

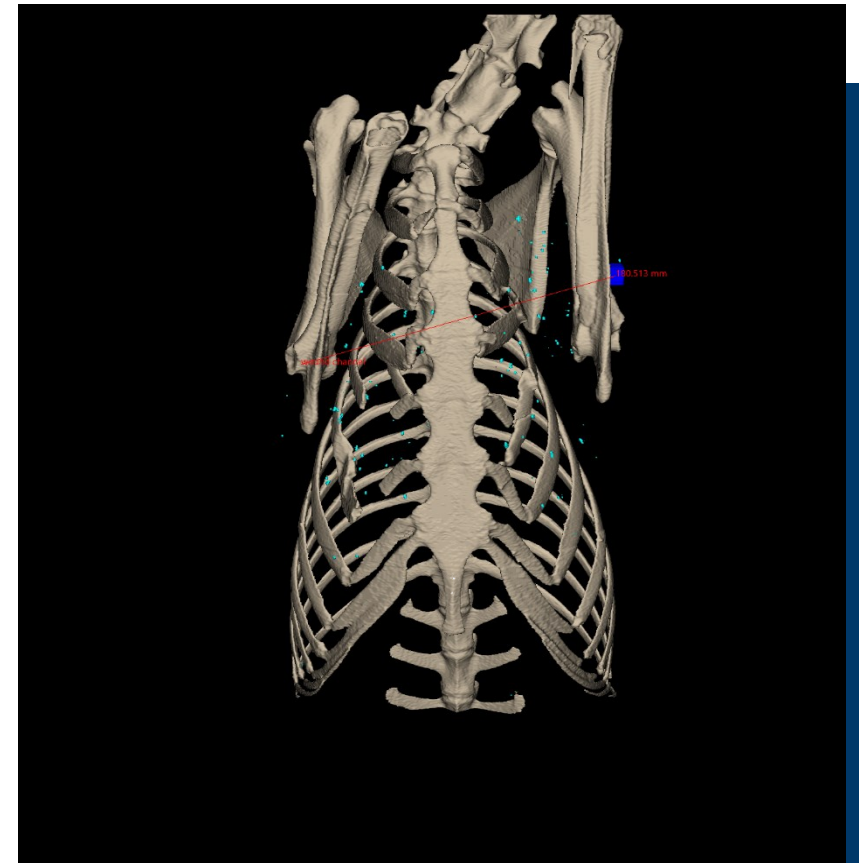
Analysis of number, size and spatial distribution of lead containing bullet fragments in game using computed tomography

14/15 March 2024, German Federal Institute for Risk Assessment

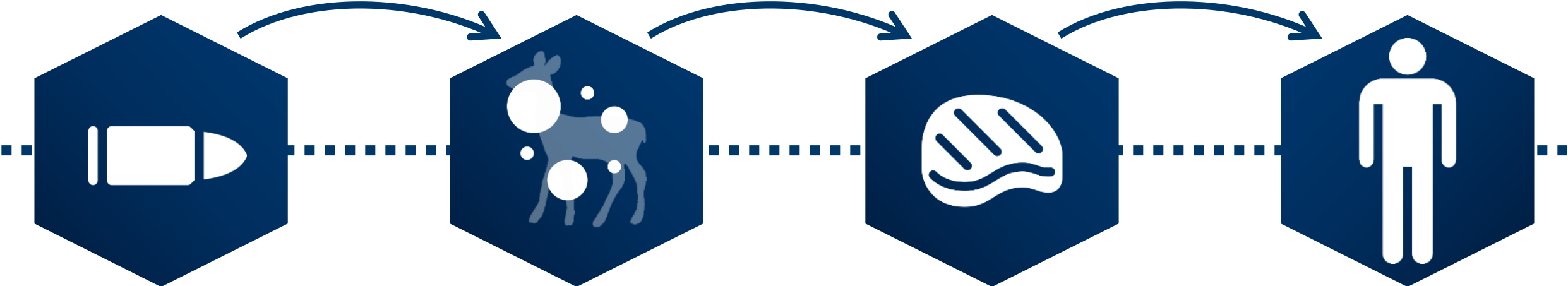
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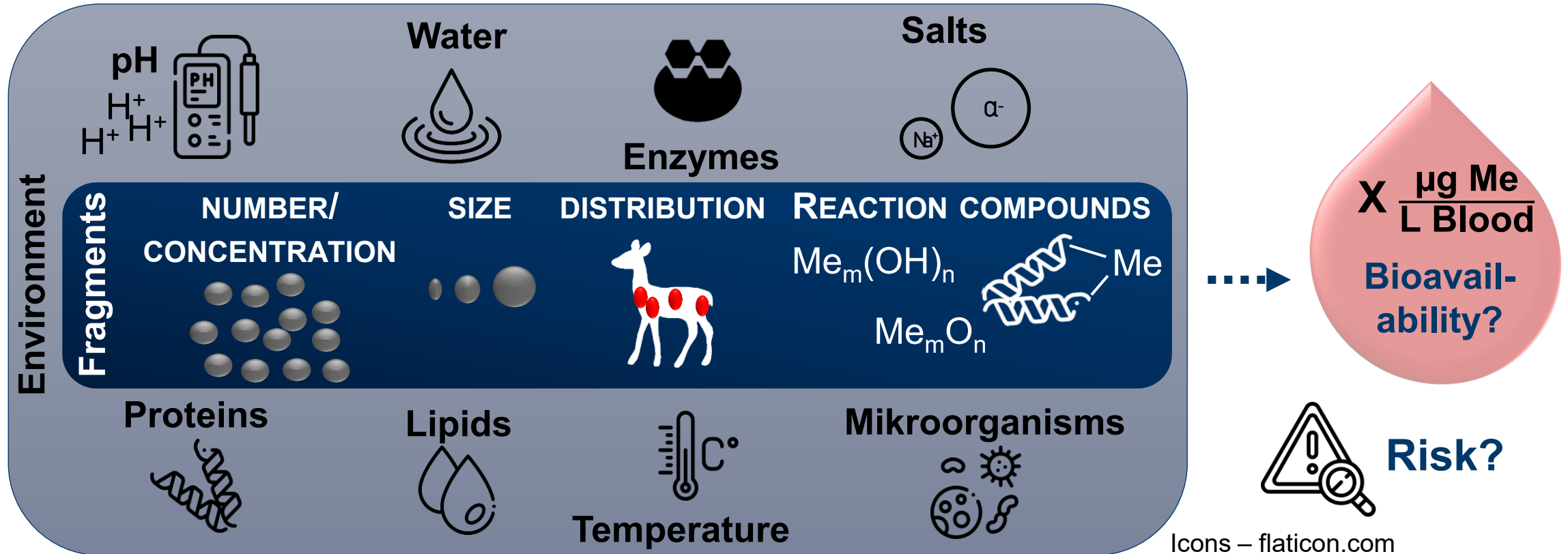


Background



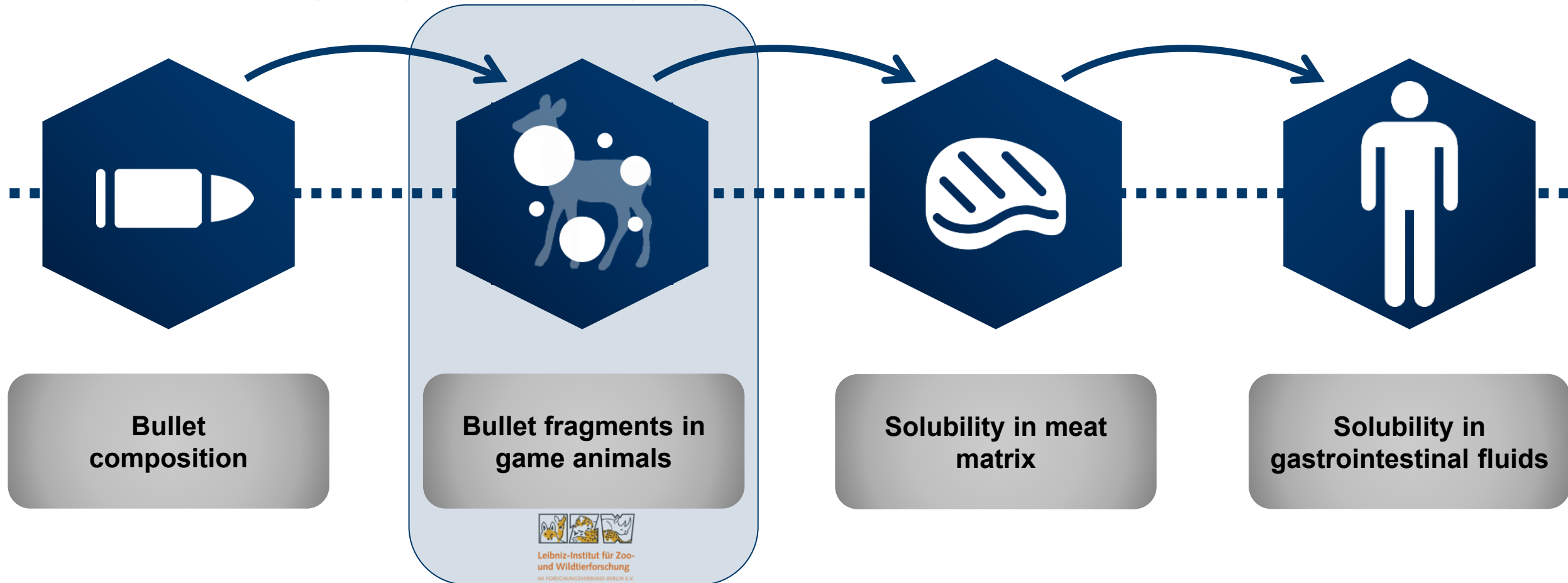
Icons – flaticon.com

Background – Need for Research



Icons – flaticon.com

Bioavailability (experimental projects)



Haase et al. 2023 (Discover Food): "Analysis of number, size and spatial distribution of rifle bullet-derived lead fragments in hunted roe deer using computed tomography"

Icons – flaticon.com

Study design – Bullet fragments in game animals



Remington Core Lokt .308
controlled expansion
Lead core with copper jacket



Meat processing



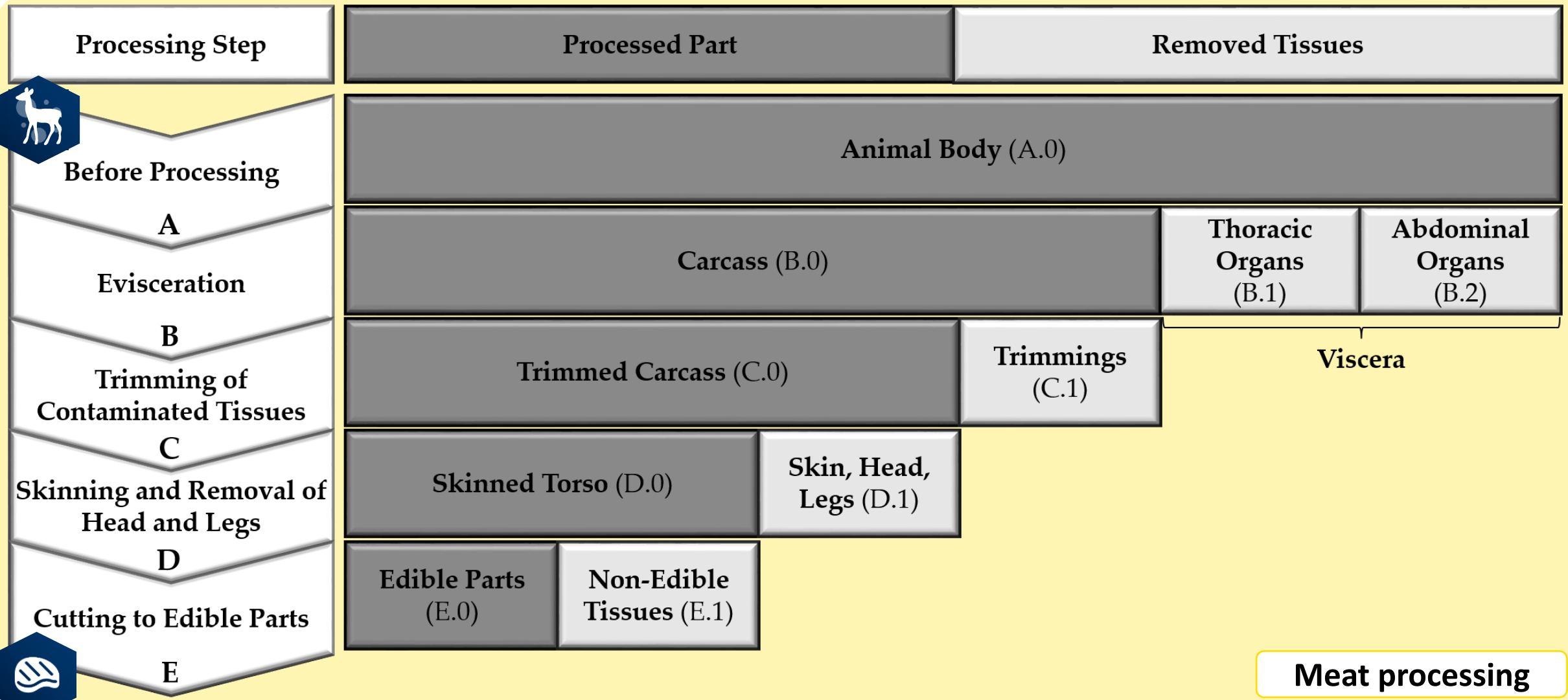
Environ-
ment



Aim

- Determination:
- of spatial distribution
 - of properties of bullet fragments

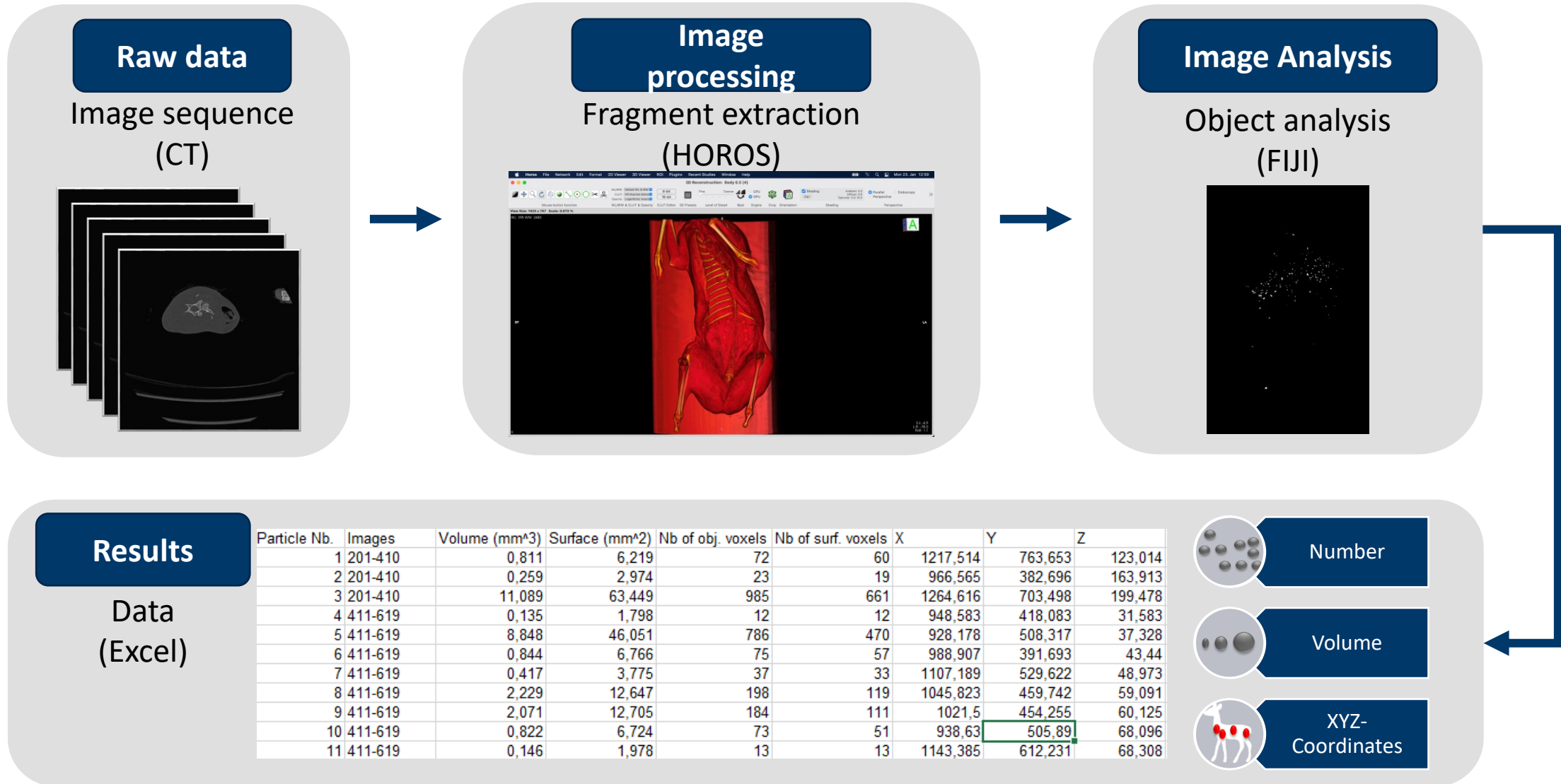
Study design – Bullet fragments in game animals



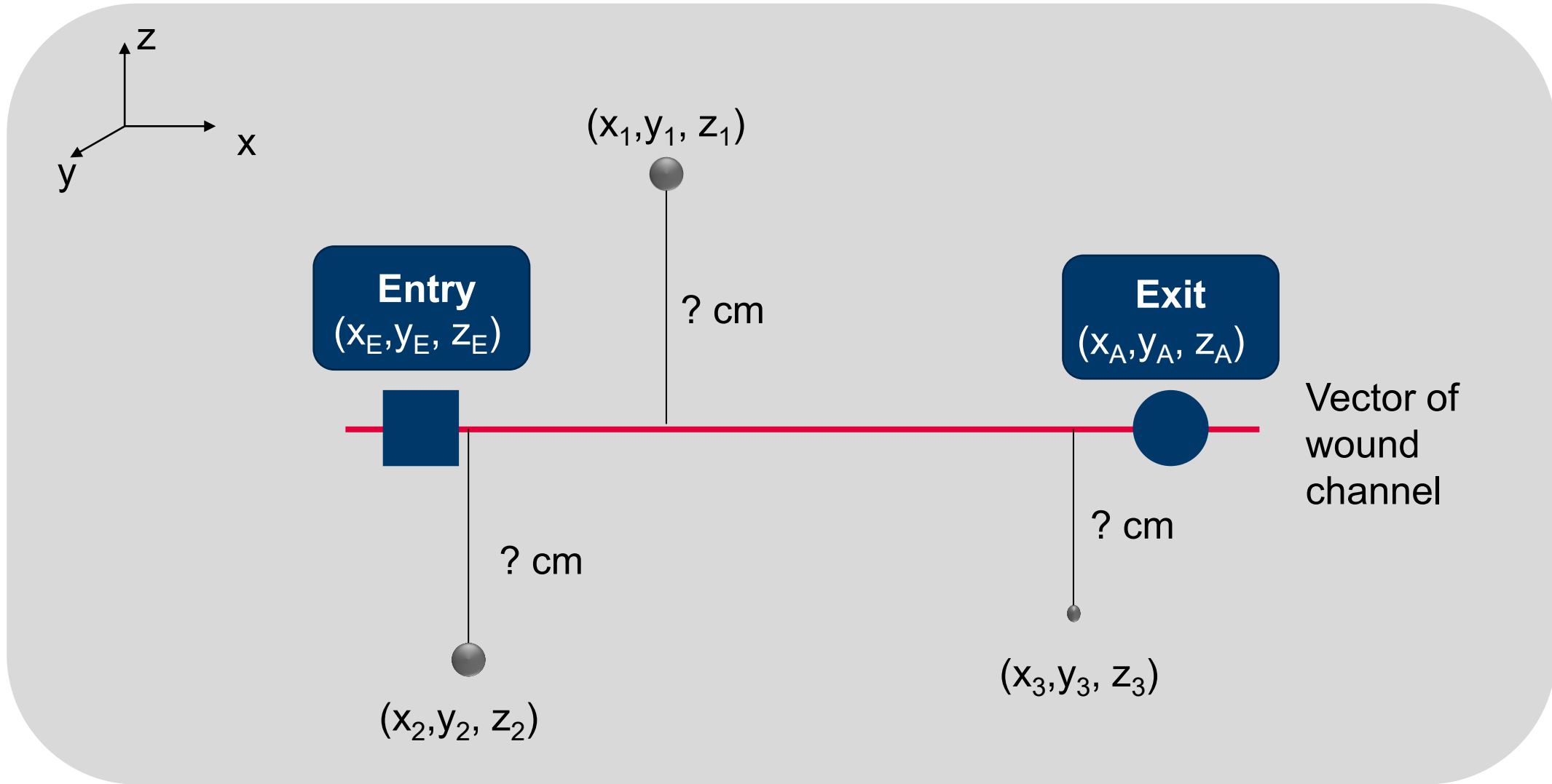
Study design, Haase et al. 2023

Meat processing

Data evaluation



Data evaluation – Distance of fragments to wound channel

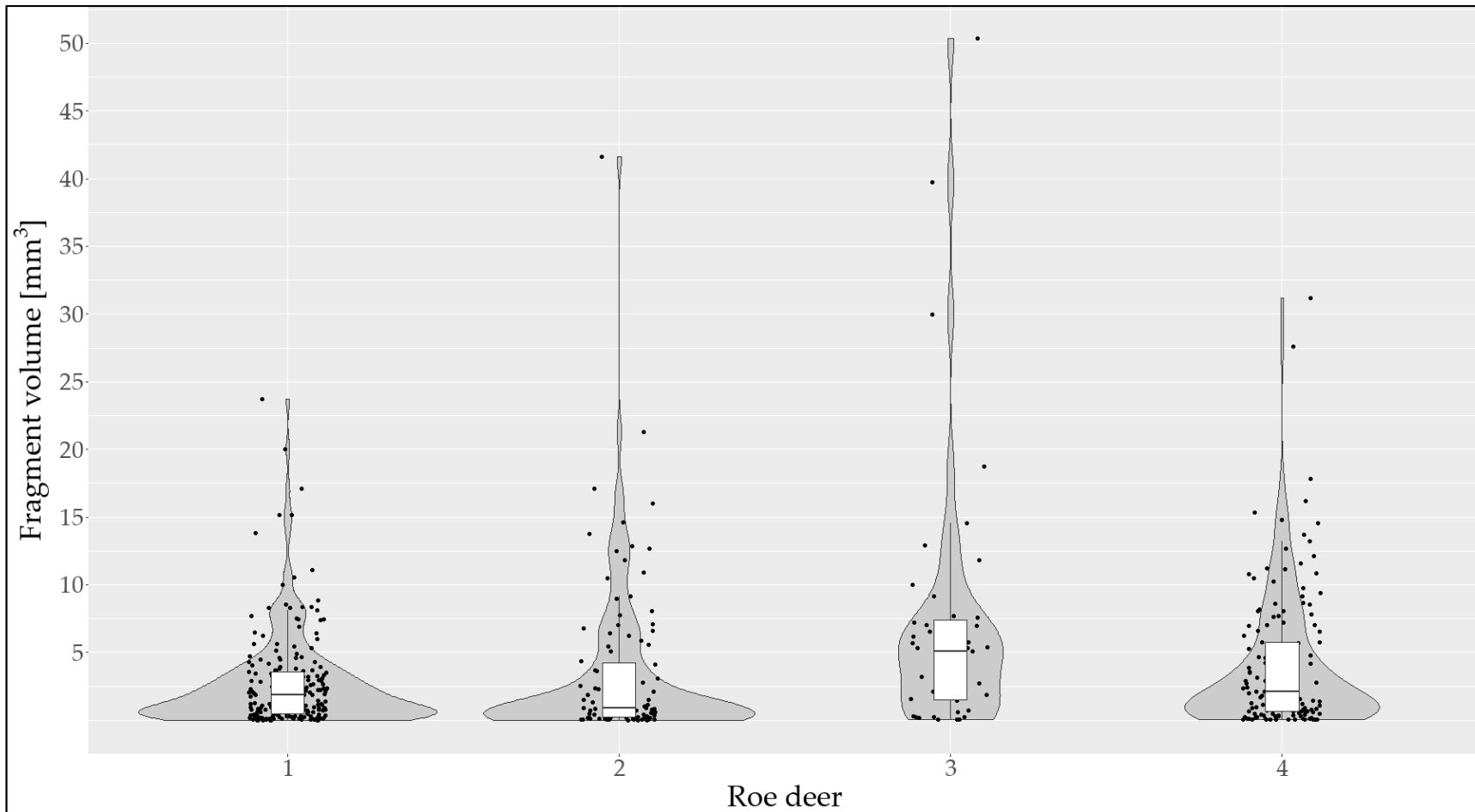


Results – Number of fragments during meat processing in processed parts and removed tissues

Data Set		Fragment Numbers			
Processed Part	Removed Tissues	Roe deer 1	Roe deer 2	Roe deer 3	Roe deer 4
Animal Body (A.0)		199	107	43	152
Carcass (B.0)		77	22	20	11
	Thoracic Organs (B.1)	74	66	12	69
	Abdominal Organs (B.2)	5	9	6	41
Trimmed Carcass (C.0)		8	1	14	2
	Trimmings (C.1)	101	27	7	14
Skinned Torso (D.0)		3	0	1	2
	Skin, Head and Legs (D.1)	4	0	12	0
Edible Parts (E.0)		3	0	1	2
	Non-Edible Tissues (E.1)	0	0	0	0

Shoulder n = 3, Ribs n = 2, Haunch n = 1

Results – Size of fragments in animal bodies



- Mean volume $3.71 \pm 5.49 \text{ mm}^3$
- 40% of fragments $< 1 \text{ mm}^3$
- Lower size detection limit 0.01 mm^3
- Kollander et al. 2017: 40-750 nm in game meat (sp-ICP-MS)
- Leontowich et al. 2022: $< 10 \mu\text{m}$ in gelatin (synchrotron X-ray)

Results – Spatial distribution of fragments in roe deer bodies

■ Skeleton (thorax, spine, front legs)

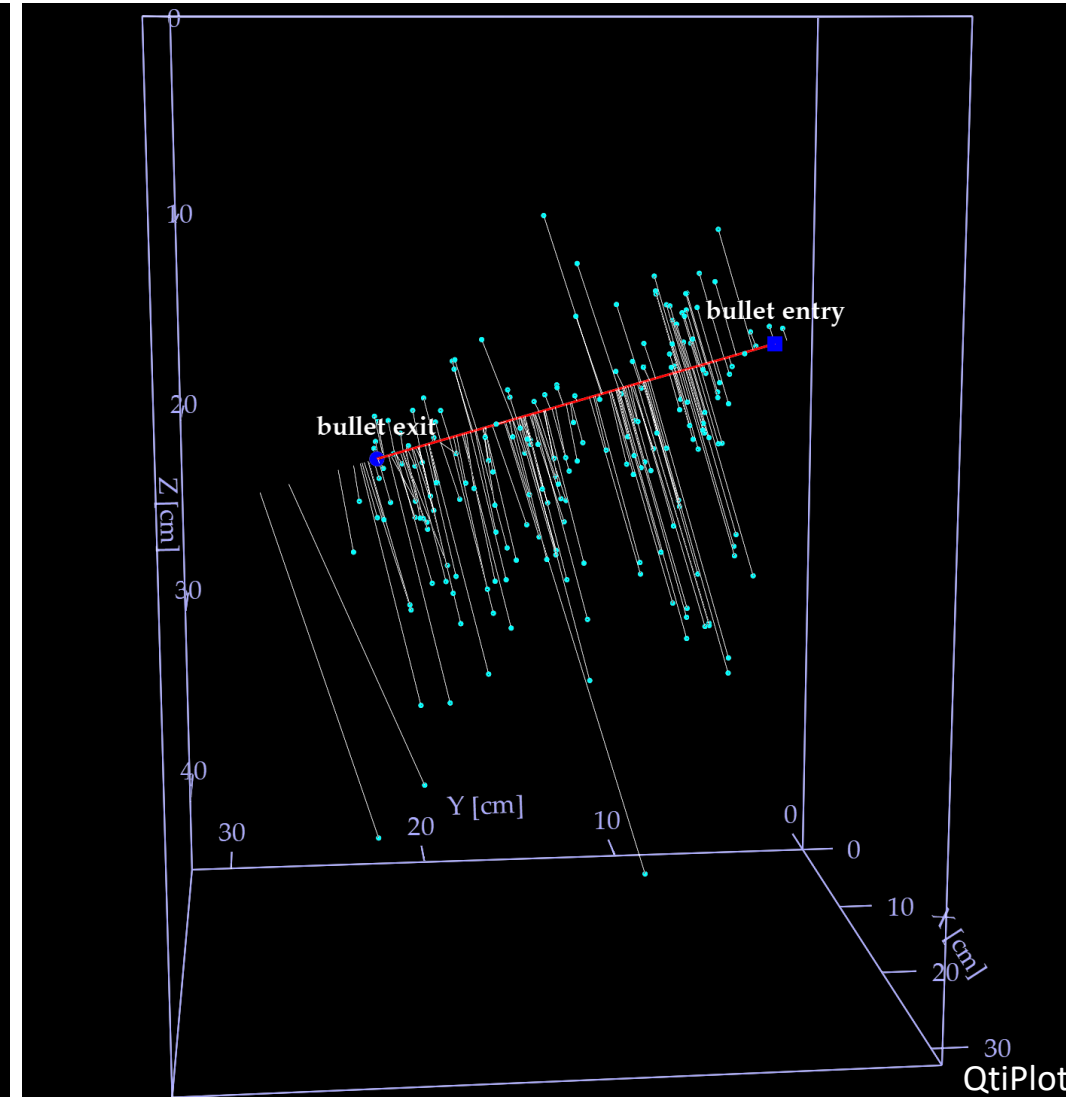
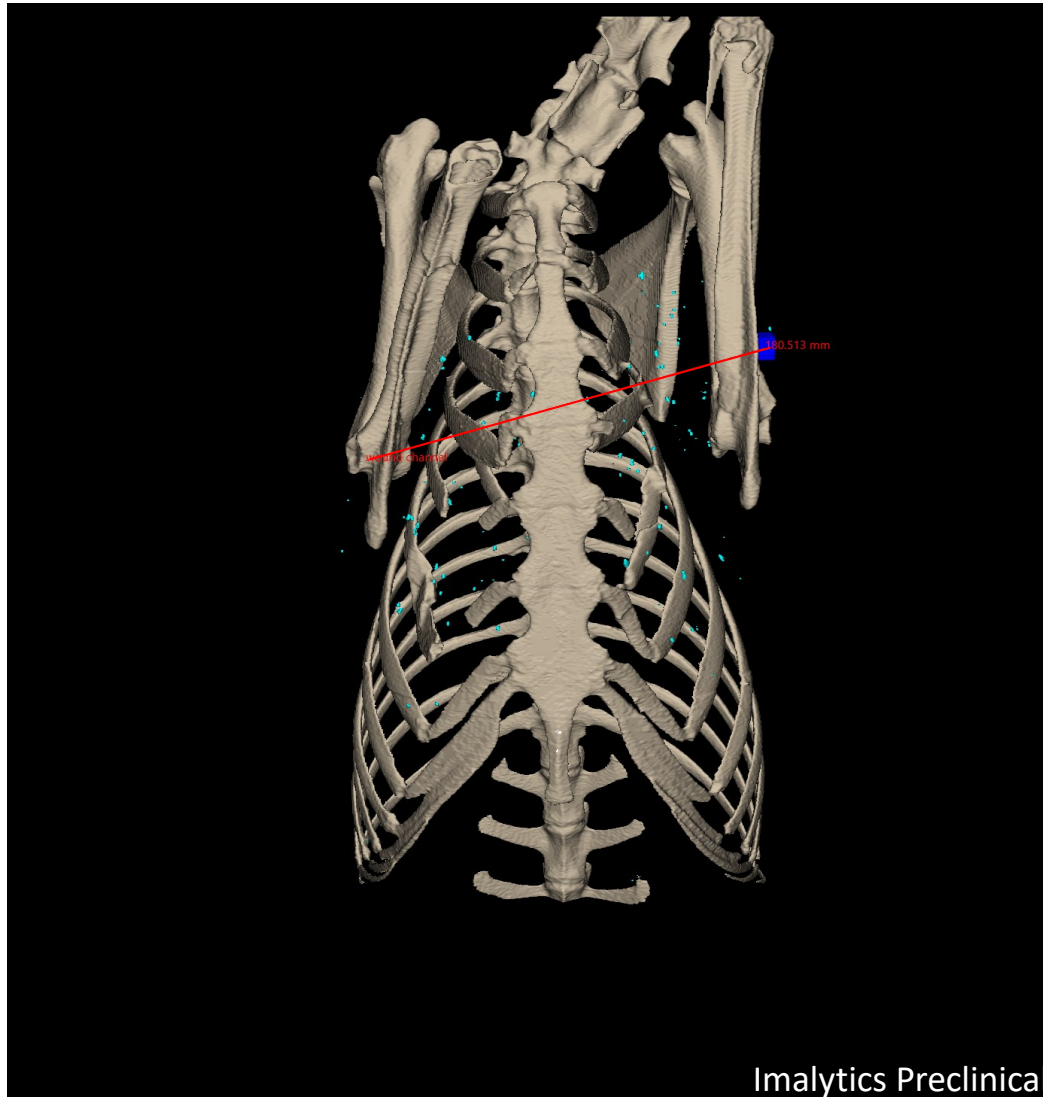
■ Fragments

a) reconstructed,
b) center of mass

■ Bullet entry

● Bullet exit

— Wound channel



Results – Spatial distribution of fragments in roe deer bodies

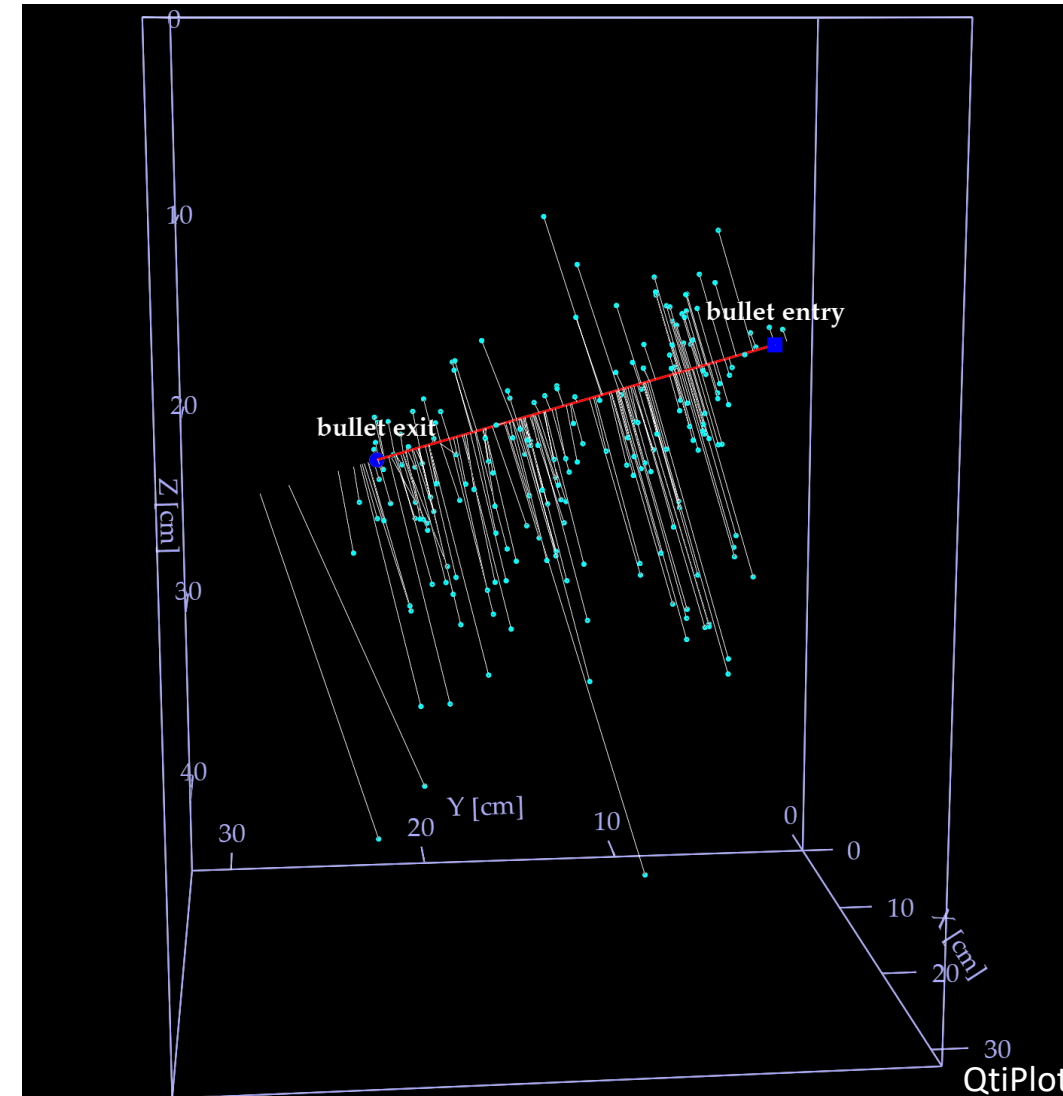
Distribution of fragments in the 4 roe deer differed significantly

Mean orthogonal distance to wound channel 6.5 ± 4.6 cm

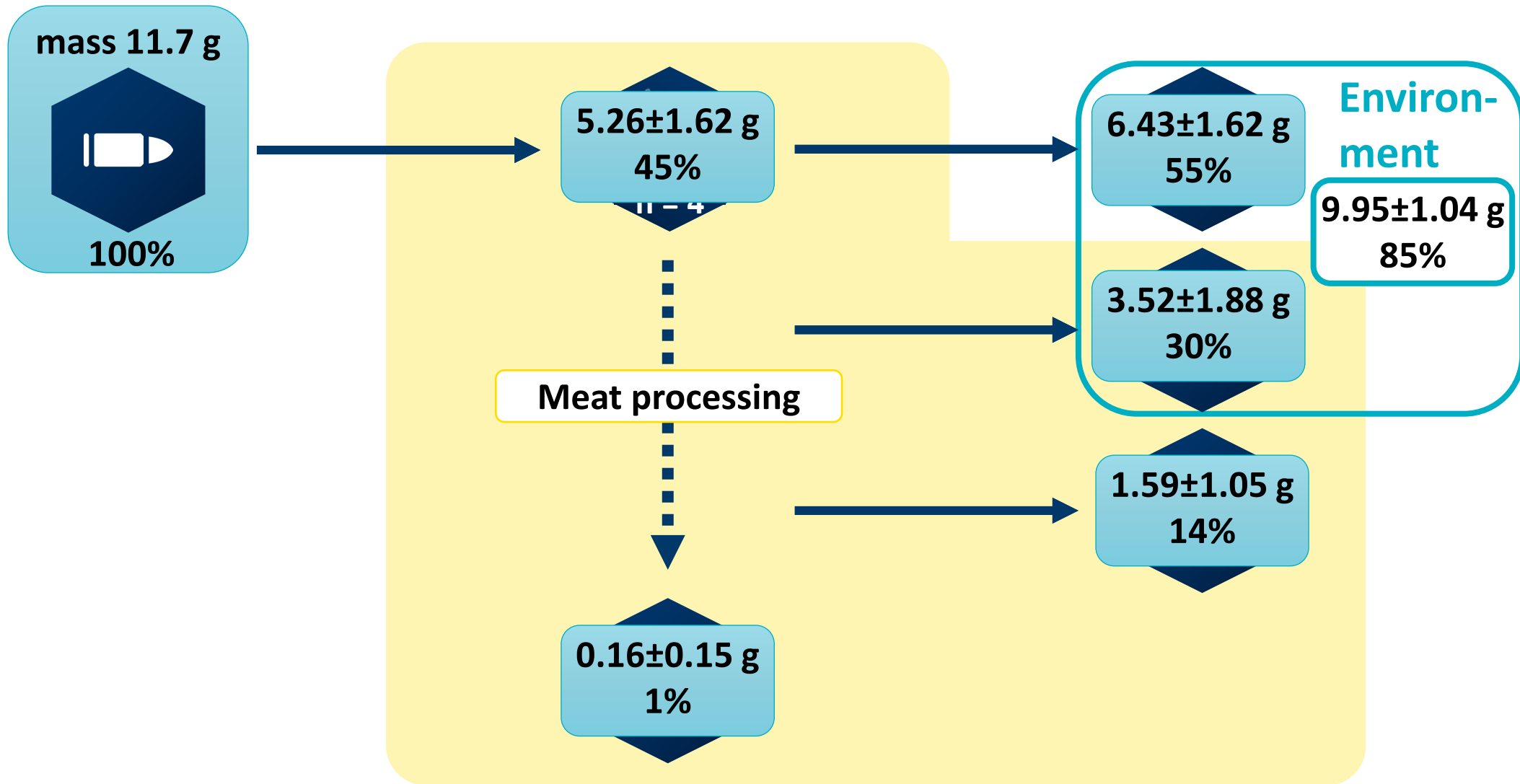
Individual fragments very distant, up to 22.2 cm

Lowest radius of distribution in the 4 roe deer 17.3 cm

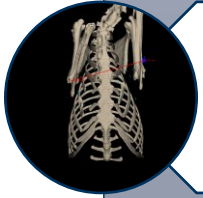
95% of fragment mass in a radius of 15.9 cm



Result – Mass balance of the bullet



Summary and outlook



Wide distribution in animal body



Edible parts can contain fragments



Recommendations to minimise the exposure of game consumers to lead complicated



Other measures required to minimize lead exposure

Thank you to all Co-authors!

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