Visualization Tools for Multi-Objective Algorithms - Draft

Mark Giuliano, STSCI

Mark Johnston, JPL Cal Tech

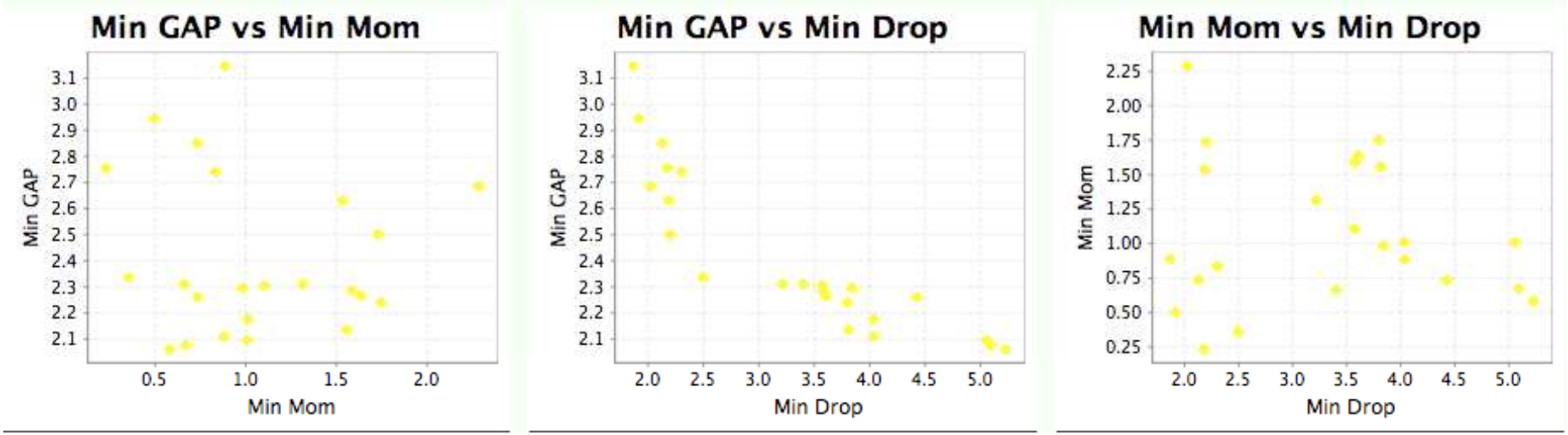
Multi-Objective Scheduling

- Background on Multi-objective scheduling

Interface Challenges

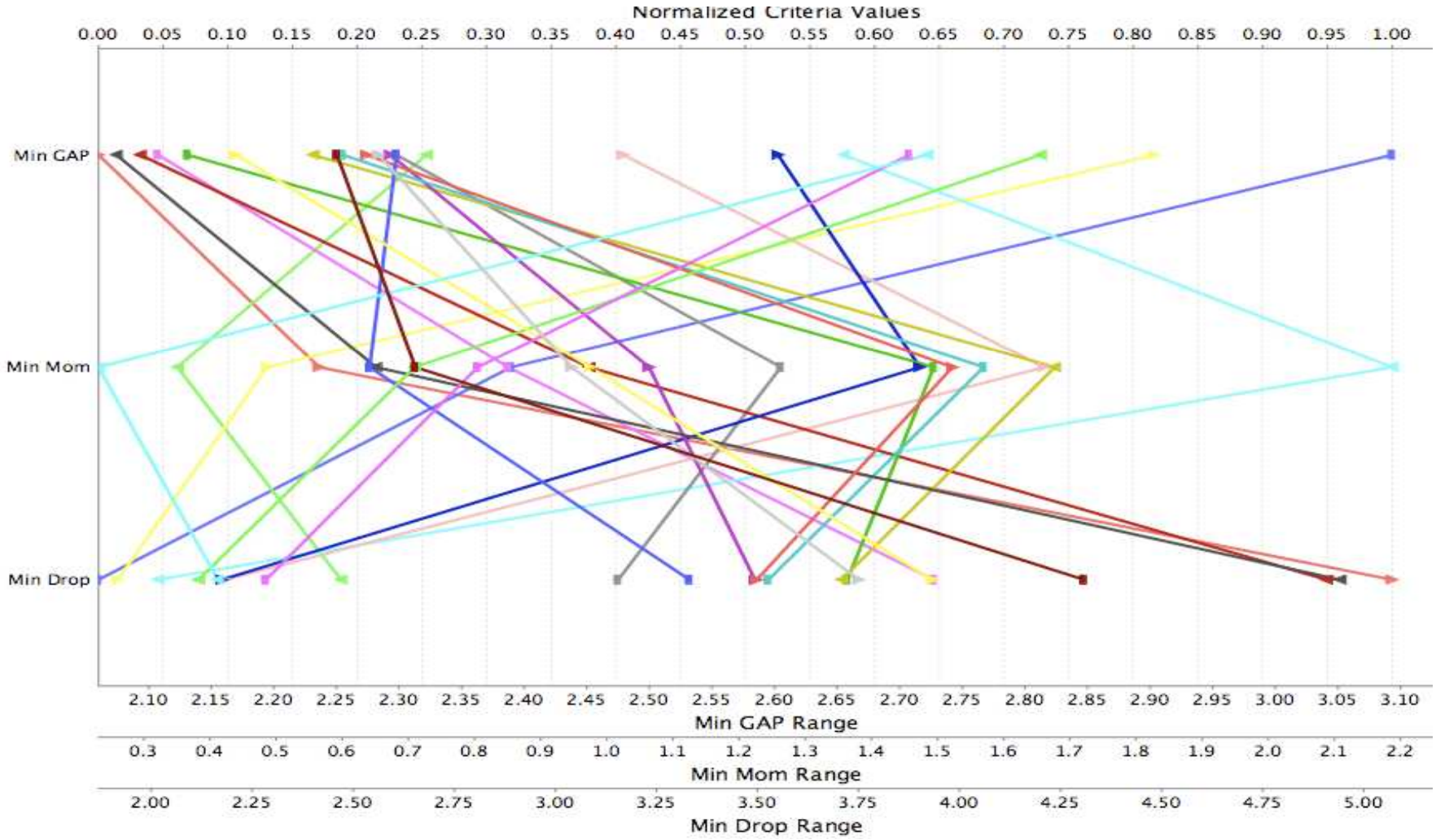
- High dimensionality in objective space
  - Simple X/Y plots insufficient
  - Need multiple views of the data
- Multiple users with different concerns
  - As expressed by different objectives
  - Need to collaborate to determine a mutually acceptable solution
  - Distributed and asynchronous usage

Visualizing the trade-off space



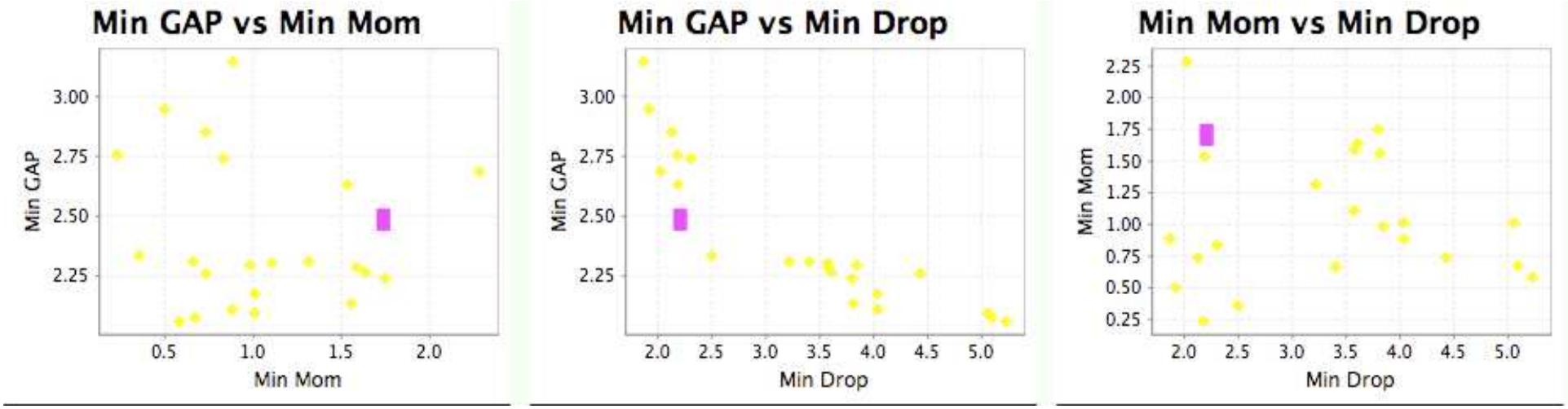
- Traditional X-Y plots show trade offs between 2 objectives
  - Hard to see relationships between the different graphs
  - The number of plots increases rapidly as the number of objectives increases

Parallel Coordinate Graphs



Interconnect graphs

- Interconnect the graphs: selecting a point or region on one graph highlights the point on other graphs

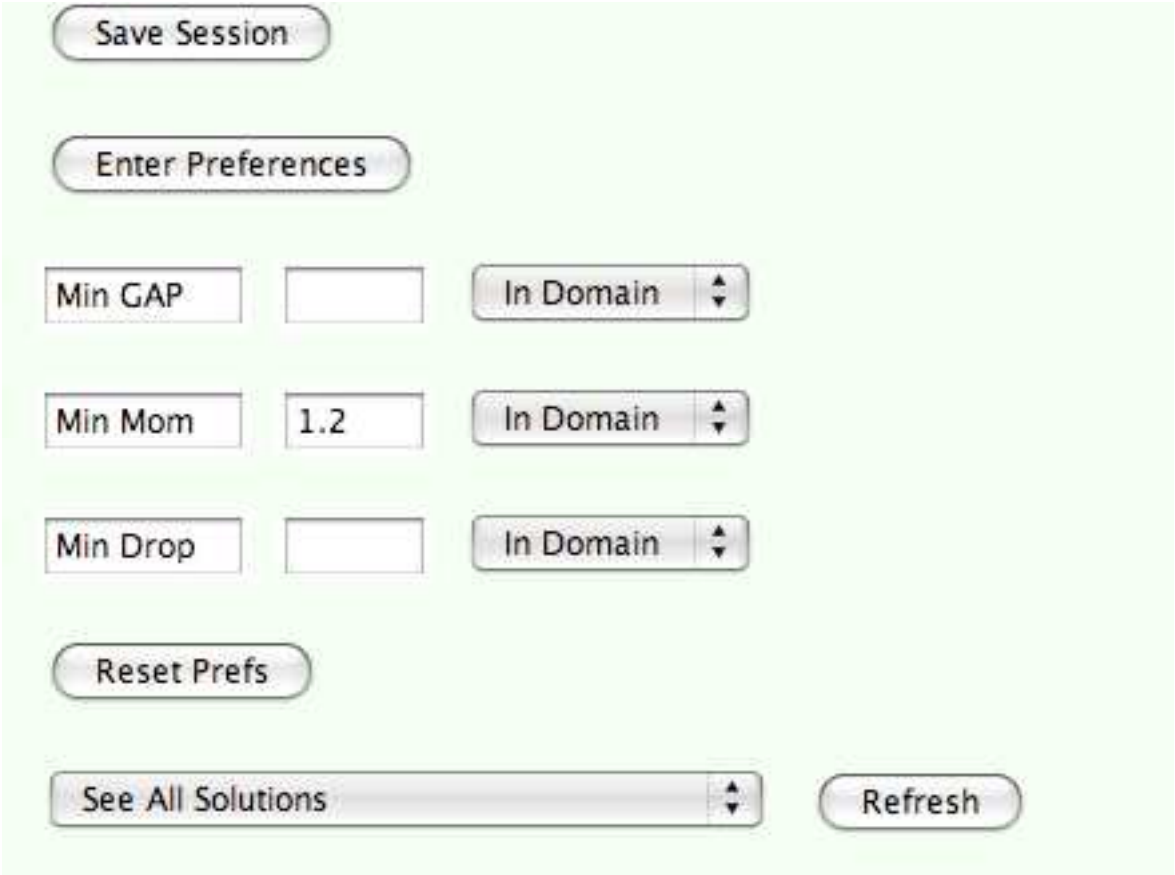


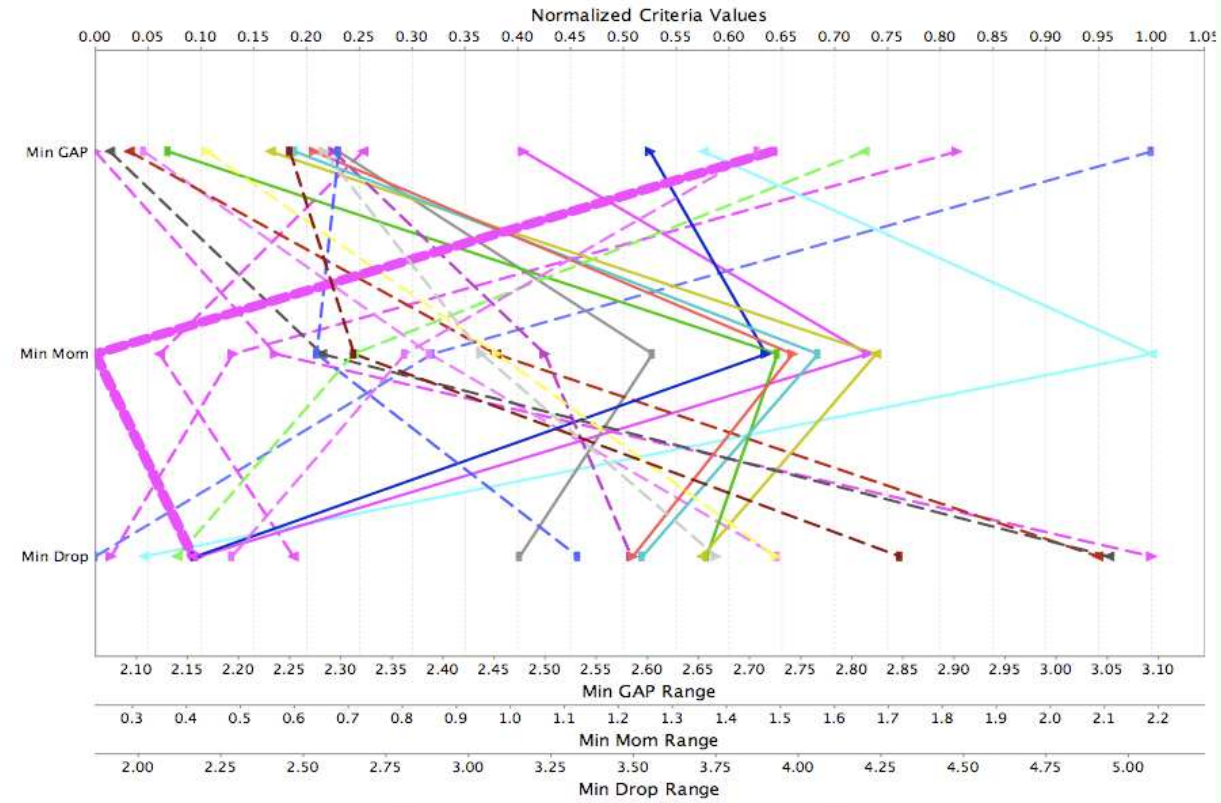
Alternate views

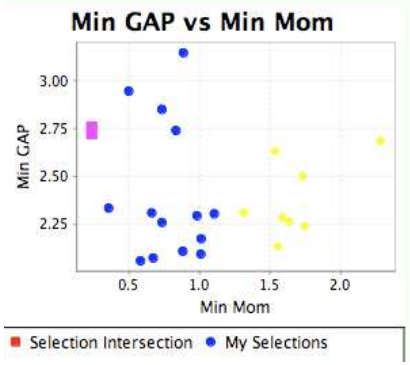
- Table (sortable)
- Value order

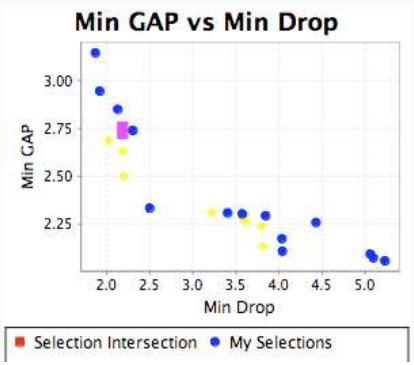
Index	Min GAP	Min Mom	Min Drop
0	2.06	0.5820426183...	5.23
1	3.145	0.8862978897...	1.87
2	2.335	0.3567022812...	2.5
3	2.945	0.4990168659...	1.92
4	2.11	0.8820475086...	4.04
5	2.685	2.2850866883...	2.025
6	2.5	1.7325837896...	2.2
7	2.31	1.3148033978...	3.22
8	2.095	1.0102924033...	5.0600000000...
9	2.63	1.5354204210...	2.19
10	2.1350000000...	1.5577325599...	3.815
11	2.24	1.7493877104...	3.8000000000...
12	2.305	1.1054975821...	3.575
13	2.265	1.6368651392...	3.61
14	2.075	0.6720651372...	5.095
15	2.285	1.5873128994...	3.58
16	2.31	0.6619029822...	3.4050000000...
17	2.85	0.7335429807...	2.13
18	2.1750000000...	1.0126939769...	4.035
19	2.74	0.8336212967...	2.305
20	2.755	0.2315510987...	2.18
21	2.295	0.9827801601...	3.845
22	2.2600000000...	0.7345708652...	4.43

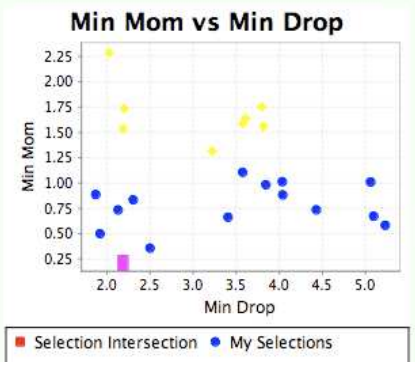
Selecting Preferences











Save Session

Enter Preferences

Min GAP		In Domain
Min Mom	1.2	In Domain
Min Drop		In Domain

Reset Prefs

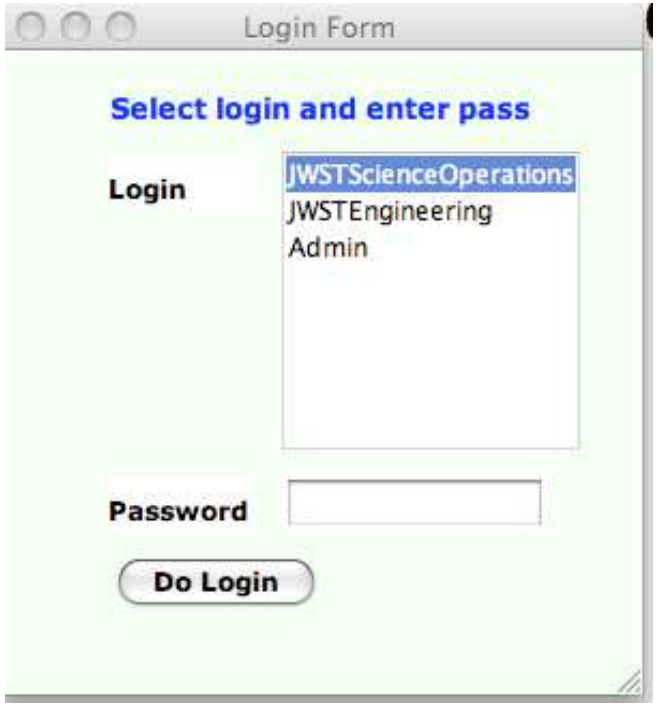
See All Solutions | Refresh

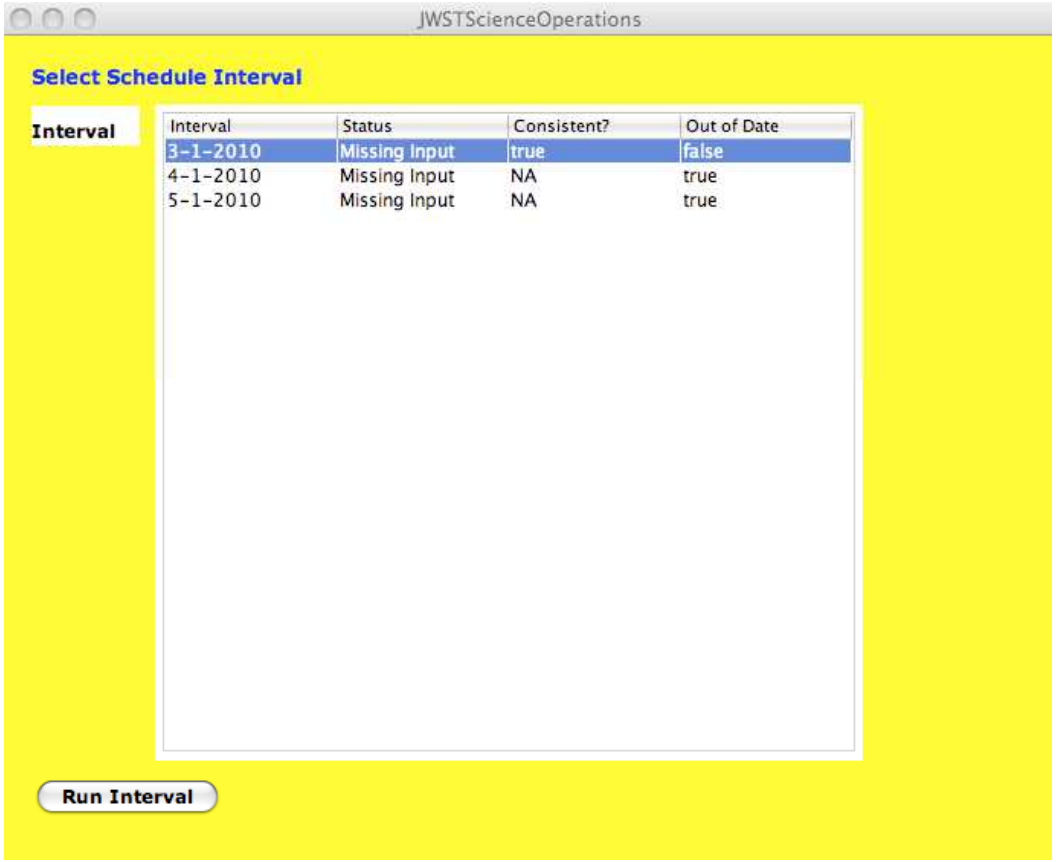
Index	Min GAP	Min Mom	Min Drop
0	2.06	0.5820426183...	5.23
1	3.145	0.8862978897...	1.87
2	2.335	0.3567022812...	2.5
3	2.945	0.4990168659...	1.92
4	2.11	0.8820475086...	4.04
5	2.685	2.2850866883...	2.025
6	2.5	1.7325837896...	2.2
7	2.31	1.3148033978...	3.22
8	2.095	1.0102924033...	5.0600000000...
9	2.63	1.5354204210...	2.19
10	2.1350000000...	1.5577325599...	3.815
11	2.24	1.7493877104...	3.8000000000...
12	2.305	1.1054975821...	3.575
13	2.265	1.6368651392...	3.61
14	2.075	0.6720651372...	5.095
15	2.285	1.5873128994...	3.58
16	2.31	0.6619029822...	3.4050000000...
17	2.85	0.7335429807...	2.13
18	2.1750000000...	1.0126939769...	4.035
19	2.74	0.8336212967...	2.305
20	2.755	0.2315510987...	2.18
21	2.295	0.9827801601...	3.845
22	2.2600000000...	0.7345708652...	4.43

Supporting multiple Users

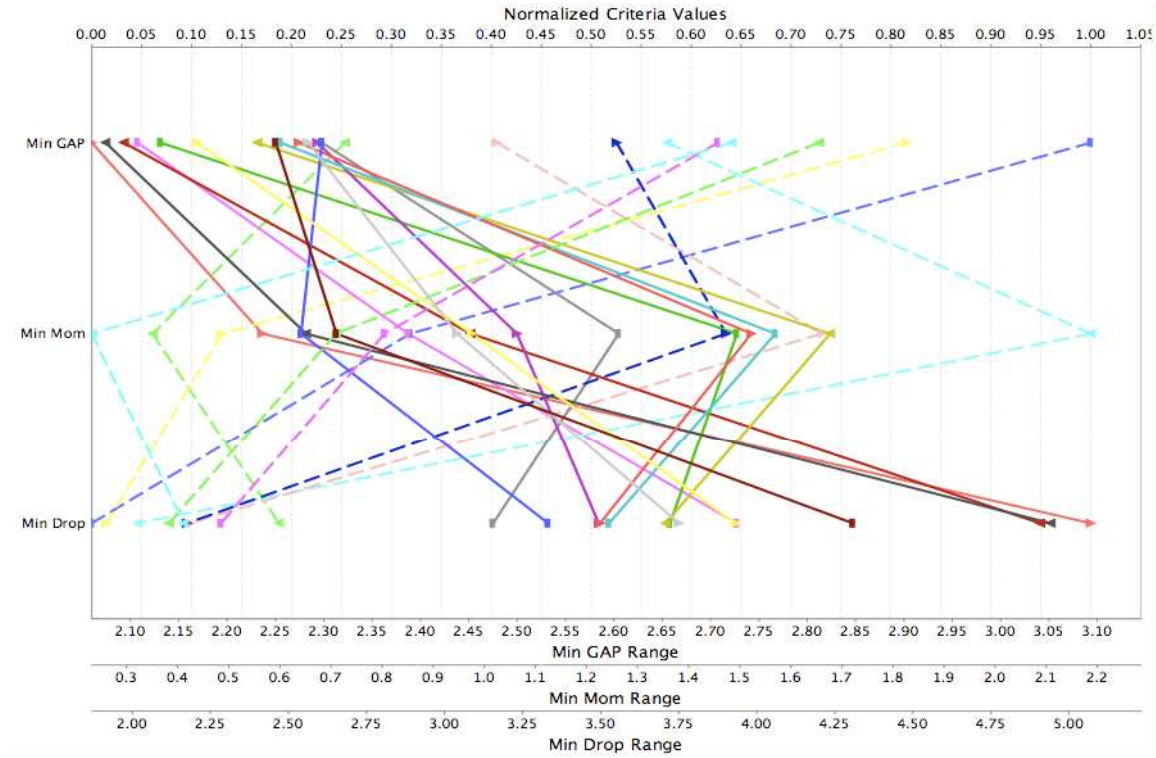
- Different scheduling constituents will have different priorities
  - Engineering concerned with lifetime issues
  - Science concerned with not loosing observations
- Usage distributed over time and location
  - Server based approach

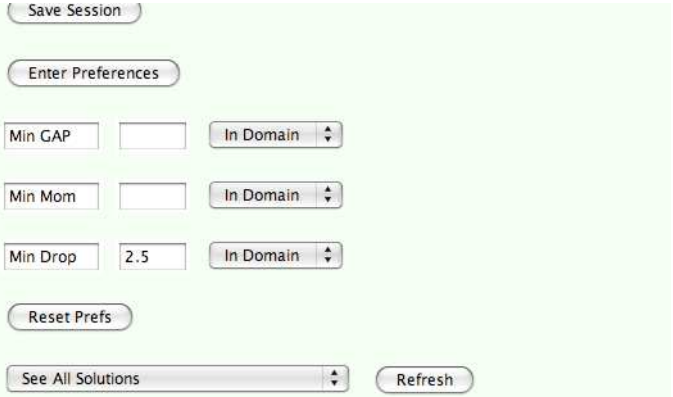
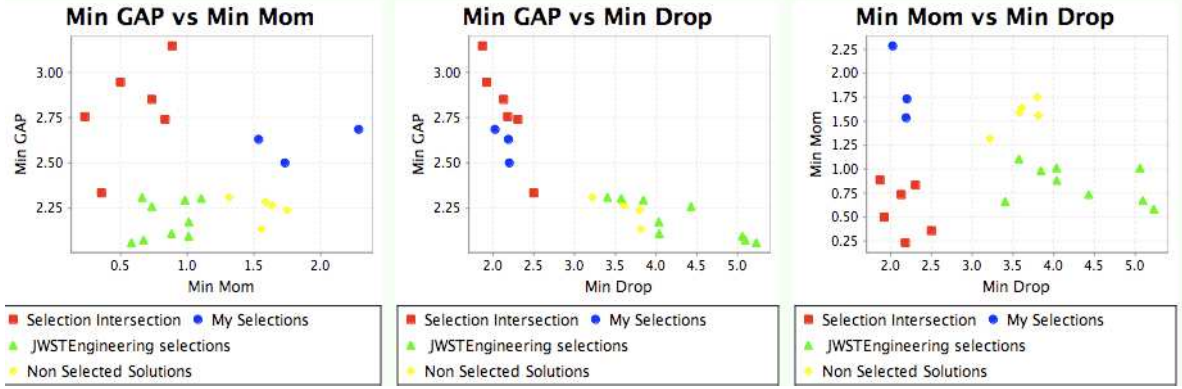
Users login and select interval





Can view their own selections as well as other users.





Index	Min GAP	Min Mom	Min Drop
0	2.06	0.5820426183...	5.23
1	3.145	0.8862978897...	1.87
2	2.335	0.3567022812...	2.5
3	2.945	0.4990168659...	1.92
4	2.11	0.8820475086...	4.04
5	2.685	2.2850866883...	2.025
6	2.5	1.7325837896...	2.2
7	2.31	1.3148033978...	3.22
8	2.095	1.0102924033...	5.0600000000...
9	2.63	1.5354204210...	2.19
10	2.1350000000...	1.5577325599...	3.815
11	2.24	1.7493877104...	3.8000000000...
12	2.305	1.1054975821...	3.575
13	2.265	1.6368651392...	3.61
14	2.075	0.6720651372...	5.095
15	2.285	1.5873128994...	3.58
16	2.31	0.6619029822...	3.4050000000...
17	2.85	0.7335429807...	2.13
18	2.1750000000...	1.0126939769...	4.035
19	2.74	0.8336212967...	2.305
20	2.755	0.2315510987...	2.18
21	2.295	0.9827801601...	3.845
22	2.2600000000...	0.7345708652...	4.43