ALICE ANALYSIS PRESERVATION

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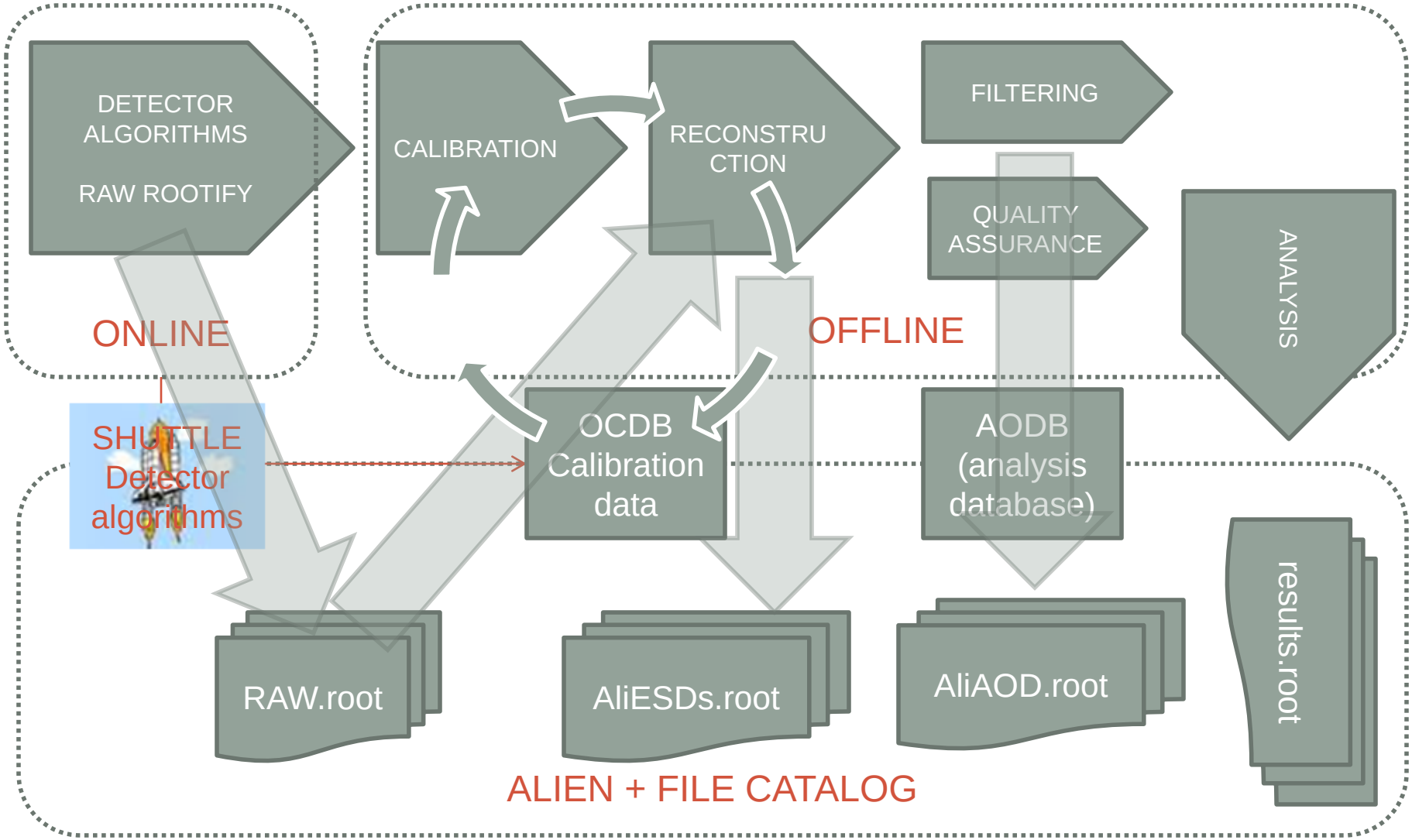
DASPOS/DPHEP7 workshop

Outline

- ALICE data flow
- ALICE analysis
- Data & software preservation
- Open access and sharing analysis tools
- Conclusions

ALICE data flow



Filtering analysis input data

- Event summary data (ESD) produced by reconstruction
  - Can be used as input by analysis
  - Not efficient for distributed data processing (big size, a lot of info not relevant for analysis)
  - Filtering is the procedure to create a lighter event format (AOD) starting from ESD data
    - Reducing the size by a factor of >3
- AOD files contain events organized in ROOT trees
  - Only events coming from physics triggers
  - Additional filters for specific physics channels (muons, jets, vertexing) – producing AOD tree friends (adding branches)
  - Big files (up to 1GB)
- First filtering runs in the same process with reconstruction
  - Filtering can be redone any time on demand
  - Backward compatibility: any old AOD file can be reprocessed with the current version

Base ingredients for analysis

- Code describing the AOD data format
  - AOD event model (AliAODEvent) class library, containing tracks, vertices, cascades, PID probabilities, centrality, trigger decisions or physics selection flags
- AOD data sets
  - Filtered reconstructed events embedding best knowledge of detector calibration
  - Classified by year, collision type, accelerator period, ...
- Run conditions table (RCT)
  - All data relevant for the quality and conditions for each individual run and per detector
  - The base for quality-based data selections
- Analysis database (OADB)
  - Containing "calibrated" objects used by critical analysis services (centrality, particle identification, trigger analysis) + analysis specific configurations (cuts)
- The infrastructure allowing to run distributed analysis
  - GRID, local clusters with access to data, PROOF farms, ...
- Monte Carlo AOD's produced from simulated data
  - Contains both the reconstructed information and the MC truth (kinematics)
  - Almost 1/1 ratio with real data AODs, associated with anchor runs for each data set

What will we need to process data after 10+ years?

- ROOT library
- A minimal versioned lightweight library with the data format and analysis framework
  - Allowing to process the ROOT trees in the AOD files
- The RCT and cross-links from the ALICE logbook (snapshot)
- Relevant AOD datasets (data & MC), produced by filtering most recent reconstruction passes, with the corresponding versioned OADB
- Relevant documentation, analysis examples and processing tools

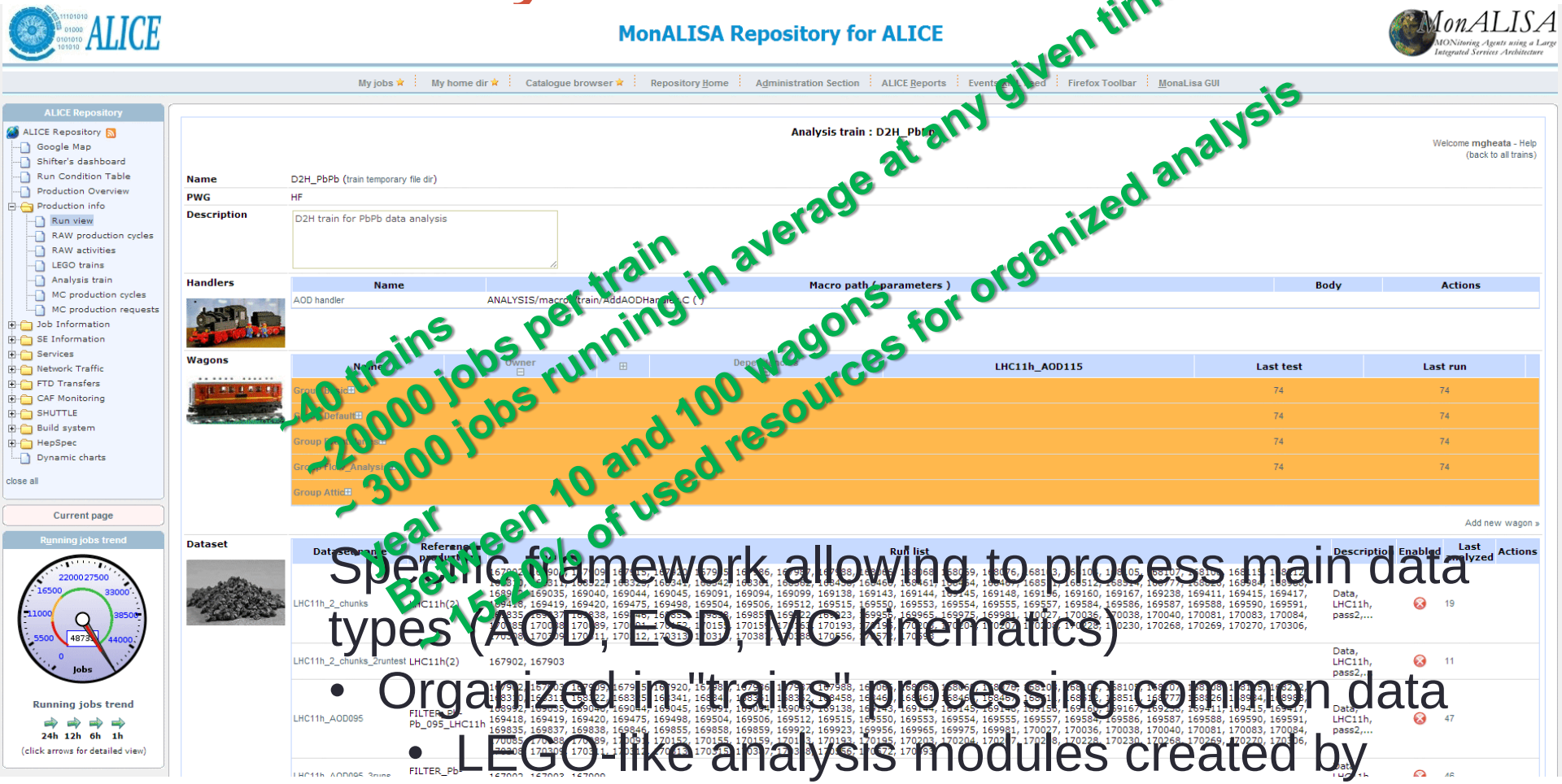
Software preservation

- GPL or LGPL SW based on ROOT
  - Assuming that ROOT will still "exist" and provide similar functionality (such as schema evolution) in 10-20 years
- Single SVN repository for the experiment code
  - External packages: ROOT, GEANT3/4, event generators, AliEn GRID
  - Several work packages bundled in separate libraries (per detector or analysis groups)
- Several production tags with documented changes
  - Multiple platform support
- The documentation describes clearly the analysis procedure
  - The provided documentation is generally enough for a newcomer doing analysis.
- The problems show up after the software is not maintained anymore

Data preservation for analysis

- If reprocessing is needed (improved reconstruction algorithms, major bug fixes, AOD data loss), primary data is needed
  - Raw data, calibration data, conditions metadata
- Most recent AOD datasets
- The metadata related to analysis and run conditions
  - Essential for dataset selection

ALICE analysis shareable tools



- Specific framework allowing to process main data types (AOD, ESD, MC kinematics)
  - Organized in "trains" processing common data
    - LEGO-like analysis modules created by users via a simple web interface
  - ALICE internal usage, too complex for outreach

Level 3 preservation and open access

- A replication of the current analysis LEGO services on dedicated resources is possible
  - Technically feasible in short time (on clusters or clouds)
  - The only problems are related to partitioning data and services for external usage (in case of sharing GRID with ALICE users)
- The procedure to process ALICE data very well documented
  - Several examples and walkthroughs, tutorials
- External code can be compiled on the fly in our framework
  - Simple examples on how to pack in tarballs
- The resources to be assigned for open access still to be assessed by management
  - Like other important details: when, which data, procedure, access control, outcome validation, publication rules...

Data access and sharing

- No external sharing foreseen for RAW, calibration and conditions data
- For analysis formats, a simplification is considered
  - Both for data format and processing SW
- Sharing of data started for level 2 (small samples used for outreach)
  - Not yet for other levels
  - To be addressed during the SW upgrade process
- Time for public data and SW releases not defined at this point

Conclusions

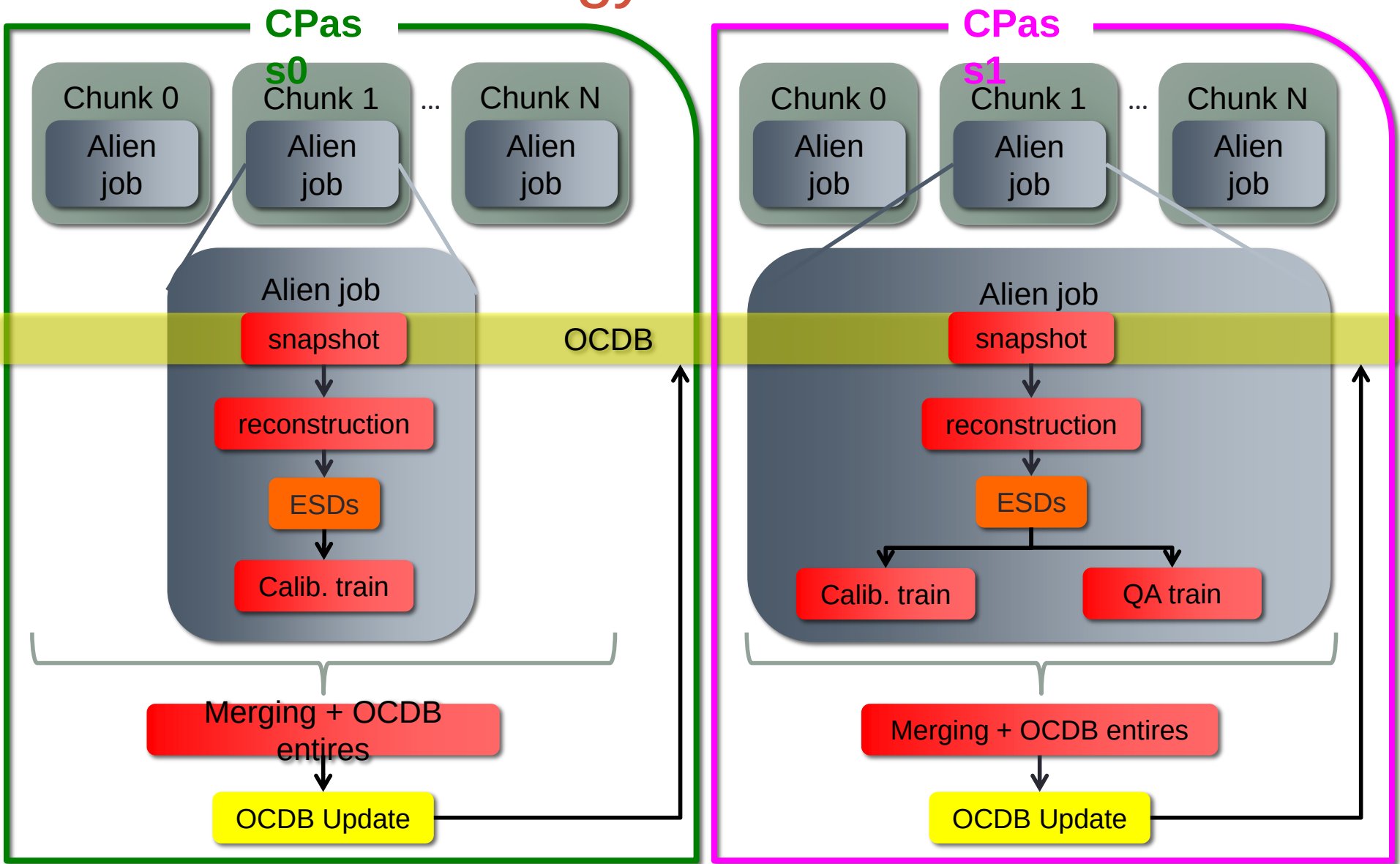
- ALICE is aware on the importance of long term data preservation
  - A medium to long plan to be accommodated in the ambitious upgrade projects
- We are already investigating technical solutions allowing to reproduce results and re-run analysis in 10+ years
  - Using existing tools, but also others (e.g. virtualization technology)
- Sharing of data is possible, but the implementation depends on the availability of resources
  - Practical sharing conditions not considered yet

BACKUP SLIDES

Raw and calibration data

- Raw files are "rootified" on the global data concentrators
- Copied in CASTOR then replicated in T1 - tape
  - /alice/data/<yyyy>/<period>/<run%09>/raw/<yy><run%09><GDC_no>.<seq>.root
- All runs copied, but not all reconstructed
  - Some runs marked as bad
  - The ALICE logbook contains metadata and important bservations related to data taking for each run
- Primary calibration data extracted from online by the "Shuttle" program
  - Running detector algorithms (DA) and copying calibration to OCDB

Calibration strategy – CPass0 + CPass1



Reconstruction

- Input: raw data + OCDB
- Output: event summary data (ESD)
  - Copied in at least 2 locations (disk)
- Content: ALICE event model in ROOT trees
  - Events, tracks with extended PID info, vertices, cascades, V0's, ...
  - Trigger information and physics selection masks, detector specific information (clusters, tracklets)
- ESD format used as input by filtering procedures and analysis
- ESD files can always be reproduced using latest software+calibration -> reconstruction passes
  - Backward compatibility (old data always readable)