



# HV & LV SYSTEM FOR RE4

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On behalf of CMS RPC Group



# Introduction

- ❑ High Voltage (HV) and Low Voltage (LV) is required to power up 144 RPCs which will be installed on RE+4 and RE-4.
  - ❑ Total HV channels = 288.
  - ❑ Similarly, total LV channels = 288.
- ❑ The same solution as used for RE1, RE2 and RE3 from CAEN, Italy i.e. EASY3000 (Embedded Assembly SYstem) will be used for RE4 HV and LV system.
  - ❑ To save cost for HV boards, HV distributor boxes will be produced locally as it was done previously.



# RE4 HV and LV Hardware from CAEN



SY 1527 Multichannel Power Supply



Branch Controller (A1676A)



HV AC to DC Convertor A3485



LV MAO A3486 AC to DC convertor



HV Module A3512N



LV Module A3009



EASY3000 Back Side



EASY3000 Front Side



# HV SYSTEM FOR RE4

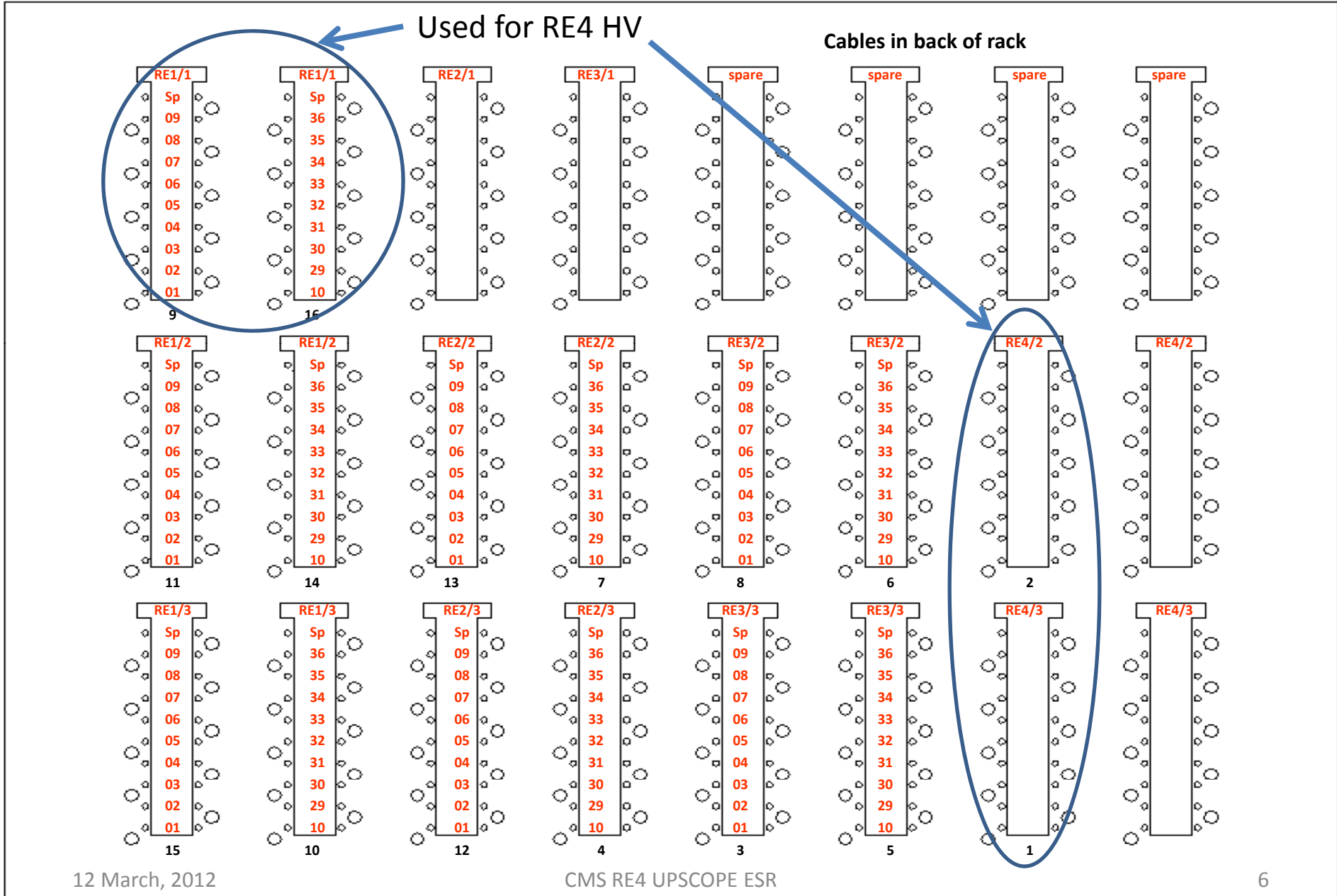
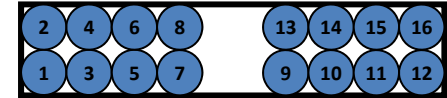


# RE4 HV System Requirement List

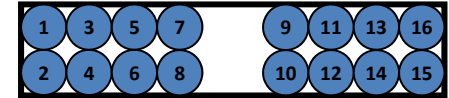
Item	Required Quantity
SY1527	not required
EASY Crate	not required
HV Board A3512N (6 Channel Board) and 3 HV boards per rack in USC	12 +2
A3485	not required
Branch Controller	not required
HV Distributor Box (10 input 40 output)	8 + 3

- No need to route HV cables from USC to UXC. Our plan is to use existing cables.

# RE YE+1 Near HV PP as seen from IP

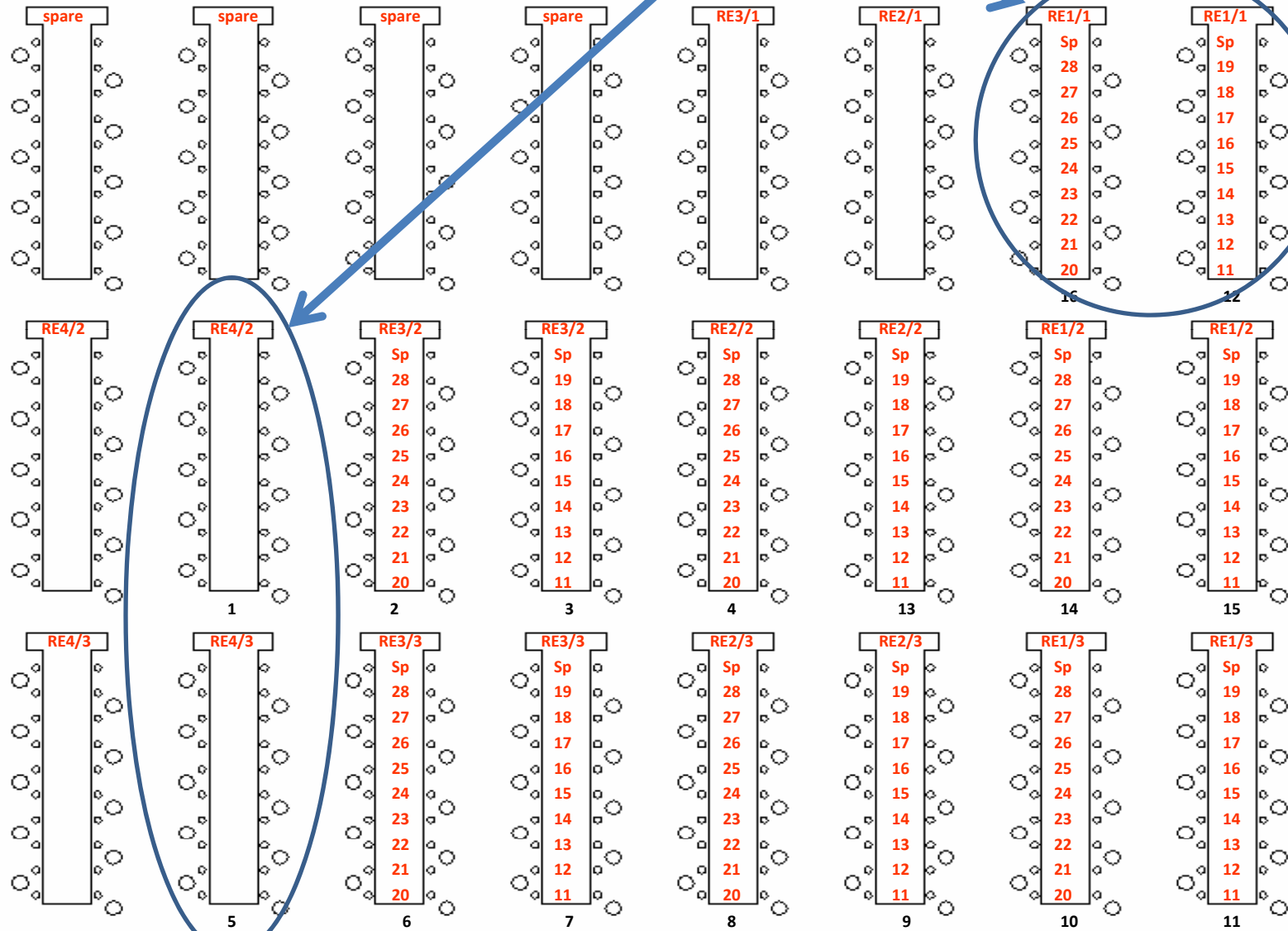


# RE YE+1 Far HV PP as seen from IP



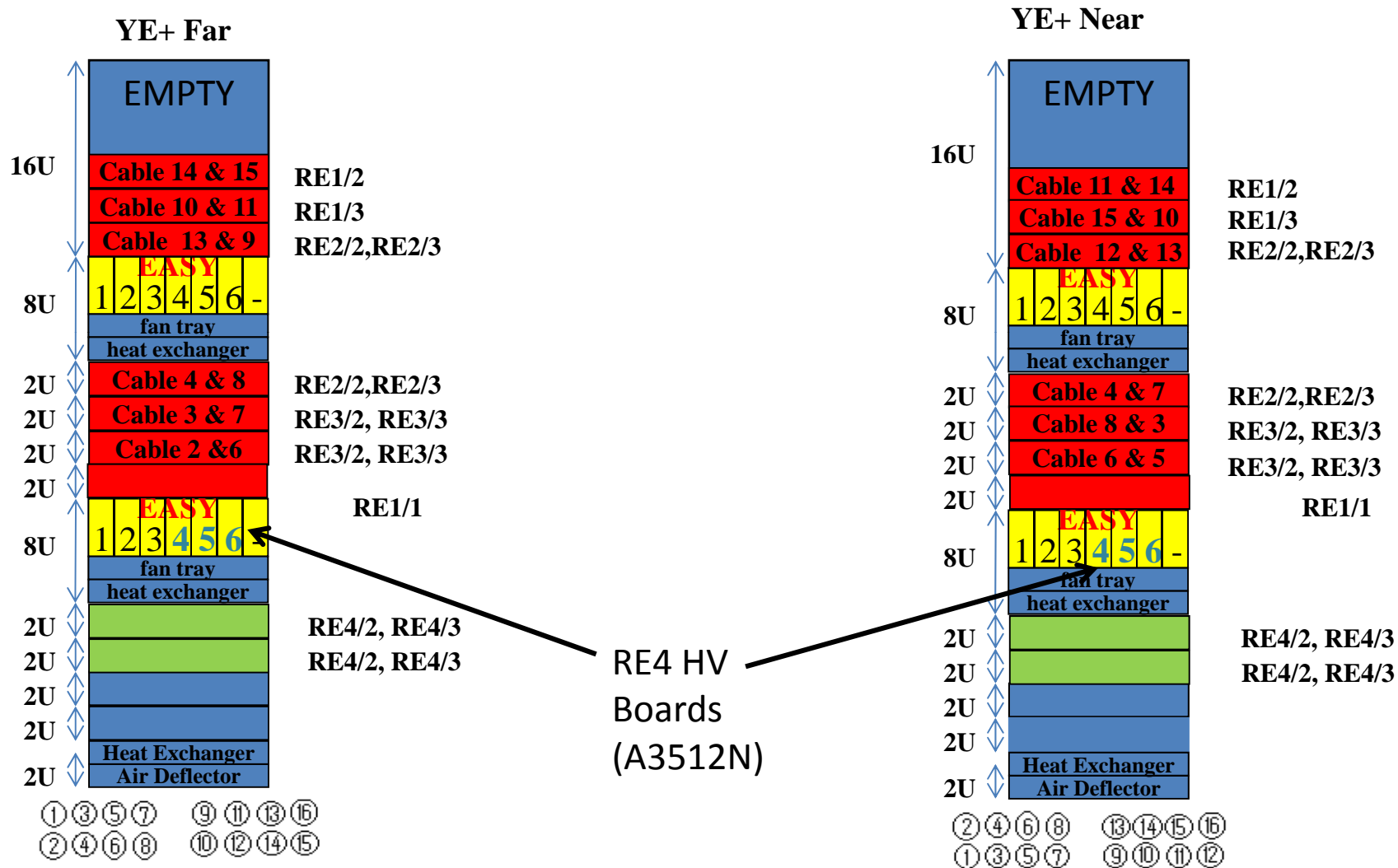
Used for RE4 HV

Cables in back of rack





# Proposed HV racks layout in USC







# HV Distribution Box I

- ❑ 10 input and 40 output HV distribution box(DB) will be prepared locally for RE4.
  - ❑ 1 input and 4 outputs will be used for spare.
- ❑ By using DB, one HV channel of HV board (A3512N) will be able to power up 2 RPCs (i.e. 4 HV channels).
- ❑ One DB can provide HV to 18 RPCs, therefore 4 DBs are required for each station.



Input Side of Distribution Box



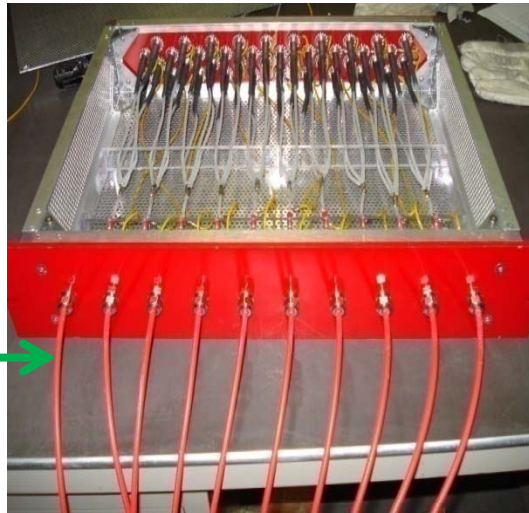
Output Side of Distribution Box



# HV Distribution Box II



HV Module



Distribution Box Input Side



Distribution Box Output Side



Jupiter Connector

# LV SYSTEM FOR RE4



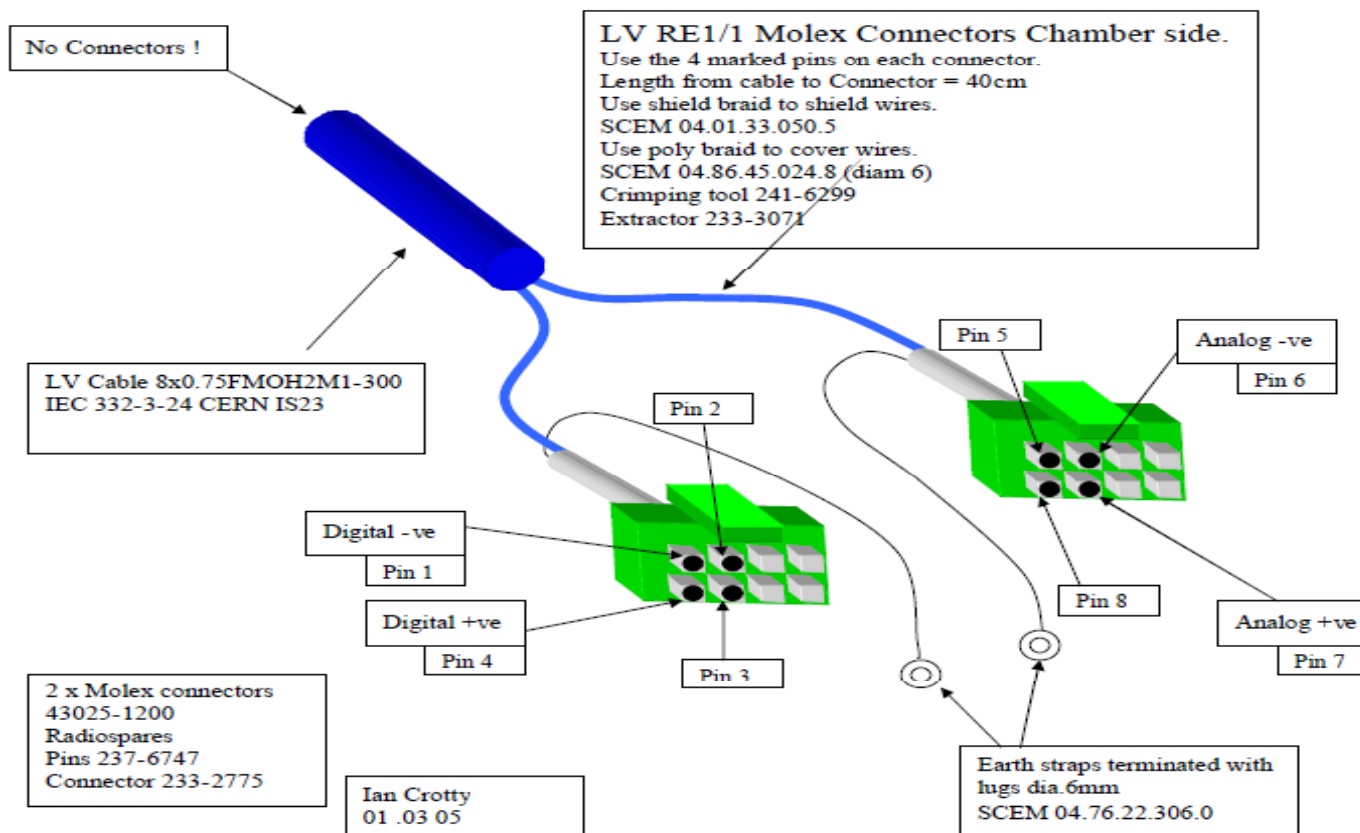
# RE4 LV Hardware Requirement



Item	Required Quantity
SY1527	not required
EASY Crate	4
LV Board A3009 (12 Channel Board)	12 + 1
MAO (A3486/A3486S)	2
Branch Controller	2

- We need to route cables from USC to UXC.
  - These cables are control cables and service power cables from branch controller to MAO as they are laid for existing RE1, RE2 and RE3.

# LV Cable layout from LV Board to RPC



- 2 Analog Channels of two RPCs are combined to make one RE LV analog channel (7V).

- Similarly, 2 digital channels combine to make 1 RE digital channel (7.5V).

- Total no of LV channels reduce to 144.

- Digital in the leftmost vertical pair: 1,4 and 5,8. Analog in the second pair: 2,3 and 6,7.

RE+4 branch controller(USC, S4F03 RACK)

RE+4 MAQ(X2A52)

RE+4 EASY Crate FAR side(X2A52)

A3009 board in EASY Crate first slot(X2A52)

A3009 channel 0	RE4/2-13,RE4/3-13 ANA
A3009 channel 1	RE4/2-13,RE4/3-13 DIG
A3009 channel 2	RE4/2-14,RE4/3-14 ANA
A3009 channel 3	RE4/2-14,RE4/3-14 DIG
A3009 channel 4	RE4/2-15,RE4/3-15 ANA
A3009 channel 5	RE4/2-15,RE4/3-15 DIG
A3009 channel 6	RE4/2-16,RE4/3-16 ANA
A3009 channel 7	RE4/2-16,RE4/3-16 DIG
A3009 channel 8	RE4/2-17,RE4/3-17 ANA
A3009 channel 9	RE4/2-17,RE4/3-17 DIG
A3009 channel 10	RE4/2-18,RE4/3-18 ANA
A3009 channel 11	RE4/2-18,RE4/3-18 DIG

A3009 board in EASY Crate fifth slot(X2A52)

A3009 channel 0	RE4/2-19,RE4/3-19 ANA
A3009 channel 1	RE4/2-19,RE4/3-19 DIG
A3009 channel 2	RE4/2-20,RE4/3-20 ANA
A3009 channel 3	RE4/2-20,RE4/3-20 DIG
A3009 channel 4	RE4/2-21,RE4/3-21 ANA
A3009 channel 5	RE4/2-21,RE4/3-21 DIG
A3009 channel 6	RE4/2-22,RE4/3-22 ANA
A3009 channel 7	RE4/2-22,RE4/3-22 DIG
A3009 channel 8	RE4/2-23,RE4/3-23 ANA
A3009 channel 9	RE4/2-23,RE4/3-23 DIG
A3009 channel 10	RE4/2-24,RE4/3-24 ANA
A3009 channel 11	RE4/2-24,RE4/3-24 DIG

A3009 board in EASY Crate ninth slot(X2A52)

A3009 channel 0	RE4/2-25,RE4/3-25 ANA
A3009 channel 1	RE4/2-25,RE4/3-25 DIG
A3009 channel 2	RE4/2-26,RE4/3-26 ANA
A3009 channel 3	RE4/2-26,RE4/3-26 DIG
A3009 channel 4	RE4/2-27,RE4/3-27 ANA
A3009 channel 5	RE4/2-27,RE4/3-27 DIG
A3009 channel 6	RE4/2-28,RE4/3-28 ANA
A3009 channel 7	RE4/2-28,RE4/3-28 DIG
A3009 channel 8	RE4/2-29,RE4/3-29 ANA
A3009 channel 9	RE4/2-29,RE4/3-29 DIG
A3009 channel 10	RE4/2-30,RE4/3-30 ANA
A3009 channel 11	RE4/2-30,RE4/3-30 DIG

## Layout for RE+4 Far LV cables connections to LV boards

## RE+4 EASY Crate NEAR side (X2J52)

RE+4 EASY Crate NEAR side (X2J52)			
	A3009 board in EASY Crate first slot(X2J52)		
		A3009 channel 0	RE4/2-01,RE4/3-01 ANA
		A3009 channel 1	RE4/2-01,RE4/3-01 DIG
		A3009 channel 2	RE4/2-02,RE4/3-02 ANA
		A3009 channel 3	RE4/2-02,RE4/3-02 DIG
		A3009 channel 4	RE4/2-03,RE4/3-03 ANA
		A3009 channel 5	RE4/2-03,RE4/3-03 DIG
		A3009 channel 6	RE4/2-04,RE4/3-04 ANA
		A3009 channel 7	RE4/2-04,RE4/3-04 DIG
		A3009 channel 8	RE4/2-05,RE4/3-05 ANA
		A3009 channel 9	RE4/2-05,RE4/3-05 DIG
		A3009 channel 10	RE4/2-06,RE4/3-06 ANA
		A3009 channel 11	RE4/2-06,RE4/3-06 DIG
	A3009 board in EASY Crate fifth slot(X2J52)		
		A3009 channel 0	RE4/2-07,RE4/3-07 ANA
		A3009 channel 1	RE4/2-07,RE4/3-07 DIG
		A3009 channel 2	RE4/2-08,RE4/3-08 ANA
		A3009 channel 3	RE4/2-08,RE4/3-08 DIG
		A3009 channel 4	RE4/2-09,RE4/3-09 ANA
		A3009 channel 5	RE4/2-09,RE4/3-09 DIG
		A3009 channel 6	RE4/2-10,RE4/3-10 ANA
		A3009 channel 7	RE4/2-10,RE4/3-10 DIG
		A3009 channel 8	RE4/2-11,RE4/3-11 ANA
		A3009 channel 9	RE4/2-11,RE4/3-11 DIG
		A3009 channel 10	RE4/2-12,RE4/3-12 ANA
		A3009 channel 11	RE4/2-12,RE4/3-12 DIG
	A3009 board in EASY Crate ninth slot(X2J52)		
		A3009 channel 0	RE4/2-31,RE4/3-31 ANA
		A3009 channel 1	RE4/2-31,RE4/3-31 DIG
		A3009 channel 2	RE4/2-32,RE4/3-32 ANA
		A3009 channel 3	RE4/2-32,RE4/3-32 DIG
		A3009 channel 4	RE4/2-33,RE4/3-33 ANA
		A3009 channel 5	RE4/2-33,RE4/3-33 DIG
		A3009 channel 6	RE4/2-34,RE4/3-34 ANA
		A3009 channel 7	RE4/2-34,RE4/3-34 DIG
		A3009 channel 8	RE4/2-35,RE4/3-35 ANA
		A3009 channel 9	RE4/2-35,RE4/3-35 DIG
		A3009 channel 10	RE4/2-36,RE4/3-36 ANA
		A3009 channel 11	RE4/2-36,RE4/3-36 DIG
12 March, 2012		CMS RE4 UPSCOPE ESR	15



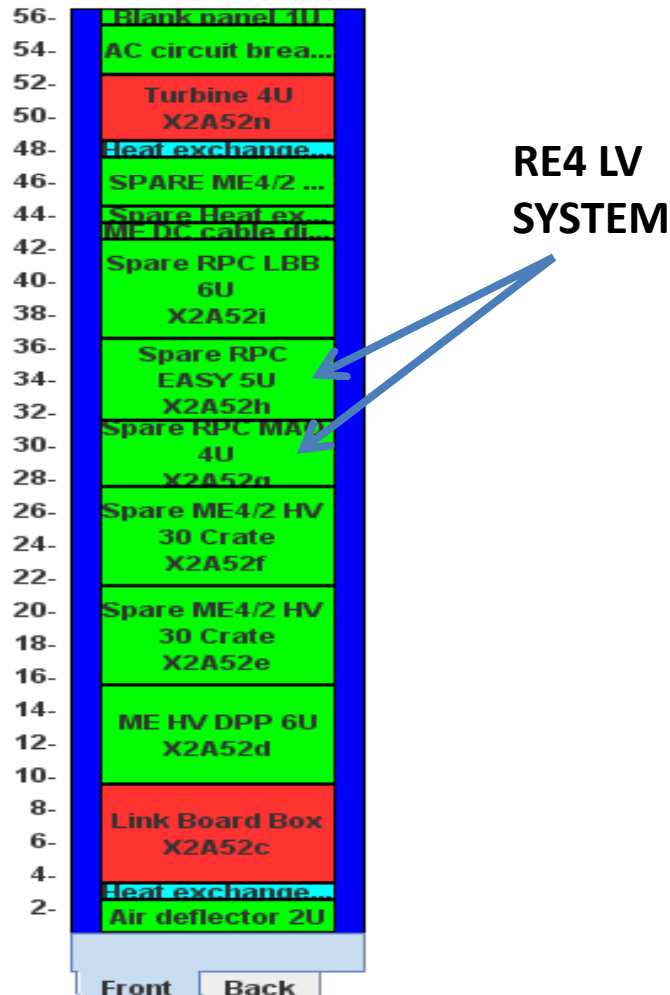
# Power Estimation

- ❑ For one LV analog channel, Power =  $V.I = 7(V) \times 1.2(A)_{\text{max}} = 8.4 \text{ Watts}$ .
- ❑ Similarly, for one LV digital channel =  $7.5(V) \times 2(A)_{\text{max}} = 15 \text{ Watts}$ .
- ❑ Therefore for A3009 board i.e.  $(6 \times 8.4) + (6 \times 15) = 140.4 \text{ Watts}$ .
  - ❑ For one EASY Crate it will be around =  $104.4 \times 3 = 421.2 \text{ watts}$ .
- ❑ Adding safety factor we can say total power for EASY Crate = **600Watts approximately.**
  
- ❑ For HV system, as the current drawn is very small i.e.  $\sim 15 \text{ micro Ampere}$  for applied HV  $\sim 9700V$ . Therefore for one HV channel the estimated power using same formula  $P = V.I = \sim 1.455 \text{ Watt}$ .





# Rack Layouts



Proposed rack layout of RE4 hardware in UXC rack X2A52

- Rack layouts are finalized after discussion with CSC colleagues.
- RE4 hardware will be installed in the existing racks in USC and UXC
- Full layout of racks is shown in dedicated talk.



# Hardware Status

- Quotation from CAEN is already received for the estimate of HV and LV system.
  - Soon we will proceed for the order and it is expected that we will receive the hardware by the end of 2012.
  
- HV distribution box components are already ordered.
  
- All the RE4 hardware will be tested in building 904 RPC test setup before moving it to point 5.



# Thank you