

Interactive Generation of HPGe Gamma-Ray Spectra Using an MCNP Response Matrix

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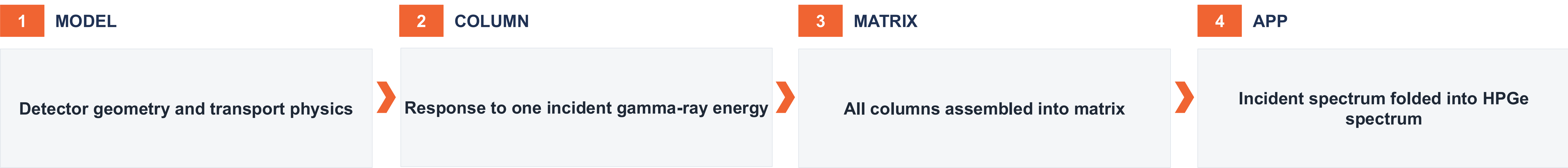


A PRECOMPUTED DETECTOR MODEL BECOMES AN INTERACTIVE SPECTRUM TOOL

Motivation

Complex gamma-ray fields produce detector responses that are difficult to predict intuitively. By converting MCNP-calculated HPGe responses into a reusable response matrix, realistic spectra can be generated interactively for **teaching and preliminary measurement planning**.

THE COMPLETE FLOW

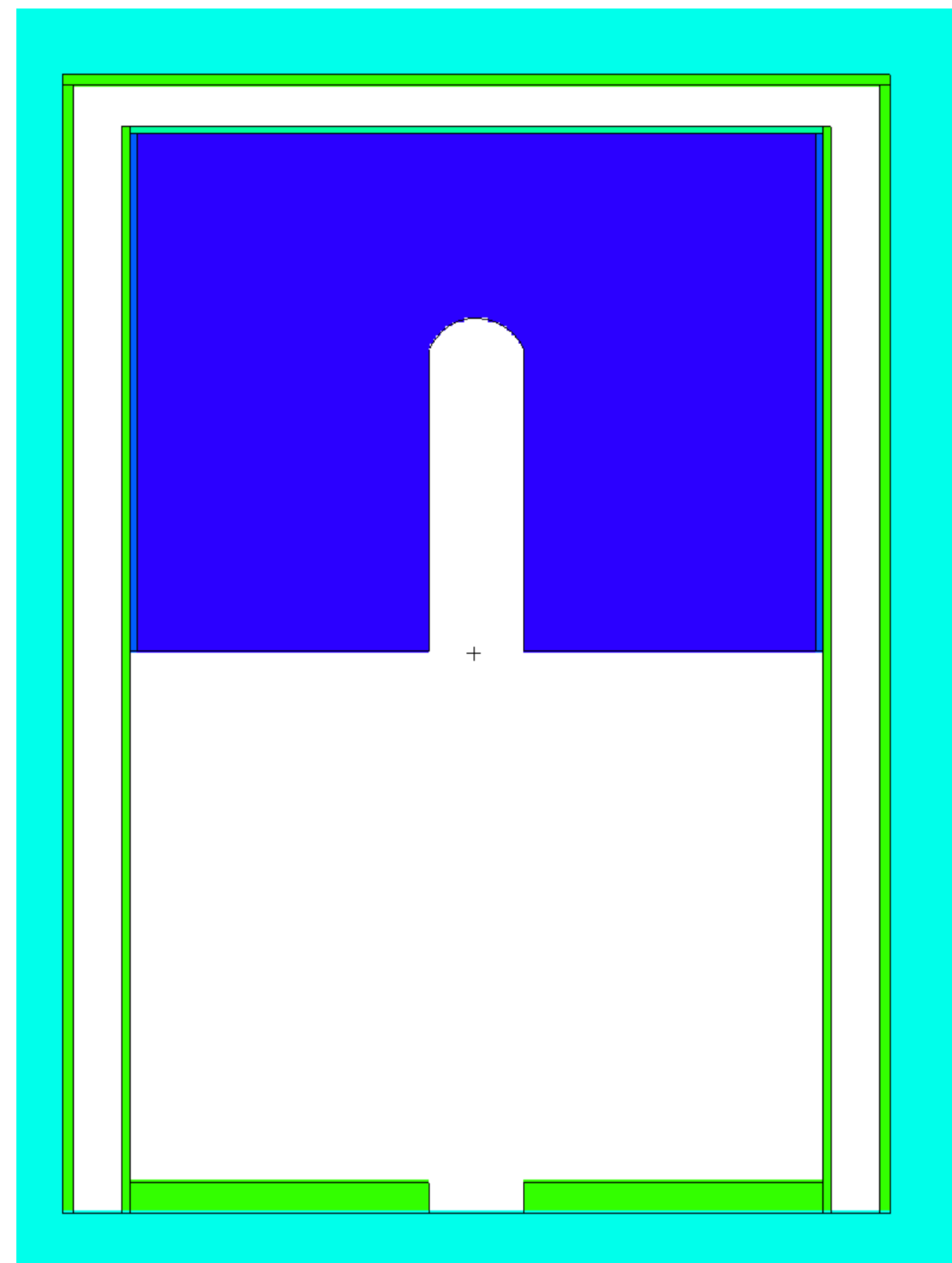


MCNP transport calculations generate monoenergetic detector responses. Their assembly into R_{ij} enables rapid folding of arbitrary incident spectra without rerunning the transport model.

$$y_i = \sum_j R_{ij} x_j$$

x_j : incident photon bin · R_{ij} : detector response · y_i : deposited-energy bin

1 Physical detector model

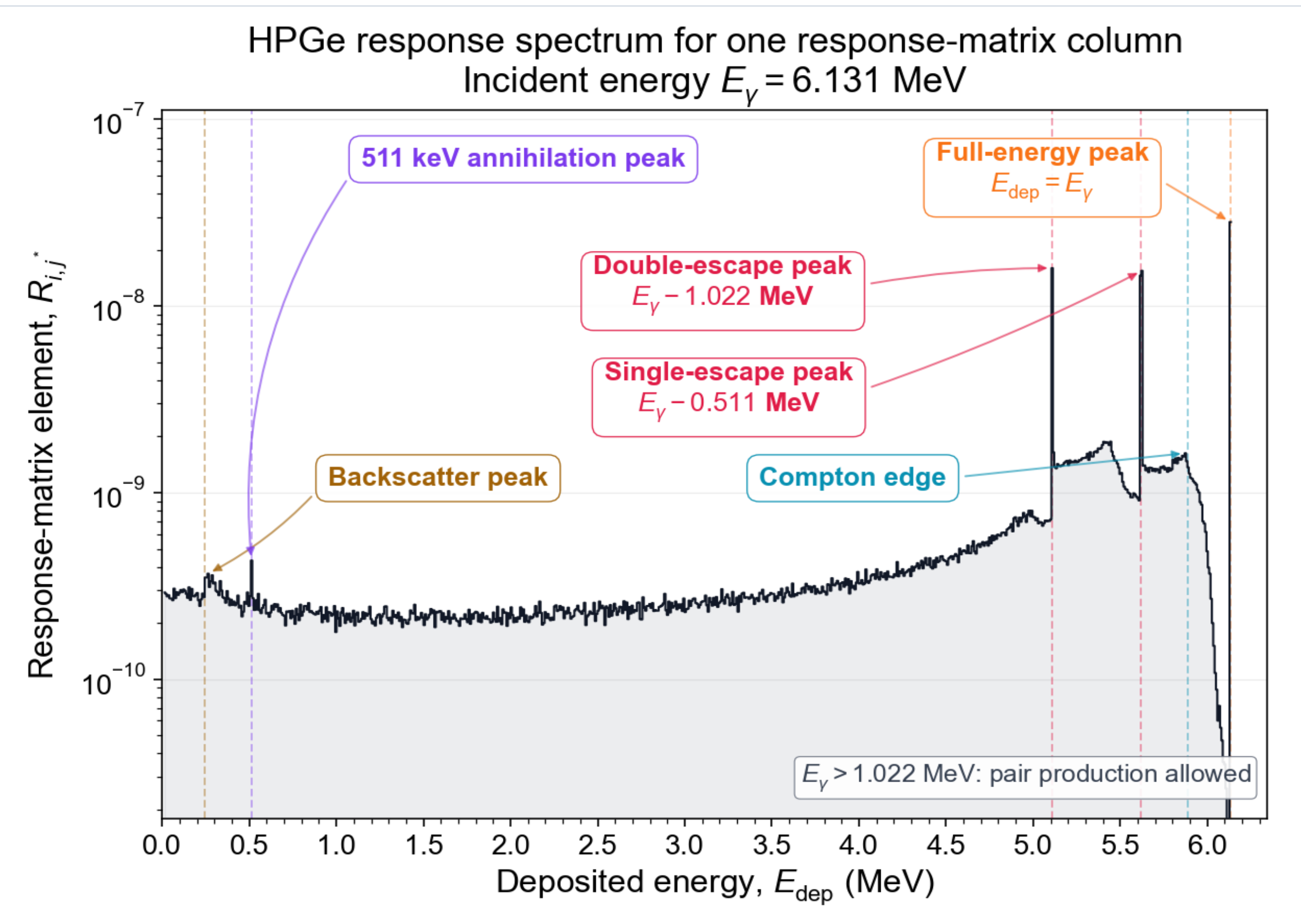


- Geometry and materials
- Photon-electron transport
- Pulse height scoring
- Monoenergetic simulations

OUTPUT
Response spectra for individual incident energies

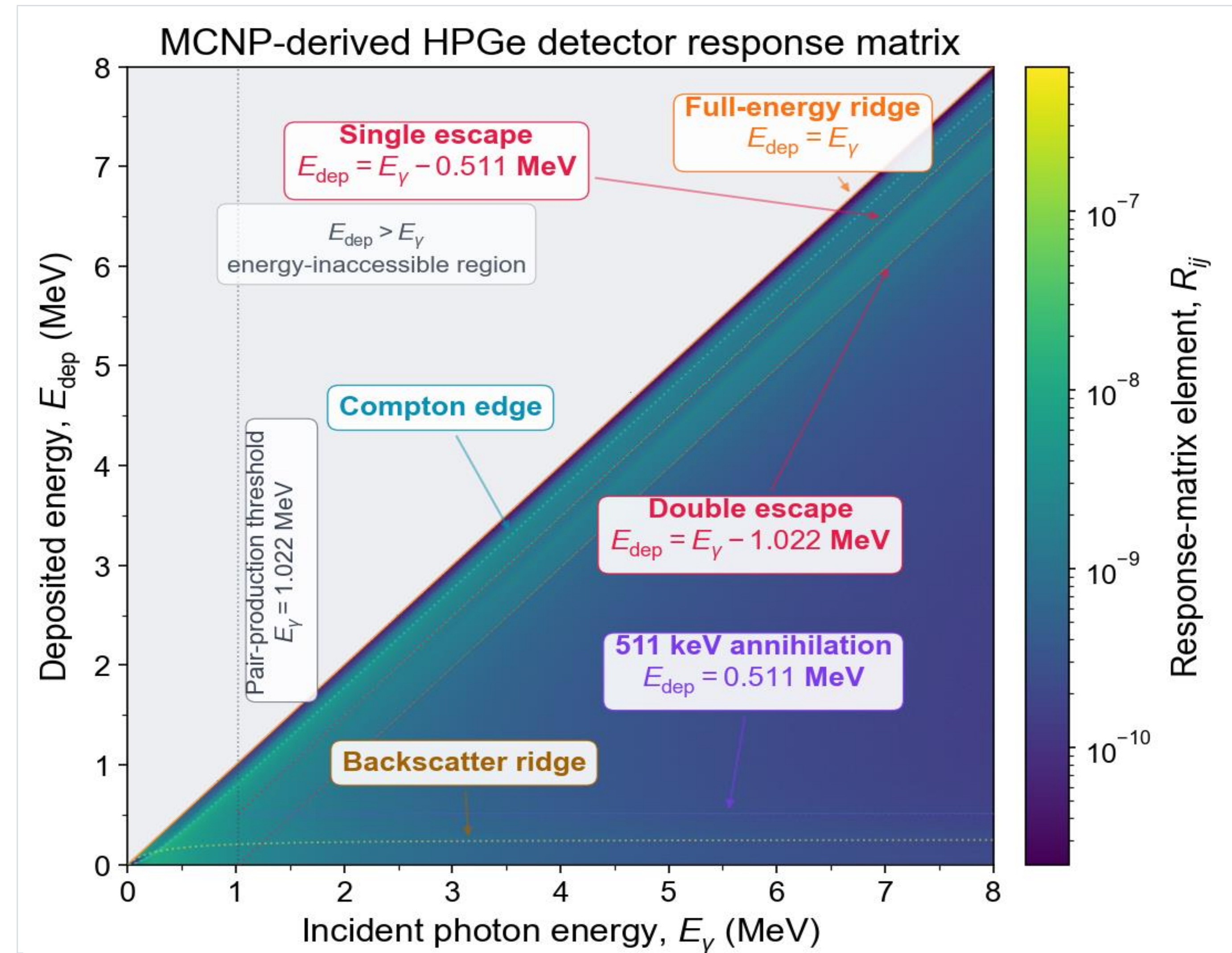
- Materials:
- Germanium
 - Aluminum
 - Air
 - Vacuum

2 One response column



- One column = one incident E_γ
- Contains FEP, Compton and backscatter
- At high energy: 511 keV, SE and DE peaks
- All columns together form the response matrix

3 Full response matrix



All monoenergetic response columns form a reusable mapping from incident to deposited energy.

4 Interactive application

SOURCE DEFINITION

- Activated water
- Isotope mix
- Manual lines

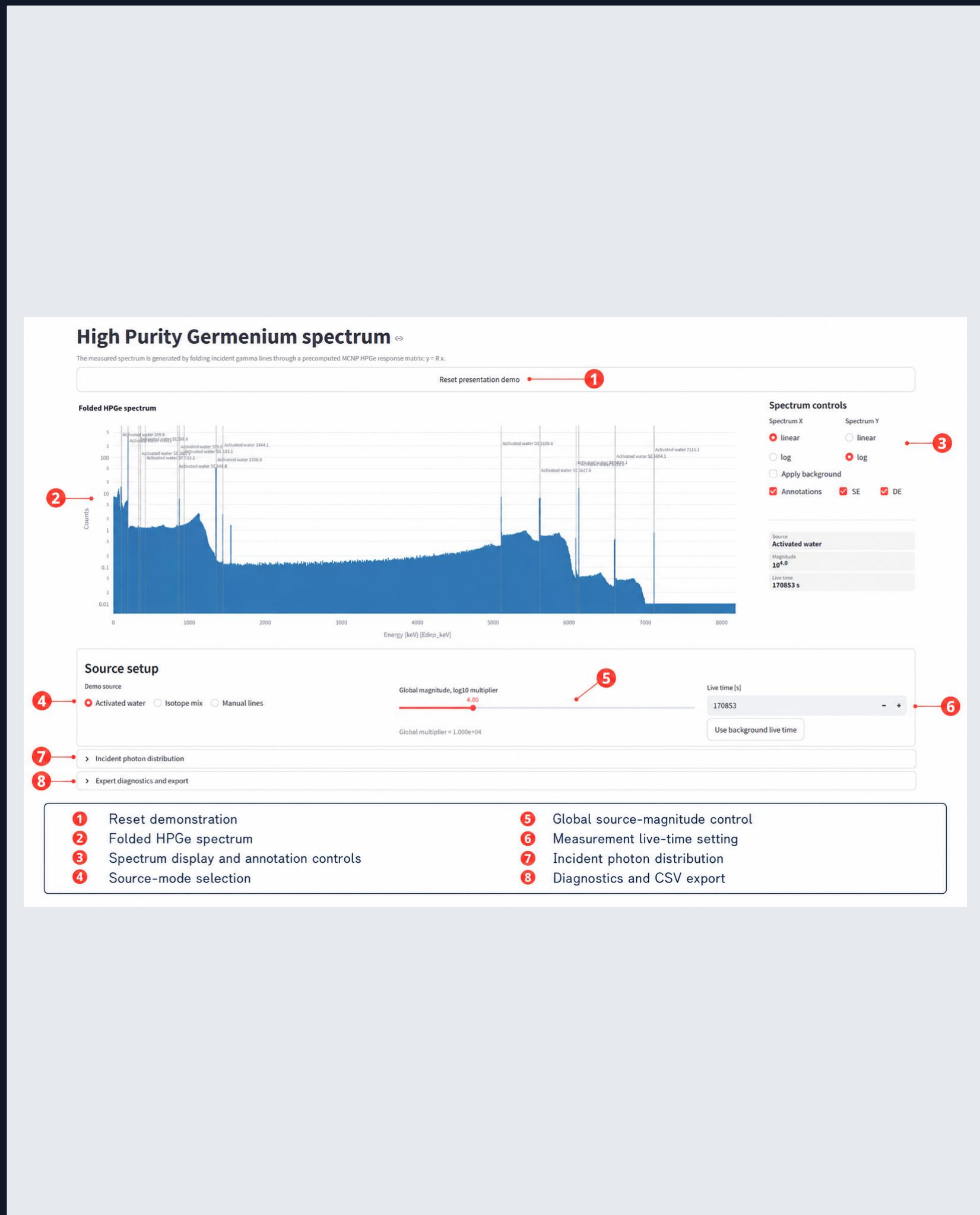
CONTROLS AND OUTPUT

- Set source magnitude and live time
- Optionally add measured background
- Inspect folded HPGe spectrum
- Export spectrum and incident vector

TAKE AWAY

Bridging detailed Monte Carlo detector modelling and interactive analysis, preserving key HPGe response features while allowing rapid exploration of user defined gamma-ray fields.

RESERVED PHYSICAL SCREEN AREA



23.7 cm wide × 35.5 cm tall

The mounted screen replaces this printed preview.