

## 0.1 Baseline

Cycle	Days	Shifts / day	Shifts	# Maintenance Days per week	# MOM Shifts		
2014/03	10	4	40		18		
2015/01a	36	6	206	1	Shift credit for One MOM Shift		
2015/01b	10	6	58		28		
2015/02	39	6	224		#MOM Shifts		
2015/03	45	6	258		504		
2015/04	45	6	258		Total Shifts		
		Total Experimental shift	1044		1548		
		# shifts / person			22.4347826087	Shift block length	5 shifts
Institute	Scientists	RA + Students	MOMs	Total	Shifts / Institute	Shift Blocks per Scientist	Shift blocks per RA/Grad student
Belgrade	1	0	0	1	22.43	4.49	0.00
CERN	0	0	0	0	0.00	0.00	0.00
IHEP	1	0	0	1	22.43	4.49	0.00
Osaka	0	0	0	0	0.00	0.00	0.00
Sichuan	0	0	0	0	0.00	0.00	0.00
Brookhaven	1	0	0	1	22.43	4.49	0.00
DL	0	0	0	0	0.00	0.00	0.00
Iowa	1	0	0	1	22.43	4.49	0.00
LBNL	2	0	0	2	44.87	4.49	0.00
Liverpool	1	0	0	1	22.43	4.49	0.00
Milano	1	0	0	1	22.43	4.49	0.00
Napoli	1	0	0	1	22.43	4.49	0.00
NIKHEF	1	0	0	1	22.43	4.49	0.00
Oxford	1	0	0	1	22.43	4.49	0.00
Pavia	1	0	0	1	22.43	4.49	0.00
Imperial	4	4	2	10	224.35	2.81	2.81
RAL	1	0	1	2	44.87	3.37	0.00
Riverside	1	1	0	2	44.87	4.49	4.49
Roma	2	0	0	2	44.87	4.49	0.00
Glasgow	1	1	1	3	67.30	1.13	1.13
Sofia	2	1	0	3	67.30	4.49	4.49
Mississippi	3	0	0	3	67.30	4.49	0.00
Sheffield	1	1	2	4	89.74	0.00	0.00
Geneva	1	2	1	4	89.74	2.25	2.25
Strathclyde	1	3	0	4	89.74	4.49	4.49
Warwick	1	2	1	4	89.74	2.25	2.25
Brunel	1	2	1	4	89.74	4.12	4.12
IT	3	2	1	6	134.61	4.26	4.26
Femilab	2	3	1	6	134.61	4.26	4.26
				69	1548		

Figure 1: Baseline shift pattern.

Figure 0.1 shows the current shift allocation pattern under the following assumptions:

1. The MOMs receive one shift credit for each day that they act as MOM
2. The MOMs do not do experimental shifts in the control room
3. All members of the collaboration carry out their personal allocations in full.
4. 24 hour running for all ISIS cycles, except the first where we run only on weekends.
5. Wednesdays are reserved for maintenance days. This implies that on Wednesdays the daytime shifts are not filled.

The total number of shifts to allocate is 1548, made up of 1044 *experimental shifts* which are the shifts taken in the control room tending the experiment and 504 *MOM shifts*.

Personnel from institutes have been divided into three categories

- **Scientists**, which includes academics at Universities or research scientists at national laboratories.
- **RAs and students**
- **MOMs**

There are a total of 69 personnel who are available for shifts. This number has been checked with the full collaboration list.

The number of 5-shift blocks that each member of the collaboration must fulfill is shown in the final two columns of the spreadsheet (entitled "Scientist" and "RA/students"). We take Warwick as an example : there are four people contributing shifts from Warwick : one of them is a Scientist (myself) and 3 are RAs or students. We have not (currently) contributed to the MOM category. The institutional shift load is 90 shifts. The personal shift allocation for Warwick is therefore  $90/4 \approx 22$  shifts which is recorded in the table as as 4.49 shift *blocks*.

The number of blocks assigned to people depend on how many MOM shifts the institute has signed up for. Taking Glasgow as another example, there are three active personnel with an institutional shift load of 67.3 shifts. Glasgow contributes one scientist, one RA/Student and one MOM. The MOM shifts take up 56 shifts, leaving only 11 shifts to allocate for the other two members of the group. This is just over 1 shift block for the other members of the group.

The implications of this shift model has some downsides

- Single person institutes must fulfill 4.49 shift blocks to meet their institutional shift allocation.
- The MOM shifts comprise almost one third of the total number of shifts.
- A significant number of personnel (10, one of which is unallocated at the moment) who act as MOMs are taken out of doing experimental shifts altogether.

There are a limited number of actions that can be taken to reduce the shift load:

### 0.1.1 MOM shift Weighting

We currently assume that each day as MOM is accorded one shift credit. The weighting can be changed, reducing the number of MOM shifts. Figure 0.1.1 shows the effect of reducing the MOM shift credit from 1 per day to 0.5 per day.

Cycle	Days	Shifts / day	Shifts	# Maintenance Days per week	# MOM Shifts		
2014/03	10	4	40		18		
2015/01a	36	6	206	1	Shift credit for One MOM Shift		
2015/01b	10	6	58		15		
2015/02	39	6	224		#MOM Shifts		
2015/03	45	6	258		252		
2015/04	45	6	258		Total Shifts		
Total Experimental shifts:			1044		1296		
# shifts / person					18.7826086957	Shift block length	5 shifts
Institute	Scientists	RA + Students	MOMs	Total	Shifts / Institute	Shift Blocks per Scientist	Shift blocks per RA/Grad student
Belgrade	1	0	0	1	18.78	3.76	0.00
CERN	0	0	0	0	0.00	0.00	0.00
IHEP	1	0	0	1	18.78	3.76	0.00
Osaka	0	0	0	0	0.00	0.00	0.00
Sichuan	0	0	0	0	0.00	0.00	0.00
Brookhaven	1	0	0	1	18.78	3.76	0.00
DL	0	0	0	0	0.00	0.00	0.00
Iowa	1	0	0	1	18.78	3.76	0.00
LBNL	2	0	0	2	37.57	3.76	0.00
Liverpool	1	0	0	1	18.78	3.76	0.00
Milano	1	0	0	1	18.78	3.76	0.00
Napoli	1	0	0	1	18.78	3.76	0.00
NIKHEF	1	0	0	1	18.78	3.76	0.00
Oxford	1	0	0	1	18.78	3.76	0.00
Pavia	1	0	0	1	18.78	3.76	0.00
Imperial	4	4	2	10	187.83	3.30	3.30
RAL	1	0	1	2	37.57	4.71	0.00
Riverside	1	1	0	2	37.57	3.76	3.76
Roma	2	0	0	2	37.57	3.76	0.00
Glasgow	1	1	1	3	56.35	2.83	2.83
Sofia	2	1	0	3	56.35	3.76	3.76
Mississippi	3	0	0	3	56.35	3.76	0.00
Sheffield	1	1	2	4	75.13	1.91	1.91
Geneva	1	2	1	4	75.13	3.14	3.14
Strathclyde	1	3	0	4	75.13	3.76	3.76
Warwick	1	2	1	4	75.13	3.14	3.14
Brunel	1	2	1	4	75.13	4.08	4.08
IIT	3	2	1	6	112.70	3.95	3.95
Femilab	2	3	1	6	112.70	3.95	3.95
				69	1296		

Figure 2: Shift option one : MOM shift weighting reduced from 1 / day to 0.5 /day.

The effect is to reduce the total number of shifts to 1296, and the personal shift allocation to 3.76 shift blocks. It should be noted that the MOMs have already signed up to be MOM based on our current shift policy.

### **0.1.2 Option 2 : MOM Experimental shifts**

Taking so many people ( 10 out of 69 ) out of doing experimental shifts entirely by acting as MOM has the effect of increasing the shift load on other collaborators. We could require the MOMs to take at most half their personal allocation. Doing this, however, would only affect the number of shifts taken by other members of the institutional group. It would do nothing to lower the shift burden on single person institutes, for example.

### 0.1.3 Options 3 : Sixteen hour / 7 day a week running

Of course, there are less shifts if we reduce the total shift load. If, instead of taking data 24 hours a day, we take data from 08:00 to 24:00 we will reduce the total shift load by one third. The shift pattern under this option is shown in Figure 0.1.3. The shift load reduces by approximately one shift block from 4.49 to 3.7.

Cycle	Days	Shifts / day	Shifts	# Maintenance Days per week	# MOM Shifts		
2014/03	10	4	40		18		
2015/01a	38	4	134	1	Shift credit for One MOM Shift		
2015/01b	10	4	38		28		
2015/02	39	4	146		#MOM Shifts		
2015/03	45	4	168		504		
2015/04	45	4	168		Total Shifts		
			<b>Total Experimental shifts</b>	694	1198		
					<b># shifts / person</b>	17.3623188406	
					<b>Shift block length</b>	5 shifts	
Institute	Scientists	RA + Students	MOMs	Total	Shifts / Institute	Shift Blocks per Scientist	Shift blocks per RA/Grad student
Belgrade	1	0	0	1	17.36	3.47	0.00
CERN	0	0	0	0	0.00	0.00	0.00
IHEP	1	0	0	1	17.36	3.47	0.00
Osaka	0	0	0	0	0.00	0.00	0.00
Sichuan	0	0	0	0	0.00	0.00	0.00
Brookhaven	1	0	0	1	17.36	3.47	0.00
DL	0	0	0	0	0.00	0.00	0.00
Iowa	1	0	0	1	17.36	3.47	0.00
LBNL	2	0	0	2	34.72	3.47	0.00
Liverpool	1	0	0	1	17.36	3.47	0.00
Milano	1	0	0	1	17.36	3.47	0.00
Napoli	1	0	0	1	17.36	3.47	0.00
NIKHEF	1	0	0	1	17.36	3.47	0.00
Oxford	1	0	0	1	17.36	3.47	0.00
Pavia	1	0	0	1	17.36	3.47	0.00
Imperial	4	4	2	10	173.62	1.54	1.54
RAL	1	0	1	2	34.72	1.34	0.00
Riverside	1	1	0	2	34.72	3.47	3.47
Roma	2	0	0	2	34.72	3.47	0.00
Glasgow	1	1	1	3	52.09	0.00	0.00
Sofia	2	1	0	3	52.09	3.47	3.47
Mississippi	3	0	0	3	52.09	3.47	0.00
Sheffield	1	1	2	4	69.45	0.00	0.00
Geneva	1	2	1	4	69.45	0.90	0.90
Strathclyde	1	3	0	4	69.45	3.47	3.47
Warwick	1	2	1	4	69.45	0.90	0.90
Brunel	1	2	1	4	69.45	2.76	2.76
IT	3	2	1	6	104.17	3.05	3.05
Femilab	2	3	1	6	104.17	3.05	3.05
				69	1198		

Figure 3: Shift option three : Running is reduced to 16 hours / day, 7 days / week.

### 0.1.4 Option 4 : 16 hour / day, 7 day / week, half load to single person institutes

In addition we could be satisfied if the single person institutes fulfill only half their personal shift allocation and we assume that this is also the institutional load. The resulting shift pattern is shown in Figure 0.1.4. The effect is to reduce the single person institute shift load to just under two, but at the expense of increasing all the other institutional loads.

Cycle	Days	Shifts / day	Shifts	# Maintenance Days per week	# MOM Shifts		
2014/03	10	4	40		18		
2015/01a	36	4	134	1	Shift credit for One MOM Shift		
2015/01b	10	4	38		28		
2015/02	39	4	146		#MOM Shifts		
2015/03	45	4	168		504		
2015/04	45	4	168		Total Shifts		
Total Experimental shifts			694		1198		
# shifts / person					17.3623188406	Shift block length	
						5 shifts	
Institute	Scientists	RA + Students	MOMs	Total	Shifts / Institute	Shift Blocks per Scientist	Shift blocks per RA/Grad student
Belgrade	1	0	0	1	17.36	1.74	0.00
CERN	0	0	0	0	0.00	0.00	0.00
IHEP	1	0	0	1	17.36	1.74	0.00
Osaka	0	0	0	0	0.00	0.00	0.00
Sichuan	0	0	0	0	0.00	0.00	0.00
Brookhaven	1	0	0	1	17.36	1.74	0.00
DL	0	0	0	0	0.00	0.00	0.00
Iowa	1	0	0	1	17.36	1.74	0.00
LBNL	2	0	0	2	34.72	3.47	0.00
Liverpool	1	0	0	1	17.36	1.74	0.00
Milano	1	0	0	1	17.36	1.74	0.00
Napoli	1	0	0	1	17.36	1.74	0.00
NIKHEF	1	0	0	1	17.36	1.74	0.00
Oxford	1	0	0	1	17.36	1.74	0.00
Pavia	1	0	0	1	17.36	1.74	0.00
Imperial	4	4	2	10	173.62	1.54	2.15
RAL	1	0	1	2	34.72	1.34	0.00
Riverside	1	1	0	2	34.72	3.47	3.96
Roma	2	0	0	2	34.72	3.47	0.00
Glasgow	1	1	1	3	52.09	0.00	0.73
Sofia	2	1	0	3	52.09	3.47	4.20
Mississippi	3	0	0	3	52.09	3.47	0.00
Sheffield	1	1	2	4	69.45	0.00	0.97
Geneva	1	2	1	4	69.45	0.90	1.38
Strathclyde	1	3	0	4	69.45	3.47	3.80
Warwick	1	2	1	4	69.45	0.90	1.38
Brunel	1	2	1	4	69.45	2.76	3.25
IT	3	2	1	6	104.17	3.05	3.78
Femilab	2	3	1	6	104.17	3.05	3.53
				69	1198		

Figure 4: Shift option four : Running is reduced to 16 hours / day, 7 days / week. In addition, single person institutes are allowed to do only half their personal allocation.

### 0.1.5 Option 5 : 16 hour / day , 7 day / week except Commissioning period

We could decide not to staff Cycle 2015/01 (the period set aside for commissioning) to the same extent as the data production runs. In this option we

run 16 hours / day, 7 days / week except for Cycle 2015/01 where we only have 2 8 hour shifts a day set aside for data taking. Figure 0.1.5 shows the effect. The shift load is now reduced to roughly 16 shifts / shifter with the single person institutes required to fulfill 3 shift blocks over Step IV.

Cycle	Days	Shifts / day	Shifts	# Maintenance Days per week	# MOM Shifts		
2014/03	10	4	40		18		
2015/01a	36	2	62	1	Shift credit for One MOM Shift		
2015/01b	10	2	18		28		
2015/02	39	4	146		#MOM Shifts		
2015/03	45	4	168		504		
2015/04	45	4	168		Total Shifts		
			602		1106		
		Total Experimental shifts	602				
		# shifts / person			16.0289855072	Shift block length	5 shifts
Institute	Scientists	RA + Students	MOMs	Total	Shifts / Institute	Shift Blocks per Scientist	Shift blocks per RA/Grad student
Belgrade	1	0	0	1	16.03	3.21	0.00
CERN	0	0	0	0	0.00	0.00	0.00
IHEP	1	0	0	1	16.03	3.21	0.00
Osaka	0	0	0	0	0.00	0.00	0.00
Sichuan	0	0	0	0	0.00	0.00	0.00
Brookhaven	1	0	0	1	16.03	3.21	0.00
DL	0	0	0	0	0.00	0.00	0.00
Iowa	1	0	0	1	16.03	3.21	0.00
LBNL	2	0	0	2	32.06	3.21	0.00
Liverpool	1	0	0	1	16.03	3.21	0.00
Milano	1	0	0	1	16.03	3.21	0.00
Napoli	1	0	0	1	16.03	3.21	0.00
NIKHEF	1	0	0	1	16.03	3.21	0.00
Oxford	1	0	0	1	16.03	3.21	0.00
Pavia	1	0	0	1	16.03	3.21	0.00
Imperial	4	4	2	10	160.29	1.21	1.21
RAL	1	0	1	2	32.06	0.81	0.00
Riverside	1	1	0	2	32.06	3.21	3.21
Roma	2	0	0	2	32.06	3.21	0.00
Glasgow	1	1	1	3	48.09	0.00	0.00
Sofia	2	1	0	3	48.09	3.21	3.21
Mississippi	3	0	0	3	48.09	3.21	0.00
Sheffield	1	1	2	4	64.12	0.00	0.00
Geneva	1	2	1	4	64.12	0.54	0.54
Strathclyde	1	3	0	4	64.12	3.21	3.21
Warwick	1	2	1	4	64.12	0.54	0.54
Brunel	1	2	1	4	64.12	2.41	2.41
IT	3	2	1	6	96.17	2.73	2.73
Femilab	2	3	1	6	96.17	2.73	2.73
				69	1106		

Figure 5: Shift option five : Running is reduced to 16 hours / day, 7 days / week except the commissioning period which only has one 8-hour data taking period a day allocated.

### 0.1.6 Option 6 : 16 hour / day , 7 day / week except Commissioning period, half load to single person institutes

Finally, we keep the shift pattern of Option 5, but allow single person institutes to only do half their personal allowance. The shift pattern is shown in Figure 0.1.6.

Cycle	Days	Shifts / day	Shifts	# Maintenance Days per week	# MOM Shifts		
2014/03	10	4	40		18		
2015/01a	36	2	62	1	Shift credit for One MOM Shift		
2015/01b	10	2	18		28		
2015/02	39	4	146		#MOM Shifts		
2015/03	45	4	168		504		
2015/04	45	4	168		Total Shifts		
					1106		
		Total Experimental shifts		602			
		# shifts / person			16.0289855072	Shift block length	5 shifts
Institute	Scientists	RA + Students	MOMs	Total	Shifts / Institute	Shift Blocks per Scientist	Shift blocks per RA/Grad student
Belgrade	1	0	0	1	16.03	1.60	0.00
CERN	0	0	0	0	0.00	0.00	0.00
IHEP	1	0	0	1	16.03	1.60	0.00
Osaka	0	0	0	0	0.00	0.00	0.00
Sichuan	0	0	0	0	0.00	0.00	0.00
Brookhaven	1	0	0	1	16.03	1.60	0.00
DL	0	0	0	0	0.00	0.00	0.00
Iowa	1	0	0	1	16.03	1.60	0.00
LBNL	2	0	0	2	32.06	3.21	0.00
Liverpool	1	0	0	1	16.03	1.60	0.00
Milano	1	0	0	1	16.03	1.60	0.00
Napoli	1	0	0	1	16.03	1.60	0.00
NIKHEF	1	0	0	1	16.03	1.60	0.00
Oxford	1	0	0	1	16.03	1.60	0.00
Pavia	1	0	0	1	16.03	1.60	0.00
Imperial	4	4	2	10	160.29	1.21	1.77
RAL	1	0	1	2	32.06	0.81	0.00
Riverside	1	1	0	2	32.06	3.21	3.66
Roma	2	0	0	2	32.06	3.21	0.00
Glasgow	1	1	1	3	48.09	0.00	0.67
Sofia	2	1	0	3	48.09	3.21	3.88
Mississippi	3	0	0	3	48.09	3.21	0.00
Sheffield	1	1	2	4	64.12	0.00	0.90
Geneva	1	2	1	4	64.12	0.54	0.99
Strathclyde	1	3	0	4	64.12	3.21	3.51
Warwick	1	2	1	4	64.12	0.54	0.99
Brunel	1	2	1	4	64.12	2.41	2.86
ILL	3	2	1	6	96.17	2.73	3.40
Femilab	2	3	1	6	96.17	2.73	3.18
				69	1106		

Figure 6: Shift option six : Running is reduced to 16 hours / day, 7 days / week except the commissioning period which only has one 8-hour data taking period a day allocated. Single person institutes do half personal load.