New cooling FANS for AdV Vacuum racks: preliminary tests

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Present (-like) fan

- EbmPapst 4650N

Bearing type = Sleeve
Speed = 44.17 Hz (2650rpm)
Air fllow = 160 CFM
Noise = 46 dBA
Size = 119 x 119 x 38 (mm^3)

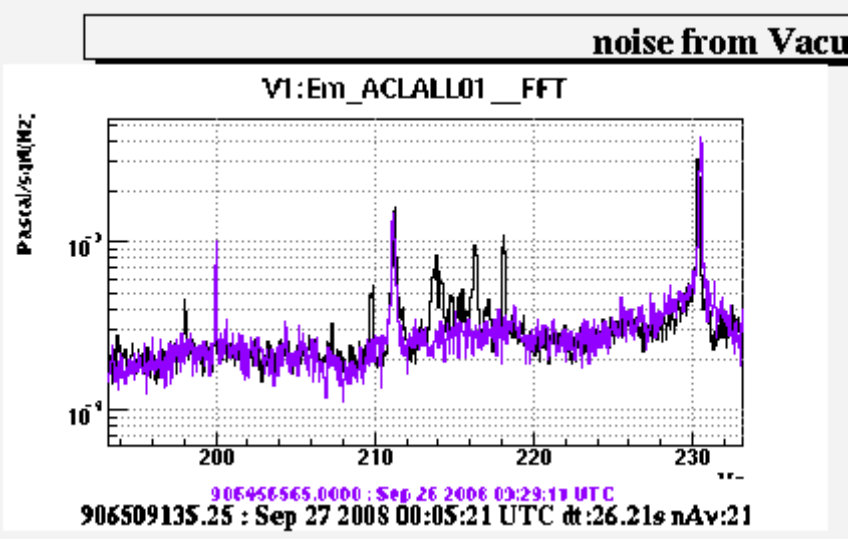
- For 1 rack: (4 fans in a tray) x 2

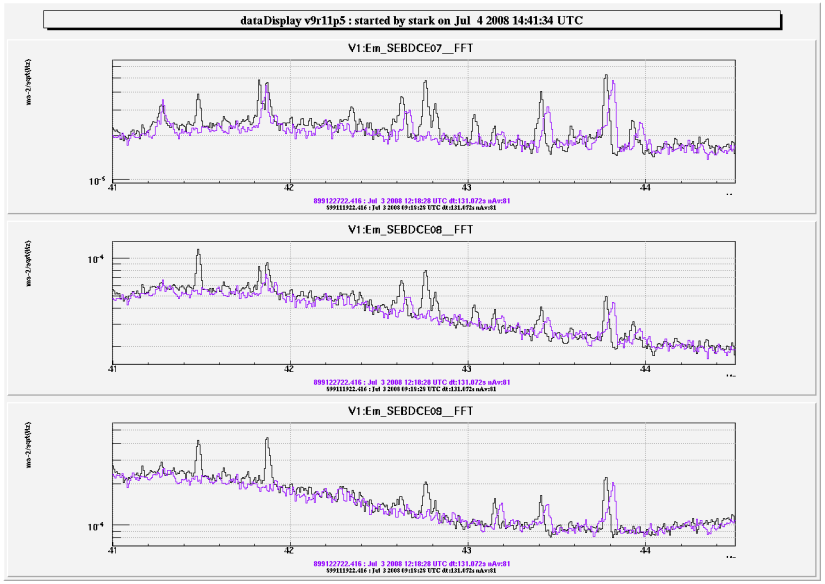
…. → 1280 CFM total flux

(to be CHECKED)

Acoustic noise problem

- In VSR1: lines in dark fringe associated to racks (Marque, the 41-44Hz forest). Then DET LAB racks moved to EE room. But still acoustic /seismic noise in LL from vacuum racks on the platform (C.Stark, 20745 and switch off tests, **report in VIR-064A-08**).





- Paths: although AdV most of external benches will be suspended and in-vacuum, yet acoustic noise can seismically excite vacuum tanks (possible diffused light)
- Requirement for AdV (see IME sec. in Final Design): 10 times reduction of amplitude monochromatic emissions (i.e. 6dB rms) in experimental halls.

Less noisy fans?

Noise is influenced by:

- **Speed**: noise rises with some power (3 to 6) of the blades rotation velocity
  BUT, we need “large enough” air flux
  → go for SLOWER but LARGER fans

- **Bearings type**: friction, can produce harmonics. “ball” type is better than “sleeve” type, also “double ball” and better lubricated exist.

- **Mounting:** vibration of the fan case on the tray support
  → use of special rubber screws...

Purchased a few commercial fans

...easy to find, from internet sites farnel/digikey):

(The one in use)

Fan	Bearings type	Speed (RPM /Hz)	Air Flow (CFM)	Noise (dBA)	Weight (gr)	Size (mm^3)
Papst 4650N	Sleeve	2650 /44.1	160	46	550	119x119x38
Sunon DP203A	Ball	2225 /37.08	127	38	550	120x120x38
Sunon DP203AT	Ball	1800/ 30	86	38.5	330	119x119x25
EbmPapst 4890N	Sintec	1550 /25.83	80	25	540	119x119x38
EbmPapst 3956L	Sintec	1550 /25.83	31	24	280	92x92x25

Test setup

- Measured acoustic emission of single fan

1) need QUIET location: into arm tunnel, about 100m from 1500N lab.
2) we suspended the fan to seismically decouple it from the support → avoid acoustic noise possibly emitted by the vibration of the support.
3) Microphone (B&K mod. 4190)

   Larson 2210 power supply and ONOSOKKI

   sepectrum analyzer.
4) Microphone placed behind the fan

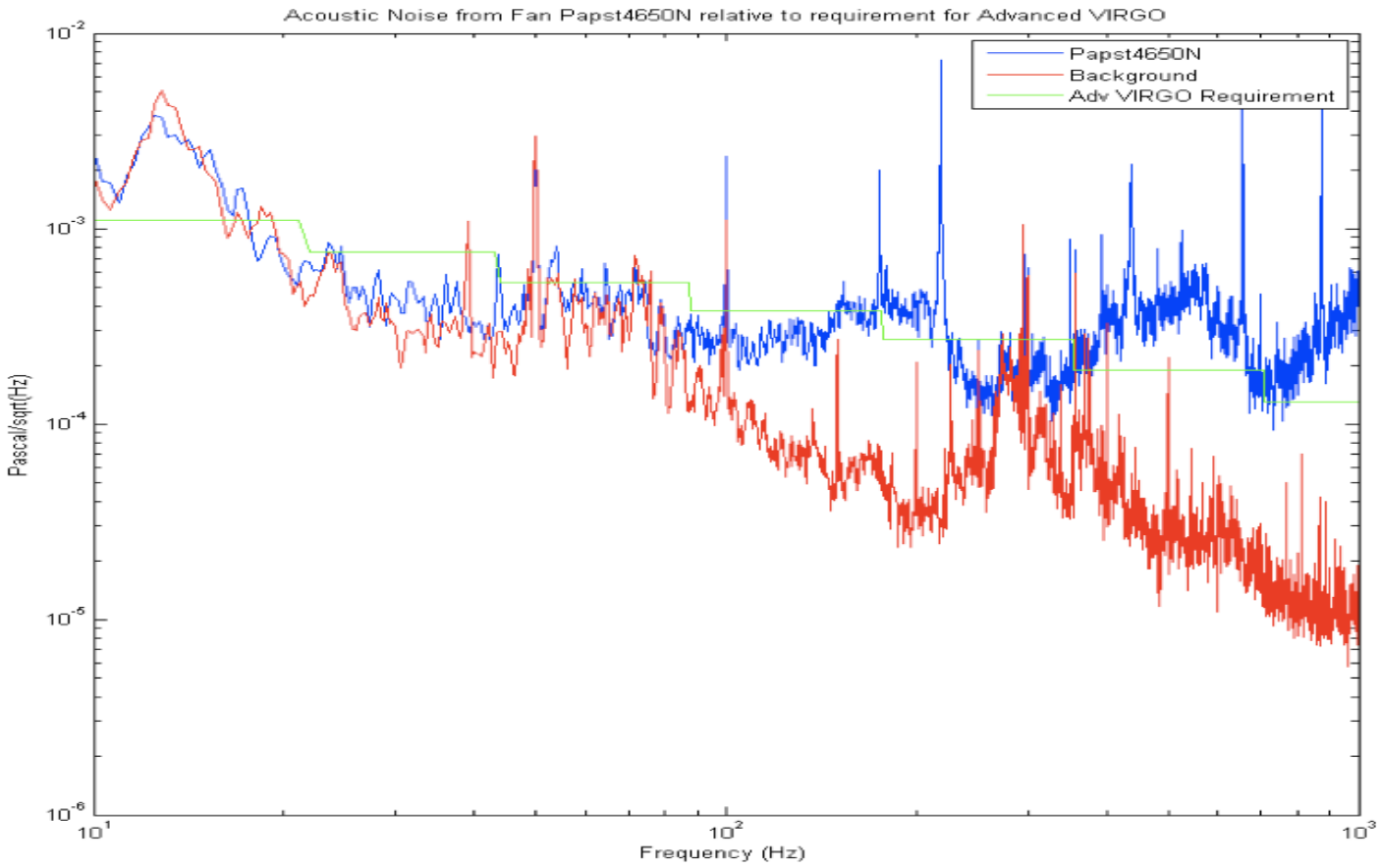
(i.e. side of the incoming air flux)

and along the fan axis,

about 30cm from the fan.

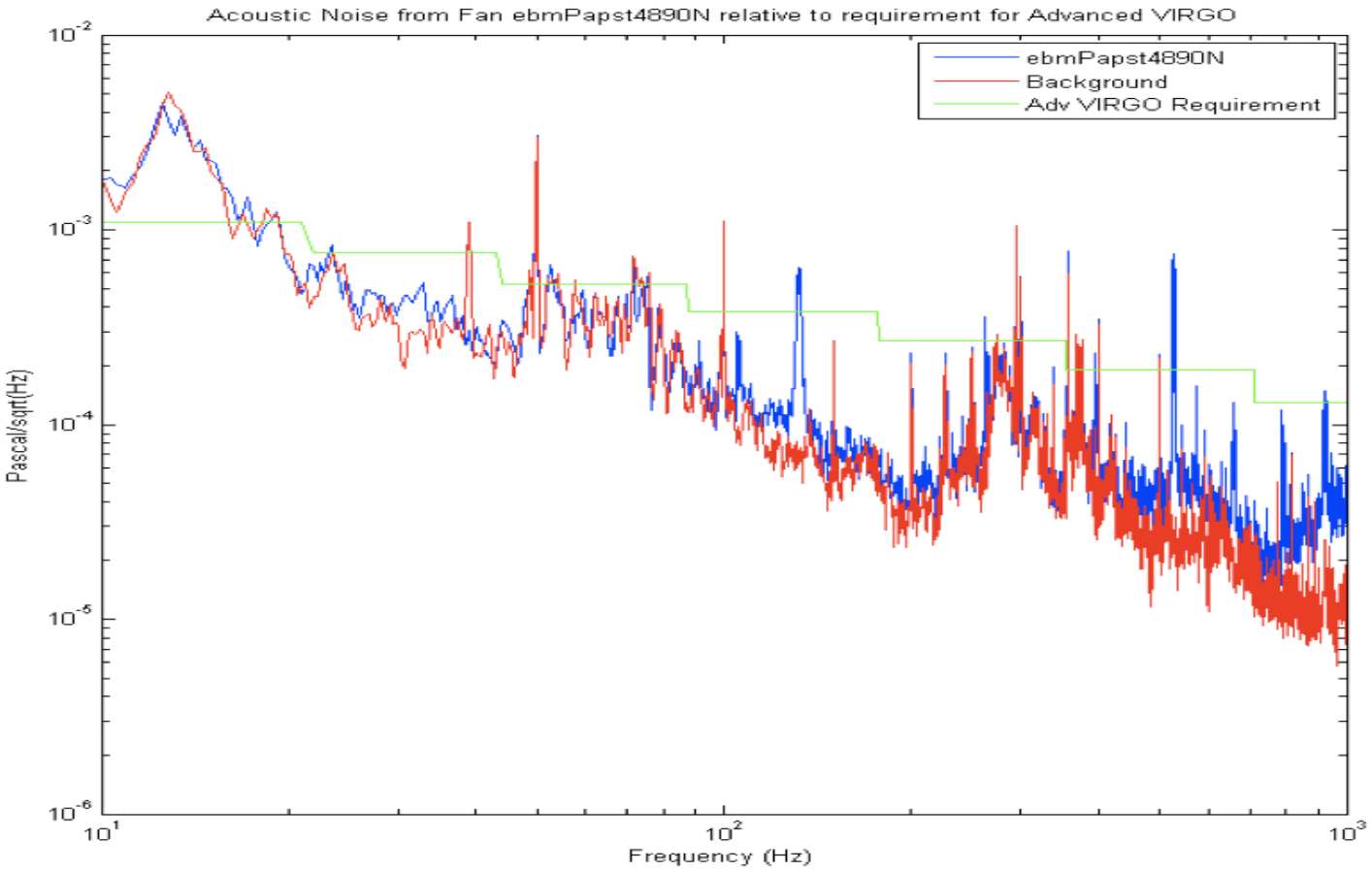
Results

- Papst 4650 (currently in use), 160 CFM, 44Hz



Results

- EbmPapst 4890, 80 CFM, 26Hz, Better bearings



RMS noise / air flux

We want to OPTIMIZE this number.

FAN	RMS (Pa)	Air Flux (CFM)	RMS/CFM
Papst 4650N	17.6 E-3	160	**0.11**
Sunon DP203A	8.5 E-3	127	**0.07**
Sunon DP203AT	5.6 E-3	86	**0.07**
EbmPapst 4890N	2.4 E-3	80	**0.03**
EbmPapst 3956L	2.9 E-3	31	**0.09**

Conclusions

- Tested some “easy to find on the market” fans.
- One model with “better” bearings is significantly less noisy, but gives half the flux.

  David is preparing a report with all measurements.

<u>Go on with:</u>

- Test some Larger size fan (next slide)

→Need to know which is the necessary AIR FLUX, and if possible to reduce the total air flux.

Larger and slower fans, examples:

NILOX, 140x140x25 mm, 1000 rpm, CFM not given
Easy to find at PC shop EFFEGI in Pisa

Looks many available on the market, espiacially for application in Personal Computers (silent PC: http://www.pcsilenzioso.it/forum/showthread.php?t=6421)
Sizes from 20cm to 60cm and speed in the range 1000-600rpm.