UT schedule: transition to construction & construction plans

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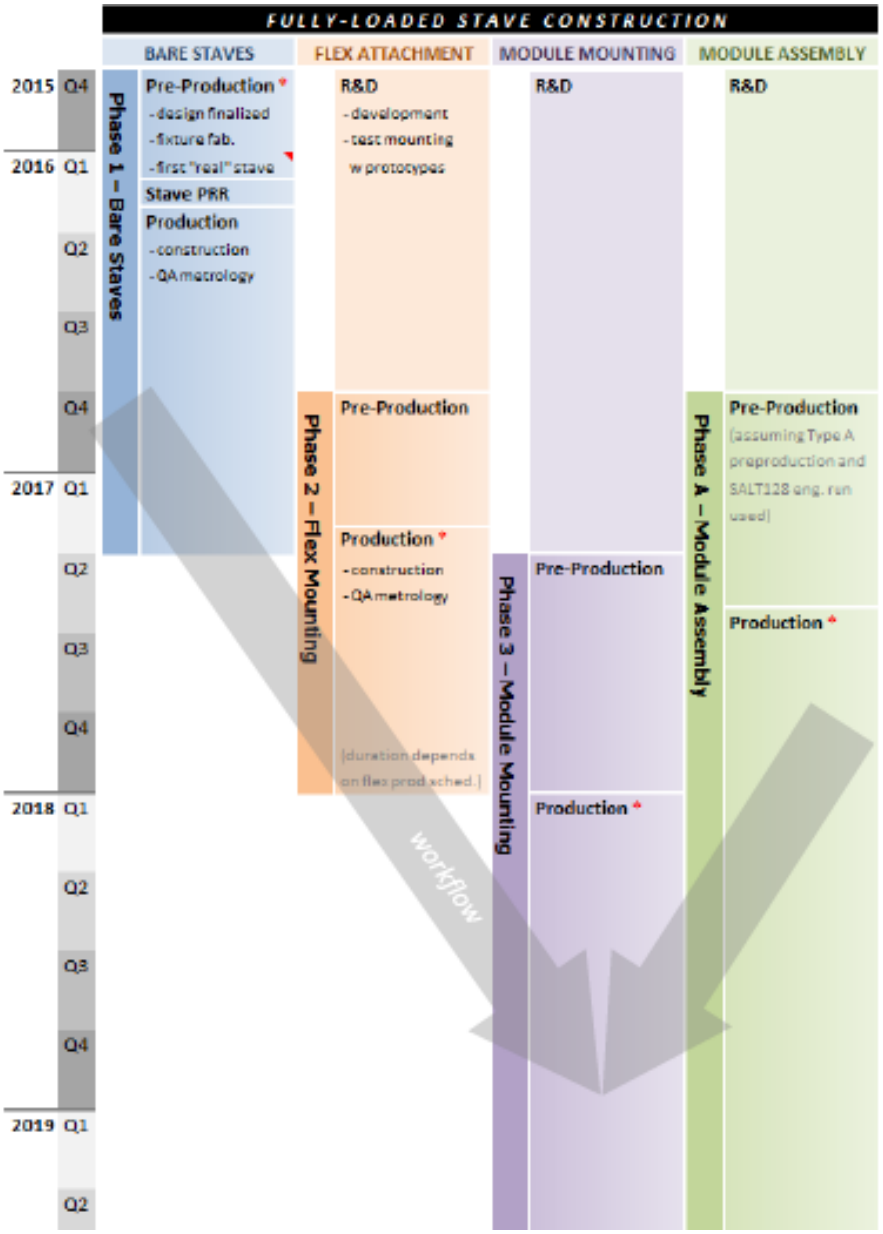
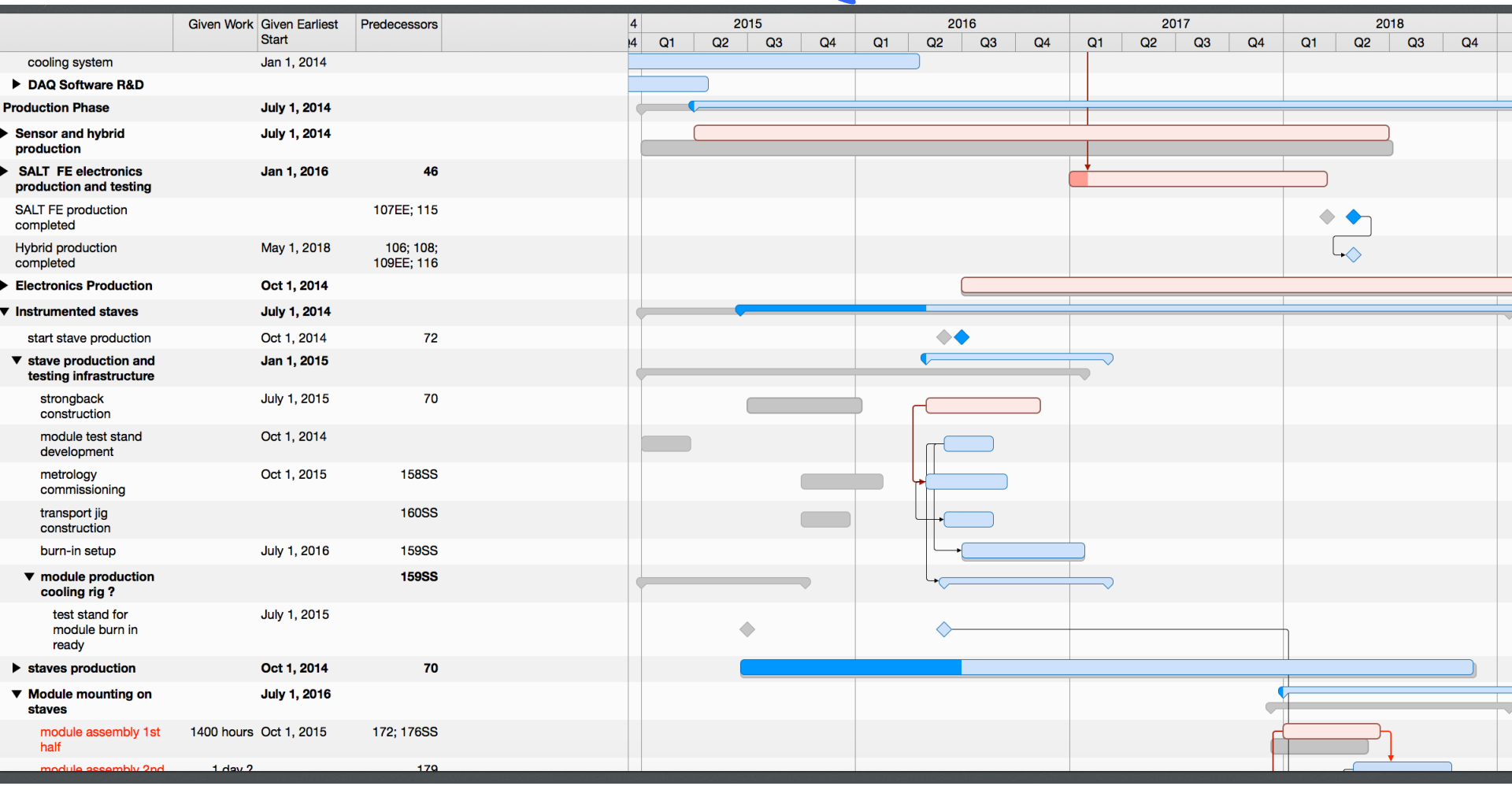
How subprojects are connected

From last year plan of transition to construction



Critical path



	Given Work	Given Earliest Start	Predecessors
cooling system		Jan 1, 2014	
DAQ Software R&D			
Production Phase		**July 1, 2014**	
Sensor and hybrid production		**July 1, 2014**	
SALT FE electronics production and testing		**Jan 1, 2016**	**46**
SALT FE production completed			107EE; 115
Hybrid production completed		May 1, 2018	106; 108; 109EE; 116
Electronics Production		**Oct 1, 2014**	
Instrumented staves		**July 1, 2014**	
start stave production		Oct 1, 2014	72
stave production and testing infrastructure		**Jan 1, 2015**	
strongback construction		July 1, 2015	70
module test stand development		Oct 1, 2014	
metrology commissioning		Oct 1, 2015	158SS
transport jig construction			160SS
burn-in setup		July 1, 2016	159SS
module production cooling rig ?			**159SS**
test stand for module burn in ready		July 1, 2015	
staves production		**Oct 1, 2014**	**70**
Module mounting on staves		**July 1, 2016**	
module assembly 1st half	1400 hours	Oct 1, 2015	172; 176SS
module assembly 2nd	1 day ?		179

Remarks on SALT

- To assess:
  - Building blocks to be added in the final iteration (only rad-hard memory?)
  - Performance parameters (e.g. power consumption, SEU immunity…) IRRADIATION plans
  - Mass production testing plans (key element to determine production timeline)

Note: this remains one of the key schedule drivers

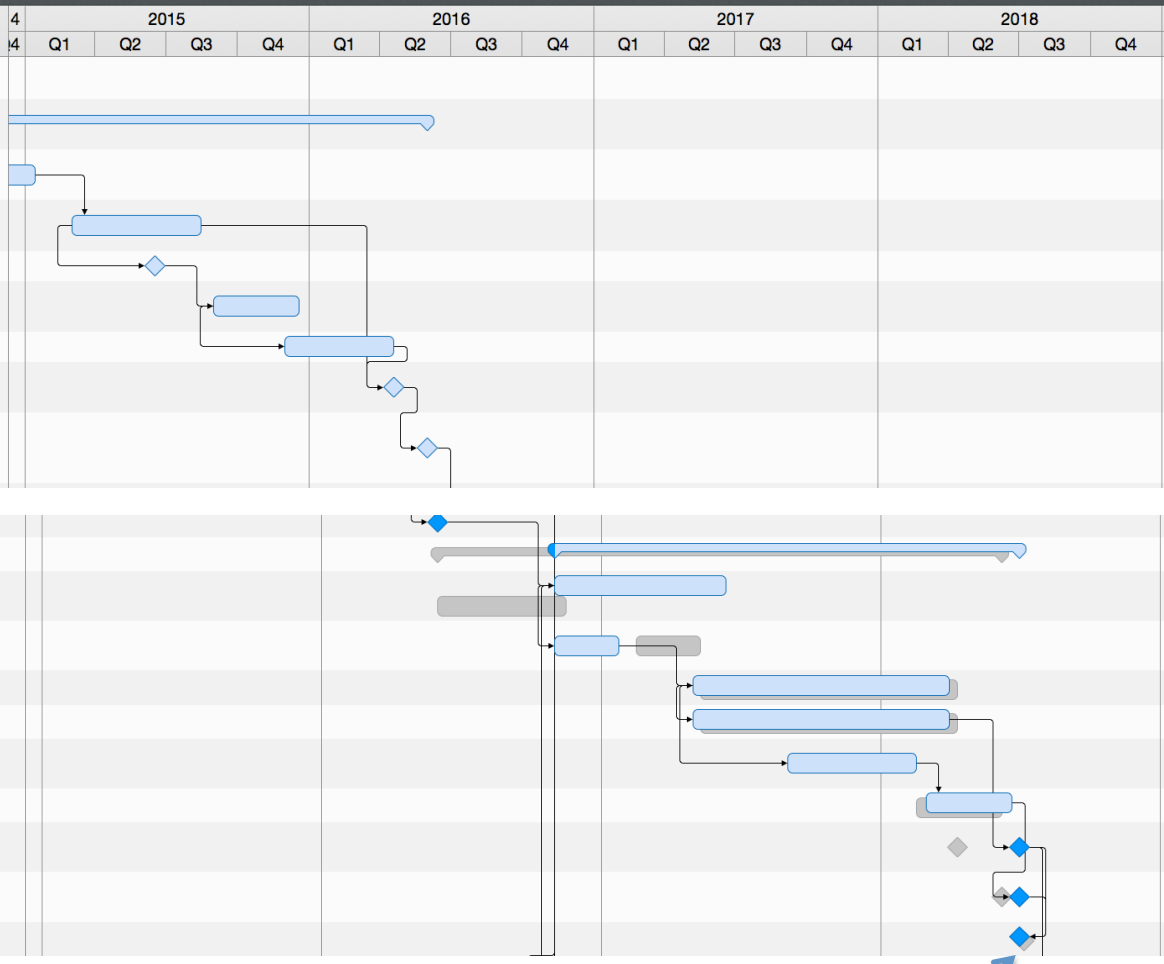
A few key issues

- Production of the staves is starting:
  - check of the risks associated to R&D still in progress (full SALT design, validation of HV/LV distribution, flex& pigtails, hybrids, "slice test")
  - Definition of assembly procedure, test, and shipment method ⇒ better evaluation of the construction and commissioning times
- Testing program needs to be defined as it is the important time driver (many components to test thoroughly

WP1a: Sensor

Entry

	Given Work	Given Earliest Start	Predecessors
sensor phase 1 completed		July 1, 2014	
nsor prototyping ase II		**July 1, 2014**	
sensor phase II fabrication		July 30, 2014	8SS
sensor phase II testing		Mar 1, 2015	10
sensor EDR		Jun 17, 2015	11SS
sensor batch in response to edr	1.4 months	Aug 31, 2015	12
sensor R&D III test		Nov 30, 2015	13SS
sensor R&D completed		Oct 31, 2015	11; 14
Sensor pre-production readiness review		May 31, 2016	15
sensor production starts			16; 89
sensor production		**April 1, 2015**	
sensor a preproduction		Oct 15, 2015	90
sensor a preproduction testing	3 months	Feb 15, 2017	92SS
sensor a production	1 day ?	May 1, 2017	93
sensor a testing		Mar 1, 2017	94SS
sensor b,c,d production	0 days ?	Sep 1, 2017	94SS
sensor b,c,d testing	4 months	July 1, 2015	96
sensor a production completed		July 1, 2016	95
sensor b,c,d production completed		July 1, 2017	97
sensor production ends		July 6, 2018	98EE; 99EE



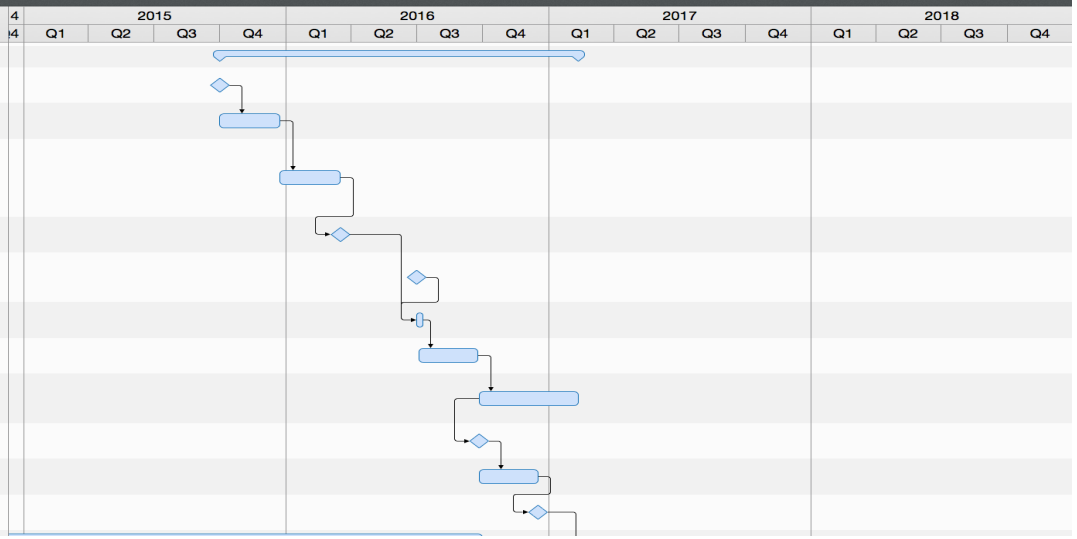
LHCC milestone

WP1b Hybrids

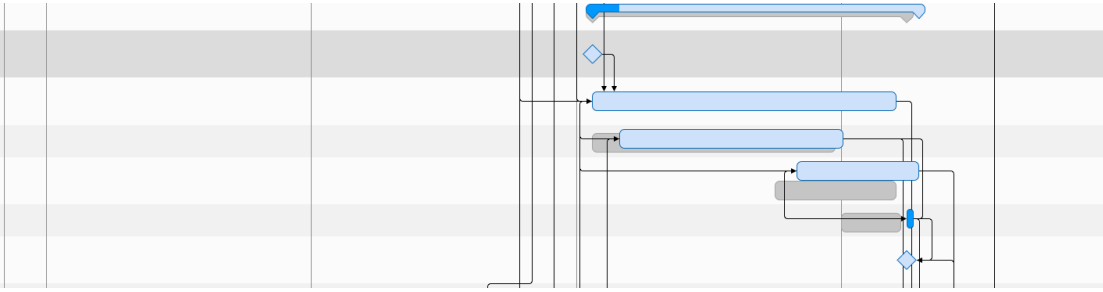
- Remarks:
  - Prototyping necessary to establish that we have a working system
  - Need to be ready well in advance of population of instrumented staves to validate system design

Hybrids

Title	Given Work	Given Earliest Start	Predecessors
hybrid R&D			
8 channel hybrid design review		Sep 30, 2015	
hybrid prototype SALT 8 channels	3 months	Feb 1, 2015	21
hybrid prototype SALT 8 channels tested and instrumented with silicon detectors	1 day ?		22
8 channel hybrid performance review			23
finalize chip distance from silicon edge		July 1, 2016 !	16; 18; 19
128 channel hybrid conceptual review	1 day ?	Sep 8, 2015	15SS; 24; 25
hybrid prototype 128 channel salt	3 months	July 1, 2015	26
hybrid prototype 128 channel asic test	1 day ?		27
hybrid engineering review		Sep 26, 2016	28SS
implement design changes	1 day ?		29
hybrid production readiness review		Dec 16, 2016	30



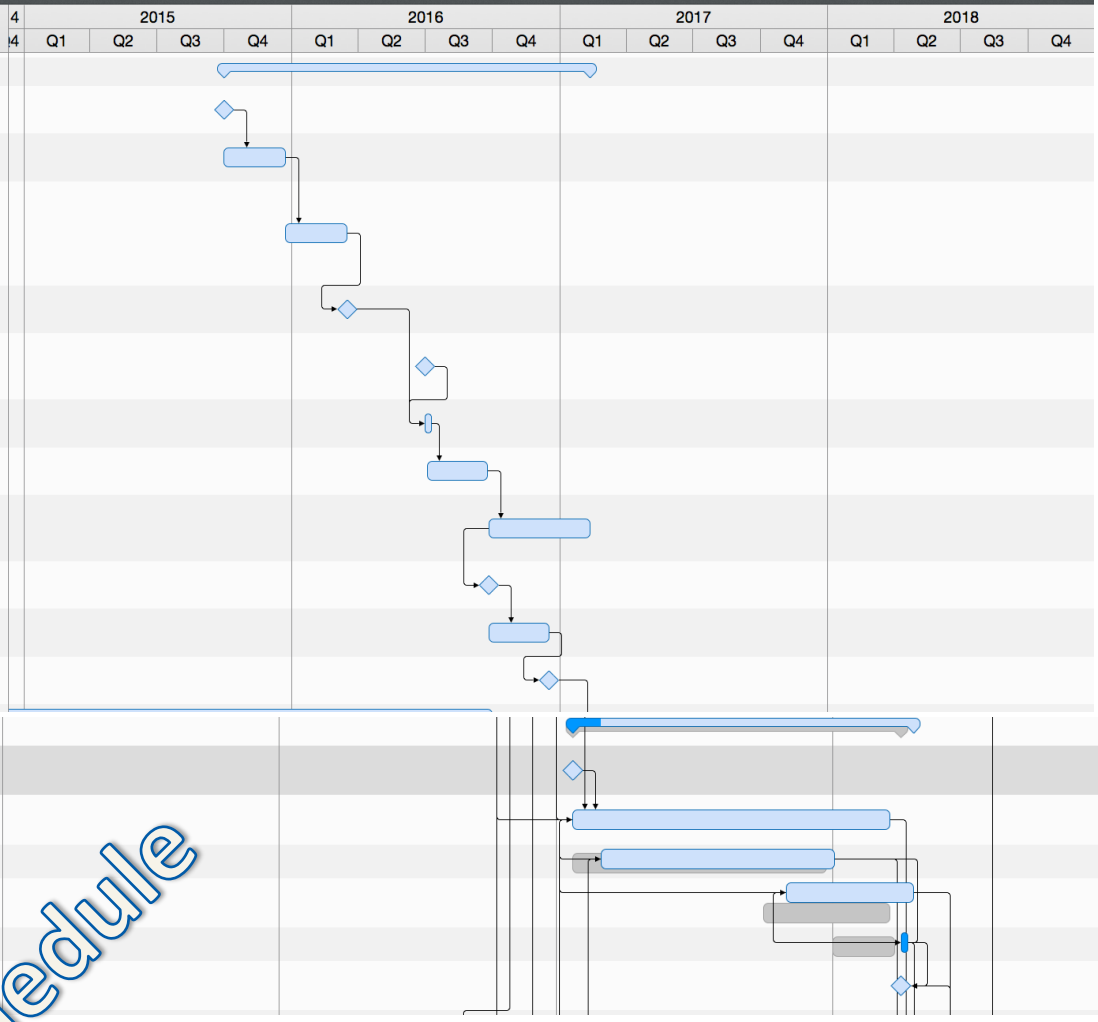
hybrid production	**1.5 years**	**Jan 1, 2016**	
Hybrid production starts		Jan 23, 2017	
4 ASIC Hybrid production		Mar 31, 2016	31; 45; 92SS; 101; 104
hybrid testing	1 year	Jan 1, 2017	105SS
8 ASIC hybrid production	1 day ?	Oct 1, 2017	105SS
8 ASIC hybrid testing	1 day ?	Jan 1, 2018	106EE; 107…
hybrid production completed		Mar 31, 2018	108EE



WP2: SALT

- SALT128 urgently needed for system design validation
- Concerns:
  - Complexity (tradeoff between complexity of digital and power consumption)
  - New technology: radiation effects
  - Performance with chosen powering scheme

Title	Given Work	Given Earliest Start	Predecessors
hybrid R&D			
8 channel hybrid design review		Sep 30, 2015	
hybrid prototype SALT 8 channels	3 months	Feb 1, 2015	21
hybrid prototype SALT 8 channels tested and instrumented with silicon detectors	1 day ?		22
8 channel hybrid performance review			23
finalize chip distance from silicon edge		July 1, 2016 !	16; 18; 19
128 channel hybrid conceptual review	1 day ?	Sep 8, 2015	15SS; 24; 25
hybrid prototype 128 channel salt	3 months	July 1, 2015	26
hybrid prototype 128 channel asic test	1 day ?		27
hybrid engineering review		Sep 26, 2016	28SS
implement design changes	1 day ?		29
hybrid production readiness review		Dec 16, 2016	30
hybrid production	**1.5 years**	**Jan 1, 2016**	
Hybrid production starts		Jan 23, 2017	
4 ASIC Hybrid production		Mar 31, 2016	31; 45; 92SS; 101; 104
hybrid testing	1 year	Jan 1, 2017	105SS
8 ASIC hybrid production	1 day ?	Oct 1, 2017	105SS
8 ASIC hybrid testing	1 day ?	Jan 1, 2018	106EE; 107…
hybrid production completed		Mar 31, 2018	108EE

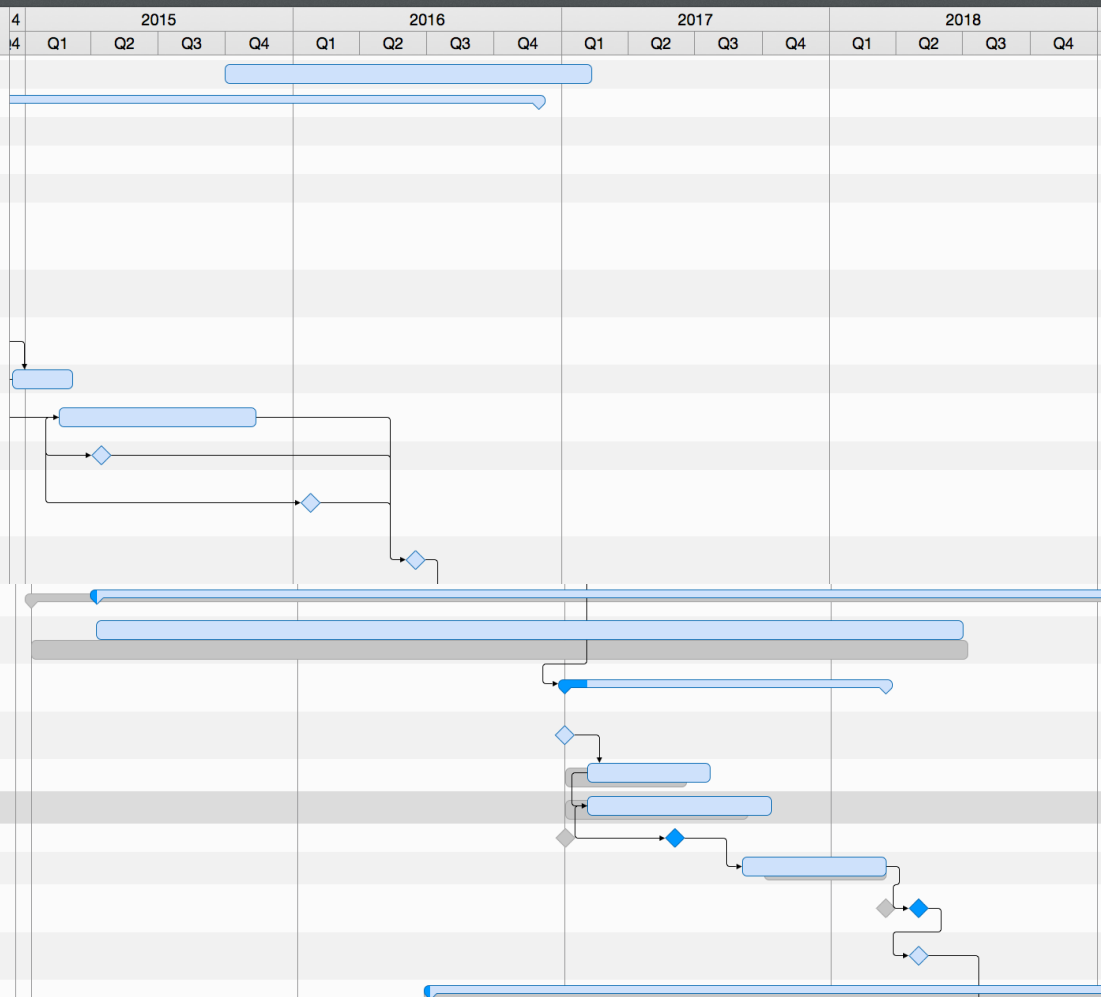


Old salt schedule

LHCC milestone: modules completed May 2018

Breakdown > Entry

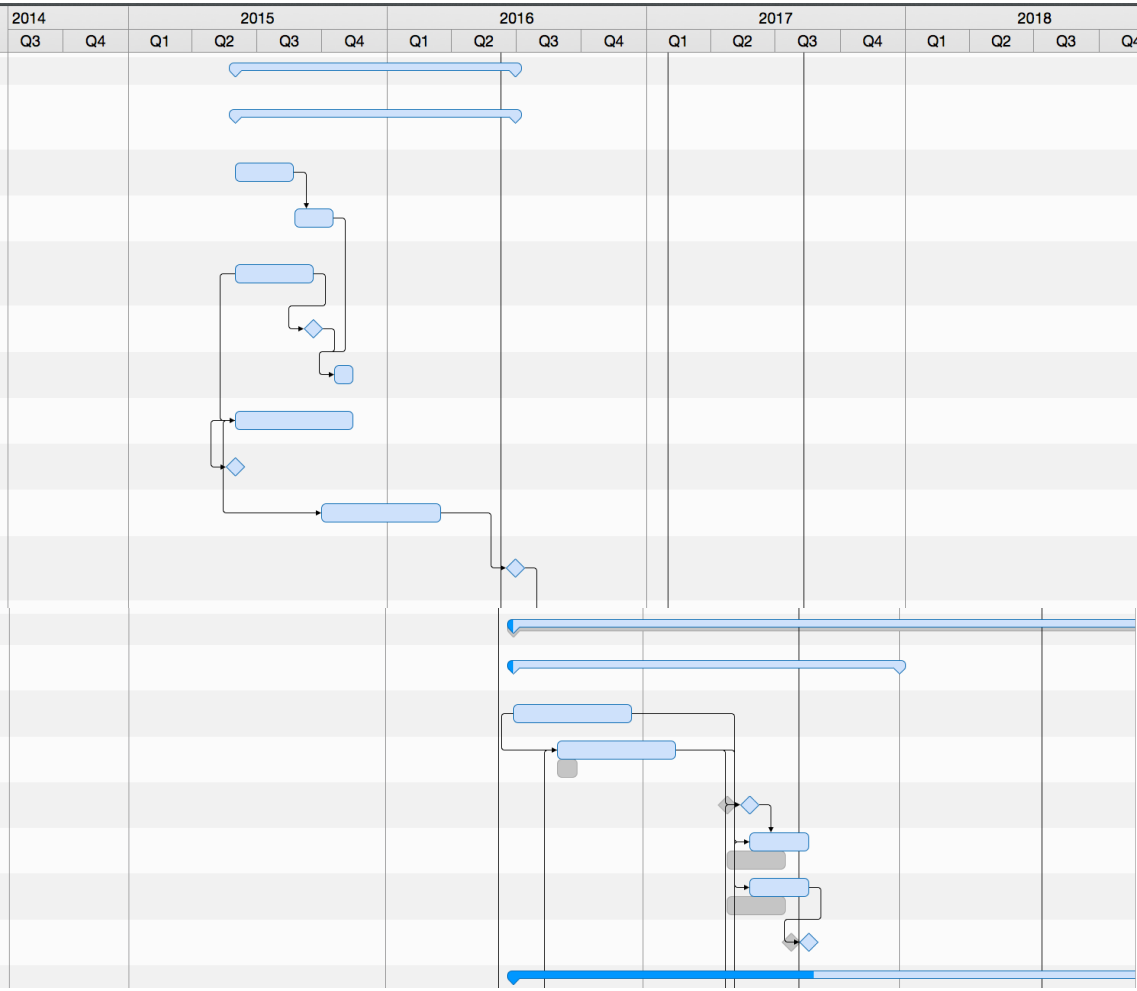
Title	Given Work	Given Earliest Start	Predecessors
hybrid R&D			
SALT ASIC R&D			
final specifications		Dec 1, 2013	
ASIC analog design		May 1, 2014	33
ADC radiation test	6 weeks ?	June 7, 2014	
internal review of radiation tolerance of ADC design		July 21, 2014	35
design of 8 channel analog+ADC block	24 weeks ?	Feb 1, 2014	34SS; 35SS
8 channel FE+ADC submission		Nov 3, 2014 !	37
proto ASIC 1 testing		Dec 15, 2014	38
128 channel asic design	6 months	Apr 15, 2015	39SS
chip footpring fixed		Apr 15, 2015	40SS
128 channel asic engineering design review		Jan 25, 2016	40SS
128 channel asic submission		Jun 16, 2016	40; 41; 42
Production Phase		**July 1, 2014**	
Sensor and hybrid production		**July 1, 2014**	
SALT FE electronics production and testing		**Jan 1, 2016**	**46**
salt engineering run readiness review		Sep 30, 2016	
ASIC engineering run		Oct 20, 2016	101; 111
wafer testing		May 31, 2016	112SS
ASIC production starts		Oct 31, 2016	113SS
salt testing	6 months		105EE; 114
SALT FE production completed			107EE; 115
Hybrid production completed		May 1, 2018	106; 108; 109EE; 116
Electronics Production		**Oct 1, 2014**	



WP3: Electronics

- Three branches:
  - Flex cable
  - Near detector electronics:
    - Data Combiner boards & backplanes
    - LV distribution boards

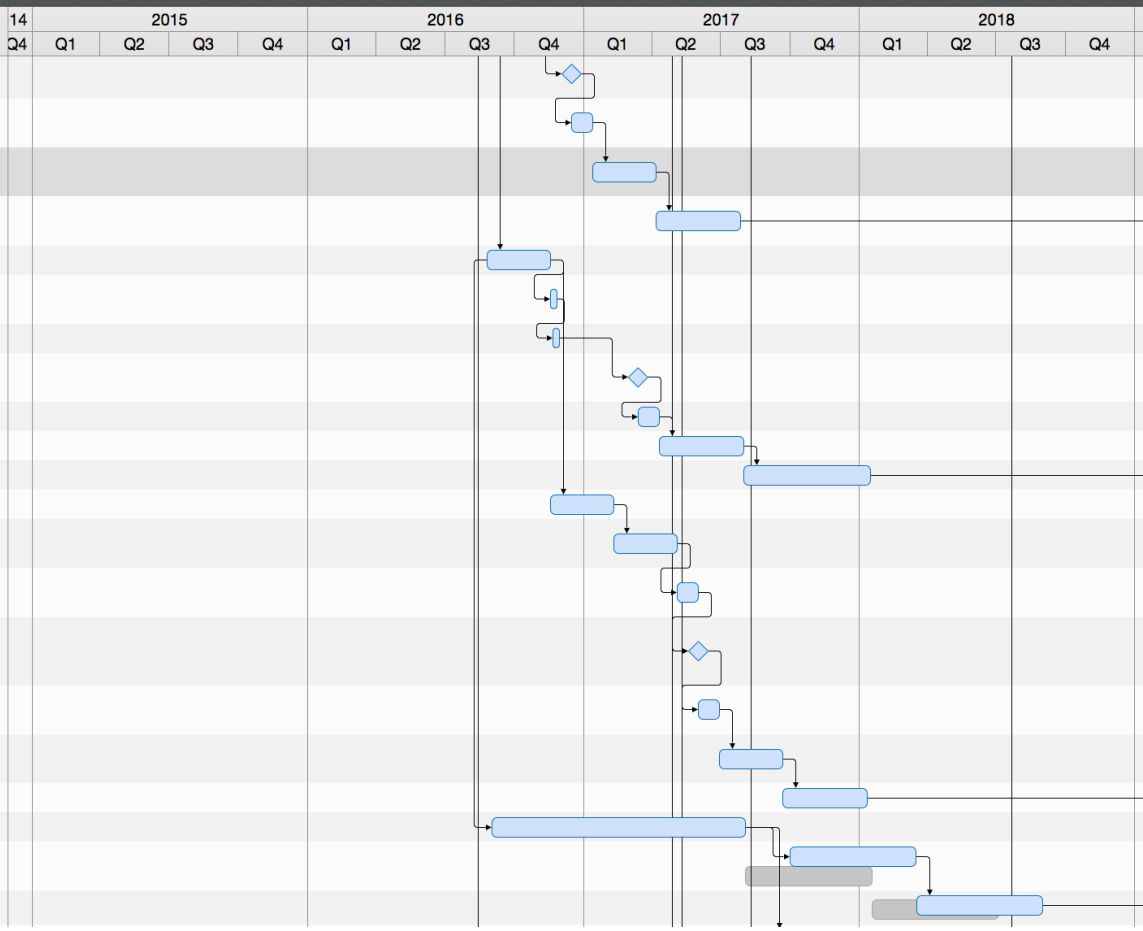
Title	Given Work	Given Earliest Start	Predecessors
Cable R&D			
prototype cable design and production		**April 1, 2014**	
cable prototype design		April 3, 2014	
cable prototype fabrication			56
prototype flex cable test board design and construction	2 months ?	April 2, 2014	
test stand for data cable ready		July 1, 2014	58
prototype data cable test	1 month ?		57; 59
prototype power bus test	0 days ?	June 1, 2015	58SS
cable engineering design review		June 1, 2015	61SS
evaluation of prototype b	1 day ?	Sep 30, 2015	61SS
flex cable production readiness review		Jun 30, 2016	63
Electronics Production		**Oct 1, 2014**	
Cable production and testing		**Oct 1, 2015**	
power/data cable production first half		July 1, 2016	64
power/data cable testing		Sep 1, 2016	120SS
first batch of cable production ended		Mar 31, 2017	121; 172SS
power/data cable second half	3 months		120; 122
power-data cable testing	3 months	Jan 31, 2017	123SS
flex cable production ended		July 31, 2017	124
balcony electronics		**July 1, 2016**	



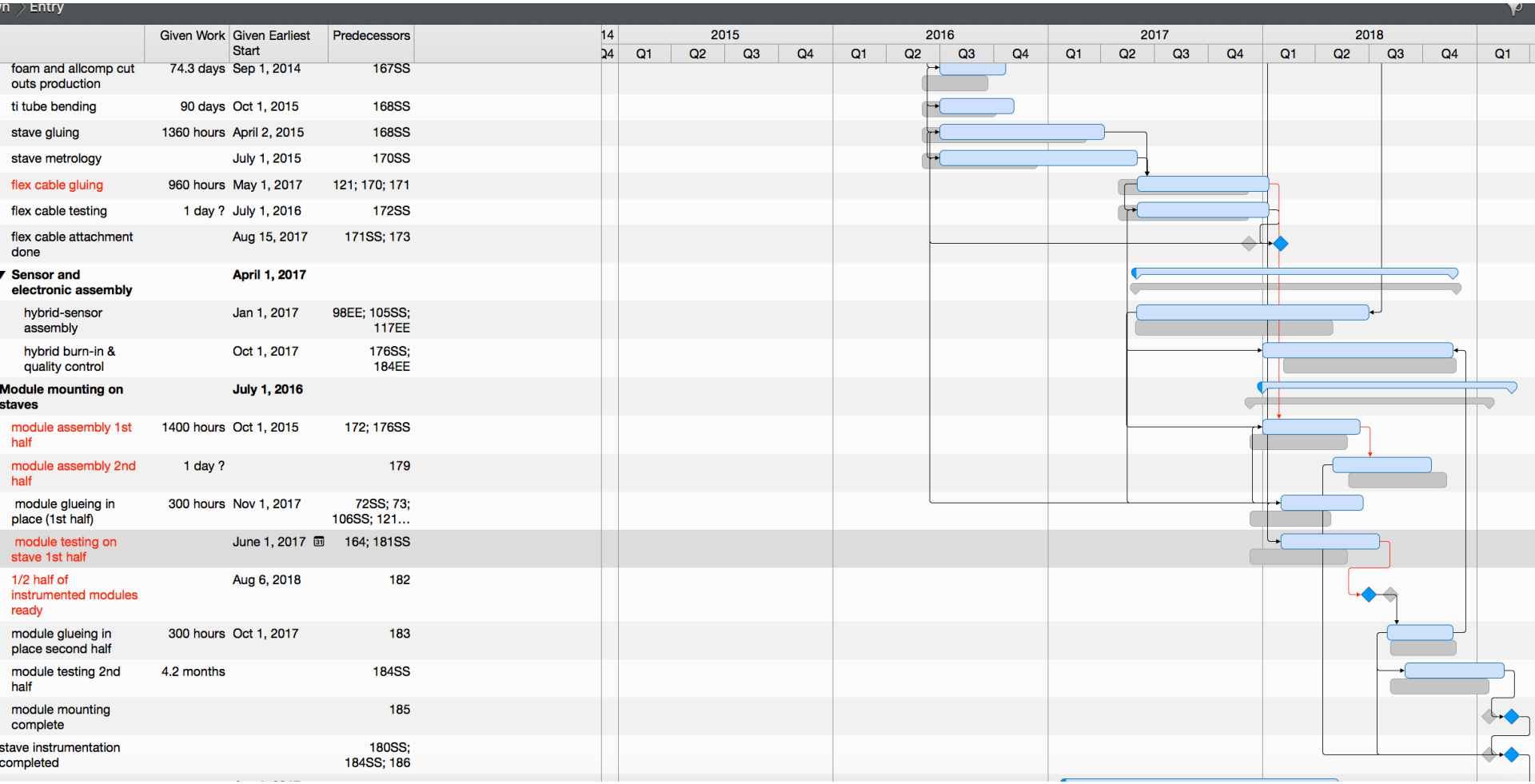
LV/DCB electronics

own Entry

	Given Work	Given Earliest Start	Predecessors
Power distribution PRR			129
power boards final design	1 month		130
power board construction	3 months		131
power board testing and burn in	4 months		132
dcb preprod design	3 months		127
dcb preprod production	1 day ?		134
dcb preprod testing	1 day ?		135
dcb prod readiness review		Mar 13, 2017	136
dcb final design	1 month		137
dcb production	4 months		138
dcb testing	6 months		139
master control design	3 months	Sep 30, 2016	134
master control preproduction	3 months		141
master control preprod testing	1 month		142
master control production readiness review			143
master control final design	1 month		144
master control production	3 months		145
master control test	4 months		146
backplane design	1 year	Sep 1, 2016	134SS
backplane construction	6 months	April 1, 2017	148
backplane test	6 months		149



mechanics



	Given Work	Given Earliest Start	Predecessors
foam and allcomp cut outs production	74.3 days	Sep 1, 2014	167SS
ti tube bending	90 days	Oct 1, 2015	168SS
stave gluing	1360 hours	April 2, 2015	168SS
stave metrology		July 1, 2015	170SS
flex cable gluing	960 hours	May 1, 2017	121; 170; 171
flex cable testing	1 day ?	July 1, 2016	172SS
flex cable attachment done		Aug 15, 2017	171SS; 173
Sensor and electronic assembly		**April 1, 2017**	
hybrid-sensor assembly		Jan 1, 2017	98EE; 105SS; 117EE
hybrid burn-in & quality control		Oct 1, 2017	176SS; 184EE
Module mounting on staves		**July 1, 2016**	
module assembly 1st half	1400 hours	Oct 1, 2015	172; 176SS
module assembly 2nd half	1 day ?		179
module glueing in place (1st half)	300 hours	Nov 1, 2017	72SS; 73; 106SS; 121…
module testing on stave 1st half		June 1, 2017	164; 181SS
1/2 half of instrumented modules ready		Aug 6, 2018	182
module glueing in place second half	300 hours	Oct 1, 2017	183
module testing 2nd half	4.2 months		184SS
module mounting complete			185
stave instrumentation completed			180SS; 184SS; 186