# Aerogel HV cable assembling procedures (for W1-NORTH-side of 80 Aerogel Boxes)

Phenix high-pt PID upgrade team

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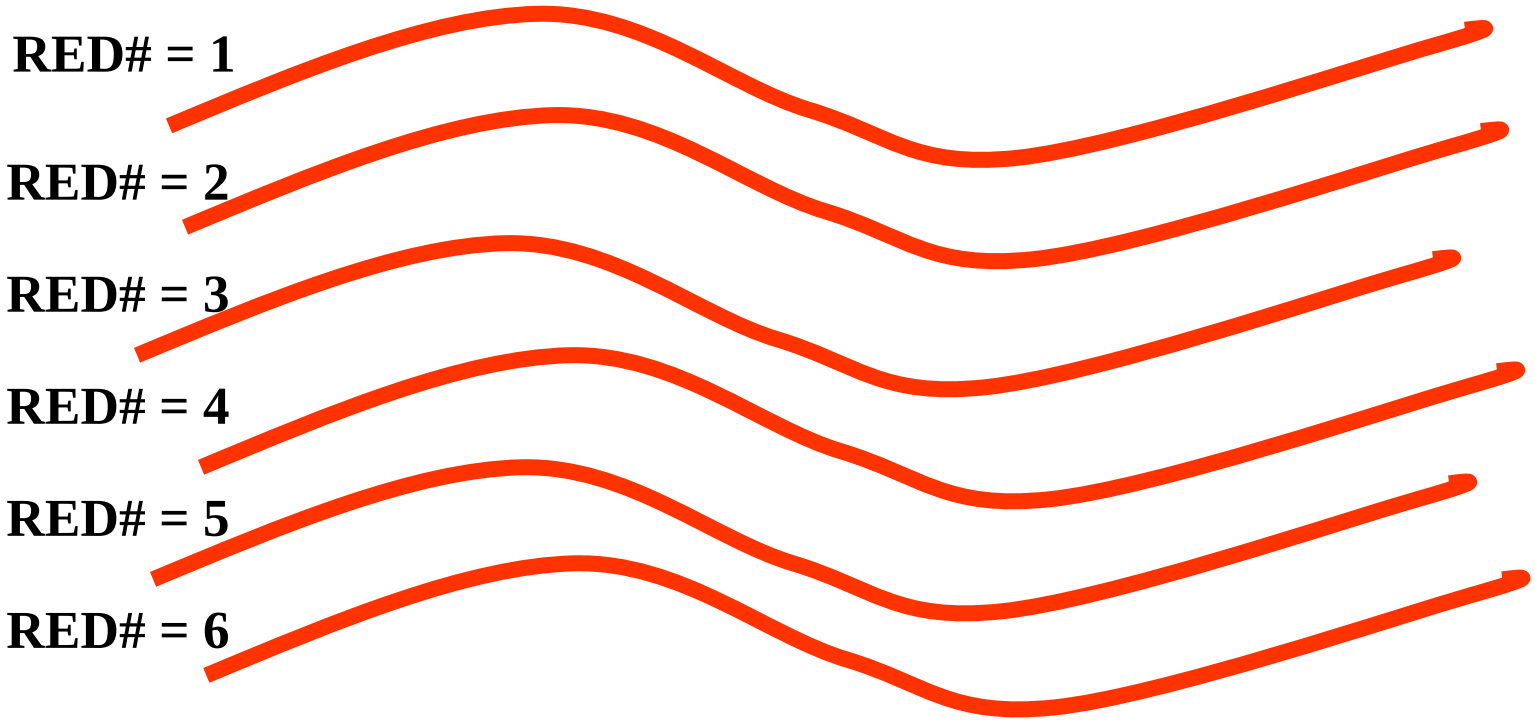
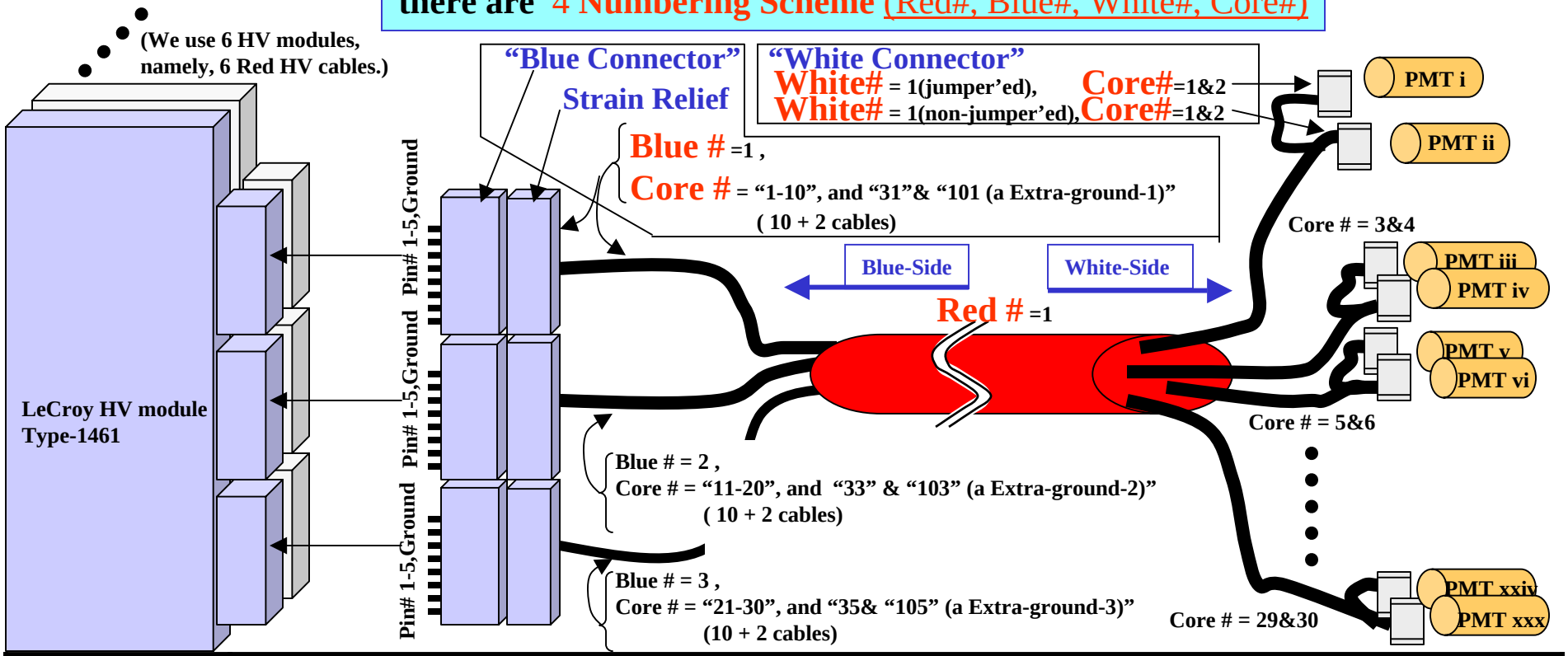
# Step 0:

(i) Remember that, *at the beginning of assembling*, there are 6 Red-cables.
(ii) Each of them is identified by **RED#** (from 1 to 6).



# Step 0: -dash

**(iii) Remember that: for each Red cable,**
***when cable assembling has been accomplished,***
**there are 4 Numbering Scheme (Red#, Blue#, White#, Core#)**




| | Blue Connector | | Red Cable | | | | White Connector | |
|---|---|---|---|---|---|---|---|---|
| Item | Bleu Connector | Strain Relief | Insulated region (LeCroy Side) | | Red-Covered region | Insulated region (PMT-side) | For Odd PMT-number | For Even PMT-number |
| Cable's Counting scheme | **Blue #** | (=Blue #) | (=Blue #) | **Core #** | **Red #** | 2 White#'s | **White #** | |
| Number of cables in each Red # | 3 | 3 | 3 | 30 (15HV+15GND) + 6GND | ( 1 ) | 15 sets of 2 White#'s | 15 | 15 |

# Step 1: Let's Begin !!

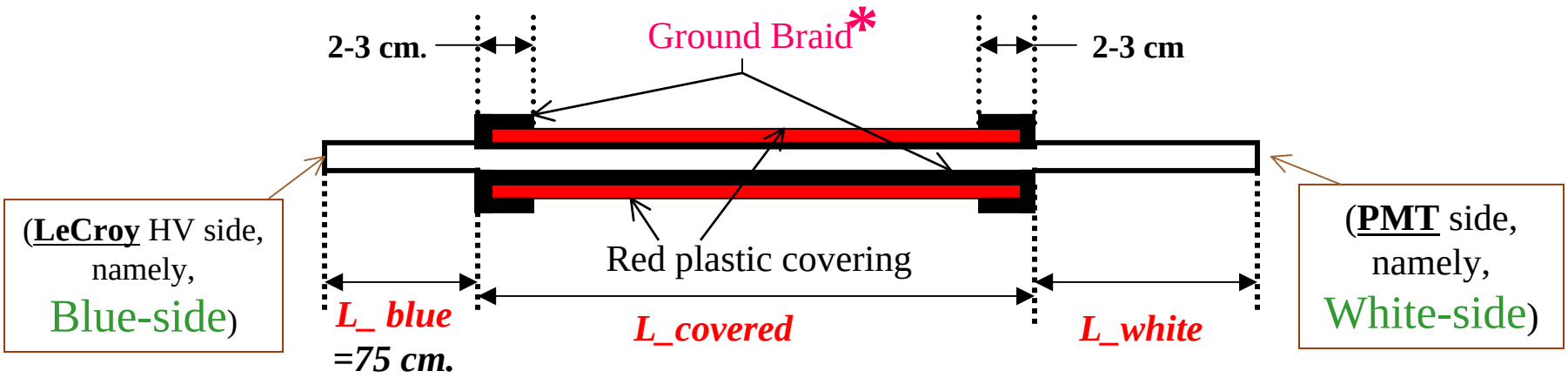
(i) Cut the Red cable with length for each RED#.
(ii) The lengths of the cables are shown in the below table.

| RED # | Total length L(total) (cm.) | FYI (Number of Blue connector) |
|---|---|---|
| 1 | 1034 | 3 |
| 2 | 987 | 3 |
| 3 | 965 | 3 |
| 4 | 918 | 3 |
| 5 | 896 | 3 |
| 6 | 849 | 1 |

**6 Read cables for HV, have different lengths.**

# Step 2 (a):

**(i) Remember the naming of 2 ends (*Blue-side*, and *White-side*) of Red cable.**
**(ii) Strip the red cable as shown in figure below (Do not see on the proportions).**




(1)
On the Blue-side's (namely LeCroy-side's) end of each cable,
red plastic covering and the ground braid have to be mounted as shown in the above figure.
The length of the LeCroy-side's jacket parts, ***L_blue***, is the same value = 75 cm for all 6 RED#..

(2)
On the White-side's (namely PMT-side's) end of each cable,
the same operation have to be done.
But the the length on this PMT-side's end, ***L_white***, is different for different RED#. .

(3)
The length of red-covered part of cable, ***L_covered***, is different for different RED#.

**(*) Note that the "Ground Braid" of red cable is different from the "Ground Strap" in the Blue connector's strain relief.**

# Step 2 (b):

(iii) Follow the below table for value of ***L_blue***, ***L_covered***, and ***L_white***.

| RED # | ***L_blue*** | ***L_covered*** | ***L_white*** |
|---|---|---|---|
| 1 | 75 cm. | 768 cm. | 191 cm. |
| 2 | 75 cm | 745 cm. | 167 cm. |
| 3 | 75 cm. | 699 cm. | 191 cm. |
| 4 | 75 cm. | 676 cm. | 167 cm |
| 5 | 75 cm | 630 cm. | 191 cm. |
| 6 | 75 cm. | 607 cm. | 167 cm. |

# Step 3

(o) Repeat the following 2 procedures, (i) and (ii), for each of 6 Red#'ed cable.
(i) Blue-side's end of the cable have to be divided on the the three parts, and then call them as "Blue# =1", "Blue# =2", and "Blue# =3"
(ii) Each Blue#'ed cable contains 12 wires which have to be place into the shrinking tube.

(ii-0)
Prepare 3 single core cables with about 75 cm length.
The 3 core cables can to be obtained as a "re-cycling" of cut-out cables during previous assembling.
And let's call them, Core#101, Core#103, and Core#105, respectively.

(ii-1)
Blue# = 1 contains 12 Core#'ed wires, namely,
Core# = 1, 2, 3, 4, 5, 6, 7, 8, 9,10, and
Core# = 31, and
Core# = 101.

(ii-2)
Blue# = 2 contains 12 Core#'ed wires, namely,
Core# = 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and
Core# = 33, and
Core# = 103.

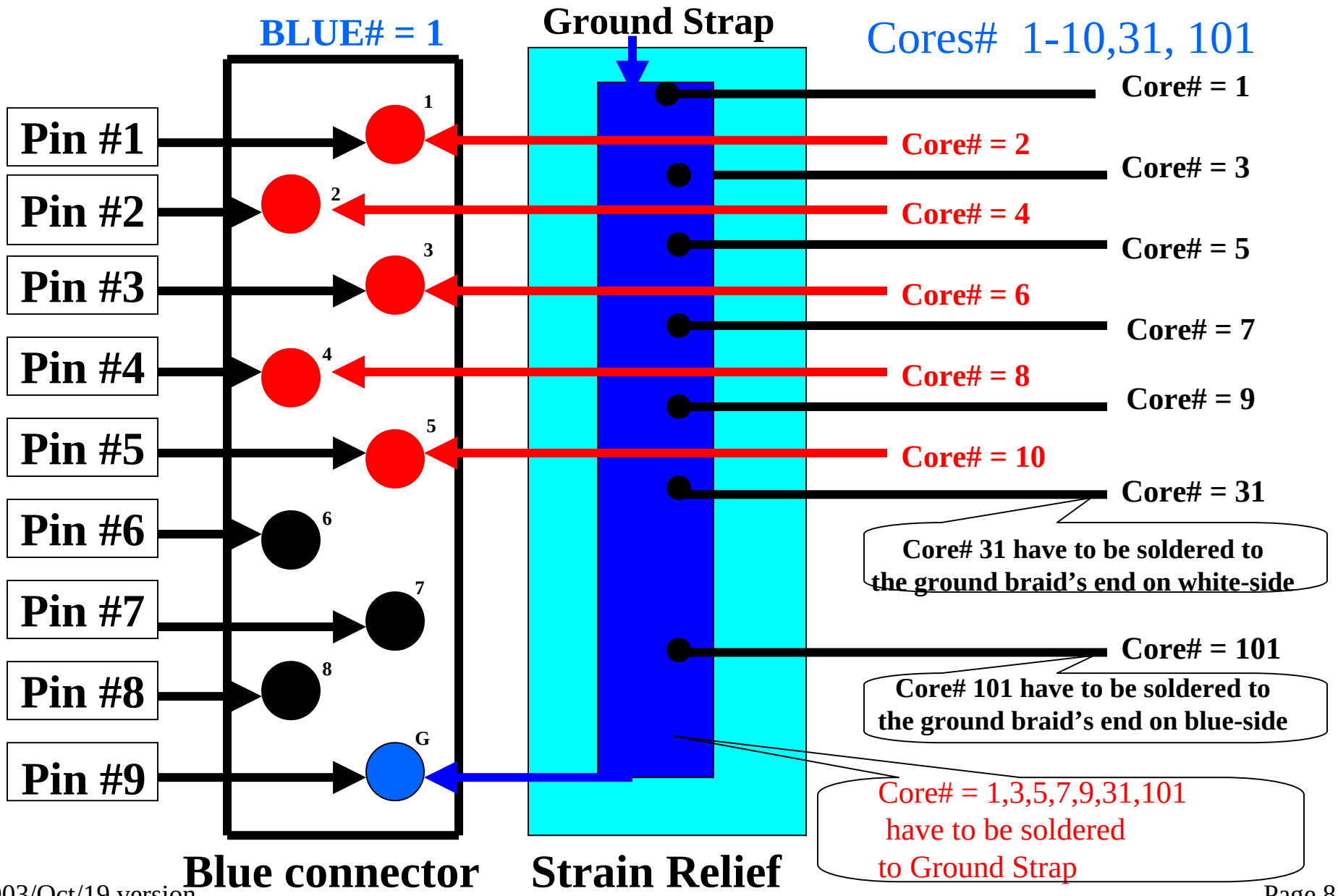
(iii-3)
Blue# = 3 contains 12 Core#'ed wires, namely,
Core# = 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, and
Core# = 35, and
Core# = 105.

# Step 4 (a):

(0) Each of Blue#'ed sets of Core#'ed cables have to be connected to the position plug *LKH 9*, which we call "Blue connector" with a "Strain Relief "

(i) For 12 Core#'ed cable in Blue# =1, follow the below figure.

1

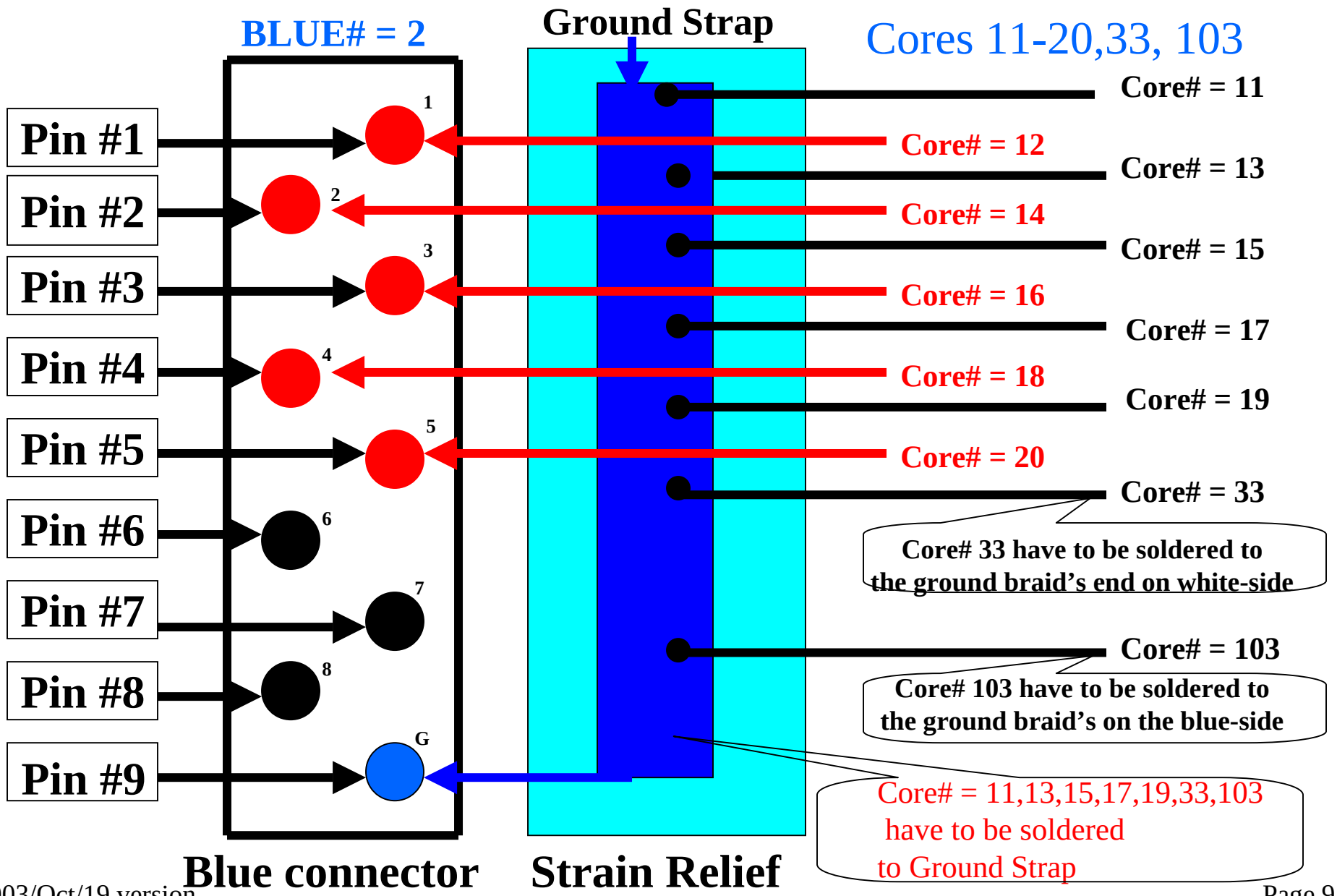


# Step 4 (b):

(0) Each of Blue#'ed sets of Core#'ed cables have to be connected to the position plug *LKH 9*, which we call "Blue connector" with a "Strain Relief "

(i) For 12 Core#'ed cable in Blue# =2, follow the below figure.

2

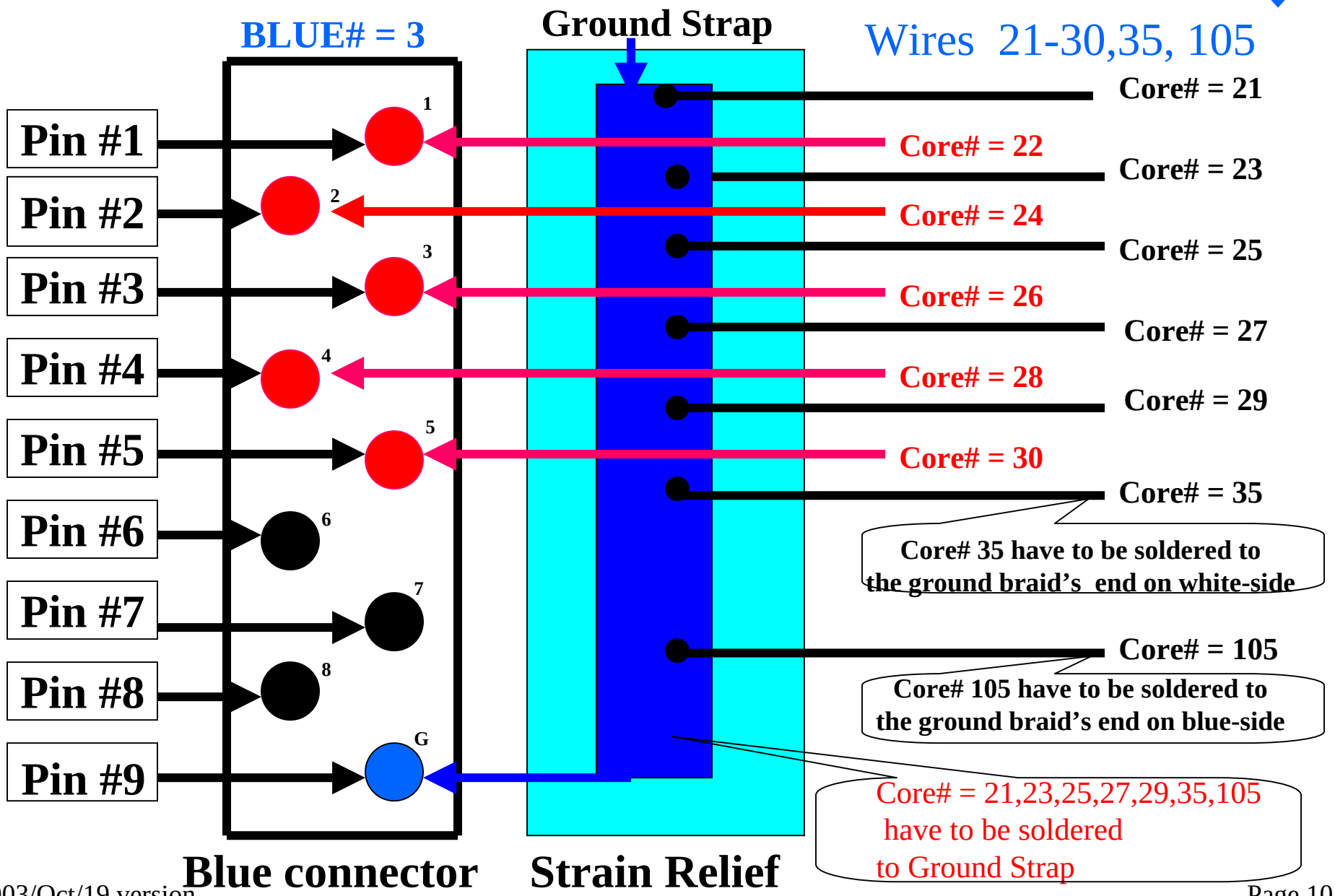


# Step 4 (c):

(0) Each of Blue#'ed sets of Core#'ed cables have to be connected to the position plug *LKH 9*, which we call "Blue connector" with a "Strain Relief "

(i) For 12 Core#'ed cable in Blue# =3, follow the below figure.

3

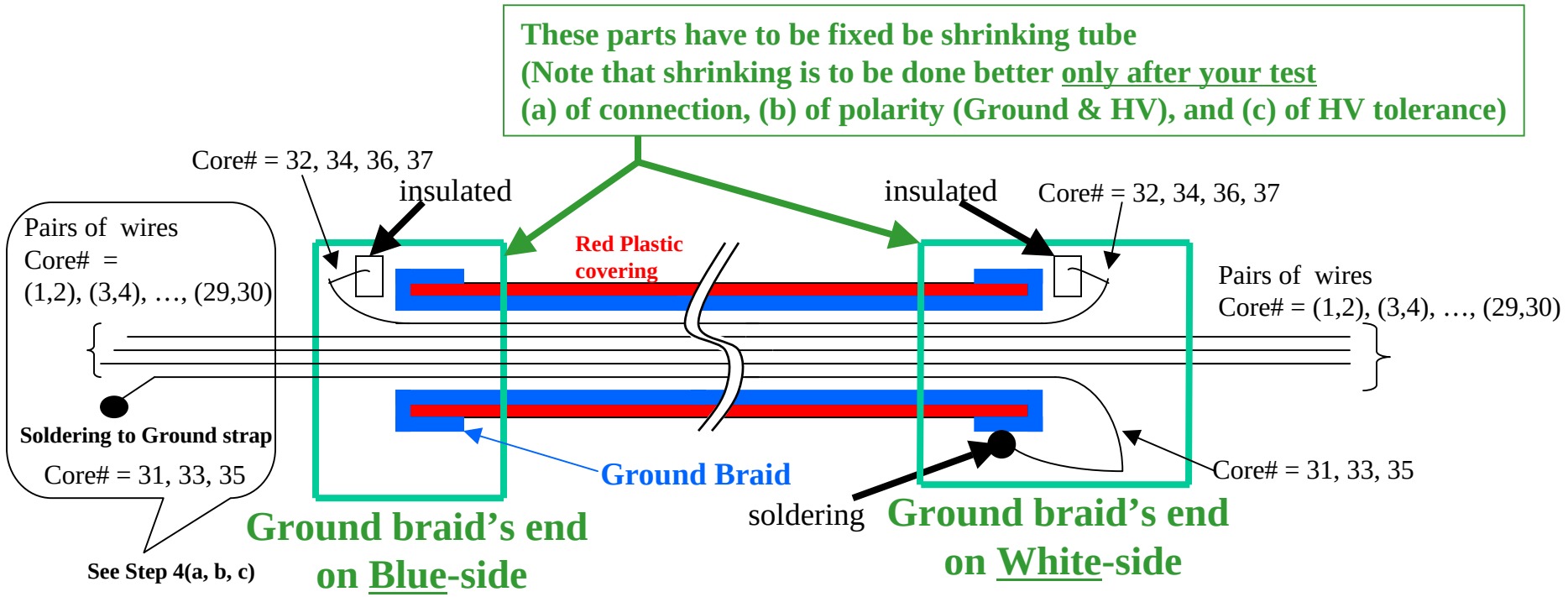


# Step 5 (a):

(o) Core# 31, 33, 35 have been soldered to Ground Braid 's end on the Blue-side in the previous Step 4(a,b,c).

(i) Cut the cores with Core# = 31,33,35 at reasonable-to-handle length, and solder them to the ground braid's end on the White-side.

(ii) At the both (namely, Blue-side and White-side) ends of Ground Braid, cut the cores with Core# = 32,34,36,37 at reasonable-to-handle length, and make them open and make them electrically-insulated.



# Step 5 (b):

(iii) White-side of the all 6 cables with RED# = 1, 2, 3, 4, 5, and 6
have to be divided into 15 sets per RED# (namely, each devided set has 2 Core#s).

(iv) Each of divided set has different length,
between a White connector and a Ground braid's end on White-side.
The length is shown in the below tables.

(v) Each of divided set has to be placed into a shrinking tube.

## RED# 1

| Connector | Box # | Core # | Length cm |
|---|---|---|---|
| Blue1 | 70 | 1,2 | 191 |
| | 69 | 3,4 | 179 |
| H (NW) | 68 | 5,6 | 167 |
| | 67 | 7,8 | 155 |
| | 66 | 9,10 | 143 |
| Blue2 | 65 | 11,12 | 131 |
| | 64 | 13,14 | 119 |
| G (NW) | 63 | 15,16 | 107 |
| | 62 | 17,18 | 95 |
| | 61 | 19,20 | 83 |
| Blue3 | 80 | 21,22 | 167 |
| | 79 | 23,24 | 155 |
| H (NE) | 78 | 25,26 | 143 |
| | 77 | 27,28 | 132 |
| | 76 | 29,30 | 119 |

## RED# 2

| Connector | Box # | Core # | Length cm |
|---|---|---|---|
| Blue1 | 75 | 1,2 | 131 |
| | 74 | 3,4 | 119 |
| G (NE) | 73 | 5,6 | 107 |
| | 72 | 7,8 | 95 |
| | 71 | 9,10 | 83 |
| Blue2 | 50 | 11,12 | 167 |
| | 49 | 13,14 | 155 |
| F (NW) | 48 | 15,16 | 143 |
| | 47 | 17,18 | 131 |
| | 46 | 19,20 | 119 |
| Blue3 | 45 | 21,22 | 107 |
| | 44 | 23,24 | 95 |
| E (NW) | 43 | 25,26 | 83 |
| | 42 | 27,28 | 71 |
| | 41 | 29,30 | 59 |

## RED# 3

| Connector | Box # | Core # | Length cm |
|---|---|---|---|
| Blue1 | 60 | 1,2 | 191 |
| | 59 | 3,4 | 179 |
| F (NE) | 58 | 5,6 | 167 |
| | 57 | 7,8 | 155 |
| | 56 | 9,10 | 143 |
| Blue2 | 55 | 11,12 | 131 |
| | 54 | 13,14 | 119 |
| E (NE) | 53 | 15,16 | 107 |
| | 52 | 17,18 | 95 |
| | 51 | 19,20 | 83 |
| Blue3 | 30 | 21,22 | 167 |
| | 29 | 23,24 | 155 |
| D (NW) | 28 | 25,26 | 143 |
| | 27 | 27,28 | 132 |
| | 26 | 29,30 | 119 |

## RED# 4

| Connector | Box # | Core # | Length cm |
|---|---|---|---|
| Blue1 | 25 | 1,2 | 131 |
| | 24 | 3,4 | 119 |
| C (NW) | 23 | 5,6 | 107 |
| | 22 | 7,8 | 95 |
| | 21 | 9,10 | 83 |
| Blue2 | 40 | 11,12 | 167 |
| | 39 | 13,14 | 155 |
| D (NE) | 38 | 15,16 | 143 |
| | 37 | 17,18 | 131 |
| | 36 | 19,20 | 119 |
| Blue3 | 35 | 21,22 | 107 |
| | 34 | 23,24 | 95 |
| C (NE) | 33 | 25,26 | 83 |
| | 32 | 27,28 | 71 |
| | 31 | 29,30 | 59 |

## RED# 5

| Connector | Box # | Core # | Length cm |
|---|---|---|---|
| Blue1 | 10 | 1,2 | 191 |
| | 9 | 3,4 | 179 |
| B (NW) | 8 | 5,6 | 167 |
| | 7 | 7,8 | 155 |
| | 6 | 9,10 | 143 |
| Blue2 | 5 | 11,12 | 131 |
| | 4 | 13,14 | 119 |
| A (NW) | 3 | 15,16 | 107 |
| | 2 | 17,18 | 95 |
| | 1 | 19,20 | 83 |
| Blue3 | 20 | 21,22 | 167 |
| | 19 | 23,24 | 155 |
| B (NE) | 18 | 25,26 | 143 |
| | 17 | 27,28 | 132 |
| | 16 | 29,30 | 119 |

## RED# 6

| Connector | Box # | Core # | Length cm |
|---|---|---|---|
| Blue1 | 15 | 1,2 | 131 |
| | 14 | 3,4 | 119 |
| A (NE) | 13 | 5,6 | 107 |
| | 12 | 7,8 | 95 |
| | 11 | 9,10 | 83 |
| - | - | 11,12 | 126 |
| | - | 13,14 | 126 |
| | - | 15,16 | 126 |
| | - | 17,18 | 126 |
| | - | 19,20 | 126 |
| - | - | 21,22 | 126 |
| | - | 23,24 | 126 |
| | - | 25,26 | 126 |
| | - | 27,28 | 126 |
| | - | 29,30 | 126 |

# Step 5 (c):

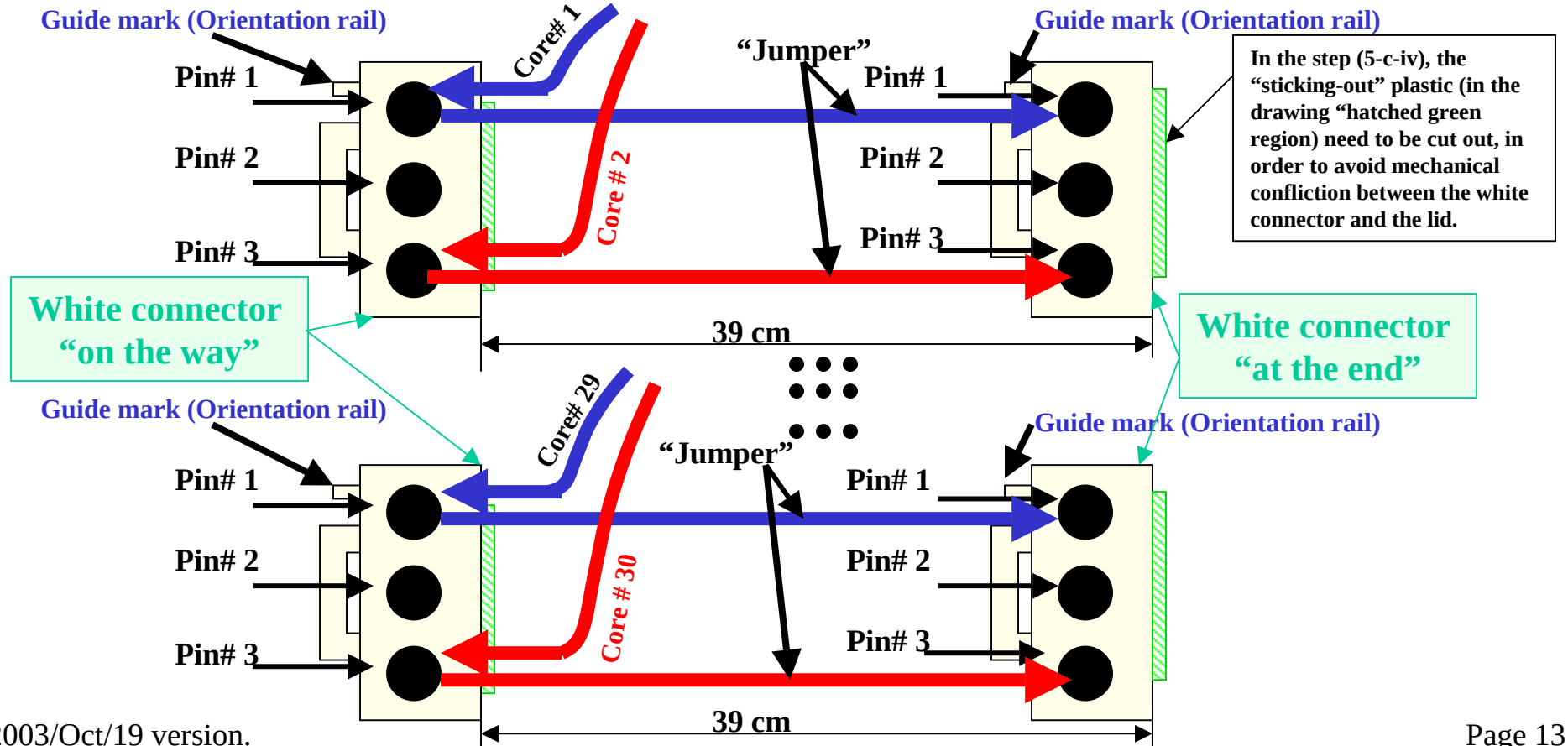
(i) For each of all 6 RED#, the 30 edges (on the White connector side) of Core# 1 ~30 have to be connected to White connectors.
Note that even Core# is for HV, and odd Core# is for returning ground. Use color labeling !

(ii) For each of 15 (per RED#) White connectors, make a "jumper cable".
Each jumper cable consist of 2 core lines (made from re-cycled core cables, which probably available during previous red cable assembling).

(iv) Put the heat-shrink tube for each of jumper cable. Note that shrinking is better after your test (a) of connection, (b) of polarity, and (c) of HV tolerance.

(iii) Put the jumper cable between (a) Core#-cable-connected white connector, and (b) another white connector.

(iv) Cut the "sticking-out plastic", which is on the opposite side of Guide mark (Oriental rail). If cut is not done, then the white connector cannot be inserted to the lid-side of connector, because of mechanical confliction between the "sticking-out plastic" and the Al-lid.



# Step 6 (a):

**(i) Make test measurements**

**(a) of connection,**

**(b) of polarity (Ground & HV)**

**→Best if you use color labels, e.g. a red label for HV),**

**(c) of HV tolerance**

**→FYI: 2.1kV_negative is max voltage which LeCroy 1491N can provide**

**(ii) Fill up the test results in the following standardized tables.**

# Step 6 (b):

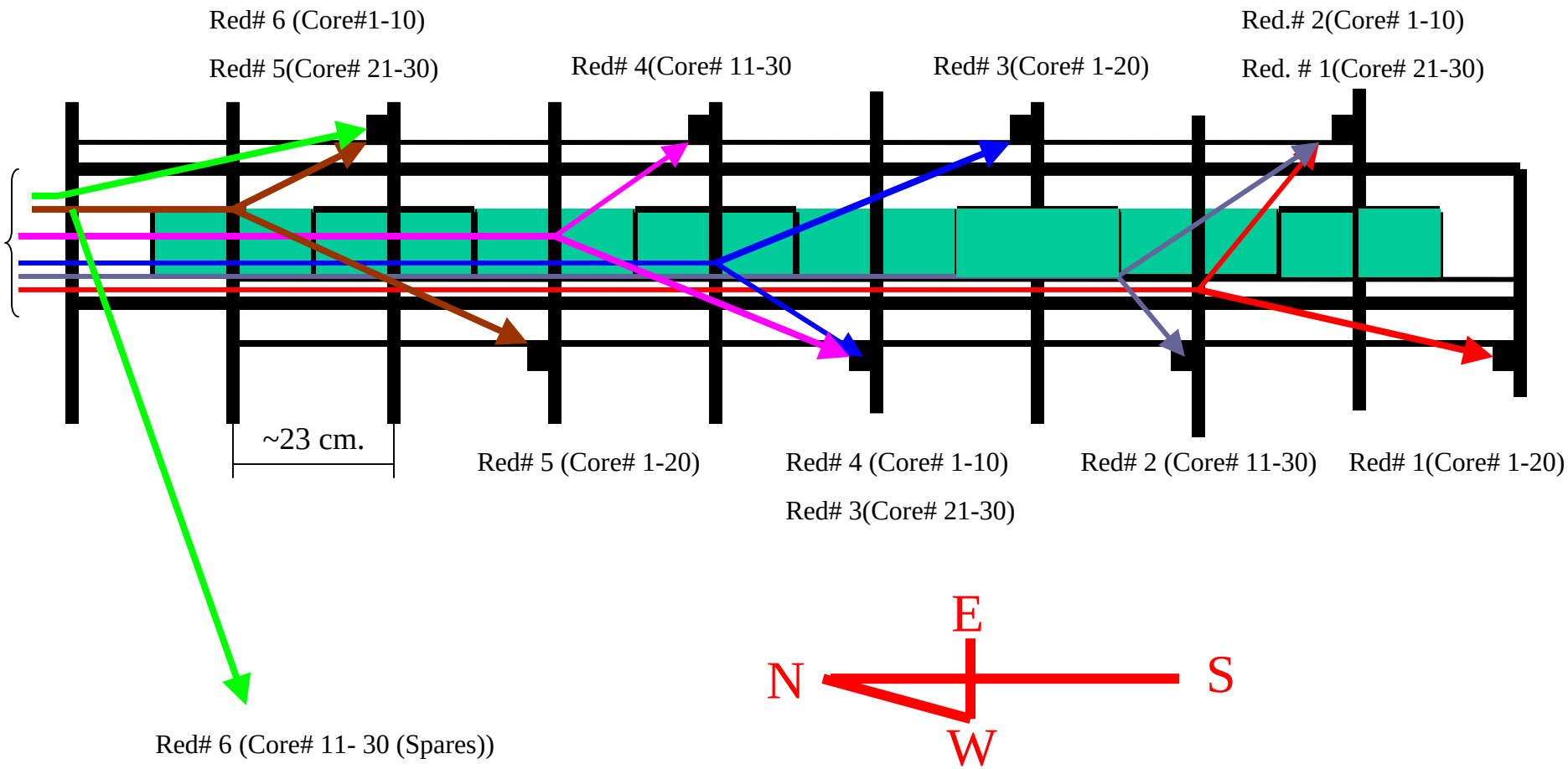
**Marking convention:**


**"O" for connection-tested,**
**"V" for polarity-tested, and**
**"+ " for HV(2.1kV negative)-tolerance-tested.**

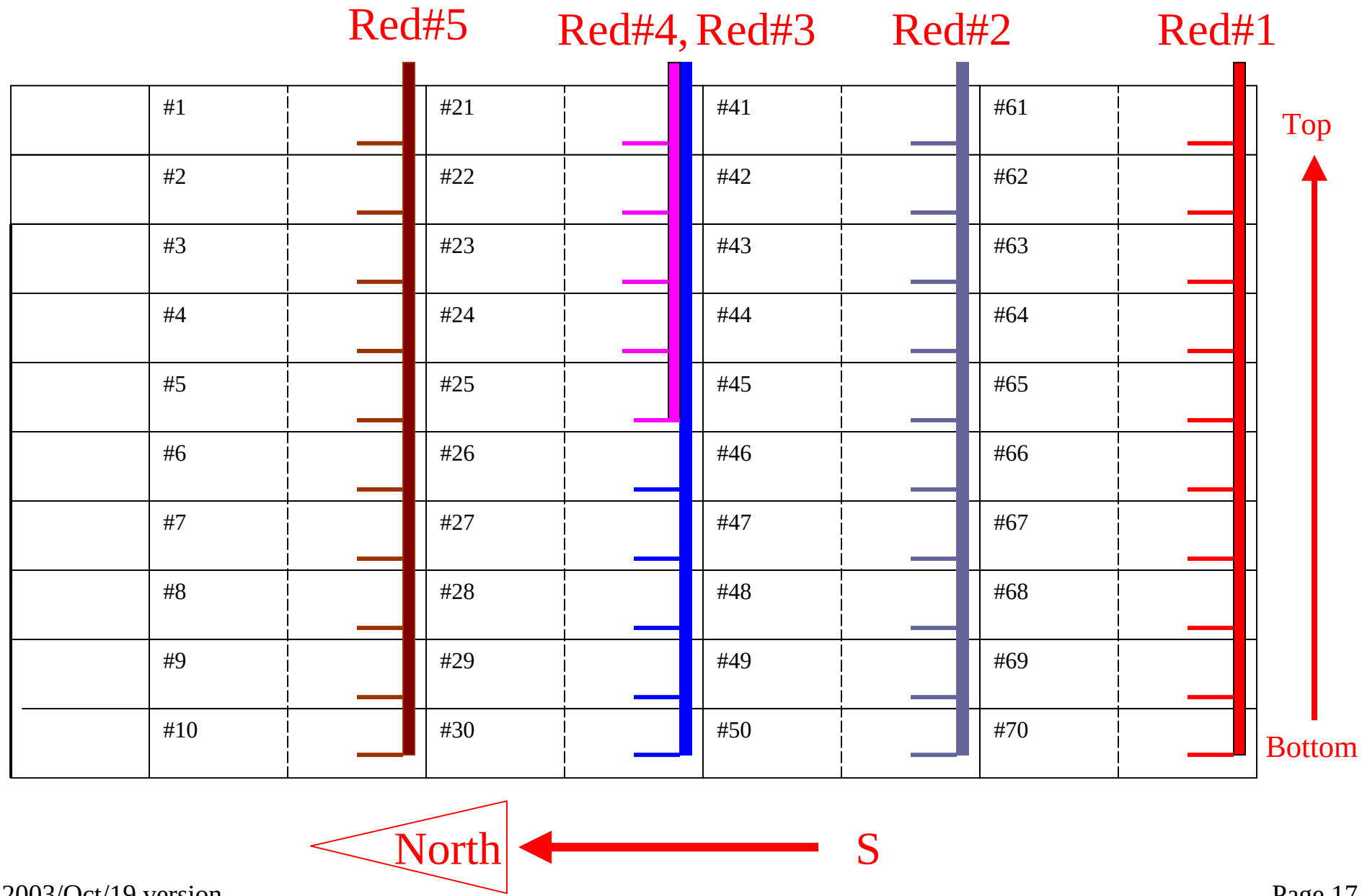
| Red# | Blue# | Pin#-in-Blue | White# *-on-the-way (non-jumper'ed)* | Pin# in on-the-way-of-white | White# *-at-the-end (jumper'ed)* | Pin# in at-the-end-of-white |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | | 2 | | 2 |
| | | 2 | | 4 | | 4 |
| | | 3 | | 6 | | 6 |
| | | 4 | | 8 | | 8 |
| | | 5 | | 10 | | 10 |
| | | Ground | | 1 | | 1 |
| | | | | 2 | | 2 |
| | | | | 3 | | 3 |
| | | | | 4 | | 4 |
| | | | | 5 | | 5 |
| | | | Ground Braid inside red cable | | | |

# Step 7 (a): FYI of HV cable layout

North sub-sector
Top view of HV cable on the boxes supporting frame



# Step 7(b): West-side view on the HV cables



# Step 7(c): East-side view on the HV cables