



Beginner **ExtravDose** Training

utilizing VARSKIN+ (V+) Version 2.0, software release: April 1, 2025

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Disclaimer

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Training Progression for ExtravDose



Training on theory covers multiphysics mathematical models for fluid flow, activity concentrations, and dosimetry

Beginner training emphasizes Basic calculation

← You are here.

Intermediate training includes Advanced calculation features

ExtravDose discussions

Beginner Training Outline



1. Installation

2. Application Overview

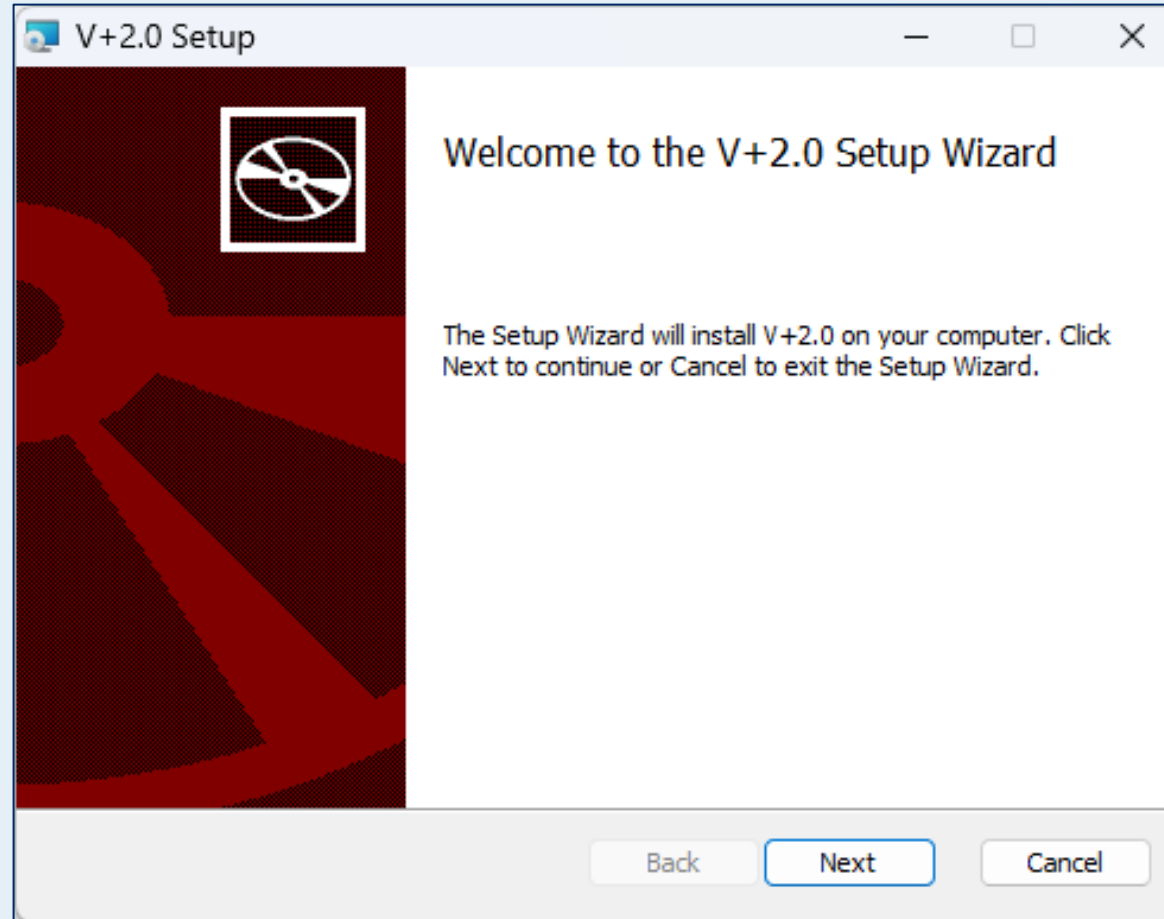
3. Parameters & Buttons

4. Basic Calculation Example

5. Questions

1. Installation

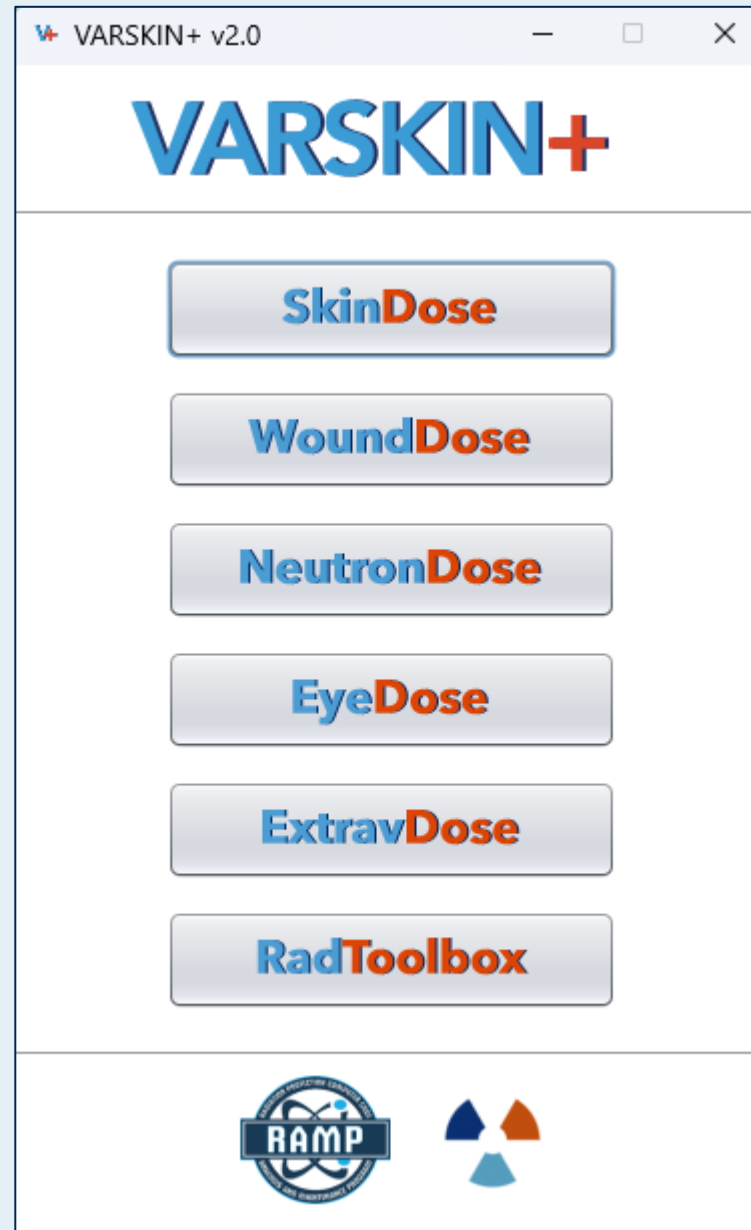
Software installation



V+ v2.0 software suite



ExtravDose module



one of six options



License key



Program Serial Key

Enter a valid serial key for Extravasation Dose. This will need to be entered only once the first time Extravasation Dose is opened.

Serial Key

```
eIZMsFYvRkm8562I7rHGGa0+uutlwrrer66K3kHzKpFTtx0D1yR4AnWq  
Y3kz7bgHyBqq5545gEQsiMxMPjJeRjOqqDH7AOe2x+QdHmGNa599  
RIKVEIb2Ij7E4u+W3hNWTntYGmW+Bi0PnjTNThIL8XTRnBPir/Mqa04  
7tJLXATOQWi4pECLML/iPwtAG9fS16KVocON6t7OCKo2MZKBrUwn  
RHrmU0qmMFd+83WFvCa9r1DfzYvRyw5M2JxrdZsTD+GPJmLST7m  
Ev4Sq+DrXD67zkgXlkvlinUsW9giRzEdGozg3kOZK9bmUgPAy74dYs  
OtljkUJW+OQXW9Uvh1uaG+w==
```

License Information

User: rcd@rcdsoftware.com
Institution: Renaissance Code Development (RCD)
Expiration Date: Dec 31 2025

Cancel Accept



2. Application Overview

Graphical user interface (GUI) overview



Inputs are entered in two windows

- MODEL INPUTS
-  EVENT INPUTS

Results are presented in one window

Graphical user interface (GUI) overview: Inputs



ed Extravasation Dosimetry v1.0

File Mode Help

V+ Extravasation Dosimetry v1.0
MODEL INPUTS

Source and Concentration Inputs

Database: ICRP-38 ICRP-107 Concentration: 100.000 MBq/mL

Nuclide: Tc-99m Flow Rate: 1.000 mL/min

Layer Inputs

Tissue Model: Homogeneous

Number of Layers: 1

Layer 1

Effective Tissue Thickness: 5.000 mm

Transport Inputs

Dose Notification Threshold: 2.000 Gy

Region Width: 10.000 cm

Region Length: 20.000 cm

Diagram

Timeline Calculate Results

ed Extravasation Timeline

V+ Extravasation Dosimetry v1.0
EVENT INPUTS

#	Event	Day	Start Time	End Time	Duration (hr)
1	Extravasation	1	12:00AM	12:05AM	0.08
2	Warm Compress	1	12:05AM	12:05AM	0.00
3	Analysis Period	1	12:00AM	12:30AM	0.50

Add/Delete Events

Add Event Delete Selected Event

Edit Selected Event (#2)

Type: Warm Compress

Start Time: 12:05 AM 1

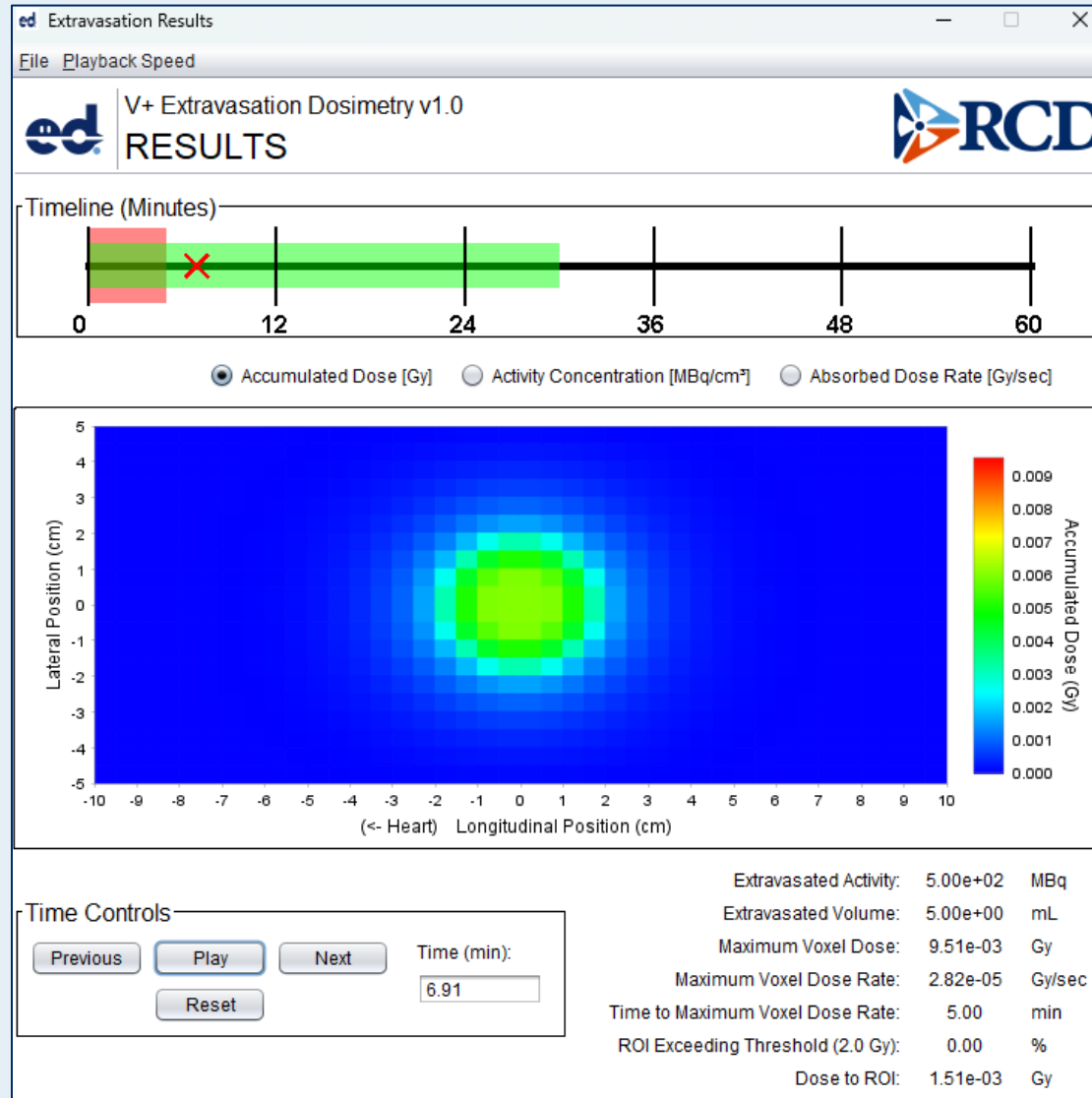
End Time: 12:05 AM 1

Duration: 0.00 Hours

Timeline (Minutes)

Click to access second window

Graphical user interface (GUI) overview: Results



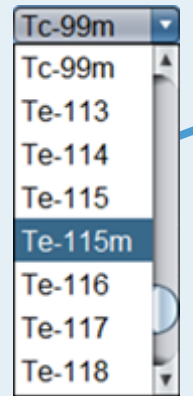
3. Parameters & Buttons

Source and Concentration Inputs



Select decay data

Select radionuclide from dropdown list



Note: Once box is clicked, user can type the first letter to jump to those radionuclides.

ed Extravasation Dosimetry v1.0

File Mode Help

ed V+ Extravasation Dosimetry v1.0

MODEL INPUTS

Source and Concentration Inputs

Database: ICRP-38 ICRP-107

Concentration: 100.000 MBq/mL

Nuclide: Tc-99m

Flow Rate: 1.000 mL/min

Layer Inputs

Tissue Model: Homogeneous

Number of Layers: 1

Layer 1

Effective Tissue Thickness: 5.000 mm

Transport Inputs

Dose Notification Threshold: 2.000 Gy

Region Width: 10.000 cm

Region Length: 20.000 cm

Diagram

Timeline Calculate Results

Enter radionuclide concentration in extravasated fluid

Enter flow rate into tissue



Layer Inputs



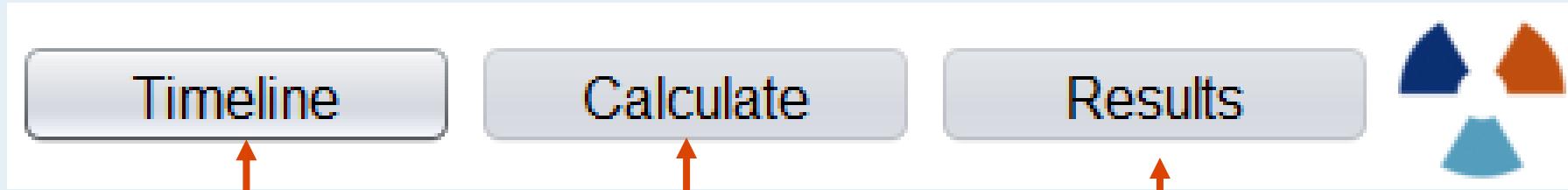
Required for Basic calculations

Homogeneous
Single layer

Enter thickness of tissue
infiltrated by extravasated fluid



Main button description



Timeline button click required to specify inputs

Calculate button *enabled* after Timeline inputs are specified to resolve this warning

A proper timeline has not been specified.

Results button *enabled* & window *activated* when calculation is in progress or finishes

Transport Inputs



ed Extravasation Dosimetry v1.0

File Mode Help

ed V+ Extravasation Dosimetry v1.0
MODEL INPUTS

RCD

Source and Concentration Inputs

Database: ICRP-38 ICRP-107

Nuclide:

Concentration:

Flow Rate:

Layer Inputs

Tissue Model: Homogeneous

Number of Layers:

Layer 1

Effective Tissue Thickness:


Transport Inputs

Dose Notification Threshold:

Region Width:

Region Length:

Diagram



Timeline Calculate Results

Enter threshold for tallying percentage of voxels exceeding that notification dose

Enter tissue width for simulation

Enter tissue length for simulation

Event Inputs



ed Extravasation Timeline

V+ Extravasation Dosimetry v1.0

EVENT INPUTS

#	Event	Day	Start Time	End Time	Duration (hr)
1	Extravasation	1	12:00AM	12:05AM	0.08
2	Warm Compress	1	12:05AM	12:10AM	0.08
3	Limb Elevation	1	12:10AM	12:20AM	0.17
4	Analysis Period	1	12:00AM	12:30AM	0.50

Add/Delete Events

Edit Selected Event (#3)

Type:

Start Time: Day

End Time: Day

Duration: Hours

Elevation: Degrees

Timeline (Minutes)

Summary Table of Numbered Events

Blue highlight shows Selected Event

Events illustrated with overlapping color bands

- Red – Extravasation
- Purple – Warm Compress
- Light Blue – Limb Elevation
- Green – Analysis Period

Select Limb Elevation or Warm Compress

Enter start & end times for elevation
HH:MM with AM/PM format

Elevation duration automatically shown

Enter limb lift angle

4. Basic Calculation Example

EXAMPLE: Basic calculation with ^{177}Lu therapeutic radiopharmaceutical



ed Extravasation Dosimetry v1.0

File Mode Help

V+ Extravasation Dosimetry v1.0
MODEL INPUTS

Source and Concentration Inputs

Database: ICRP-38 ICRP-107
 Nuclide: **Lu-177**
 Concentration: 296.000 MBq/mL
 Flow Rate: 0.417 mL/min

Layer Inputs

Tissue Model: Homogeneous
 Number of Layers: 1
 Layer 1
 Effective Tissue Thickness: 7.000 mm

Transport Inputs

Dose Notification Threshold: 2.000 Gy
 Region Width: 7.000 cm
 Region Length: 14.000 cm

Diagram

Timeline Calculate Results

A proper timeline has not been specified.

Approximate large-volume event (worst case)
 Include mitigative action taken by medical staff
 – Apply warm compress for 45 min

ed Extravasation Timeline

V+ Extravasation Dosimetry v1.0
EVENT INPUTS

#	Event	Day	Start Time	End Time	Duration (hr)
1	Extravasation	1	12:00AM	01:00AM	1.00
2	Warm Compress	1	01:10AM	01:55AM	0.75
3	Analysis Period	1	12:00AM	08:00AM	8.00

Add/Delete Events
 Add Event Delete Selected Event

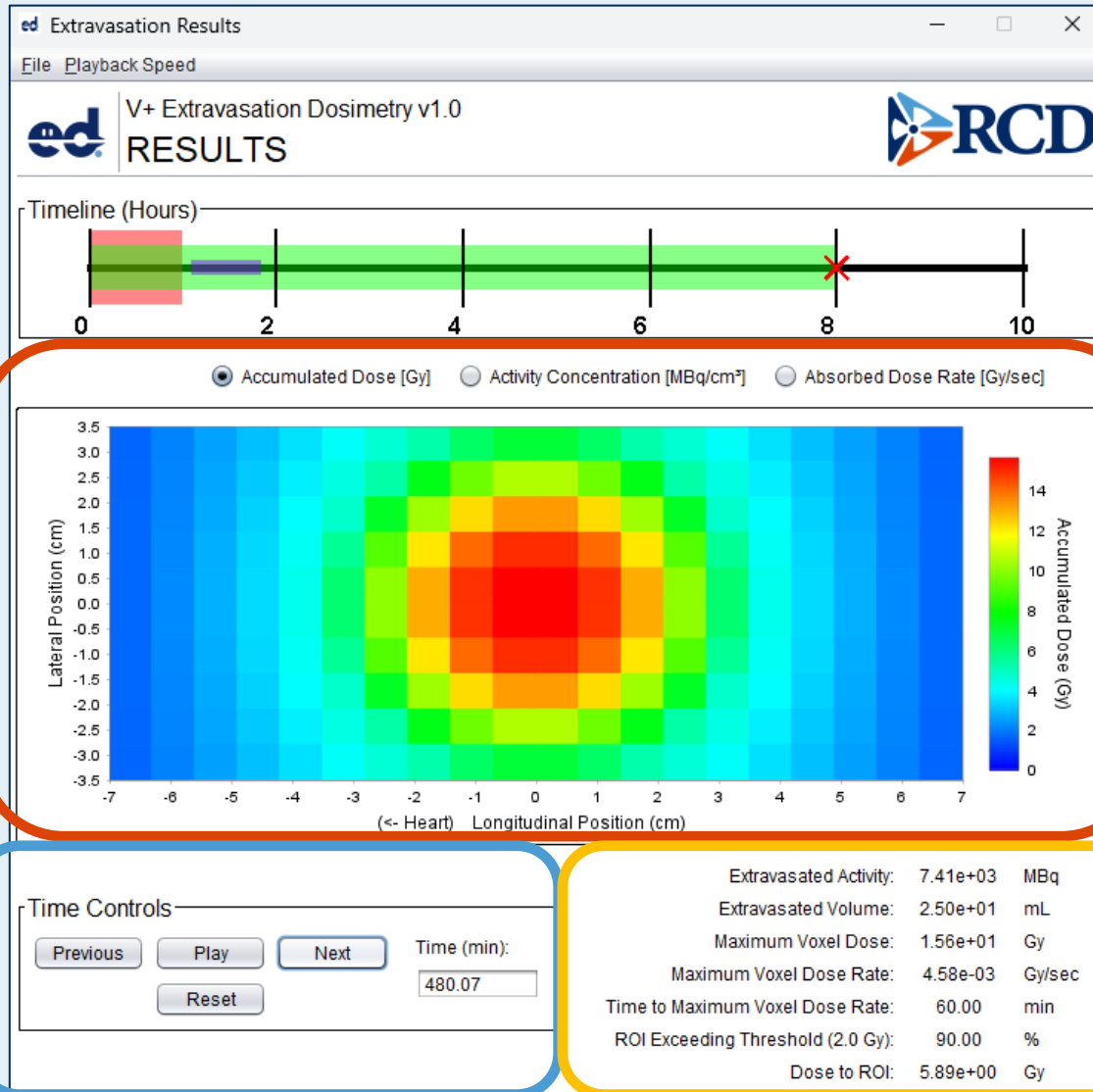
Edit Selected Event (#2)

Type: Warm Compress
 Day: 1
 Start Time: 01:10 AM
 End Time: 01:55 AM
 Duration: 0.75 Hours

Timeline (Hours)

Dermal & hypodermal extravasation approximated in homogeneous tissue matrix with 8-h basic calculation

EXAMPLE: ^{177}Lu results for large volume extravasation



Graphical results display spatial effects with numerous voxels

- Accumulated local tissue dose
- Activity concentration in tissue
- Absorbed dose rate

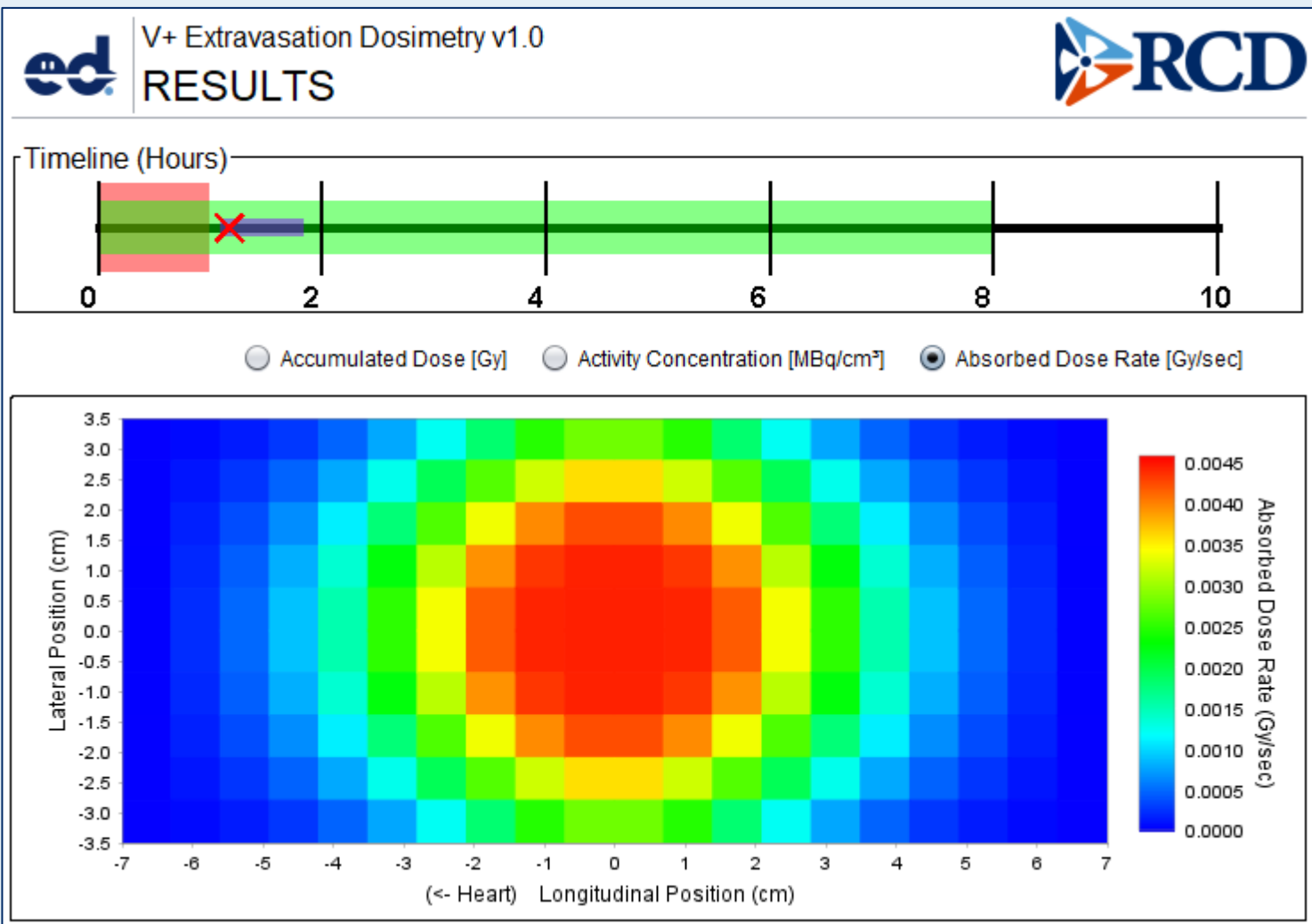
Time Controls elucidate temporal effects

- Static graphic at various times
- Manual forwarding or rewind
- Option to play time-sequenced progression

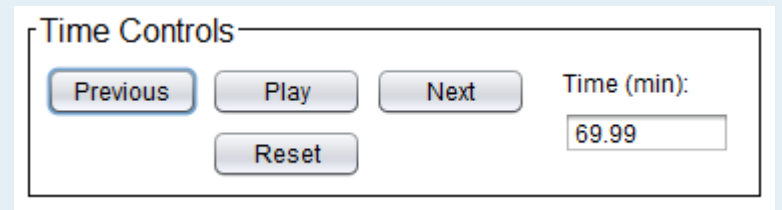
Summary results reported for full analysis time



EXAMPLE: Results as a snapshot in time

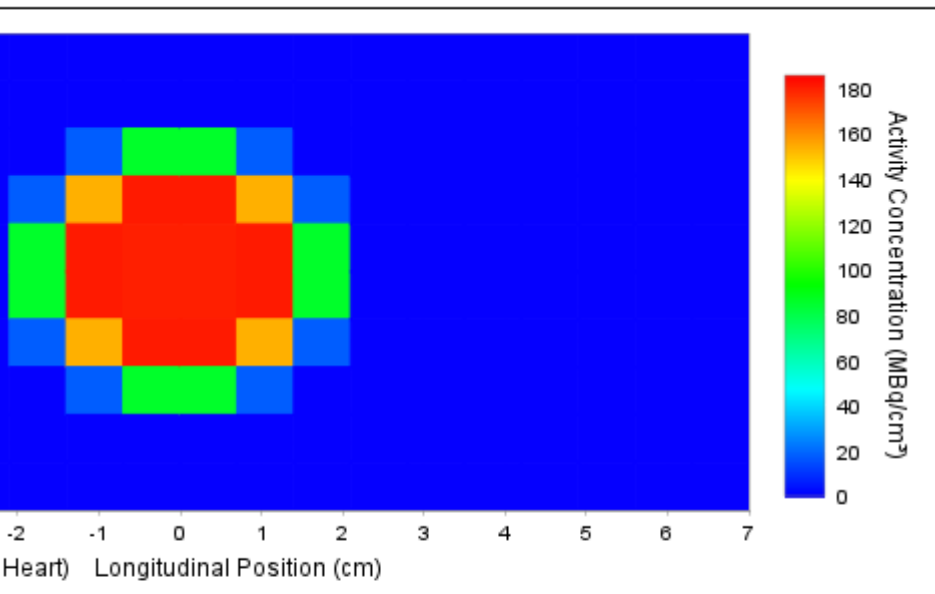


- V+ basic calculation took <2 min on laptop
- Radioactive fluid infiltrates tissue and flows away from extravasation site
- Watch time-dependent results as a movie
- Adjust time control for static images



- Red X on timeline shows static image time
- Dose rates to tissue shown (left)





Time (min):

15.00

Extravasated Activity:	7.41e+03	MBq
Extravasated Volume:	2.50e+01	mL
Maximum Voxel Dose:	1.56e+01	Gy
Maximum Voxel Dose Rate:	4.58e-03	Gy/sec
Time to Maximum Voxel Dose Rate:	60.00	min
ROI Exceeding Threshold (2.0 Gy):	90.00	%
Dose to ROI:	5.89e+00	Gy

Results summary



Pertains to full analysis time (e.g., 8 h)

Documents tissue region percentage with accumulated doses exceeding user-specified notification threshold

Summary values are *updated during the simulation*

Summary does not change after the simulation ends

- When results movie is played
- When static result images are called up (e.g., 15 min)

5. Questions