# ALTERNATIVE DIGITIZATION APPROACH FOR STEREO PHONOGRAPH RECORDS USING OPTICAL AUDIO RECONSTRUCTION

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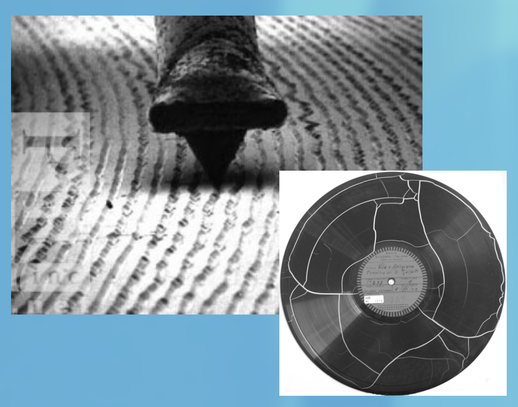
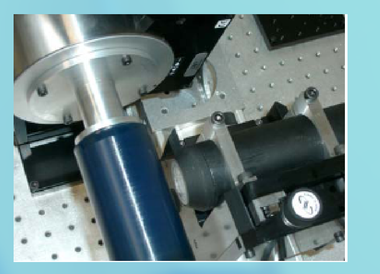
## Motivation

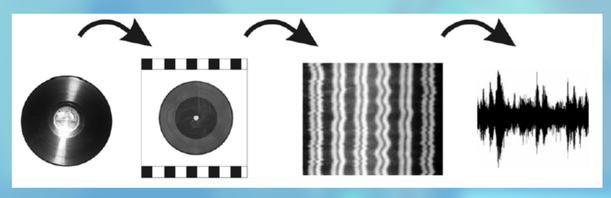


**Optical Audio Reconstruction:**
the only way to digitize
broken phonograph records

## Related Work

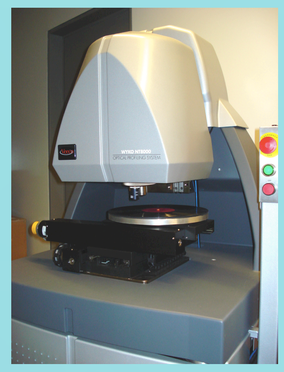


**Lawrence Berkeley National Laboratory:**
Wax cylinder, **Mono**
Confocal microscope

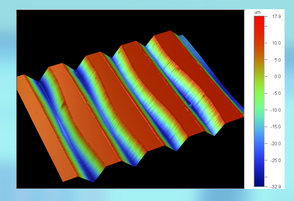


**University of Fribourg:**
78rpm, **Mono**
Microfilm, Scanner

## Our Approach

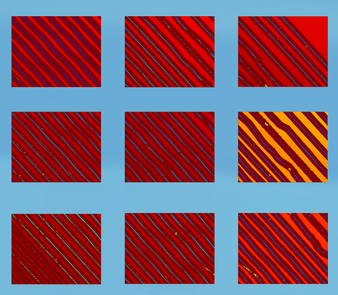


**McGill Image to Audio Conversion (MItAC):**
White-light Interferometer,
Vertical resolution: 1nm
Lateral resolution: 0.1μm



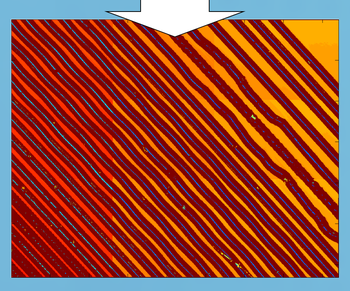
**Digitization for both Mono Records and Stereo LPs:**
Scan 3D info of disc grooves

## Method

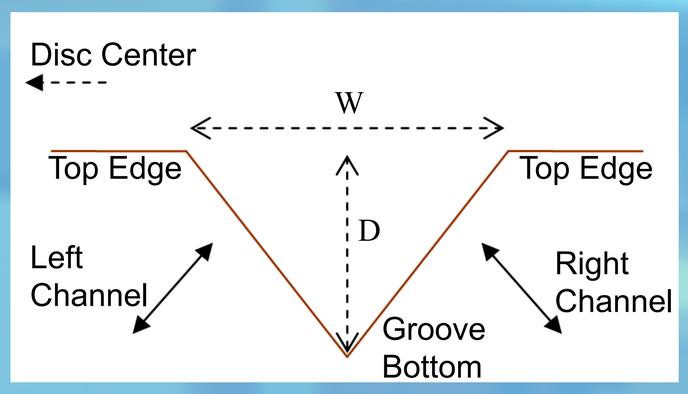


**Scan the large disc area with multiple small Fields of View (FOV: 640x480)**

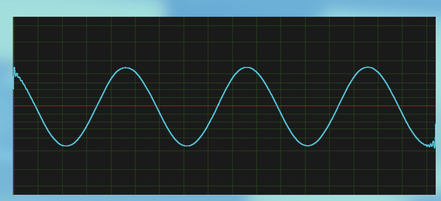
**Stitching**



**Groove recognition:**
Connected Component Analysis

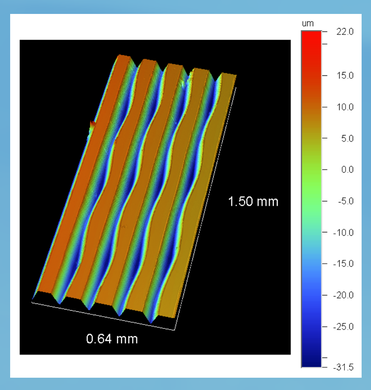



**Numerically differentiate the displacement:**
The stylus velocity.
**Polynomial fit and linear interpolation:**
Fill missing data.

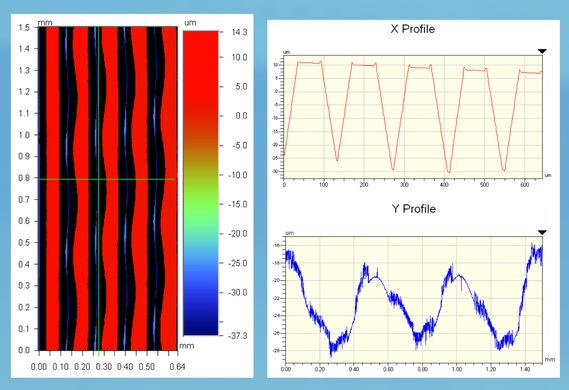


**Sound Signal**

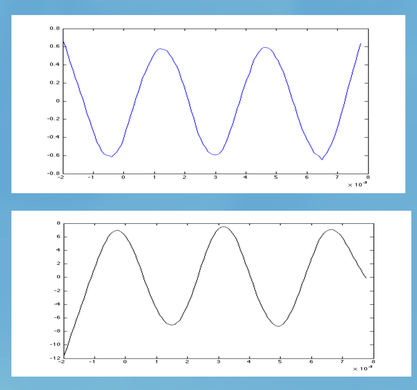
## Results




**The 3D contour view**




**The 2D contour and the cross-section views**



**The lateral and the vertical velocity of the stylus**

**The stereo signal:**
Right channel: a 1kHz sine wave
Left channel: silence
Three FOV-sized stitched frames

## Discussions & Future Work

| | Time to scan one side | Storage space (GB) | Pixel size (μm) | Sampling rate (kHz) |
|---|---|---|---|---|
| **10x Mag.** | 10 days | 173 | 1.0 | 147.8 |
| **100x Mag.** | 3 years | 17,156 | 0.1 | 1490 |

**Future work:**

- Experiments on various records, including broken ones
- Image restoration to improve reconstructed audio quality

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