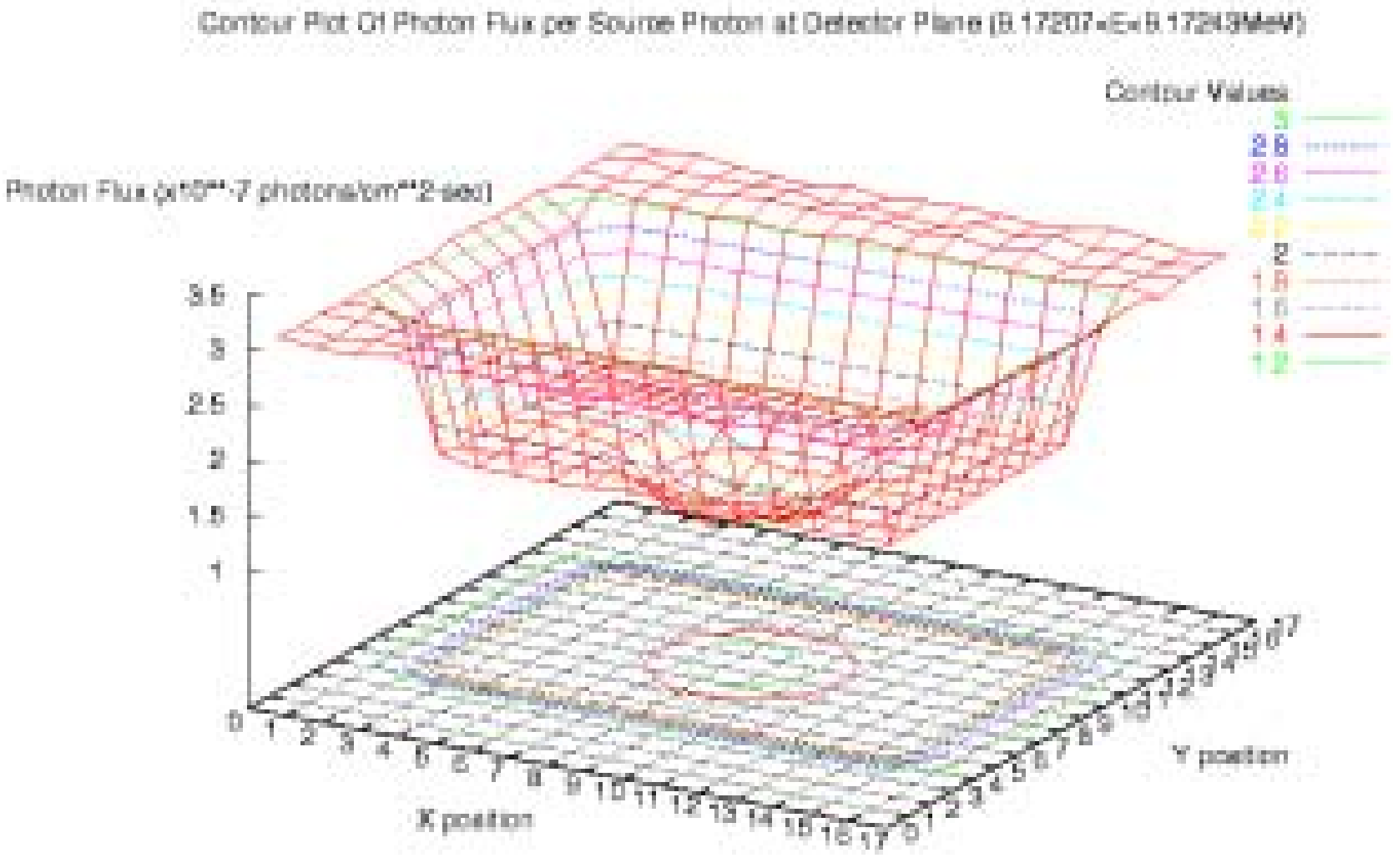
Gamma Resonance Technology Applications

Using four ramps may inspect simultaneously 40 foot container in about 3 to 4 minutes, stacked containers will double the capacity.

(Times extrapolated from experiments)




Contour Plot Of Photon Flux per Source Photon at Detector Plane (8.17207<E<8.17243MeV)
Contour Values
Photon Flux (x10**-7 photons/cm**2-sec)
3.5
3
2.5
2
1.5
1
0
X position
Y position