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A New Chamber Hall in M. Karlowicz Philhamonic Orchestra in Szczecin, Poland

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Abstract

This paper describes a new Chamber Hall inside of: "M.Karlowicz Philharmonic, in Szczecin". The acoustic design of the project was finished in 2009. It was built later and finally opened on 6nd September 2014. The acoustics of the two halls of new Philharmonic hall have been very well received by audience public. On this report, we outline several acoustic aspects of design which were developed, obtaining a very result excellent. Furthermore we show the acoustic results. In this design we have played with convex curves that are excellent diffusers of sound. This curves more tensed are seen also in the walls. "The Chamber hall, also known as **"**acoustical gem**",** may accommodate nearly 192≈200 people. All acoustic parameters of the Chamber hall are excellent. In this report, we outline several acoustic aspects of design which were developed, obtaining a good result.

Keywords: Room acoustics, acoustic design.

1.Introduction

The acoustics of the new Chamber Hall have been very well received by public audience. “The Chamber hall, also known as the Gem Hall, may accommodate nearly 200 people.

The magnificent acoustics of the Gem Hall is originated from its special geometry of the walls and ceiling. All parameters of the Chamber hall (strength, uniformity of sound, delay and lateral energy fractions have been excellent.

2.Geometry of the hall, audience size

This room is rectangular in plan section and convex curved in vertical section. Acoustic Design of the hall obeys to a criteria be getting most sound and better by the diffusing properties have the convex surfaces. The beauty of all surfaces curved in great dimensions was a good solution.

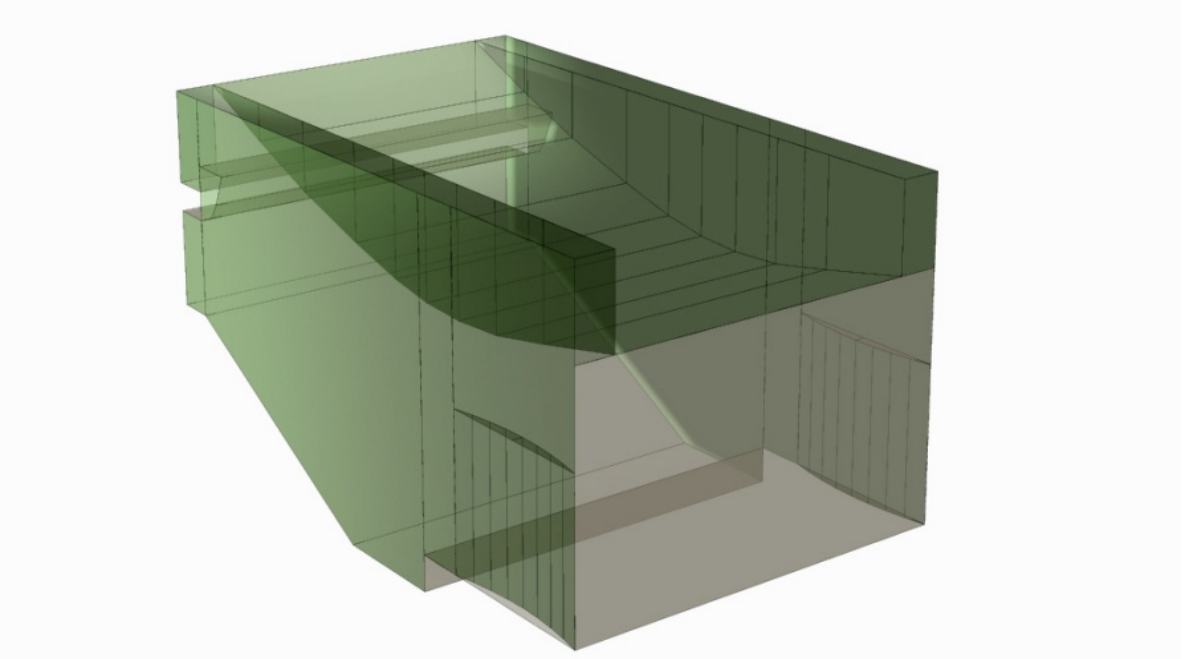

Figure 1. Several Pictures and photos of the Szczecin Chamber Hall.

3. Preliminary: Chamber Hall configuration

The capacity audience of this hall is: N= 192 ≈ 200 seats.

The volume hall for get a T_{mid} = 1.46 s, according the dimensioned law [1], it is

V= 1448.8 m^3. In this case we assume that only absorption is due to the audience

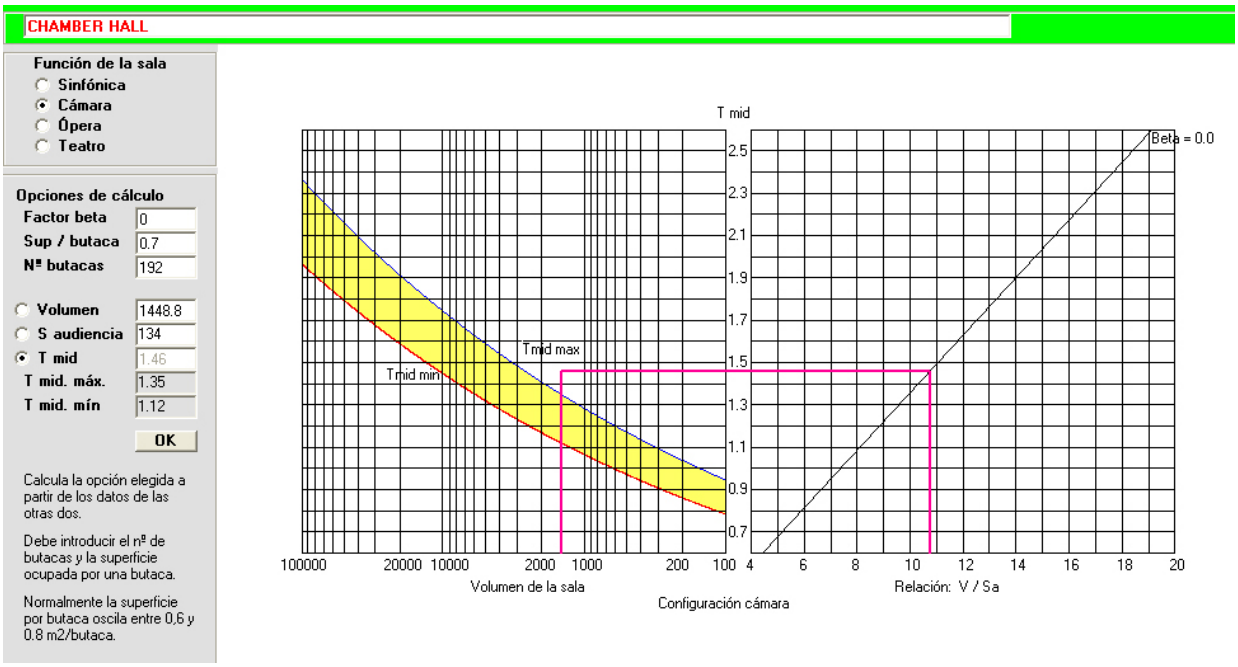

Figure 2. Calculation of dimensioned hall

4. Acoustic goal parameters for occupied hall

The goal parameters for occupied room must be approximately:

ACOUSTIC GOAL PARAMETRES (OCCUPIED HALL)		
Parameter	**Denomination**	**Range Advised**
T_{MID} (500 Hz - 1 kHz)	Reverberation Time in middle frequencies	1,11 s ≤ T_{MID} ≤ 1.50 s
T_{MID} design	Reverberation Time of design: Chamber	1.50 s
EDT_{MID} (500 Hz - 1 kHz)	"Early Decay Time"	EDT_{MID} ≈ 0.9 T_{MID}
BR	Bass Ratio: Warmth	1,1 ≤ BR ≤ 1,3
Br	Brilliance	Br ≥ 0,85
C_{80} (500 Hz - 1 kHz)	Clarity music	-2 dB ≤ C80 ≤ 4 dB
G_{MID} (500 Hz-1kHz)	Strength dB	0 dB ≤ G_{MID} dB
ST1 (250 Hz - 2 kHz)	Objective Suport on Stage	ST1 ≥ -12 dB dB
LF (125 Hz - 1 kHz)	Lateral Efficiency	LF ≥ 20%
ITDG	"Initial Time Delay Gap"	ITDG ≤ 20 ms

5. RT of Chamber hall with occupied seats analyzed by Odeon and others software.

FREQUENCY (Hz)	125	250	500	1000	2000	4000	T_{MID}	T_{LOW}	T_{HIGH}
RT-Sabine	1.25	1.30	1.33	1.35	1.39	1.31	**1.34**	1.27	1.35
RT-Vian (Epidaure)	1.18	1.21	1.22	1.22	1.27	1.21	**1.22**	1.19	1.24
RT-Arau-P.	1.17	1.26	1.43	1.56	1.65	1.39	**1.50**	1.21	1.52
(o)RT-Odeon T-average	1.38	1.46	1.60	1.75	1.81	1.56	**1.68**	1.42	1.71

(+) RT-Odeon T_{30}	1.42	1.52	1.68	1.86	1.92	1.60	**1.77**	1.47	1.76
(+)RT-Odeon T_{20}	1.35	1.41	1.53	1.65	1.71	1.53	**1.59**	1.38	1.66
(o)RT- Odeon T- av	1.38	1.46	1.60	1.75	1.81	1.56	**1.68**	1.42	1.71

(+) Global estimation RT; (o+) Average of RT_Odeon T_{20} and T_{30}

EDT *of chamber hall with occupied seats*

FREQUENCY (Hz)	125	250	500	1000	2000	4000	EDT_{MID}
EDT_Arau-P. (*)	1.02	1.09	1.21	1.29	1.34	1.14	**1.25**

RT *of chamber hall with occupied seats + curtain in rear stage wall*

FREQUENCY (Hz)	125	250	500	1000	2000	4000	T_{MID}	T_{LOW}	T_{HIGH}
RT-Sabine	1.20	1.08	1.08	1.11	1.13	1.03	**1.10**	1.14	1.08
RT-Arau –P.	1.13	1.06	1.15	1.20	1.25	1.07	**1.175**	1.095	1.16
(o+)RT-Odeon T-av	1.35	1.33	1.30	1.42	1.45	1.29	**1.36**	1.34	1.41

(-) No computed

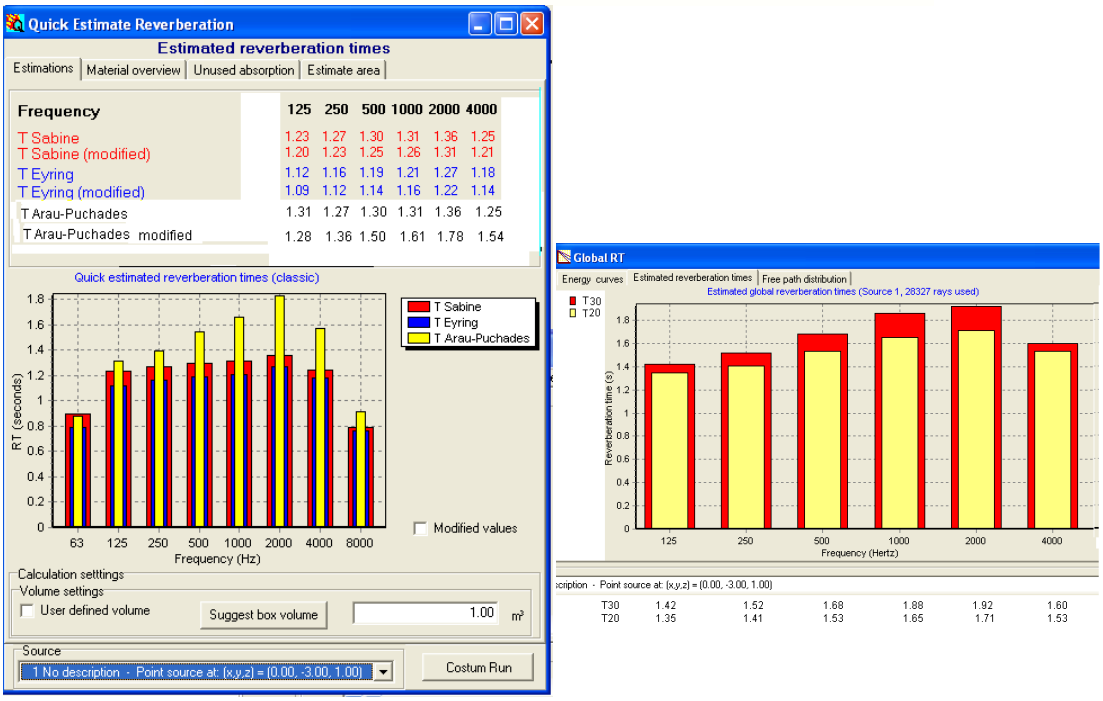

Figure 3. Drawings Odeon of Calculations realised.

6. RT of chamber hall with occupied seats analyzed by statistical methods.

RT, calculated by Statistical Methods, W.C.Sabine, C.F:Eyring, H. Arau-P. with hall seats occupied by audience.

Case 1: Hall with Audience

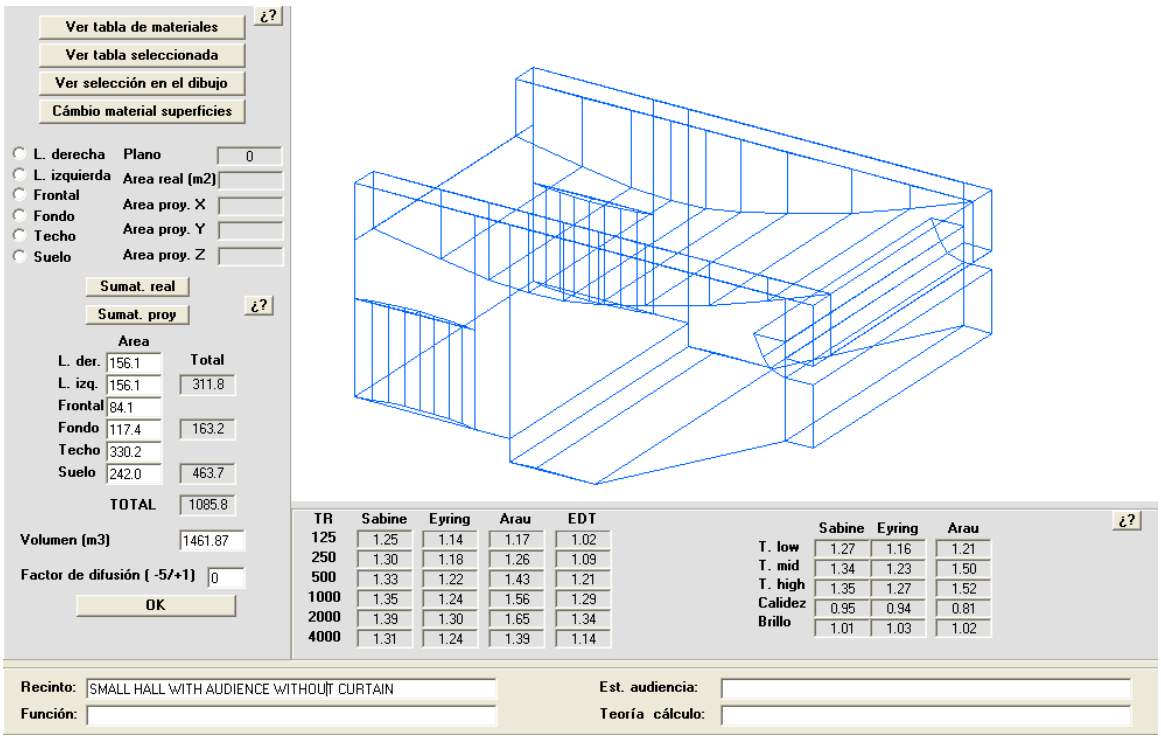

Figure 4. Figure of calculations realised by Statistical Arau Software.

Case 2: Hall with Audience + Curtains in bottom stage

Figure 5. Photo hall with curtains

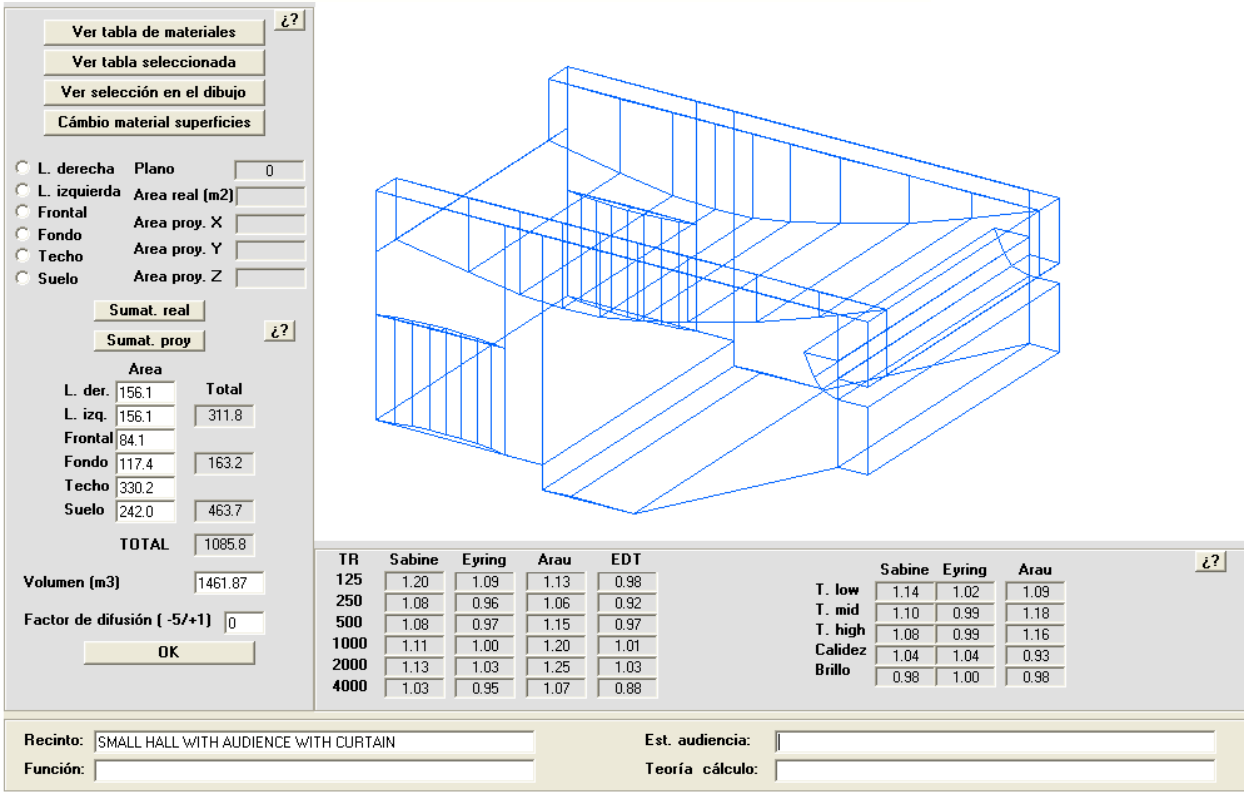

Figure 6. Figure of calculations realised by Statistical Arau Software.

7. Final measurements

Here we are exposing the results of average values measured by "os laboratory Katedra Politechnika Wroclawska Akustyki i Multimediów Laboratorium Badawcze Akustyki", are:

CHAMBER HALL		125	250	500	1000	2000	4000	MID
RT or T30 (s)	Unocc. seat	1.52	1.48	1.58	1.68	1.64	1.52	**1.63**
	Occ. Seat	1.34	1.35	1.47	1.53	1.5	1.39	**1.50**
EDT (s)	Unocc. seat	1.32	1.19	1.35	1.5	1.42	1.32	**1.42**
	Occ. Seat	1.03	0.94	1.17	1.41	1.32	1.24	**1.29**
G (dB)	Unocc. seat	15.7	13	12.2	13.3	13.8	12.1	**12.75**
	Occ. Seat	16.1	12	12.3	12.9	13.9	12.6	**12.6**
C_{80} (dB)	Unocc. seat	2.4	2.3	1.5	1	1.2	1.9	**1.25**
	Occ. Seat	3.5	3.8	2.2	1.1	1.4	1.8	**1.65**
LE_F	Unocc. seat	0.16	0.29	0.36	0.65	0.3	0.35	**0.505**
	Occ. Seat	--	--	--	--	--	--	**--**
ST_{early} (dB)	Unocc. seat	-8.2	-6.4	-6.175	-5.3	-3.35	-3.55	**-5.3**
	Occ. Seat	--	--	--	--	--	--	**--**

ST_{late} (dB)	Unocc. seat	-8.65	-8.075	-7.3	-6.7	-5.45	-5.8	**-6.9**
	Occ. Seat	--	--	--	--	--	--	**--**
Distribución L_p (dB)	Unocc. seat							**92.1 - 90.9**
	Occ. Seat							**72.2 - 70.2**
ITDG[-5dB] (ms) (*)	Unocc. seat							**9**
	Occ. Seat							**11**
ITDG[-10dB] (ms) (*)	Unocc. seat							**9**
	Occ. Seat							**10**
Background Noise L_p (dB) (max.)	Ventilación OFF – Iluminación escenario OFF							**8.2**
	Ventilación ON – Iluminación escenario OFF							**19.4**
	Ventilación OFF – Iluminación escenario ON Config1(**)							**18.5**
	Ventilación ON – Iluminación escenario ON Config1(**)							**23.8**
	Ventilación OFF – Iluminación escenario ON Config2(**)							**28.4**
	Ventilación ON – Iluminación escenario ON Config2(**)							**28.6**

Notes:
1. Seats are upholstered.
2. ITDG measurements: (*).
3. The Mean Noise levels values of Ventilation on Hall with Stage lighting ON or OFF.
   (**)Lighting configuration: Config1: 10 focos, Quiet Mode 0%, Intensidad 70%
   and Config2: 10 focos, Quiet Mode 100%, Intensidad 70%

8. Conclusions

The Owner explains that this chamber hall – designed for 192 people – the reverberation time is compliant with the project to the hundredth of a second. This is why this hall is known as the **"acoustical gem"**.

References

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