CEBAF SRF/RF/Cryo Workshop

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JLAB

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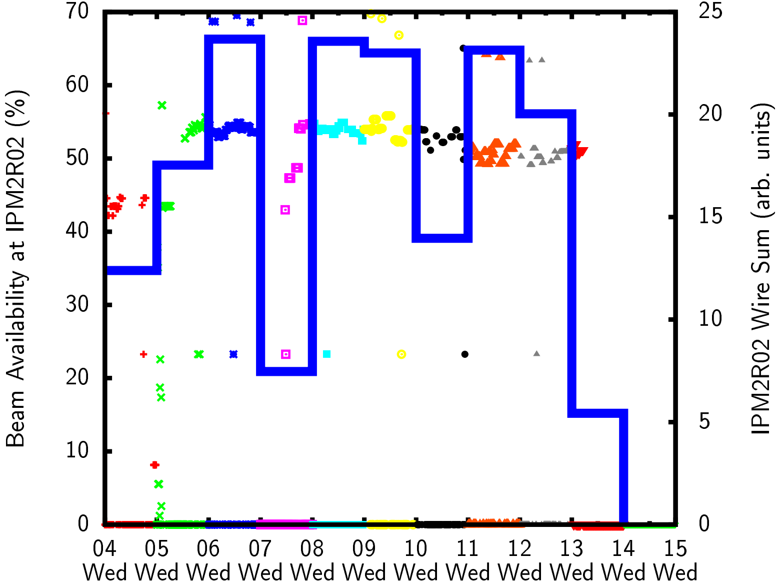
Outline

Workshop Goal

Within the last year cavity performance data has been collected on every cavity in CEBAF. This includes 242 original C25 cavities, 88 refurbished C50 cavities and 88 C100 cavities. In addition data exists on the initial performance with beam of the accelerating system. The goal of this work shop is to present the data that has been collected, develop working groups, if needed, to fully analyze the data and develop a plan for maintenance and improvement of CEBAF SRF systems and cavity performance.

February 5 2014: 2.214GeV beam availability



RF gradients Feb. 5 2.2GeV/pass

RF and ARC1:p/ARC2:p status at: 2014-02-05 09:05

Linac	Type	Ncav	<GMES> (MV)	$GMES_{RMS}$ (MV)	Min-Max (MV)	Egain (MeV)
Inj	C25	10	6.72	0.81	5.86-8.63	33.6
NL	C25	119	7.19	1.64	2.97-11.71	427.6
NL	C50	40	11.03	1.49	6.34-13.45	220.7
NL	C100	38	17.59	2.40	9.80-20.77	467.9
SL	C25	108	7.05	1.40	4.78-10.56	380.7
SL	C50	47	10.06	1.90	6.41-12.36	236.4
SL	C100	40	16.66	2.75	9.70-20.00	466.4

Linac	Egain (MeV)	Σ_E (MeV)	Spectrometer	Momentum (MeV/c)
Injector	33.58	33.58	INJ:p	33.41
North	1116.15	1149.73	Arc1:p	1124.03
South	1083.44	2233.17	Arc2:p	2214.51

Injector Beam Current(IBCOR08): 8.88

Beam-Target Interactions with $E_{beam} > 6$ GeV

Start_Run_20354,Run_type=Commission,target_type=Carbon,comment_text=Run type: Comm., Carbon tgt,I=1 micro A, ps1=1, no raster, sieves out

Lognumber 3279524. Submitted by adaq on Tue, 04/01/2014 - 22:35.

Last updated on Tue, 04/01/2014 - 22:35

Logbooks: HALOG
Tags: StartOfRun

User name adaq

Log entry time 22:35:56 on April 1, 2014

Entry number 388530

keyword=Start_Run_20354,Run_type=Commission,target_type=Carbon,comment_text=Run type: Comm., Carbon tgt,I=1 micro A, ps1=1, no raster, sieves out

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Run Timestamp: Tue Apr 1 22:32:46 EDT 2014
Beginning-of-run EPICS data for Run Number 20354 at Tue Apr 1 22:35:36 EDT 2014
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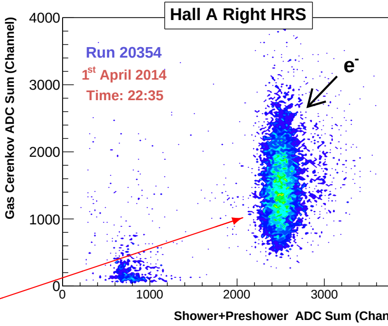
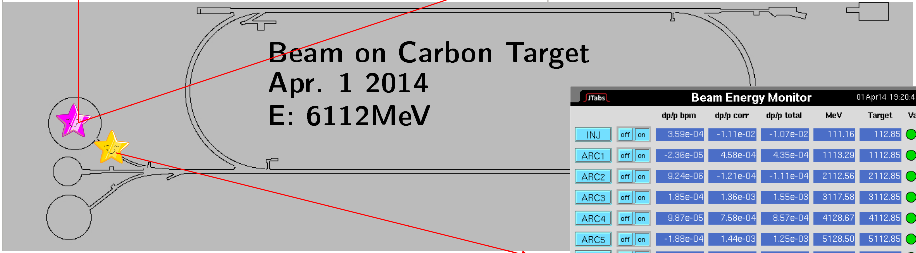
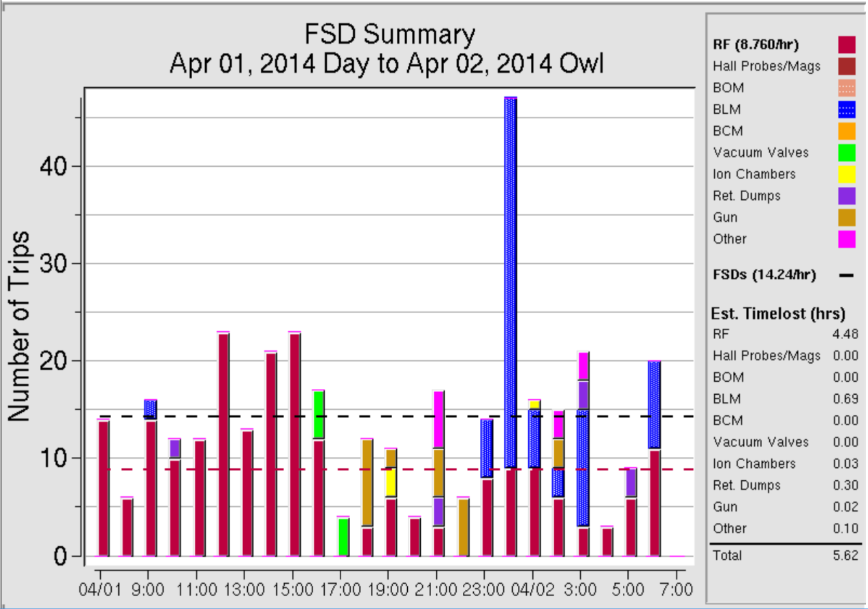




Beam Energy Monitor — JTabs — 01Apr14 19:20:49

		dp/p bpm	dp/p corr	dp/p total	MeV	Target	Valid
INJ	off on	3.59e-04	-1.11e-02	-1.07e-02	111.16	112.85	
ARC1	off on	-2.36e-05	4.58e-04	4.35e-04	1113.29	1112.85	
ARC2	off on	9.24e-06	-1.21e-04	-1.11e-04	2112.56	2112.85	
ARC3	off on	1.85e-04	1.36e-03	1.55e-03	3117.58	3112.85	
ARC4	off on	9.87e-05	7.58e-04	8.57e-04	4128.67	4112.85	
ARC5	off on	-1.88e-04	1.44e-03	1.25e-03	5128.50	5112.85	
HALLA	off on	-5.92e-05	6.75e-05	8.28e-06	6051.77	6112.85	

FSD for 2000MeV/pass



RF Gradient distribution during 2000MeV/pass

RF and arc1/arc2 status at: 2014-04-01 19:22:10

Linac	Type	Ncav	AVG-GMES (MV)	STD-GMES (MV)	Min-Max (MV)	Egain (MeV)
Inj	C25	10	6.54	0.75	4.76- 7.39	32.7
Inj	C100	8	14.69	0.53	14.09-15.90	82.3
NL	C25	116	5.26	1.53	2.94- 9.31	305.1
NL	C50	39	10.11	1.70	6.16-13.03	197.1
NL	C100	40	17.78	1.71	13.06-21.57	497.9
SL	C25	111	6.85	1.41	4.62-12.26	380.4
SL	C50	40	9.18	2.45	5.47-12.32	183.5
SL	C100	39	15.90	2.55	8.99-19.84	434.0

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   Injector Energy:  114.93 Cumulative E:  114.93  INJ:p = 112.37
North Linac Energy:  999.99 Cumulative E: 1114.93 ARC1:p = 1112.81
South Linac Energy:  997.91 Cumulative E: 2112.83 ARC2:p = 2112.80
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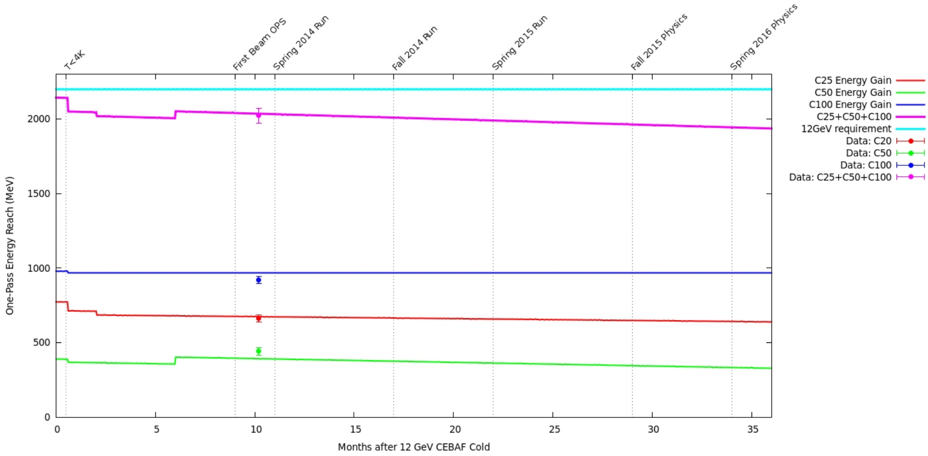
Towards CEBAF support of a 11/12GeV Physics

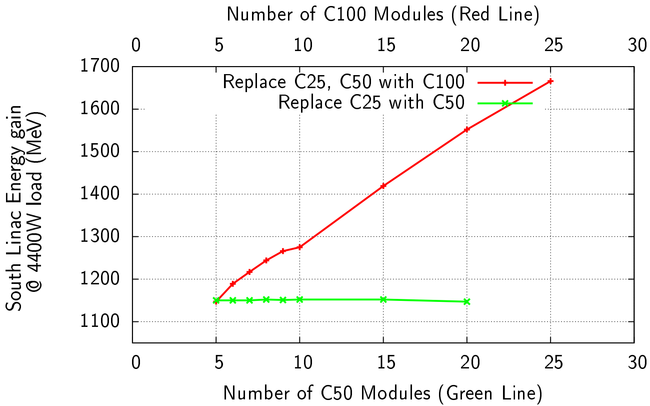


Update of Figure 5 from JLAB-TN-12-049, including data (points) from Feb. 2014 operations.

Accelerator Loads Time Period 3			12 GeV Operations Era (Oct 2015 and beyond)					
	Unit Loads		North Linac			South Linac		
	2 K	35K	#	2K	35K	#	2K	35K
Static								
Transfer Lines	530	7000	0.57	302.1	3990	0.43	227.9	3010
Original CM's	16	110	22.25	356.0	2447.5	20	320	2200
12GeV CM's	50	250	5	250.0	1250	5	250	1250
TL Bayonets				75.0			75	
FEL	370	1310				1	370	1310
Dynamic								
Original CM's	72	0	22.25	1602.0	0	20	1440	0
12GeV CM's	250	50	5	1250.0	250	5	1250	250
FEL	295	375				1	295	375
Totals (W)			27.25	3835.1	7937.5	26	4227.9	8395
						FEL 2K heat load acceptable		
						JLamp 2K heat load too large		
			CHL #1	4400	12000	CHL #2	4400	12000
			% Full Load	0.87	0.66	% Full Load	0.96	0.70

- What is the capacity now that the CHLs are operational?
- What are the loads?
- What is the margin? headroom?

Gradient Maintenance Path



Based off of DRCC, South Linac/CHL-2 at 96% capacity prediction.
JLAB-TN-13-001,

SRF/RF/Cryo and Operations and beams for Physics

- Maximize availability across all systems.
- Optimize for beam operations/conditions.

Physics users will tolerate no more than 15trips/h. Of those 15trips/h, **10 trips/h is the nominal goal for the cavity trip rate**. The other 5trips/h are allotted to other MPS events.

Operations matters!!! Operators turn down cavities for a reason: *the cavity is problematic and interfering with the goal of delivering beam*. Time to debug nuisance cavities in real-time is a luxury operations does not have. Understanding why Ops turns down/by-passes cavities often has be performed post-mortem, do we have the right tools?

trips/h $<$ 10
CEBAF Total availability $>$ 90%

Open questions/goals

- What is a reasonable trip rate goal for the C100 or C50 modules? Why isn't it 0trips/h?
- What is the best distribution of gradients across cavity type (C25, C50, C100)? Do we have minimize downtime? or heatload?
- Do we have all the tools required to optimize the system? If not what do we need?
- Minimize *mean time to repair* or maximize *mean time between failure*? Can we afford to **not** work on both?
- What are the gradient maintenance options? Cost/benefit.

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