MUSE Project Management

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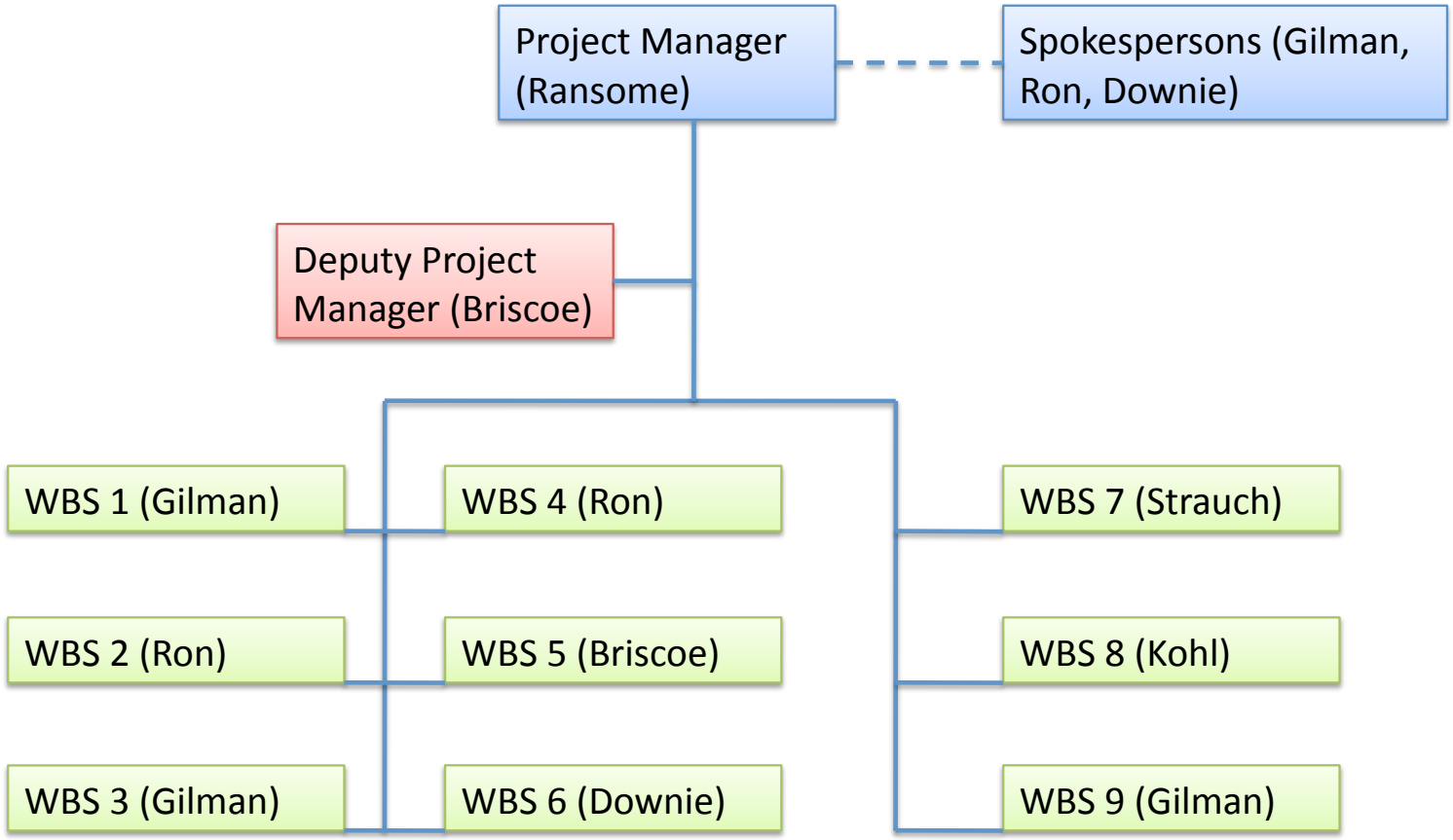
For the MUSE Collaboration

Outline

- Project WBS Organization
- Overall Schedule
- Assessment of each WBS
- Contingency management

WBS

- There are 8 construction elements
- We've included a catch-all "Installation" element
  - This will contain miscellaneous work to be done before and after installation, as well as installation milestones
- The Gantt chart also has a WBS 10 (Funding) which is simply for convenience of linking tasks to the funding schedule


Project Manager (Ransome)
Spokespersons (Gilman, Ron, Downie)
Deputy Project Manager (Briscoe)
WBS 1 (Gilman)
WBS 4 (Ron)
WBS 7 (Strauch)
WBS 2 (Ron)
WBS 5 (Briscoe)
WBS 8 (Kohl)
WBS 3 (Gilman)
WBS 6 (Downie)
WBS 9 (Gilman)

WBS Dictionary

WBS	Institution	Scope
1	Rutgers	Build support table and frames for detectors
2	Tel Aviv	Scintillating Fiber Detector
3	Rutgers	Cerenkov Detector
4	Hebrew	Straw Chambers
5	GWU	LH2 Target
6	GWU	Electronics and DAQ
7	S.Carolina	Scintillators
8	Hampton	GEM detectors

Each WBS is independent of the others until final assembly, except some electronics needed for testing

Schedule

- Two major milestones:
  - Test run in fall 2015
  - Full run in fall 2016
- Items needed for 2015 Run
  - Support Table (WBS1) – by June (anticipated by March 2015)
  - GEMs (already there)
  - Half of Cerenkov (WBS3) – by July (by January 2015)
  - Half of Scintillator (WBS7), Veto – by August (by August 2015)
  - Sci-Fi detector (WBS2) – by September (by August 2015)
  - Straw tube – 1 chamber (WBS4) – by October (by June 2015)
  - Half of electronics (WBS6) – with associated detector (by July 2015)
  - Does not need LH2

Budget & Contingency

- Each WBS has a combination of labor and equipment.
- Equipment is mainly standard, from well known designs, or off-the-shelf.
  - Largest uncertainties come from currency exchange risks
- Labor is mainly in salaried employees (i.e. grad students, post-docs, full time tech), not hourly. This gives some less uncertainty in costs.

Does not include F&A or contingency	Quotes, recent purchases	from similar projects	more uncertain		
WBS	Material-Firm	Material-medium	Other Material	%Firm	%Firm/Med
1-table	$0	$13,205	$0	0.0%	100.0%
2-Sci-Fi	$33,134	$32,000	$0	50.9%	100.0%
3-Cerenkov	$200,150	$0	$2,250	98.9%	98.9%
4-Straw	$55,737	$268,450	$19,000	16.2%	94.5%
5-Cryo	$0	$217,000	$0	0.0%	100.0%
6-Electronics	$402,719	$14,000	$0	96.6%	100.0%
7-Scintillator	$265,812	$65,873	$0	80.1%	100.0%
8-GEM	$26,934	$3,500	$0	88.5%	100.0%
Total	$984,486	$614,028	$21,250	60.8%	98.7%
	GS/PD	Technician/UG	Shop, uncertian times		
	Wages-Firm	Wages-medium	Other Wages	%Firm	%Firm/Med
1-table	$0	$10,347	$0	0.0%	100.0%
2-Sci-Fi	$50,000	$20,000	$0	71.4%	100.0%
3-Cerenkov	$0	$0	$4,000	0.0%	0.0%
4-Straw	$115,236	$0	$21,000	84.6%	84.6%
5-Cryo	$146,916	$190,512	$49,000	38.0%	87.3%
6-Electronics	$149,460	$0	$0	100.0%	100.0%
7-Scintillator	$0	$67,735	$0	0.0%	100.0%
8-GEM	$0	$0	$0	0.0%	0.0%
Total	$461,612	$288,594	$74,000	56.0%	91.0%

Travel

- Travel is a major expense
  - Meetings (~$40K/year)
  - Installation/testing 2015 (~$250K)
  - Running 2016 onward (~$350K/year)

WBS

- I will discuss major cost components, schedule, and risks for the WBS 2,3,4,7.
- WBS 1 consists of low cost construction with very low construction, technical, or schedule risk
- WBS 8 consists of minor backup to working system
- WBS 5,6 discussed earlier today
- WBS 9 currently has a primary cost of an on-site post-doc

WBS 4 - Straw Tubes

- Major Cost Items
  - Straws
    - Straws & wire BOE – quote $24K
    - Hardware (pins, caps) BOE – PANDA experience - $327K
    - Contingency $146K
  - Labor
    - Salaried – 2 GS (one from HU, one from Temple)
    - $175K (includes travel for Temple student)
    - Contingency $35K
  - Total Cost $637K +$202K contingency

WBS 4 - Schedule

- Set up
  - Requires mounting table, clean room
  - Estimated Completion date – August 2014
- Straw Construction
  - Estimated at least 25/week
  - First chamber completed – May, 2015
  - Chamber 2-4 completed – January 2016

WBS4

4	**Straw Chambers**		87	**135**	1.83 years	7/2/14	3/8/16
4.1	Order straw material	6 months	11		6 months	7/2/14	12/16/14
4.2	Order gas system	2 months	118		2 months	7/2/14	8/26/14
4.3	Set up clean room	2 months	57	135	2 months	7/2/14	8/26/14
4.4	Manufacture Jigs	2 months	111	135	2 months	7/2/14	8/26/14
4.5	Design chamber mounting	2 months	127	135	2 months	7/2/14	8/26/14
4.6	manufacture straws ch 1	2 months	75	56; 58; 59	2 months	12/17/14	2/10/15
4.7	manufacture gas dist.	2 months	95	57	2 months	8/27/14	10/21/14
4.8	machine chamber mounting	2 months	6	60	2 months	8/27/14	10/21/14
4.9	assemble & test ch 1	2 months	65	61; 63	2 months	2/11/15	4/7/15
4.10	ship to PSI	1 month	69	64	1 month	4/8/15	5/5/15
4.11	Commission ch 1 at PSI	1 month	97	65	1 month	5/6/15	6/2/15
4.12	Ch 1 ready at PSI		19	66	0 hours	6/2/15	6/2/15
4.13	Purchase 2nd gas system	1 month	21	61	1 month	2/11/15	3/10/15
4.14	Build ch 2-4	9 months	119	64	9 months	4/8/15	12/15/15
4.15	Ship ch 2-4 to psi	1 month	2	69	1 month	12/16/15	1/12/16
4.16	Commision at PSI	2 months	79	70	2 months	1/13/16	3/8/16

WBS 4 – QA and Risk

- QA
  - Straws will be tested with source, planes with cosmics
  - Pressure testing as straws are built
- Major Risks
  - Higher than anticipated failure rate
    - Close consultation with PANDA to conform to proven procedures
    - Buy enough extra parts to mitigate small batch costs/time delay
    - We will buy 4000 straws at outset, and parts for 3500, with contingency for 500 more sets of parts

WBS 7 - Scintillator

- Major Costs
  - PMTs – BOE quote - $187K
  - Scintillator – BOE quote - $78K
  - Backing structure – BOE quote $44K
  - Labor – BOE past experience - $110K
- Total Cost $442K + $72K contingency

WBS 7 - Schedule

- Pre-construction – order PMT's and scintillator (2-3 months)
- Scintillators are made in batches of 6, with one set completed before moving on.
- Need to place orders by July 2014 to be ready for fall 2015 run.
- Full set completed by early 2016, no risk on full run

WBS7

7	Scintillators		31			2.15 years	4/1/14	3/22/16
7.1	Design scint., beam mon., veto	1 month	146		4/1/14	1 month	4/1/14	4/28/14
7.2	Procure materials		134	135FS+1 month		10.85 months	7/30/14	5/28/15
7.2.1	Order scintillator	2 months	136			2 months	7/30/14	9/23/14
7.2.2	Order PMTs	2 months	135			2 months	7/30/14	9/23/14
7.2.3	Order Supplies	1 month	145			1 month	7/30/14	8/26/14
7.2.4	Order backing structure	1 month	144		5/1/15	1 month	5/1/15	5/28/15
7.2.5	Order shipping crates	1 month	142		5/1/15	1 month	5/1/15	5/28/15
7.3	Construction		133			1.58 years	9/24/14	3/8/16
7.3.1	Test PMTs	1.25 months	140	105		1.25 months	9/24/14	10/28/14
7.3.2	Beam Monitor	2 months	138	110		2 months	10/29/14	12/23/14
7.3.3	Veto Detector	2 months	137	111		2 months	12/24/14	2/17/15
7.3.4	TOF-batch 1	1.5 months	143	112		1.5 months	2/18/15	3/31/15
7.3.5	TOF-batch 2	1.5 months	139	113		1.5 months	4/1/15	5/12/15
7.3.6	TOF-batch 3-8	2.75 months	141	114		2.75 months	5/13/15	7/28/15
7.3.7	Beam Mon, Veto first half TOF ready		147	115		0 hours	7/28/15	7/28/15
7.3.8	TOF-batch 9-12	4 months	149	115		4 months	7/29/15	11/17/15
7.3.9	TOF-batch 12-16	4 months	148	117		4 months	11/18/15	3/8/16
7.3.10	TOF second half ready		150	118		0 hours	3/8/16	3/8/16
7.4	Shipping		151			8.5 months	7/29/15	3/22/16
7.4.1	Ship first half	0.5 months	153	116		2 weeks	7/29/15	8/11/15
7.4.2	Ship second half	0.5 months	152	118		2 weeks	3/9/16	3/22/16

WBS 7 - QA & Risk

- QA – scintillators checked with source and cosmics before shipping
- Risks
  - low technical risk, this is a proven technology
  - Some schedule risk for 2015 test run if material is delayed in arriving. Would require using smaller number for test, additional shipping costs.
  - Some design risk, may increase size slightly if decision is made to move farther back (<10% cost)

WBS 2 SciFi

- Major costs
  - Fiber – BOE quotes - $12K
  - PMT – BOE quotes - $23 K
  - PMT bases, supplies – BOE past experience - $32K
  - Labor – GS $70 K
  - Total - $152K plus $29K contingency

WBS2

2	**Scintillating Fiber**		40		1.21 years	7/2/14	8/11/15
2.1	**Order Materials**		99	**135**	6 months	7/2/14	12/16/14
2.1.1	**Order Fiber**	**6 months**	64		6 months	7/2/14	12/16/14
2.1.2	**Order PMTs**	**6 months**	53		6 months	7/2/14	12/16/14
2.1.3	**Order tools**	**2 months**	107		2 months	7/2/14	8/26/14
2.2	**Prototype**	**1 month**	112	**32**	1 month	12/17/14	1/13/15
2.3	**Construct fibers**	**3 months**	16	**36**	3 months	1/14/15	4/7/15
2.4	**Mount fibers**	**1 month**	43	**37**	1 month	4/8/15	5/5/15
2.5	**Testing**	**1 month**	76	**38**	1 month	5/6/15	6/2/15
2.6	**Ship to PSI**	**2 weeks**	20	**39**	2 weeks	6/3/15	6/16/15
2.7	**Test at PSI**	**2 months**	59	**40**	2 months	6/17/15	8/11/15

WBS 2 Schedule, QA, Risk

- Easily completed in 6 months after materials arrive
- Will be tested with source and cosmics
- No schedule risk
- Low technical risk, proven technology

WBS 3 - Cerenkov

- Major Cost
  - PMTs – BOE quote - $195K
  - Total cost $212 K plus $27 contingency
- Schedule – easily assembled in 2 months after materials arrive
- QA – cosmic and beam tests
- No schedule risk
- Low technical risk, proven technology

WBS3

3	Cerenkov		105		1.87 years	2/3/14	10/21/15
3.1	Design Cerenkov	5 months	85		5 months	2/3/14	6/20/14
3.2	Buy materials first part		77	135	4 months	7/2/14	10/21/14
3.2.1	Buy first 4 tubes	4 months	109		4 months	7/2/14	10/21/14
3.2.2	Buy sapphire	3 months	73		3 months	7/2/14	9/23/14
3.2.3	Buy assembly materials	1 month	45		1 month	7/2/14	7/29/14
3.3	Assemble	2 months	33	44	2 months	10/22/14	12/16/14
3.4	Ship to PSI	1 month	13	48	1 month	12/17/14	1/13/15
3.5	First set at PSI		51	49	0 hours	1/13/15	1/13/15
3.6	Buy 5 tubes	4 months	9	136	4 months	7/2/15	10/21/15
3.7	Buy mounting fixtures	1 month	34	136	1 month	7/2/15	7/29/15
3.8	Frame for 2nd cerenkov	2 months	71	52	2 months	7/30/15	9/23/15
3.9	Install at PSI	1 month	90	53	1 month	9/24/15	10/21/15

Handling Contingency

- Plans for handling contingency
  - M&S/Labor Contingency
    - <$5K up to WBS manager
    - $5-25 K up to Project Manager
    - >$25 K must be reviewed by managers for impact on scope and schedule, approval by Project Manager
  - Travel Contingency
    - Any anticipated change over $2 K must be approved by Project Manager
    - Must take into account importance to set-up, construction, maintaining experiment (e.g. move to set-up travel out of collaboration meeting travel)

Schedule & Reporting

- Schedule will be reviewed once date is know for funding
  - Set milestones
- Determine funding distribution based needs to prioritize test run 2015
- Each WBS manager will report project progress to Project Manager on a bi-monthly basis.

WBS 1

1	**Frames & Design**		7			1.87 years	3/1/14	11/18/15
1.1	**Table**		36			1.12 years	3/1/14	3/13/15
1.1.1	Design table	9 months	47		3/1/14	9 months	3/1/14	11/7/14
1.1.2	**Buy table parts**		125	3; 135		1 month	11/10/14	12/5/14
1.1.2.1	rotary bearings	1 month	92			1 month	11/10/14	12/5/14
1.1.2.2	extrutions for frame	1 month	4			1 month	11/10/14	12/5/14
1.1.2.3	linear bearings	1 month	67			1 month	11/10/14	12/5/14
1.1.3	**Machine & assemble table**		74	4		1.5 months	12/8/14	1/16/15
1.1.3.1	machine donuts and table	1 month	30			1 month	12/8/14	1/2/15
1.1.3.2	machine extrusions	1 month	98			1 month	12/8/14	1/2/15
1.1.3.3	assemble table	2 weeks	91	9; 10		2 weeks	1/5/15	1/16/15
1.1.4	**Ship and assemble table**		60			2 months	1/19/15	3/13/15
1.1.4.1	Ship to PSI	1 month	113	8		1 month	1/19/15	2/13/15
1.1.4.2	Assemble table at PSI	1 month	1	13		1 month	2/16/15	3/13/15
1.2	**Table ready at PSI**		86	14		0 hours	3/13/15	3/13/15
1.3	**Scintillator and Veto**		48			1.42 years	7/1/14	10/21/15
1.3.1	Design scintillator frames	6 months	96		7/1/14	6 months	7/1/14	12/15/14
1.3.2	Build first scintillator frame	2 months	66	17; 135		2 months	12/16/14	2/9/15
1.3.3	Ship first frames to PSI	1 month	54	18		1 month	2/10/15	3/9/15
1.3.4	Build second scint. frames	2 months	38	18; 136		2 months	7/2/15	8/26/15
1.3.5	Ship second set to PSI	1 month	120	20		1 month	8/27/15	9/23/15
1.3.6	Assemble at PSI	1 month	80	21		1 month	9/24/15	10/21/15
1.3.7	Veto design	2 months	8	17		2 months	12/16/14	2/9/15
1.3.8	Build veto	1 month	103	23		1 month	2/10/15	3/9/15
1.3.9	Ship veto to PSI	1 month	14	24		1 month	3/10/15	4/6/15
1.4	**Beam Monitor**		68			5 months	7/2/15	11/18/15
1.4.1	Design beam monitor	2 months	61	23; 136		2 months	7/2/15	8/26/15
1.4.2	Build beam monitor	1 month	15	27		1 month	8/27/15	9/23/15
1.4.3	Ship to PSI	1 month	122	28		1 month	9/24/15	10/21/15
1.4.4	Assemble PSI	1 month	42	29		1 month	10/22/15	11/18/15

WBS5

5	Cryo-target		37				2.28 years	3/1/14	4/5/16
5.1	Set up lab	3 months	28			3/1/14	3 months	3/1/14	5/23/14
5.2	Do Design	4 months	55			3/1/14	4 months	3/1/14	6/20/14
5.3	Order major elements	2 months	25		74; 135		2 months	7/2/14	8/26/14
5.4	Construct prototype	2 months	56		75		2 months	8/27/14	10/21/14
5.5	Test and eval. of prototype	2 months	5		76		2 months	10/22/14	12/16/14
5.6	Redesign and 2nd proto.	2 months	115		77		2 months	12/17/14	2/10/15
5.7	Test and final design	2 months	46		78		2 months	2/11/15	4/7/15
5.8	Target Cell design		23		79		0 hours	4/7/15	4/7/15
5.9	Const. Scatt. Chamb. & cells	2 months	82		79		2 months	4/8/15	6/2/15
5.10	Test and Evaluate	3 months	29		81		3 months	6/3/15	8/25/15
5.11	Test complete system	2 months	10		82		2 months	8/26/15	10/20/15
5.12	Review	1 month	72		83		1 month	10/21/15	11/17/15
5.13	Ship and set up	2 months	93		84		2 months	11/18/15	1/12/16
5.14	In situ testing	1 month	108		85		1 month	1/13/16	2/9/16
5.15	Final review	2 months	24		86		2 months	2/10/16	4/5/16
5.16	Ready to Run		117		87		0 hours	4/5/16	4/5/16
6	Electronics & DAQ		17				2.17 years	7/2/14	6/28/16

WBS6

6.1	Order first half electronics	6 months	52	135	6 months	7/2/14	12/16/14
6.2	Mounting/order cables	2 months	114	90	2 months	12/17/14	2/10/15
6.3	Manufacture/Install cables	2 months	44	91	2 months	2/11/15	4/7/15
6.4	Develop DAQ	1 year	130	135	1 year	7/2/14	6/2/15
6.5	Install and test complete DAQ	2 months	62	92; 93	2 months	6/3/15	7/28/15
6.6	DAQ ready for test run		129	94	0 hours	7/28/15	7/28/15
6.7	Order 2nd half electronics	6 months	102	136	6 months	7/2/15	12/16/15
6.8	Optimize DAQ	1 year	131	94	1 year	7/29/15	6/28/16
6.9	Install and complete DAQ	3 months	12	96	3 months	12/17/15	3/9/16
6.10	Final test of DAQ	3 months	58	98	3 months	3/10/16	6/1/16
6.11	Write initial analysis program	1 year	132	135	1 year	7/2/14	6/2/15