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# **Best practices for minimizing vibration sources in ancillary systems**

Curt Baffes

Microphonics Meeting

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[PIP-II-doc-30](#)

# Background

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- It is challenging to write good requirements for vibration control that are
  - Understandable to non-experts
  - Analyzable
  - Enforceable
- PIP-II's current approach
  - Develop rigorous requirements that apply to systems that “touch” SRF cavities (see J. Holzbauer)
  - Disseminate best practices for passive vibration control in other systems (this talk)
  - We are piloting this approach in the ongoing construction of the PXIE test bed

# Best Practices Document

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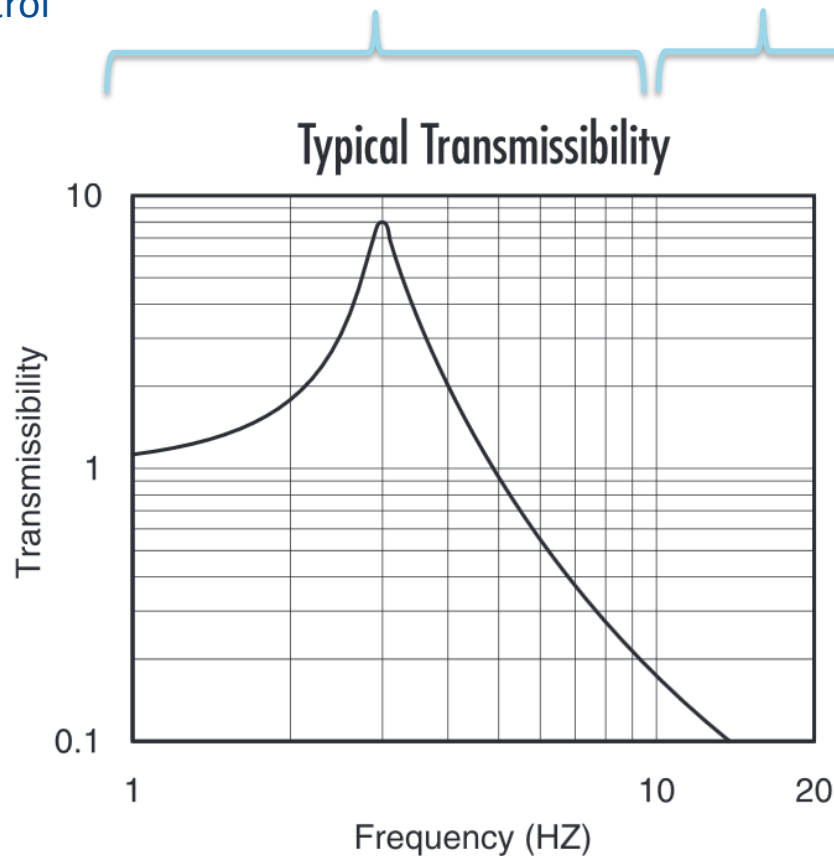
- Available in Teamcenter – ED0002931
  - For external access, the document will be filed with this talk <http://pip2-docdb.fnal.gov/cgi-bin/ShowDocument?docid=30>
- Outline of document
  - List of common vibration sources
  - Guidelines for passive isolation of vibration-causing equipment
    - Administrative controls for “environmental” sources
    - Compliant mounting of rotating equipment
  - Guidelines for passive measures in beamline structural design
    - Avoidance natural frequencies  $< \sim 10\text{Hz}$  or near  $60\text{Hz}$
    - Consideration of load paths to vibration sources
  - Known good component list

# Compliant isolation philosophy

Keep transmitted vibrations:

- At  $f <$  beamline hardware natural frequencies
- Within plausible bandwidth for active vibration control

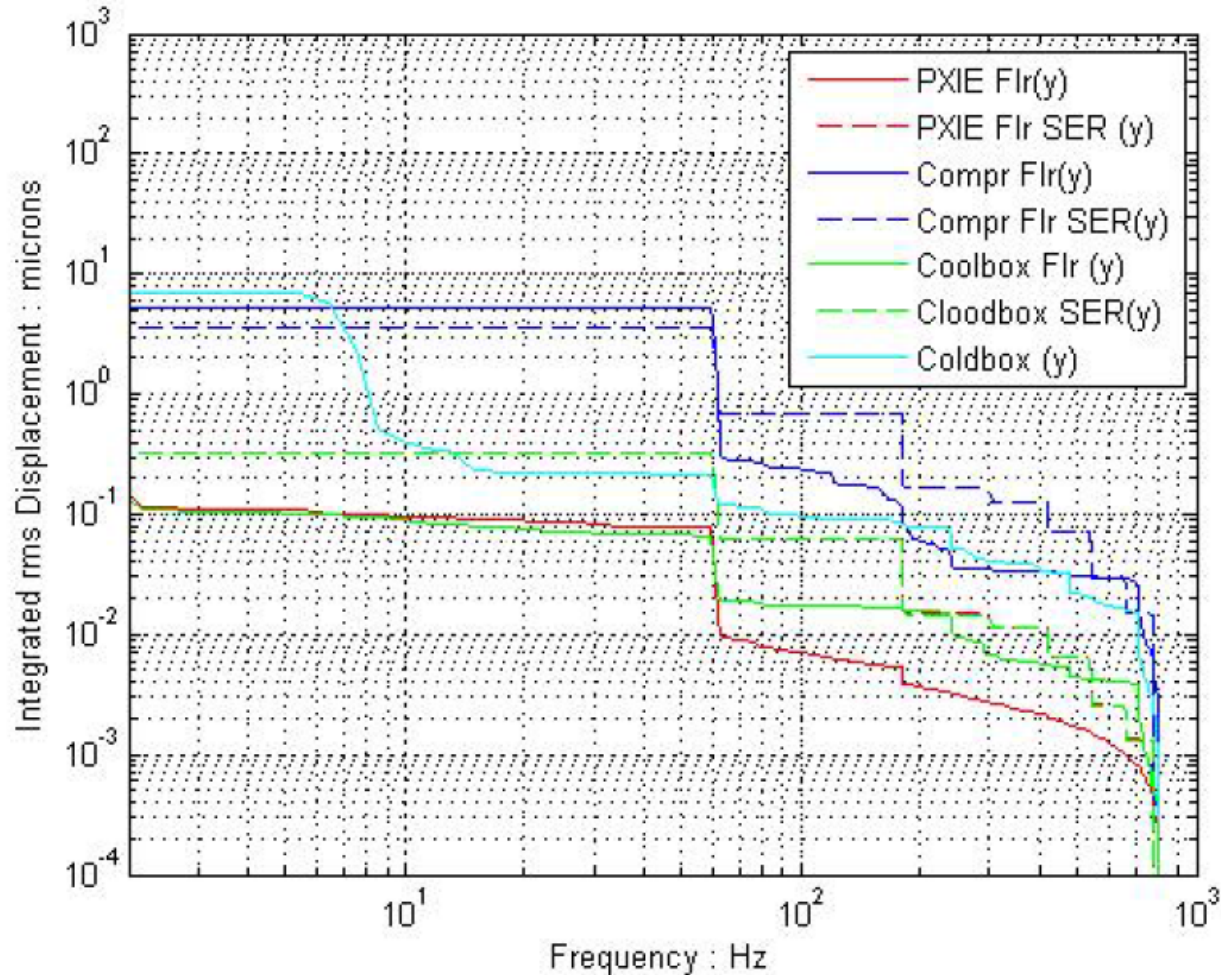
Attenuate vibrations above  
~tens of Hz



Example transmission curve:  
Barry Controls  
pneumatic machine mount

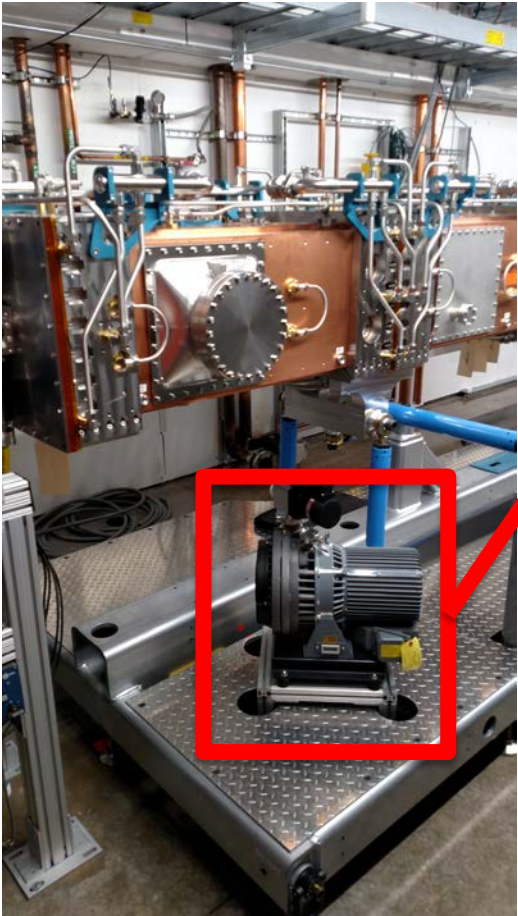
# Current efforts at PXIE – Facility characterization

Integrated vertical floor displacements (M. McGee)



# Current efforts at PXIE – Passive isolation of sources

PXIE RFQ scroll pump



Elastomer vibration mounts

Separate interface to slab



# Current efforts at PXIE – Passive isolation of sources

PXIE RFQ cooling system (J. Czajkowski)

Compliant flow connection

Compliant machine mounts



# Current efforts at PXIE - Component selection

- Not all components are created equal
- We are attempting to build a list of known “quiet” components
  - Suggestions are welcome and needed
  - Please email to [cbaffes@fnal.gov](mailto:cbaffes@fnal.gov)

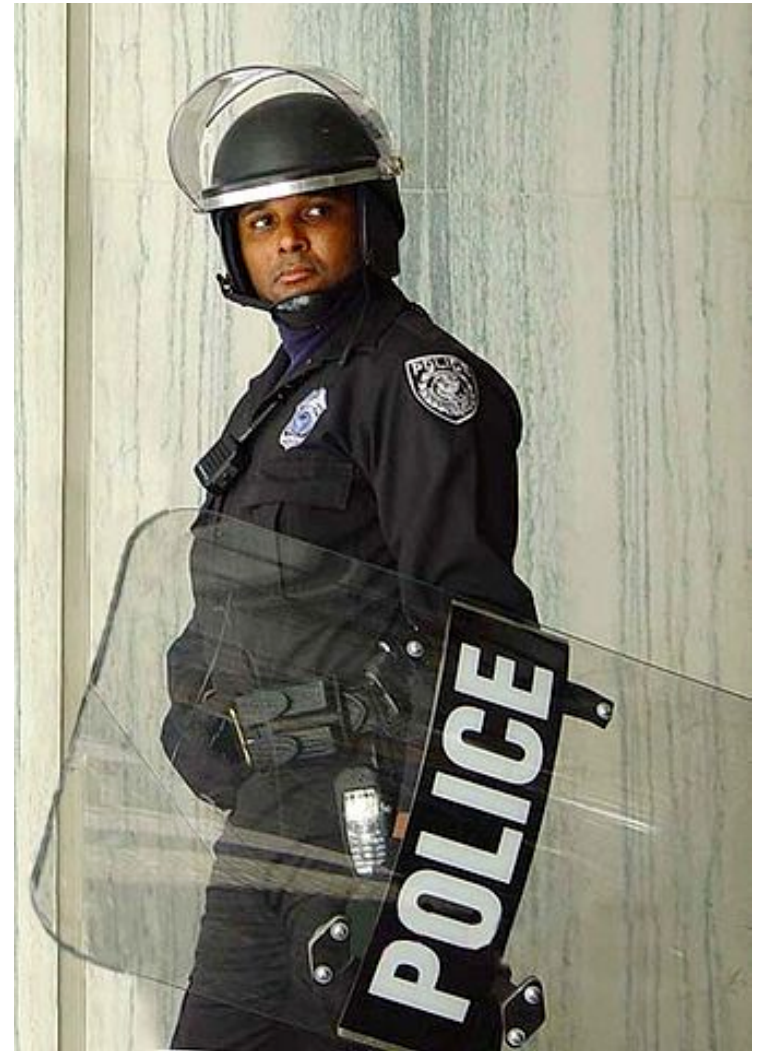
Edwards nXDS  
scroll pumps –  
well balanced,  
low acoustic load





# How do we police this?

- **Design reviews**
  - Vibration needs to be considered in the review of anything that *could* be a problem
- **Training**
  - Sensitize engineers and techs to the issues
- **Measures specific to PXIE**
  - Facility walk-thrus
  - In-situ measurements to identify changes



# Future Plans

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- PXIE will continue to be a testing ground
  - Compromises inherent in a shared facility should allow us to investigate “worst case” conditions
  - Will allow our beamline engineering team to gain experience with vibration issues
  - Will allow us to gain experience with specific components passive isolation implementations
- We will document mistakes and lessons-learned to improve the best-practices document for the PIP-II implementation