

# Vibration Measurements at CERN

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# Measurements

- Plan
  - Measure vibration correlations across “Point 4” hall, as model of future linear collider interaction region
- Actual
  - Unable to access hall itself
  - Measured vibration correlation vs distance in eqpt tunnel

# Access Problem


**SIR - Safety Information Registration**

BERTSCHE Kirk Joseph  
Logout

Help English

Welcome to SIR - Safety Information Registration.  
This application allows you to access CERN safety self-training modules. Click on any of the training proposed below.  
Please pass your mouse over a course title to see a quick description of it. You can also find out which course is made for you by selecting a pre-defined profile in the "Filter" list.

Please note that successfully passing a course doesn't give you any access rights to controlled zones but, on the opposite, safety courses may be required to validate your existing access authorizations. You can control the validity of your access authorizations on [ADaMS](#) and request new access authorizations on [EdH](#).

Available courses and their current status	Course description	Your safety contacts	News
<b>- Show all courses -</b>			There are no active news
Go Basic Safety (Levels 1 and 2)	Move the mouse cursor over course name on the left to find a quick description, target audience and goals of the course.	DSO (Dept PH) Christopher GRIGGS	Your access authorizations
Go Specific Risks (level 3)		TSO (Bog 4) Marie-Noelle BEAUMONT	
Go Computer Security		First Aiders (Bog 4) Michelle CONNOR	Click on the image above to check all your access rights on the ADaMS system.
Go LHC Machine (Level 4)		Odlie MARTIN	
Go ATLAS Safety (Level 4A)		Elena GIANDOLIO	
Go LHCb Safety (Level 4b)		Catherine MONTAGNIER	
Go CMS Safety (Level 4C)		Sascha SCHEMELING	
Go Electrical Safety Awareness		Isabel MACCHIONI	
Go ATLAS Run Control		Sophie MOLES	
Go ATLAS Muon Shifters		RSO (Dept PH) Michael HAUSCHILD	
Go ALICE SLIMOS			
Go ISOLDE Primary			
Go TREC: Traceability of Radioactive Equipment			

USER\_PERSON\_ID:735941; LANG:EN; COURSE\_ID:; COURSE\_CUR\_CODE:; MOD\_CUR\_ID:; CUR\_APP:; TEST\_ID:; LAN:EN; Want to add a course in SIR?

**ADaMS** (KBERTSCH) | Help | Logout

Personal Requests and Exceptions Access to Zones Home Access to Zones

This page: https://www.cern.ch/adams/access.php?person\_id=735941

**Kirk Joseph Bertsche**

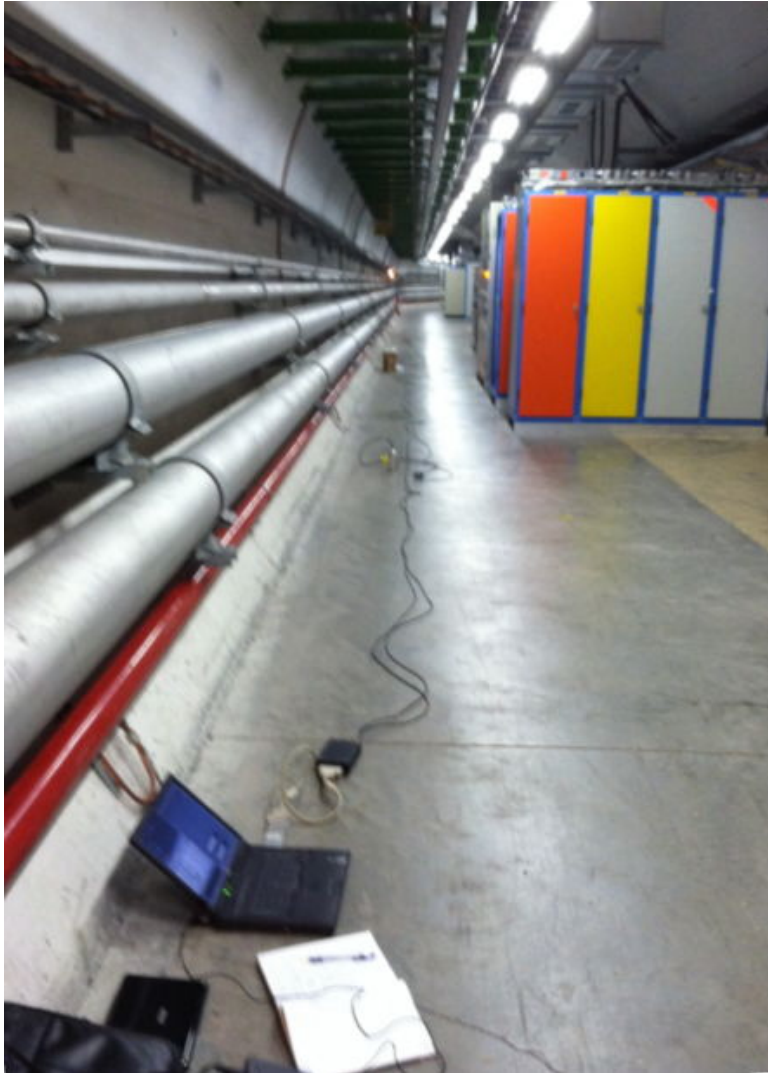
Access to Zones (Expanded) Automatically Generated Accesses (Expanded)

Collapse Access Details

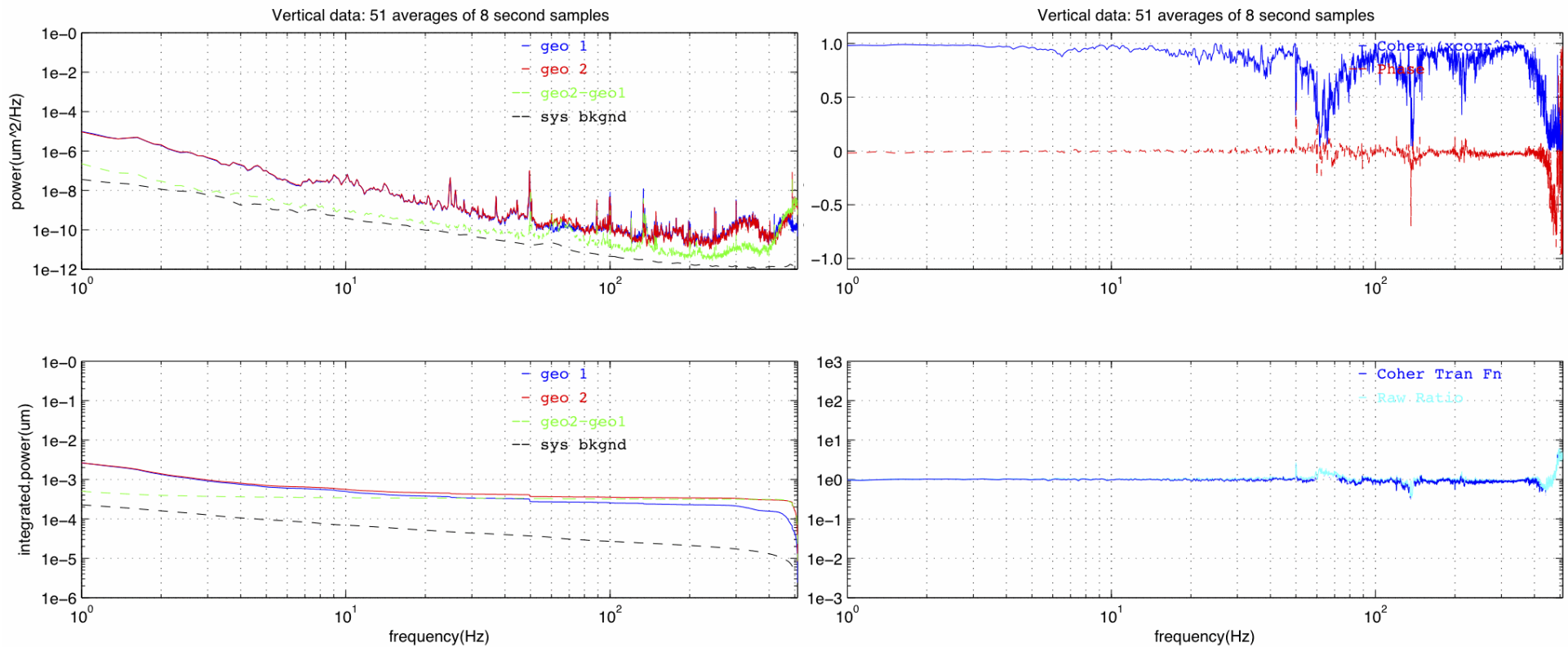
Buildings	Zone Code	Short Description	Situation	Card	Request	Doimeter	Courses	Exception	Rate	Access Granted
N/A	LHC-TUN	Access to LHC Tunnel Areas	+	+	+	+	+	+	+	+
<b>POINT 1 LHC/LEP</b>										
Buildings	Zone Code	Short Description	Situation	Card	Request	Doimeter	Courses	Exception	Rate	Access Granted
2127	ATL_US	US15 - ATLAS racks in machine zone	+	+	+	+	+	+	+	+
2175	ATL_SRL1	ATLAS SRL	+	+	+	+	+	+	+	+
3125	ATL_USA	USALS - ATLAS service cavern	+	+	+	+	+	+	+	+
3126	ATL_TOR	Toroid area in ATLAS detector	+	+	+	+	+	+	+	+
3126	ATL_UX	UX15 - ATLAS detector cavern	+	+	+	+	+	+	+	+
3162	ATL_CR	ATLAS CONTROL ROOM	+	+	+	+	+	+	+	+
3178	AT_SDX1	Trigger and Data Acquis/5th	+	+	+	+	+	+	+	+
3185	ATL_RBZ	BUFFER ZONE	+	+	+	+	+	+	+	+
3185	ATL_SX1	SX1 building	+	+	+	+	+	+	+	+
<b>POINT 1.8 LHC/LEP</b>										
Buildings	Zone Code	Short Description	Situation	Card	Request	Doimeter	Courses	Exception	Rate	Access Granted
2173, 3152	SM18	LHC Test Hall	+	+	+	+	+	+	+	+
3173	SMA18	LHC Assembly Hall SMA18	+	+	+	+	+	+	+	+
3173	SMA18-BHX	Stockage et travail TE-VSC (TASBaccif)	+	+	+	+	+	+	+	+
3173	SMA18-VSC	Stockage et travail TE-VSC	+	+	+	+	+	+	+	+
<b>POINT 2 LHC/LEP</b>										
Buildings	Zone Code	Short Description	Situation	Card	Request	Doimeter	Courses	Exception	Rate	Access Granted
2228	ALJ_UX	caveme experimentale ALICE	+	+	+	+	+	+	+	+
2252	ALJ-CLR	Clean Room 2252/R-E21	+	+	+	+	+	+	+	+
2285	ALJ-ACR	Room 2285/R-207	+	+	+	+	+	+	+	+
2285	ALJ-COP	Room 2285/R-C19	+	+	+	+	+	+	+	+
6595	ALJ-CR1	Building 6595	+	+	+	+	+	+	+	+
6596	ALJ-CR2	Building 6596	+	+	+	+	+	+	+	+
6597	ALJ-CR3	Building 6597	+	+	+	+	+	+	+	+
6598	ALJ-CR4	Building 6598	+	+	+	+	+	+	+	+
N/A	ALJ-CR5	GAS DISTRIBUTION AND SAFETY RACKS	+	+	+	+	+	+	+	+
<b>POINT 4 LHC/LEP</b>										
Buildings	Zone Code	Short Description	Situation	Card	Request	Doimeter	Courses	Exception	Rate	Access Granted
N/A	LHC-RP	Rf area of the LHC in POINT 4	+	+	+	+	+	+	+	+
<b>POINT 5 LHC/LEP</b>										
Buildings	Zone Code	Short Description	Situation	Card	Request	Doimeter	Courses	Exception	Rate	Access Granted
3524	CMS-USC	CMS USC	+	+	+	+	+	+	+	+
3524	CMS-LAS	CMS LASER ROOM	+	+	+	+	+	+	+	+
3525	CMS-UAC	Access to CMS UAC'S cavern	+	+	+	+	+	+	+	+



# Measurements



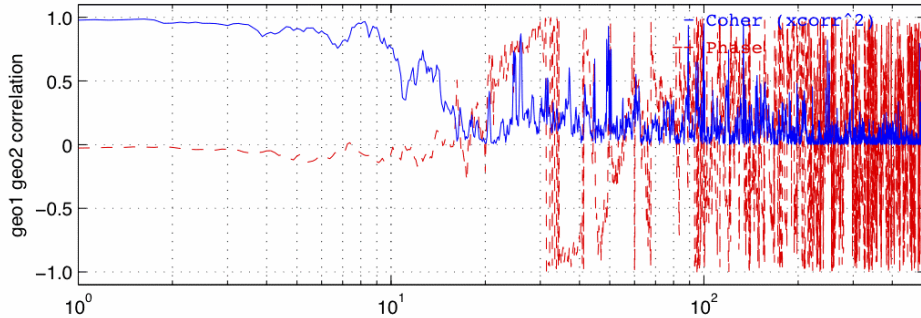
# Sensors Together



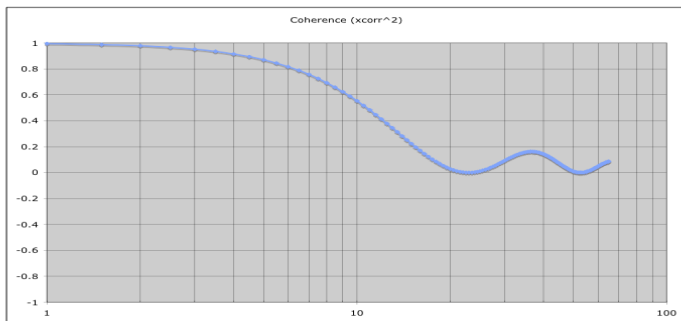
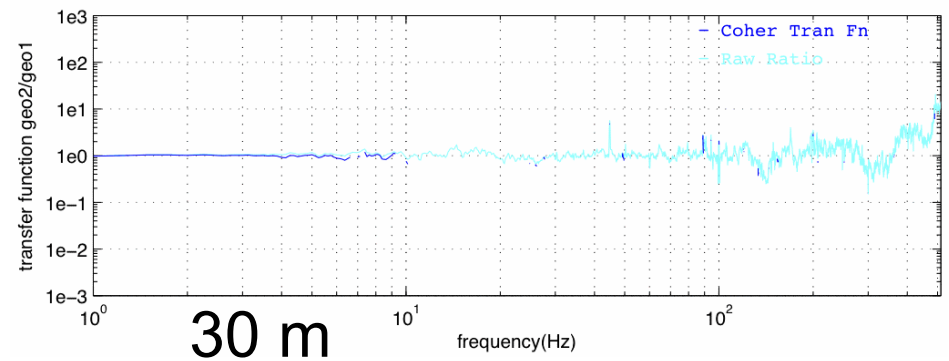
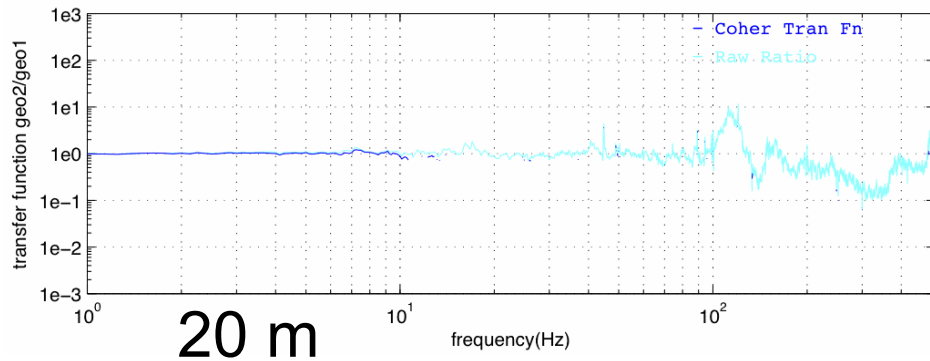
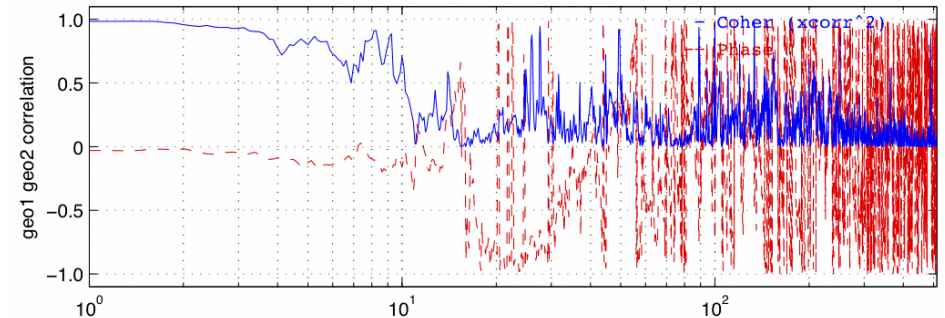
- Surprisingly low vibration levels ( $\sim 10\times$  below SLC)
- Good agreement between sensors
- Probably slight aliasing above 200 Hz

# Sensors Separated

Vertical data: 128 averages of 8 second samples



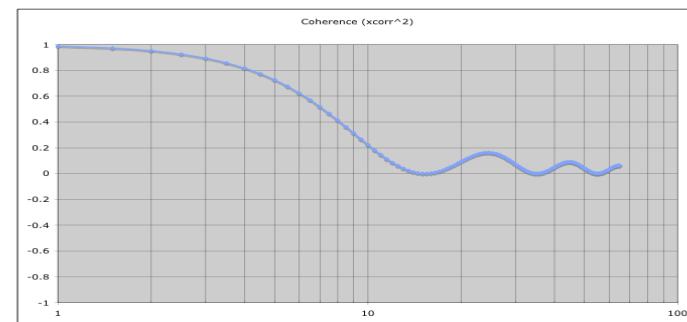
Vertical data: 128 averages of 8 second samples



Model

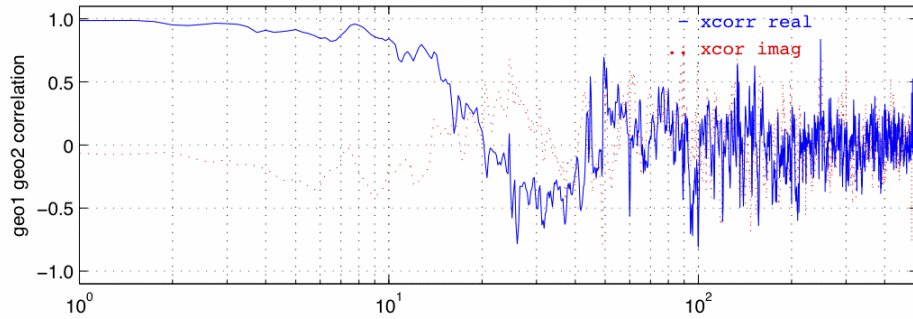
$$J_0^2\left(\frac{\omega L}{v}\right)$$

$v \sim 1200 \text{ m/s}$

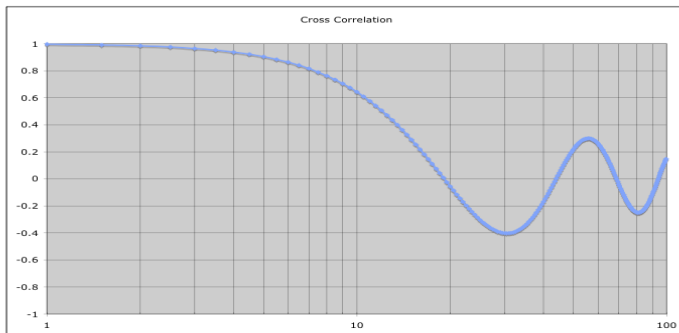
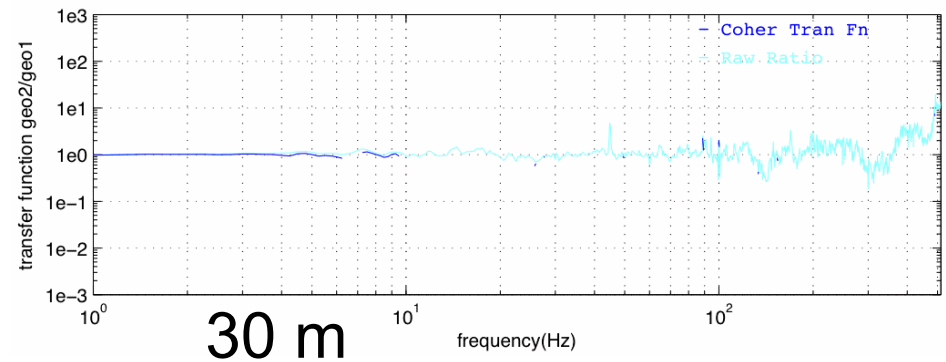
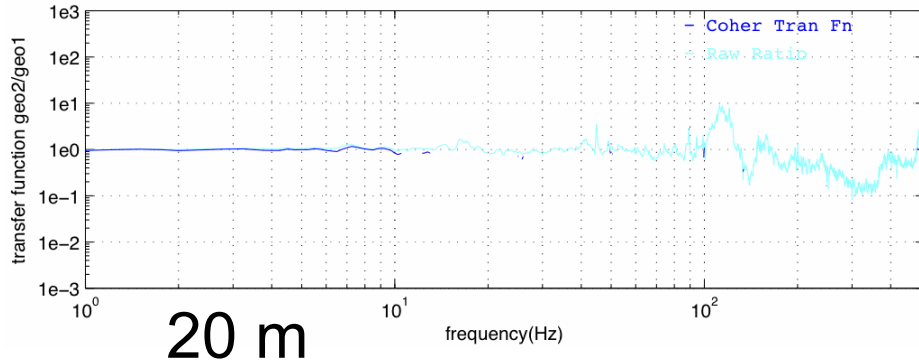
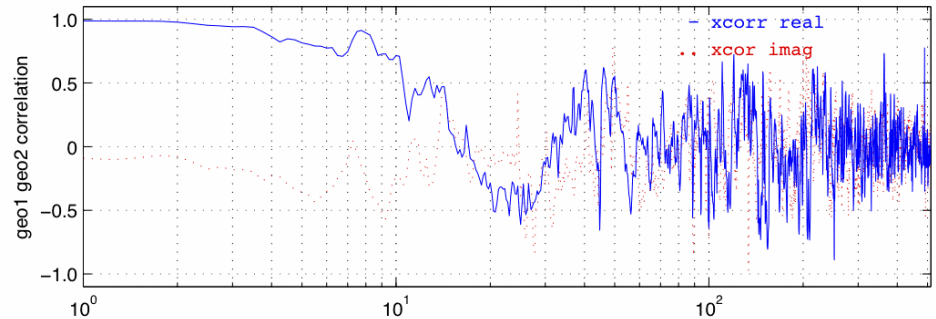


# Sensors Separated

Vertical data: 256 averages of 4 second samples



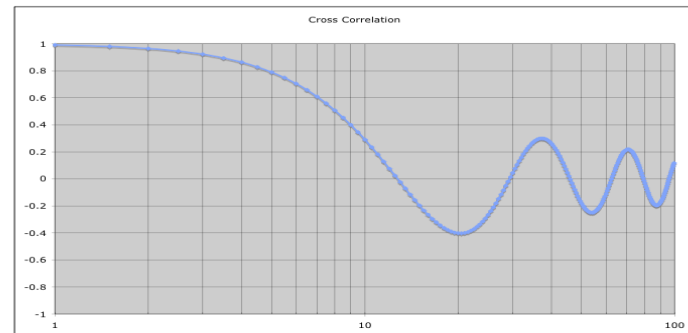
Vertical data: 256 averages of 4 second samples



Model

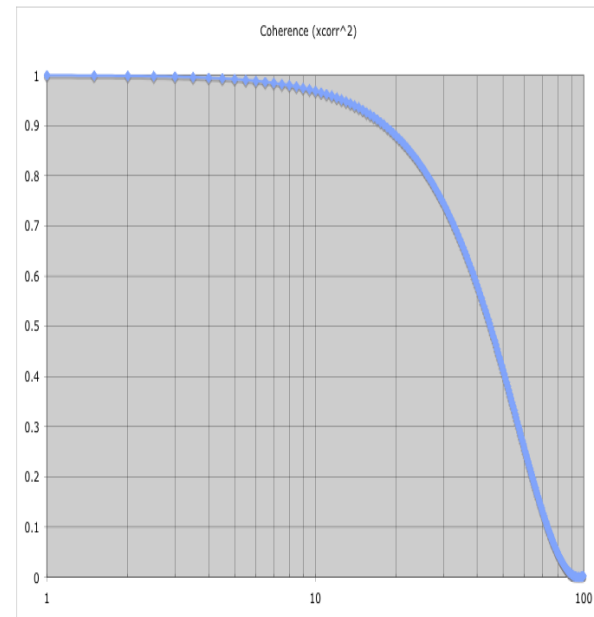
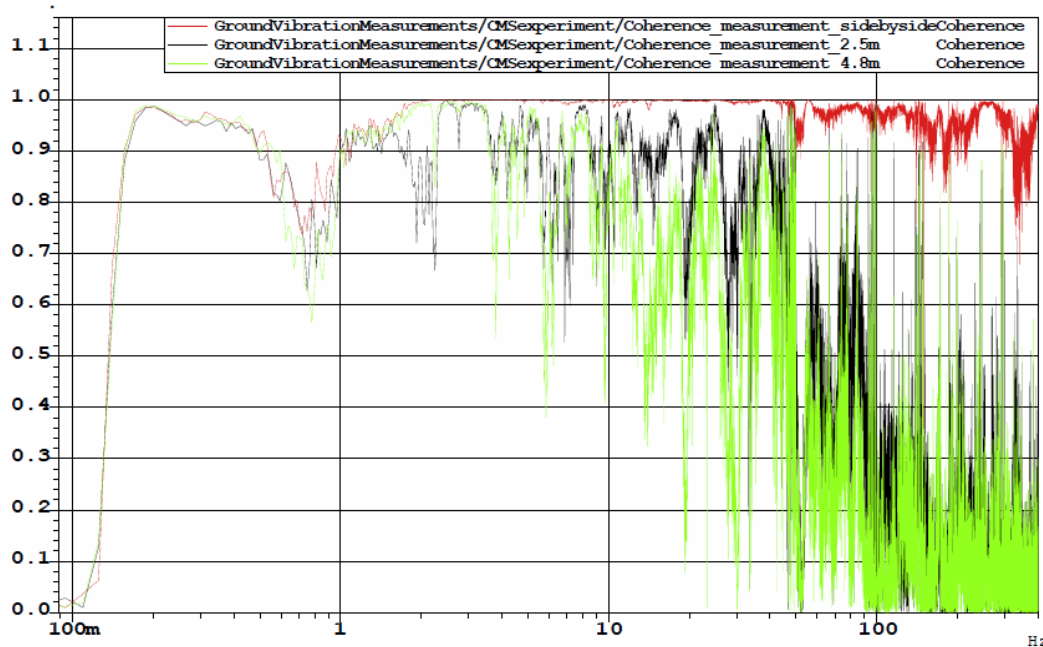
$$J_0\left(\frac{\omega L}{v}\right)$$

$v \sim 1000 \text{ m/s}$





# Previous CMS Cavern Data

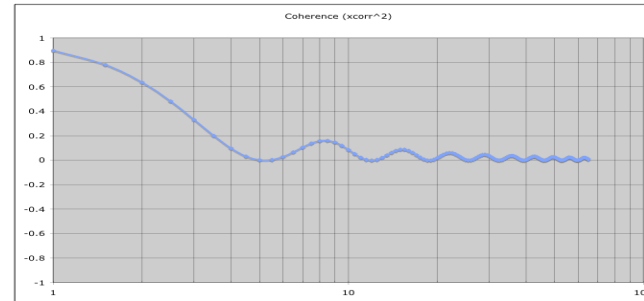
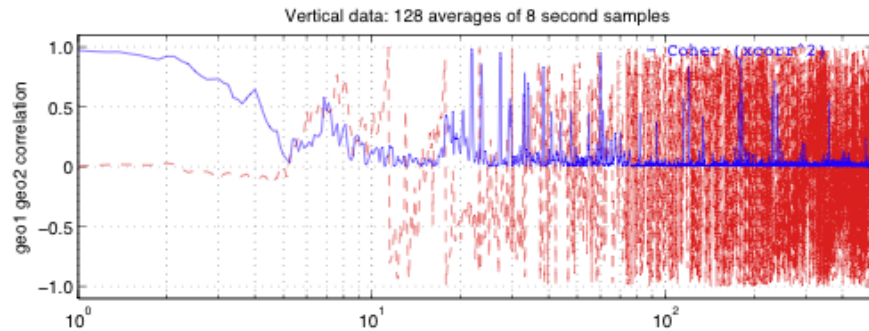


$$\text{Model } J_0^2\left(\frac{\omega L}{v}\right)$$

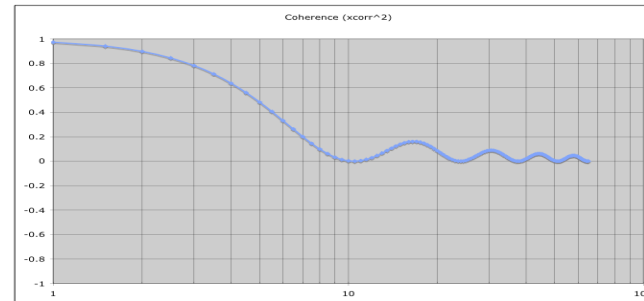
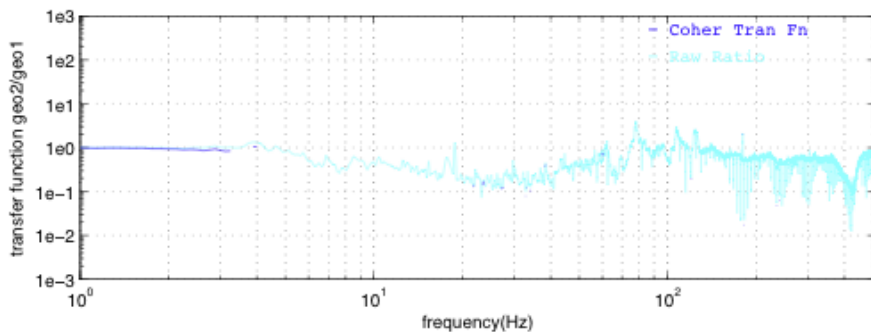
$$L=4.8 \text{ m, } v\sim 1200 \text{ m/s}$$

- Null for 4.8 m is  $\sim 100$  Hz, roughly consistent with  $v\sim 1200$  m/s
- Data from A. Kuzmin, "Ground vibration measurements and Experimental parts motion measurements at CMS", CERN EDMS 1027459, 07-12-2009

# Previous SLC Data



Model:  
300 m/s



Model:  
600 m/s,  
or 1200  
m/s and  
2x path

- Sensors in FF tunnels ~22 m apart
- Coherence consistent with
  - Air transmission?
  - 2x-4x path length??

