

Availsim runs and questions

Tom Himel

August 4, 2009

Very Preliminary

- Results have NOT been thoroughly checked.
- There are quite a few guesses as to numbers of components. Likely to stay guesses.
- Just ran out of time.

RDR simulation input deck

- Did not have central injector (DRs were at low energy ends of linac)
- Had long e^+ transport in linac tunnel, but not long e^+ and e^- low emittance RTML transport lines
- Had e^+ source at 150 GeV
- Did not have low P option (had 24 cavities per RF unit)
- 2 vs 1 tunnel changed almost everything from being accessible with beam on to not in all regions (including DR and BDS)

ILC105: Updated towards RDR and SB2009

- Put DRs in single tunnel near the IP
- Put transport lines from DRs through part of BDS, all of linac to turnaround and then into a single stage bunch compressor.
- Solyak provided numbers of magnets. Accurate for compressor, scaled from RDR for transport lines.
- Have used 1 PS per magnet as Solyak said to. (Turn-around bends will have some stringing but he did not say how much.)
- May have too much MPS, controls, pumps in new sections as copied from an old one.
- We end up with fewer PPS zones due to the transport lines. Can no longer have people in linac or BDS when beam is in compressor.
- E+ source is now at 250 GeV point. Guessed at reduced magnet count of high emittance e+ transport which now only goes to near IP instead to low energy end of e+ linac (300->100)
- Have slightly more tunetimefraction because of extra beamlines
- Run 5 months then 1 month shutdown

Region definitions, PPS zones

name	ppszone	upstream	tunetimefraction	% MD time	tunnel configuration
none	none	none	0	0	
Cryo plants	none	none	0	0	
Site power	none	Cryo plants	0	0	
Global controls	none	Site power	0	0	
e- source	e- source	Global controls	0.1	1	2 tunnels minimum in accel tunnel
e- DR	e- DR	e- source	0.2	2	2 tunnels minimum in accel tunnel
e- extraction	e- linac	e- DR	0.05	0.5	2 tunnels minimum in accel tunnel
e- transport	e- linac	e- extraction	0.05	0.5	all in 1 tunnel, no robots
e- turnaround	e- linac	e- transport	0.05	0.5	2 tunnels minimum in accel tunnel
e- compressor	e- linac	e- turnaround	0.1	2	2 tunnels minimum in accel tunnel
e- linac	e- linac	e- compressor	0.1	1	all in 1 tunnel, no robots
e- BDS	e- linac	e- linac	0.1	1	all in 1 tunnel, no robots
e+ source	e+ source	e- linac	0.1	1	2 tunnels minimum in accel tunnel
e+ transprt hi e	e- linac	e+ source	0.2	2	2 tunnels minimum in accel tunnel
e+ DR	e- DR	e+ transprt hi e	0.2	2	2 tunnels minimum in accel tunnel
e+ extraction	e+ linac	e+ DR	0.05	0.5	2 tunnels minimum in accel tunnel
e+ transport	e+ linac	e+ extraction	0.05	0.5	all in 1 tunnel, no robots
e+ turnaround	e+ linac	e+ transport	0.05	0.5	2 tunnels minimum in accel tunnel
e+ compressor	e+ linac	e+ turnaround	0.1	1	all in 1 tunnel, no robots
e+ linac	e+ linac	e+ compressor	0.1	1	all in 1 tunnel, no robots
e+ BDS	e+ linac	e+ linac	0.1	1	2 tunnels minimum in accel tunnel
IP	IP	e+ BDS	0.2	1	2 tunnels minimum in accel tunnel

Added ability to have each region independently be in one or two tunnels.
 Note that 0.5% MD is 4 shifts per year.

How often to warm up?

- In past have done it once per year, fixing all broken items that required warm-up
- That was probably too often
- Twice a year is clearly too often, also not sure 1 month down is really long enough.

Repairs during long downtime

- 6570.00 mainloop: Long shutdown repaired all 1 e- source linac Cavity tuner cavity Cavity tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 4 e- source linac Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 1 e- compressor Cavity tuner cavity Cavity tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 1 e- compressor Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 20 e- linac upstream Cavity tuner cavity Cavity tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 38 e- linac upstream Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 2 e- linac upstream power coupler disc coupler power coupler disc coupler
- 6570.00 mainloop: Long shutdown repaired all 12 e- linac downstream Cavity tuner cavity Cavity tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 30 e- linac downstream Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 3 e- linac downstream power coupler disc coupler power coupler disc coupler
- 6570.00 mainloop: Long shutdown repaired all 1 e+ source e+ linac Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 1 e+ compressor Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 1 e+ linac Cavities cavity Cavities cavity
- 6570.00 mainloop: Long shutdown repaired all 1 e+ linac Cavities cavity Cavities cavity
- 6570.00 mainloop: Long shutdown repaired all 45 e+ linac Cavity tuner cavity Cavity tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 66 e+ linac Cavity piezo tuner cavity Cavity piezo tuner cavity
- 6570.00 mainloop: Long shutdown repaired all 3 e+ linac power coupler disc coupler power coupler disc coupler

In 9 month run this is about 1.7 GeV energy loss per linac.

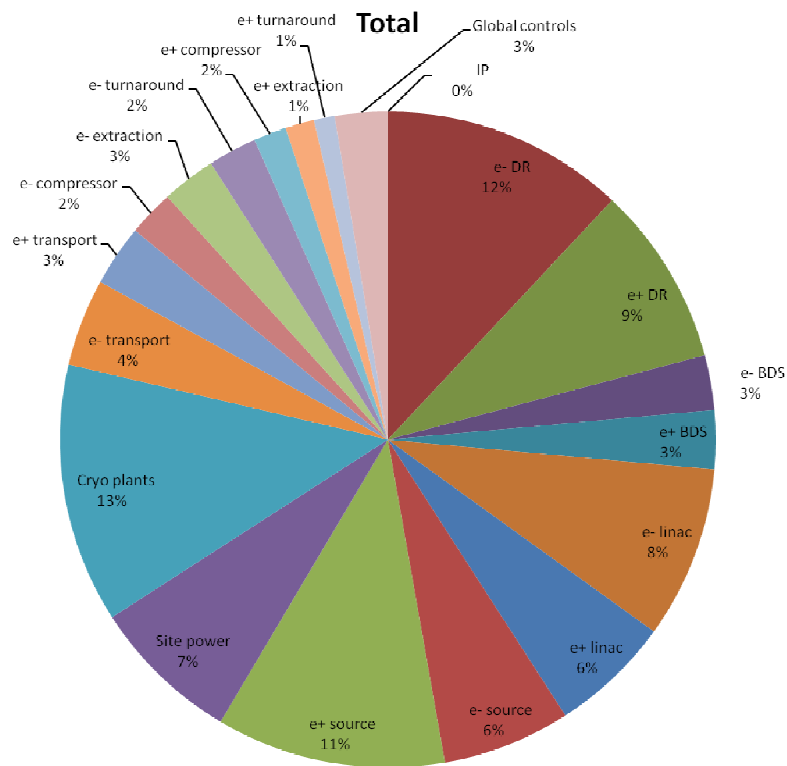
MTBF of tuner is 1,000,000 hours, of piezo tuner is 500,000. Lose 31 and 5 MeV.

Availsim results

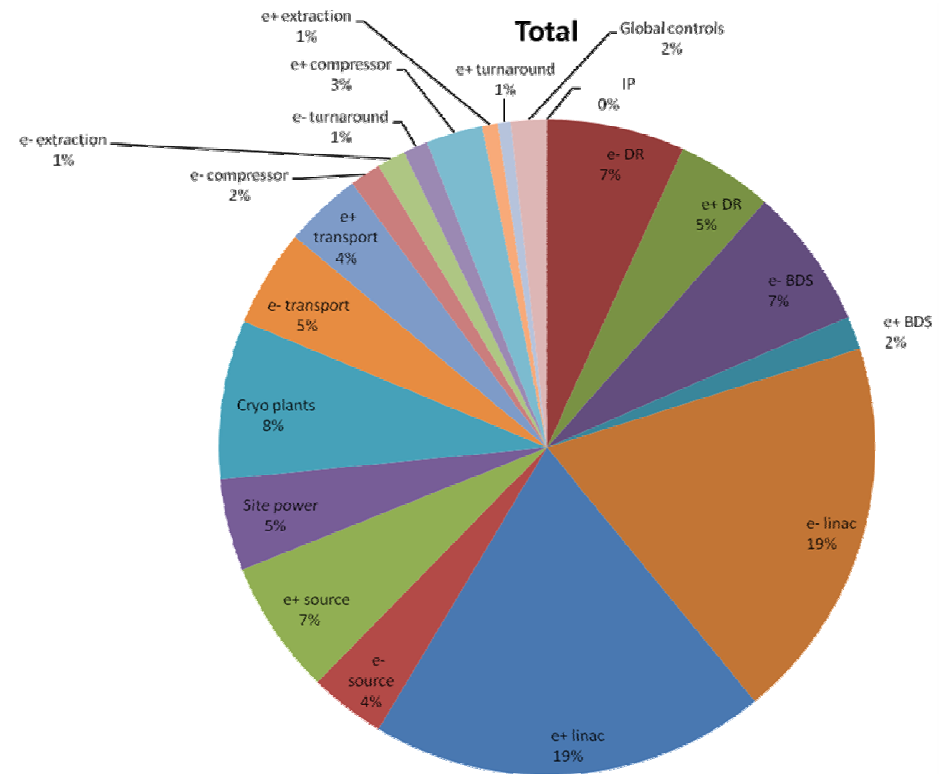
Run Number	LC description	Simulated % time down incl forced MD	Simulated % time fully up integrating lum or sched MD	% time scheduled maintenance	Simulated % time integrating lum	Simulated % time scheduled MD	Simulated % time actual opportunistic MD	Simulated % time useless down	Max people in access
ILC5	Pre-RDR, undulator e+, KAS	17.7	82.3	0.0	76.7	5.6	1.9	15.8	47
ILC105	Updated towards RDR and SB2009	21.1	78.9	0.0	70.0	9.0	1.6	19.5	98
ILC106	ILC 105 but linac in 1 tunnel	30.8	69.2	0.0	60.9	8.3	2.2	28.6	52
ILC107	ILC 105 but no extra repairs during unsched down	34.7	65.3	0.0	60.7	4.6	5.9	28.8	100
ILC108	ILC 107 but add sched downs with no repairs made	33.2	62.3	4.5	57.7	4.6	6.0	27.3	96
ILC109	ILC 107 but add sched downs with repairs made (incl klys)	23.8	69.0	6.9	60.8	8.1	2.4	21.5	44
ILC110	ILC105 but fix nothing in the long down	35.7	64.3	0.0	58.4	5.9	4.6	31.1	1000
ILC111	ILC105 but fix everything during the long down	21.0	79.0	0.0	70.1	8.9	1.6	19.4	60
ILC112	ILC105 but tunetimefraction=0	8.9	91.1	0.0	82.4	8.7	1.8	7.2	56

Compare 2 and 1 tunnel

ILC105: 2 tunnel, 21.1% down



ILC106: 1 tunnel, 30.8% down



Remaining questions

- Should opportunistic repairs be done?
- Do we want to have scheduled maintenance days?
- Should we repair things on those days? Including klystrons?
- Correct to assume running 5 months followed by 1 month downtime (including recovery)?
- How should cryogenic repairs be handled?
- Are there MTBF changes I should make in advance (e.g ignore flow switches, circuit breakers and what else)?

MTTF/MTTR Improvement Factors

MTBF to improve	Table A	Table C
factor_mttf_PS_controller	10	50
factor_mttf_water_instr	10	30
factor_mttf_magnet	20	20
factor_mttf_electronic_modu	3	10
factor_mttf_fs	10	10
factor_mttf_elec_small	1	10
factor_mttf_PS	5	5
factor_mttf_kickpulser	5	5
factor_mttf_mb_klystron	1	5
factor_mttf_coupler_intlk	5	5
factor_mttf_coupler_intlk_el	1	5
factor_mttf_vac_valve_conti	1	5
factor_mttf_vac_mech_devic	5	5
factor_mttf_MPS_region	1	5
factor_mttf_PS_corrector	1	3
factor_mttf_modulator	1	3
factor_mttf_valve	1	3
factor_mttf_waterpump	1	3