

# CO2 in vascular imaging a new era just started

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# Disclosure

Speaker name:

Sven Seifert

I have the following potential conflicts of interest to report:

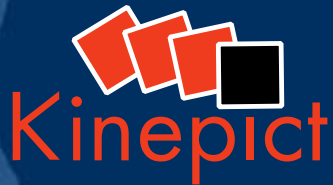
- Consulting
  - Employment in industry
  - Stockholder of a healthcare company
  - Owner of a healthcare company
  - Other(s)
- 
- I do not have any potential conflict of interest



# CO2 – a new era



**PHILIPS**



1. **New application system**
2. **less radiation by new adjustments**
3. **better pictures with a new software**



1

Hand-based  
injecting systems

automated  
injector

fully automatic  
injector

new

**Optimed**  
*CO2-Angioset*  
Germany

**Angiodroid**  
*The CO2 Injector*  
Italy

**Malek Medical GmbH**  
*INSPECT 3005R*  
Germany



**AngioAdvancements**  
*CO2mmander ELITE &  
AngiAssist*  
USA



**Pragmatic Oy**  
*CO2 Angio Flush Set*  
Finland





## What is new?

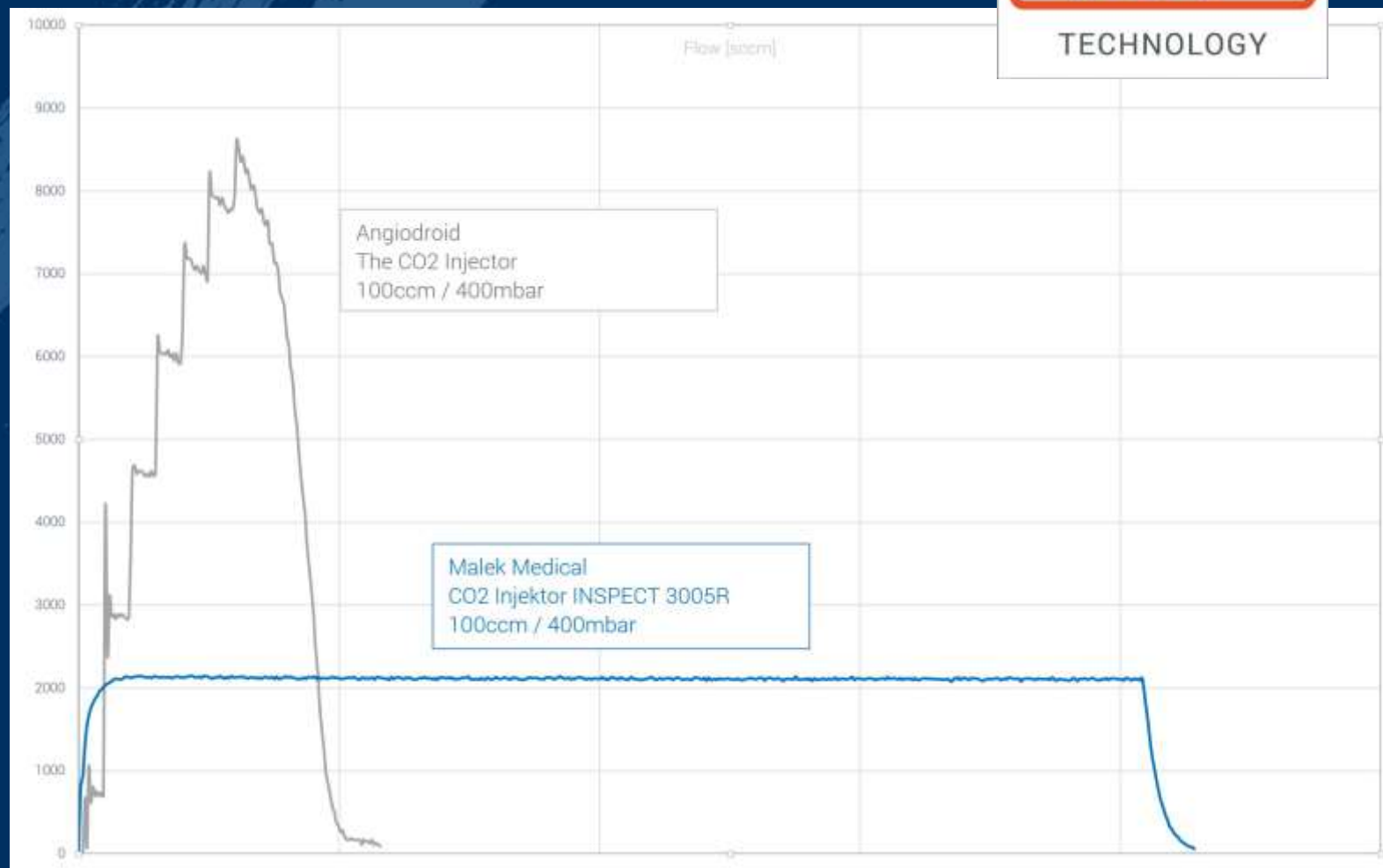
- intelligent continuous flow technique (ICF)
- direkt injection technique (DIT)
- Maximum range pressure up to 1400mbar
- higher volume up to 200ccm
- pre-warmed gas up to 36 degrees
- quick start - no software – 10s to next injection



**INSPECT 3005 R**  
**Available since 01/2020**



## INTELLIGENT CONTINUOUS FLOW TECHNOLOGY

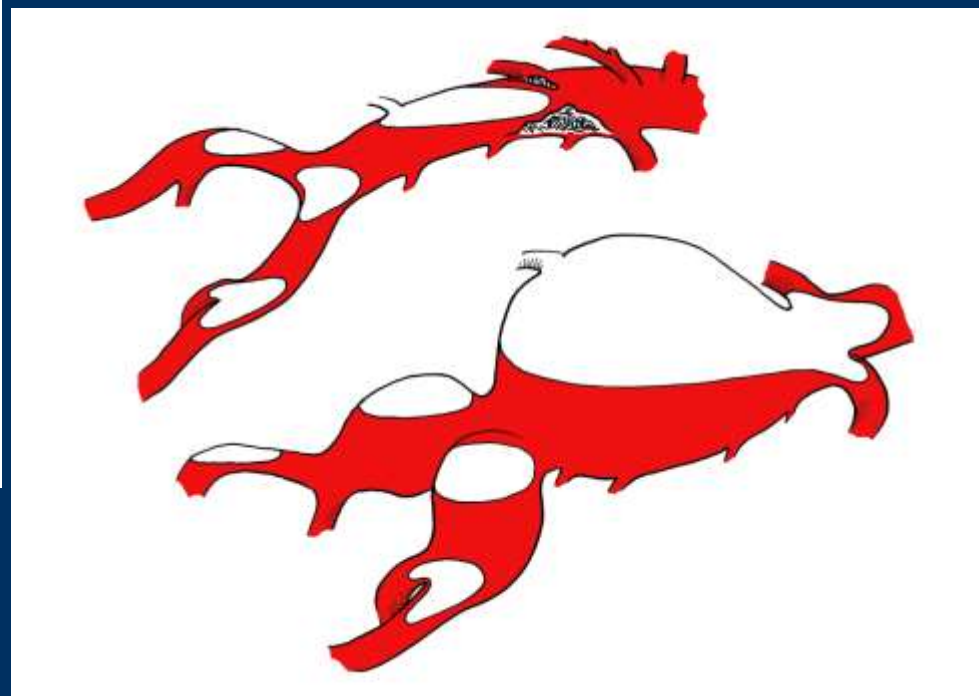
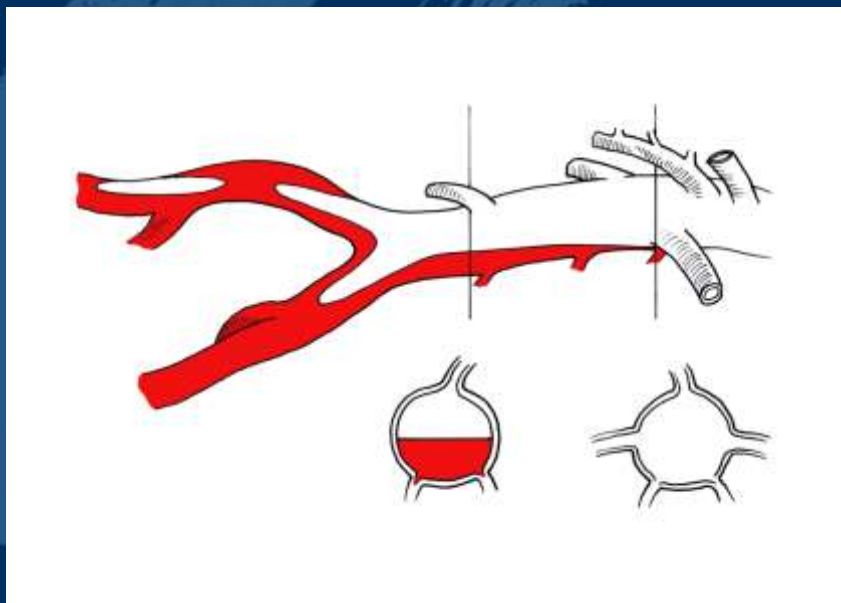


# 1

## WHY ICF?



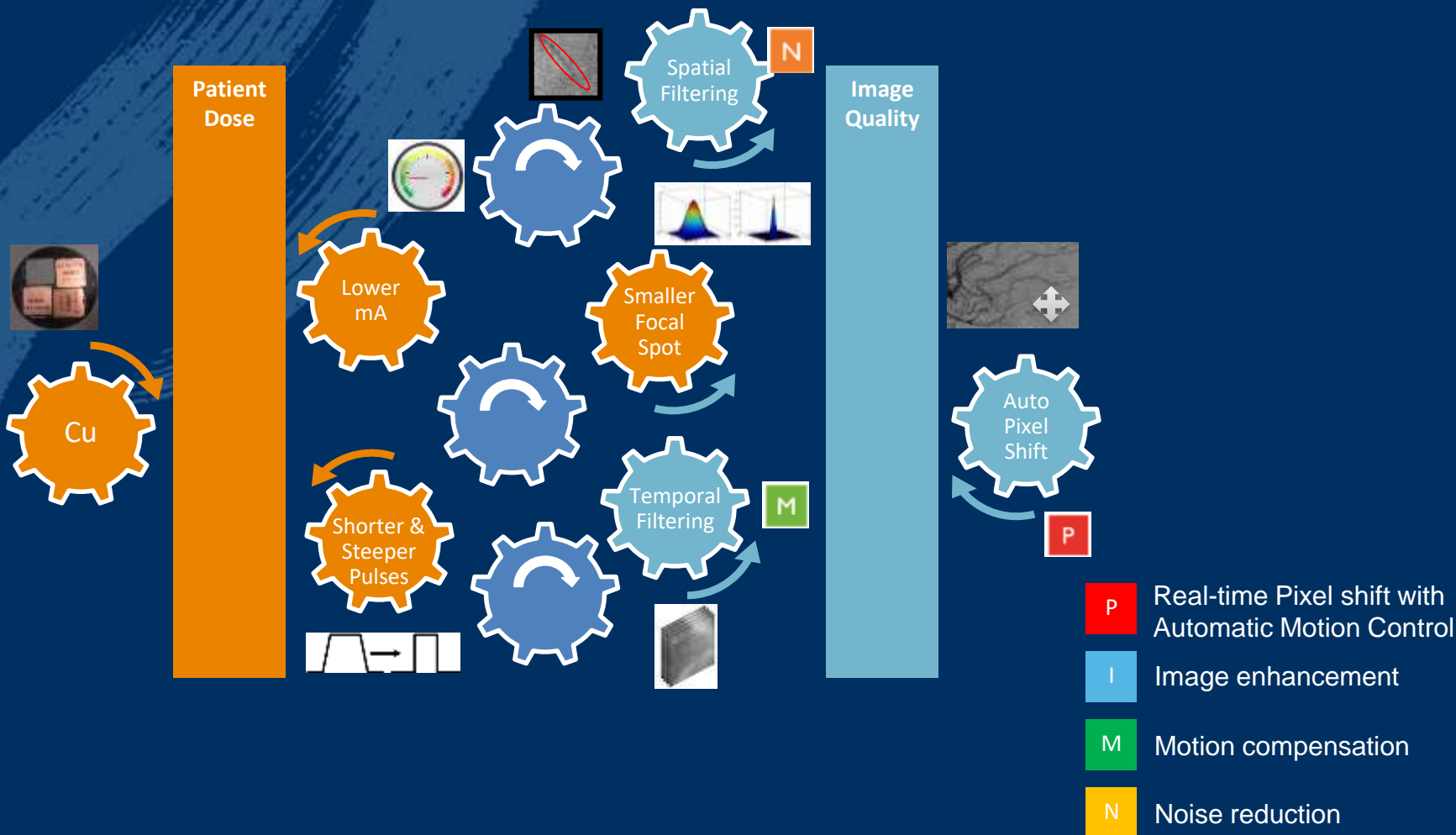
- complete filling of the vessels
- less bolus separation on stenosis and bifurcations
- no need for patient positioning



INSPECT 3005 R



# ClarityIQ technology







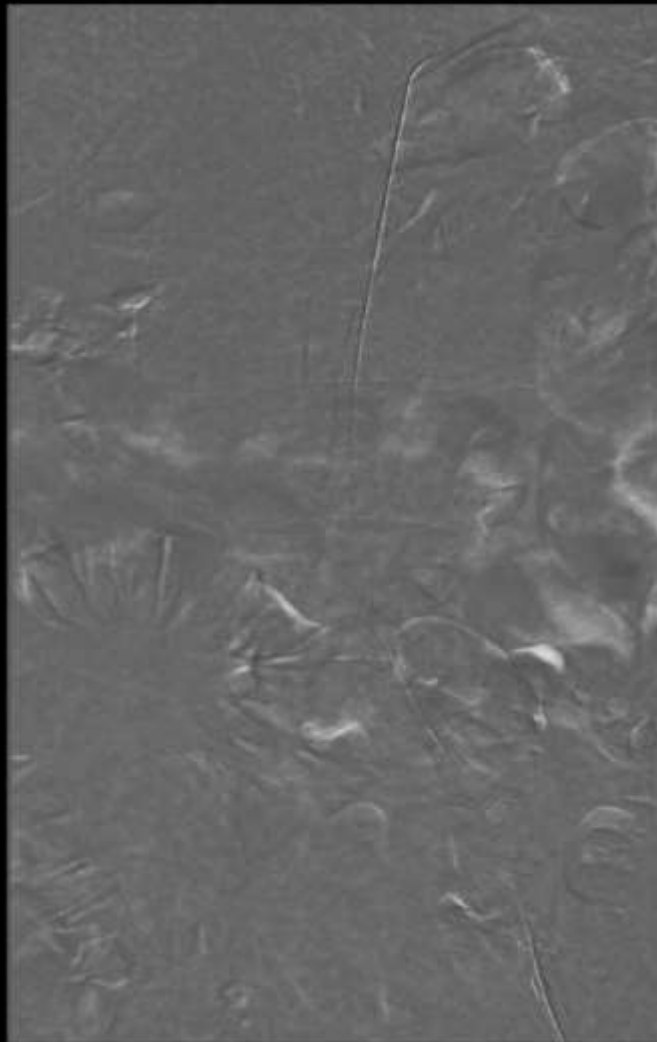
33%

60 cc, 600 mbar

Durchl.-nr.	Bildanzahl	Verfahren	Geschw. B/s				DFP [mGy $\cdot$ cm $^2$ ]	LK [mGy]	Rotation	Angulation	SID [cm]
			KV	mA	mAs	ms					
1	18	Abdomen CO2 2fps 33 %	2	80	29	4518	13.28	0	0	102	
2	20	Abdomen CO2 2fps 33 %	2	80	29	5069	14.90	0	0	102	
3	18	Abdomen CO2 2fps 33 %	2	80	34	5303	15.59	0	KAUD13	102	
4	15	Abdomen CO2 2fps 33 %	2	80	33	4375	12.86	0	KAUD13	102	
5	1	Abdomen CO2 2fps 33 %	2	80	73	221	1.77	LAO3	KAUD1	107	
6	14	Abdomen CO2 2fps 33 %	2	80	36	3255	13.07	LAO3	KAUD1	107	
7	15	Abdomen CO2 2fps 33 %	2	80	37	4353	14.32	LAO3	KAUD1	107	
8	88	Durchleuchtung	15	93	3	225	0.74	LAO3	KAUD1	107	
9	131	Durchleuchtung	15	93	3	328	1.08	LAO3	KAUD1	107	
10	104	Durchleuchtung	15	92	3	259	0.84	LAO3	KAUD1	107	
11	49	Durchleuchtung	15	93	3	124	0.39	LAO3	KAUD1	107	
12	130	Durchleuchtung	15	92	3	325	1.07	LAO3	KAUD1	107	
13	18	Abdomen CO2 2fps 33 %	2	80	36	5063	16.66	LAO3	KAUD1	107	
14	12	Abdomen CO2 2fps 33 %	2	80	36	3447	11.34	LAO3	KAUD1	107	

2  
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Study REMOVED  
16.01.2020  
13:29:30  
8 IMA 15 FRM 5

Klinikum Chemnitz  
Ref.: K382  
AlluraXper



25%

Abdomen CO2 3fps 25%  
CO2 Low Dose  
SINGLE PLANE\SINGLE A  
CRA 0  
LAO 4

W: 68  
C: 41

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\* P 01.9999  
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16.01.2020  
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9 IMA 25 FRM 1

Klinikum Chemnitz  
Ref.: K382  
AlluraXper



25%

Abdomen CO2 3fps 25%  
CO2 Low Dose  
SINGLE PLANE\SINGLE A  
CRA 0  
LAO 4

W: 683  
C: 413



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\* P: 01.9999  
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16.01.2020  
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23 IMA 18 FRM 1

Klinikum Chemnitz  
Ref.: K382  
AlluraXper

25%

Leg CO2 3fps  
CO2 Low Dose  
SINGLE PLANE\SINGLE A  
CRA 0  
LAO 4

W: 683  
C: 413



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 ID: REMOVED  
 \* 01.01.9999  
 Study REMOVED  
 16.01.2020  
 17:06:59  
 1 IMA

Berichtstatus:

Kumulative Durchleucht.-zeit:

Kumulat. DAP (Durchleuchtung):

Kumulatives DAP (Aufnahme):

Gesamt-DAP:

Kumulative Luftkerna:

Gesamtzahl aufgen. Durchläufe:

Gesamtzahl aufgenommener Bilder:

Gesamtzahl aufgen. Aufnahmebilder:

durchl. nr.	Bildanzahl	Verfahren	Geschw.
1	19	Abdomen 3 B/s	
2	19	Abdomen CO2 3fps 25%	
3	17	Abdomen CO2 3fps 25%	
4	90	Durchleuchtung	1
5	150	Durchleuchtung	1
6	16	Abdomen CO2 3B/s	
7	115	Durchleuchtung	1
8	15	Abdomen CO2 3fps 25%	
9	25	Abdomen CO2 3fps 25%	
10	25	Leg CO2 3fps	
11	7	1 Unterschenkel 1 B/s	
12	57	Durchleuchtung	1
13	150	Durchleuchtung	1
14	68	Durchleuchtung	1
15	127	Durchleuchtung	1
16	142	Durchleuchtung	1
17	21	Leg CO2 3fps	
18	23	Leg CO2 3fps	
19	9	1 Unterschenkel 1 B/s	
20	7	1 Unterschenkel 1 B/s	
21	150	Durchleuchtung	1
22	18	Leg CO2 3fps	
23	18	Leg CO2 3fps	
24	18	Leg CO2 3fps	
25	17	Leg CO2 3fps	

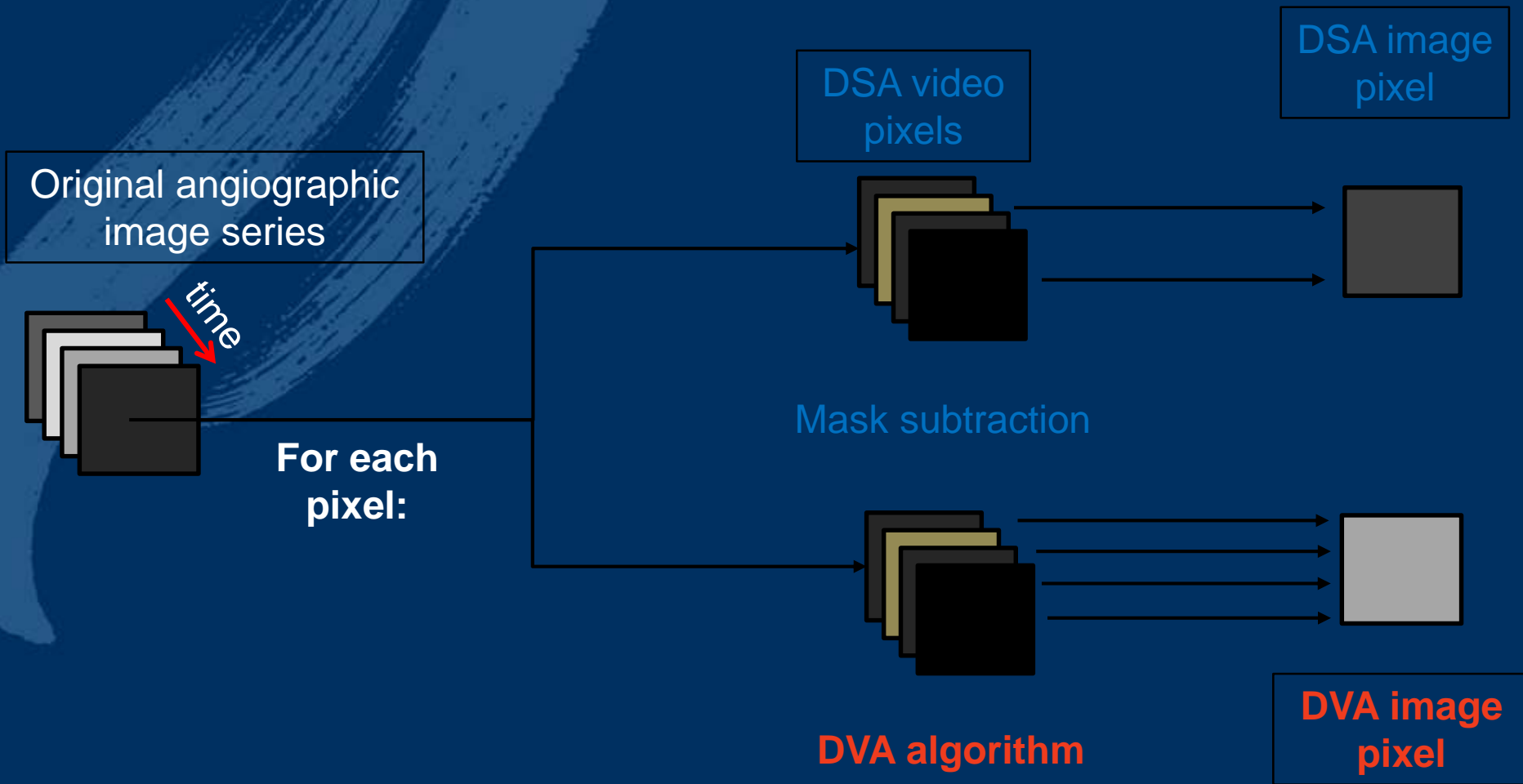
Bildanzahl	Verfahren	Geschw. B/s	kV	mA	MS	DFP [mGy <sup>cm</sup> ²]	LK [mGy]
19	Abdomen 3 B/s	3	80	7		3134	9.02
19	Abdomen CO2 3fps 25%	3	100	5		2082	5.95
17	Abdomen CO2 3fps 25%	3	100	5		1646	4.69
90	Durchleuchtung	15	81	3		154	0.43
150	Durchleuchtung	15	81	3		485	1.38
16	Abdomen CO2 3B/s	3	80	13		9925	8.90
115	Durchleuchtung	15	82	3		187	0.57
15	Abdomen CO2 3fps 25%	3	100	5		1518	4.33
25	Abdomen CO2 3fps 25%	3	86	2		299	1.61
25	Leg CO2 3fps	3	81	2		396	1.57
7	1 Unterschenkel 1 B/s	1	65	2		142	0.51
57	Durchleuchtung	15	65	2		23.9	0.08
150	Durchleuchtung	15	67	2		85.6	0.28
68	Durchleuchtung	15	67	2		36.8	0.13
127	Durchleuchtung	15	66	2		53.5	0.20
142	Durchleuchtung	15	65	2		50.9	0.17
21	Leg CO2 3fps	3	82	2		402	1.46
23	Leg CO2 3fps	3	81	2		340	1.19
9	1 Unterschenkel 1 B/s	1	65	4		393	1.39
7	1 Unterschenkel 1 B/s	1	65	5		402	1.42
150	Durchleuchtung	15	65	2		65.9	0.22
18	Leg CO2 3fps	3	87	2		328	1.66
18	Leg CO2 3fps	3	75	2		226	0.71
18	Leg CO2 3fps	3	81	2		305	0.96
17	Leg CO2 3fps	3	84	2		334	1.05

PHILIPS

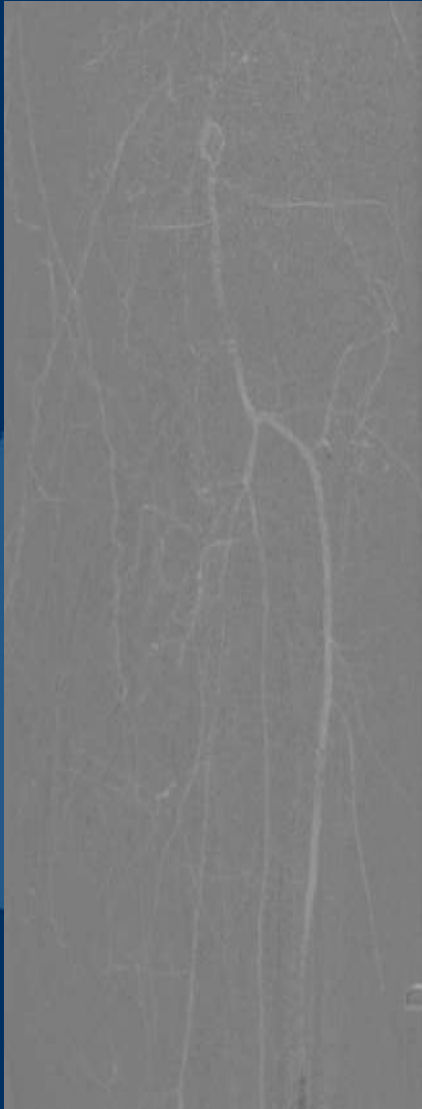
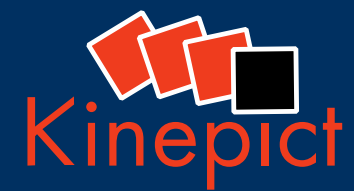


# 3

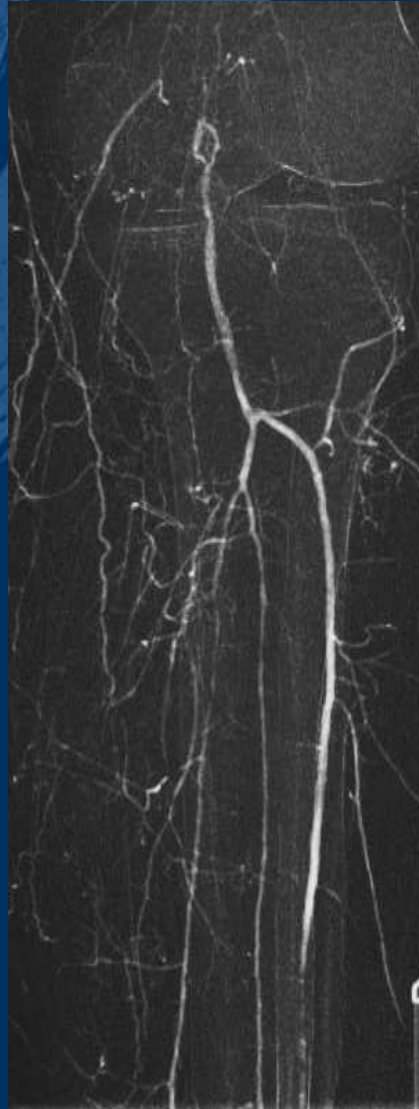
# Digital Variance Angiography



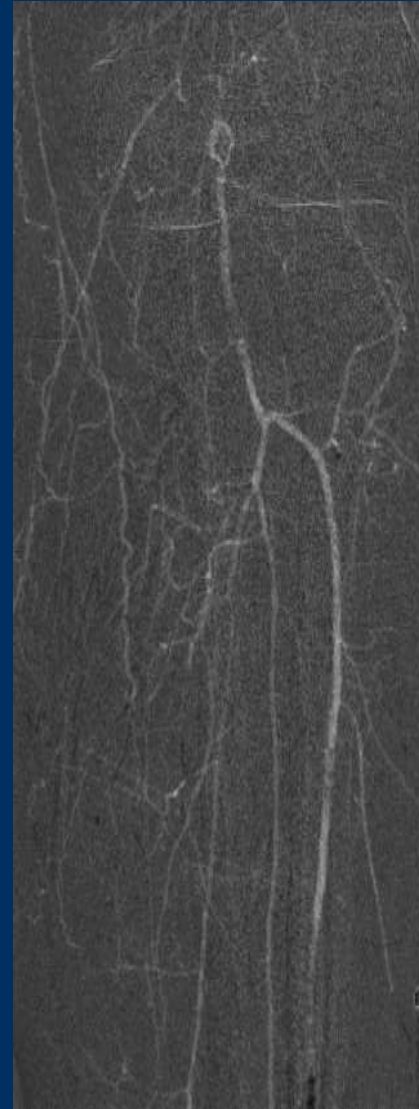
# 3 Operating Room Monitor (real-time display)



DSA



DVA



Postprocessed DSA





# 3 CO<sub>2</sub> in lower limb




- 24 patients, 114 image pairs in 6 regions of the lower limb, CO<sub>2</sub>
- 3.5-4.5 x better SNR
- DVA outperformed DSA in 85% of all pairs ( $p < 0.001$ )
- Orias et al, 2019  
**Invest Radiol 54:428**

# Conclusion

It is the first time that we have an optimal injection system and the outlook of minimal radiation dose for perfect angiograms using CO<sub>2</sub>!



Einladung




CHEMNITZER GEFÄßKURSE  
CHEMNITZ VASCULAR COURSES

Kohlendioxid als Kontrastmittel in  
der Gefäßmedizin – 10. Anwenderkurs

Chemnitz Vascular Courses  
Carbon dioxide as a contrast agent –  
10<sup>th</sup> practical course

2. / 3. April 2020



KLINIKUM CHEMNITZ  
gGmbH



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