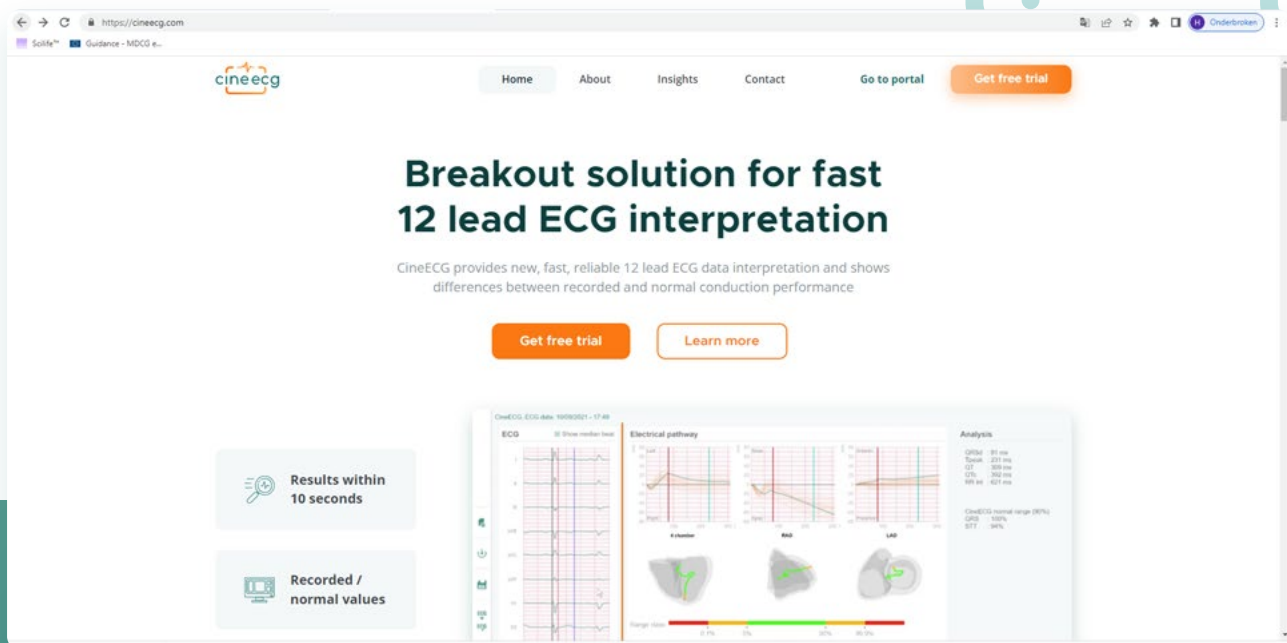


# Welcome to our community!



This is the July 2022 edition of the CineECG newsletter.



The CineECG newsletter brings you up to speed with the latest developments on the new ECG interpretation technology and provides more background on the team and organization behind this break out solution.

## In this newsletter you can find 5 stories:

1. The ECG Excellence CineECG USA tour 2022
2. A new CineECG case study
3. The introduction of the CineECG Camera arm which will increase the clinical value of the EC
4. An interview with Fabio Badilini, professor at the University of California San Francisco medical center (UCSF), founder and co-owner of AMPS-IIc and CardioCalm. SRL
5. Introducing the delta map view within CineECG

But first our reaction to some feedback we got on using the CineECG platform. This platform works with digital ECG data as input and for some users this is an obstacle to try CineECG. So if you want to try CineECG and only have a pdf version available of the ECG data, please send this file to us by email: info@cineecg.com. We are more than happy to convert the pdf (alas not an automated process but we are working on it). And send you a CineECG report in return. No costs involved, but we can not provide the 'within seconds' service we deliver on our automated platform.

After our initial collaboration agreement with Fysiologic in the Netherlands we can now announce the operational integration of our CineECG software in the the workflow of Fysiologic. Fysiologic customers now have access to the latest innovation in 12 lead ECG interpretation.

We were able to celebrate the very first PhD thesis ceremony based on our joint research with the University Medical Centre Utrecht in The Netherlands. Dr. Rob Roudijk demonstrated in his research the quality and accuracy of using our 3D vision guided system in combination with the inverse cardiac modeling technology we also offer.

We have joined the Dutch AI coalition. This is a unique initiative supported by the Dutch government to establish, stimulate and accelerate the Dutch scientific and economic progress in applying Artificial Intelligence solutions. Our first

**FREE TRIALS of CineECG are available.**

Visit <https://www.CineECG.com> to learn more on this option. Or go directly to the platform on <https://www.healthcor.cardiocalm.com/home>

encounters with the working parties with the AI coalition already demonstrate clear added value in collaboration within this eco system.

In May we had the honour to win the prestigious



*1.1 - Wrap up on major developments*

RaboBank Innovation award. All 1.8 million private account holders of Rabobank received the invitation to select their winner from the list of 12 nominees. And we were the lucky winner of the popular vote. As a result we have already been able to tell our story on national television and more communication events are in the pipeline.

The European Heart Journal-digital edition just published our research regarding the use of CineECG in evaluating P waves with CineECG. Relating the P wave with the heart anatomy and comparing the result with a normal distribution of P wave CineECG of healthy persons indicates CineECG has the ability to show changes in the anatomy of the Atria before these changes manifest as arrhythmias. More news on CineECG and the Atria is expected in the near future.



1.2 CineECG Tour

## The CineECG Tour first half year

We look back at a series of inspiring meetings of the minds and opportunities to showcase CineECG to other experts in ECG interpretation. The CineECG technologies were presented at EHRA 2022 in Copenhagen, at ISCE 2022 in Las Vegas and at HRS 2022 in San Francisco. Together with our co-researchers from Denmark, The Netherlands, Italy, Czech Republic and the USA we could present over 16 times at these leading conferences.

There are lots of stories to tell after these meetings but to highlight some key ones:

- We are excited to have met with Dr Steven Smith of Dr. Smith ECG Blog. This website has over 22 million page views and is one of the leading platforms to bring ECG/EKG readers in sync with the latest developments and provides a continuous training for improving the ECG interpretation skills. At this moment we are working with Dr. Smith on some of his critical case studies to further demonstrate the ease and added value of

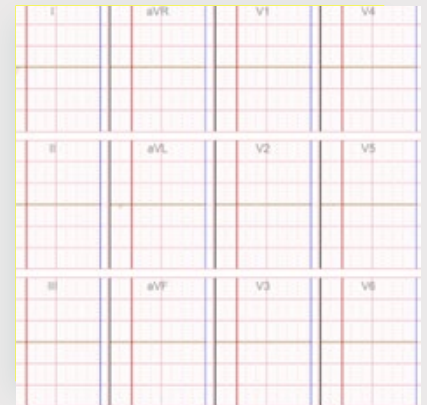
CineECG for ECG interpretation.

- We are also excited to work with the team of Dr. Salah Al-Zaiti from the University of Pittsburgh Medical Center (UPMC) and especially the emergency department of UPMC. Our collaboration has already resulted in first study results which demonstrate the outperformance of CineECG compared to current embedded algorithms for ECG interpretation and we are moving forward in expanding our work with this great medical center.

- We were able to meet with the staff of Cedars Sinai accelerator. CS, located in Los Angeles is the number 2 hospital of the USA and is a unique center of innovation, research and high quality care. We want to express our gratitude to the Netherlands Business Support Office in California for linking us to the team of Cedars Sinai. We are currently exploring synergies in collaboration.

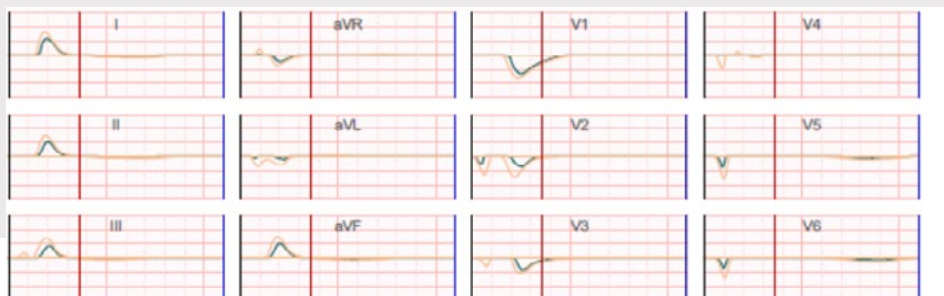
# Introducing the CineECG delta map view

At ECG Excellence we have an open mind and a listening ear for all the remarks of the people we work with. One of the key challenges we face is to make 12 lead ECG interpretation as simple as possible. And we have noticed the impact of our electrophysiology background. We are trained and used in working with heart activation maps and with the relationship between the heart anatomy and the ECG data. But this is not the case for the thousands of highly trained physicians and even cardiologists. They are trained to evaluate the classic 4 x 3 graphs which show a 2 dimensional image of the recorded potential differences. And then make a professional assessment of the graphs and amplitudes to make a distinction between a normal healthy pattern or not.....



The algorithms embedded in the ECG devices are a great help for Heart Rhythm analysis but where rhythm is expressed in clear numerical parameters (Beats per minute, QRS duration) the assessment of the ECG waveforms is qualitative ('elevated' | inverted | ...). And with the qualitative approach the 'norms' between normal or not... are in a grey zone!!! We are excited to introduce a simple but effective solution and innovation: The CineECG  $\Delta$ (delta)maps.

CineECG  $\Delta$ wave map for a healthy person. In this analysis no differences between the recorded amplitudes and the normal distribution of amplitudes of healthy persons were registered. The normal distribution is based on a data set of plus 6000 ECG's which are qualified.



1.5 CineECG views

CineECG  $\Delta$ WaveMap example. Only when a difference between the recorded and the normal amplitude occurs the delta map line will show a difference from its standard flat position.

CineECG has the unique ability to standardize the output and this way create a data set of normal healthy CineECG patterns. We already apply this method in the electrical pathway view but now have found a way to apply this method to the ECG amplitudes. We have created a normal distribution of ECG amplitudes and we in our delta map view we related the recorded mean ECG value and amplitude with this normal distribution. Basic ECG interpretation never was this easy!! If the recorded value is within the normal distribution the delta line remains flat. IF NOT, the delta maps shows which segments and electrodes differ and on which moment in the activation cycle. Additionally we noticed during the delta map view development a major difference between male and female amplitudes and especially the normal distribution. Female normal amplitude distribution remains within the boundaries of Male normal. The risk for assessing a female ECG as normal is relative higher than a Male ECG. Unless the female normal values are applied, as is now the case within CineECG. An article regarding this study and the introduction of the delta map will be published later this year as part of the ISCE 2022 proceedings.



# CineECG Case Study

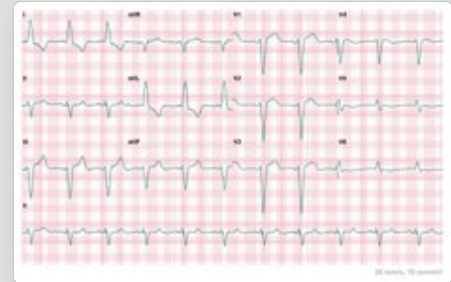
In our case study for this news letter we are using both the electrical path view and the Wave (Amplitude) view. And for both views we apply the delta map as an additional presentations of the differences between the normal values and the recorded values.



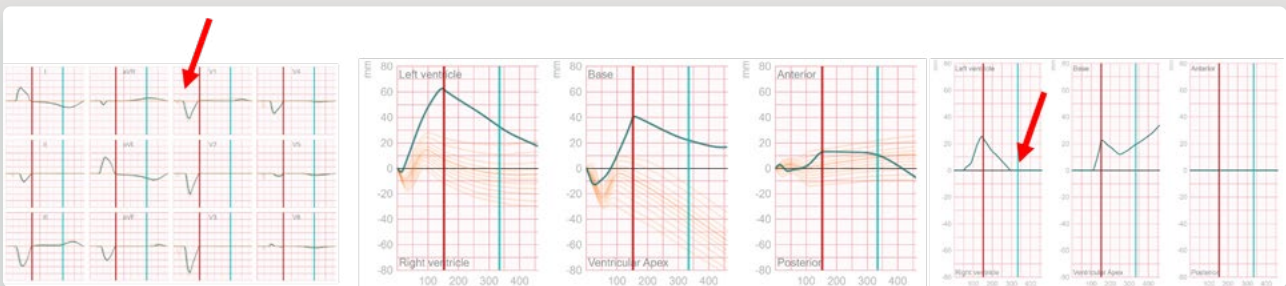
**Dr. Peter van Dam PhD**

Chief Science Officer  
ECG Excellence

The first case is a 82 year old female with a left bundle branche block. Here's the 12 lead ECG rythm strip which contains the data we use in the CineECG analysis.



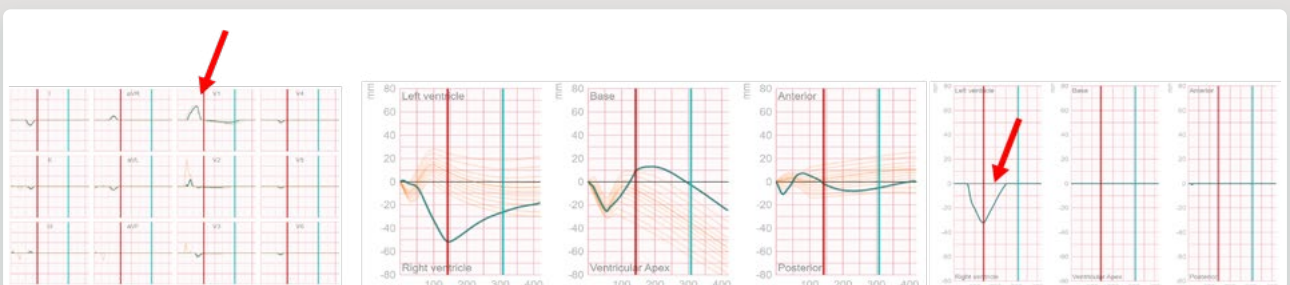
When we apply the CineECG analsis and we compare the patients data with the normal values within CineECG both the  $\Delta$  maps of either the ECG waveforms ( $\Delta$ wave ECG) or the electrical pathway ( $\Delta$ path ECG) indicate a clear LBB.



The second case is a 62 year old female with a right bundle branche block. Here's the 12 lead ECH rythm strip which contains the data we use in the CineECG analysis.



When we apply the CineECG analysis and we compare the patients data with the normal values within CineECG again both the  $\Delta$  maps of either the ECG waveforms ( $\Delta$ wave ECG) or the electrical pathway ( $\Delta$ path ECG) indicate a clear LBB.

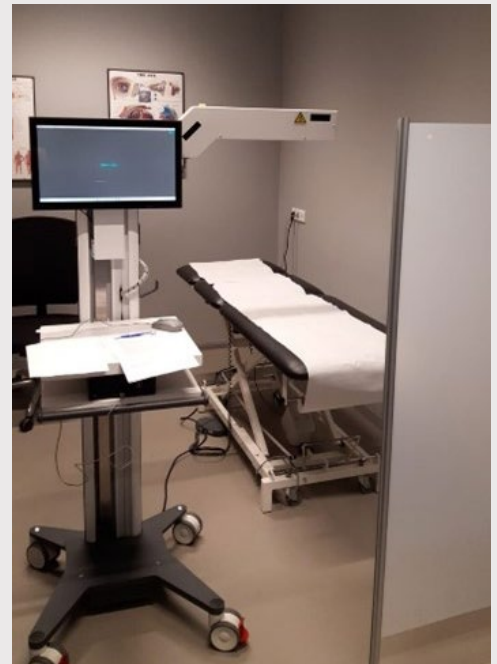


In both cases the  $\Delta$  maps show differences from normal (otherwise the  $\Delta$  maps would simply show a flat line).

1.3 - CineECG views

# The CineECG Camera arm update

In May we have shipped our first CineECG Camera arm to a University Medical Center. This device will be used in their running studies and supports serial ECG comparison of patients before and after interventions but will also support the analysis of disease progression and therapy effectiveness. A second arm is also operational in another University and we are setting up more test sites for the CineECG Camera arm. More news expected later this year. The CineECG Camera arm supports the accurate (re)positioning of ECG electrodes and ensures the conditions for personalized ECG comparison over time. But the system also captures the actual ECG electrode positions on the torso and this data can be used on CineECG to further increase the accuracy of the activation reconstruction. The system shows where to place the electrodes on the torso which supports the use of 12 lead ECG out of the clinic and still delivers a high(er) quality data registration.



1.4 - CineECG Camera arm

## Professor Fabio Badilini and the ECG

Professor Fabio Badilini is an icon in the world of ECG interpretation. He studies and lectures on the University of California San Francisco (UCSF) Medical Center and he is the founder of two leading companies (AMPS llc and Cardiacalm srl) in the domain of ECG interpretation (remote interpretation services based on unique algorithms). Fabio was a guest speaker in our first CineECG webinar in 2021 (you can still watch the webinar via this link: <https://youtu.be/TOgkFGbwQ8w>).

*Read the questions and answers on the next page.*



**Professor Fabio Badilini**

We asked Fabio Badilini the following 4 questions.

## Questions:

### 1. **What makes the Electrocardiogram so fascinating to you that you have been working on it for so long in your career?**

I started to play with the Electrocardiogram in 1988, as part of my thesis project at the Politecnico of Milan, focusing on aspects related to heart variability under the direction of Prof Sergio Cerutti. Back then I thought this playing with the ECG would have been a matter of a few months, and I surely didn't think it would have been a life choice. Everything ... then happened fast: first the doctoral years at the University of Rochester with Arthur Moss, then the post-doc in Paris with Coumel and Maison-Blanche, and finally my career at AMPS LLC, which I founded in 2000. But the common denominator has always been the passion of the ECG waveform (and perhaps a few more other cardiovascular signals) which have guided my entire career so far.

### 2. **In your opinion, what causes the ECG technology to actually show so little progress. For example, if you look at the Wikipedia page at the ECG, the last major technology change happened in the mid-40s) and what do you think of that?**

Difficult question, but I totally agree that for some reason the advancements in ECG technology have been staggering. One reason, or at least one of the possible explanations based on my experience, is that most ECG technology companies have been slowly incorporated in large organizations where the ECG component was not dominant, and thus difficult to get the proper attention in term of investments. Another reason is perhaps related to a vaguely definable distrust in some of the critical aspects of ECG signal processing, which discouraged the industry to further invest. Think again to heart rate variability, despite years of enthusiastic thrust, is rarely used in the clinical practice with medical devices.

### 3. **How do you look at CineECG as a solution/supplement for diagnostics?**

Tools like CineECG, paired with some more traditional methods of analysis (like CalECG which is a solution provide by AMPS-llc), could be the right approach to revamp this line of research and ultimately the industry technology of the electrocardiogram.

### 4. **What do you think are the next important steps in improving ECG-based diagnostics?**

We need new diagnostics and more comprehensive tools. Like everything these days all new line of research seem to turn around machine learning. But training an artificial intelligence network on ECGs labelled with existing technology will take it, at best, to the current interpretation performance level. I believe that rather than focusing solely on deep learning methods, we should also concentrate on extracting new features. And CineECG, with its novel approach to the space dimension of the ECG, is certainly the way to go.




# That's it, our second CineECG newsletter.




We hope you find this information useful. We value your feedback! If you want to unsubscribe please contact us. If you want to submit a question, react to the content or just invite yourself to a (virtual) cup of coffee, you are always welcome.

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