



LAMPS meeting

Sanghoon Hwang

2019.7.2

Design of BDC at SAMURA

Table 3
BDC Parameters.

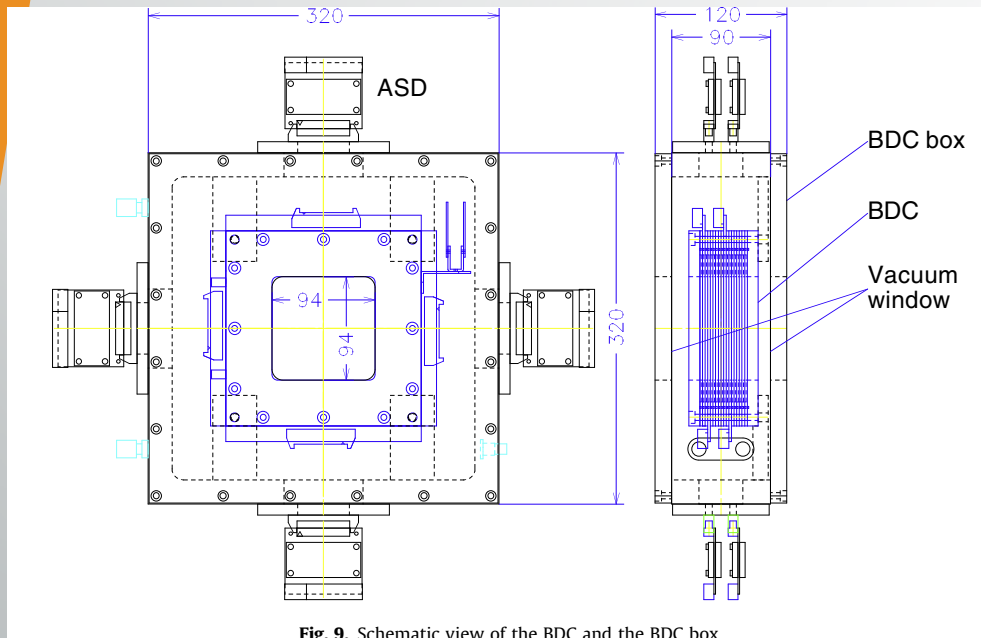
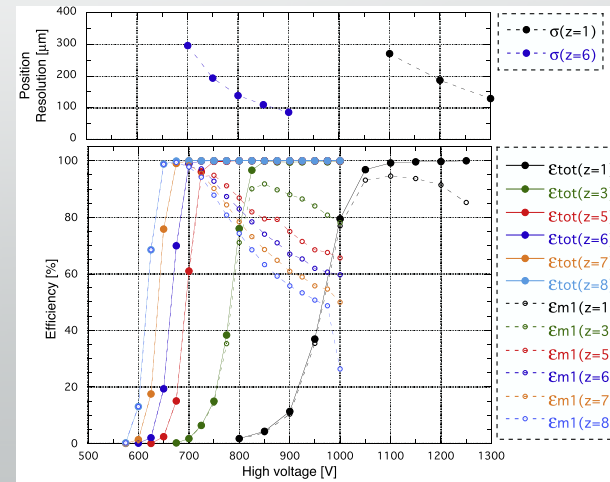


Fig. 9. Schematic view of the BDC and the BDC box.

Drift length, half gap	2.5 mm, 2.5 mm
Anode, potential wire	$\phi 20$ mm Au-W/Re, $80 \mu\text{m}$ ϕ Au-Al
Cathode (gas window)	$8 \mu\text{m}^t$ Al-Kapton $\times 9$ (2)
Configuration	$xx'yy'xx'yy'$ (8 planes)
Effective area	$8 \text{ cm} \times 8 \text{ cm}$
Readout	128 ch/chamber
Operating gas	$i\text{-C}_4\text{H}_{10}$ at 100 (50) torr
Vacuum window	80 (16) μm^t Kapton $\times 2$
Thickness	$L/L_r = 0.9 \times 10^{-3}$



Resolution $\sim 150 \mu\text{m}$
Operation voltage $> 700 \text{ V}$

Conceptual design of BDC

Beam pipe : ϕ 10 cm or ϕ 15 cm

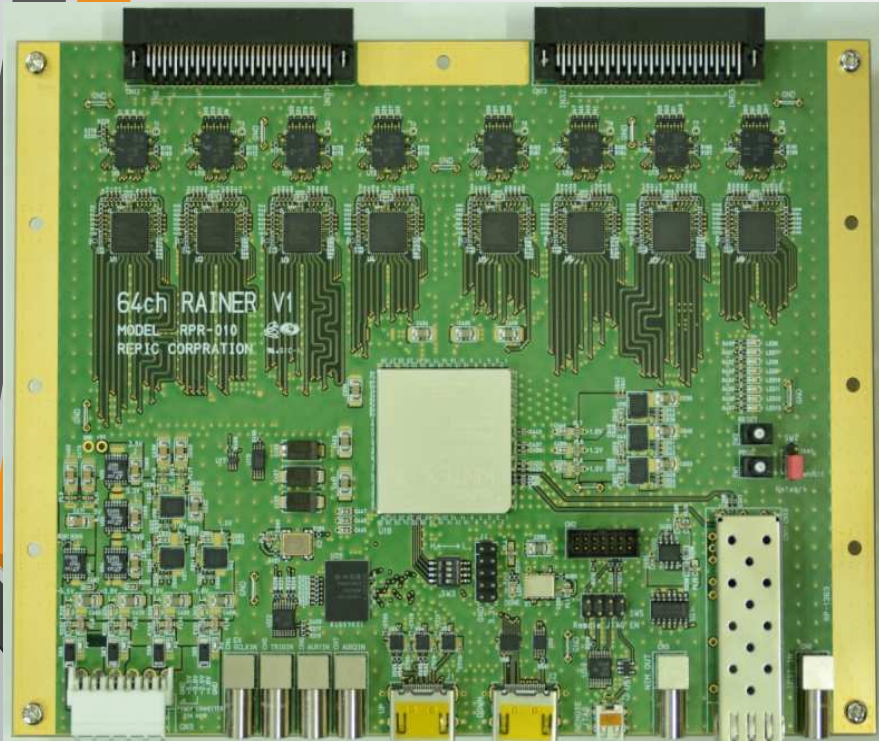
Beam size : Unknown !!!

Beam intensity : Unknown !!!

Only we knew the beam size of the SAMURA !!!

→ Assumed similar wire configuration as SAMURA

Modules



Specifications

- Signal input **64CH**
- Analog processing circuit **Amp-Shaper-Discriminator (ASD)**
- A/D Converter **AD9212 (10bit) Sampling frequency 31.25MHz**
- FPGA **XC7K325T (Xilinx)**
- TDC function **Build in FPGA / Resolution 1ns**
- FPGA Configuration option **BPI Flash memory / JTAG / Remote JTAG**
- CLOCK **40MHz LVCMOS (1) 125MHz LVDS (1)**
- Gb Ethernet **UTP (1000BASE-TX) or Optical (1000BASE-X)**
- GTX Transceiver **SFP connector**
- I/O **NIM input (3) NIM output (3) ASD test input (1) HDMI-A (2)**
- Switch **User DIP (4) SiTCP Network (1) FPGA Configuration (1) JTAG Local/Remote (1)**
- Power **5.5V (0.4A) 3.8V (0.6A) 2V (2.7A) 1.8V (1.8A)**

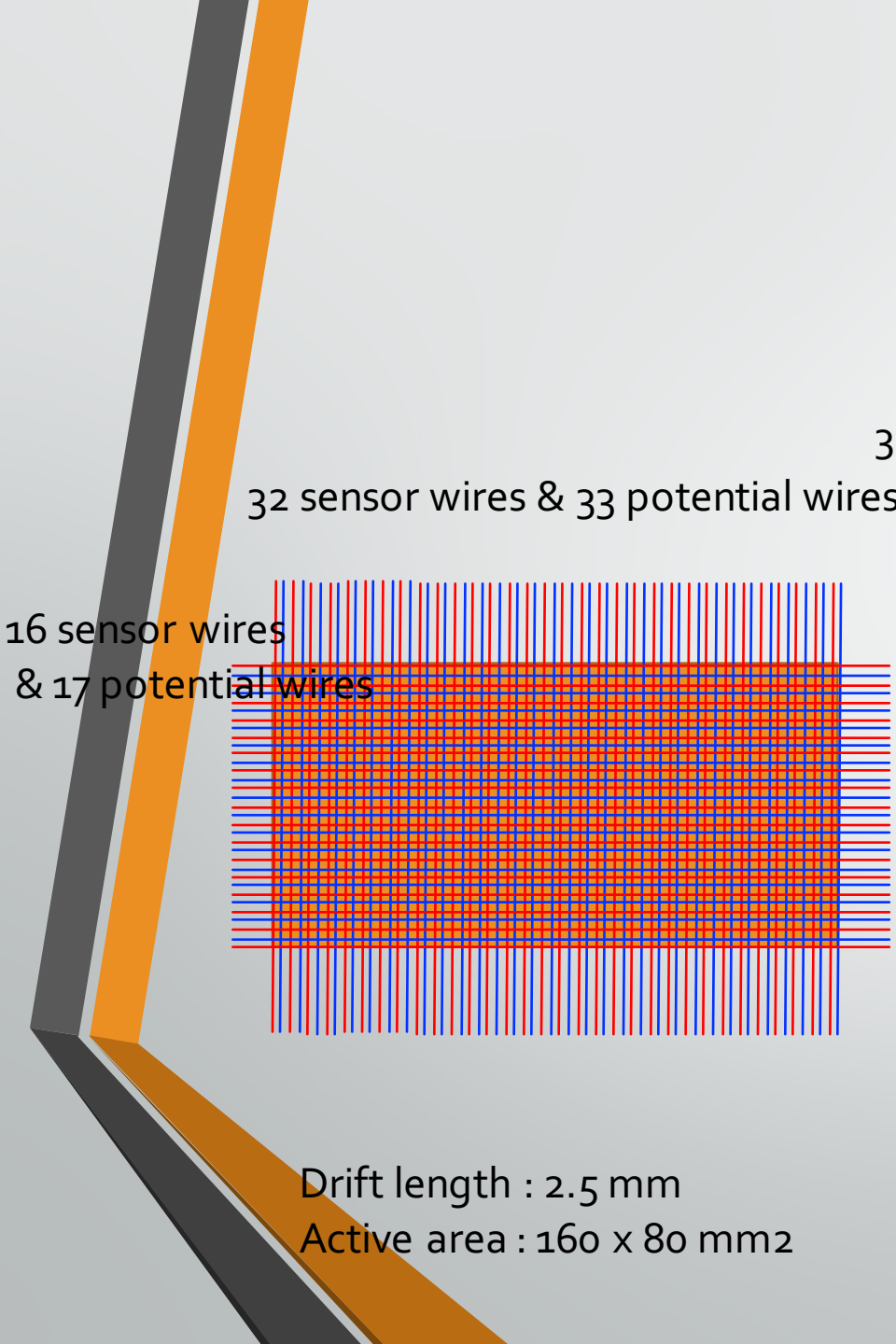
Design of BDC

- Drift length : 2.5 mm
- Configuration: $xx'yy'xx'yy'$
- Anode wire : 20 μm
- Potential wire : 80 μm
- # of CH of x/x' plane : 32 ch
- # of CH of y/y' plane : 16 ch
- Active area : 160 x 80 mm^2
- # of ASD module : **3 ASD**

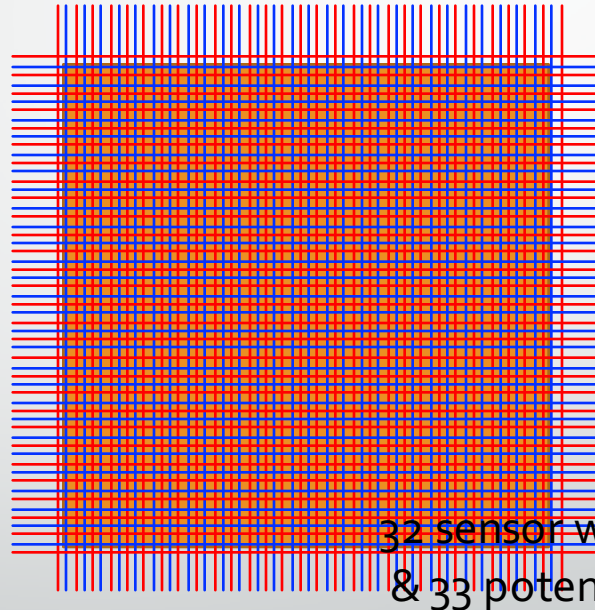
- Drift length : 2.0 mm
- Configuration: $xx'yy'xx'yy'$
- Anode wire : 20 μm
- Potential wire : 80 μm
- # of CH of x/x' plane : 32 ch
- # of CH of y/y' plane : 32 ch
- Active area : 128 x 128 mm^2
- # of ASD module : **4 ASD**

- Drift length : 2.0 mm
- Configuration: $xx'uu'vv'xx'$
- Anode wire : 20 μm
- Potential wire : 80 μm
- # of CH of x/x' plane : 32 ch
- # of CH of u/u' plane : 48 ch
- # of CH of v/v' plane : 48 ch
- # of ASD module : **5 ASD**

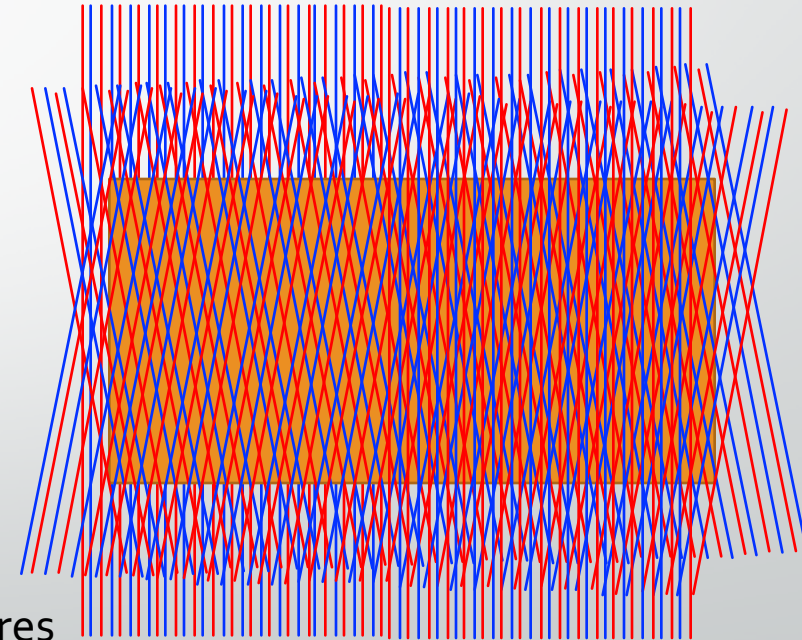
Design of BDC



32 sensor wires & 33 potential wires



xx'uu'vv' configuration



Active area with design 3

Wire spacing : 2 mm

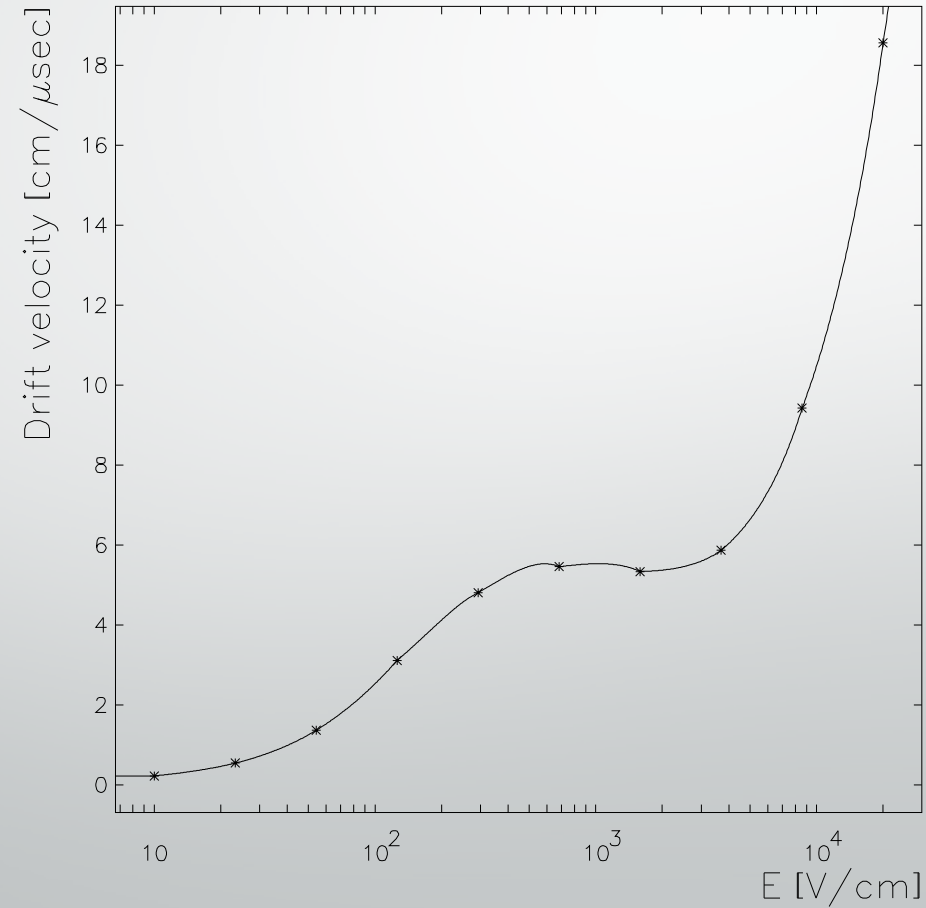
U,V angle (deg)	Active area (Y)	Wire # (X-plane)	Wire # (V,U planes)	Active area (X)
15	36	44	144	120
	36	44	144	130
	36	44	144	140
20	36	44	144	120
	35	45	140	130
	35	45	140	140
30	34	46	136	120
	34	46	136	130
	33	47	132	140

Drift velocity

- I-CH₄, 100 Torr

Drift velocity vs E

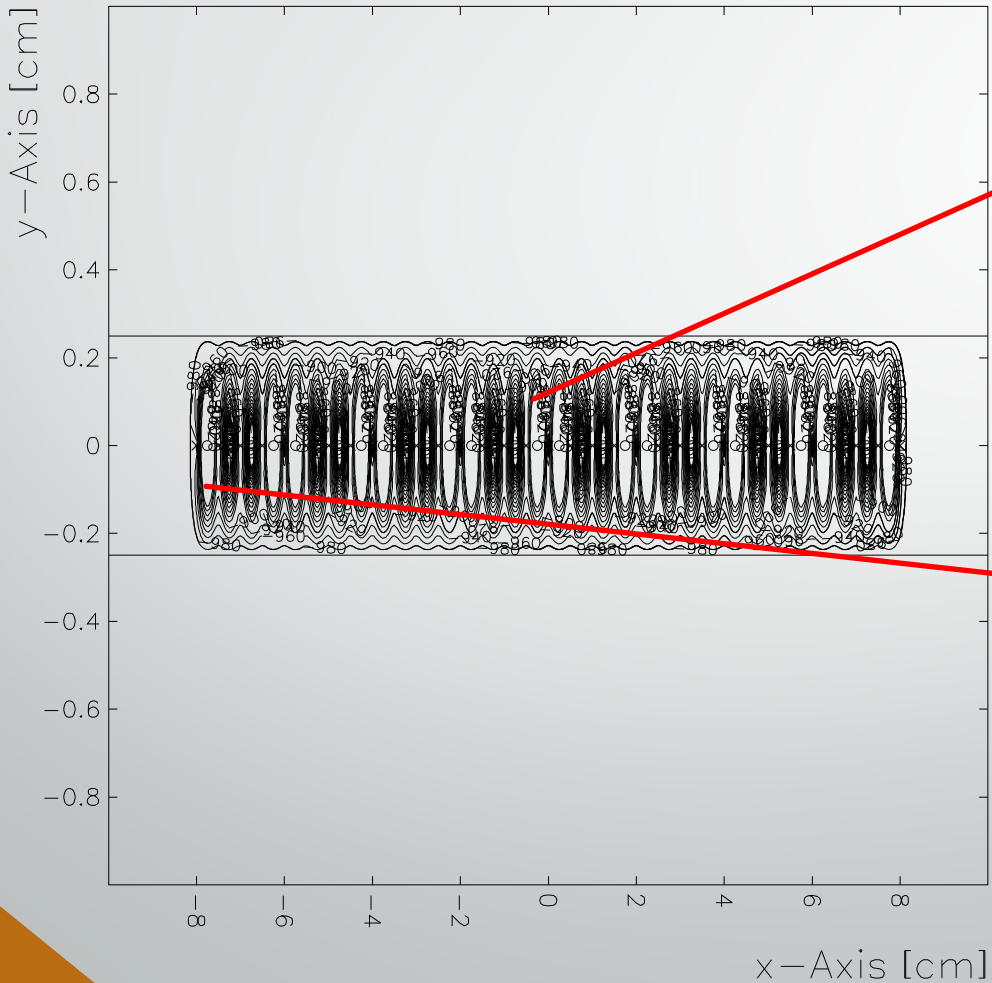
Gas: iC₄H₁₀ 100%, T=300 K, p=0.13158 atm



Plotted at 05:15:38 on 13/06/19 with Garfield version 7.44.

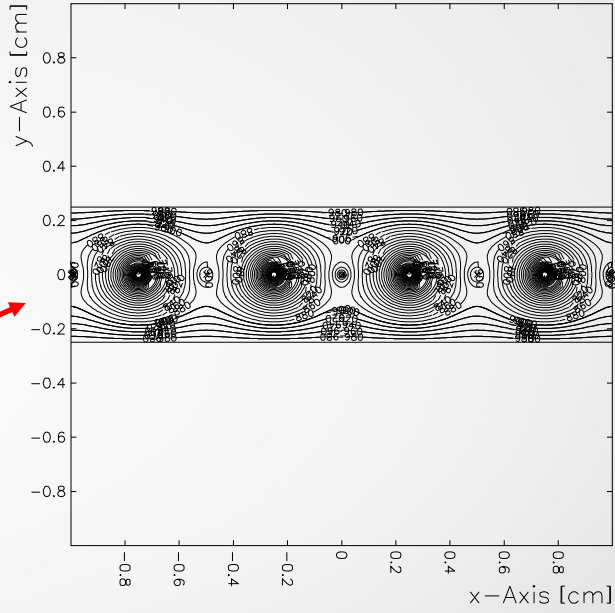
Electric field

Contours of V



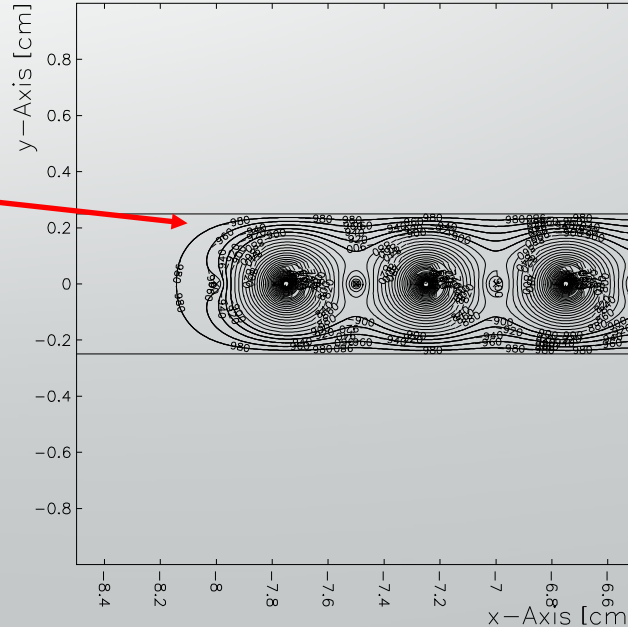
Plotted at 05:30:53 on 13/06/19 with Garfield version 7.44.

Contours of V



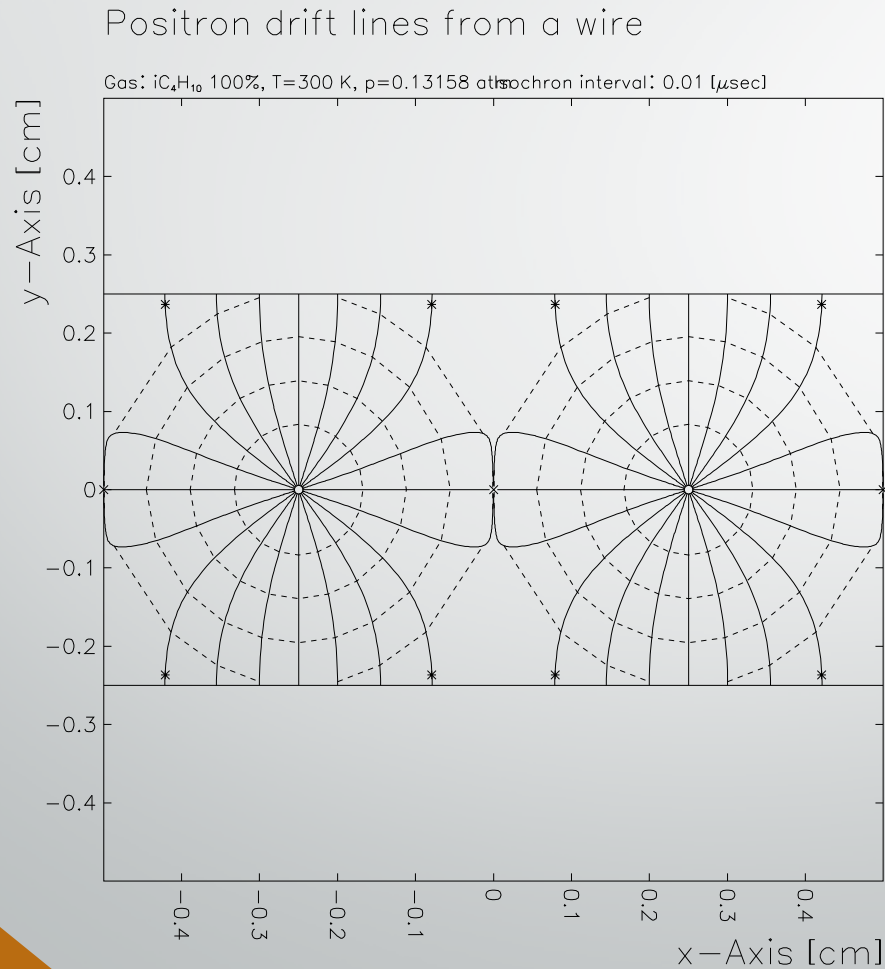
Plotted at 05:30:55 on 13/06/19 with Garfield version 7.44.

Contours of V



Plotted at 05:30:57 on 13/06/19 with Garfield version 7.44.

Drift line



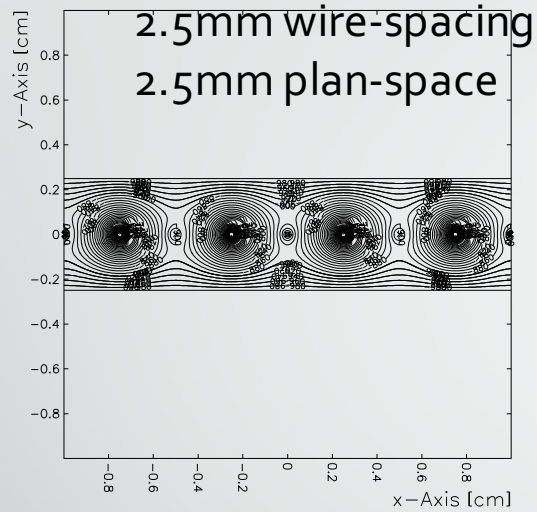
The wire spacing and the active area are same distance

→ Circle shape of electric field

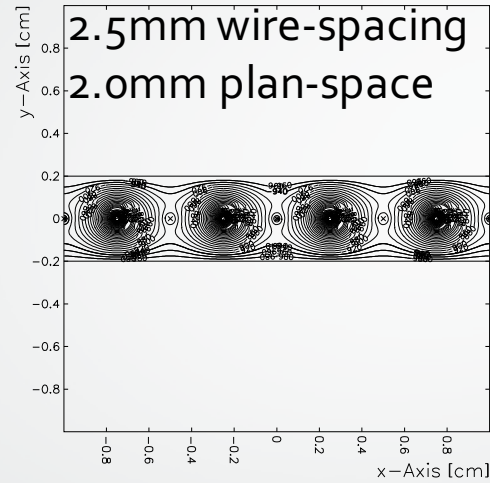
Drift time : ~ 40 ns (1000V)

Garfield sim

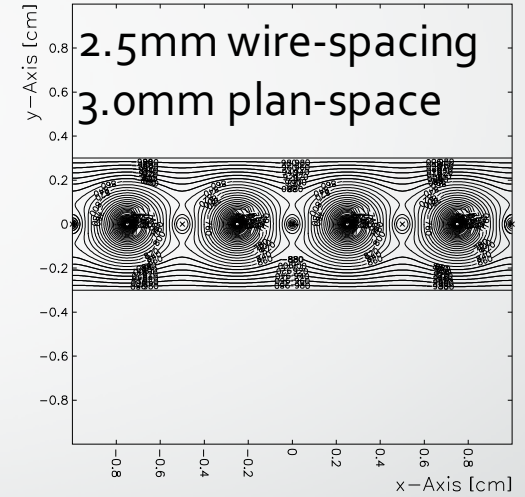
Contours of V



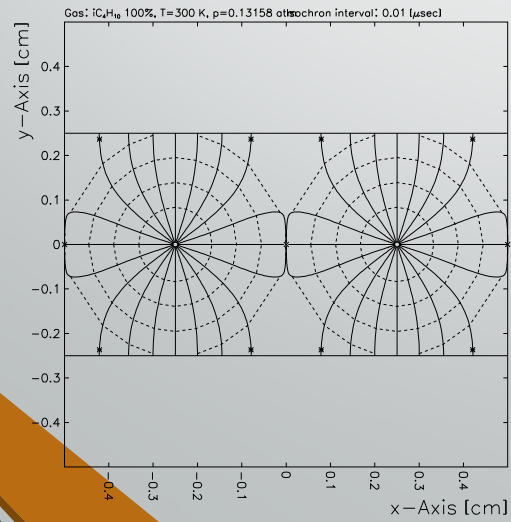
Contours of V



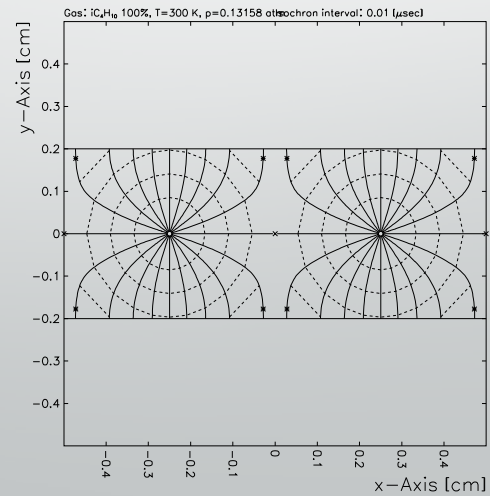
Contours of V



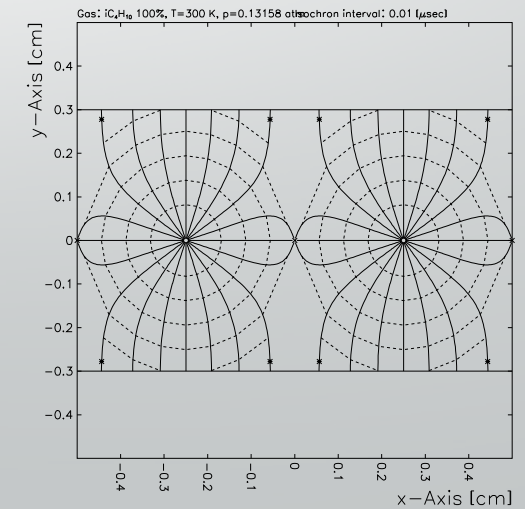
Positron drift lines from a wire



Positron drift lines from a wire



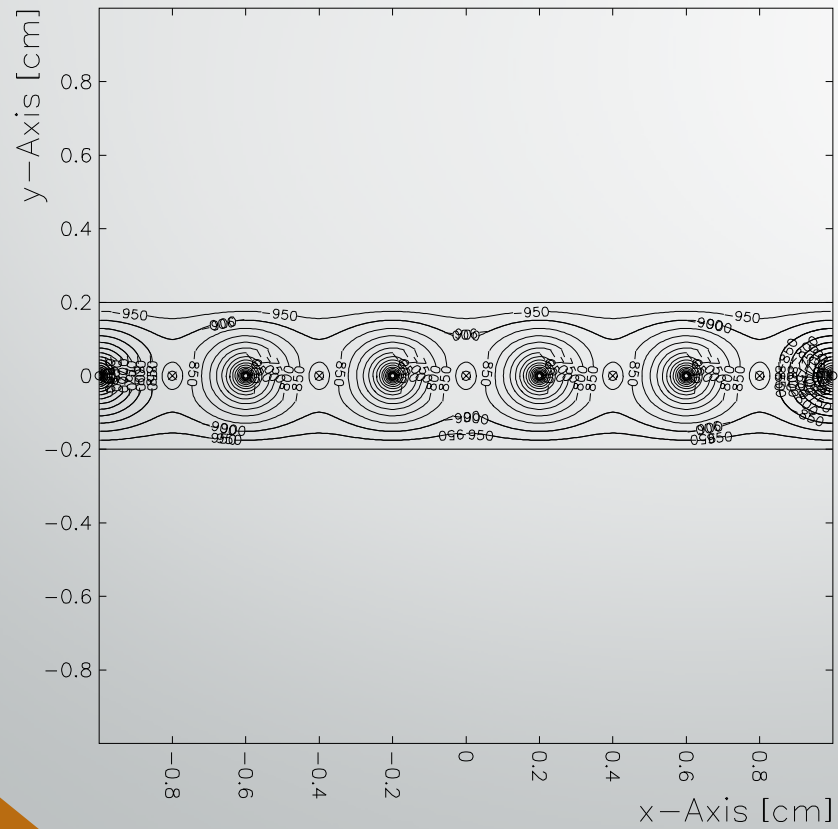
Positron drift lines from a wire



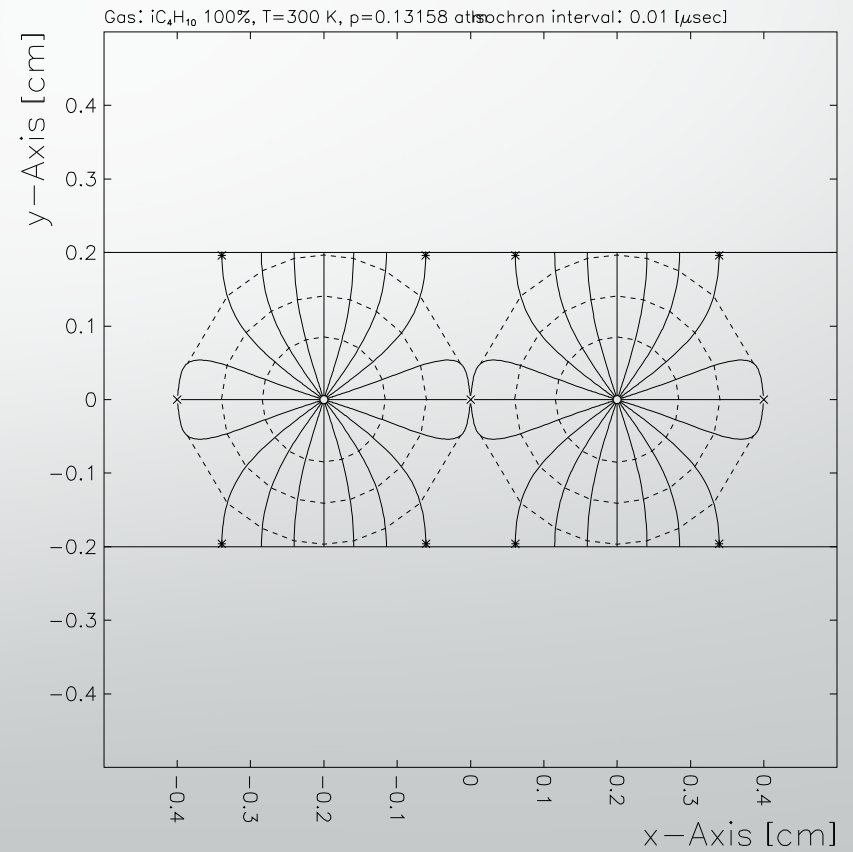
Garfield sim

2.0mm wire-spacing
2.0mm plan-space

Contours of V



Positron drift lines from a wire



Mylar

 **EJ-590/B10** distributed by 
aluminized polyester film

Low pinhole rate aluminized polyester film for Scintillators
made by double side aluminized polyester film for radiation detector

This EJ-590/B10 is an extremely thin polyester film evaporated on both sides with aluminum metal. The film is specifically fabricated for use in alpha and beta particle radiation detectors as a light-tight radiation window. It's extreme thinness precludes the absence of pinholes, and a light-tight radiation window is usually constructed with two closely laid layers of the film thus achieving light tightness by virtue of the mis-alignment of the pinholes.

The film is supplied on rolls with a maximum width of 323mm (12 · 3/4 inch) and maximum length of 7,620mm (25 feet). It should be handled in a clean environment with care to avoid wrinkling and abrasion.

It may be cemented to support frames by using a variety of commercial adhesives including acrylics, silicones and epoxies. It may be cleaned by rinsing with methanol or isopropyl alcohol or by gentle wiping with clean cotton soaked in alcohol.

This EJ-590/B10 also can be used as the reflector sheet for scintillators.

Specifications	
Thickness	2.0µm (8.0 x10 ⁻⁵ inch)
Density	0.29mg / cm ²
aluminized layer thickness	1,000 angstroms per side

Transparency by alpha and beta particles	
2 layers will stop approximately 1 MeV of energy from an alpha particle	
2 layers will stop approximately 20 keV of energy from a beta particle	

Standard form	
320mm wide x 5,800mm long roll	
320mm wide x 7,500mm long roll	
Available in custom roll width up to 750mm	

 **G-tech, Corp.** local representative in Japan
365-1, Sayamagahara, Iruma-shi, Saitama 358-0032
Phone# 04-2935-2777 Fax# 04-2935-2778

| [ELJEN top](#) | [ELJEN products](#) | [G-tech index](#) | 



- EJ-590/B10 is discontinued
- G-tech (JAP)
- Type : B(11)
- thickness : 2.540 micron
- film base :Polyester

- 12 um Aluminized Mylar @ KRISS

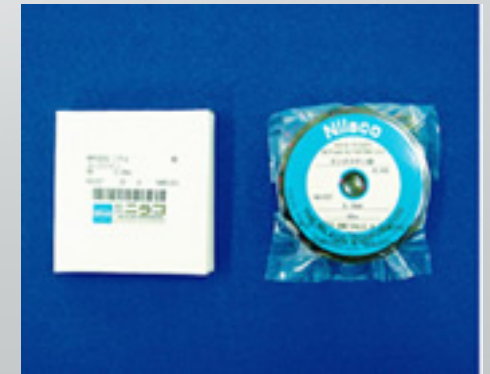
Wire

- SAMURA
 - 20 um Au-coated W/Re
 - 80 um Au-Al



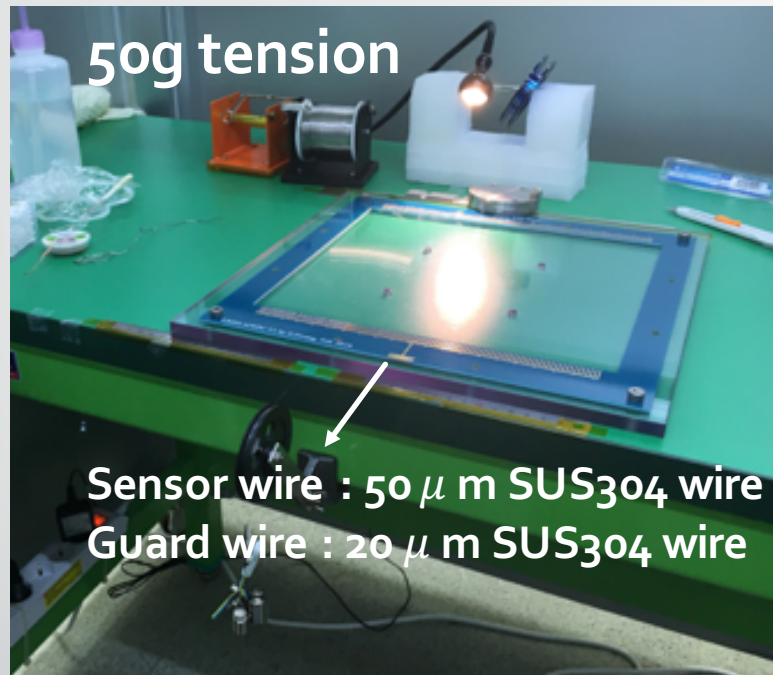
Gold Plated Tungsten-Rhenium Wire

Diameter	Microns	17.8	25.4	31.7	38.1	50.8	76.2
	Mils	0.7	1.0	1.25	1.5	2.0	3.0
ALW-29S (hard)							
Elongation (%)		1 – 4	1 – 4	1 – 4	1 – 4	1 – 4	1 – 4
Breaking Load (g)		7.5 – 8.0	17.0 – 19.0	24.0 – 27.0	35.0 – 38.0	55.0 – 65.0	120.0 – 140.0
ALW-29S (medium)							
Elongation (%)		1 – 4	1 – 4	1 – 4	1 – 4	1 – 4	1 – 4
Breaking Load (g)		7.0 – 7.5	15.0 – 17.0	21.0 – 24.0	30.0 – 34.0	45.0 – 55.0	110.0 – 120.0
ALW-29S (soft)							
Elongation (%)		1 – 4	1 – 4	1 – 4	1 – 4	1 – 4	1 – 4
Breaking Load (g)		6.0 – 7.0	13.0 – 15.0	19.0 – 21.0	25.0 – 30.0	39.0 – 45.0	100.0 – 110.0
Fusing Current (Amp)		0.3	0.5	0.7	1.0	1.4	1.8

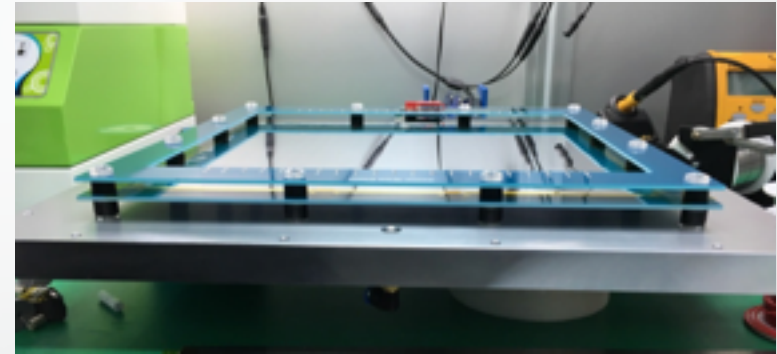


Gold coated Tungsten Wire

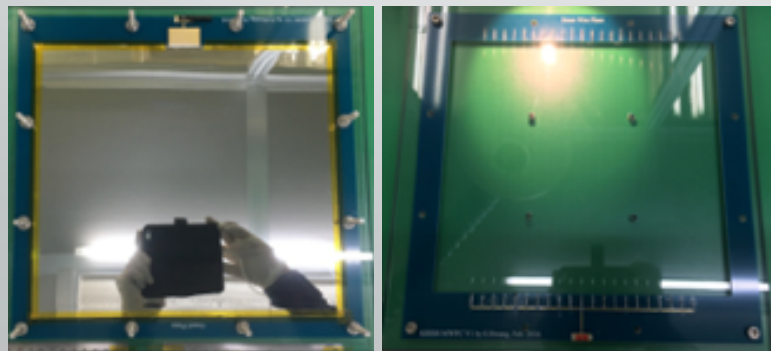
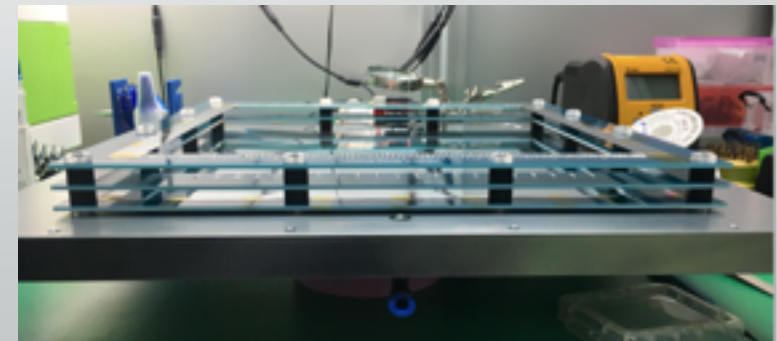
Soldering bench@KRISS



< Cathode & Sensor ($50\ \mu\text{m}$) >



< Cathode & Sensor ($50\ \mu\text{m}$) & Guard ($20\ \mu\text{m}$) >



Schedule of wiring and requirements

- **Schedule**

- Design of PCB board : 1 week
- Fabrication of PCB board : 1 week
- Wiring : 1 plane / 0.5 day * 8 planes → about 1 week
- Cathode plane : 1 week

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- **Requirements**

- Beam size !!!
- Beam size !!!
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