

Hump investigations status

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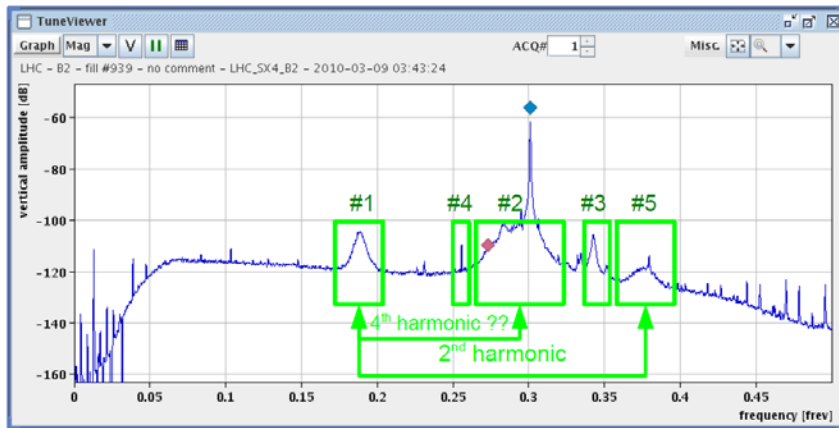
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The hump



Effects seen so far III – Correlation between Humps I/II

- If structure '#5' is a true second harmonic of '#1' → width difference would give an indication on the base-band origin of the effect
 - Central frequency #1: $0.185 f_{rev}$ or ~ 2 kHz
 - Shifting the tune out this region would help for the diagnostics

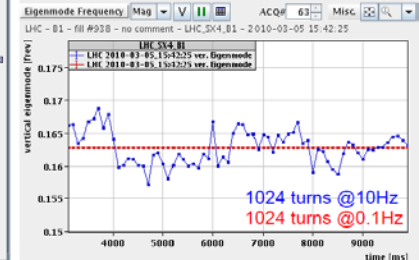
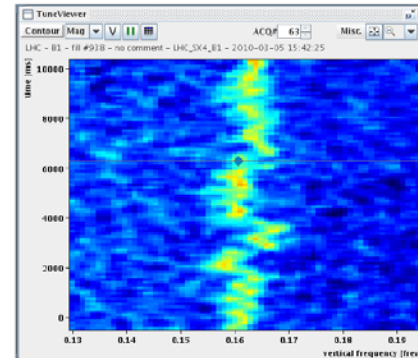


5



Effects seen so far IV

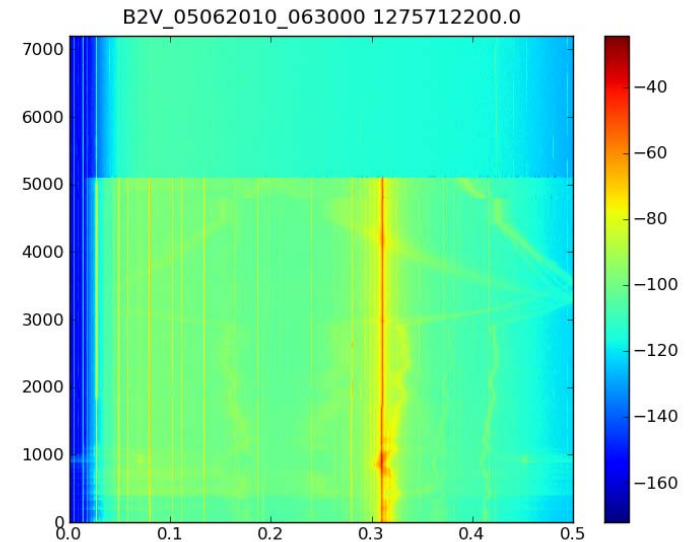
- Structure of the perturbation depends on the observation time-scale, e.g.
 - 0.1 Hz b → broad 'hump', or
 - 10 Hz acquisition BW → narrow-bandwidth line with shifting mean frequency
- Here, 'Hump' at $0.16 f_{rev}$:



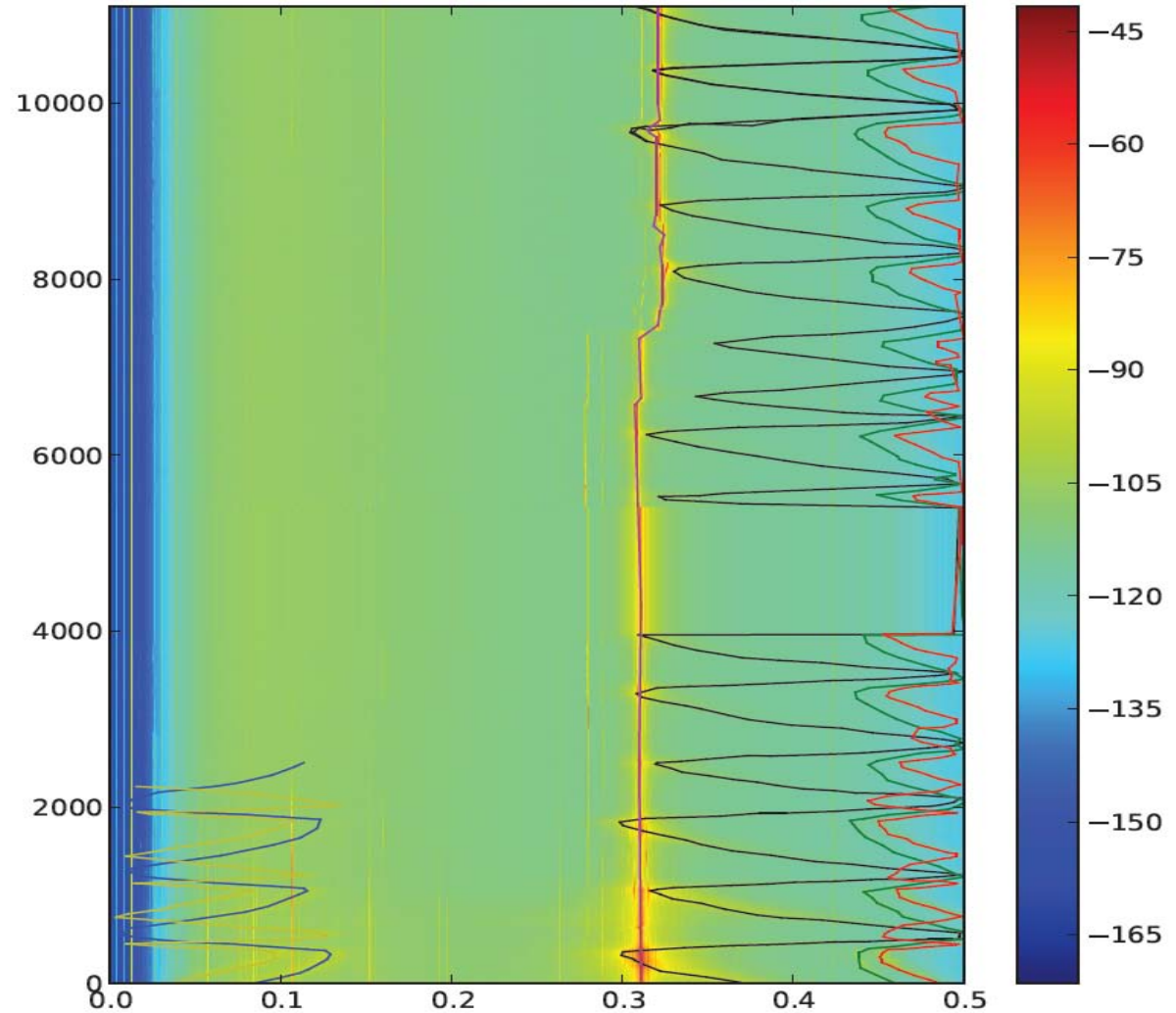
R. Steinhagen @ LMC

The hump and not only

- Frequencies visible in the beam:
 - 250, 288 (could be related to TI2/8 pulsing), 300, 313, (could be related to TI2/8 pulsing), 550, 651, 850, 951, 1203, 2167, 2224, 2628, 2685, 2966, 3146, 3881, 3939, 4169, 4619, 5096, 5399, 7988
 - Some other lines are visible but not correlated with beam (i.e. noise in the instrumentation)
 - Only some of the multiples of 50 Hz are visible
 - 8 kHz is visible
 - Some other lines not identified (related to various UPS types?)

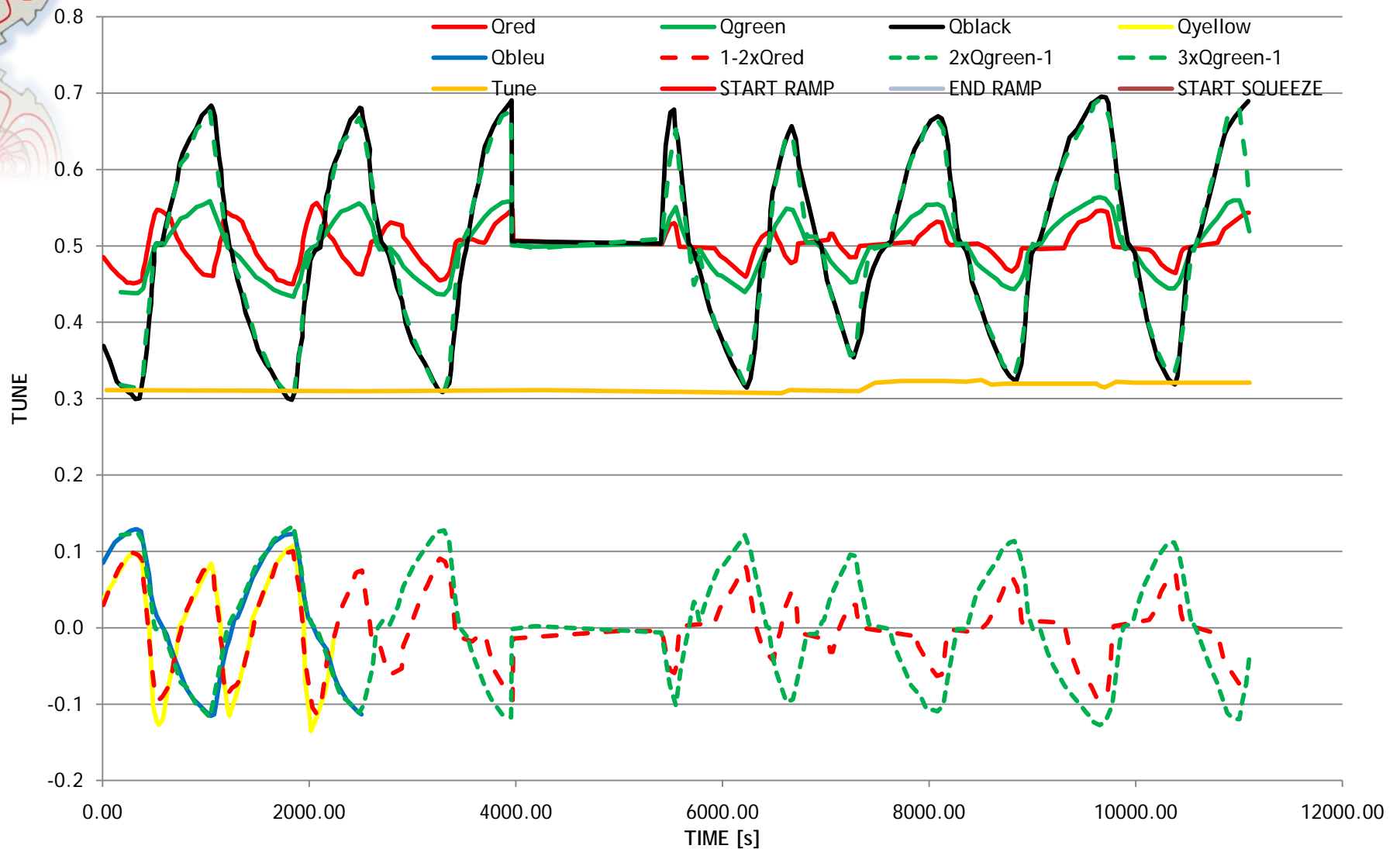


The hump



R. De Maria

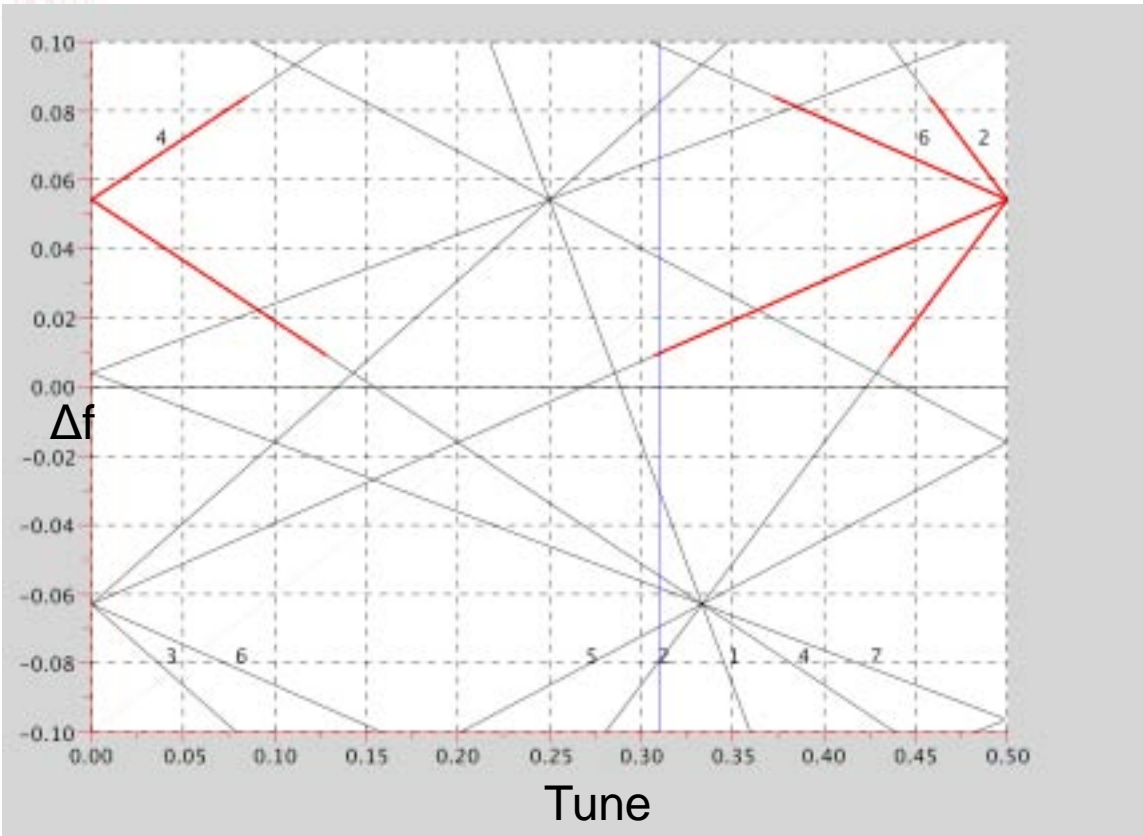
The hump



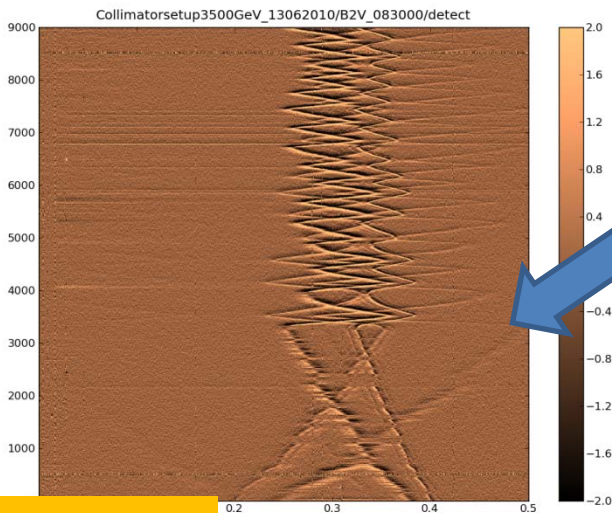
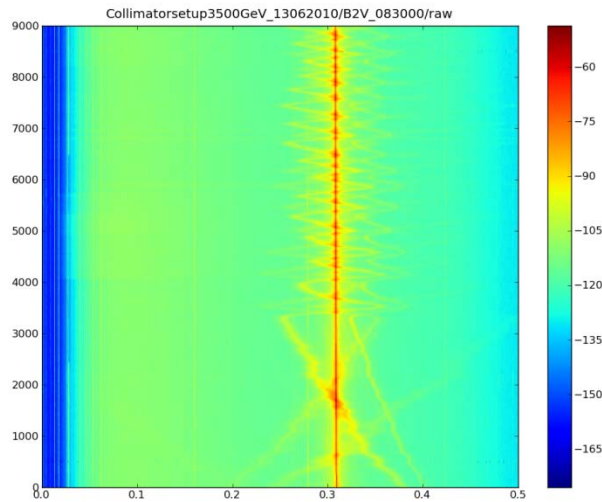
No evident dependence of the hump lines vs. energy → low harmonic or RF related

Frequency sweep of 8kHz & harmonics

- Spectrum compatible with :
 - Harm. 2, 4, 6
 - Frequency sweep 1-8 %
 - 8 kHz absent
 - Odd harm. Absent
- If suspect not UPS@8kHz:
 - Lines near tune 0 and 0.5 + reflections from above imply $f > f_{rev}/2 = 5.5 \text{ kHz}$
- We may consider a sick UPS box
 - Dead or crazy clock
 - Thyristors running around 16 kHz
- Measurements in the tunnel (during technical stops) ongoing to characterize UPS noise and to identify possible locations with noisier UPSs

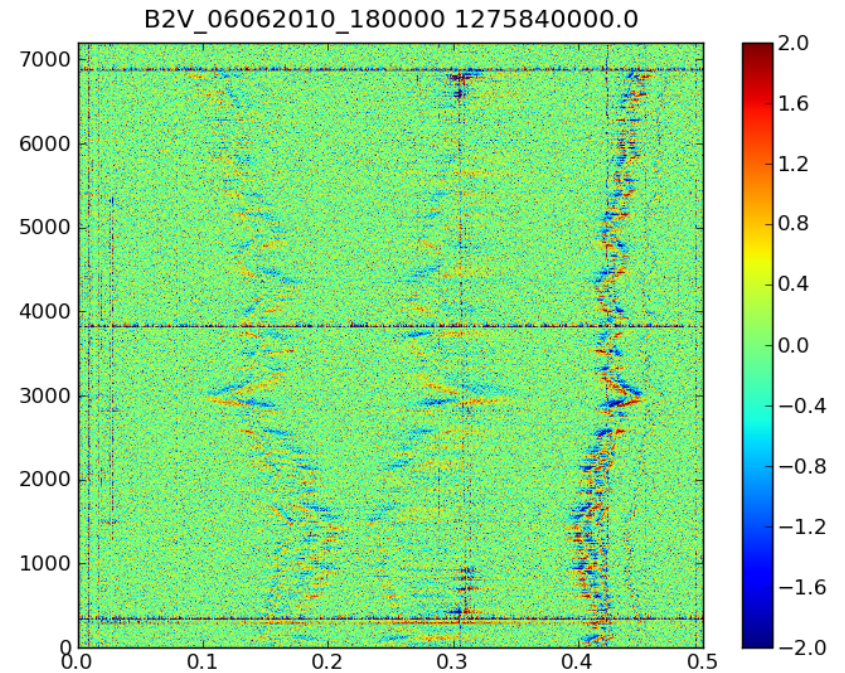
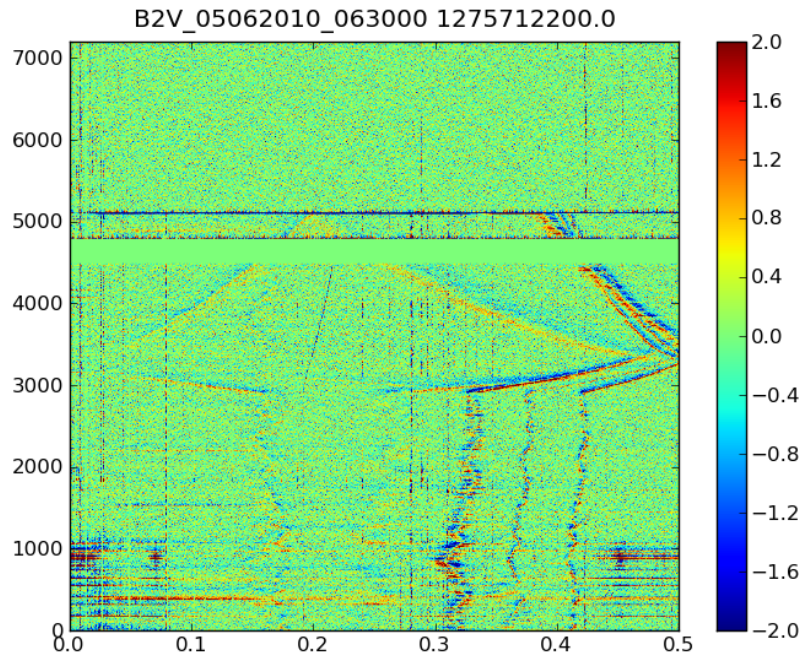


The hump is there all the time

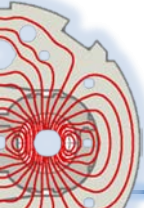


- But with different patterns more or less disturbing for the beam according to the amount of overlap with the tune...
- Correlation with events changing the structure is important (ongoing for some of the cases observed) → need fixed display → work starting

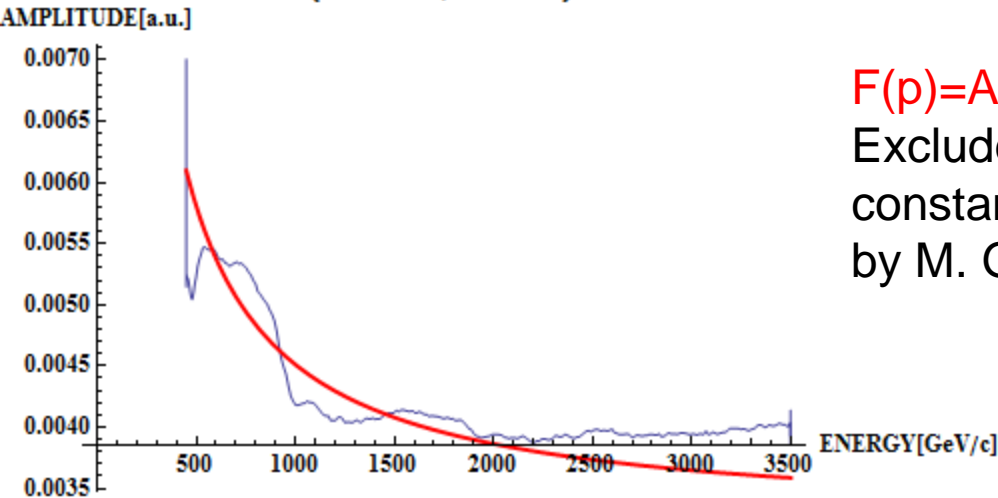
The hump is there all the time



Momentum dependence during the ramp

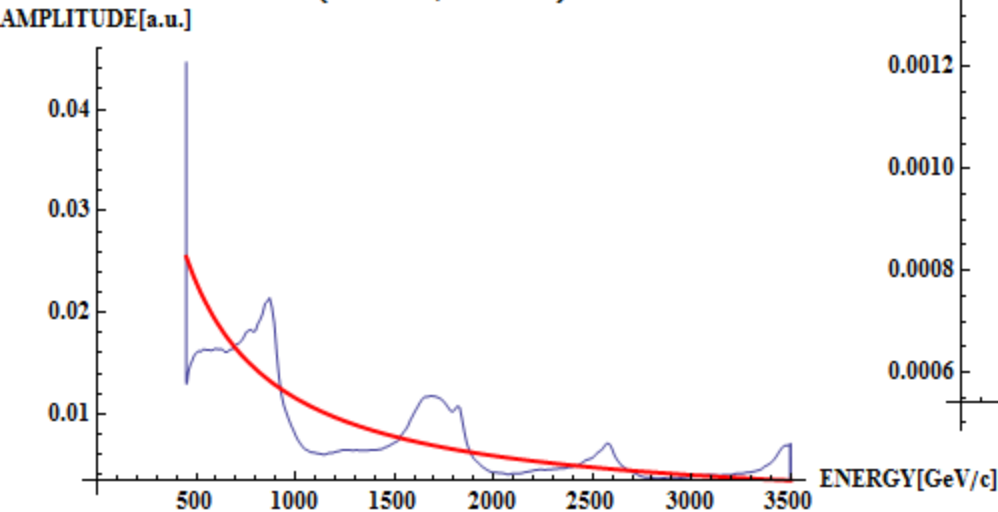


{0.0439453, 0.151367}

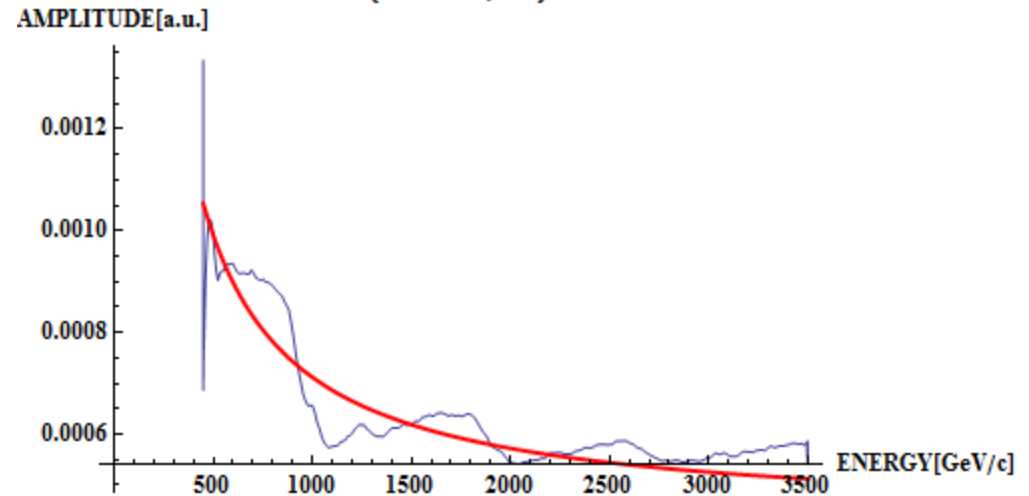


$F(p)$ = Average Amplitude at 450 GeV / p
Excludes mechanical vibrations with constant amplitude (measured in the triplet by M. Guinchard and team)

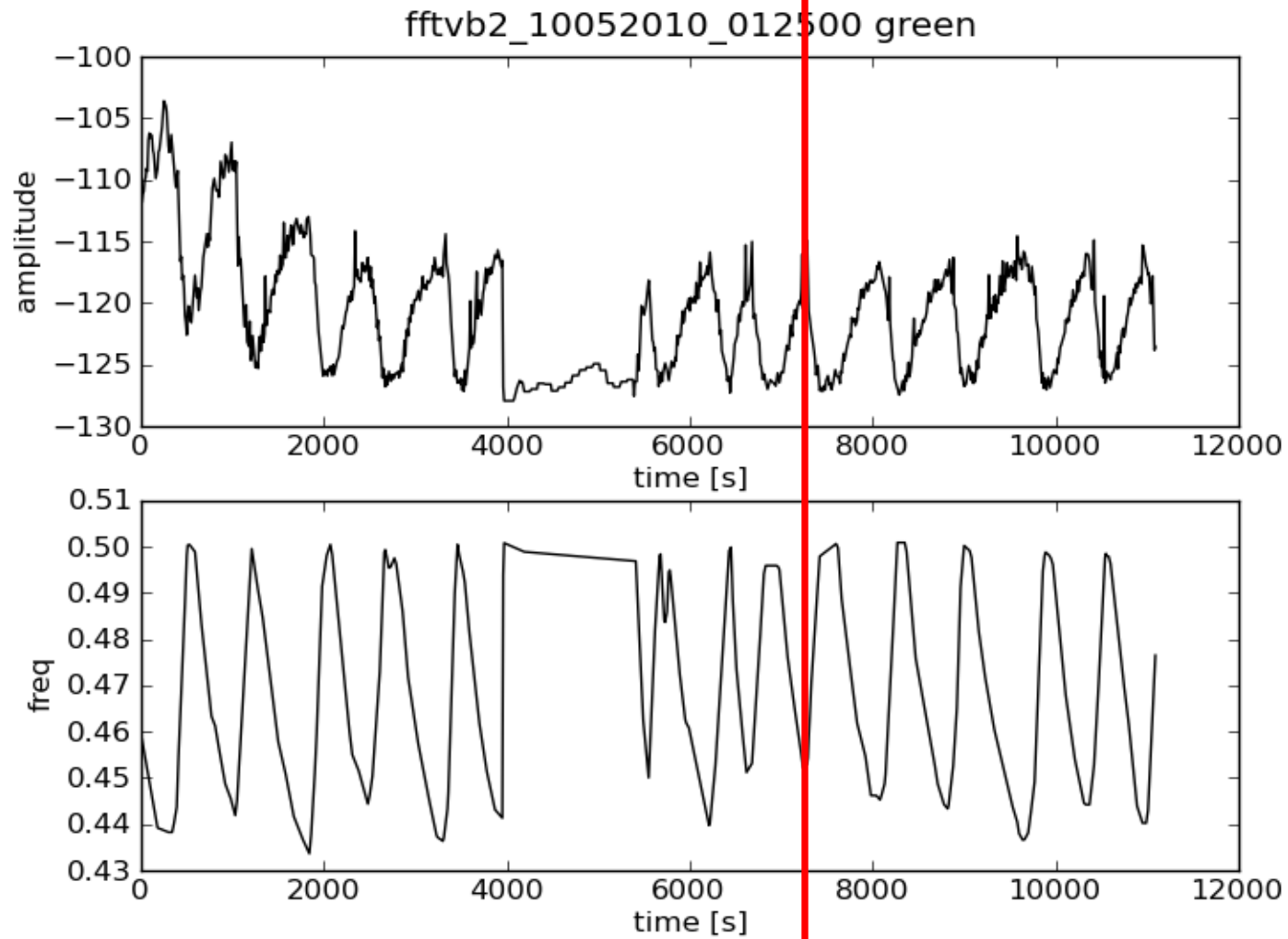
{0.279541, 0.427246}



{0.427246, 0.5}



Squeeze



No localized source in the insertions in IR1/2/5/8

No evident effect (preliminary) of:

- RF cavities voltage distribution
- MKI kickers
- Beam screen cooling in the triplets (consistent with observations on the squeeze)

Being further analyzed

Correlation of T12/T18 pulsing with low-frequency noise (~300 Hz)



Ongoing / To be done

- Fixed display and temporal correlation with other parameters
 - Effect of orbit on RF → to rule out completely RF
 - Effect of GSM network and its surveillance (tentatively on Thu?)
 - BLM signals and noise evaluation (ongoing with Mariusz)
 - Schottky

 - Noise map in the tunnel and spectral characterization of the UPS EM noise for the different models and understanding of possible failure modes
 - Sources of low frequency part of spectrum → EPC (MSD,MSI)

 - Hump dumping (implies noise reduction)
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