
**Plans for
9-cell
Cavity Processing and Testing
(focusing on the Americas region)**

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Progress and Prospect of Cavity Gradient Yield Statistics

	PAC-09 Last/Best May 2009	FALC 1 st Pass Jul 2009	ALCPG 2nd Pass Oct 2009	Current Dec 2009	Coming Prod/Test Jun 2010	Research cavities
DESY	9 (AC) 16 (ZA)	8 (AC) 7 (ZA)	14 (AC/ZA)	10-6 (Prod-4)	5	8 (large grain)
JLAB FNAL/ANL/ Cornell	8 (AC) 4 (AE) 1 (KE-LL5) 1 (JL-2)	7 (AC)	7 (AC)	5 (AE) 1 (AC)	12 (RI) 6 (AE) 2 (AC)	6 (NW) (including large-G)
KEK/IHEP /PKU			(4 -4:MH)	5 -5 (MH)	2 (MH)	~5 (LL) 1 (IHEP) 2 (PKU)
Sum	39	22	21	21 -11	27	~ 22
G-Sum				42-11 = 31	69-11=58	

Statistics for Production Yield in Progress to reach ~ 60, within TDP-1.
We may need to have separate statistics for 'production' and for 'research',

Handful of cavities in Asia

Tens of cavities in Europe until XFEL production starts (800)

highest priority

- **Objective: Identify and prepare 8 cavities + backups for dressing for CM2 (and beyond)**
 - Favor cavities which have gradient performance >31.5 MV/m in vertical test without substantial field emission
- **Timescale**
 - CM2: dressed cavities originally needed March 2010; schedule relaxed until CM1 cooldown
 - Reminder: after a bare cavity is qualified, need
 - A minimum of 2 weeks for dressing, and
 - 1 month if horizontally testing
- **Prioritization: To get as many qualified cavities as quickly as possible,**
 - Prioritize first in terms of fastest preparation, then
 - Take lowest risk cavities first
 - In case of poor performance, put cavity aside (aka R&D path) and start with the next one; address R&D cavities as time permits
- **Other high priority: Qualify FNAL/ANL processing facility for 9-cell cavities – facility not yet proven for CM cavity preparation**
- **Other high priority: S0 production yield data accumulation - compatible so far only with JLab effort**
- **Other high priority: R&D topics**
- **Other high priority: New vendor development**



- **Cornell**
 - Vertical EP commissioning
 - R&D on poor performers and cavity repair
 - Recent (March 20) commissioning of helium liquefaction unit
- **JLab**
 - Only “qualified” production-style cavity process, routinely producing >35 MV/m cavities, with fast turn-around
 - Training personnel in cavity processing, including two Fermilab staff
 - Expected to process/test about half of the production cavities for cryomodules
 - Commission new (borrowed) KEK/Kyoto camera system
- **Fermilab**
 - Expected to process/test about half of the production cavities for cryomodules
 - Qualify FNAL/ANL cavity process for 9-cells, install/commission 800C furnace
 - LANL collaborating on 9-cell instrumentation
 - Cryomodule assembly
 - Overall coordination of 9-cell process/test program

1. ANL EP optimization

2. R&D cavities

Genfa Wu

Tumbling

Laser re-melting

Eddy current scanning investigation: cavities made from bad sheets

Atomic Layer Deposition (ALD) cavities

Traveling wave cavities

3. Vendor qualification

RRCAT cavities

ABLE industrial EP

4. Infrastructure support

Furnace verification

Diode T-map and second sound development

ANL HPR water verification

5. Basic R&D, e.g., Q-slope studies

When successful, knowledge transferred to 9-cells where relevant



Americas 9-cell Cavity Inventory



Fermilab

STATUS 08-FEB-2010

Tesla-shape nine-cell cavities

Vendor	Description	#cavities	PO(s)	cavity serial #'s	date received	(guessed) material vendor	dressed/bare	status/plan
AES	AES 1-4	4	563393	AES001	~3/13/2007	Wah-Chang	dressed	R&D
				AES002	~3/13/2007	Wah-Chang	dressed	R&D
				AES003	~3/13/2007	Wah-Chang	bare	R&D
				AES004	~3/13/2007	Wah-Chang	dressed	S1-Global cryomodule
	AES 5-10	6	571757, 562729	TB9AES005	12/9/2008	Wah-Chang	bare	R&D
				TB9AES006	12/9/2008	Wah-Chang	bare	R&D
				TB9AES007	12/22/2008	Wah-Chang	bare	production
				TB9AES008	4/14/2009	Wah-Chang	bare	dressing->CM2
				TB9AES009	12/22/2008	Wah-Chang	bare	dressing->CM2
				TB9AES010	4/14/2009	Wah-Chang	bare	dressing->CM2
	AES 11-16	6	562729	TB9AES011		Wah-Chang	bare	ordered 9/26/2008; due 9/30/2009; likely ready Feb.2010
				TB9AES012		Wah-Chang	bare	ordered 9/26/2008; due 9/30/2009; likely ready Feb.2010
				TB9AES013		Wah-Chang	bare	ordered 9/26/2008; due 9/30/2009; likely ready Mar.2010
				TB9AES014		Wah-Chang	bare	ordered 9/26/2008; due 9/30/2009; likely ready Mar.2010
				TB9AES015		Wah-Chang	bare	ordered 9/26/2008; due 9/30/2009; likely ready Mar.2010
				TB9AES016		Wah-Chang	bare	ordered 9/26/2008; due 9/30/2009; likely ready Mar.2010
Accel/Research Instruments	Accel 6-9	4	563062	ACCEL6	9/14/2005		bare	R&D
				ACCEL7	9/14/2005		bare	R&D
				ACCEL8	9/14/2005		bare	dressing->CM2
				ACCEL9	9/14/2005		bare	R&D
	Accel 10-17	8	571761	TB9ACC010	11/28/2007	Tokyo-Denkai	bare	R&D
				TB9ACC011	11/28/2007	Tokyo-Denkai	dressed	S1-Global cryomodule
				TB9ACC012	11/28/2007	Tokyo-Denkai	bare	R&D
				TB9ACC013	11/28/2007	Tokyo-Denkai	dressed	HTS->CM2
				TB9ACC014	11/28/2007	Tokyo-Denkai	bare	R&D
				TB9ACC015	11/28/2007	Tokyo-Denkai	bare	R&D
				TB9ACC016	11/28/2007	Tokyo-Denkai	bare	production
				TB9ACC017	11/28/2007	Tokyo-Denkai	bare	R&D
	Accel 18-29	12	576712	TB9R018	5/21/2009	Wah-Chang	bare	at vendor welded Ti ring; received Dec.2009
				TB9R019	5/21/2009	Wah-Chang	bare	at vendor welded Ti ring; received Dec.2009
				TB9R020	5/21/2009	Wah-Chang	bare	at vendor welded Ti ring; received Dec.2009
				TB9R021	5/21/2009	Wah-Chang	bare	at vendor welded Ti ring & bulk-EP; received Jan.2010
				TB9R022	6/10/2009	Wah-Chang	bare	at vendor welded Ti ring & bulk-EP; received Jan.2010
				TB9R023	6/10/2009	Wah-Chang	bare	at vendor welded Ti ring & bulk-EP; received Jan.2010
				TB9R024	6/10/2009	Wah-Chang	bare	at vendor welded Ti ring & bulk-EP; received Jan.2010
				TB9R025	6/10/2009	Wah-Chang	bare	at vendor welded Ti ring & bulk-EP; received Jan.2010
TB9R026				6/10/2009	Wah-Chang	bare	at vendor welded Ti ring; received Dec.2009	
TB9R027				6/10/2009	Wah-Chang	bare	at vendor welded Ti ring; received Dec.2009	
TB9R028				6/10/2009	Wah-Chang	bare	at vendor welded Ti ring; received Dec.2009	
TB9R029				6/10/2009	Wah-Chang	bare	at vendor welded Ti ring & bulk-EP; received Jan.2010	
JLab	JLab 1-2	4	JLAB-1	2008?		bare	none	
			JLAB-2	2008?		bare	cavity tuning machine commissioning	
			LG-1	2008?		bare	none	
			LG-2	2008?		bare	none	
Nlowave-Roark	NR 1-6	6	562633 (Roark)	TB9NR001?		Plansee	bare	ordered 30-JUN-09; due 28-AUG-09; likely ready Feb.2010
				TB9NR002?		Plansee	bare	ordered 30-JUN-09; due 28-AUG-09; likely ready Apr.2010
				TB9NR003?		Plansee	bare	ordered 30-JUN-09; due 28-AUG-09; likely ready Apr.2010
			562579 (Nlowave)	TB9NR004?		Plansee	bare	ordered 30-JUN-09; due 28-AUG-09; likely ready Apr.2010
				TB9NR005?		Plansee	bare	ordered 30-JUN-09; due 28-AUG-09; likely ready Apr.2010
				TB9NR006?		Plansee	bare	ordered 30-JUN-09; due 28-AUG-09; likely ready Apr.2010
# cavities ordered		50	# cavities received		38			

38 9-cell cavities have been received, out of 50 ordered (not incl ARRA)

- **12 new RI cavities**
 - Received at Fermilab and just starting the process/test cycle at JLab or Fermilab
 - Half were bulk EP'd at RI facility
- **6 Niowave-Roark cavities**
 - First two to be delivered next week; remaining four by June
- **6 AES cavities**
 - To be delivered within a few weeks
 - ~10 um BCP at AES facility

- **Through ARRA (stimulus funding) ordering 40 additional cavities from US vendors: 20 just ordered from AES, remaining 20 TBD**

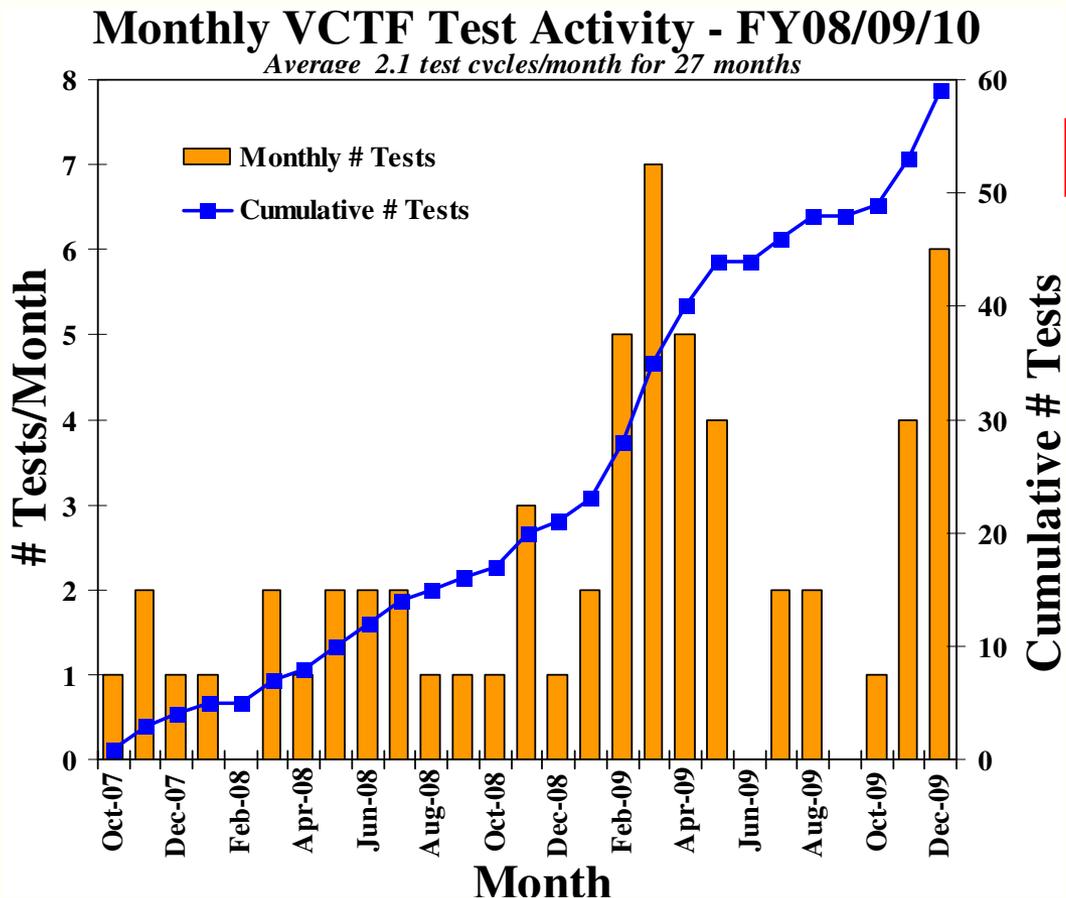
- **We plan to construct five cryomodules in the next several years (CM2-6)**

14			
15		Prepare RI(no-EP)#2 (via JLab) for CM [TB9RI018]	35 days
16		Arrival at FNAL	0 days
17		IB4 inspection	5 days
18		Ship to JLab	3 days
19		JLab: bulk-EP,800C,proc/assy/test,replace HW	15 days
20		Ship to Fermilab	3 days
21		At MP9 ready for dressing	0 days
22			
23		Prepare RI(EP)#1 for CM [TB9RI024]	44 days
24		Arrival at FNAL	0 days
25		IB4 inspection	5 days
26		Optical inspection	2 days
27		Ship to JLab	3 days
28		JLab: 800C	4 days
29		Ship to Fermilab	3 days
30		Tuning	2 days
31		ANL/FNAL light-EP+process/assemble	5 days
32		VTS 120C bake,test	5 days
33		MP9 re-install cavity HW for dressing	1 day
34		At MP9 ready for dressing	0 days
35			

JLab path

Fermilab path

Work proceeds partially in parallel for multiple cavities



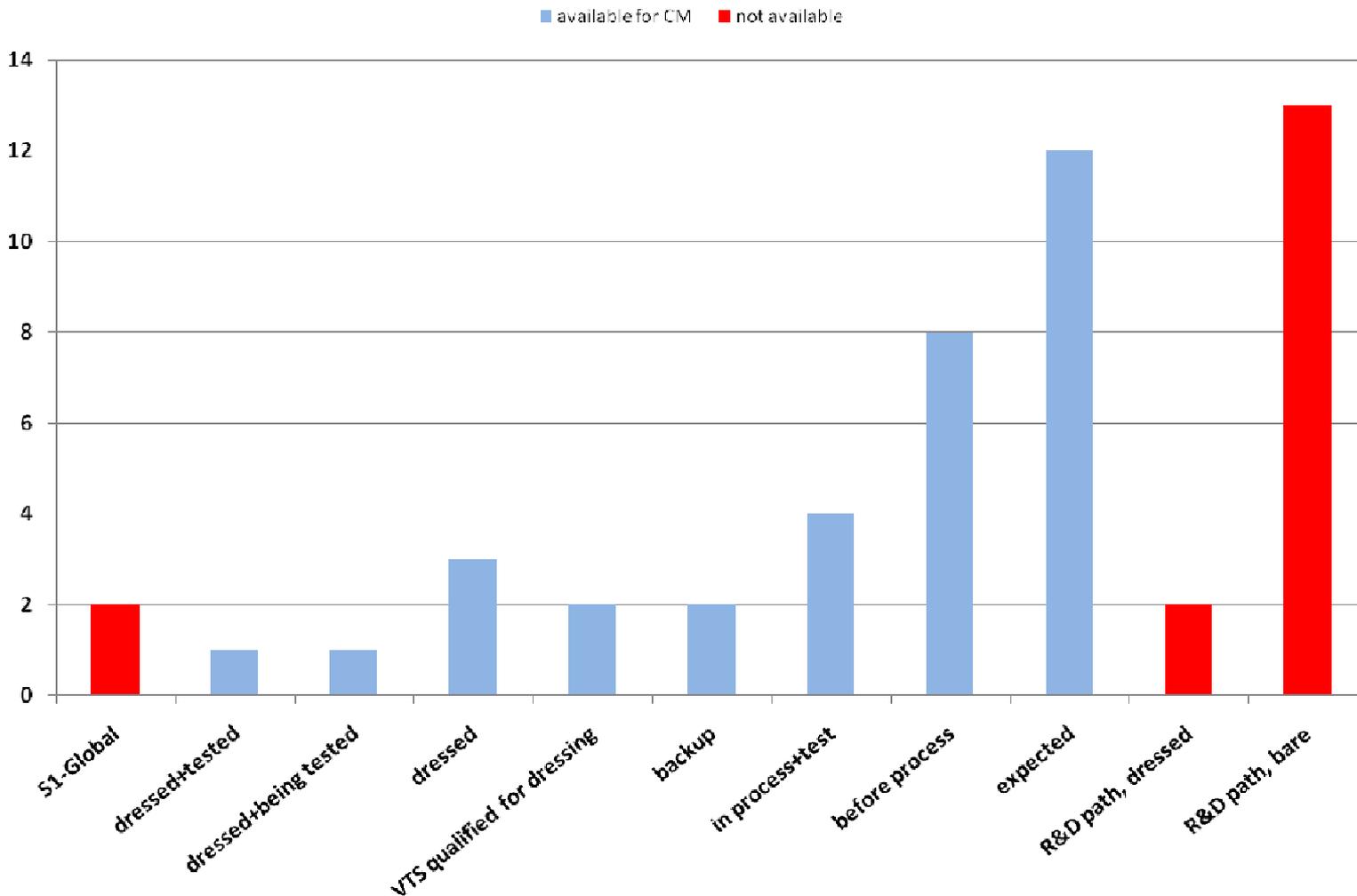
Joe Ozelis

Vertical tests include 9-cell, 1-cell and SSR1 cavities
 Up to two cooldowns per week achieved, under ideal conditions

- AES004 and TB9ACC011 went to KEK for S1G
- 8 cavities plus backups needed for CM2 [...then more cavities, more CM's...]
 - Dressed cavities
 - TB9ACC013 [was HTS'd], TB9AES009 [in HTS], ACCEL8, TB9AES008, TB9AES010
 - Qualified and ready for dressing
 - TB9ACC016, TB9AES007
 - Potential backup cavities which, although not fully qualified, are essentially useable now [>31.5 MV/m but significant FE]
 - ACCEL7 [35 MV/m (quench/FE)], ACCEL6 [32 MV/m (quench/FE)]
 - In process/test cycle with unknown performance – split JLab / FNAL
 - TB9RI026, TB9RI024 [FNAL]; TB9RI018, TB9RI019 [JLab]
- 8 more FNAL-received new cavities from RI to be processed/tested
- Additional new cavities as they arrive...

- **EP qualification at FNAL/ANL facility**
 - ACCEL6 [light EP, moderate performance], ACCEL7 [light+ EP; moderate performance], TB9ACC017 [full EP, poor performance]
 - TB9RI024 [production cavity, planned for light EP] – few weeks to know performance
 - TB9RI026 [production cavity, bulk EP completed] – few weeks to know performance
 - 5 others bulk EP'd at RI to arrive regularly for light EP within the next few months (plan for success)
- **VEP qualification at Cornell (partially correlated with fixing cavities suffering from pits/bumps by tumbling)**
 - ACCEL9, TB9AES005, TB9ACC010, TB9ACC015, plus 2 new ones
- **Fixing broken cavities – to return to production path**
 - TB9ACC014, TB9ACC012, JLAB-1
- **Pits and bumps studies, instrumentation development, etc. at FNAL**
 - TB9ACC017, JLAB-2
- **Dressed cavity R&D, e.g., dressed EP or BCP**
 - AES002 [20 MV/m (quench)], AES001 [22 MV/m (quench/FE)]
- **New vendor development: Niowave-Roark, ...**

Americas 9-cell Cavities



- **Four out of four new cavities process/tested at JLab in the last 6 months are ILC-qualified**
- **Fermilab dressed and tested two cavities for S1G cryomodule**
- **Can expect lots of 9-cell cavity activity this year in Americas**
- **I predict in the next six months**
 - **VEP at Cornell achieves a “qualified” designation**
 - **FNAL/ANL EP+VTS prep achieves a “qualified” designation**
 - **We’ll have a preliminary impression of the Niowave-Roark 9-cell cavities**
 - **8 new cavities will have been processed and vertically tested, of which 4 can be added to the S0 yield statistics**
 - **6 cavities will have been dressed and horizontally tested for CM2**
- **This level of activity likely to continue for at least one to two years**