Imaging & Physiology Summit: Clinical Data

CONTRAST FFR (cFFR)

Seoul, Korea, december 6th, 2014

CATHARINA-ZIEKENHUIS

Nico H. J. Pijls, MD, PhD
Catharina Hospital,
Eindhoven, The Netherlands

catharina ziekenhuis

CONTRAST STUDY: Background

- When measuring FFR, for practical reasons it is advocated presently by some investigators to skip hyperemia
- This happens at the cost of diagnostic accuracy
- Contrast injections are intrinsic part of any diagnostic angiogram or PCI
- Contrast agent is known to induce short-lasting hyperemia, but is less well investigated as i.c. adenosine

→ **P_d/P_a** measurement after regular contrast injection could be more accurate and easier than relying upon resting indices like iFR and **P*d* /Pa** at rest
and specifically unmask significant stenosis missed by iFR (young patients, proximal lesions, large coron arteries)

CONTRAST FFR (cFFR)

several small studies:

	N	cut-off	accuracy
Leone, Eurointervention 2014	80 (104)	0.83	91%
Baptista, Eur H J 2014 (abstract)	66 (98)	0.84	91%
Spagnoli, Eurointervention 2014	47 (65)	0.85	88%

Notes: - accuracy compared to FFR of 0.80
- Leone and Baptista: cut-off by ROC, i.e. retrospectively, like resting indices
- Spagnoli: 2-step approach with prospective validation

CONTRAST STUDY: Aims

cFFR (contrast FFR) is defined as Pd/Pa after a regular single bolus of contrast as routinely used in coronary angiography

Aims of the CONTRAST study:

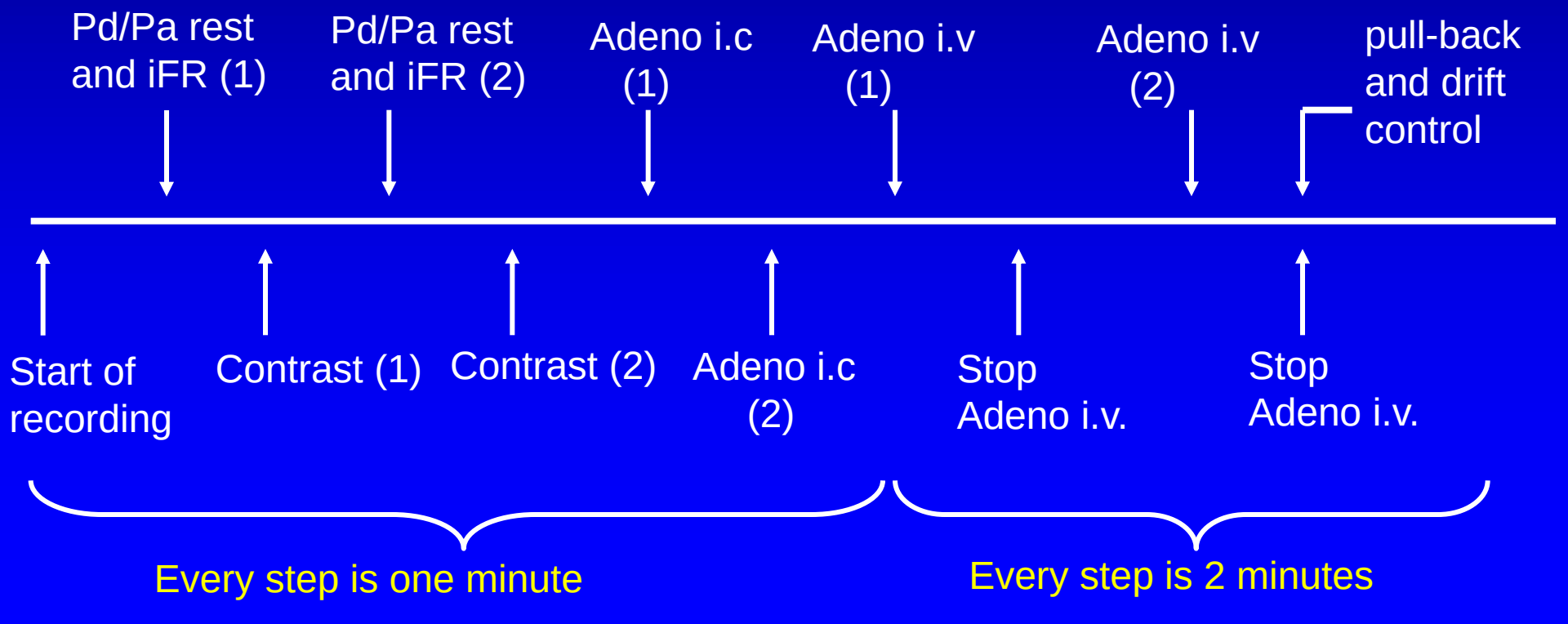
- how close is *c*FFR to true FFR ? (with ic or iv adenosine)
- how reproducible is *c*FFR ?
- is *c*FFR more accurate to predict true FFR than the purely resting indices: Pd/Pa rest and iFR
- reproducibility of all these indexes

CONTRAST STUDY: PATIENTS

- 750 patients > 18 years old, who undergo FFR for whatsoever reason
- no extremely calcified, tortuous vessels
  no previous CABG
- enrollment in sept-nov 2014: 319 patients
  expected to be completed march 2015
  and to be presented at PCR

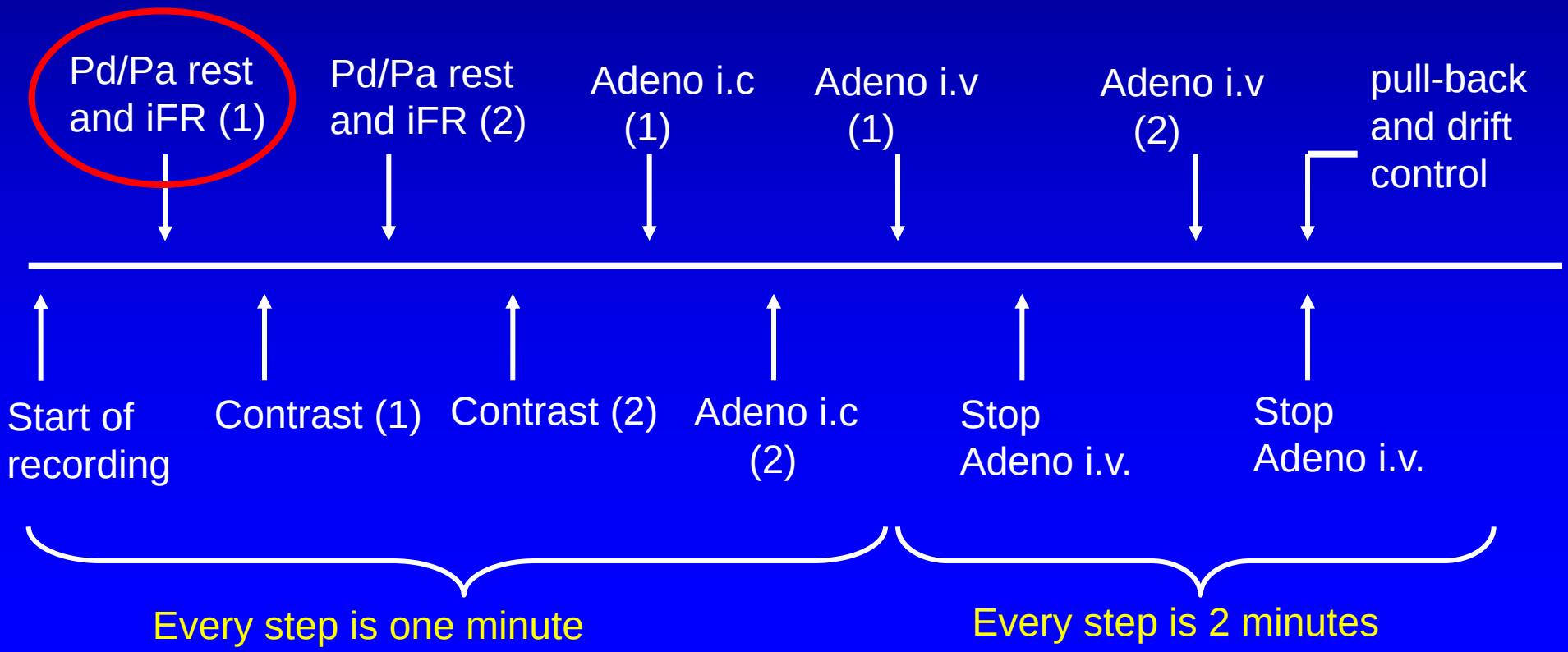
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



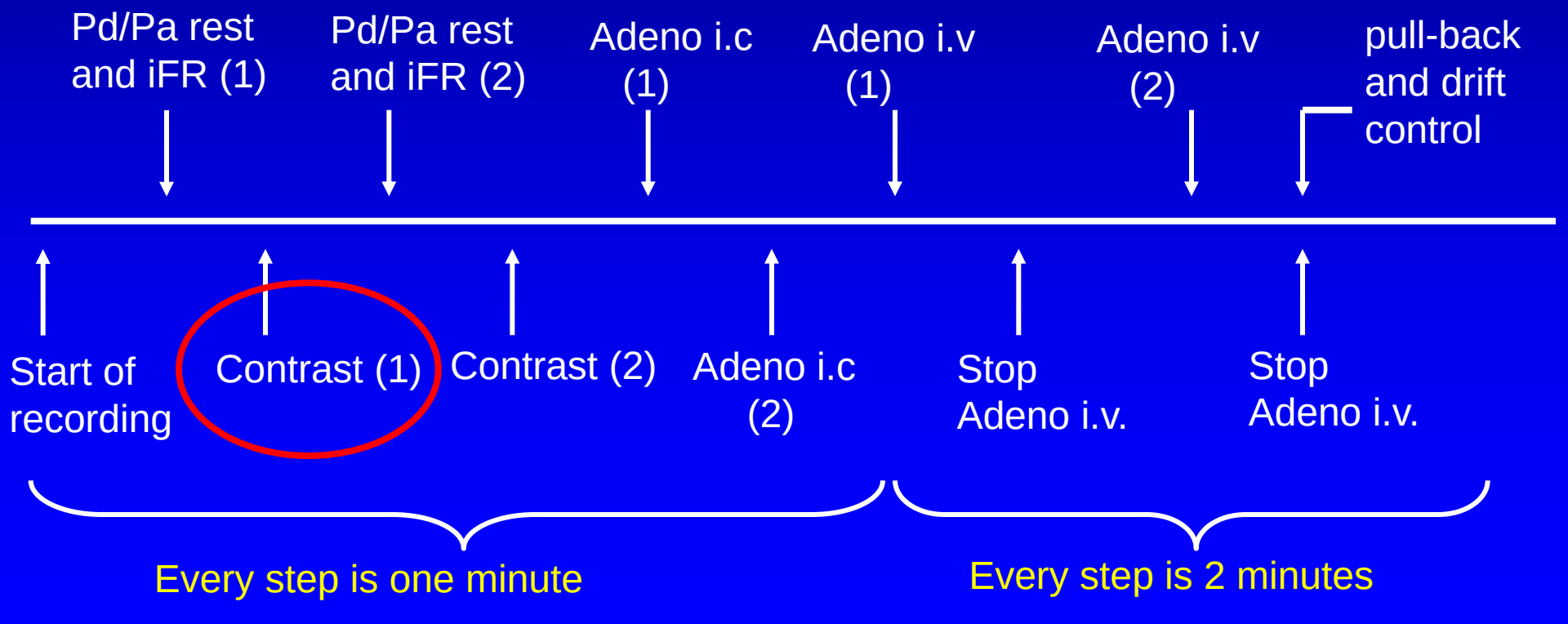
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



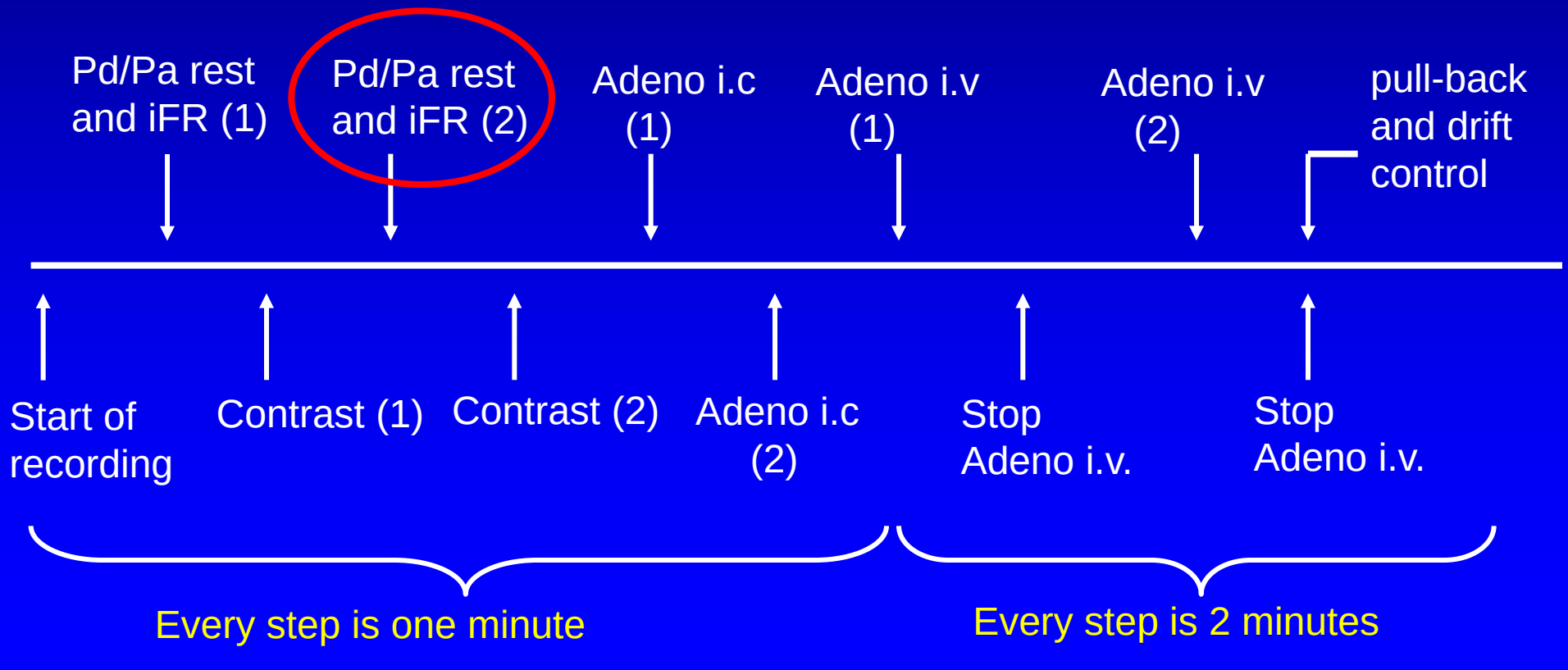
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



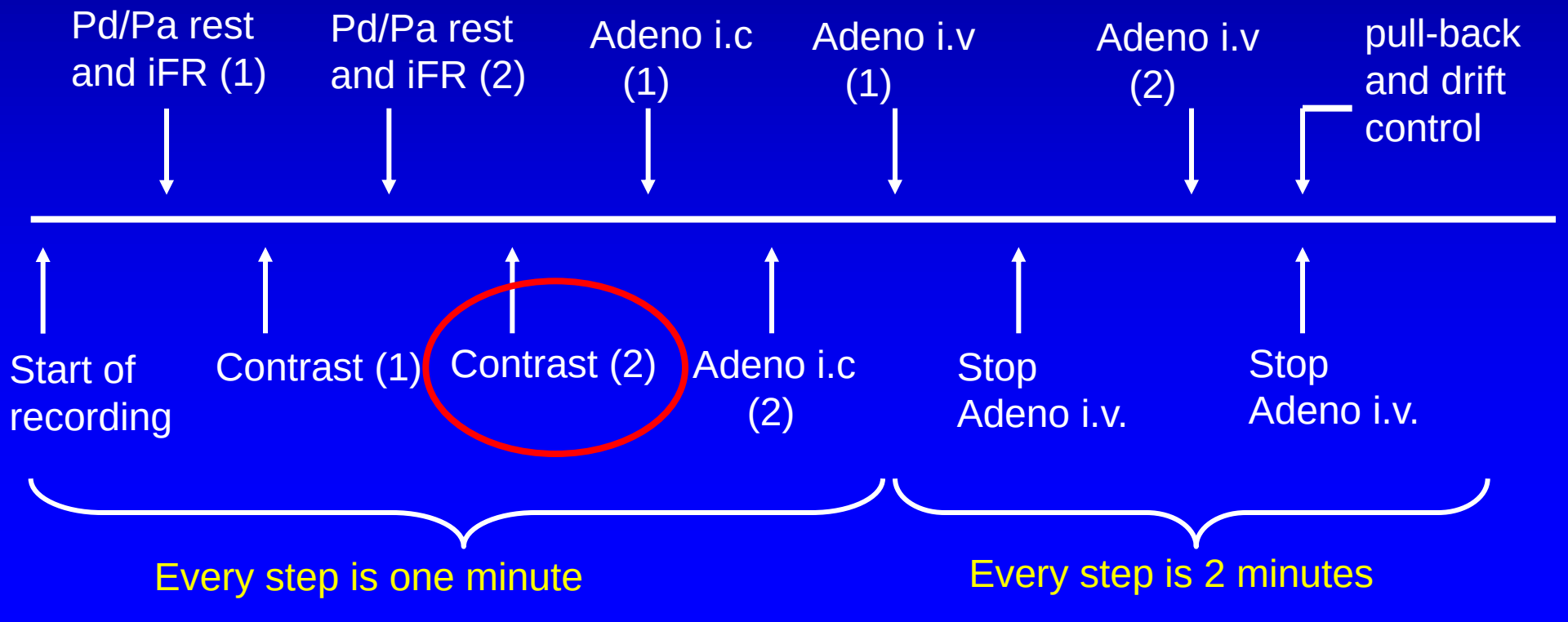
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



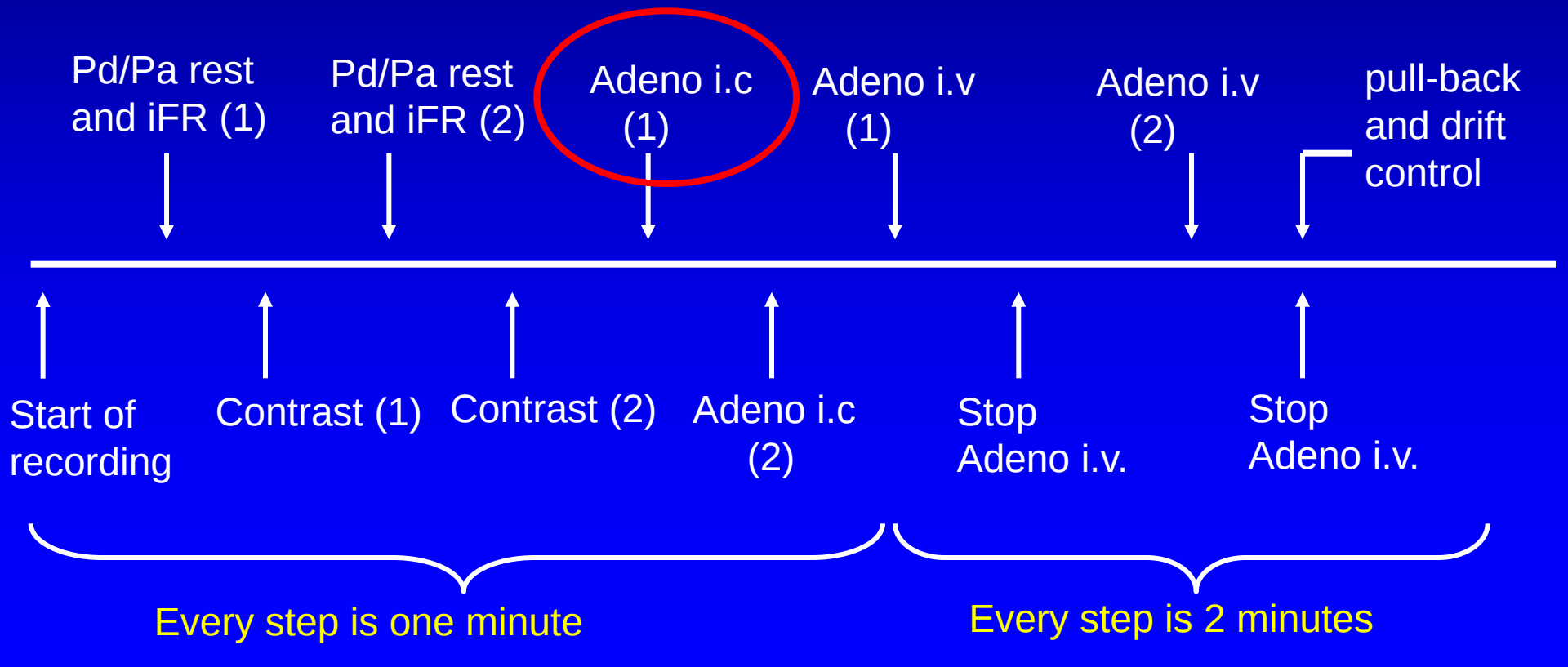
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



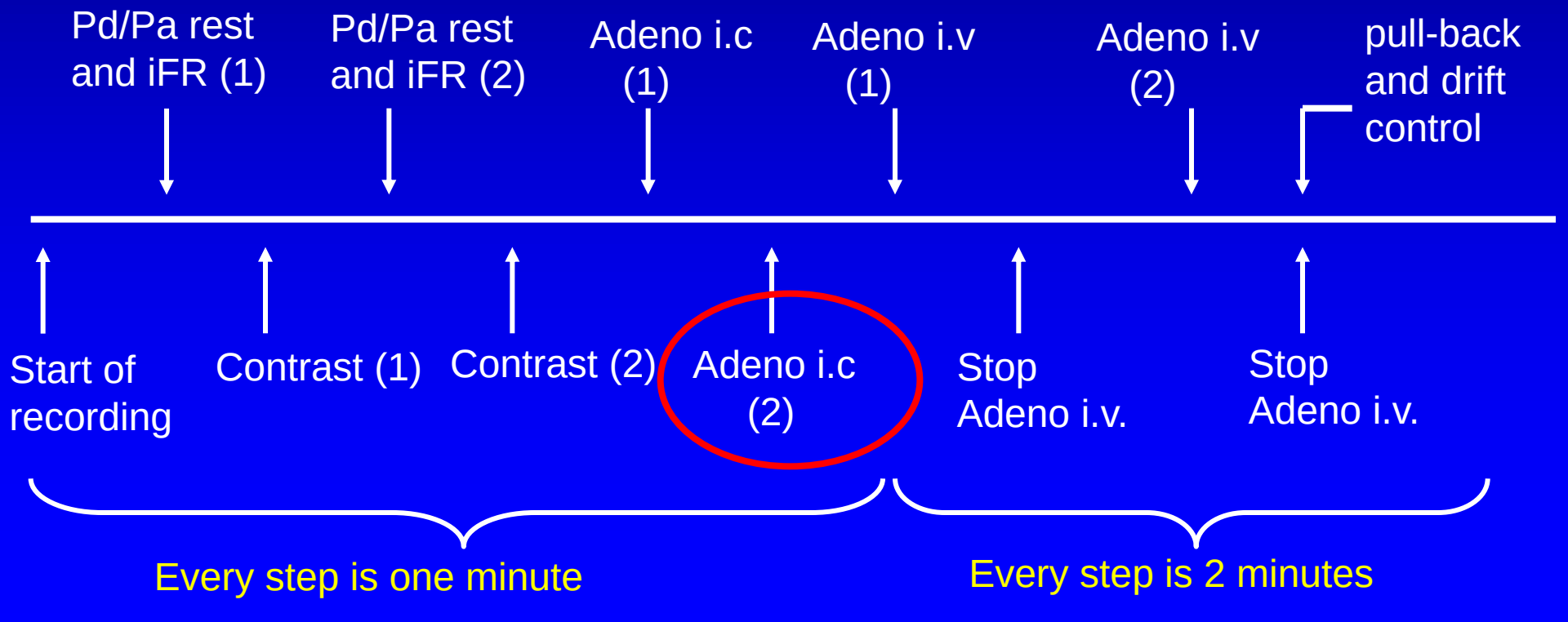
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



CONTRAST STUDY: PROTOCOL

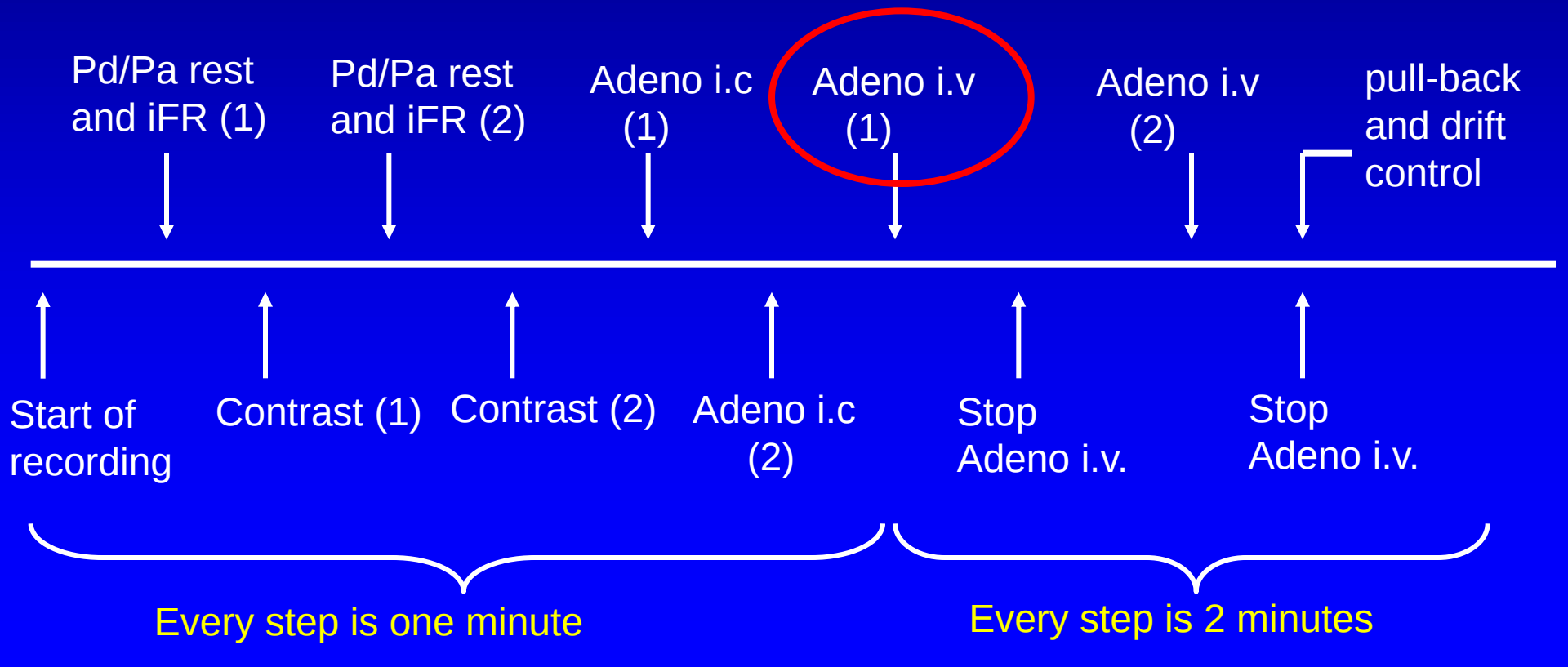
- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



CONTRAST STUDY: PROTOCOL

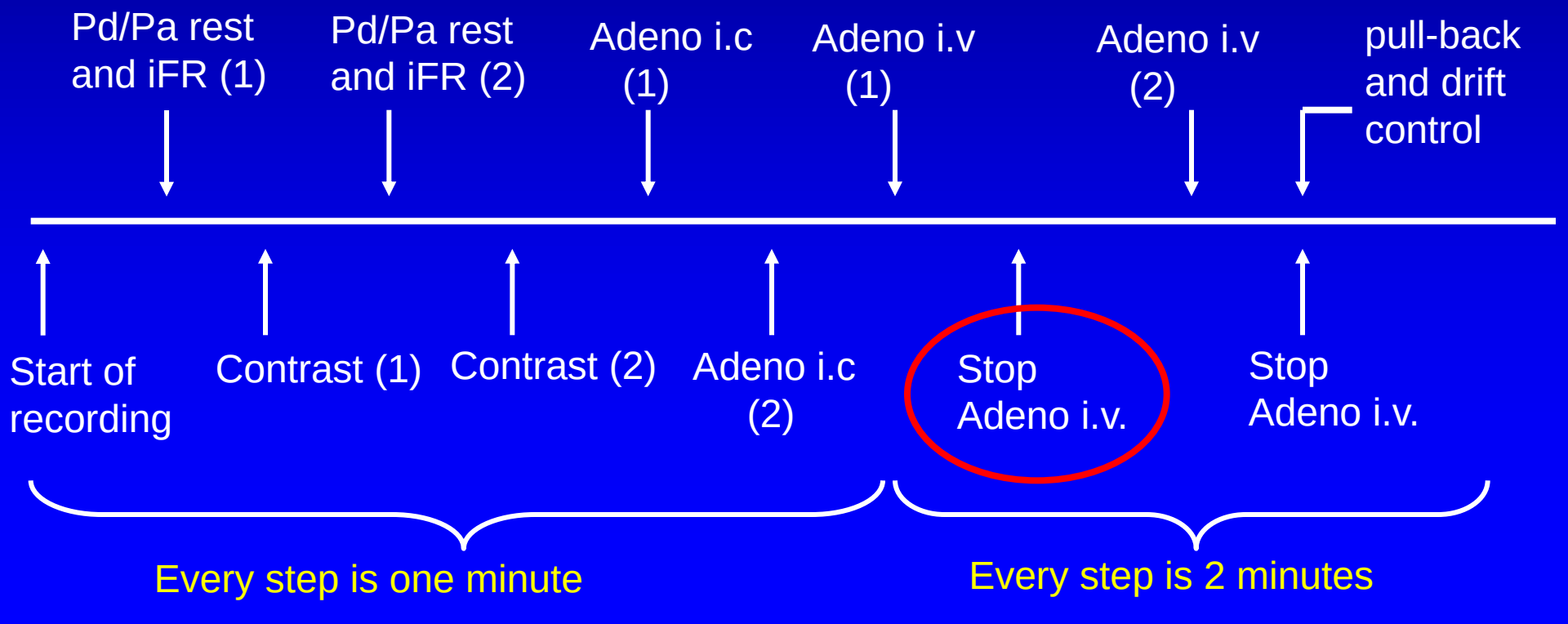
- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place

- one long recording (14 minutes) as follows



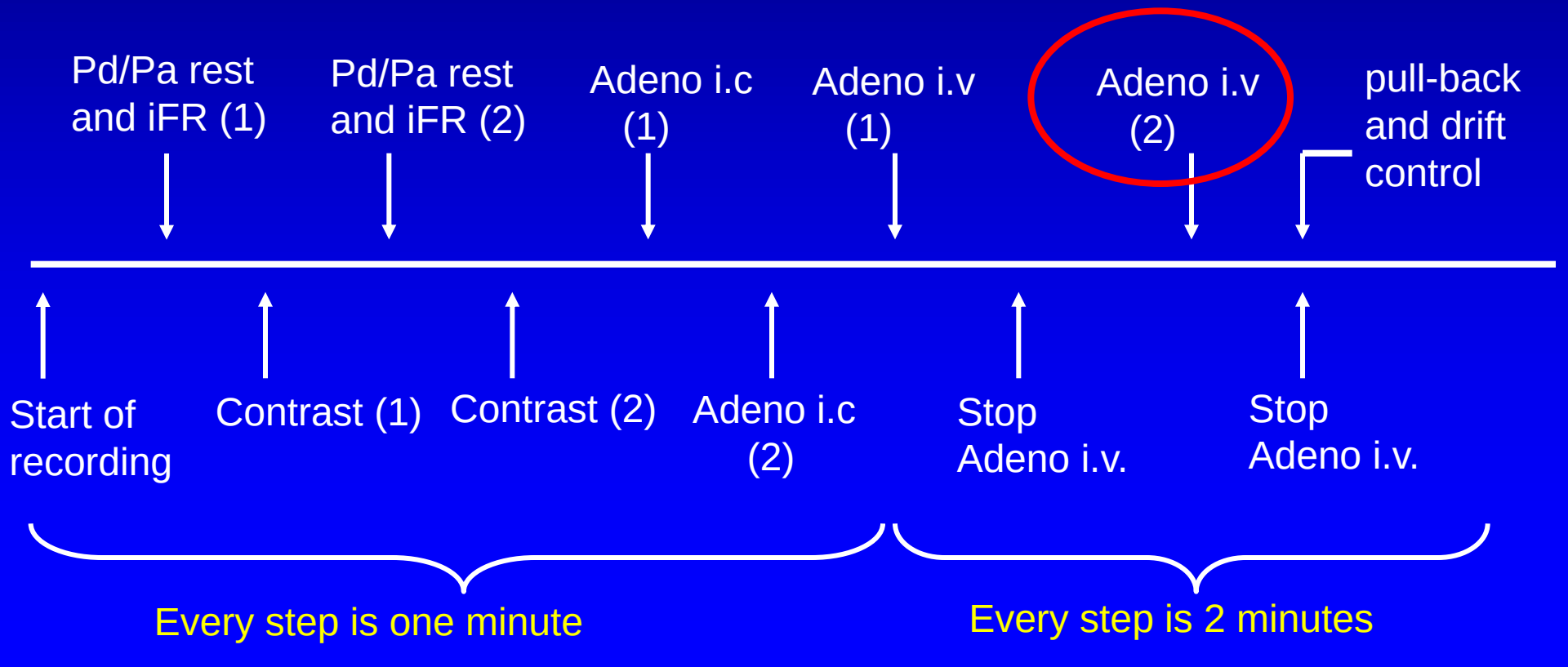
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



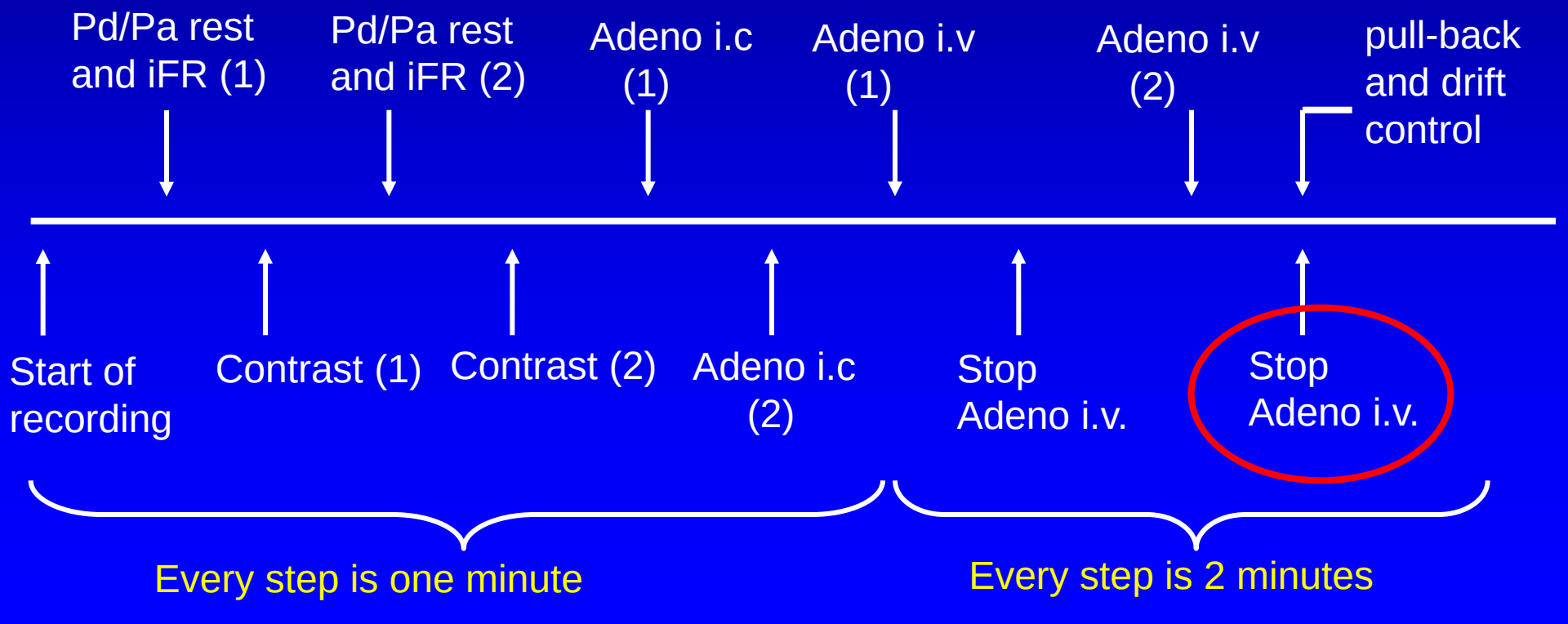
CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



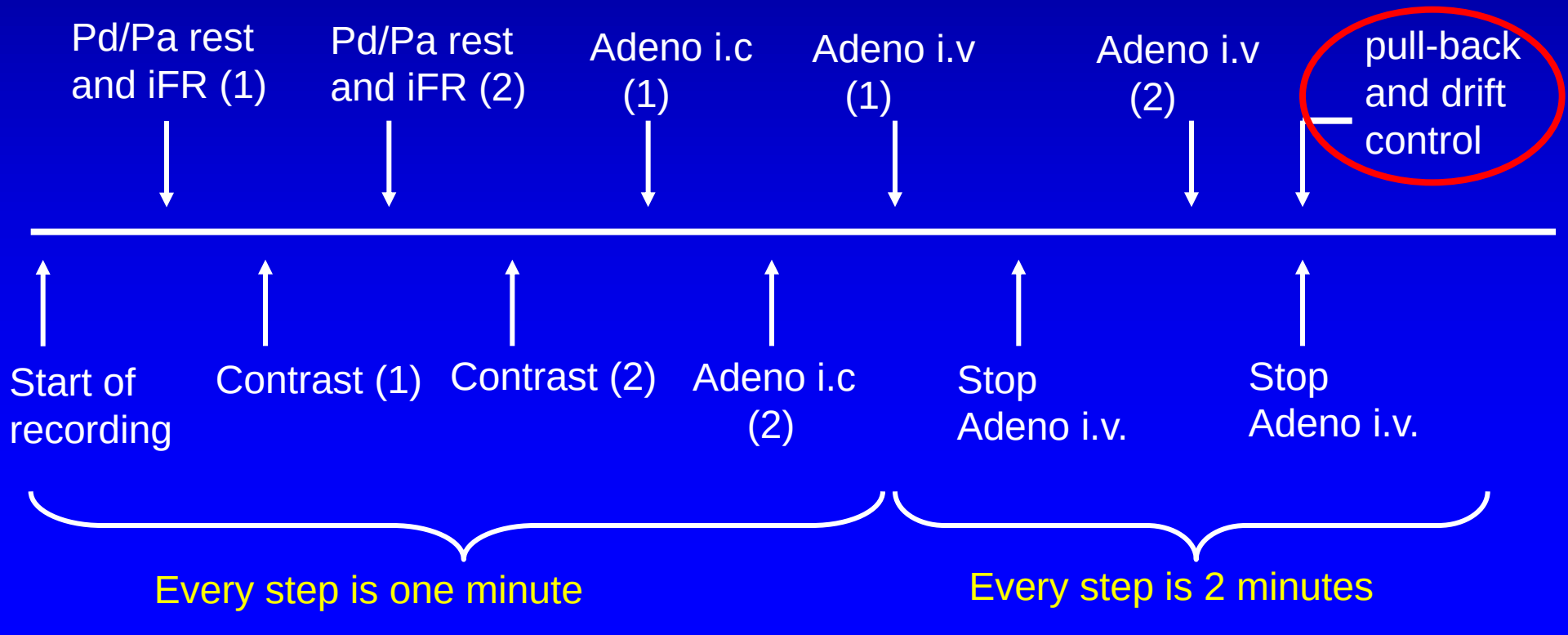
CONTRAST STUDY: PROTOCOL

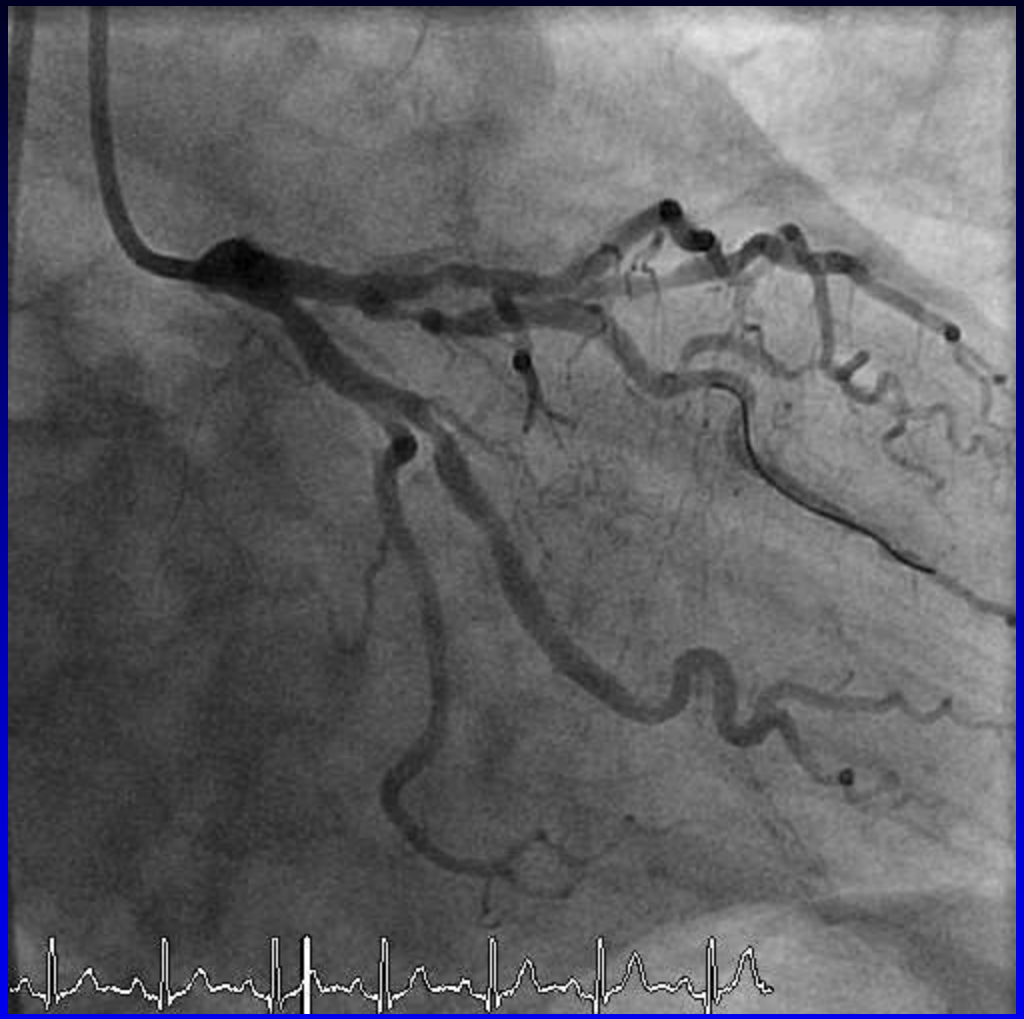
- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



CONTRAST STUDY: PROTOCOL

- equalization with pressure sensor at tip of guiding, whereafter positioning of sensor at desired place
- one long recording (14 minutes) as follows



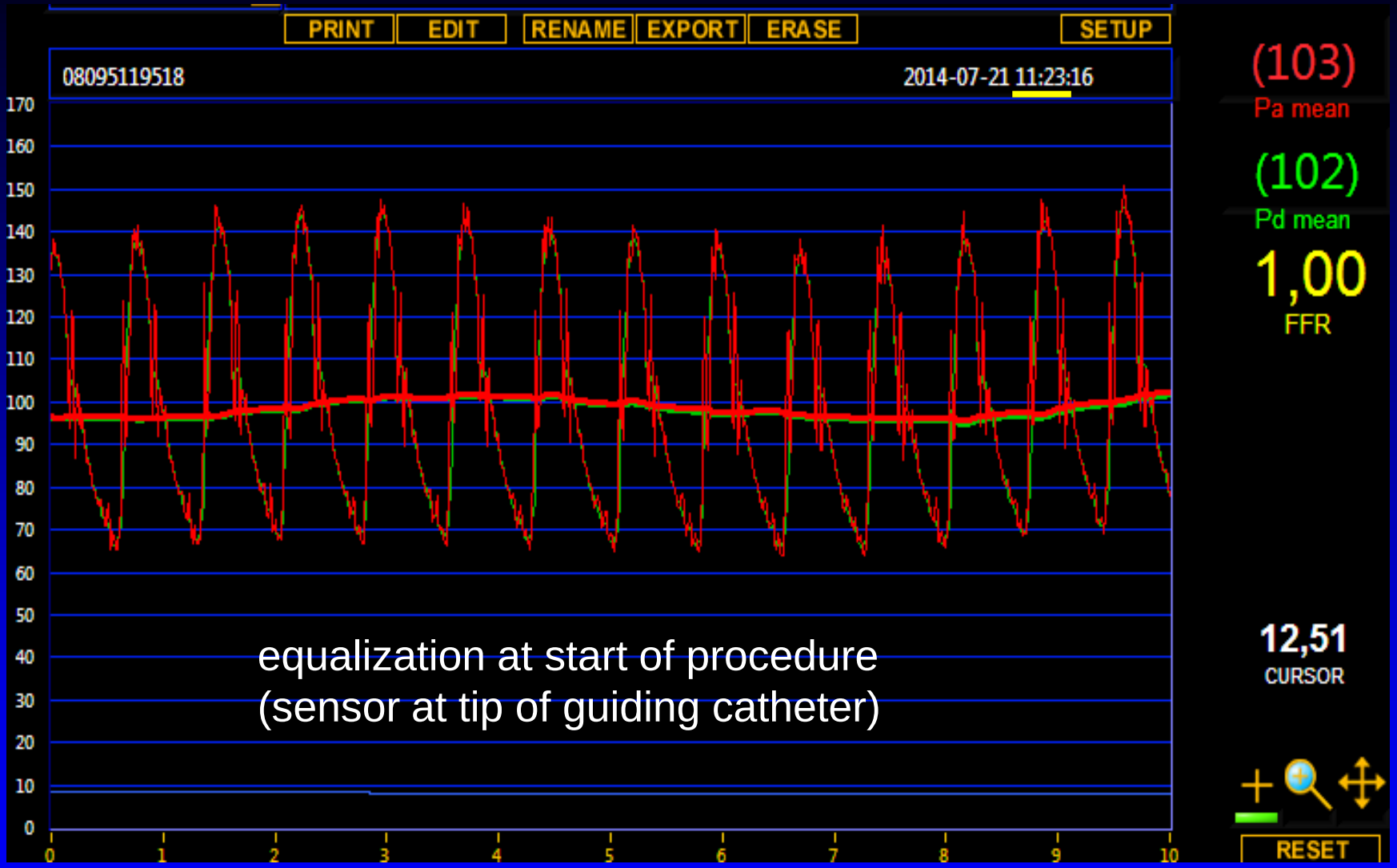


Male patient, 62 y old, angina class 3.

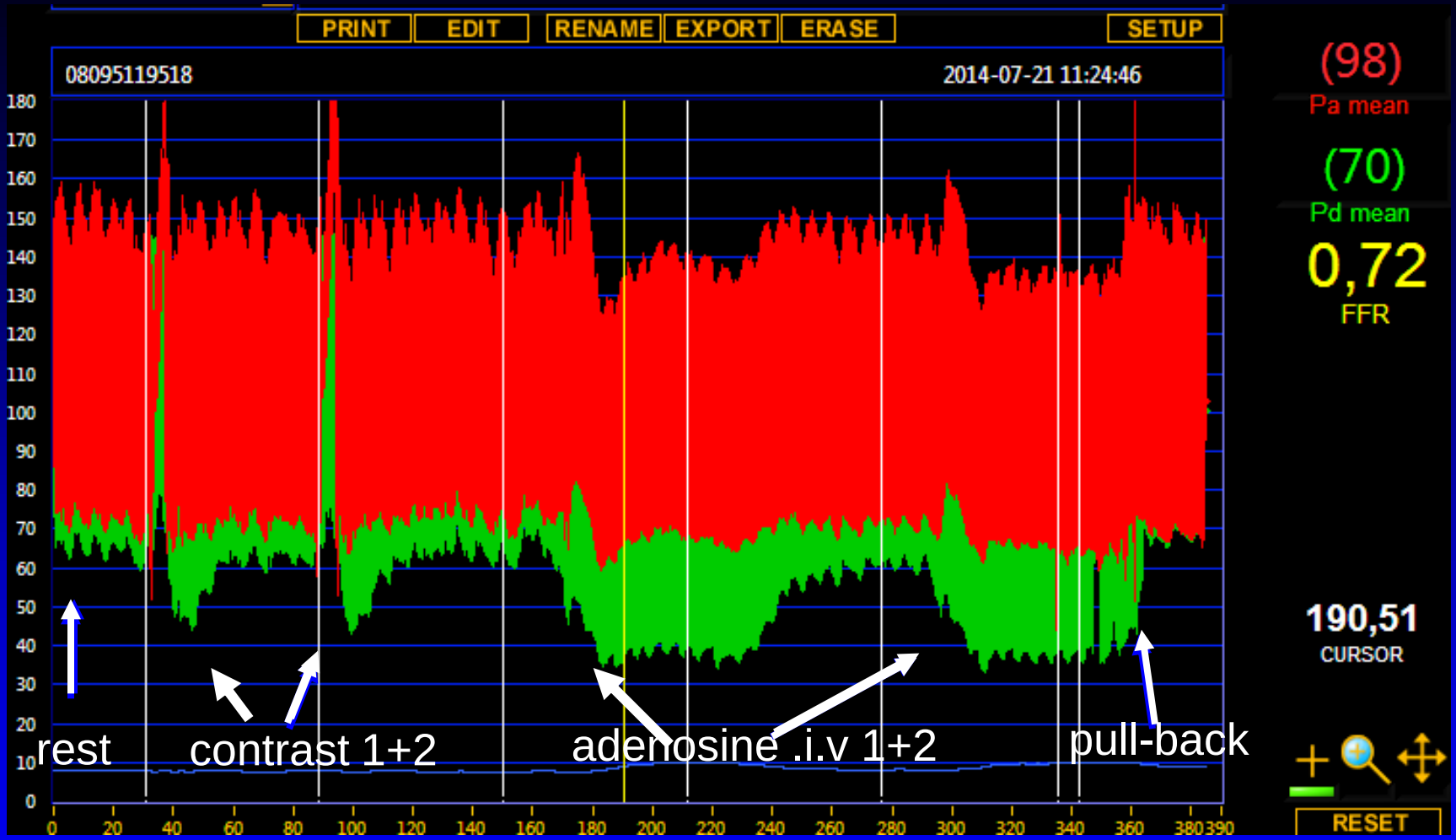
Prox LAD: 50-70%

IM branch: 80%

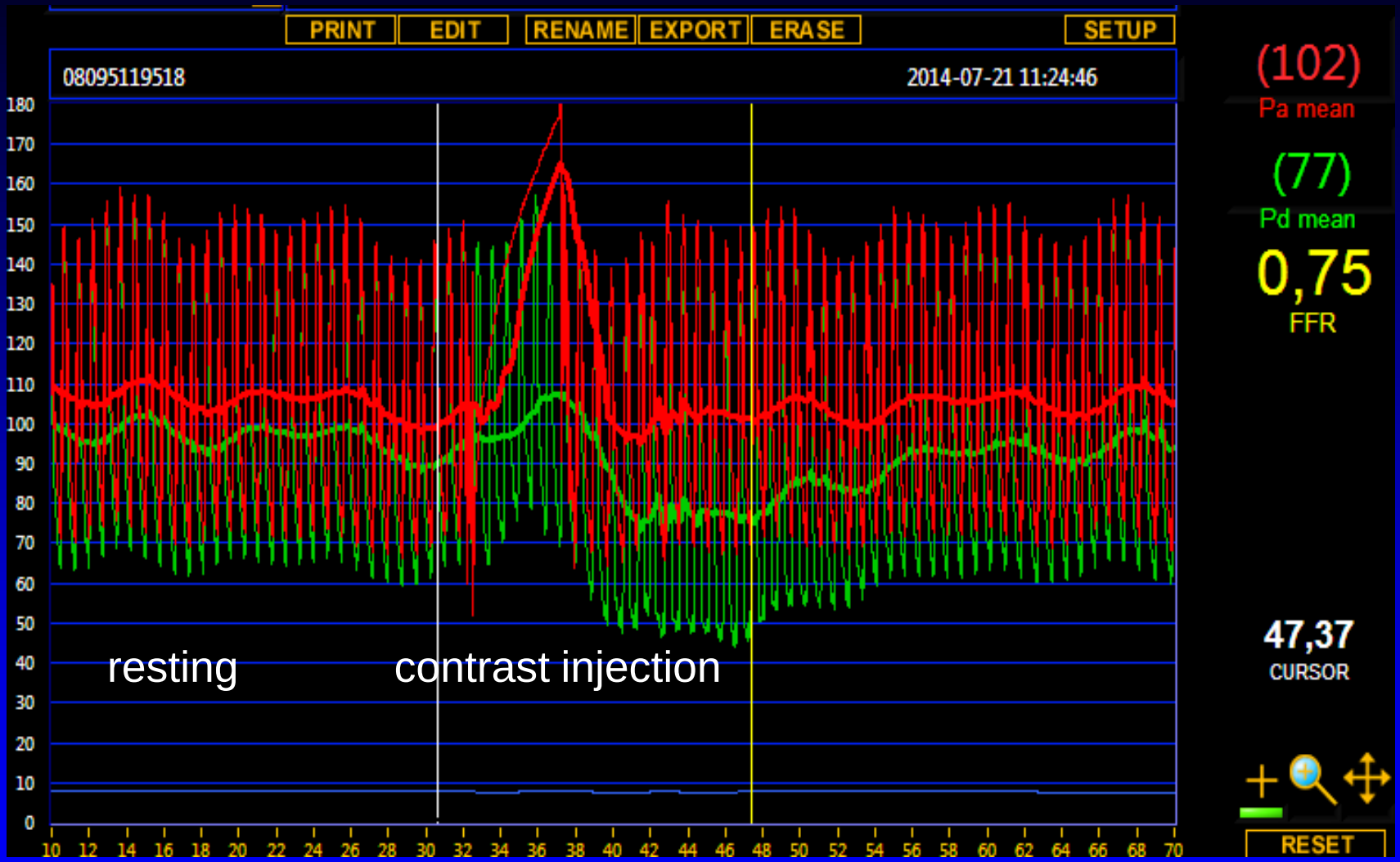
MOCX: 50%



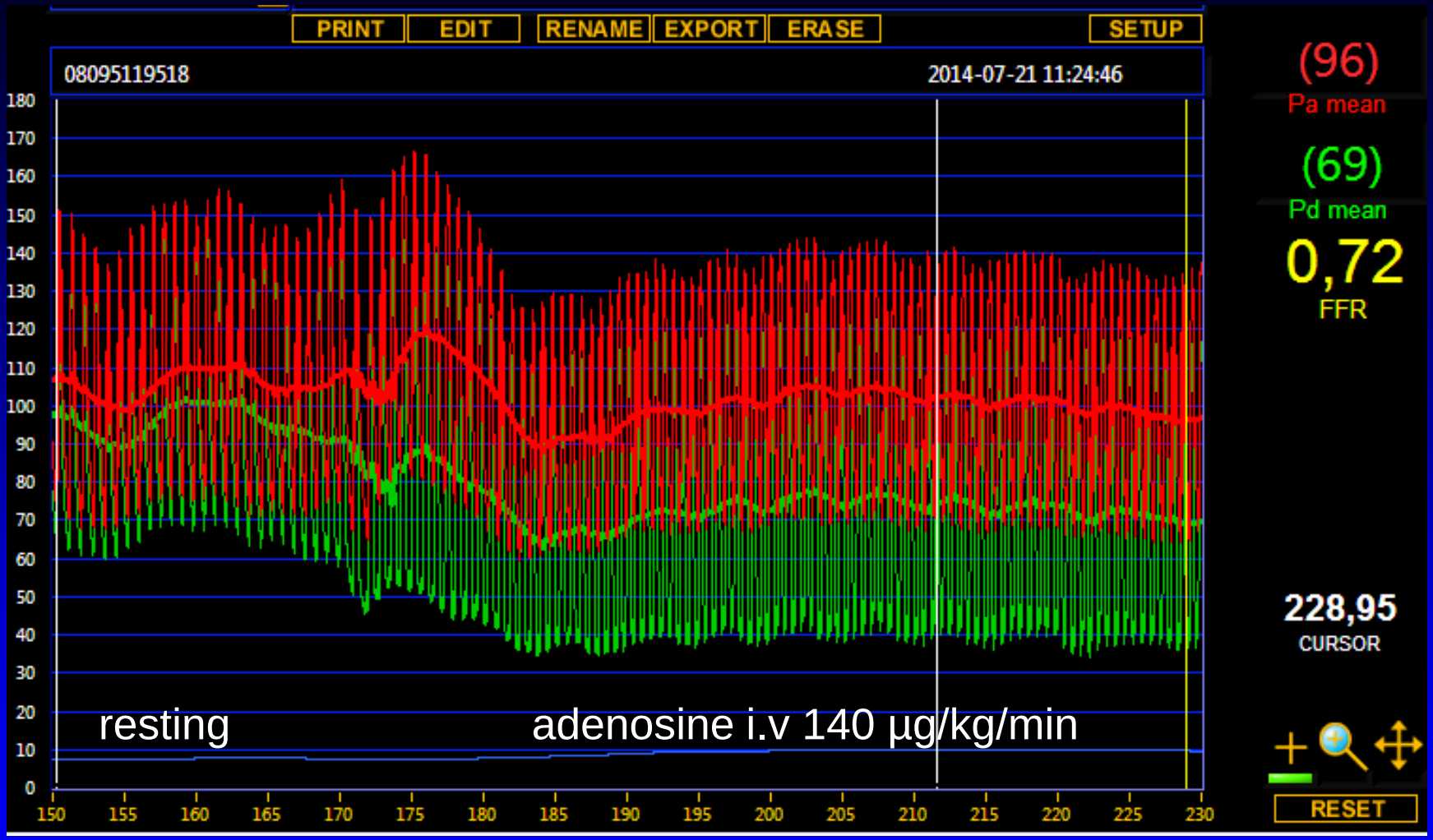
male, 62-year-old, 80% stenosis in large IM branch



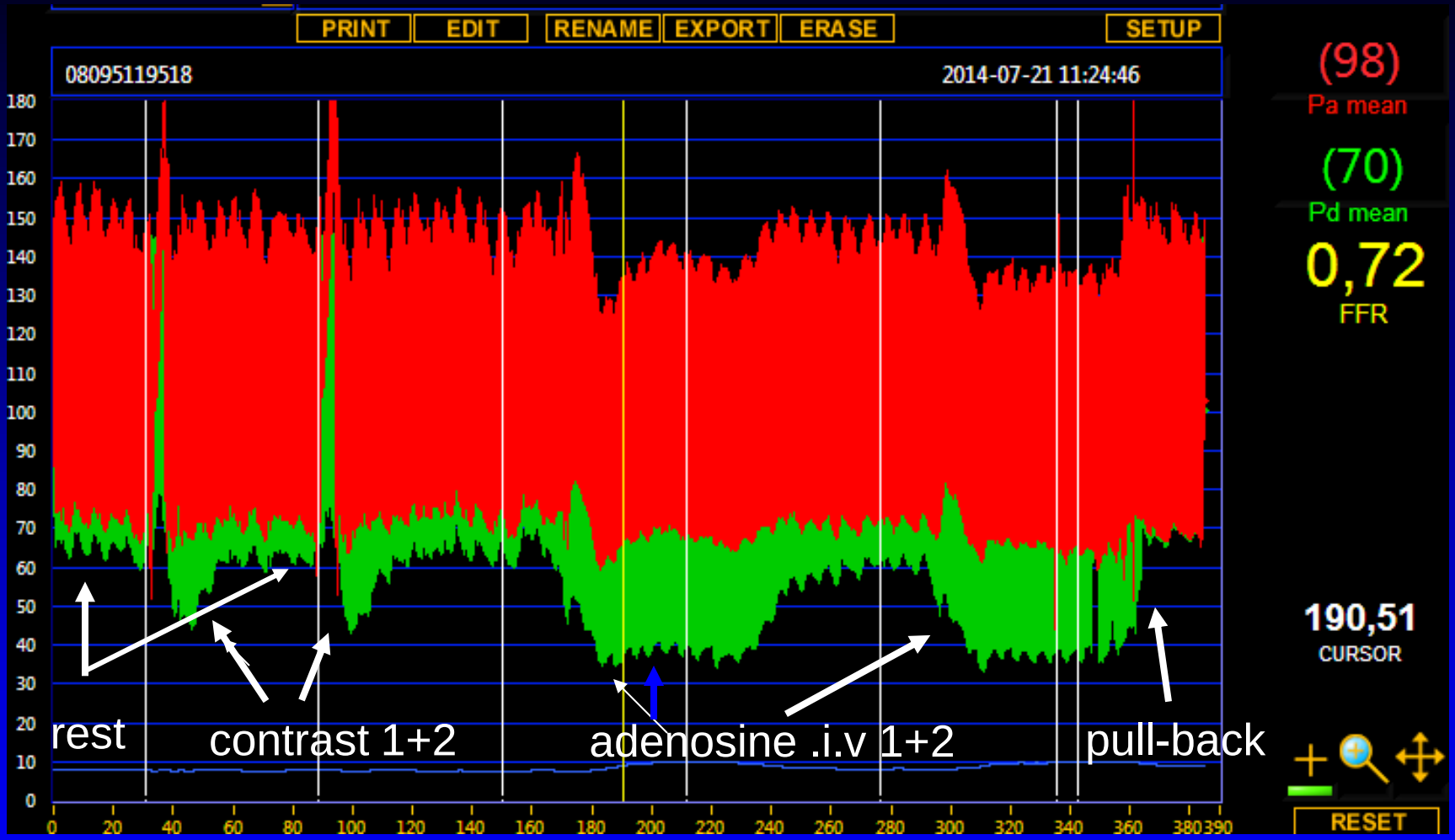
overview of the different steps of protocol



Detail #1: resting and contrast injection



Detail #2: resting and i.v. adenosine

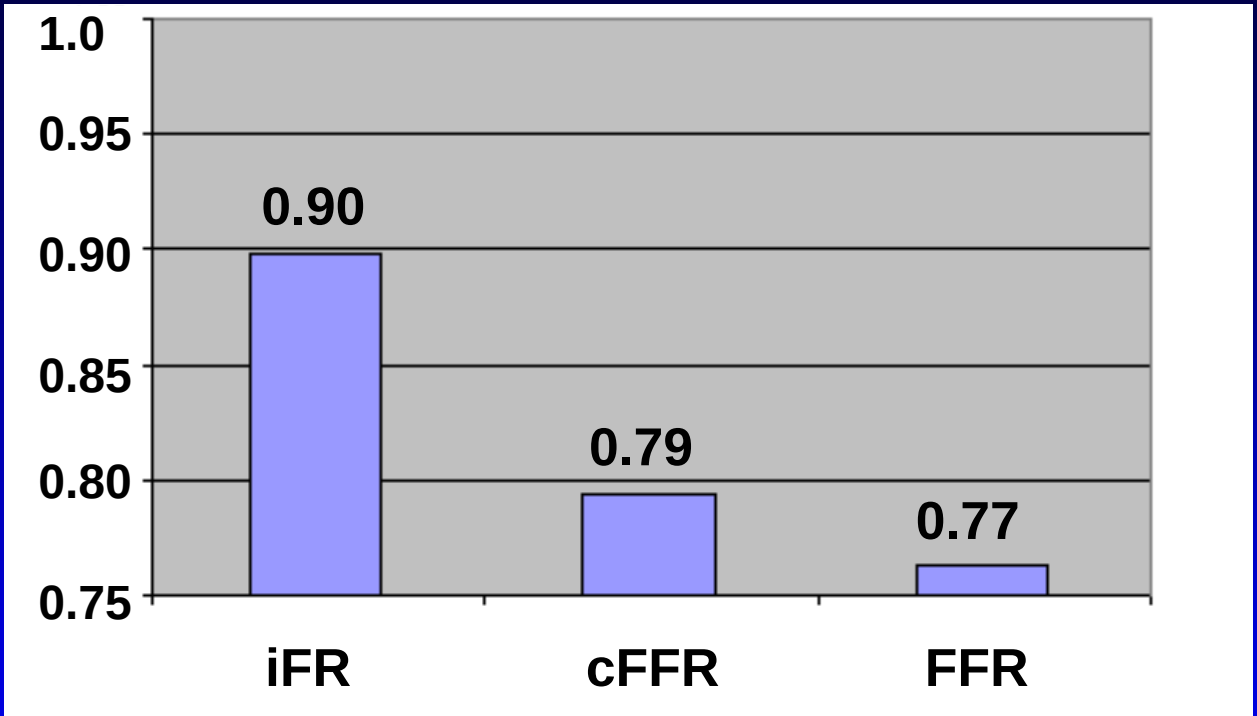


$iFR_{1,2}$ = 0.90 → 0.85

"true" $FFR_{1,2}$ = 0.71 → 0.72

$cFFR_{1,2}$ = 0.75 → 0.74

A pilot study in 40 patients was performed to test the protocol (Contrast Pilot)



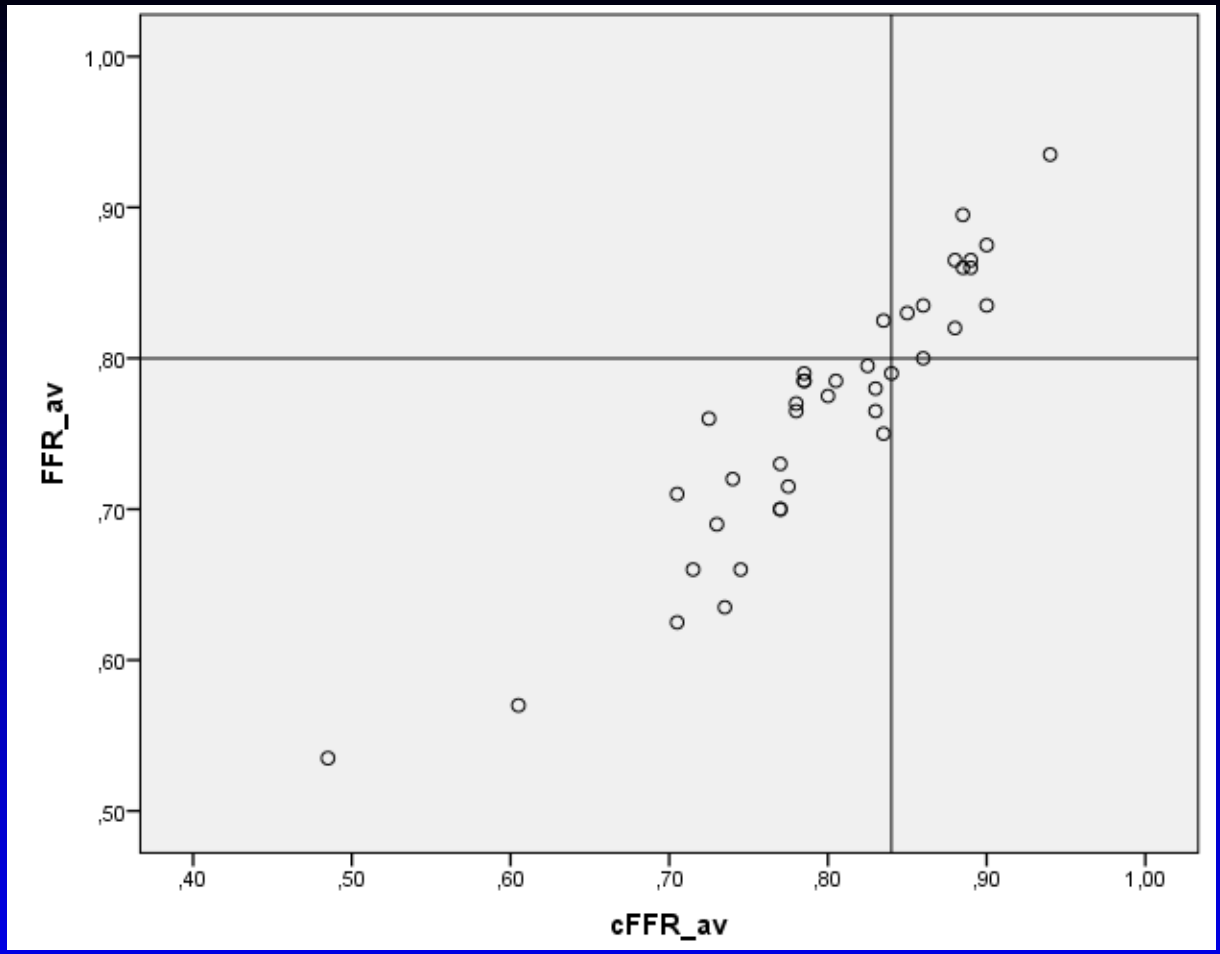
Best cut off for cFFR *(compared to FFR of 0.80)* : 0.83

Sensitivity: 97%
Specificity: 91%

Note: by ROC analysis, i.e. retrospectively

Contrast Pilot N=40

Best cut off: 0.83
Sensitiviteit: 97%
Specificiteit: 91%

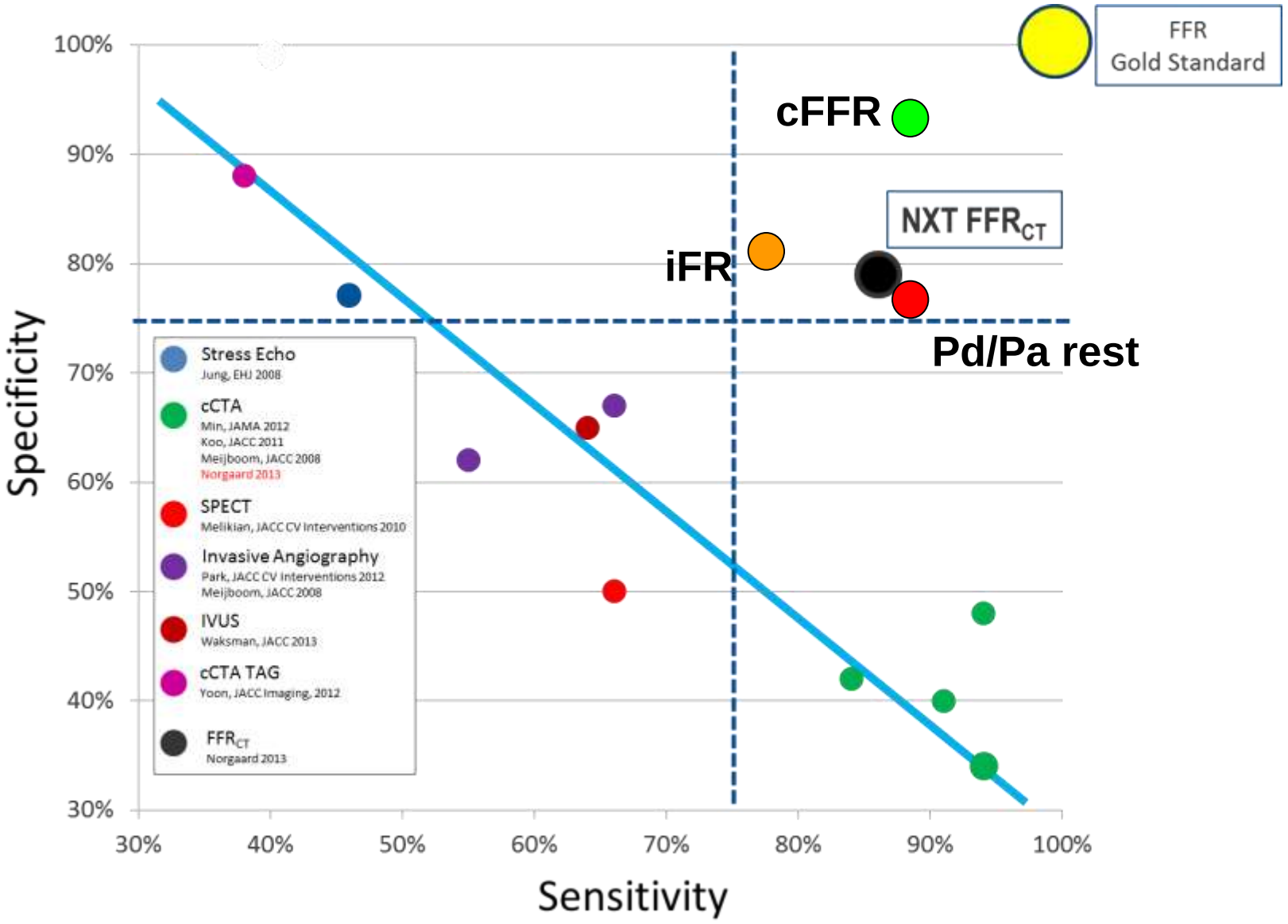


	FFR ≤ 80	FFR > 0,8	
cFFR ≤0,83	29	1	30
cFFR >0,83	1	11	12
	30	12	42

Advantages of Pd/Pa *contrast* (*cFFR*) compared to iFR

- no ECG needed; easier to perform
- no specific software needed,
  can be used with every pressure wire &interface
- no particular steady state needed
  (independant of resting conditions or hyperemia)
- significantly higher accuracy than Pd/Pa at rest and iFR in pilot-studies

Diagnostic performance of Coronary diagnostic tests for functional significant (FFR ≤ 0.80) disease



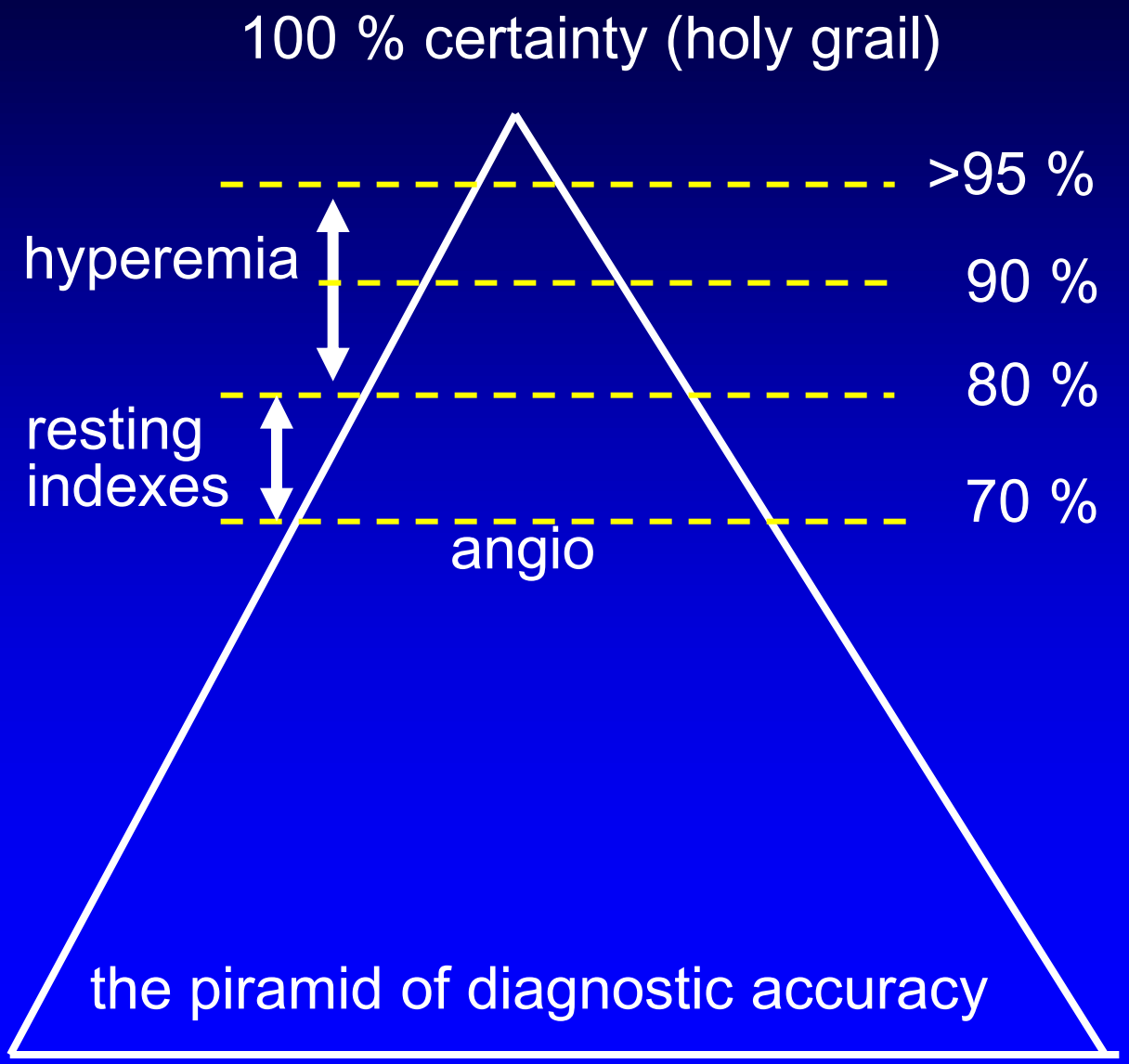
Correct Classification of Ischemic Stenosis

FFR

Contrast cFFR

resting Pd/Pa, iFR,

angiography



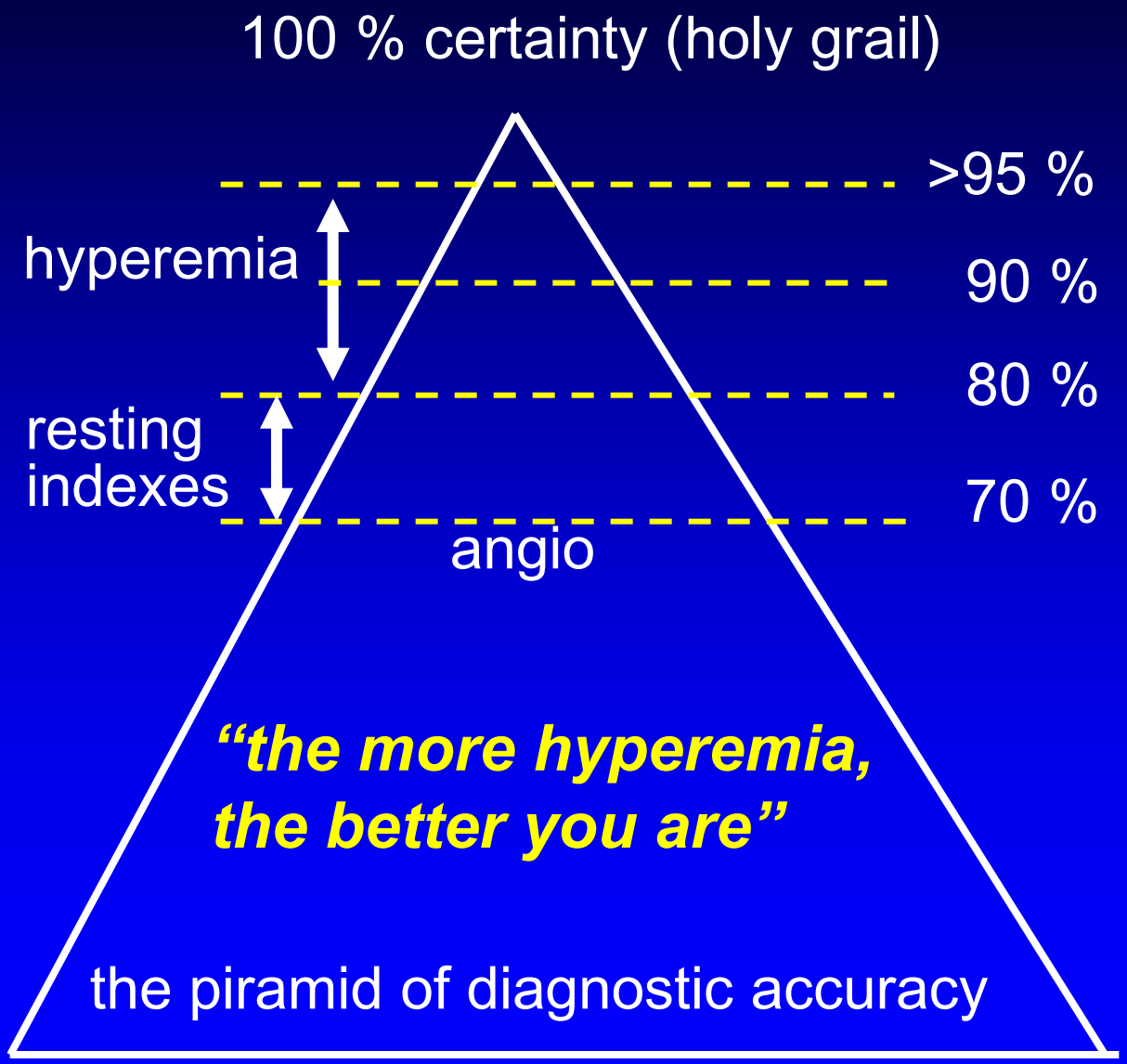
Correct Classification of Ischemic Stenosis

FFR

Contrast cFFR

resting Pd/Pa, iFR,

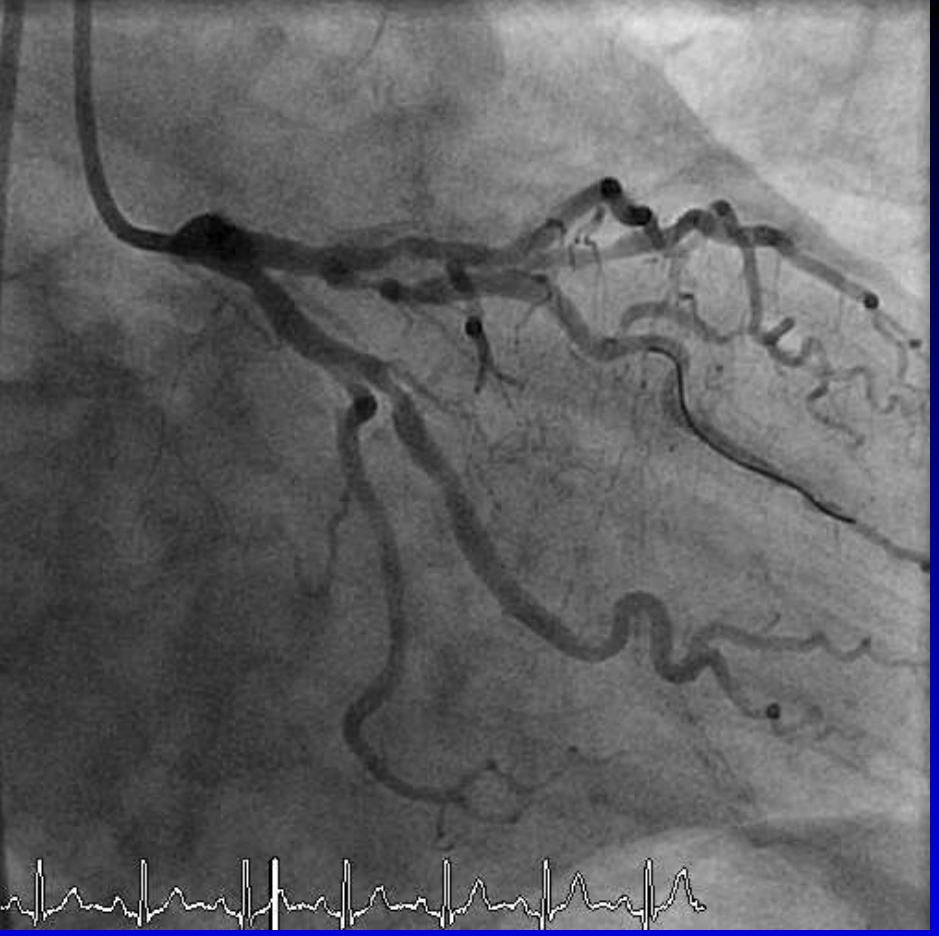
angiography



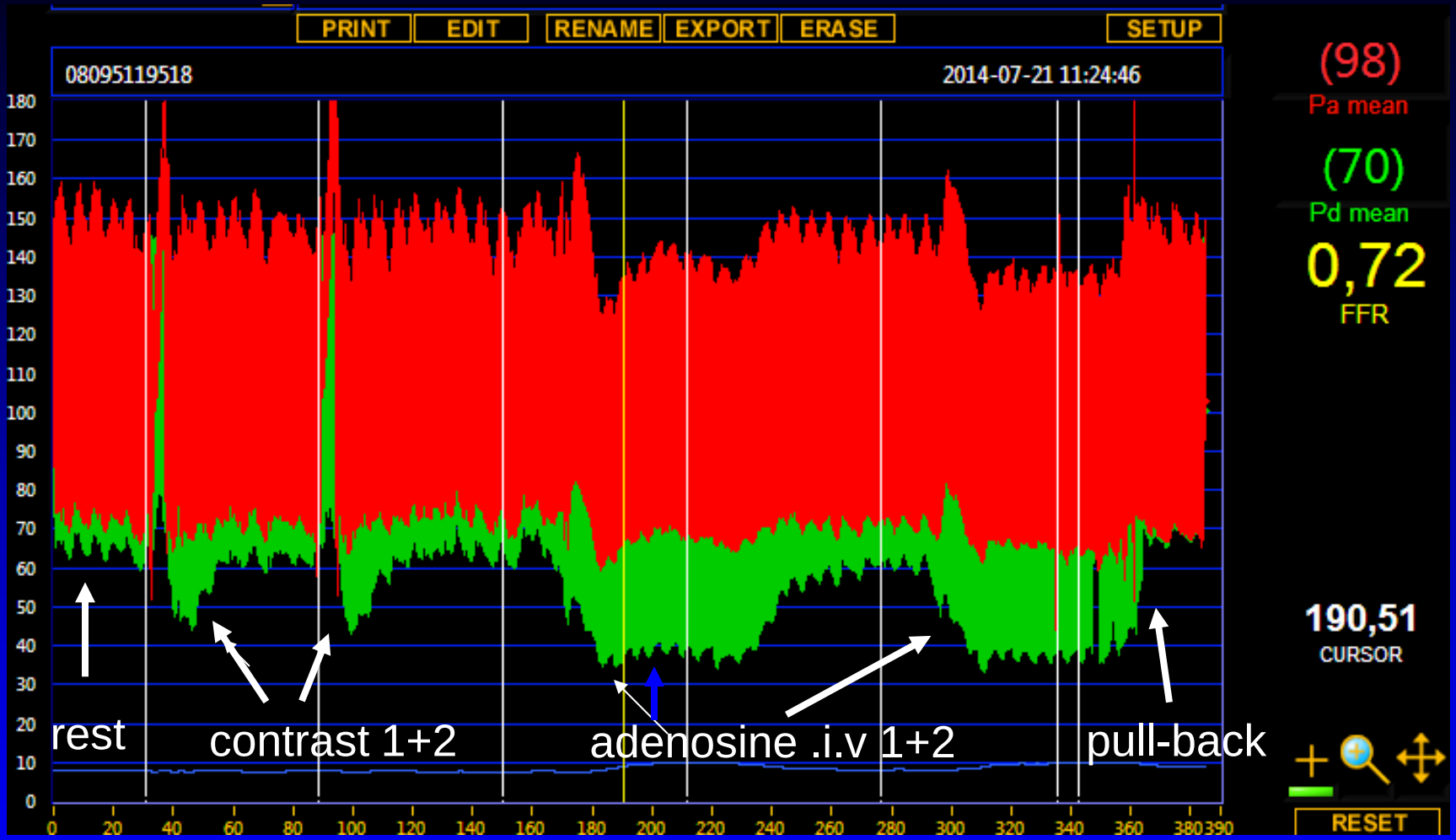
EINDE

CONTRAST STUDY: Results

- enrollment in sept-nov 2014: 319 patients
- expected to be completed (750 patients) march 2015
- promising results in pilot study
- not suitable for complex cases and pullback recordings, but well to do in simple cases
- study results will be presented at PCR 2015



Stent in LAD (3.0 x 18)
Stent in IM branch (3.0 x 12)
FFR LAD after stent: 0.92
FFR IM after stent: 0.95



True “resting” conditions are difficult to obtain……

……and definitely more difficult than hyperemia!!!!!!