Breakout_D-4 (can map to issue name later)

Issue: https://github.com/CFDSI/Kickoff_Workshop/issues/#
Related Issues:

Issue Statement: **Aside from providing a benchmark data library, what are the other critical software challenges faced by experimentalists within the fluid dynamics community?**
Discussion topic:
Moderator: Javier Jimenez
Note taker: Adam Steinberg and John Farnsworth
Reporter: John Farnsworth
Group Members:

- *Hassan Nagib*
- *Adam Steinberg*
- *Javier Jimenez*
- *Bob Moser*
- *John Farnsworth*
- *Pino Martin*
- *Federico Toschi*

Please address these topics in your discussion (moderators please make sure that there is enough time to cover all three before the session ends).

1. Describe the problem:

- There is not today a list of software tools=>list needed, experimental software is developed on an as needed basis typically during post-processing.
    - These are typically measurement type/instrument specific
- Experimental software tools are typically opaque (black box) and unknown to the community.
- Sharing and interpreting data (Standardized I/O).
- What data should be stored and archived?
- Difference between raw signals and Quantities of Interest, e.g. PIV images-> velocity fields.
- Interface between experiments and simulations at physical quantities?
- Is it better to create experimental signals from simulations for comparison (i.e. simulate the actual measurements)?
    - Can't be done in all cases?

    - Generalized software frameworks for replicating experimental signals from simulations?
    - Assessment of experimental uncertainties using ‘truth’ data?
- One challenge is converting recorded signals to physical variables in the a manner that robustly describes the uncertainty distribution.
- Are there general categories of algorithms that support different types of diagnostics?
- Is there a catalog of measurement techniques, for each of which one can develop a sustainable piece of software.
- What is the role of the using artificial signals to evaluate experimental techniques?
- There is a lot of commercial software used in standard techniques (PIV, LDV).

2. What are potential solutions?

- Use synthetic data to benchmark experimental software tools (for verification).
- Start seeing elements of measurement ‘tools’ as ‘software’.
- Encourage the creation of alternative open-source software tools to supplement the commercial tools that are available.
- Start with techniques that have less commercial involvement, due to inertia of commercial companies
- Experimentalist should be willing to share their software/post-processing techniques with other experimentalists and computationalists for clarity and to best replicate the presented results.
- The full processing chain (including data corrections) and measurement parameters should be incorporated into the meta-data of archival data.

3. What can CFDSI do to help?

- Share and vett the outcomes of various groups.
- Use/make available synthetic data to aid the development of software.
- Facilitating signal->physical variable conversion software sharing and sustainability.
- Provide good software development practices
- Sustainability, dissemination, and vetting of software for experiments where software is typically application-tool specific and developed on an as needed basis.
- When researchers make available processed data, within the meta data should include not only the full measurement parameters, but the post-processing code utilized (open up the black box).
- For example, there are open-PIV software that are much less mature than commercial software, FDSI could help cultivate better software development of these open-source platforms to help lower the bar for adoption (i.e. cost to entry).

4. Misc ideas so they don't get lost (e.g., Did you find new issues? If yes, create the issues on GitHub!):

- There are some areas where experimentental best practices are needed that software does not provide a solution. ("We need an experimental carpentry course as well.")

5. Summary for report-back (Alternatively, just bold the key points above):

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