



BOOKKEEPING IN ATLAS

HSF DAWG: Metadata discussions
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on behalf of the ATLAS collaboration





- Bookkeeping is a broad and also vague term.
- Will try to present it from the perspective of an analysis.
- The following topics will be covered:
 - Monitoring of processed events for centrally produced and for analysis datasets.
 - Event selection bookkeeping and importance of this information.
 - Challenges in working with fractional datasets.
 - Pile-up reweighting.

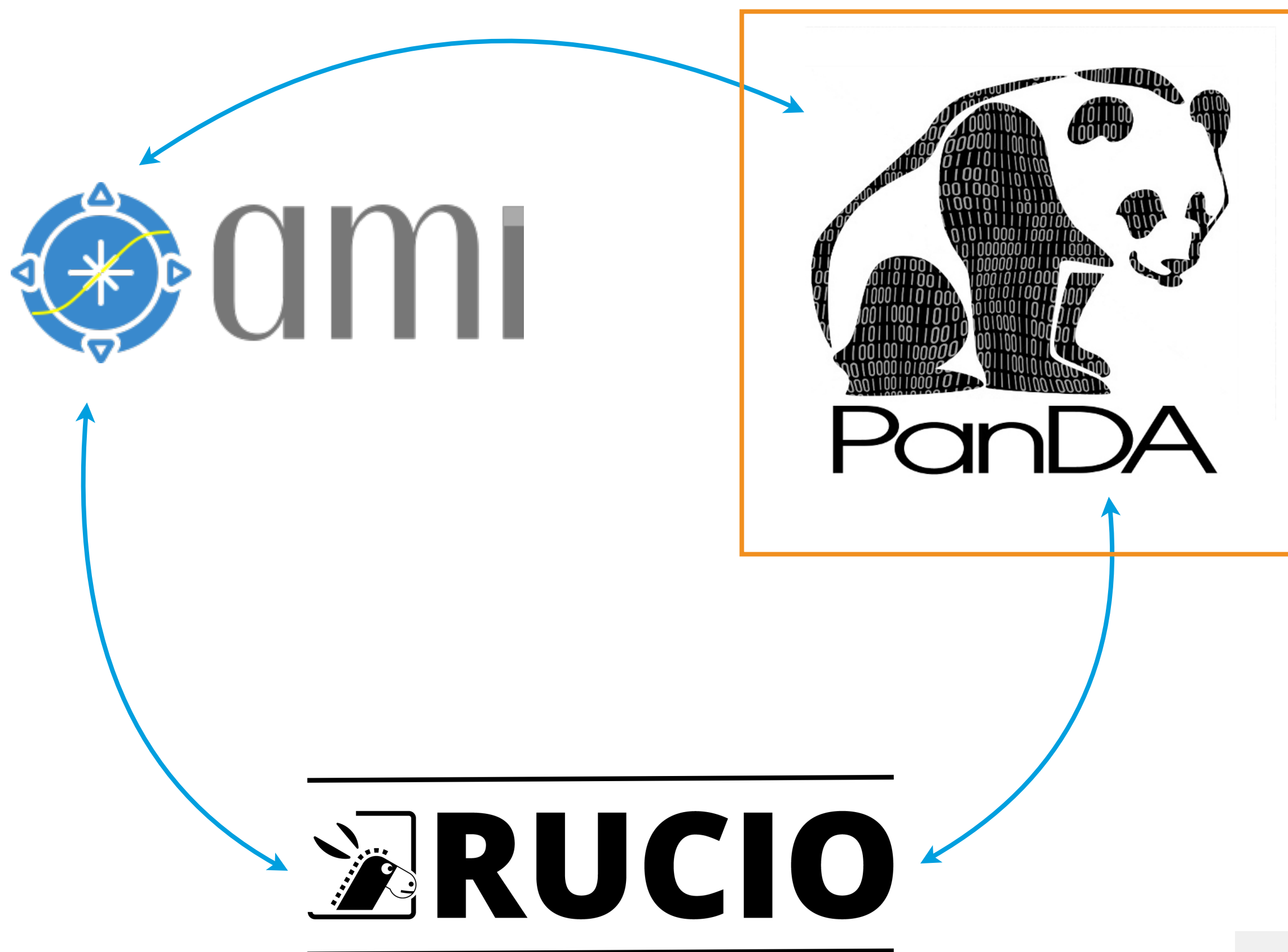


- Interplay of several services.
- Requirements for the analysis:
 - Which samples are there?
 - What is the production status of central samples?
 - What is the status of my jobs?
 - Where are my outputs located and how can I access them?



- Central database of all official ATLAS samples and datasets (no user samples).
- All basic information about a sample (e.g. cross-section, MC generator).
- Tracks **number of events** in a dataset and **production status**.
- Direct interfaces to Rucio and PanDA.

details	LOGICALDATASETNAME ^	PRODSYSSTATUS ^	DATATYPE ^	VERSION ^	NFILES ^
	⌵	⌵ #	⌵ #	⌵	⌵ x ² 
	mc16_13TeV.345060.PowhegPythia8EvtGen_NNLOPS_nnlo_30_ggH125_ZZ4l... #hashtags - Rucio - Provenance - Series	NO EVENTS YET	DAOD_STDM3	e7735_e5984_s3126_r10201_r10210_p4252 Datasets - AMI-Tags	0 Files
	mc16_13TeV.345060.PowhegPythia8EvtGen_NNLOPS_nnlo_30_ggH125_ZZ4l... #hashtags - Rucio - Provenance - Series	NO EVENTS YET	DAOD_STDM3	e7735_e5984_s3126_r9364_r9315_p4252 Datasets - AMI-Tags	0 Files
	mc16_13TeV.345060.PowhegPythia8EvtGen_NNLOPS_nnlo_30_ggH125_ZZ4l... #hashtags - Rucio - Provenance - Series	NO EVENTS YET	DAOD_STDM3	e7735_e5984_s3126_r10724_r10726_p4252 Datasets - AMI-Tags	0 Files 4

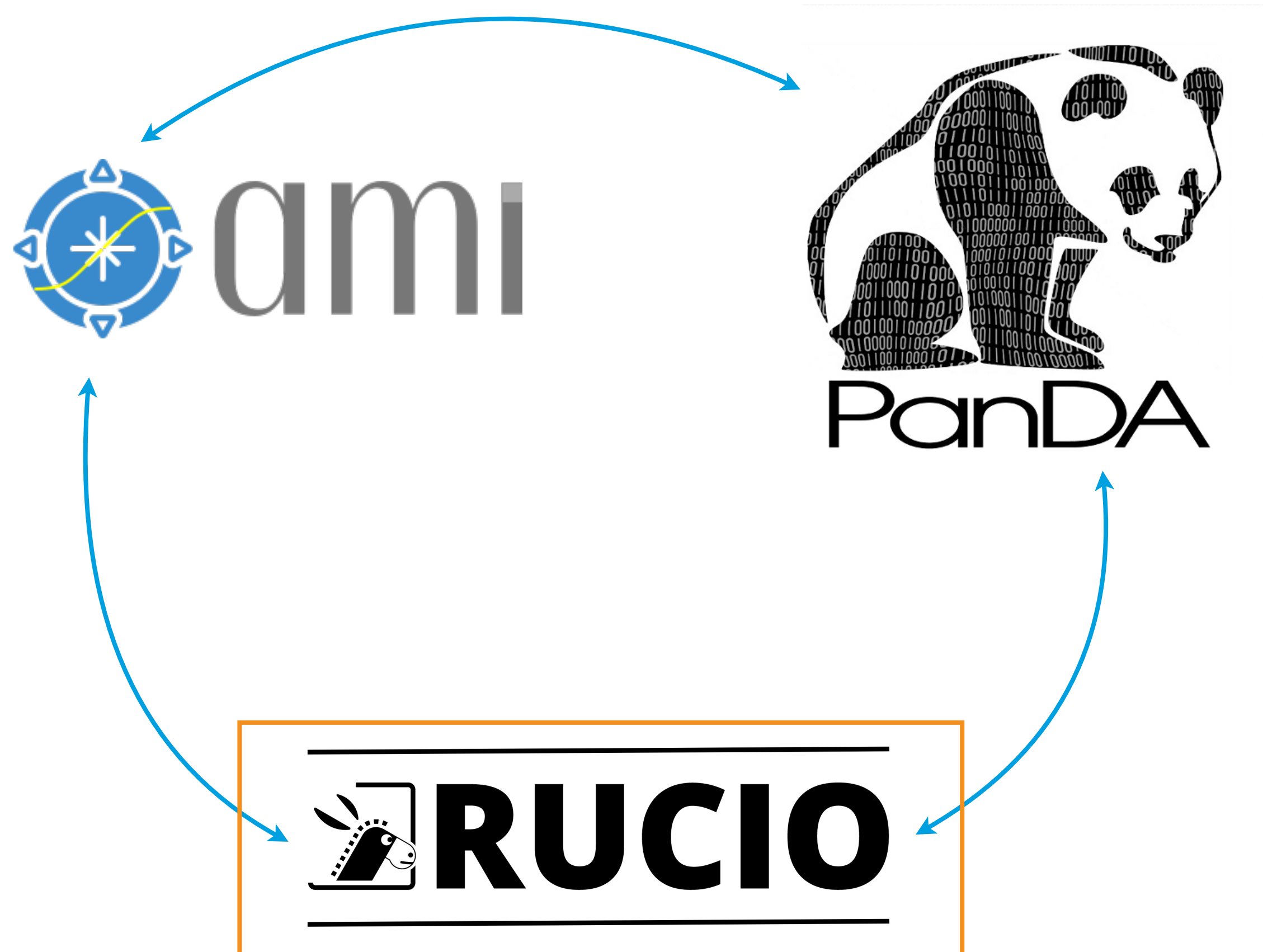


- Bookkeeping of all ATLAS grid tasks and jobs.
- All official and user/analysis tasks are tracked (never deleted!).
- Ensures all events/input files are processed.
- Number of events not always present in the downstream user outputs.

User	Nucleus	Task status	Nevents used	HS06*sec Expected Total done failed	Ninputfiles finished failed	Time stamps: created started last modified
Tadej Novak	—	done	498,606,784 498,606,784 (100%)	14,958,203,520 33,569,687 30,161,297 3,408,390	12110 12110 (100%)	2021-01-04 18:09:27 — 2021-01-06 18:20:34

mc16_13TeV.345060.PowhegPythia8EvtGen_NNLOPS_nnlo_30_ggH125_ZZ4l.deriv.e7735_e5984_s3126_r9364_r9315_p4252
 prod /deriv mc16_13TeV GP_STDM bili JIRA RequestID: 35427 Errors

running
160
18.75%
30
1598000 /
1298375
2021-02-02
08:54:19



- Scientific data management system.
- Manages all datasets.
- Central access to analysis outputs.
- Handles data replications.
- Ability to get local paths or direct URLs for direct access.

Dataset Replicas

Show entries

Search:

RSE	State	Available Files	Available Size	Creation Date	Last Accessed
INFN-FRASCATI_DATADISK	UNAVAILABLE	5	3.56 GB	Tue, 02 Feb 2021 05:44:36 UTC	
IFIC-LCG2_DATADISK	AVAILABLE	10	7.1 GB	Tue, 02 Feb 2021 05:43:46 UTC	

Showing 1 to 2 of 2 entries

Previous Next **6**

- Often datasets are not processed 1:1 but apply selection during the job.
- Software and infrastructure issues can prevent processing 100 % of the events.
- **Important questions for analysis:**
 - When do we care about how event selection was applied?
 - When do we care if events are lost?

- Luminosity calculation done centrally – sensitive to loss of events.
- All data events need to be processed without failures in both official and user jobs.
- To help with that Good Run Lists are prepared to only run on data usable for physics analyses.
- On the other hand the actual number of processed events is less important for analysers directly as no reweighting of data is done in the majority of workflows.

- Sample cross-sections computed at the Monte Carlo generation level.
 - Higher-order effects collected in event weights.
 - Generator systematic variations introduce additional event weights for each variation.
- MC is reweighted based on the luminosity of data used — it is important to know **how many events have been originally generated** before any selection — **initial sum of weights**.
- It is important to keep track of any selection made.
- Small loss of MC events not too critical.

- Collect the number of events and the sum of weights and weights squared for all events passing a specific selection requirement.
- A service collecting those counters.
 - Separate for each production step.
 - Separate for each generator systematic variation.
- Tracks if a file was fully processed or not:
 - Cut bookkeepers from previous step marked as “incomplete”.
 - Troubles with double-counting if parts of the same file are processed in multiple steps.
- **Only beneficial if actual selection performed.** Production issues are tracked using the tools described at the beginning of my talk.

cut name
step number
output stream

↓
↓
↓

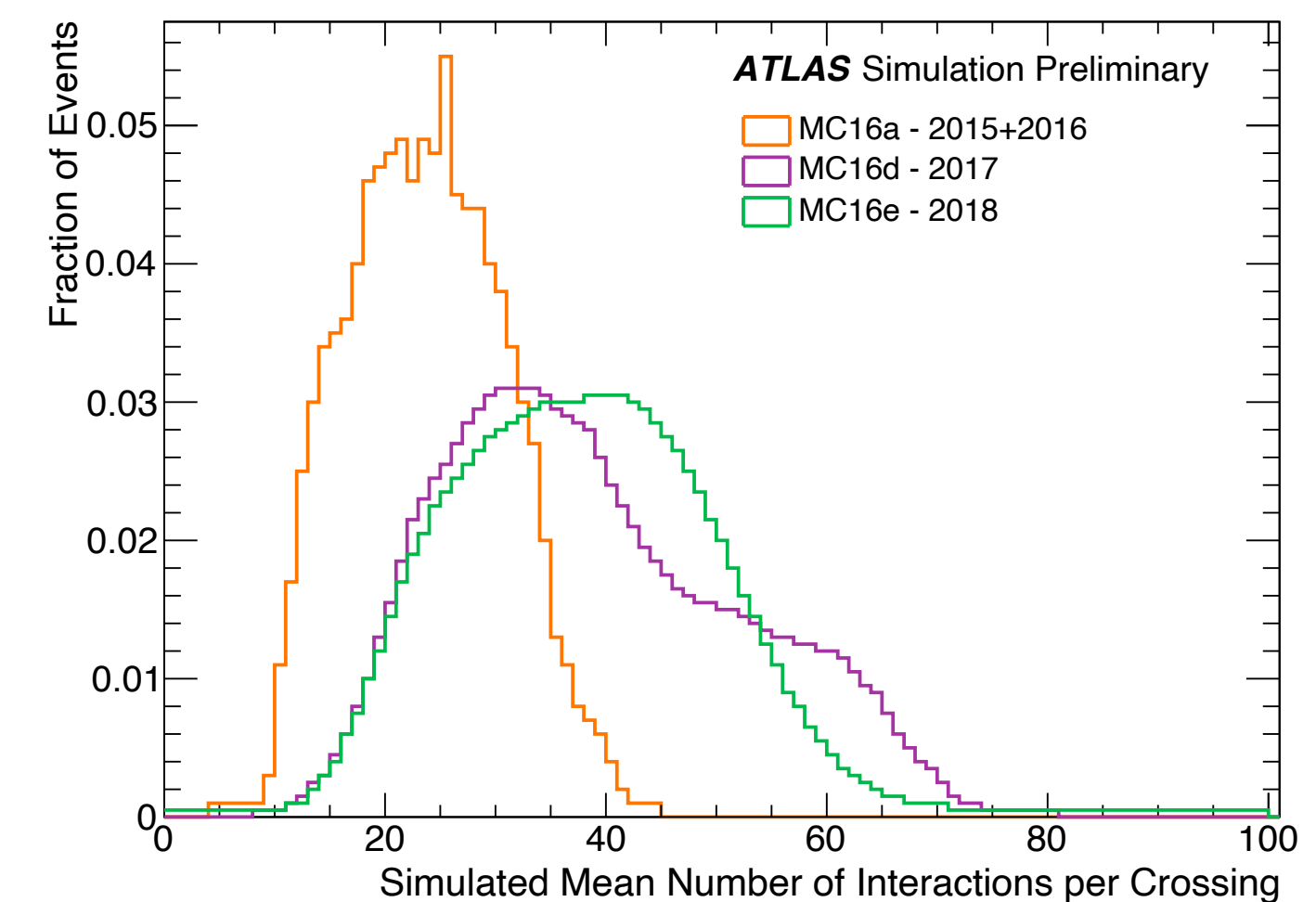
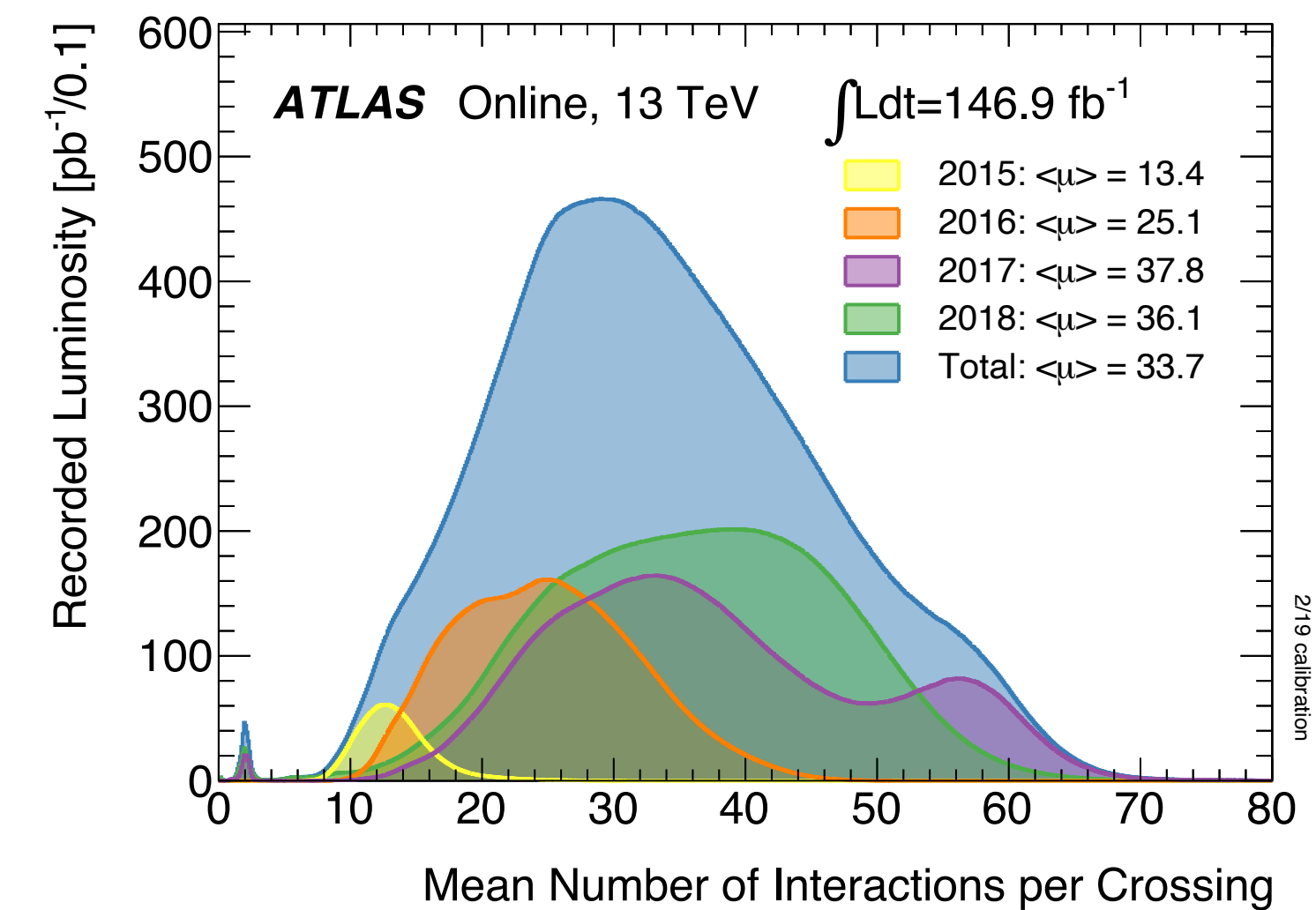
Complete CBK name= AllExecutedEvents cycle=2 stream=StreamAOD
 N=100 W=6.91852e-05 W2=4.98395e-11

↙
↙
↙

number of events
sum of weights
sum of weights squared

- Two modes possible:
 - Stop processing once the first selection criterion fails.
 - Continue processing and get independent number of events for each criterion.
- One of the uses is to allow **reweighting of MC to the data luminosity used**:
 $w = \mathcal{L}\sigma / (\text{initial sum of weights})$

- Monte Carlo samples should describe data pile-up profile well but often produced before data taking is complete.
- MC profile is reweighted based on the profile in data.
 - Weights are computed from the full profile of the sample – can not use in-file metadata.
 - Not a constant (some signal samples are small, not the whole profile covered in a job, events lost in central production).
 - Sample profiles available centrally – need to stay in sync with the processed datasets.
- Small loss of events usually not important but does effect the result!



- Technically there are no issues if only a fraction of the file is processed in one job but **it does affect metadata and makes bookkeeping harder**.
- **Data** sensitive only to partial dataset processing, less for partial file processing.
 - Often multiple files processed at once due to simpler contents and tighter selection.
- **MC** less sensitive to partial dataset processing, very sensitive to partial file processing.
 - In-file cut bookkeeping does not support processing the same file multiple times (per-file quantities).
 - Often MC jobs are longer (systematics, efficiency weights computation).

- **Production bookkeeping** using AMI, Rucio and PanDA.
 - Works well for both official and user jobs.
 - Some limitations for user jobs.
- **Event selection bookkeeping** done with in-file metadata.
 - Troubles for partial file processing.
 - Only useful when actual selection is made.
- Different requirements for data and MC due to different kind of metadata needed.

