SPOT Tutorial Slides

2021 ECP Annual Meeting

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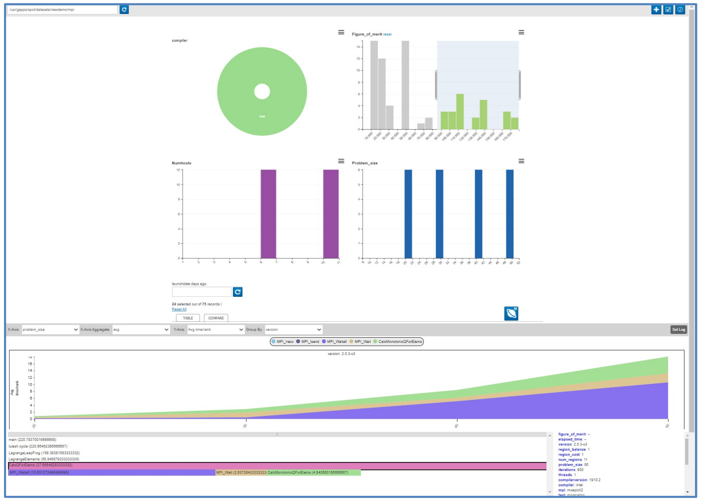
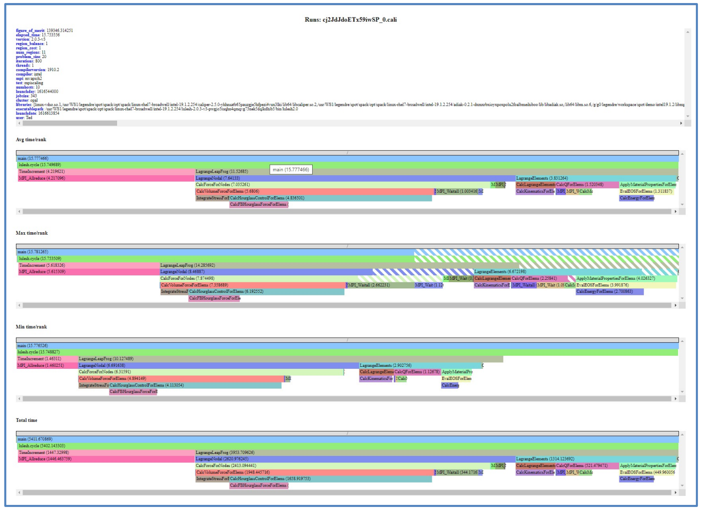
SPOT: Software Performance and Analysis Tracking

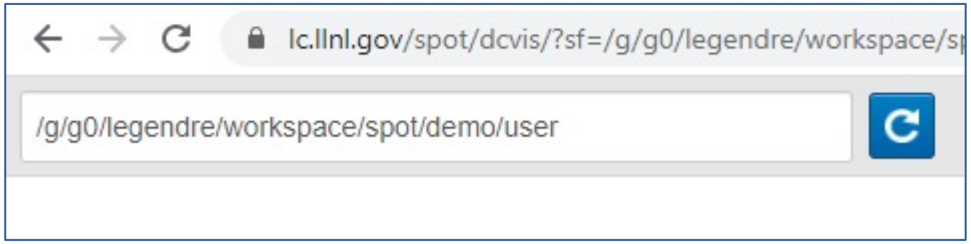
- SPOT is visualization for **collections of performance profiles**. Common uses cases are:
  - Performance comparison of nightly tests. Look for performance regressions.
  - Performance tracking of developer changes. Run an MPI scaling study.
  - Collect performance profiles from users. Understand how users run and hit performance issues.





SPOT's Workflow

1. Point SPOT webpage at directory containing *.cali files.



lc.llnl.gov/spot/dcvis/?sf=/g/g0/legendre/workspace/s

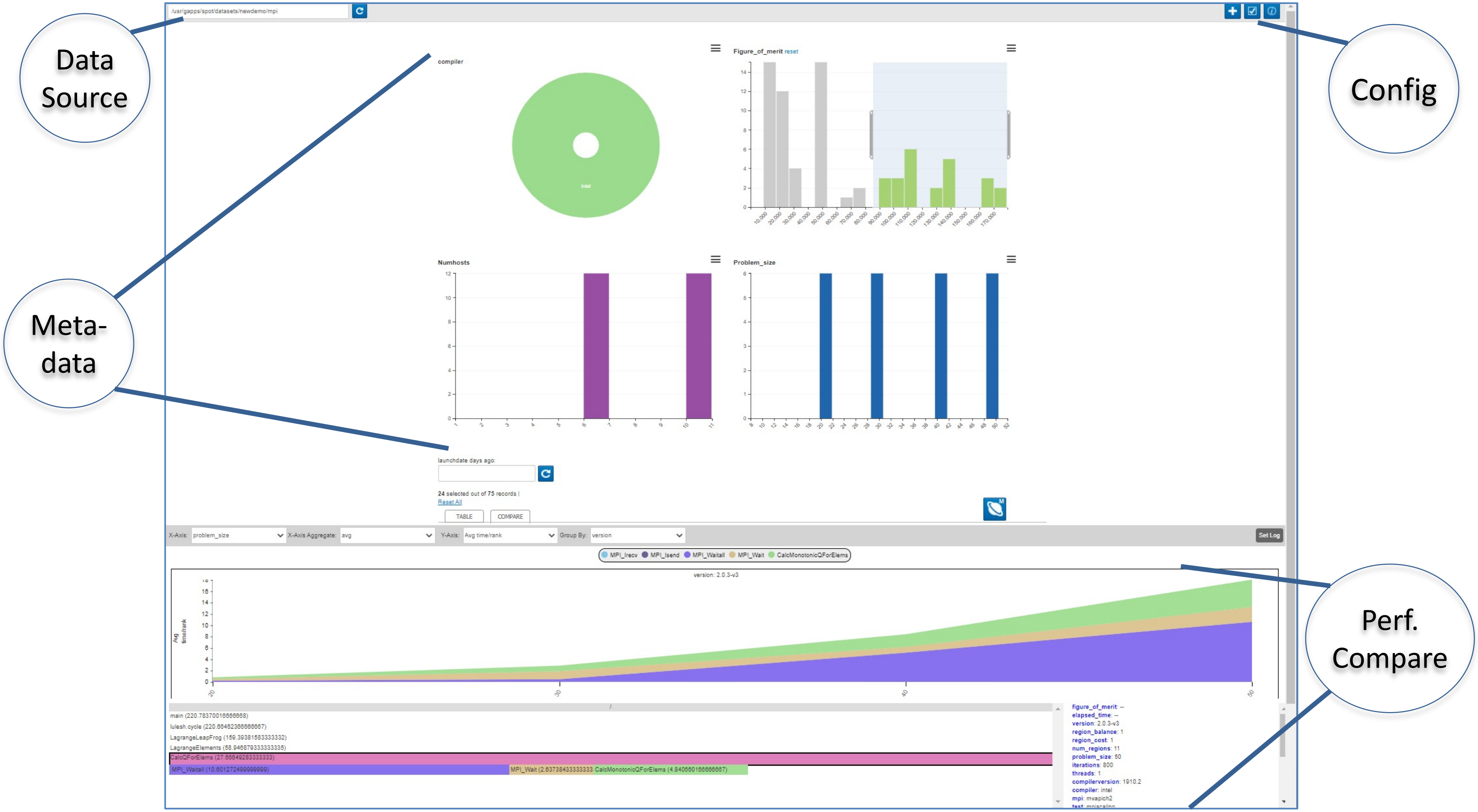
/g/g0/legendre/workspace/spot/demo/user

2. Select "interesting" sets of runs to analyze
   - Don't compare performance of 1d test run. vs 3d multi-physics run.

3. Run common analysis with SPOT.
   - i.e., Graph history of performance changes
   - i.e., View performance context trees

4. Run advanced analysis with Hatchet.

SPOT’s Landing Page



Data Source

Meta-data

Config

Perf. Compare

/usr/gapps/spot/datasets/newdemo/mpi

launchdate days ago:

24 selected out of 75 records |
Reset All

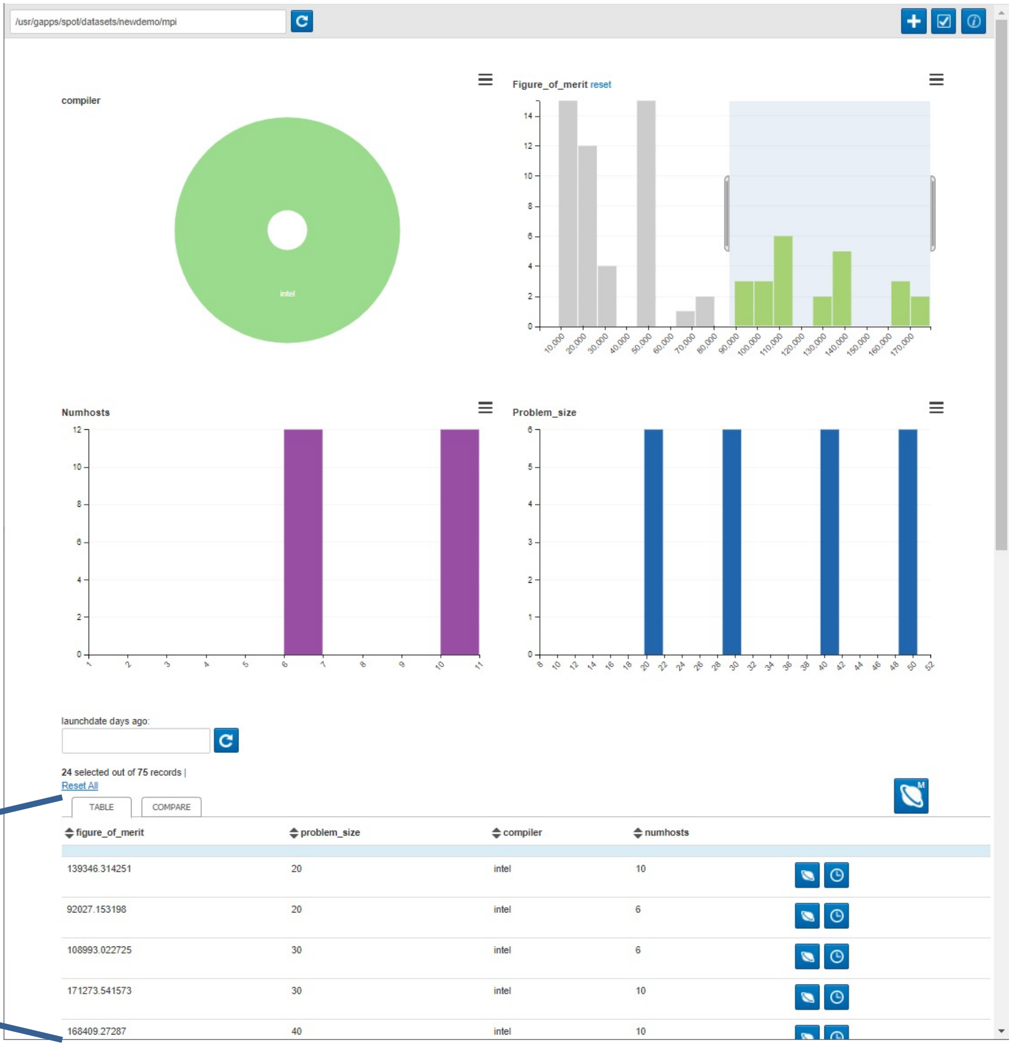
X-Axis: problem_size
X-Axis Aggregate: avg
Y-Axis: Avg time/rank
Group By: version

version: 2.0.3-v3

main (220.78370016666668)
lulesh.cycle (220.66462366666667)
LagrangeLeapFrog (159.39381583333332)
LagrangeElements (58.94687933333335)
CalcQForElems (27.66649283333333)
MPI_Waitall (10.601272499999999)
MPI_Wait (2.63738433333333
CalcMonotonicQForElems (4.84066016666667)

figure_of_merit: --
elapsed_time: --
version: 2.0.3-v3
region_balance: 1
region_cost: 1
num_regions: 11
problem_size: 50
iterations: 800
threads: 1
compilerversion: 1910.2
compiler: intel
mpi: mvapich2
test: mpiscaling

SPOT’s Landing Page

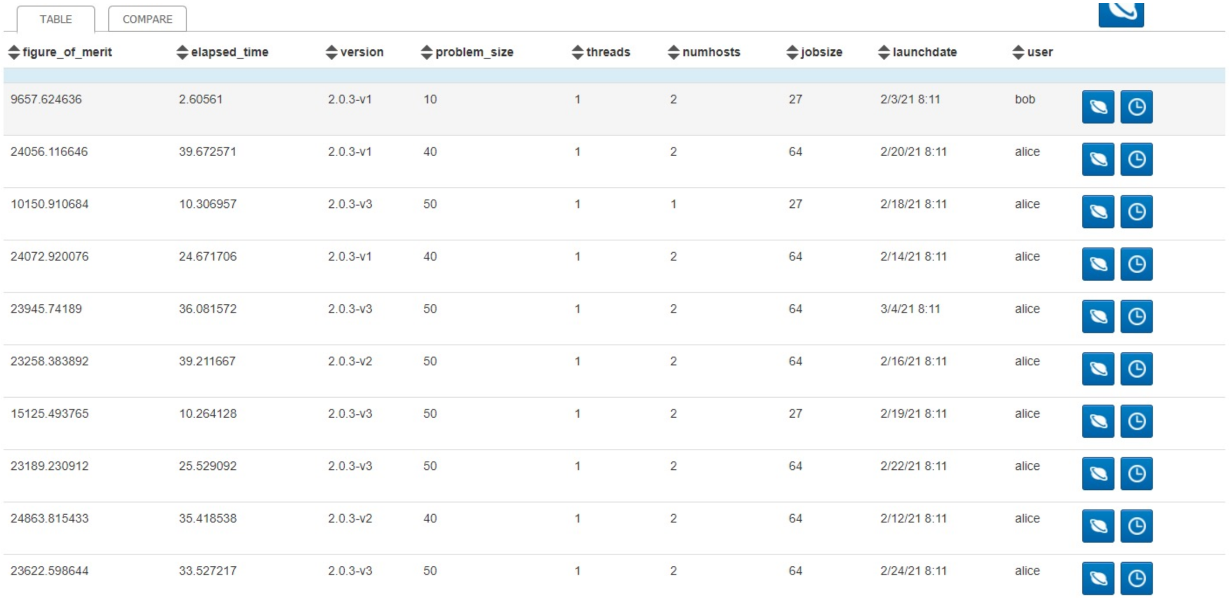


24 selected out of 75 records |
Reset All

figure_of_merit	problem_size	compiler	numhosts
139346.314251	20	intel	10
92027.153198	20	intel	6
108993.022725	30	intel	6
171273.541573	30	intel	10
168409.27287	40	intel	10

Table View

SPOT is Based on CrossFilter



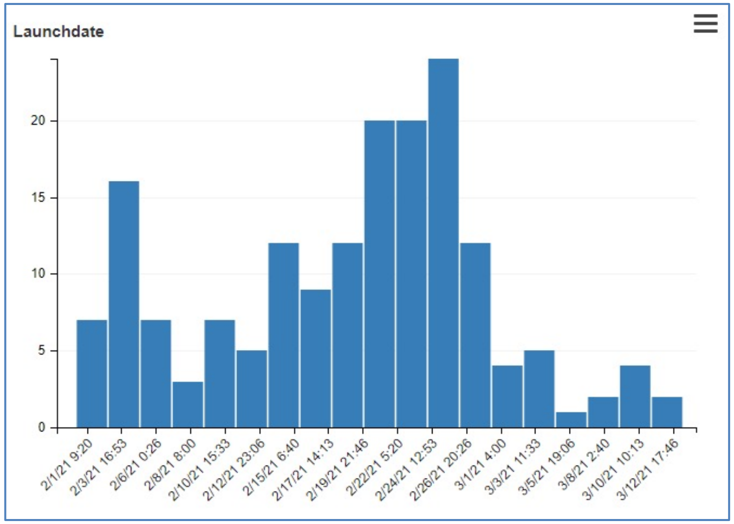
figure_of_merit	elapsed_time	version	problem_size	threads	numhosts	jobsize	launchdate	user
9657.624636	2.60561	2.0.3-v1	10	1	2	27	2/3/21 8:11	bob
24056.116646	39.672571	2.0.3-v1	40	1	2	64	2/20/21 8:11	alice
10150.910684	10.306957	2.0.3-v3	50	1	1	27	2/18/21 8:11	alice
24072.920076	24.671706	2.0.3-v1	40	1	2	64	2/14/21 8:11	alice
23945.74189	36.081572	2.0.3-v3	50	1	2	64	3/4/21 8:11	alice
23258.383892	39.211667	2.0.3-v2	50	1	2	64	2/16/21 8:11	alice
15125.493765	10.264128	2.0.3-v3	50	1	2	27	2/19/21 8:11	alice
23189.230912	25.529092	2.0.3-v3	50	1	2	64	2/22/21 8:11	alice
24863.815433	35.418538	2.0.3-v2	40	1	2	64	2/12/21 8:11	alice
23622.598644	33.527217	2.0.3-v3	50	1	2	64	2/24/21 8:11	alice

SPOT’s Crossfilter: https://dc-js.github.io/dc.js/
D3-Based Crossfilter: https://square.github.io/crossfilter/

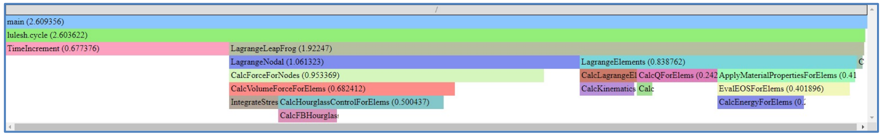
- CrossFilter is good at finding correlations in data.
- Crossfilter helps you manage/slice your data to make interesting comparisons.

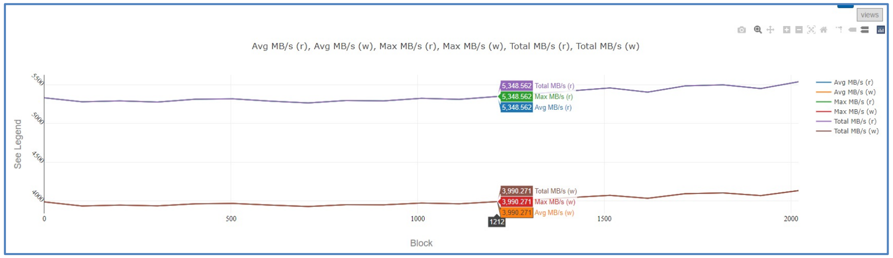
Each App Run has Two Types of Data

- **Metadata**
  - Name/value data about job.
    - User, host, FOM, input parameters, …
  - Displayed as histograms



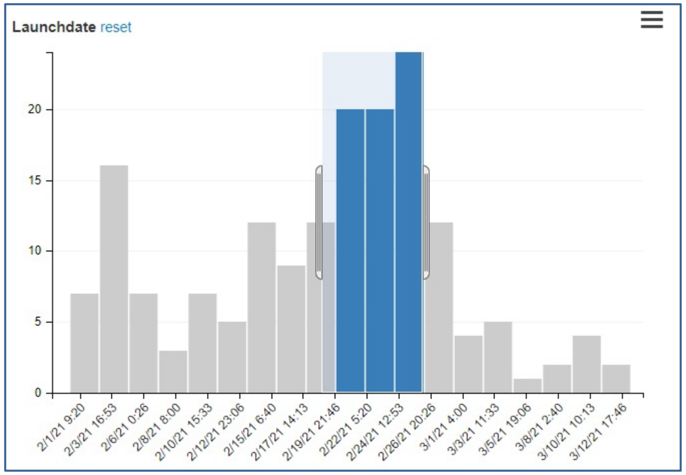
- **Performance Data**
  - Can be different metrics.
    - Avg Time/Rank, Max Time/Rank, bandwidth, …
  - Displayed as a flame graph or timeseries.

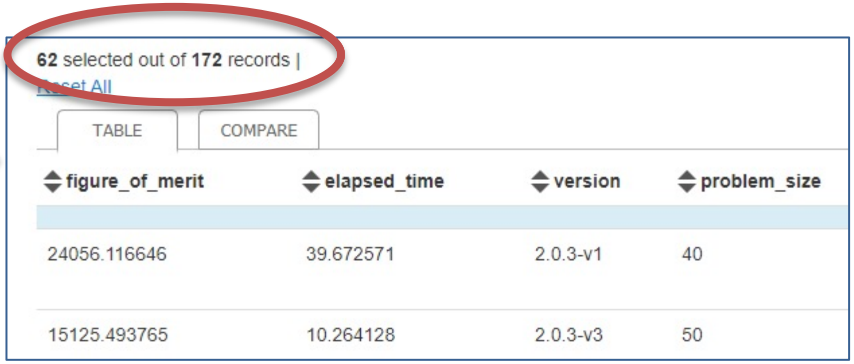

/
main (2.609356)
lulesh.cycle (2.603622)
TimeIncrement (0.677376)
LagrangeLeapFrog (1.92247)
LagrangeNodal (1.061323)
LagrangeElements (0.838762)
C
CalcForceForNodes (0.953369)
CalcLagrangeEl
CalcQForElems (0.242
ApplyMaterialPropertiesForElems (0.41
CalcVolumeForceForElems (0.682412)
CalcKinematics
Calc
EvalEOSForElems (0.401896)
IntegrateStres
CalcHourglassControlForElems (0.500437)
CalcEnergyForElems (0.
CalcFBHourglas



Metadata Can be Filtered

- Select regions of metadata histograms to filter.
  - Filtering in one histogram updates all histograms range.
    - E.g., Filtering Launchdate to ‘Feb 19-Feb26’ will update the ‘Users’ histogram to only show users who ran between those dates.
  - While filtered, comparisons and Jupyter notebooks will operate on the filtered data.



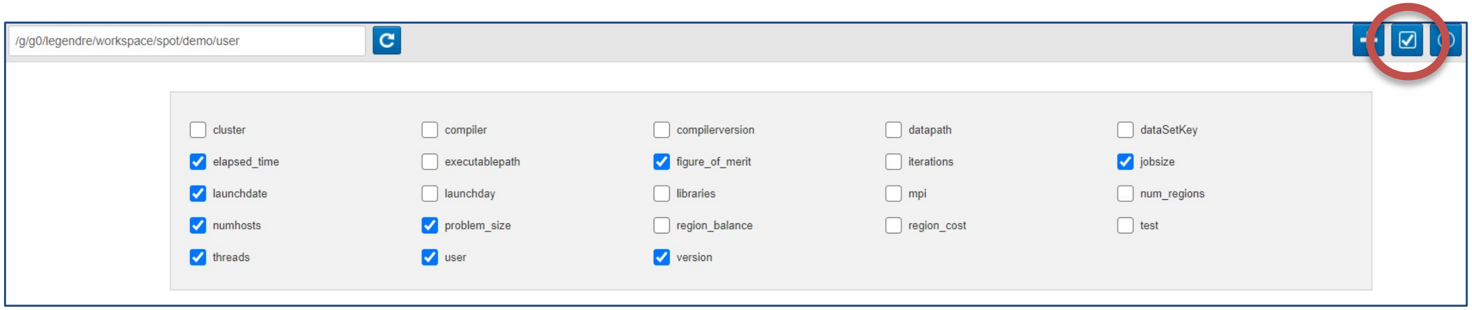


62 selected out of **172** records | Reset All

figure_of_merit	elapsed_time	version	problem_size
24056.116646	39.672571	2.0.3-v1	40
15125.493765	10.264128	2.0.3-v3	50

Metadata is Configurable

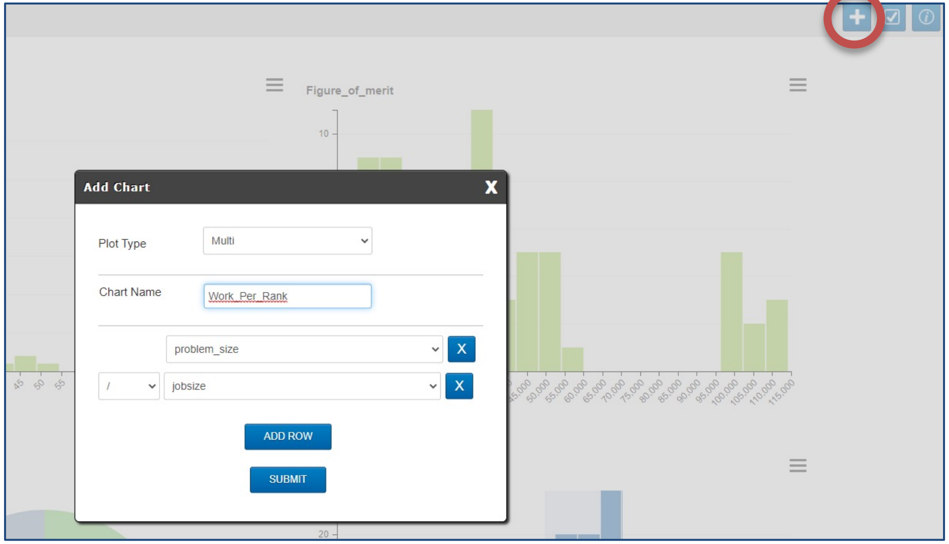
- Can show/hide metadata:



/g/g0/legendre/workspace/spot/demo/user

□ cluster
□ compiler
□ compilerversion
□ datapath
□ dataSetKey
☑ elapsed_time
□ executablepath
☑ figure_of_merit
□ iterations
☑ jobsize
☑ launchdate
□ launchday
□ libraries
□ mpi
□ num_regions
☑ numhosts
☑ problem_size
□ region_balance
□ region_cost
□ test
☑ threads
☑ user
☑ version

- Can create composite metadata:



Add Chart X

Plot Type: Multi

Chart Name: Work_Per_Rank

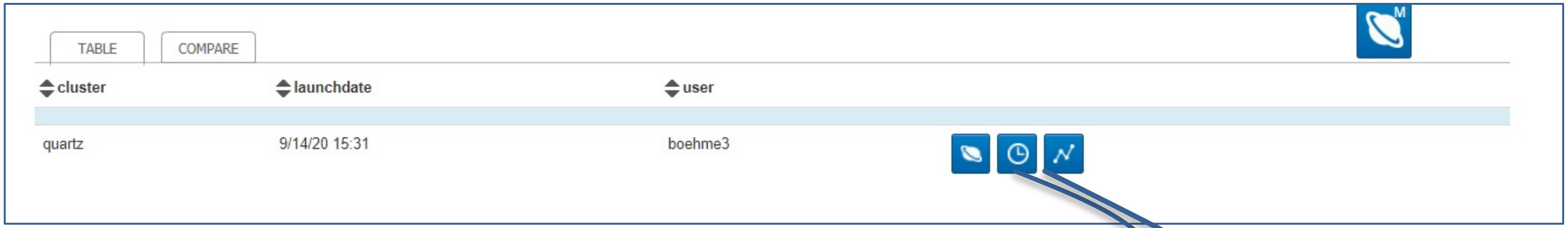
problem_size X

/ jobsize X

ADD ROW

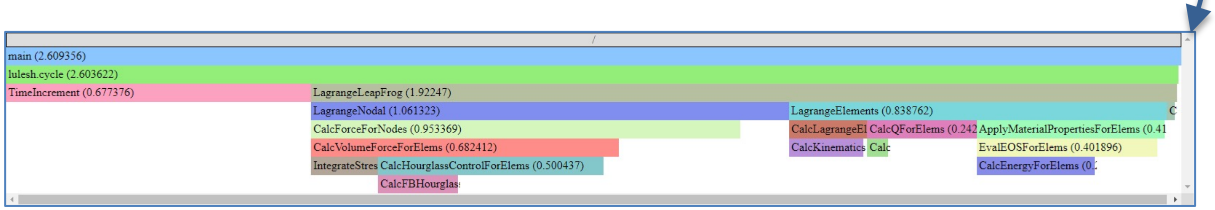
SUBMIT

Performance Data can be Visualized Per-Run

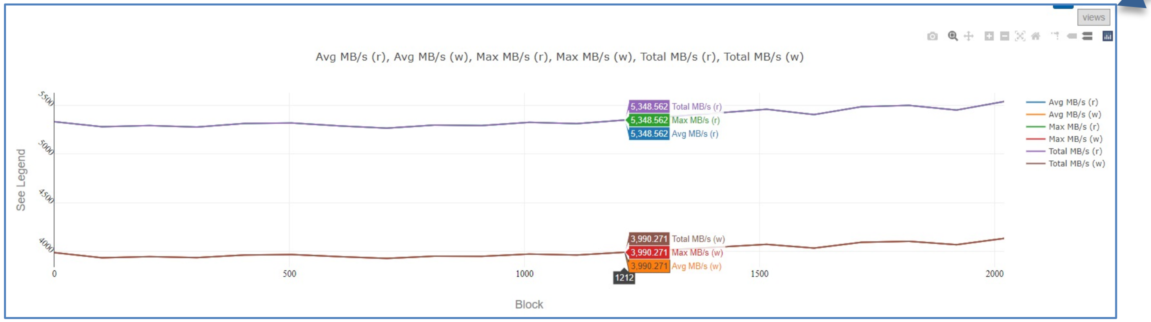


cluster	launchdate	user
quartz	9/14/20 15:31	boehme3

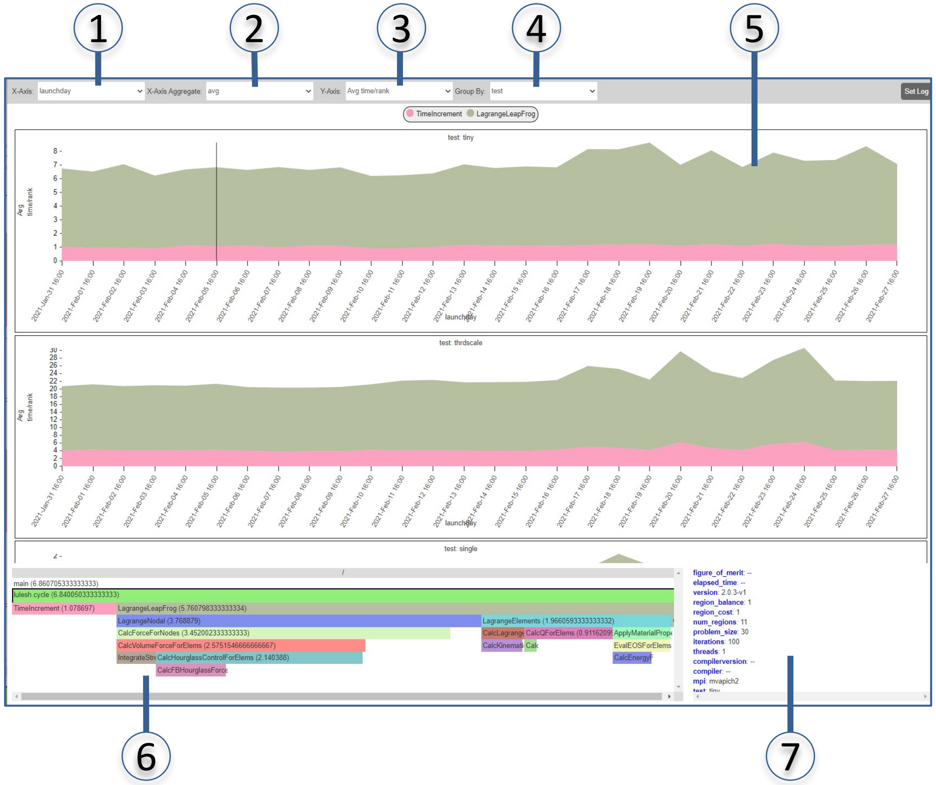
- FlameGraph: performance against code



- Timeseries: performance against time



Performance Data can be Compared Across Runs



X-Axis: launchday
X-Axis Aggregate: avg
Y-Axis: Avg time/rank
Group By: test

figure_of_merit: --
elapsed_time: --
version: 2.0.3-v1
region_balance: 1
region_cost: 1
num_regions: 11
problem_size: 30
iterations: 100
threads: 1
compilerversion: --
compiler: --
mpi: mvapich2
test: tiny

1. Metadata value on x-axis
2. Aggregation (min/max/avg…) if multiple runs at same point.
3. Metric to graph on y-axis.
4. Grouping metadata. Each unique value is a graph.
5. Stacked performance graph. Click to drill-down.
6. Flame graph for runs currently under cursor.
7. Metadata for runs currently under cursor.

Live Demo

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