

BACH-SP

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"I heard a spatial presentation that was indistinguishable from real life."

*Robert Harley, Editor, The Absolute Sound*

"The reverberation on the recordings was now a stable, solid halo around the performers, just as it is in reality."

*John Atkinson, Editor, Stereophile*

Most Significant Product Introduction at CES 2015

"This is no hat trick; it's true 3D audio that can literally put a whisper in your ear."

*Alan Taffel, The Absolute Sound*

"One of the biggest and most mind-boggling moments of CES 2015. The 3D-ness of the presentation was absolutely startling. ... [it] literally dissolved both the speakers and room..."

*Michael Lavorgna, Editor, AudioStream*

"When you experience the full effect of Dr. Choueiri's engineering, you will see the future and know that it is now."

*Herb Reichert, Stereophile*

"Sound quality did not suffer one iota: this was all about reproducing an authentic soundfield, which it achieved in spades."

*Ken Kessler, Soundstage Hi-Fi*

"Better sounding than stereo, better than 5.1, better than 10.2!"

*Bob Katz, Audio Mastering Engineer*

"I think there's no other system I've heard that even comes close to offering the kind of realism the BACCH-SP system delivers."

*Brent Butterworth, SoundStage! GLOBAL*

"It was a top act of this year's [Munich] High-End Show: Professor Edgar Choueiri presented his 3D Sound Technology and left our colleague, Matthias Boede [Editor-in-Chief of Stereo Magazine], in awe." *Stereo Magazine*

# Stereophony Reinvented

True 3D imaging with breathtaking realism



The BACCH® Stereo Purifier (BACCH-SP) is a state-of-the-art, high-definition, digital audio processor that yields highly realistic 3D sound imaging from a pair of stereo loudspeakers.



At the heart of the BACCH-SP is BACCH® 3D Sound technology developed at Princeton University, which purifies loudspeaker-based stereo playback from the crosstalk that degrades the 3D spatial cues

that exist in most stereo recordings, allowing the listener's brain to receive the proper psycho-acoustic cues that are needed to perceive the locations of recorded sound sources realistically in 3D space.



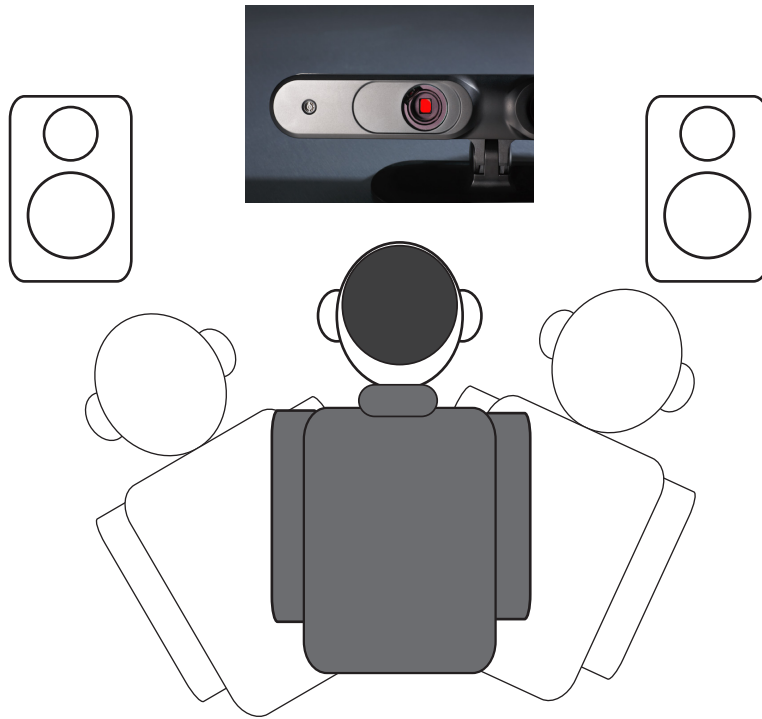


The BACCH-SP is the most advanced digital audio processor for 2-channel music playback today as it incorporates, for the first time outside the laboratory, a number of breakthrough technologies that combine to offer what amounts to a virtual reality sound experience for the audiophile.

## TECHNOLOGIES

1. Individualized tonally-transparent crosstalk cancellation filters (called BACCH® filters) designed from quick calibration (impulse response) measurements made by the listener using calibrated binaural microphones placed in the listener's ears.
2. Real time adjustment of the 3D audio sweet spot through high-spatial-resolution tracking of the listener's head position (even in pitch darkness) and advanced custom-built head tracking software.
3. State-of-the-art DAC and ADC that allow easy incorporation of the BACCH-SP in any stereo hi-fi system.
4. 64-bit audio processing through a dedicated multi-core CPU running custom-built algorithms and optimized convolution engines.

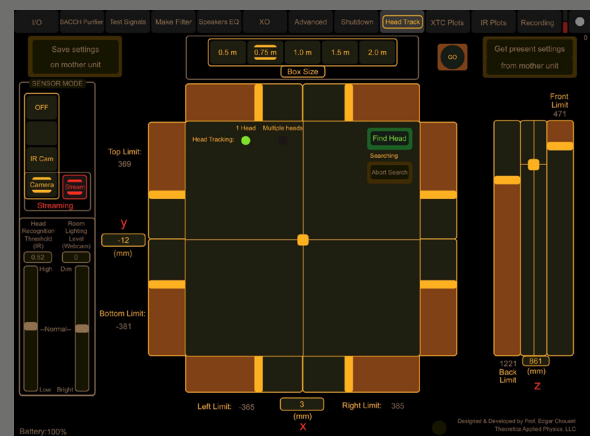
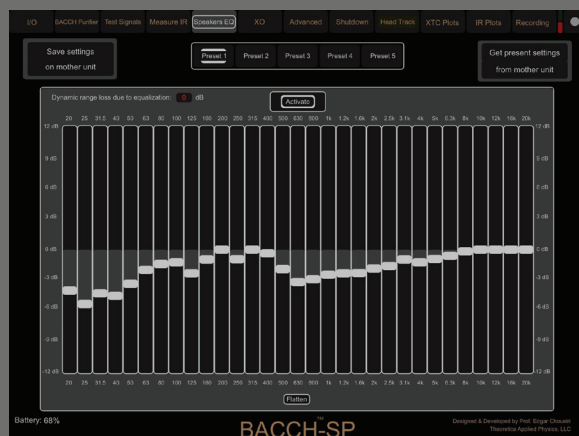
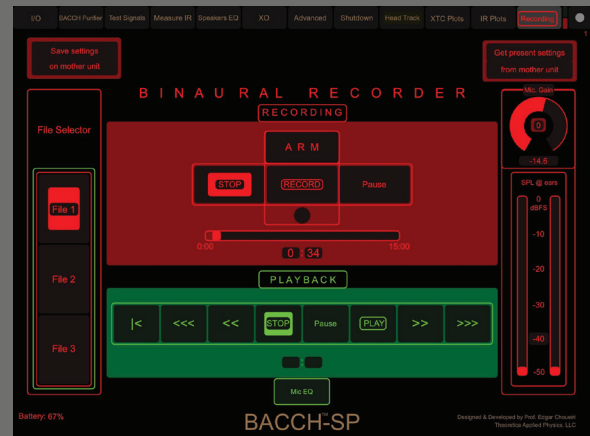
Real-time adjustment of the 3D audio sweet spot through high-spatial-resolution tracking of the listener's head position



Quick and easy individualized calibration using the BACCH-BM in-ear binaural microphones



Wi-Fi-based control of all BACCH-SP functions through a dedicated iPad that serves as the sole remote control

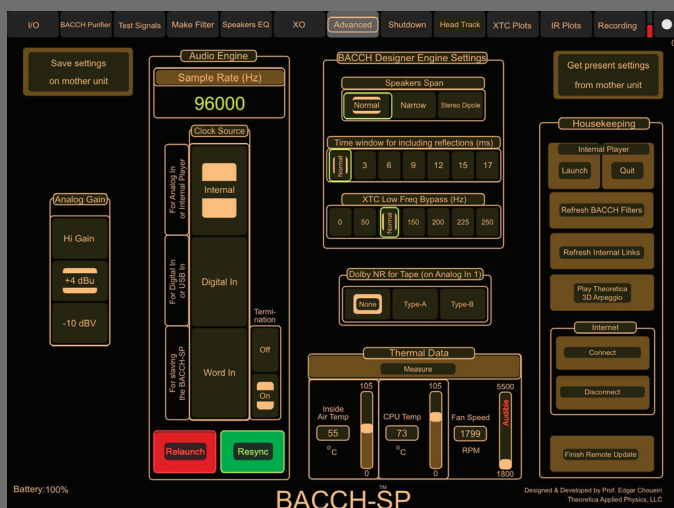
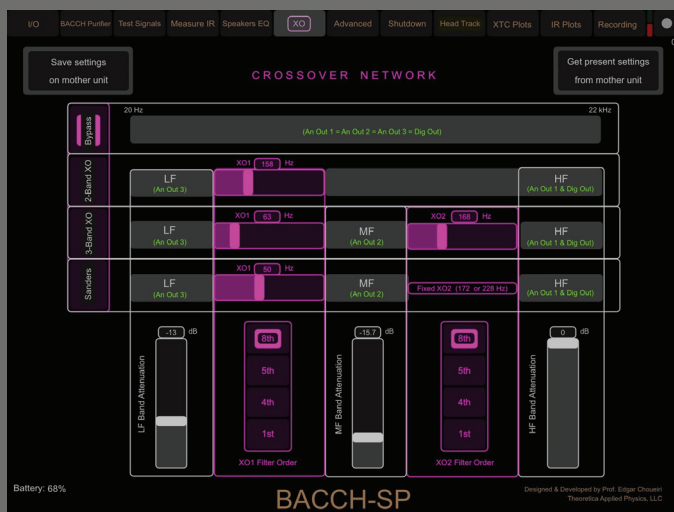
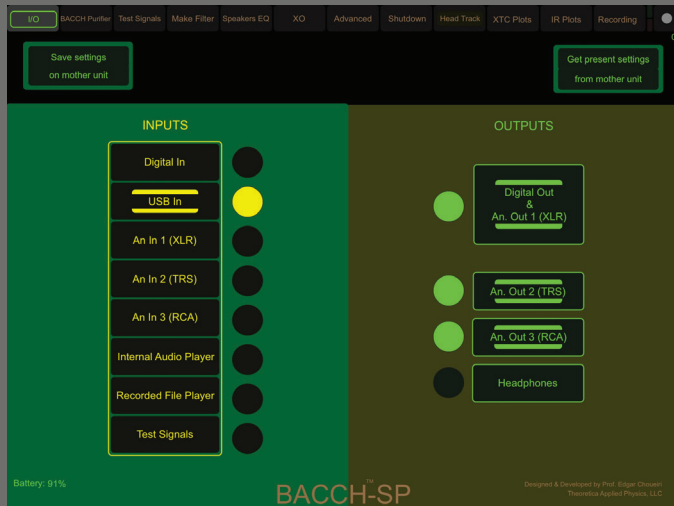


# BACCH-SP Functionality

The BACCH-SP is foremost a digital audio processor for 3D audio playback but also has a number of functions that make it a versatile hi-fi component.

In particular, the BACCH-SP

- can be used as a digital-to-digital processor, a DAC and/or an ADC thanks to its audiophile-grade digital-to-analog and analog-to-digital converters and its low-jitter internal clock;
- accommodates practically all formats of digital and analog inputs and outputs and can be used to switch between various types of digital and analog inputs and outputs at the touch of a button on the iPad SP-Remote;
- can be configured to be a Roon core or end-point player and Tidal streamer;
- has a versatile digital crossover network that can be configured to accommodate subwoofers and various bi- and tri-amping options;
- has a 31-band, 1/3-octave 64-bit transparent graphic equalizer for compensating for loudspeaker and listening room non-idealities;
- has a digital volume level control and a 3-level analog output pre-amplification stage that allows its analog output to be fed directly into a power amplifier or powered loudspeakers; and
- can be used as a digital binaural recorder along with the supplied high-end binaural microphone, the BACCH-BM.





The BACCH-SP line includes three models: The Grand BACCH-SP, the BACCH-SP adio and the BACCH-SP dio. The dio is a digital processor with no analog (DAC or ADC) stages. The various features, options and characteristics of the three models are show in the table below.

Grand



adio/dio



The BACCH-SP Line

	The Grand BACCH-SP	BACCH-SP adio	BACCH-SP dio
USB Dig. Audio Input	X	X	X
SPDIF (RCA) dig. I/O	X	X	X
Word clock I/O	X	X	X
SPDIF Optical dig Output	X	X	X
Stereo Analog Balanced XLR I/O	X	X	
Stereo Analog Balanced TRS I/O	X	X	
Stereo Analog unbalanced RCA I/O	X	X	
AES/EBU dig. I/O	X		
AES-3id dig. I/O	X		
SPDIF Optical dig Input	X		
DAC	X (6 chn)	X (2 chn)	
ADC	X (6 chn)	X (2 chn)	
Three-level preamp	X	X	
Webcam Head Tracker	X	X	X
Remote Control iPad	X	X	X
BACCH-BM microphone		X	X
BACCH-BM Pro microphone	X	Optional	Optional
3-band XO network (software)	X	Optional	
InfraRed Head Tracker	X	Optional	Optional
BACCH-HP: 3D audio dSP for headphones (software) with rotational head tracker (hardware)	X	Optional	Optional
64-bit EQ (software)	X	Optional	Optional
3D Audio Analysis Toolkit (test signal generator, XTC and IR measurements) (software)	X	Optional	Optional
Binaural Recorder (software)	X	X	X
Tripod	X	Optional	Optional
Measurements	44.45 cm x 14.6 cm x 51.75 cm	44.45 cm x 8.26 cm x 34.3 cm	44.45 cm x 8.26 cm x 34.3 cm
Weight	18 kg	11 kg	10 kg

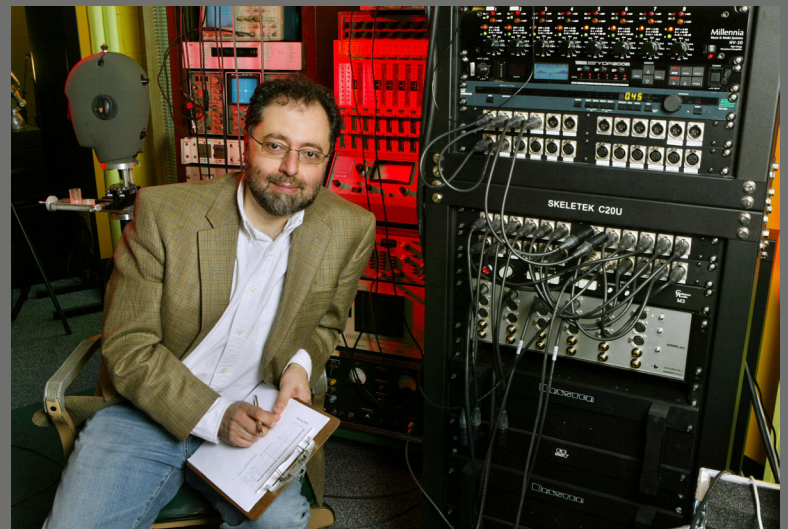
# Professor Edgar Choueiri

Edgar Choueiri, who conceived, designed and developed the BACCH-SP, is Professor of Applied Physics at the Mechanical and Aerospace Engineering Department of Princeton University, and Associated Faculty at the Department of Astrophysical Sciences, Program in Plasma Physics. He is also Director of Princeton University's Engineering Physics Program and Chief Scientist



at the University's Electric Propulsion and Plasma Dynamics Lab, a leading research laboratory in the field of advanced spacecraft propulsion. He is also the Director of Princeton University's 3D Audio and Applied Acoustics (3D3A) Lab. Professor Choueiri is a world-renowned leader in the field of plasma physics and plasma propulsion for spacecraft. He is the author of more than 250 scientific publications and encyclopedia articles on plasma rockets, plasma physics, instabilities and turbulence in collisional plasmas, plasma accelerator modeling, space physics and applied mathematics.

He has served as Principal Investigator on more than 30 competitively selected research projects (including two space experiments), funded by NASA, the US Air Force, the National Science Foundation, and other governmental and private institutions. He is Fellow of the American Institute of Aeronautics and Astronautics and the recipient of many awards and honors, including a knighthood.



An avid audiophile, acoustician and classical music recordist, Professor Choueiri's decades-long passion for perfecting the realism of music reproduction has led him to work on the difficult and fundamental problem of designing advanced digital filters that allow natural 3D audio to be extracted from stereo sound played through two loudspeakers without adding any spectral coloration to the sound (i.e. without changing its tonal character). He was able to solve this problem mathematically by applying analytical and mathematical tools he uses in his plasma physics research.



Digital I/O: USB; S/PDIF (RCA); S/PDIF (optical)

Analog I/O: +4dBu, -10 dBV (XLR, TRS, RCA)

Clock in & Clock out (BNC)

Sampling Rate: 44.1, 48, 88.2, 96, 176.4 & 192 kHz

24-bit audio, 64-bit processing

SNR: 113 dBA; THD: <-105 dB, < 0.0005%; Channel Sep: >110 dB

Max input level +19 dBu; input impedance: 10 kOhm

Dimensions: w: 44.45 cm h: 8.26 cm; d: 34.3 cm

Weight: 10 kg

Remote tech support and maintenance through the internet



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by



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