BNAM2012

Joint Baltic-Nordic Acoustics Meeting
June 18th - 20th 2012 Odense, Denmark

BREKKE STRAND

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Concert Hall Acoustics

CONCERT HALL PARAMETERS – STATUS REPORT

BNAM Odense 19 June 2012

Oslo 2008 problem

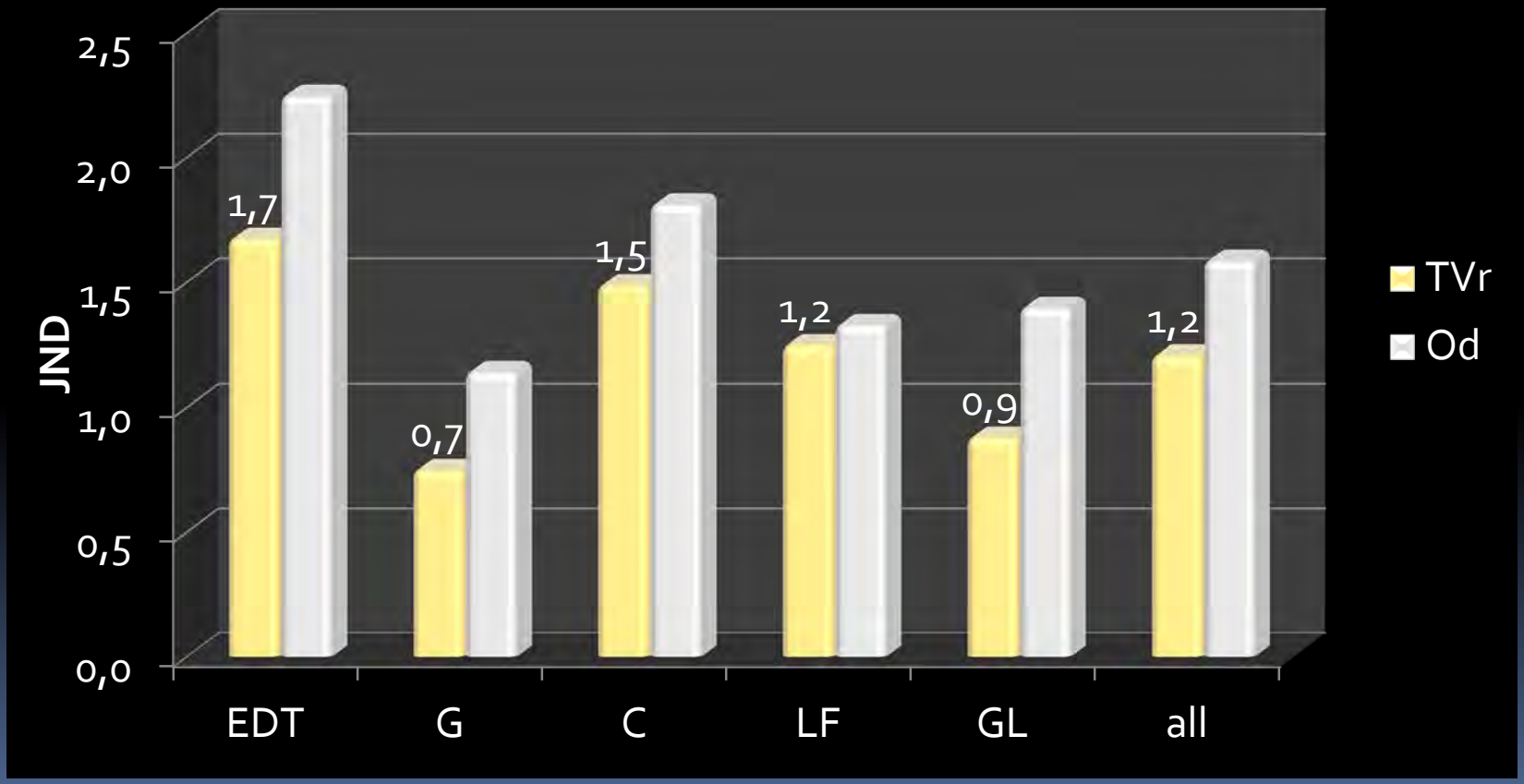
- Musikvereinsaal
  - 5 set of parameters ISO3382 ODEON analysis
  - Less than 10% of seats have parameter-values equal to hall average
  - How can top-ranked hall be explained by average parameter values if average is not present at listeners ears?

BNAM 2010 discovery

- The five ISO3382-parameters well-predicted by the TVr-predictor (Barron Revised Theory). 126 measurements in 11 halls
  - Average difference from measured is 1.2JND

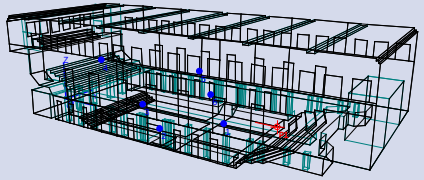
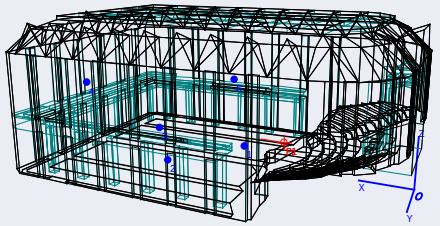
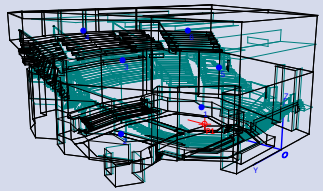
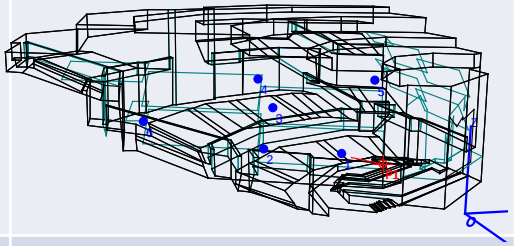
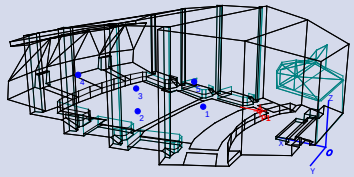
Comparison with measurements

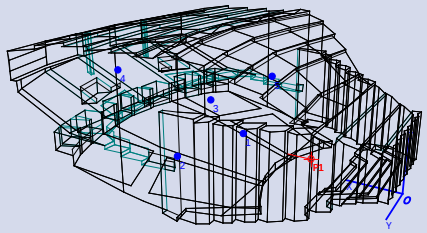
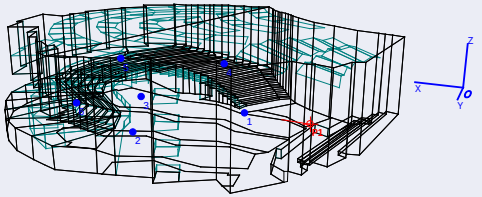
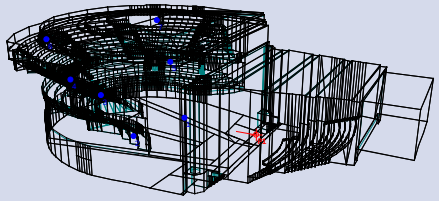
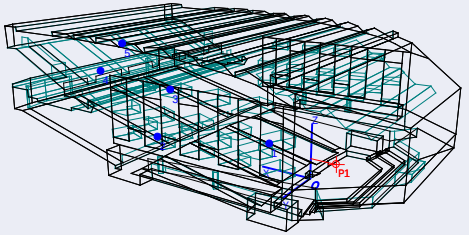
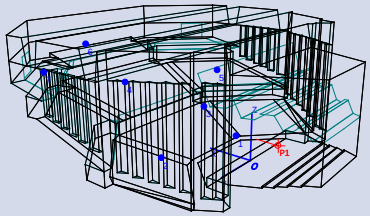
Difference (in JND units) between prediction and measurement. TVr-predictor and Odeon .



Sydney 2010
objective vs subjective da

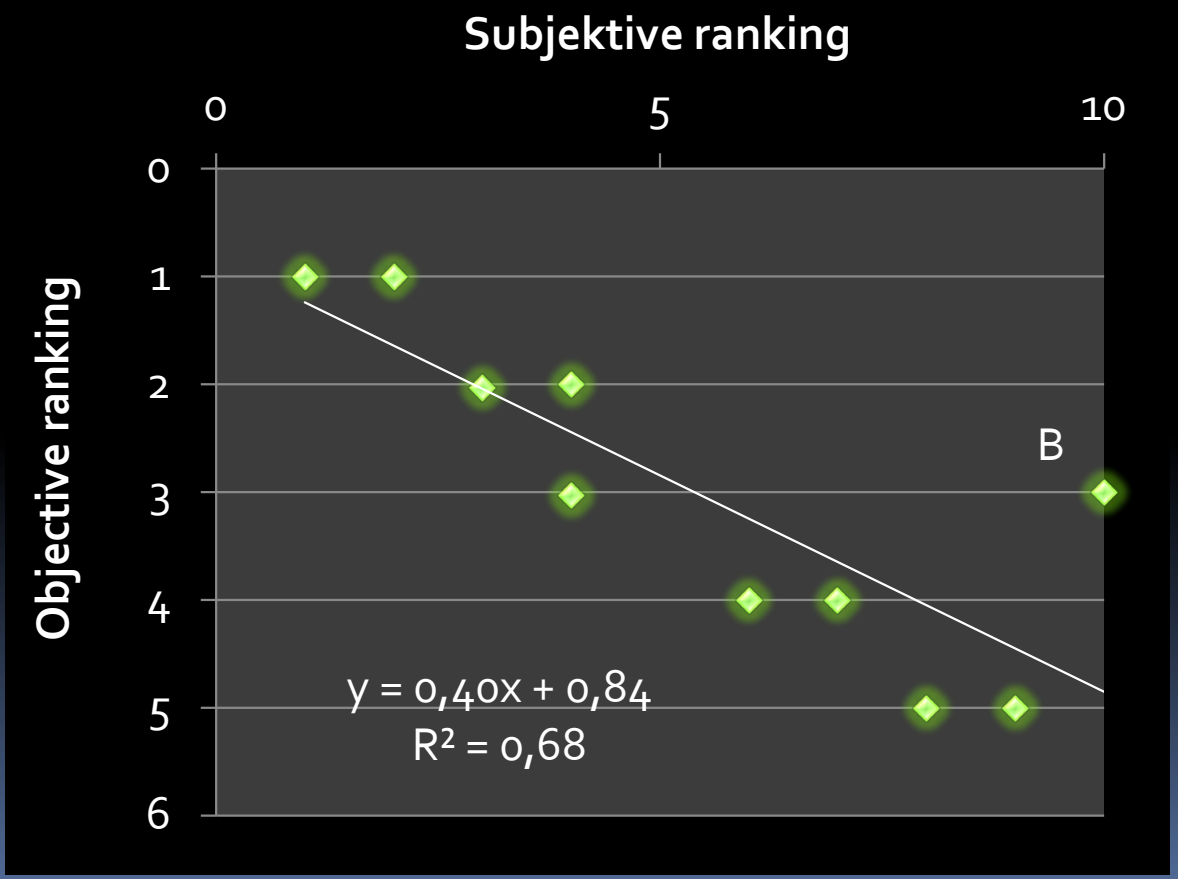
- Objective data: Measurements and predictions of 116 points in 10 Halls
  = Parameters at listeners ears
- Subjective data: Beranek ranking of the halls
- Can subjective ranking be explained by parameter-values at listener's ears?
- Musikverein and Concertgebouw values assumed qualifying criterium

Concert hall	Volume	Seats	RT (occ)	
Musikverein. Vienna	15000	1700	2.0	
Concertgebouw. Amsterdam	19000	2000	2.0	
St David. Cardiff	22000	2000	2.0	
Gasteig. Munich	30000	2500	1.9	
Konserthus. Gøteborg	12000	1300	1.6	

Concert hall	Volume	Seats	RT (occ)	
Festspielhaus. Salzburg	15500	2200	1.5	
Liederhalle. Stuttgart	16000	2000	1.6	
Usher Hall. Edinburg	16000	2500	1.3	
Royal Festival Hall. London	22000	2900	1.5	
Barbican. London	18000	2000	1.7	

Sydney: Little explanation, R^2=0.68 at listeners ears

B = Barbican Hall. London

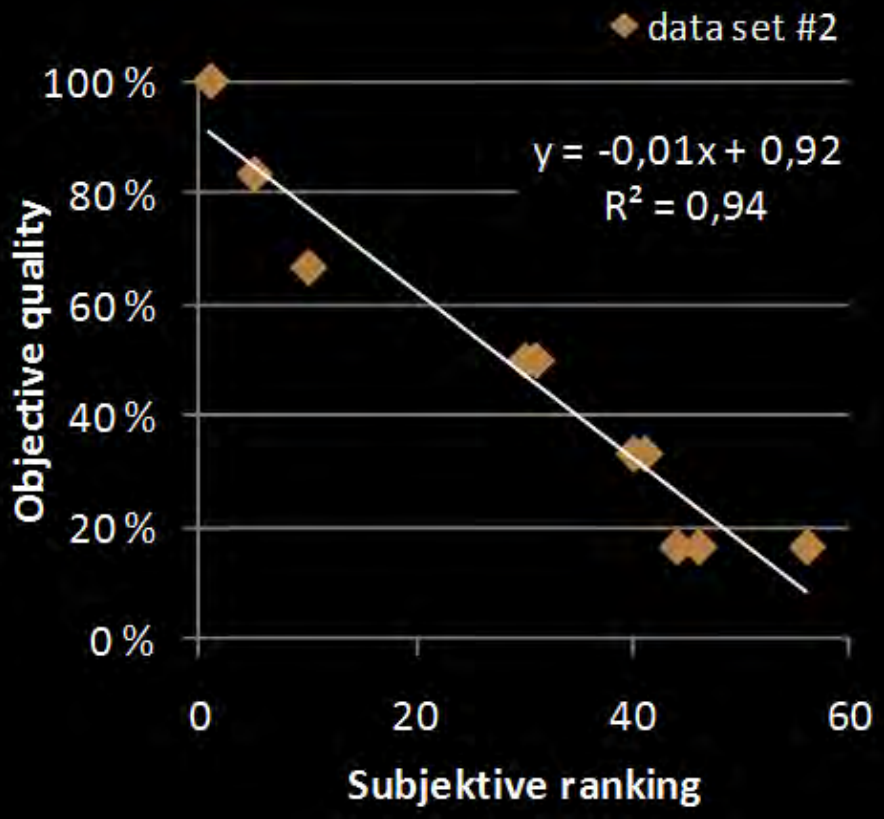


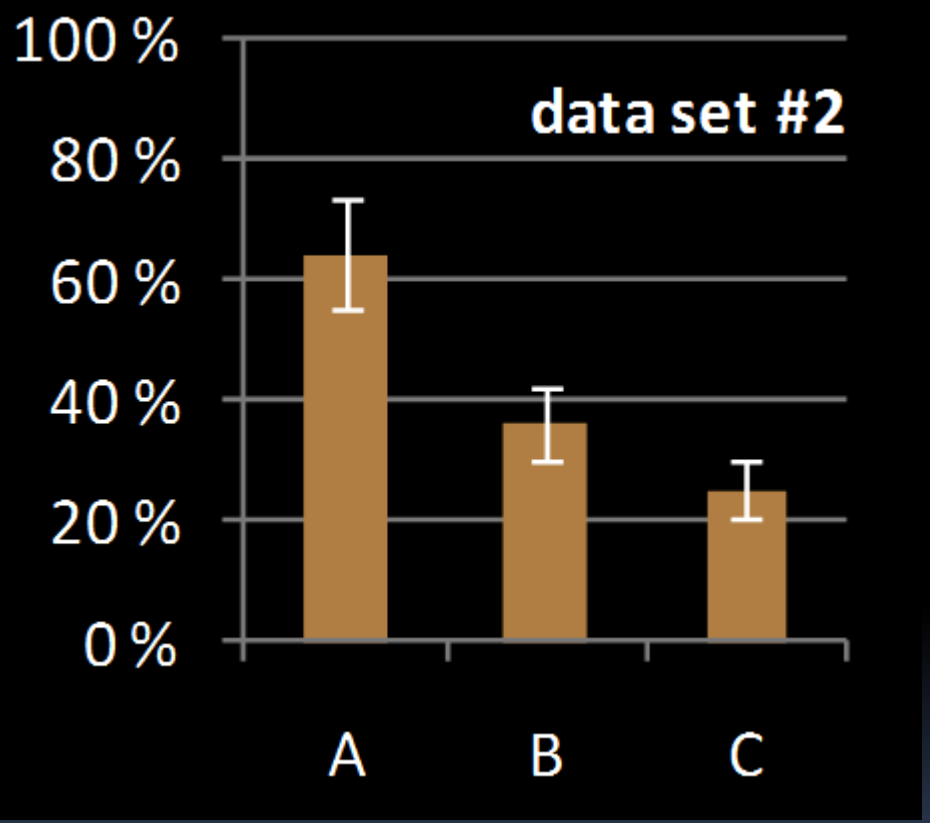
R^2=0.68

Dublin 2011 hall-averages

- Hall-average values in the 10 halls . extended parameter-set. explains subjective ranking. R^2 =0.94
- Musikverein-values qualifying criterion

BNAM 2012 explanation

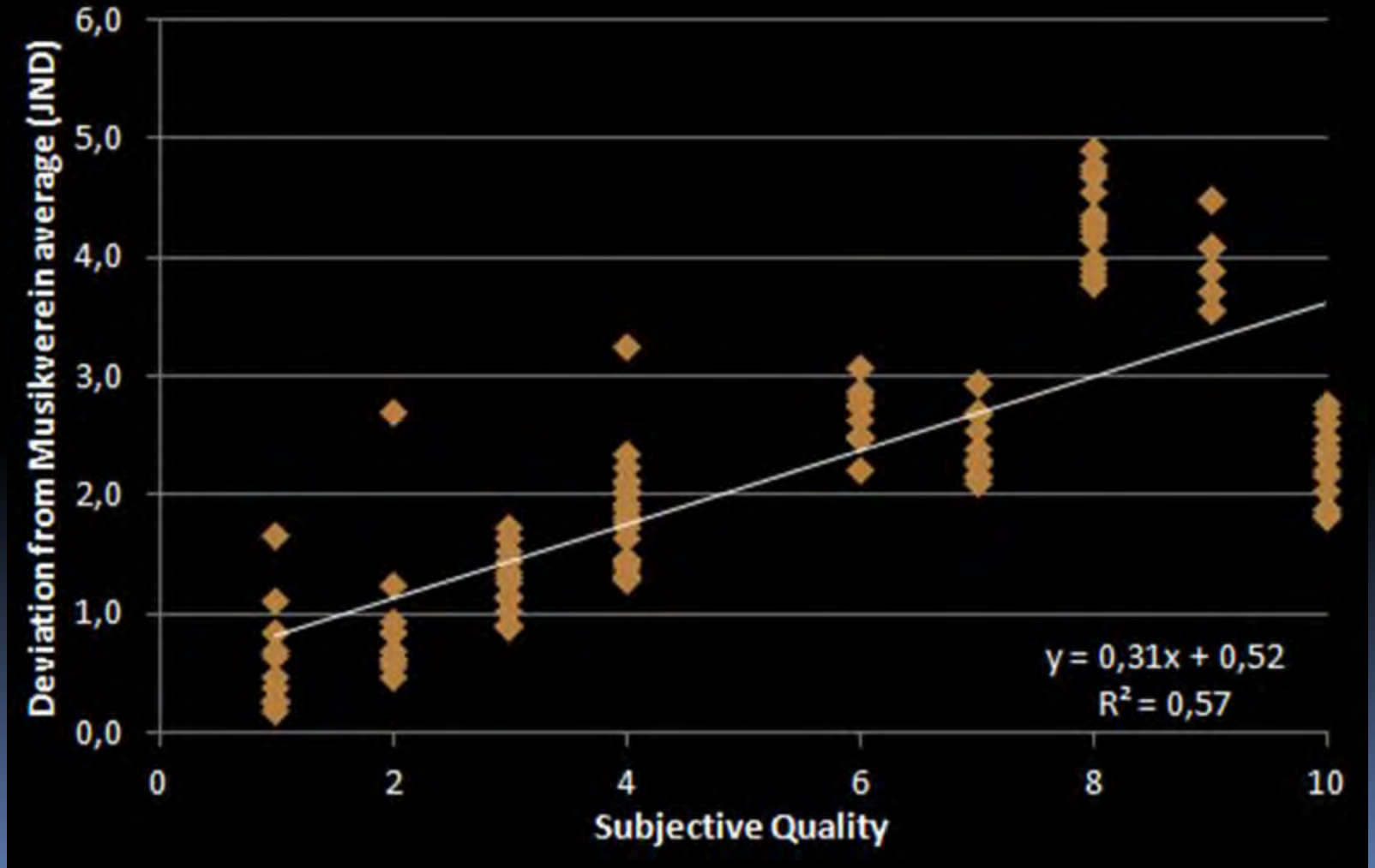




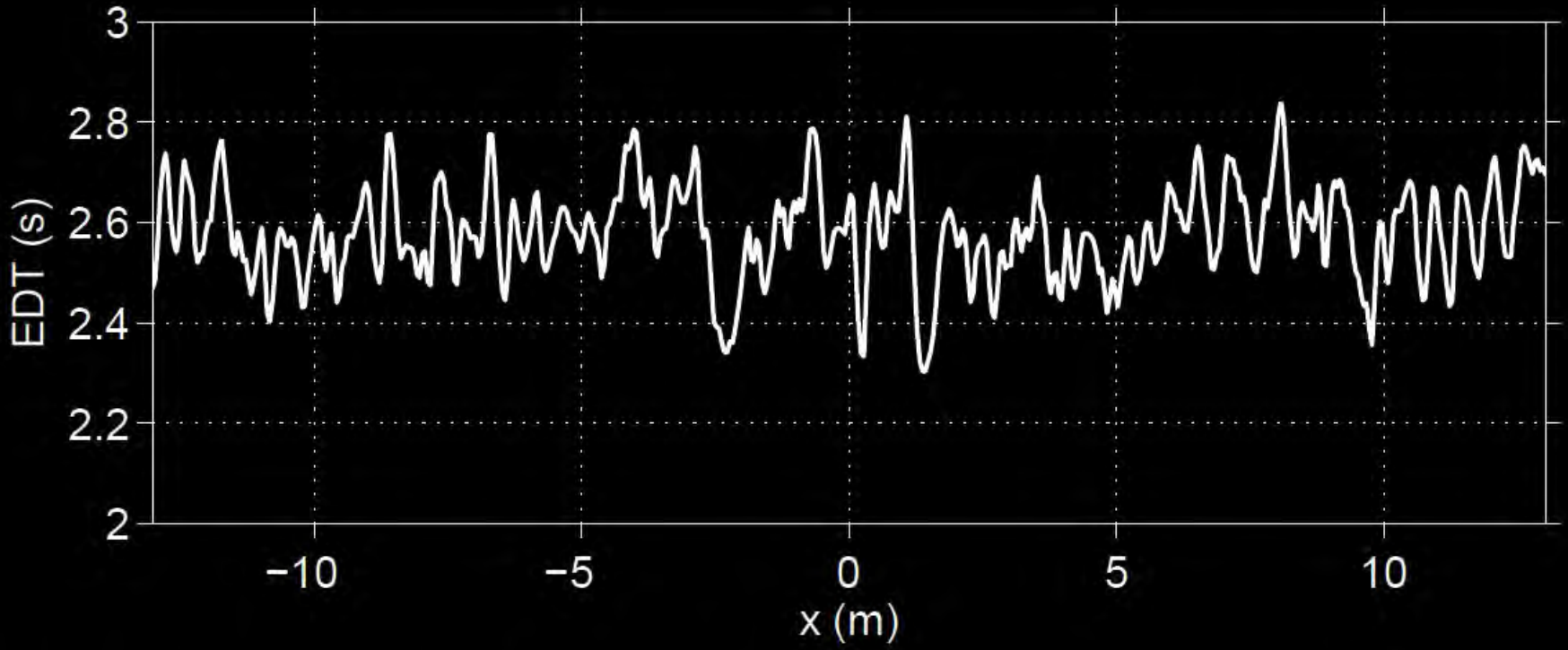
	EDT	G	C	LF	G_{late}	G_{125}
Criterion	2.0	4.3	-0.3	0.20	1.5	4.7
Tolerance ±	1.1	1.0	0.7	1.1	1.0	1.0

Deviation from Musikverein

116 points in 10 halls: Average deviation from Musikverein-average, 116 points in 10 halls



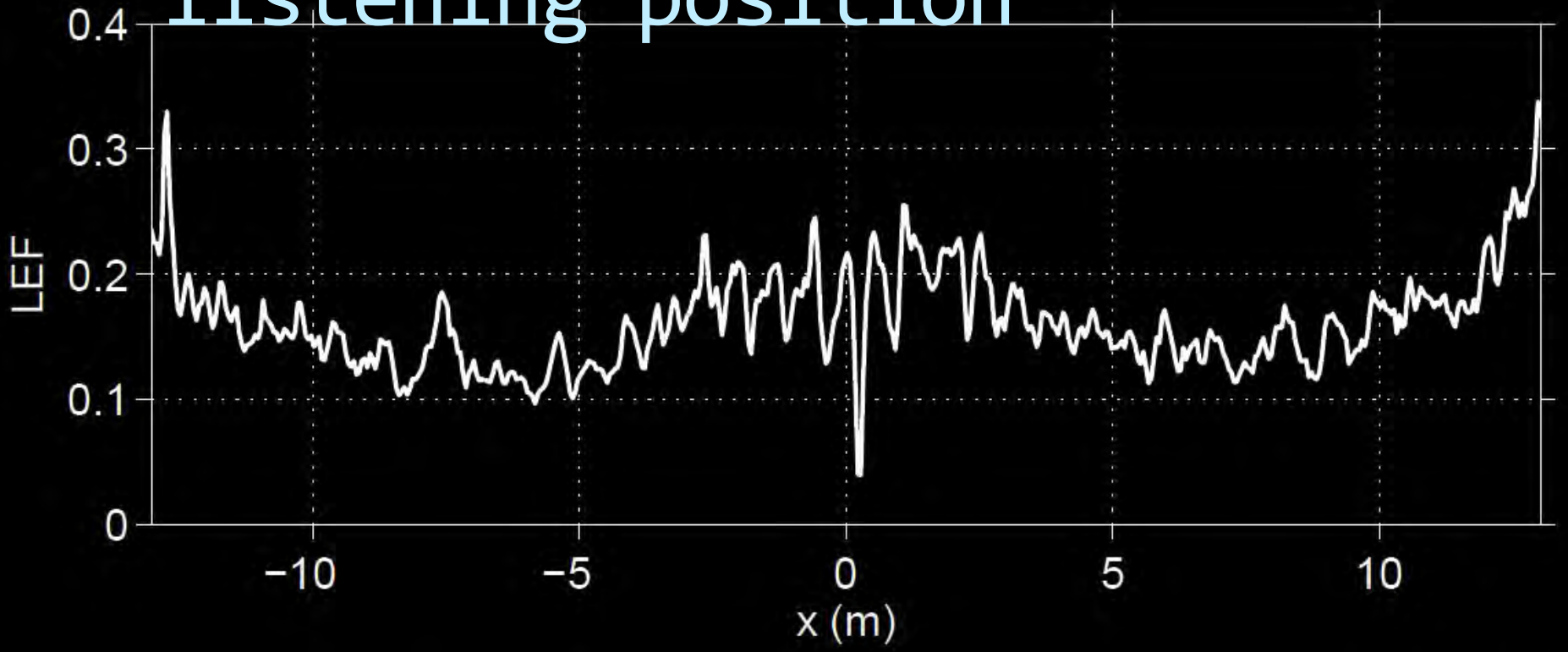
EDT variation around listening position



(a) Early Decay Time EDT (averaged over the 500 and 1000 Hz bands).

Van Dorp Shuitman (2011)

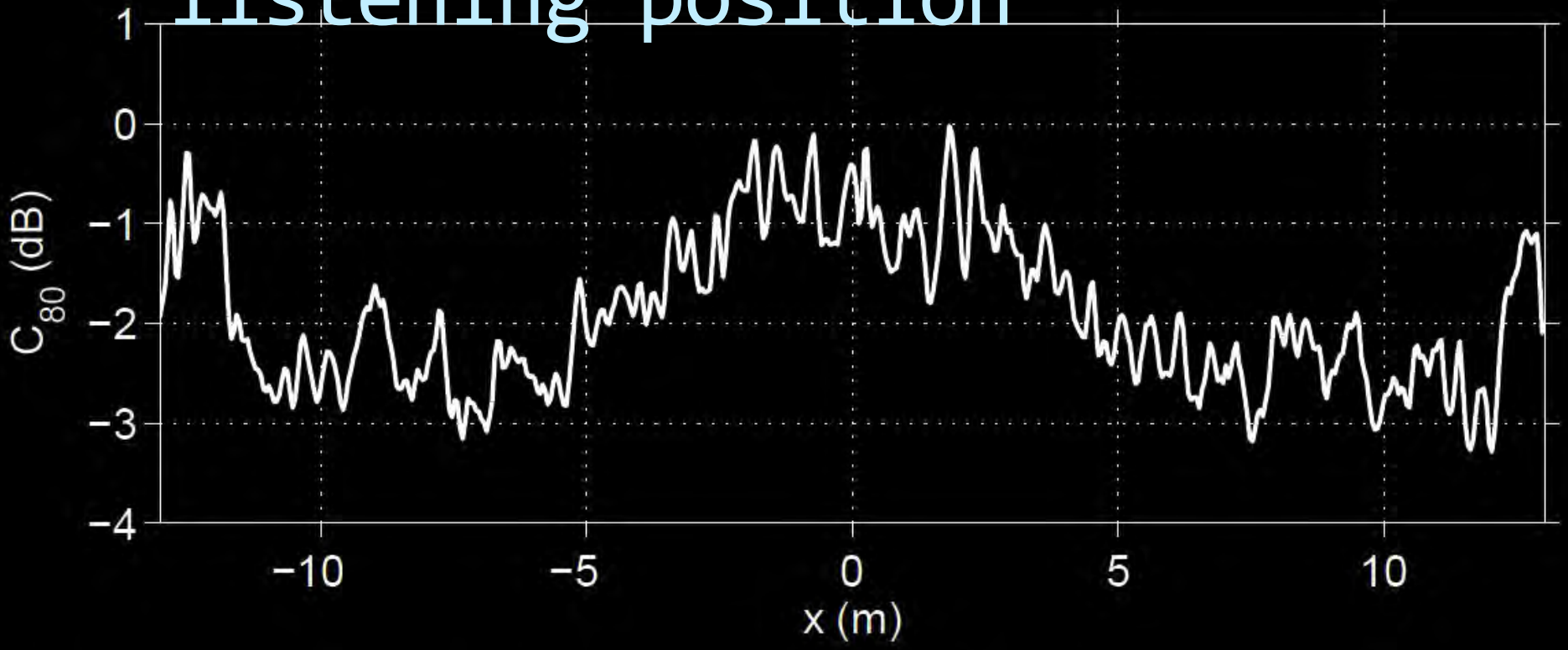
LF variation around listening position



(a) Lateral Fraction LF (averaged over the 125 to 1000 Hz bands).

Van Dorp Shuitman (2011)

C80 variation around listening position



(c) Clarity index C_{80} (averaged over the 500 and 1000 Hz bands).

Van Dorp Shuitman (2011)

Summary

- Hall-averages provide better explanation of subjective ranking than values at listeners ears
  - High explainability in hall averages
  - However, values at listeners' ears not understood
- Best prediction of subjective rank-order (R^2=0.94) as follows
  - ODEON predicted LF, and global T as input in TVr
  - TVr-predicted EDT, G, C, G_{late} and G_{125}
- Further work will include many more halls
  - Correlation may go down when including more halls, especially halls of lower ranking – since low ranked halls are experienced by fewer people

Thank you

Full paper: Concert Hall Parameters 2012—Status Report

More info?

The www center for search. research and open sources in acoustics

www.akutek.info

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