Development of a small, cost-efficient scintillation detector for use in automated synthesis of PET radiopharmaceuticals

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Two low-cost detectors were developed using plastic scintillating fibers and silicon photomultipliers

These detectors can be used to facilitate troubleshooting of faulty reactions during automated PET radiopharmaceutical synthesis

INTRODUCTION
• Multistep positron emission tomography (PET) radiopharmaceutical production is conducted within an automated synthesis module for enhanced safety and efficiency
• The key to the automation is radiation detectors to monitor the transfer of radioactivity between compartments
• Current detectors in use come at a high cost ($2,000-10,000), thus motivating the development of a low-cost alternative

METHODS
• Geant4 Monte Carlo simulations were performed to design and optimize the detector geometry
• Plastic scintillating fibers, silicon photomultipliers, and low-cost electronics were used to construct the detectors
• 18F radiotracer (t1/2=109.7 min) was used to calibrate and assess the detector performance

RESULTS

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<thead>
<tr>
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<th>16-fiber</th>
<th>Spiral</th>
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<tbody>
<tr>
<td>Cost (US $)</td>
<td>172</td>
<td>184</td>
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<tr>
<td>Measured $t_{1/2}$ (minutes)</td>
<td>167.7</td>
<td>105.88</td>
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<td>Uncertainties (± mCi)</td>
<td>45</td>
<td>4</td>
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