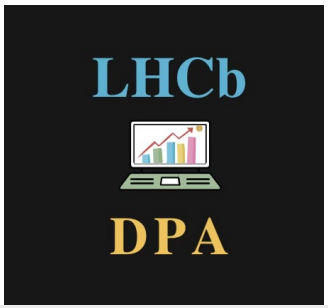
LHCb Stripping Project: Continuing to Fully and Efficiently Utilize Legacy Data

Nate Grieser, on behalf of the Collaboration

University of Cincinnati

CHEP 2024 Krakow

21-10-2024



Overview and Motivation

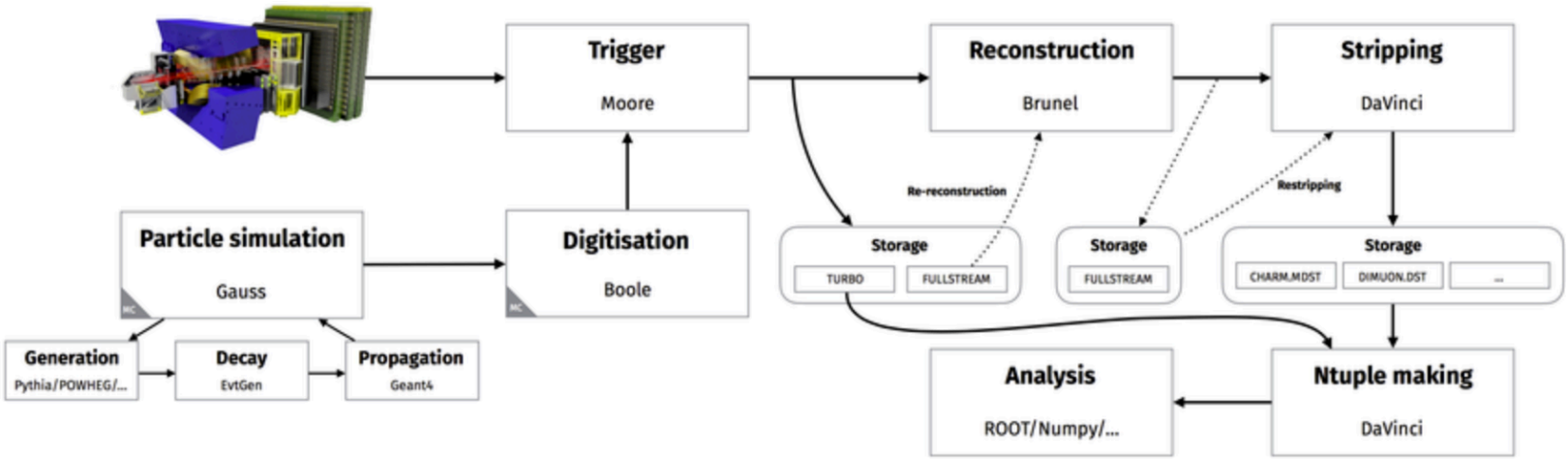
Evolving experiments have evolving dataflows and data models

→ **How do we maintain software to ensure continued data utilization?**

- Simple structure that can be learned and adapted easily
- Regular software testing to follow impact of sporadic changes
- Efficient workflows to adapt to rapidly changing operational situations
- Successful knowledge transfer, adapting new procedures when needed

→ **Provide an easy-to-use, sustainable legacy workflow!**

LHCb Legacy DataFlow



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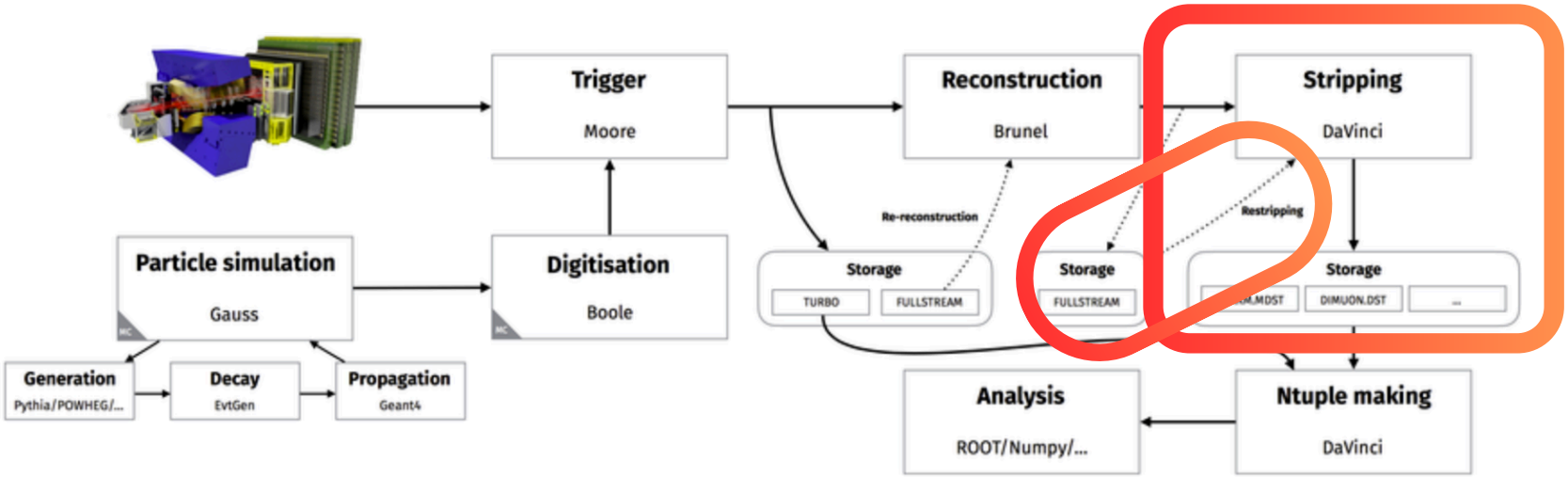

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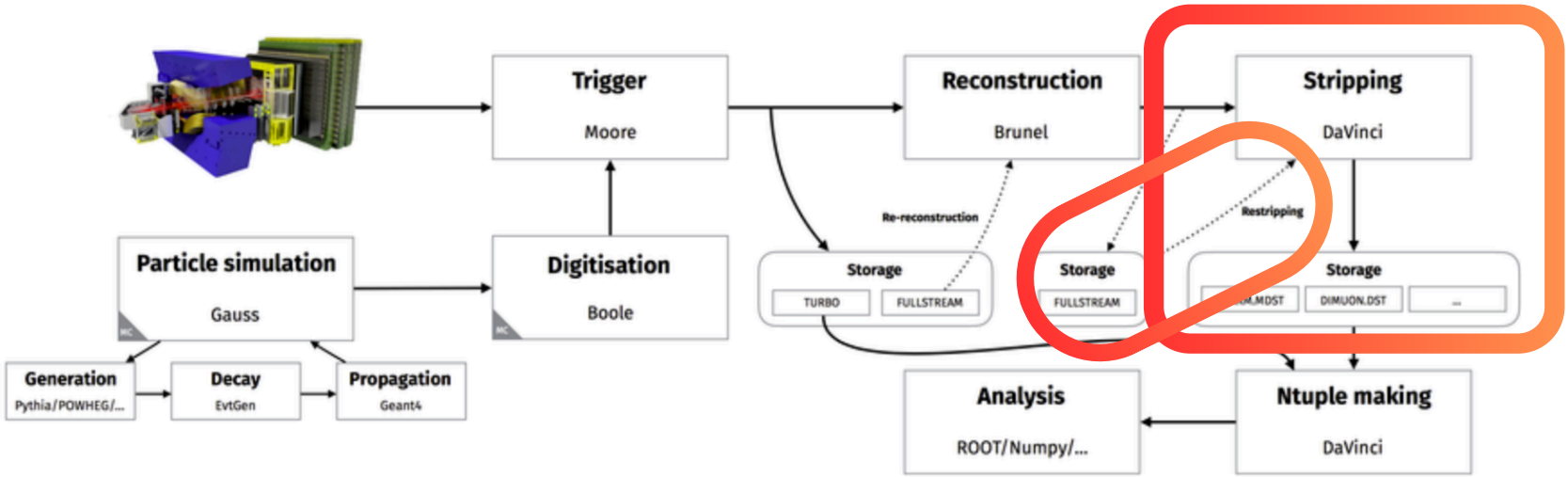
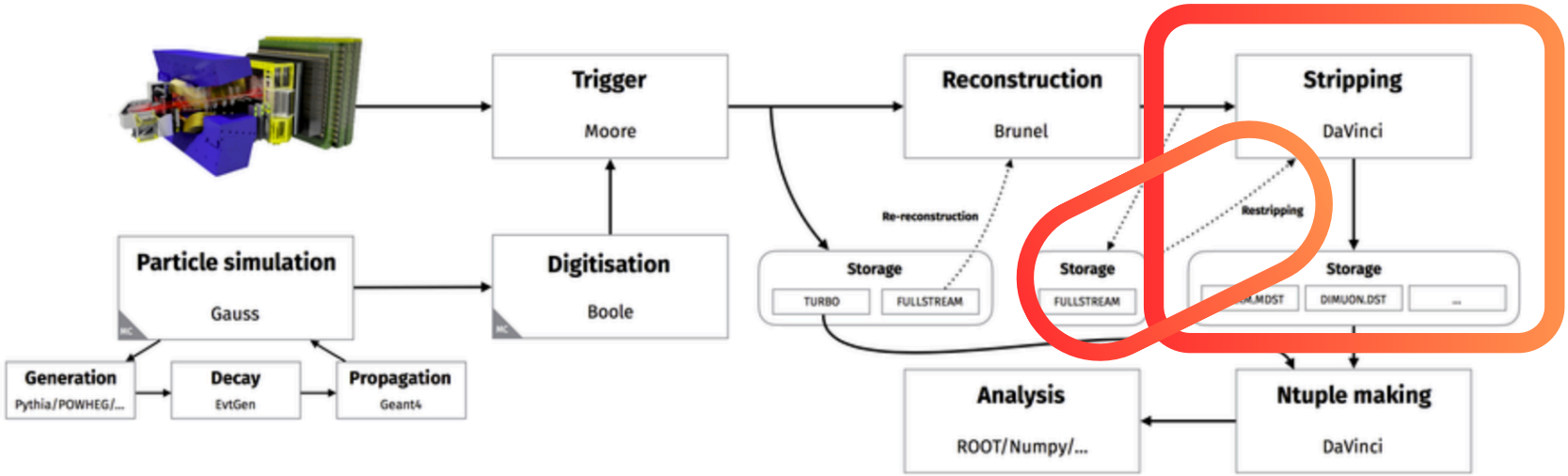


- 2-3x reduction in events, with 2x reduction in average event size

LHCb Legacy DataFlow

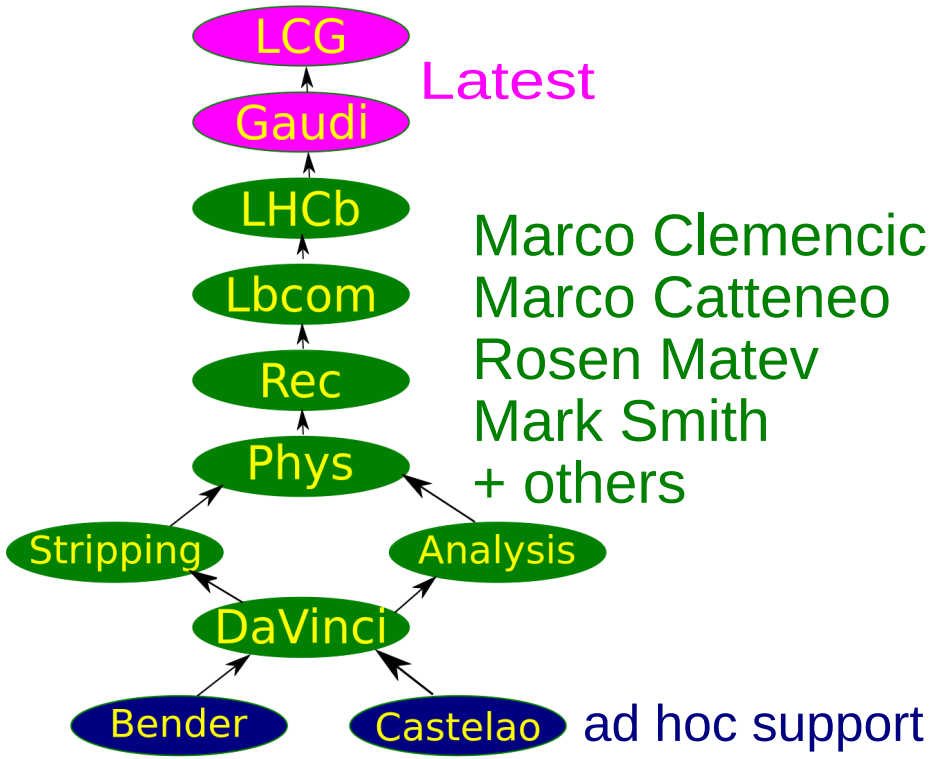


- 2-3x reduction in events, with 2x reduction in average event size
- Consistency of selections between years when possible

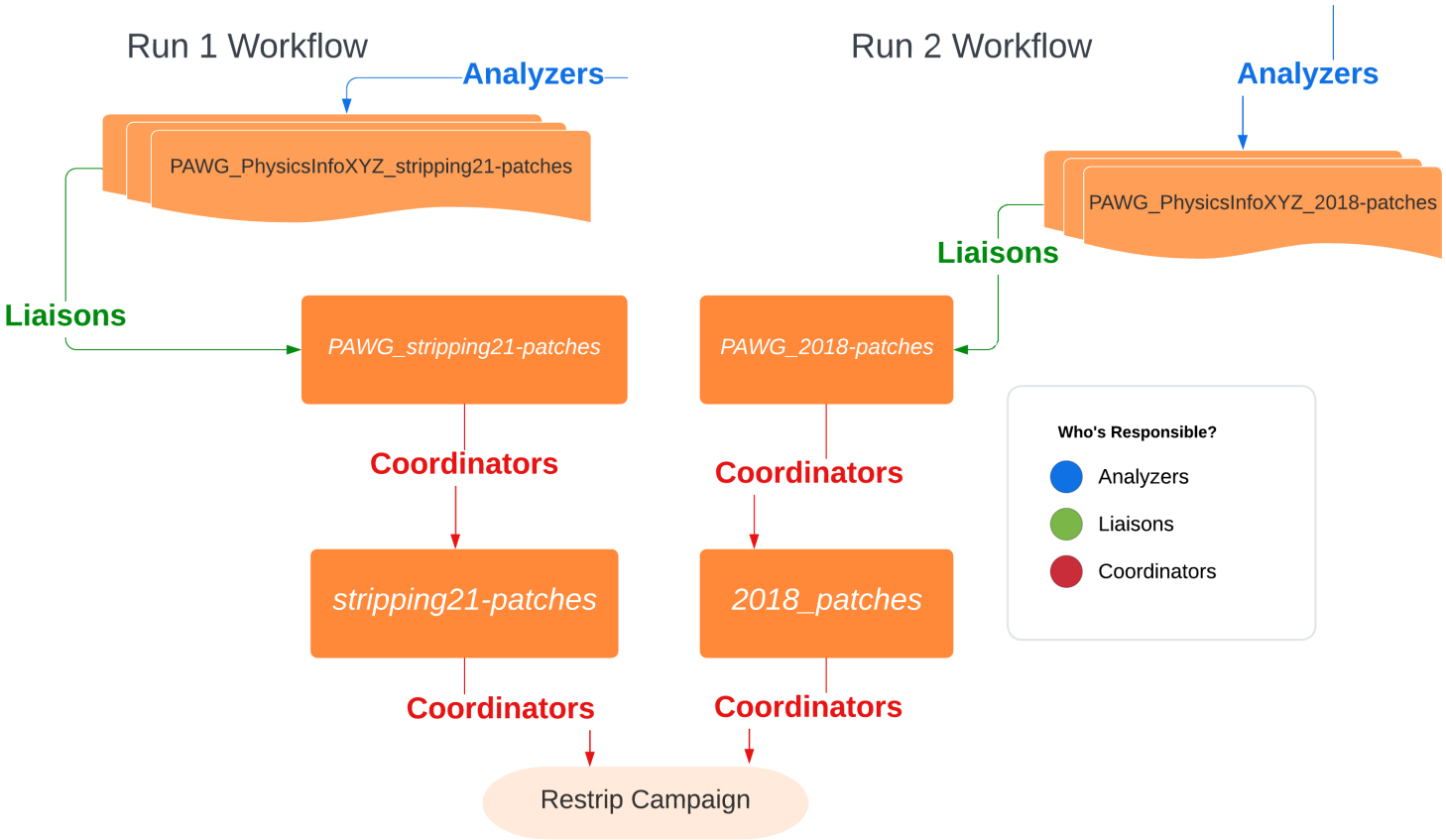
Supporting the Processing – Run 1/2 Legacy Stack

For analyzing Run 1/2 data there is a legacy stack maintained

- Everything from `LHCb` upwards is updated
  - Builds on latest LCG & Gaudi
  - Maintenance for obsolete projects are dropped
- Collaboration with core computing team to ensure stability and performance
- New tools can be added to process the legacy data after the productions!
  - Only release when necessary

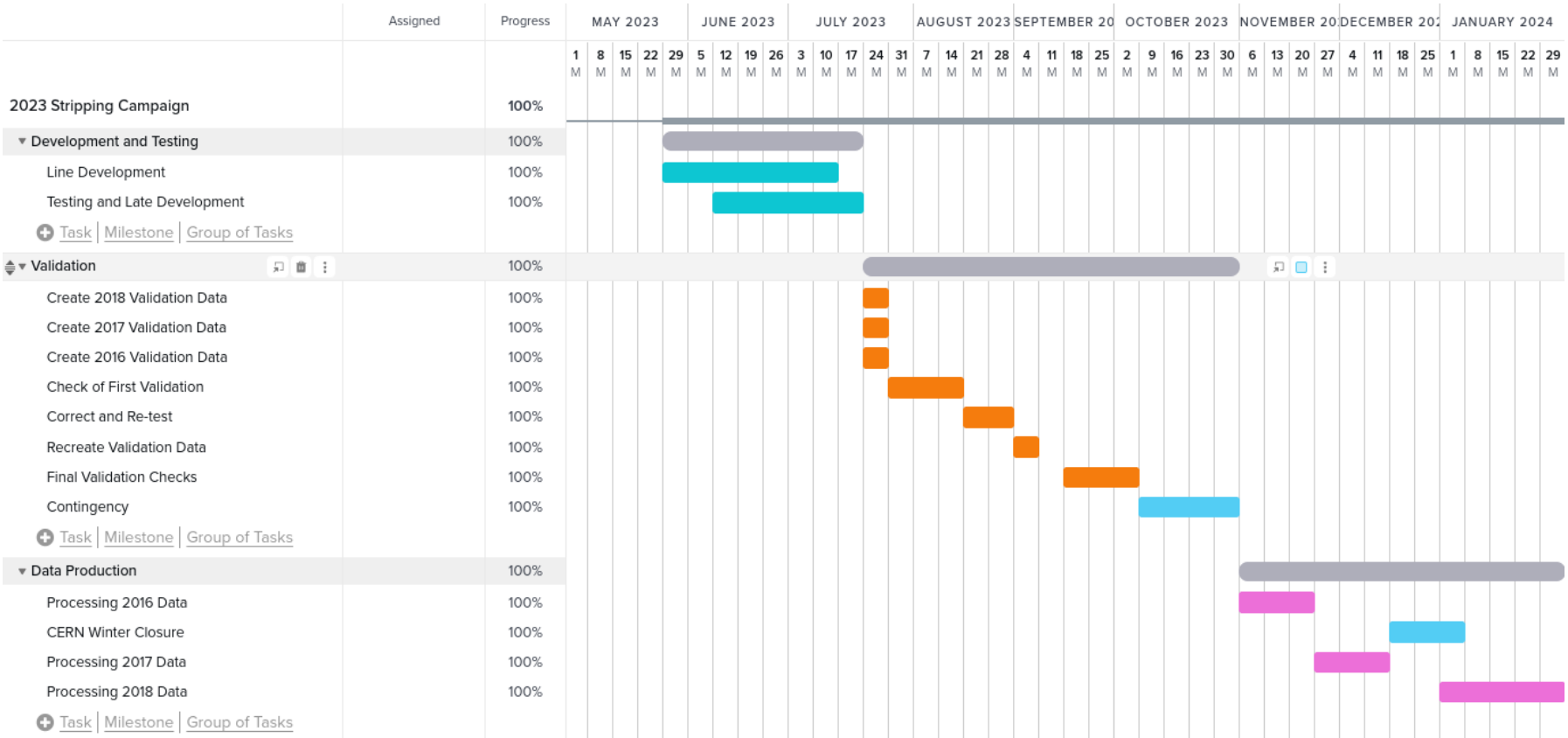


Getting Started – Fresh Faces, Fresh Ideas



- Liaisons from Physics WG to support the campaign
- In depth training to assign roles, technical crash course, and update workflows

Advertise the Plan... Then Deliver!



- Limited training and development time → Need to be efficient!

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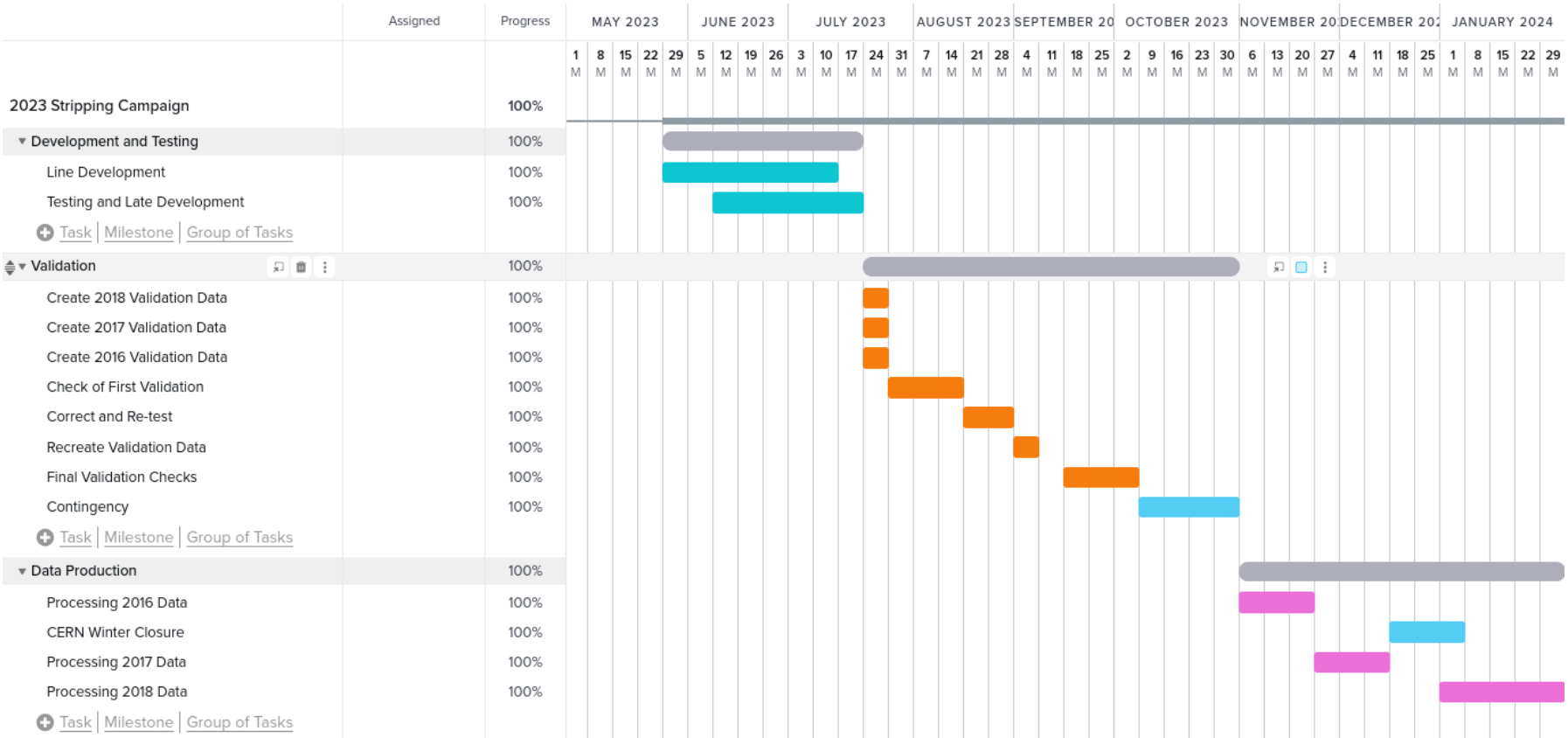
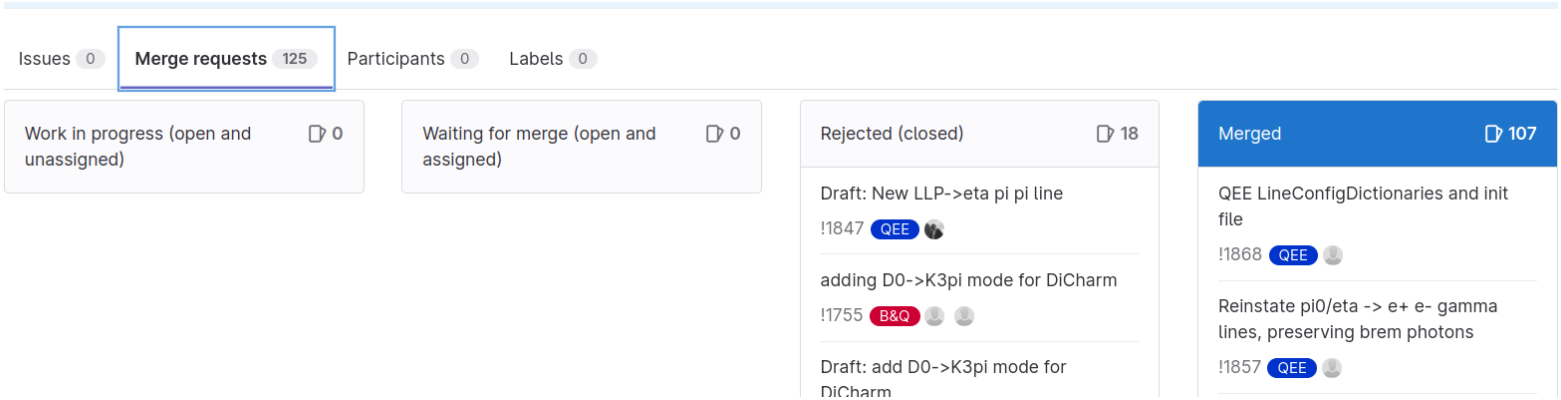
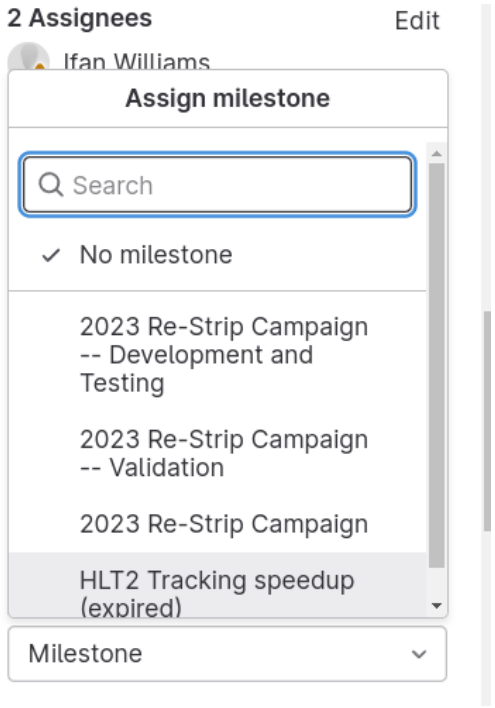


- Limited training and development time → Need to be efficient!
- Tight production windows → No contingencies, have to get it right first!

GitLab Milestones – Modern Bookkeeping

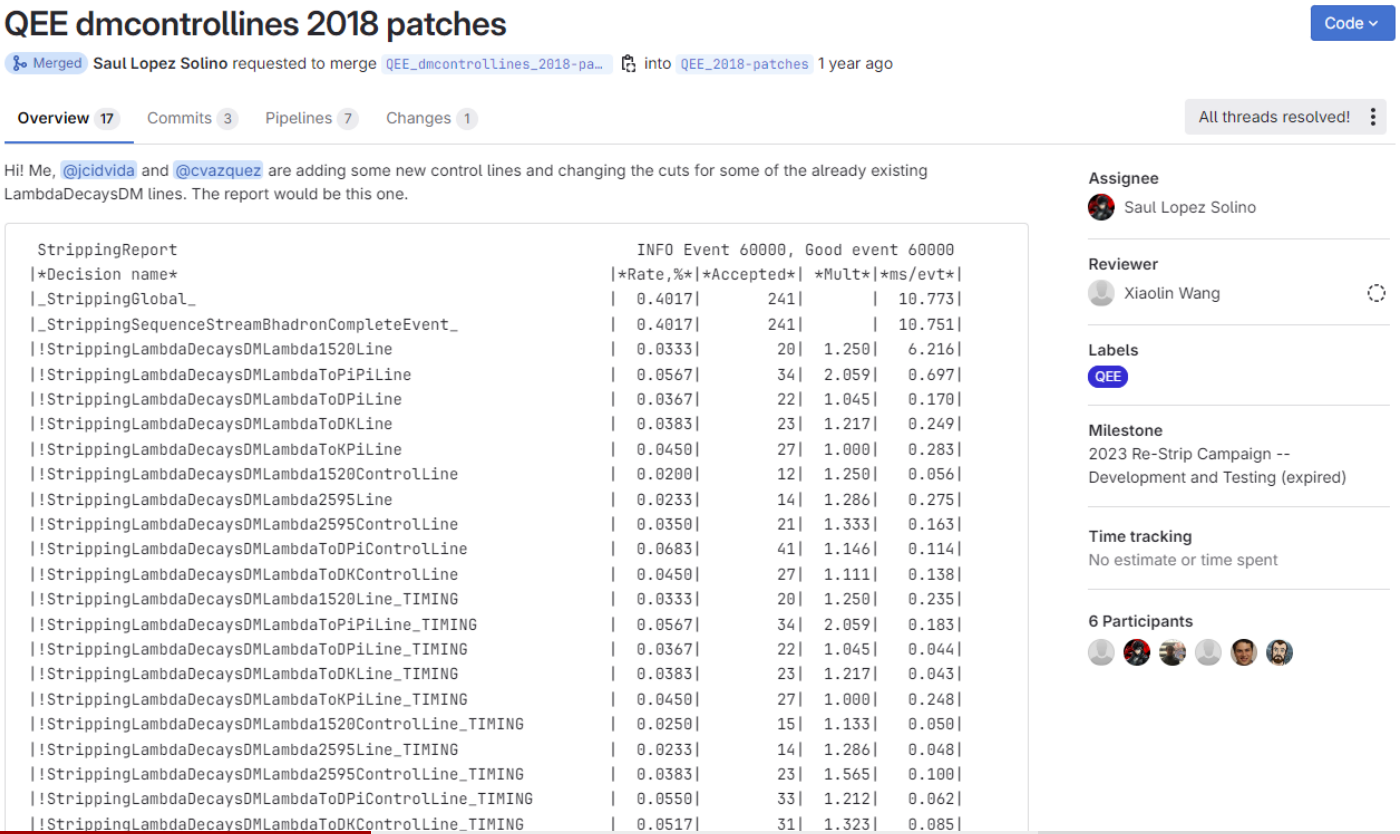


- Analysts required to add the bookkeeping, alleviating overhead of coordinators
- Liaisons and coordinators can follow things simply
- Neatly available statistics at end of campaigns to feedback to management



Development – Concise and Complete MRs

- Source branches use naming requirements to run specific WG tests
  → Efficient testing!
- All updated/new lines by name and their test output information
  - **Rate infomation**
  - **Timing information**
- WG labels and milestones used to track development process



QEE dmcontrollines 2018 patches

Code

Merged **Saul Lopez Solino** requested to merge `QEE_dmcontrollines_2018-pa…` into `QEE_2018-patches` 1 year ago

Overview 17 | Commits 3 | Pipelines 7 | Changes 1

All threads resolved!

Hi! Me, @jcidvida and @cvazquez are adding some new control lines and changing the cuts for some of the already existing LambdaDecaysDM lines. The report would be this one.

StrippingReport — INFO Event 60000, Good event 60000

Decision name	*Rate,%*	*Accepted*	*Mult*	*ms/evt*
StrippingGlobal	0.4017	241		10.773
StrippingSequenceStreamBhadronCompleteEvent	0.4017	241		10.751
!StrippingLambdaDecaysDMLambda1520Line	0.0333	20	1.250	6.216
!StrippingLambdaDecaysDMLambdaToPiPiLine	0.0567	34	2.059	0.697
!StrippingLambdaDecaysDMLambdaToDPiLine	0.0367	22	1.045	0.170
!StrippingLambdaDecaysDMLambdaToDKLine	0.0383	23	1.217	0.249
!StrippingLambdaDecaysDMLambdaToKPiLine	0.0450	27	1.000	0.283
!StrippingLambdaDecaysDMLambda1520ControlLine	0.0200	12	1.250	0.056
!StrippingLambdaDecaysDMLambda2595Line	0.0233	14	1.286	0.275
!StrippingLambdaDecaysDMLambda2595ControlLine	0.0350	21	1.333	0.163
!StrippingLambdaDecaysDMLambdaToDPiControlLine	0.0683	41	1.146	0.114
!StrippingLambdaDecaysDMLambdaToDKControlLine	0.0450	27	1.111	0.138
!StrippingLambdaDecaysDMLambda1520Line_TIMING	0.0333	20	1.250	0.235
!StrippingLambdaDecaysDMLambdaToPiPiLine_TIMING	0.0567	34	2.059	0.183
!StrippingLambdaDecaysDMLambdaToDPiLine_TIMING	0.0367	22	1.045	0.044
!StrippingLambdaDecaysDMLambdaToDKLine_TIMING	0.0383	23	1.217	0.043
!StrippingLambdaDecaysDMLambdaToKPiLine_TIMING	0.0450	27	1.000	0.248
!StrippingLambdaDecaysDMLambda1520ControlLine_TIMING	0.0250	15	1.133	0.050
!StrippingLambdaDecaysDMLambda2595Line_TIMING	0.0233	14	1.286	0.048
!StrippingLambdaDecaysDMLambda2595ControlLine_TIMING	0.0383	23	1.565	0.100
!StrippingLambdaDecaysDMLambdaToDPiControlLine_TIMING	0.0550	33	1.212	0.062
!StrippingLambdaDecaysDMLambdaToDKControlLine_TIMING	0.0517	31	1.323	0.085

Assignee Saul Lopez Solino

Reviewer Xiaolin Wang

Labels QEE

Milestone 2023 Re-Strip Campaign -- Development and Testing (expired)

Time tracking No estimate or time spent

6 Participants

Handshakes With Computing Team

Vital to communicate regularly between production and analysis teams

2023 Re-Stripping Campaign -- 2016 (S28r2p2)

Stripping production request -- WIP

Summary

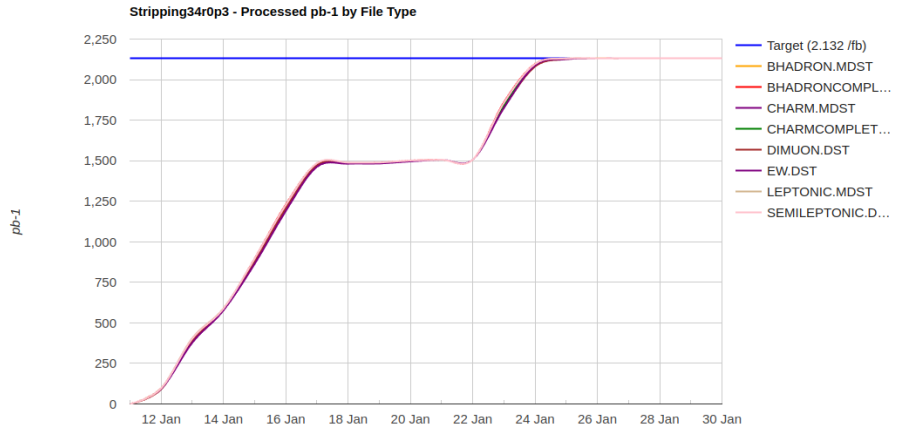
Currently prepared is a YAML for 2016 MD.

For testing locally, we need staged some samples:

Validation runs: 184604, 184642 (MU), 175835 (MD)

YAML(s)

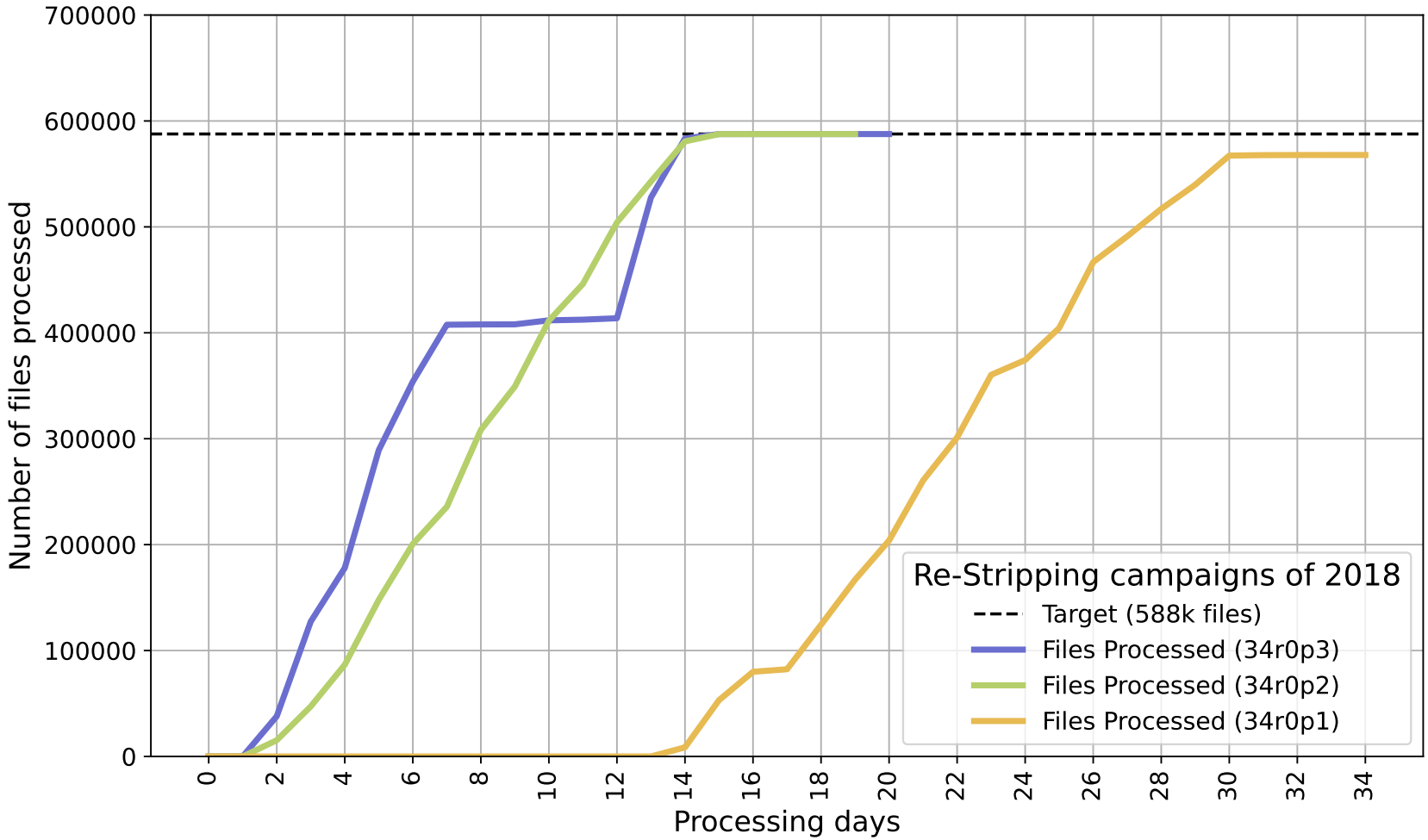
```
- author: ngrieser
  name: Stripping28r2p2  # E.g. "Passthrough / Exclusive Sprucing (2023 Magl
  comment: 2023 incremental restripping of 2016 data  # E.g. "Test for first
  type: Stripping

  wg: DPA
  inform:  # Feel free to add any other relevant person
  - ngrieser
  - avenkate
  - fredi
  priority: 1a

  input_dataset:
    # 94000000 / 90000000 for Exclusive / Passthrough Sprucing
    event_type: 90000000
    # Is there a check on consistency e.g. of magnet polarity and name?
    conditions_description: Beam6500GeV-VeloClosed-MagDown
    conditions_dict:
      configName: LHCb
      configVersion: Collision16  # E.g. "Collision23"
      inFileType: RAW
      inProPass: Real Data
      inDataQualityFlag: OK  # To be changed as soon as DQ is fully in place
```



↑ Live feedback of sample processing allows to catch any serious oversights in development

← Production requests are steered using GitLab issues and yaml files that production team can apply directly

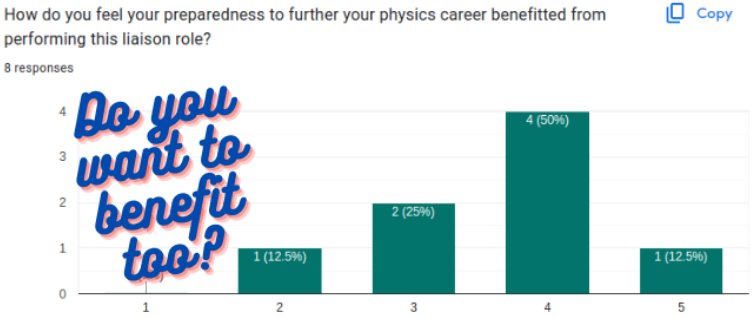
Improving the Production Times

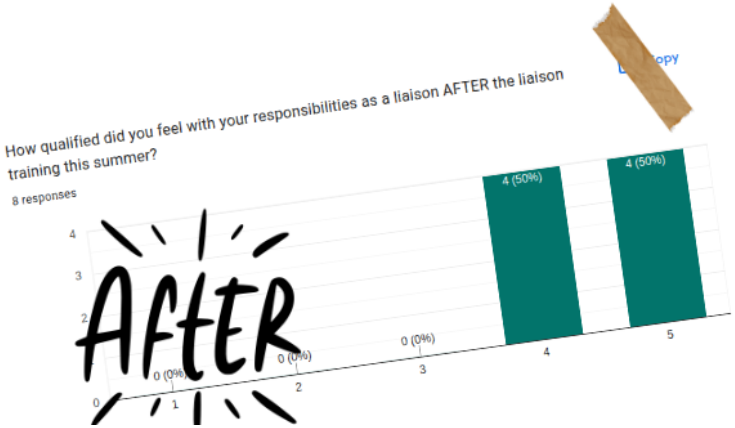


Learning From Each Other

Legacy productions will not happen regularly: **Lots of turnover to handle**
→ New minds can be a good thing, too!

- Training and procedures progress over years → need to make sure it's actually improving!
- Impact of training, comfortableness with the role, and impact of the role on their physics training were all considered!





Conclusions

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BACKUP

Using PyConf to Make Selections

```
def makeB2Charged2Body( name,
                    trChi2,trGhostProb,minPT,minIPChi2,
                    maxPT,maxIPChi2,combMassLow,combMassHigh,doca,
                    bPT,bIPChi2,bTAU,massLow,massHigh ) :

_daughters_cuts = "(TRGHOSTPROB < %(trGhostProb)s) & (TRCHI2DOF < %(trChi2)s) & (PT > %(minPT)s * MeV) & ( MIPCHI2DV(PRIMARY) > %(minIPChi2)s  )" %locals()

_combination_cuts = "(AMAXCHILD(MAXTREE('pi+'==ABSID,PT)) > %(maxPT)s ) & ( AMAXCHILD(MAXTREE('pi+'==ABSID,MIPCHI2DV(PRIMARY))) > %(maxIPChi2)s ) & (AMAXDOCA('') < %(doca)s ) & (AM > %(combMassLow)s * MeV) & (AM < %(combMassHigh)s * MeV)" %locals()

_mother_cuts = "(PT > %(bPT)s * MeV) & (M > %(massLow)s * MeV) & (M < %(massHigh)s * MeV) & ( BPVIPCHI2() < %(bIPChi2)s ) & (BPVLTIME() > %(bTAU)s )" %locals()

CombineHb2Charged2Body = CombineParticles( DecayDescriptor = 'B0 -> pi+ pi-',
                                           DaughtersCuts = { "pi+" : _daughters_cuts },
                                           CombinationCut = _combination_cuts,
                                           MotherCut = _mother_cuts )

return Selection( name,
                  Algorithm = CombineHb2Charged2Body,
                  RequiredSelections = [ StdNoPIDsPions ] )
```

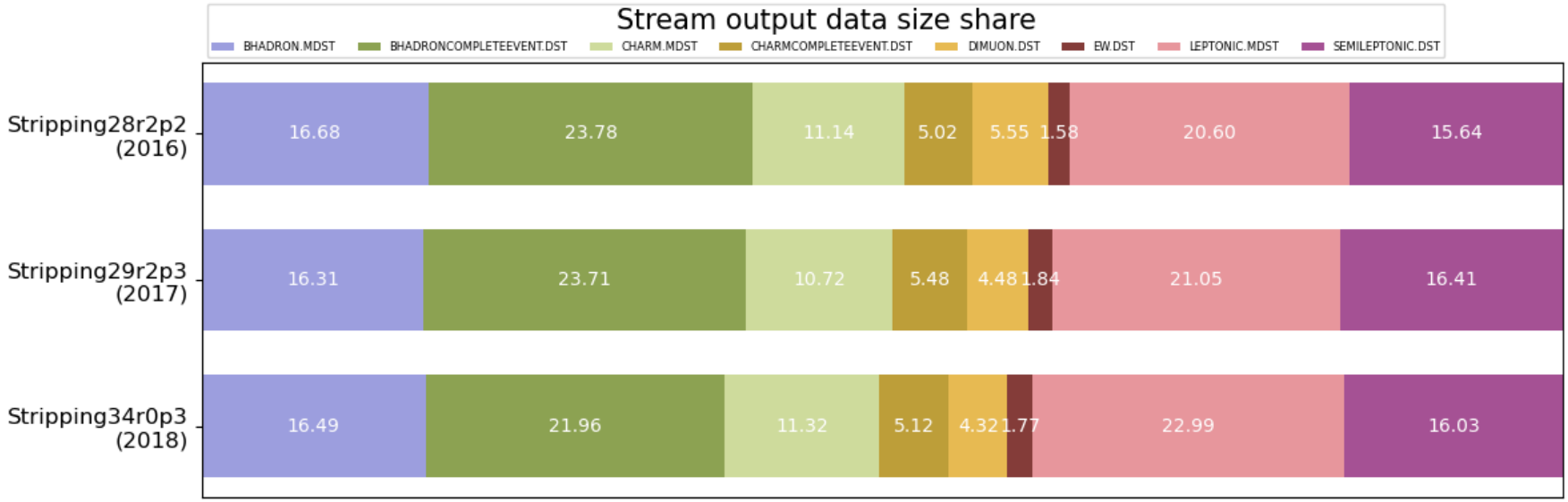
↑ Define decay selections with builders in Python

Steer selections with config libraries → Harmonize code while specific analysis selections available→

```
default_config = {
    'NAME'        : 'B2HHBDT',
    'WGs'         : ['BnoC'],
    'BUILDERTYPE' : 'B2HHBDTLines',
    'CONFIG'      : { 'PrescaleB2HHBDT' : 1.,
                      'TrChi2'          : 4,
                      'TrGhostProb'     : 3,
                      'PionPT'          : 1000,
                      'SumPT'           : 4500,
                      'DOCACHI2'        : 9,
                      'BIPCHI2'         : 9,
                      'BDIRA'           : 0.99,
                      'BPT'             : 0,
                      'BMassWinLow'     : 4700,
                      'BMassWinHigh'    : 6200,
                      'BMassLow'        : 4800,
                      'BMassHigh'       : 6200,
                      'PionIPCHI2'      : 16,
                      'BFDCHI2'         : 100,
                      'BDTCut'          : -1,
                      'BDTWeightsFile'  : "$TMVAWEIGHTSROOT/data/B2HH_BDT_v1r5.xml"
                    },
    'STREAMS'     : ['BhadronCompleteEvent']
```

Giving the User a Manageable Dataset

→ Strength of Stripping project on display: Huge compression for analysts



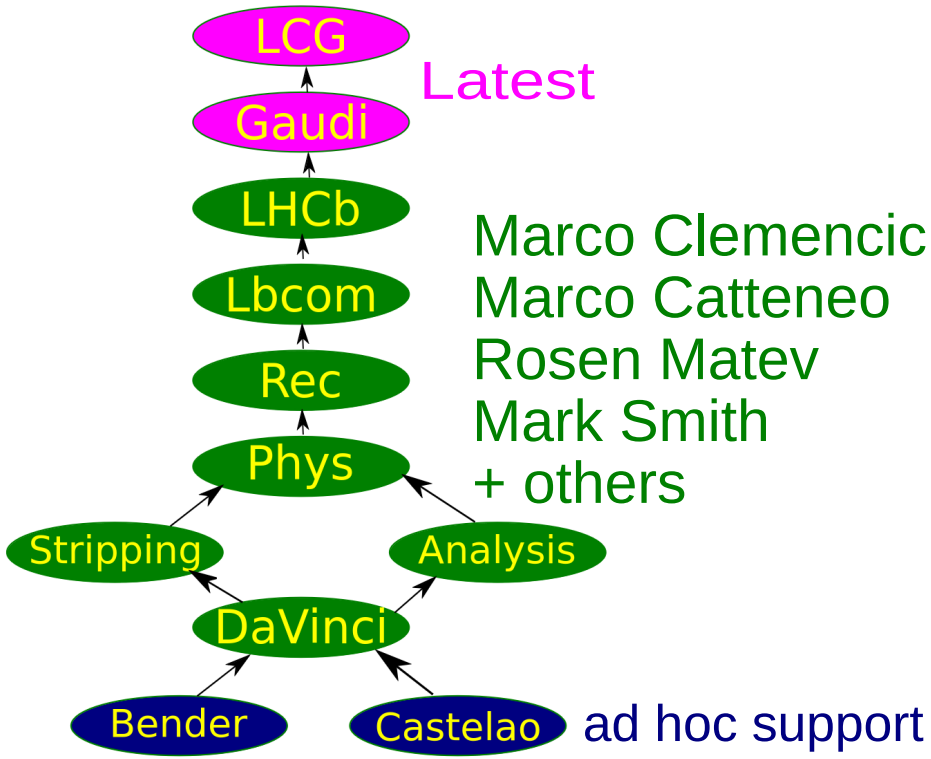
config version	processing pass	reco	magnet polarity	# events (in)	Total size (in)	Avg kB/event (in)	# events (out)	Total size (out)	Avg kB/event (out)	# events (RAW)	Total size (RAW)	Avg kB/event (RAW)	# streams (out)	# evts out/in	Size reduction
Collision16	Stripping28r2p2	Reco16	Down	21'942'558'323	1088.0	49.6	7'759'577'117	250.9	32.3	21'948'653'743	1395.0	63.6	8	0.4	4.3
			Up	20'170'963'459	970.7	48.1	6'899'525'674	225.8	32.7	20'195'067'584	1262.0	62.5	8	0.3	4.3
Collision17	Stripping29r2p3	Reco17	Down	17'662'321'998	951.5	53.9	7'323'509'172	228.2	31.2	17'662'323'449	1161.0	65.7	8	0.4	4.2
			Up	16'870'981'928	947.5	56.2	6'943'947'373	216.3	31.2	16'871'076'018	1115.0	66.1	8	0.4	4.4
Collision18	Stripping34r0p3	Reco18	Down	19'236'992'943	1073.0	55.8	8'746'097'218	272.9	31.2	19'237'119'448	1331.0	69.2	8	0.5	3.9
			Up	20'596'358'830	1139.0	55.3	9'188'827'963	284.8	31.0	20'596'464'277	1423.0	69.1	8	0.4	4.0

- Consistency of streams between different years
- 2-3x reduction in events in vs. out, with 2x reduction in average event size

Supporting the Processing – Run 1/2 DaVinci Stack

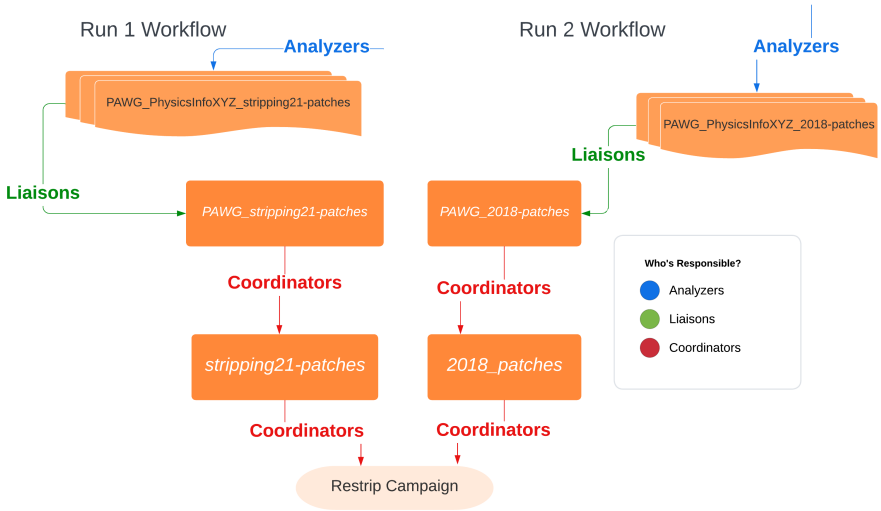
For analysing Run 1/2 data there is a legacy stack maintained

- Everything from `LHCb` upwards is updated
  - Builds on latest LCG & Gaudi
  - Maintenance for obsolete projects are dropped
- Latest `LCG`, `ROOT` etc as well as recent Python & C++ & compilers/platforms
  - Collaboration with core computing team to ensure stability and performance
- New tools can be added to process the legacy data after the productions!
  - Users can open MR towards the legacy branches, and steer the bookkeeping with GitLab labels
  - Full software stack releases occur as needed to ease burden of maintainers



Getting Started – Fresh Faces, Fresh Ideas

- Liaisons offered from Physics WG to support the campaigns
  - New liaisons providing support → Lots to learn!
- Assign roles and technical crash-course
- In-depth training on GitLab use for the campaign → Apply new workflows!



- Workflow applied similarly to run 3 project workflows
- Continuous integration tests used to allow for a rolling testing of developments

Improving the Production Times