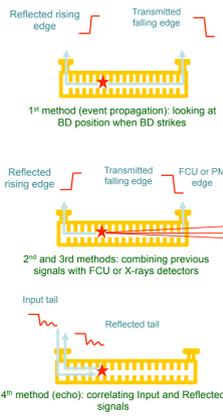


BD Cell location with RF signals

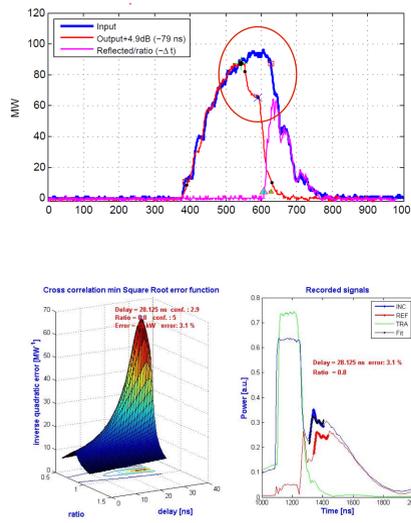


- Quite sensitive to threshold detection levels (~3ns/cell)
- Based on assumption that transmission falling edge and reflected raising edge are simultaneous events when BD
- Based on the assumption that electrons and X-rays emissions are synchronous with structure RF characteristics modifications when BD
- Very accurate (based on signals correlation)
- Confidence measurable
- Relies on a signal structure on the pulse tail.

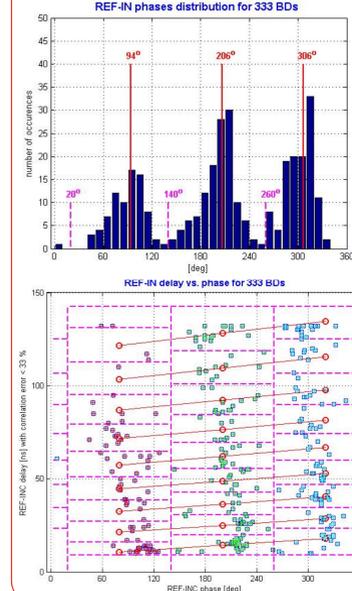
Nota:

- the 3 first methods detect the BD location at its onset, the 4th method at the end of the RF pulse (meanwhile the BD can have migrated).
- No information can be gained on the transverse position of the BD

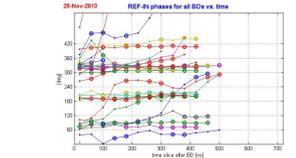
Considering the above limitations/uncertainties alternative BD location methods are to be sought.



Refinement using RF Reflected phase

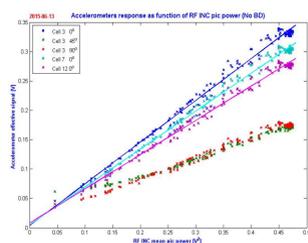
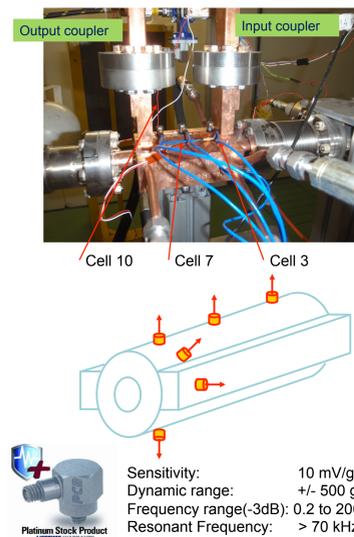


- Phase of the reflected signal after BD are distributed on 3 groups ($2\pi/3$ phase advance structure)

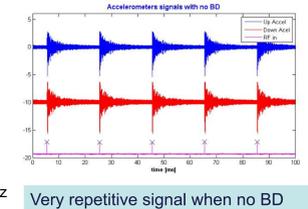


- Phase information is used to reallocate BD to adjacent cells, correcting time measurement inaccuracy.

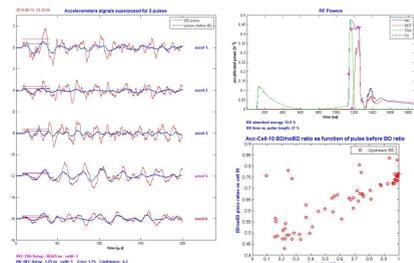
BD Cell location with acoustic signals



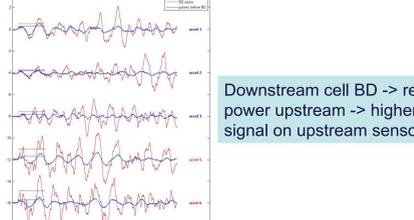
rms acoustic signal as function of RF power for various location



Very repetitive signal when no BD

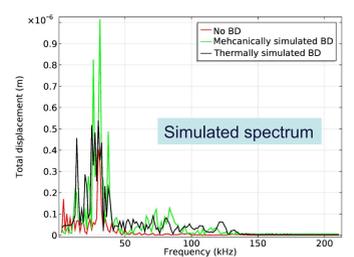
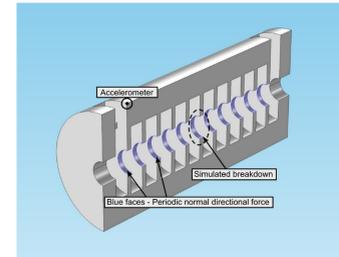


Upstream cell BD -> missing RF power downstream -> lower acoustic signal on downstream sensor

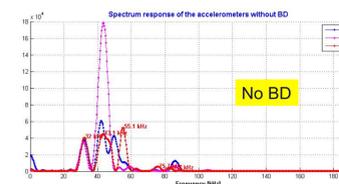


Downstream cell BD -> reflected RF power upstream -> higher acoustic signal on upstream sensor

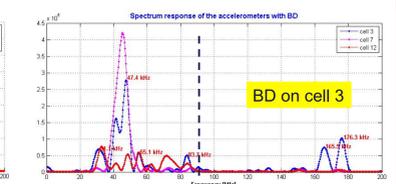
Structure vibration model



No BD: excitation by thermal expansion applied on all the irises
BD: excitation on the central iris only

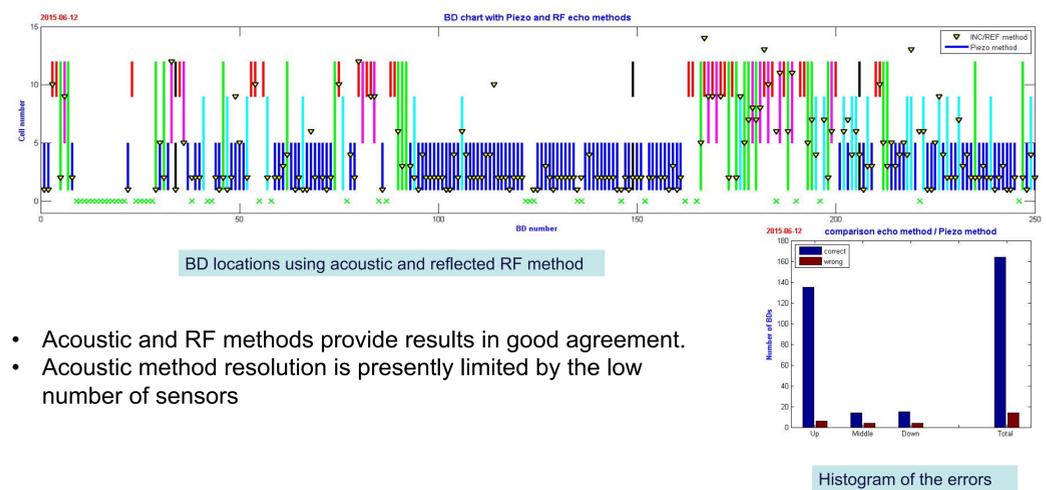
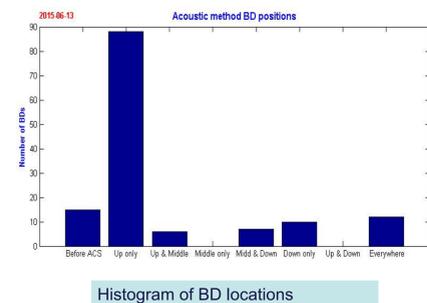
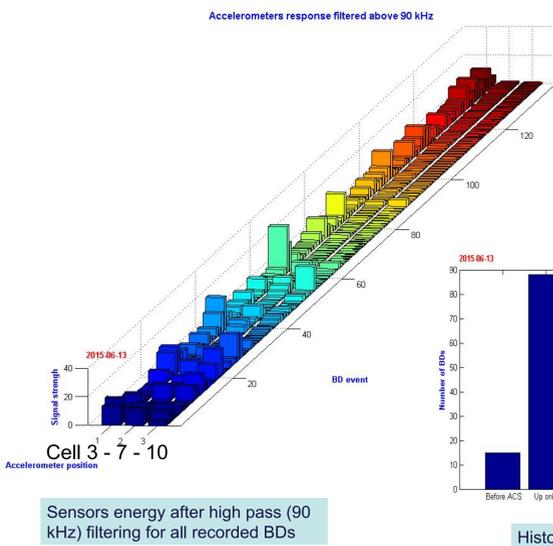


Measured spectrum



Comparison of the results

- So far time delay location method with acoustic signals as not been successful (complex wave propagation in such a structure). But possible: ref 1, 3, 5.
- Method of maximum detected signal was used instead -> increase the number of sensors for higher resolution, and azimuthal resolution also.



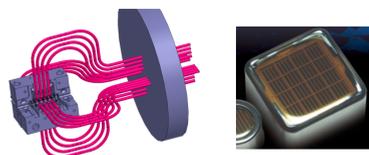
- Acoustic and RF methods provide results in good agreement.
- Acoustic method resolution is presently limited by the low number of sensors

Possible future BD localization methods

Time resolved methods are required to understand the dynamic of multiple BDs during a pulse, as BD migration.



Injection of an HOM continuous wave modulated for unambiguous cross-correlation with its reflected signal



Light detection in each cell of the structure, via optic fibre and segmented photo-multiplier

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