



JISTOTA MODERNÍ MEDICÍNY

Dozimetrie při ambulantní ^{131}I - terapii štítné žlázy

poctivě a bezbolestně

Jiří Trnka



Úvod

- Vztah mezi aplikovanou aktivitou a absorbovanou dávkou

$$A = \frac{1}{\bar{E}} \cdot \frac{m \cdot D}{\int_0^{\infty} RIU(t) dt}$$

$$\bar{E} = 2,808 \frac{Gy \cdot g}{MBq \cdot d}$$

Historie

- Upravená Marinelliho rovnice

$$A = \frac{m \cdot D}{4 \cdot T_e \cdot RIU(24h)}$$

$$A = 24,7 \cdot \frac{m \cdot D}{T_e \cdot RIU(24h, \%)} \quad [\text{Hušák, Bakos}]$$

Historie

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Doporučení EANM

2-bodová metoda

- 24-48h , 4-8d

$$T_e = \frac{(t_l - t_e) \cdot \ln 2}{\ln(RIU(t_e)) - \ln(RIU(t_l))}$$

$$A = \frac{0,714}{\bar{E}} \cdot \frac{m \cdot D}{RIU(t_l) \cdot 2^{\frac{t_l}{T_e}} \cdot T_e}$$

Doporučení EANM

3-bodová metoda

- 4-6h, 24-48h, 4-8d
- proklad biexponenciálou

$$RIU(t) = \frac{k_t}{k_B - k_T} (e^{-k_T t} - e^{-k_B t})$$

Doporučení EANM

3-bodová metoda

- Integrace křivky

$$\int_0^{\infty} RIU(t) \cdot dt = \frac{k_t}{k_B \cdot k_T}$$

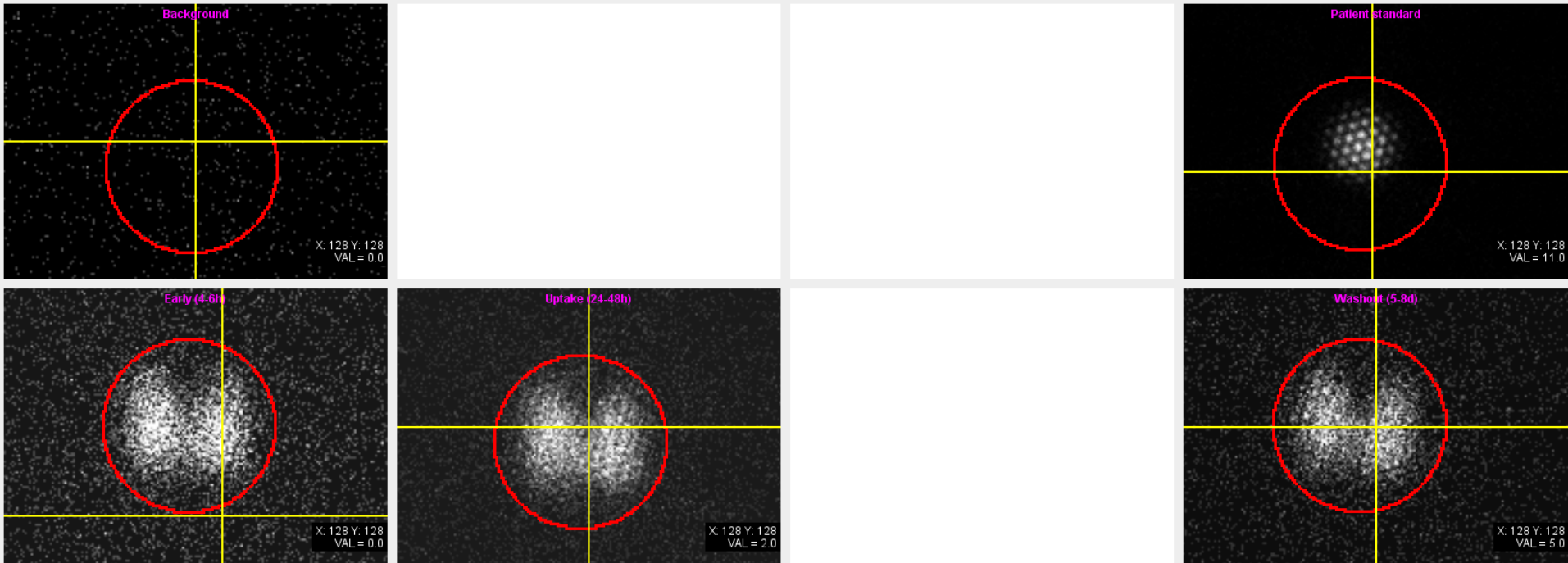
- Nebo numericky

Implementace

- Standardně 3-bodová metoda
- Nouzově 2-bodová metoda
- V krajním případě Marinelliho rovnice

- Důvod: nikdy nevíte, do jaké míry bude pacient spolupracovat

Plánování



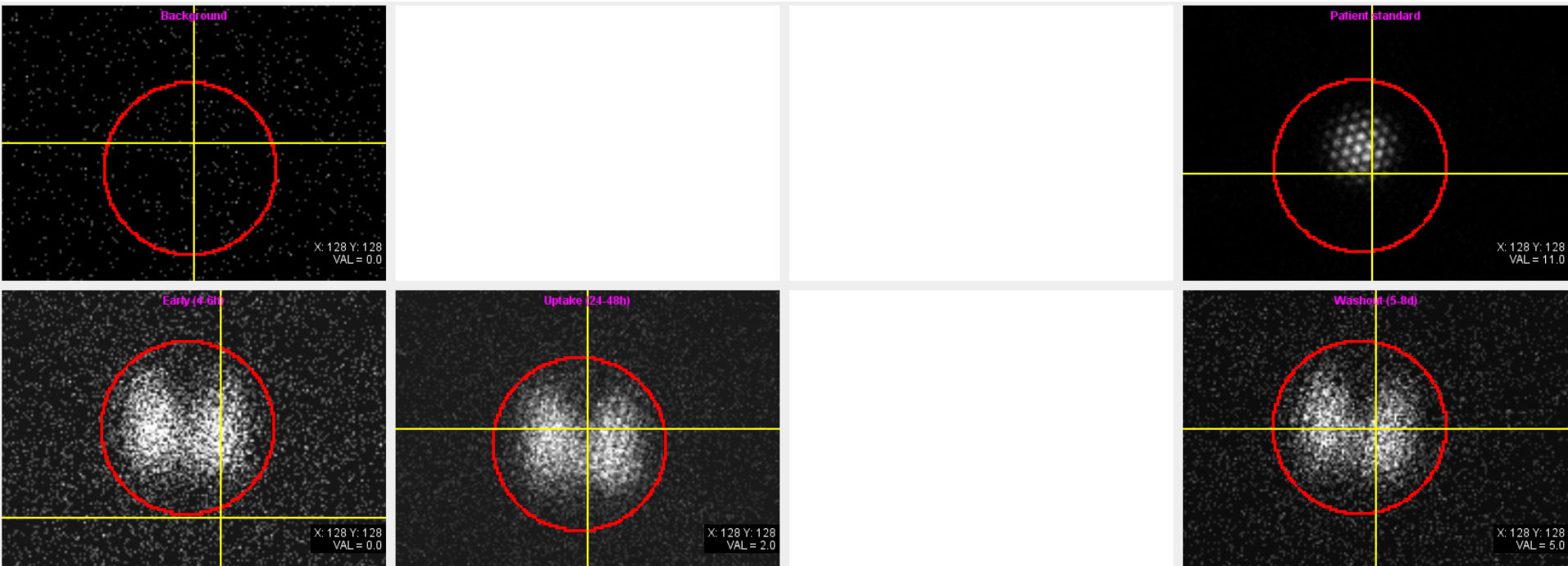
	Background	Global standard	Distance correction	Patient standard	Early (4-6h)	Uptake (24-48h)	Interim (3-4d)	Washout (5-8d)
Date [DD.MM.YYYY]				07.01.2019	14.01.2019	15.01.2019		22.01.2019
Time [hh:mm]				13:41	14:34	14:30		14:29
Duration [s]	300			300	600	600		600
Counts	227	N/A	N/A	21948	6668	13932	N/A	7519
Corrected counts		N/A	N/A	2387	627	1483	N/A	1423
Corrections [incl. duration]		background	background + decay	background + decay + distance		background + decay	background	
<input type="checkbox"/> Alter physical half-life	8.02		Ingestion date	14.01.2019	621	1348	N/A	707
Accumulation	62 %		Ingestion time	12:00				
Biologic half-life	118.4 days							
Effective half-life	7.5 days							
		<input type="button" value="Calculate"/>	<input type="button" value="Export"/>				<input type="button" value="Cancel"/>	

24/48 M

48/247 M



Plánování

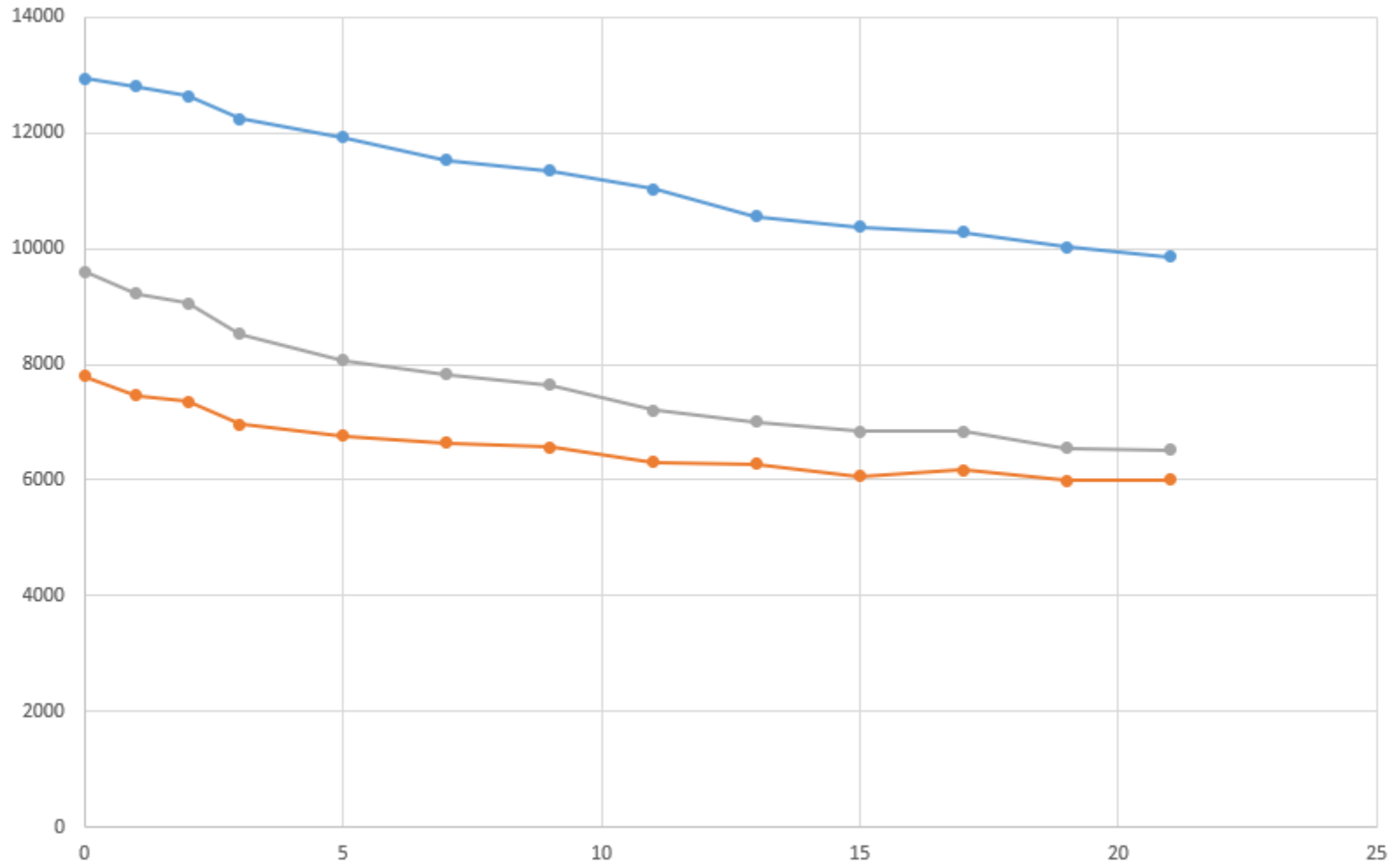


	Modified Marinelli equation (uptake only)	Two-point EANM procedure (uptake + washout)	Three-point EANM procedure (early + uptake + washout)
Thyroid mass [g]	<input type="text" value="20"/>		
Targeted dose [Gy]	<input type="text" value="300"/>		
Admin. activity [MBq]	<input type="text" value="550"/>		
	Effective half-life [d] <input type="text" value="7.6"/>	Mean energy [Gy.g/MBq.d] <input type="text" value="2.808"/>	Residential time [d] <input type="text" value="6.6"/>
	Activity to be administered [MBq] <input type="text" value="317"/>	Activity to be administered [MBq] <input type="text" value="325"/>	Activity to be administered [MBq] <input type="text" value="322"/>
	Expected absorbed dose [Gy] <input type="text" value="519"/>	Expected absorbed dose [Gy] <input type="text" value="508"/>	Expected absorbed dose [Gy] <input type="text" value="513"/>
	<input type="button" value="Calculate"/>	<input type="button" value="Export"/> (for external multi-point calculation)	<input type="button" value="Cancel"/>

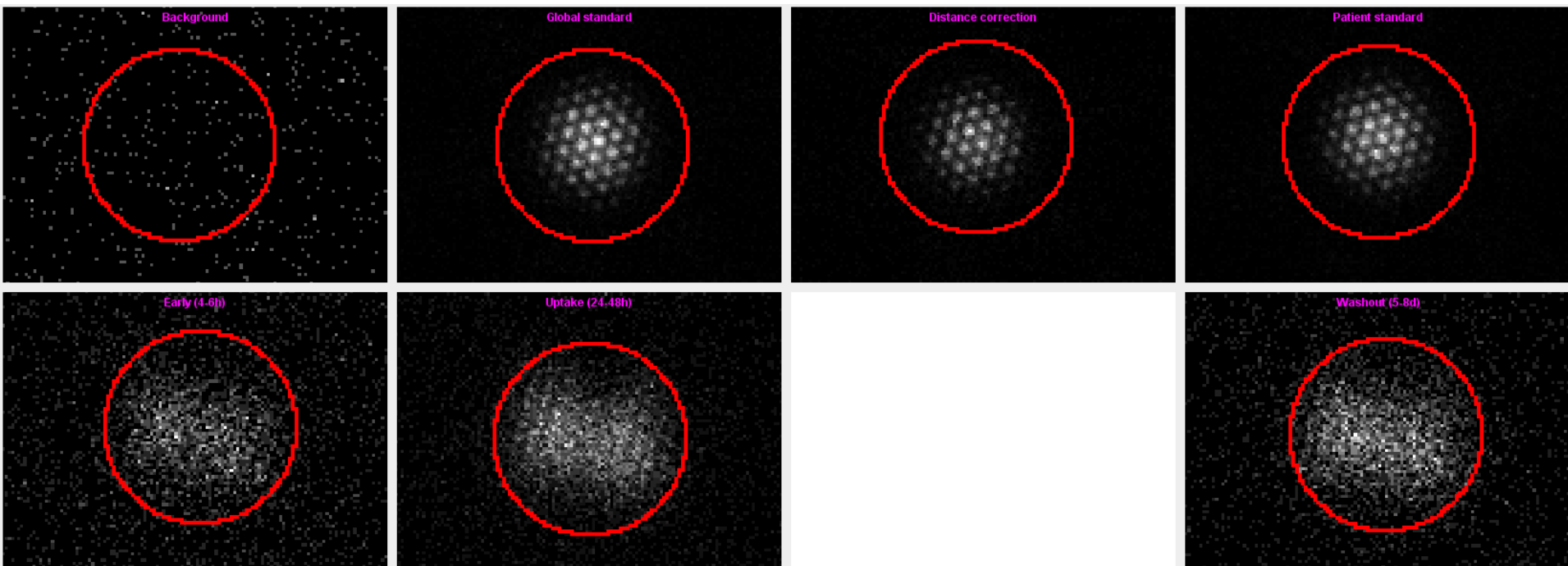
23/48 M
46/247 M



Korekce geometrie



Korekce geometrie



	Background	Global standard	Distance correction	Patient standard	Early (4-6h)	Uptake (24-48h)	Interim (3-4d)	Washout (5-8d)
Date [DD.MM.YYYY]		07.01.2019	14.01.2019	07.01.2019	14.01.2019	15.01.2019		22.01.2019
Time [hh:mm]		13:33	15:07	13:47	14:56	14:44		14:44
Duration [s]	300	300	300	300	600	600		600
Counts	126	20654	11176	20596	2639	7575	N/A	4139
Corrected counts		4106	4070	2231	241	806	N/A	784
Corrections (incl. duration)		background	background + decay	background + decay + distance		background + decay		background
<input type="checkbox"/> Alter physical half-life	8.02		Ingestion date	14.01.2019	239	732	N/A	389
Accumulation	36 %		Ingestion time	12:00				
Biologic half-life	170.9 days	Calculate	Export				Cancel	
Effective half-life	7.7 days							

Load Images

Define ROIs

Calculate kinetics

Dose / Activity

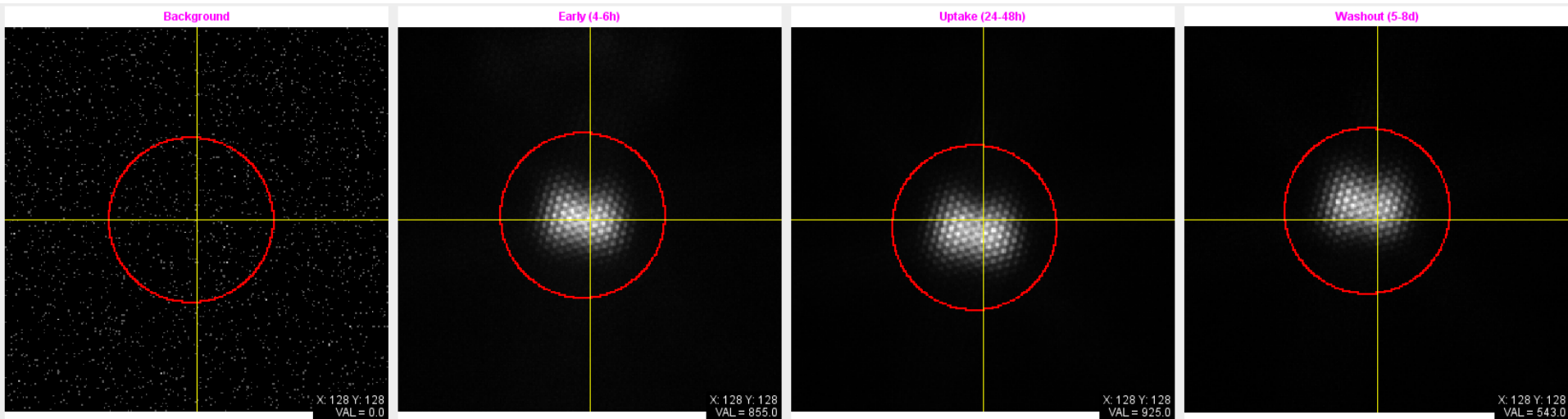
Exit

Ready

31/46 M
46/247 M

View log

Dozimetrie



Three-point EANM procedure
(early + uptake + washout)

Thyroid mass [g]	<input type="text" value="27"/>	Integrated counts	3.31e+09
Mean energy [Gy.g/MBq.d]	<input type="text" value="2.808"/>	Absorbed dose [Gy]	199
Sensitivity [cps/MBq]	<input type="text" value="20"/>		

(for external multi-point calculation)

22:30 M
30:24 M



Děkuji za pozornost.

Kontakt:

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