

ACOUSTICAL CONSIDERATIONS IN THE CONCEPT DESIGN OF AN ANIMAL RESEARCH FACILITY

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Generic facility description



- Integrated research environment
- Typical large project (diverse functional areas)
- Significant animal research component
 - ▣ holding rooms
 - ▣ transfer / transportation areas
 - ▣ behavioral, electrophysiological testing suites
 - ▣ rodents, swine, marmosets, etc.

Project Goals / Criteria



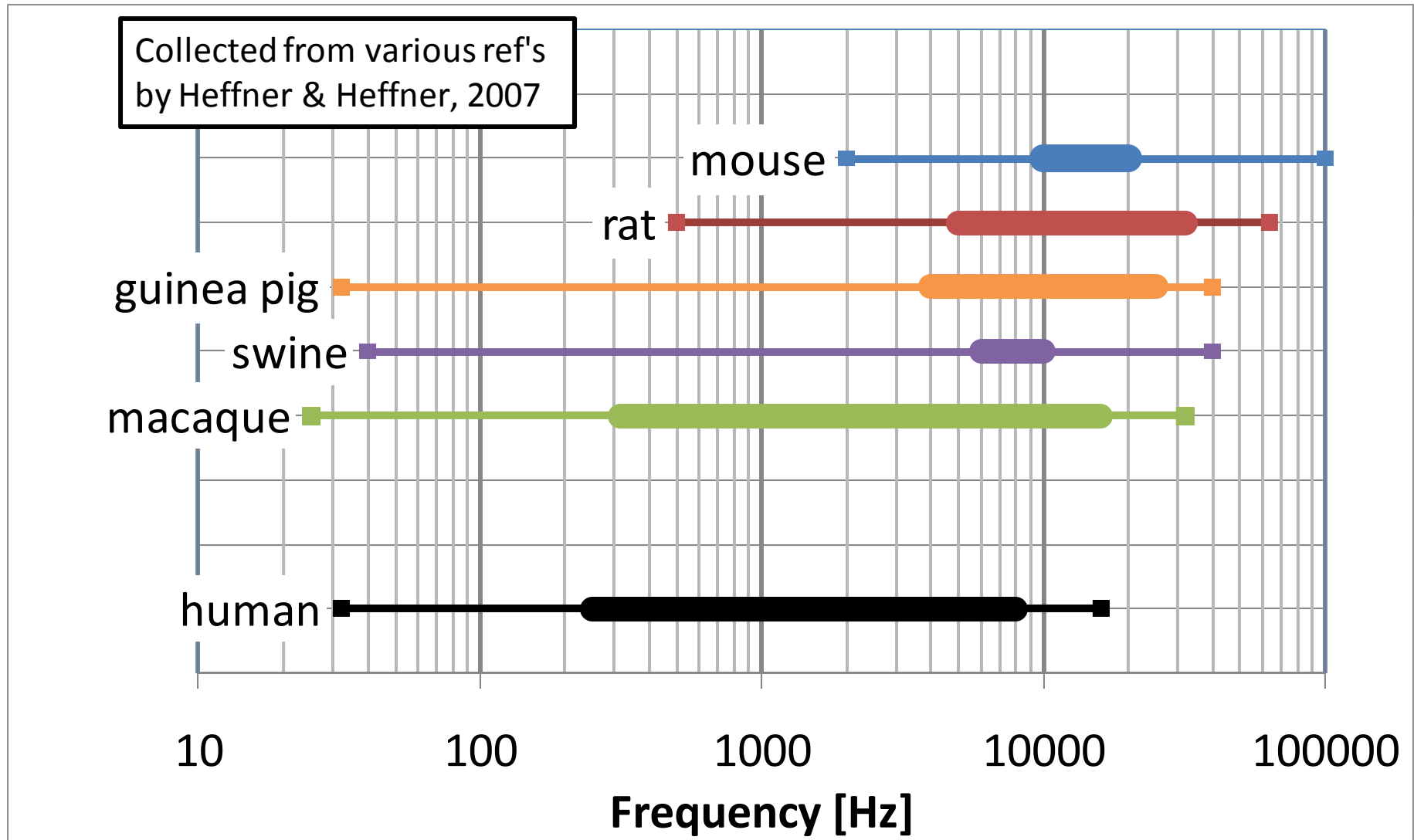
- Minimize noise-induced stress to animals
 - ▣ maximize animal comfort
 - ▣ maximize research productivity

- No coherent system of criteria exists
 - ▣ lots of data suggest behavioral/physiological effects
 - ▣ few data on sensitivities
 - ▣ fewer treatments on developing, meeting criteria

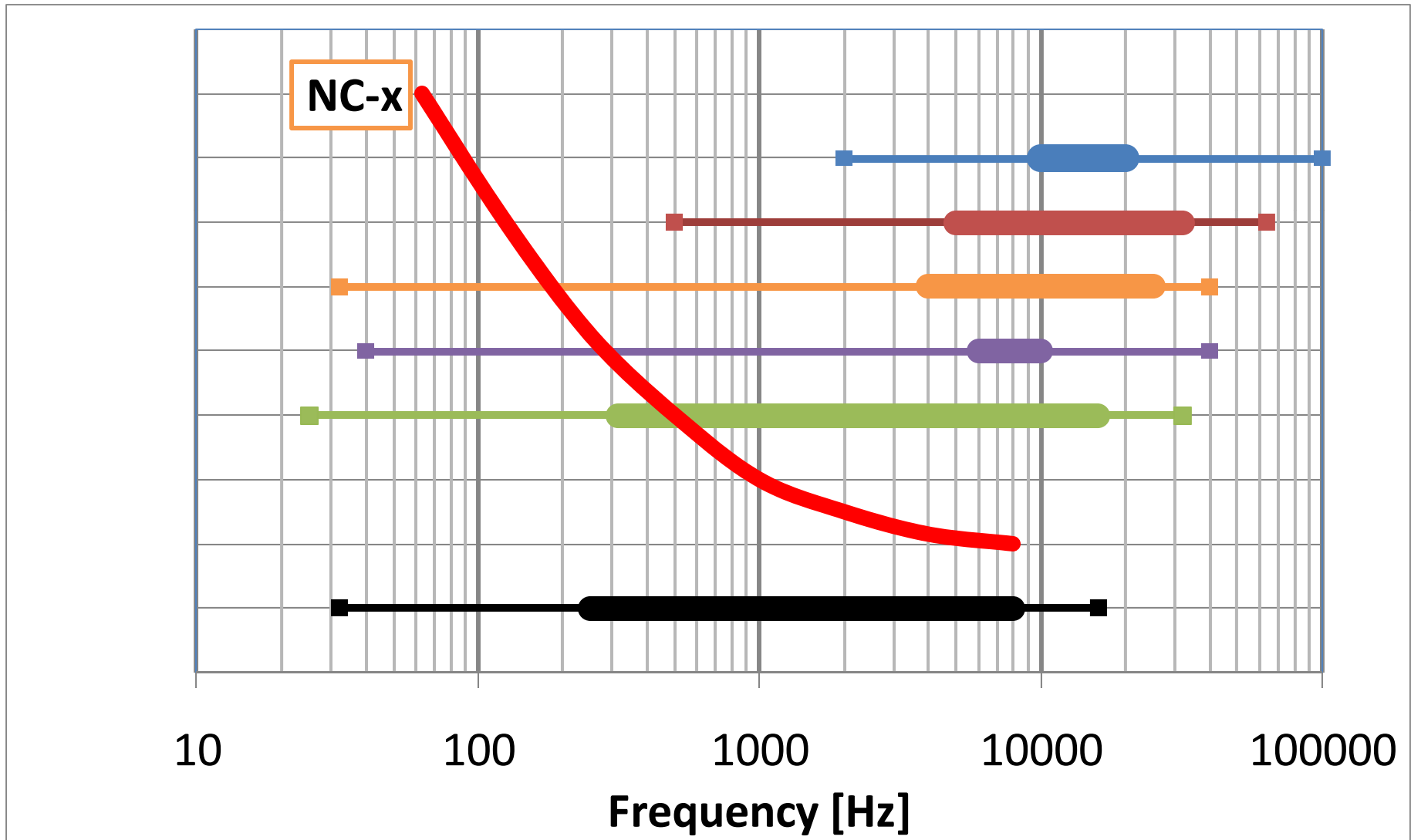
Facility layout



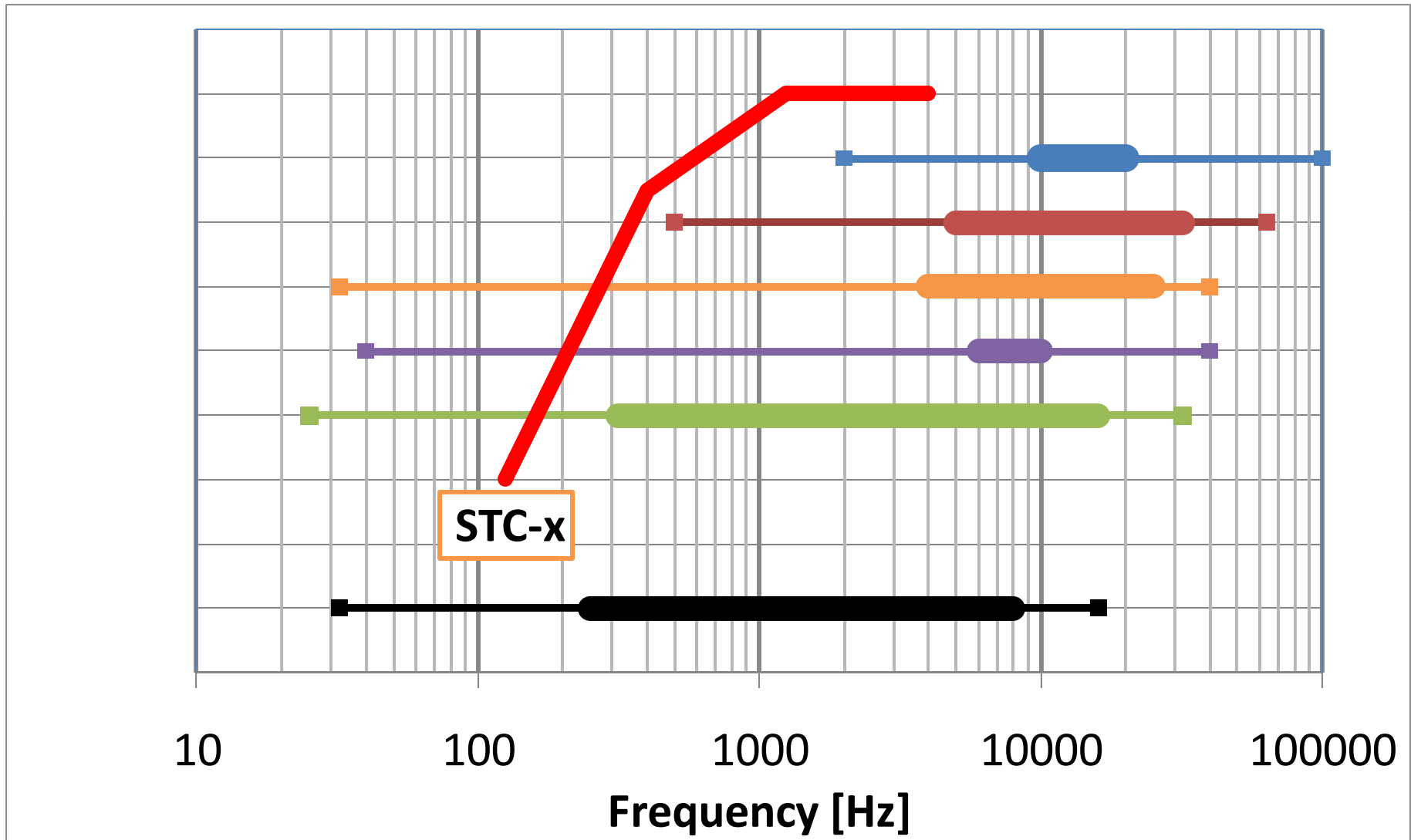
Sensitivities – different species



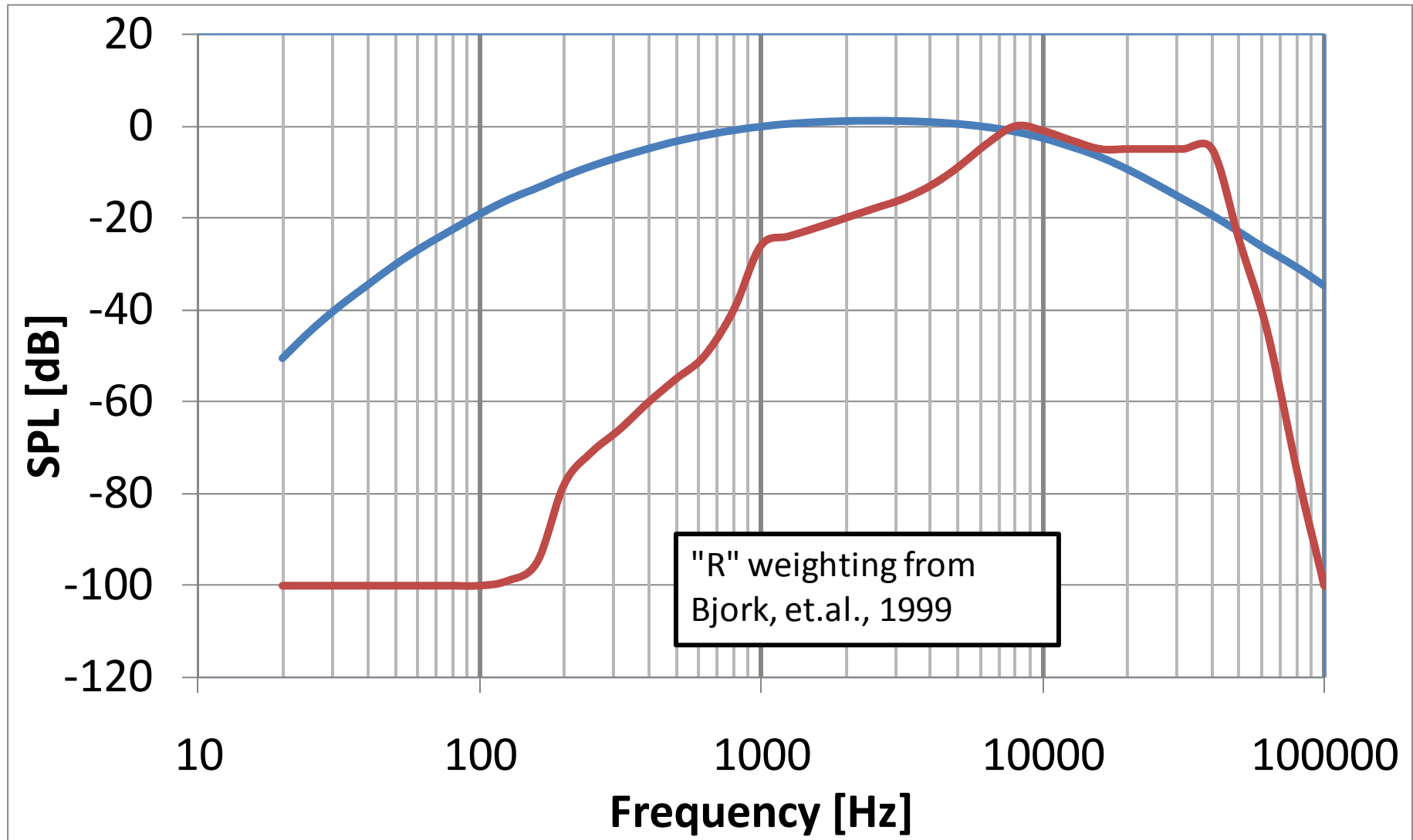
Sensitivities – human criteria?



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Sensitivities – different scenarios



- “Chronic” sensitivities

- noise impact considered over long periods
- ie, noise-induced stress in holding rooms
- affects baselines, undermine experimental assumptions

- “Acute” sensitivities

- noise impact considered in the immediate sense
- ie, behavioral/physiological aberrations during testing
- confounds experimental results

Sources



- Typical facilities noise sources
 - HVAC / exhaust
 - electrical and IT/telecom systems
 - movement of people and materials

- Animal-facility-specific noise sources
 - “self-noise”
 - animals in other spaces
 - cagewash, other special facilities systems

Concept design highlights



- Modest HVAC control (NC-35, NC-45)
- Modest partitions requirements (STC-45)
- Most adjacencies issues handled via programming
- Lighting ballasts, computer monitors (ultrasonic)
- Snorkel exhausts, compressed air (ultrasonic)
- Isolation against intrusive human sounds for primates



- Questions?

- References:

- Heffner, H. and Heffner, R., “Hearing Ranges of Laboratory Animals,” J. Am. Assoc. for Laboratory Animal Science, Vol. 46, No. 1, January 2007.
- Bjork, E. et. al., “R-Weighting provides better estimatoin for rat hearing sensitivity,” Laboratory Animals 34, 136-144 (1999)

Noise masking?



- Masking to address both chronic and acute sensitivity
 - rendering adjacent animals inaudible (chronic)
 - rendering human staff inaudible (chronic & acute)
 - reducing differences between different spaces (acute)
- Implementation might be challenging
 - frequency content
 - environmental requirements (esp. waterproof)

Is vibration an issue?



- Under limited circumstances, maybe
 - ▣ anecdotal evidence suggests construction vibration effect
 - ▣ cage dynamics amplify footfall-induced vibrations
 - ▣ facility vibration probably not an issue on SOG floors

- Cages complicate matters
 - ▣ cage systems vendor-supplied (often not in A/E scope)
 - ▣ some cage systems have integrated ventilation