Gate Scientific Meeting 2025

Athens, Greece

GATE Activities @ Orsay

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Outline

1. Activities for Gate 9.4.1

Release 2025

Devs for monolithic crystals PET

2. Activities for Gate 10

Coincidence Sorter

Activity map (as in Gate9.X)

DeadTime Digitizer Actor

CASToR compatibilities

Dosimetry for Immuno-PET

3. Conclusions

Conclusions

1. Activates for Gate 9.4.1

Gate 9.4.1 release

New version of **Geant4 11.3.0**

→ Gate 9.4.1 release on the 13th of February 2025

Presentation Marc Granado

- New features
  - Virtual Segmentation for monolithic crystals
  - Spatial resolution variation along a crystal
  - Truncated Gaussian on borders of a crystal in Spatial Resolution Digitizer Module
- Small bug corrections
- Docker and VM are available

Smooth and slow pace support

2. Activities for/with Gate 10

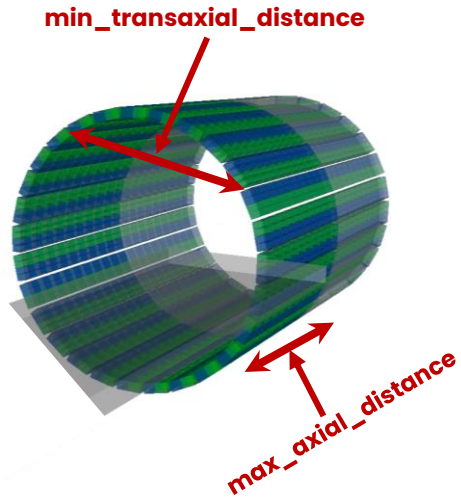
Coincidence Sorter

- Offline version
- Each new *Single* opens coincidence window (Method “2”)
- Accelerated version by **Gert Van Hoey** (XEOS company @ Ghent)

- 6 policies for multiple coincidences

- Usage (test072)

```
coincidences = coincidences_sorter(
                singles_tree,
                time_window=2 * ns,
                min_transaxial_distance = 0 * mm,
                transaxial_plane="xy",
                max_axial_distance = 60 * mm,
                policy="takeAllGoods",
                chunk_size=100000
            )
```



TODO:

→ Add option of Method “1”
→ Parallelization
→ Online integration

Source: Labeled Activity Map

- In GATE 9.X input
  - Labeled Image, i. e. each structure has an int “label”
  - ActivityMap.dat

  Label → Activity in the region

- In GATE 10 input
  - “Nuclear Medicine like” image with SUV
  - Total Activity

```
3
4 4    1
5 5    3
14 15 5
```

- Adaptation conversion “tool”:

  Generate inputs for GATE 10 from labeled image + ActivityMap.dat

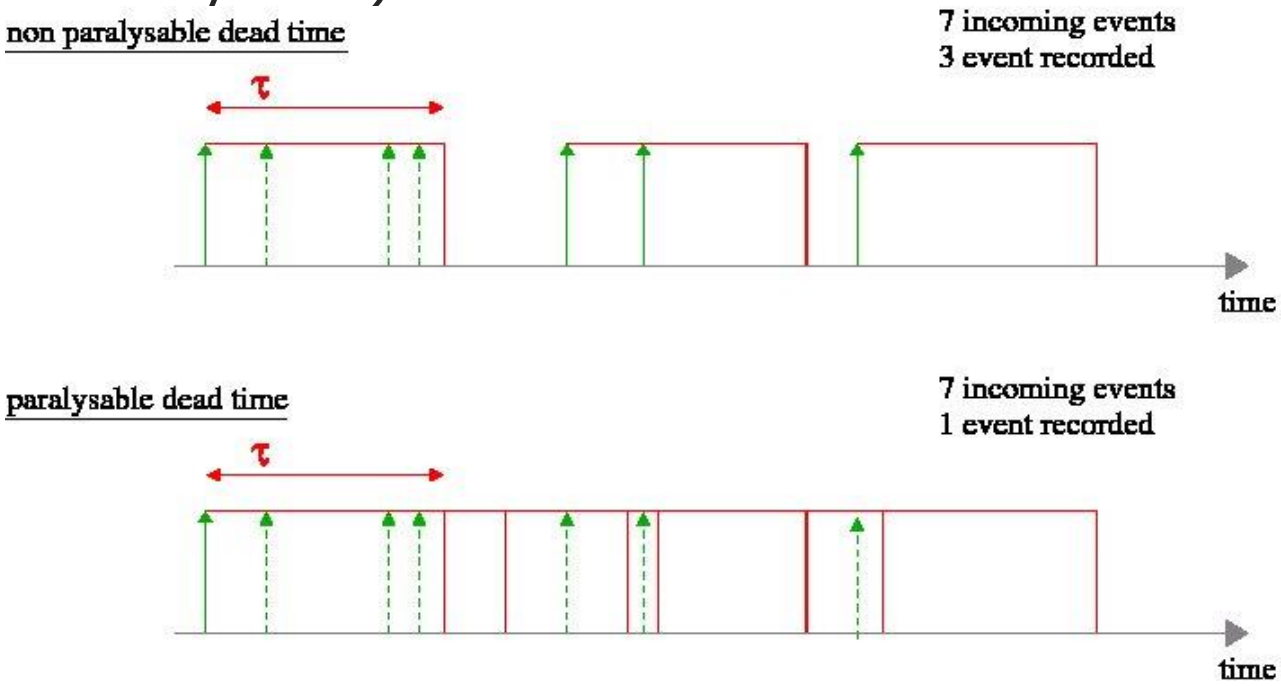
  Important for numerical voxolized phantoms use

Dead Time Digitizer Actor

- **Dead Time:** Detection system is blocked while two signals arrives too close in time

- Dead Time can be
  - Non paralyzable or Paralyzable
  - Applied to a volume (crystal/block of crystals)

- Next steps
  - Test of compatibility with GATE 9.4.1
  - Implementation
  - Documentation

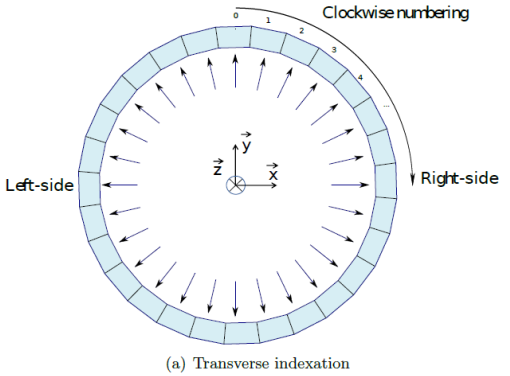


CASToR compatibilities

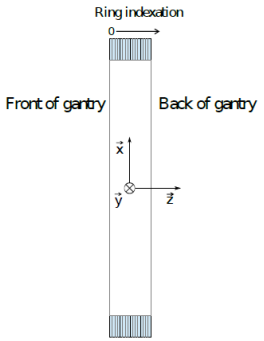
Thibaut Merlin @ Brest Univ. for CASToR

- **CASToR:** Customizable and Advanced Software for **Tomographic Reconstruction**

- Fully compatible with GATE 9.X
- Work in progress for GATE 10



(a) Transverse indexation



(b) Axial indexation

- Input
  - Information on system geometry (UniqueVolumesIDs)
  - For each Singles/Coincidences calculate castorID for LORs

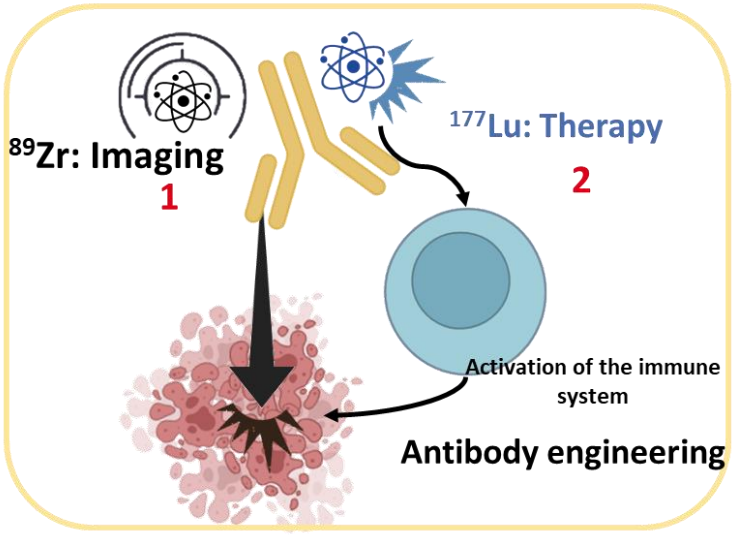
→ *System* approach in GATE 9.X but not in GATE 10
- **Save system information in .json**
- **Add castorID during the GATE simulation**

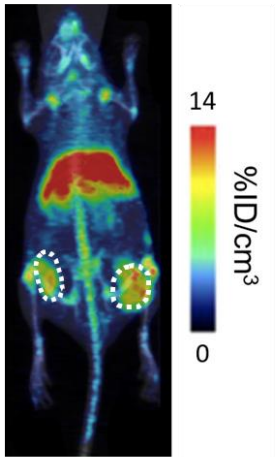
Dosimetry for Immuno-PET

Immuno-PET project RadioTreg @ BioMaps (by Charles Truillet):

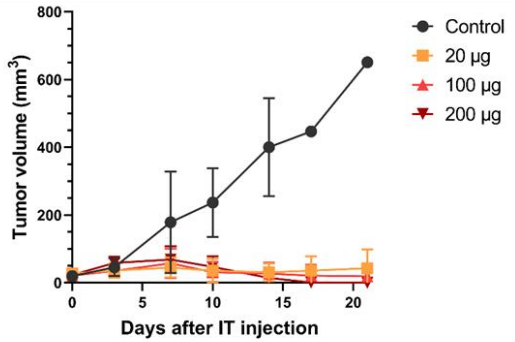
PET imaging & targeted radiotherapy against immunosuppressive cells with personalized dosimetry

- **Preclinical studies**
- **Dosimetry for better understanding of bio-effects**





Dose/efficacy correlation



Targeting Tregs (immunosuppressive)

Dosimetry to predict:
→ Treatment efficacy
→ Radiotoxicity

→ This work is starting now and will be done with GATE10

3. Conclusions

Conclusions

1. Activities for Gate 9.4.1

Follow the annual releases

2. Activities for Gate 10

Coincidence Sorter → Done for the main part

Activity map tool (as in Gate9.X) → On going

DeadTime Digitizer Actor → On going

CASToR compatibilities → On going

3. Activities with Gate 10

Dosimetry for Immuno-PET → Starting

Thank you !

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