

# Beamline chamber design for J-PARC E15 / E17

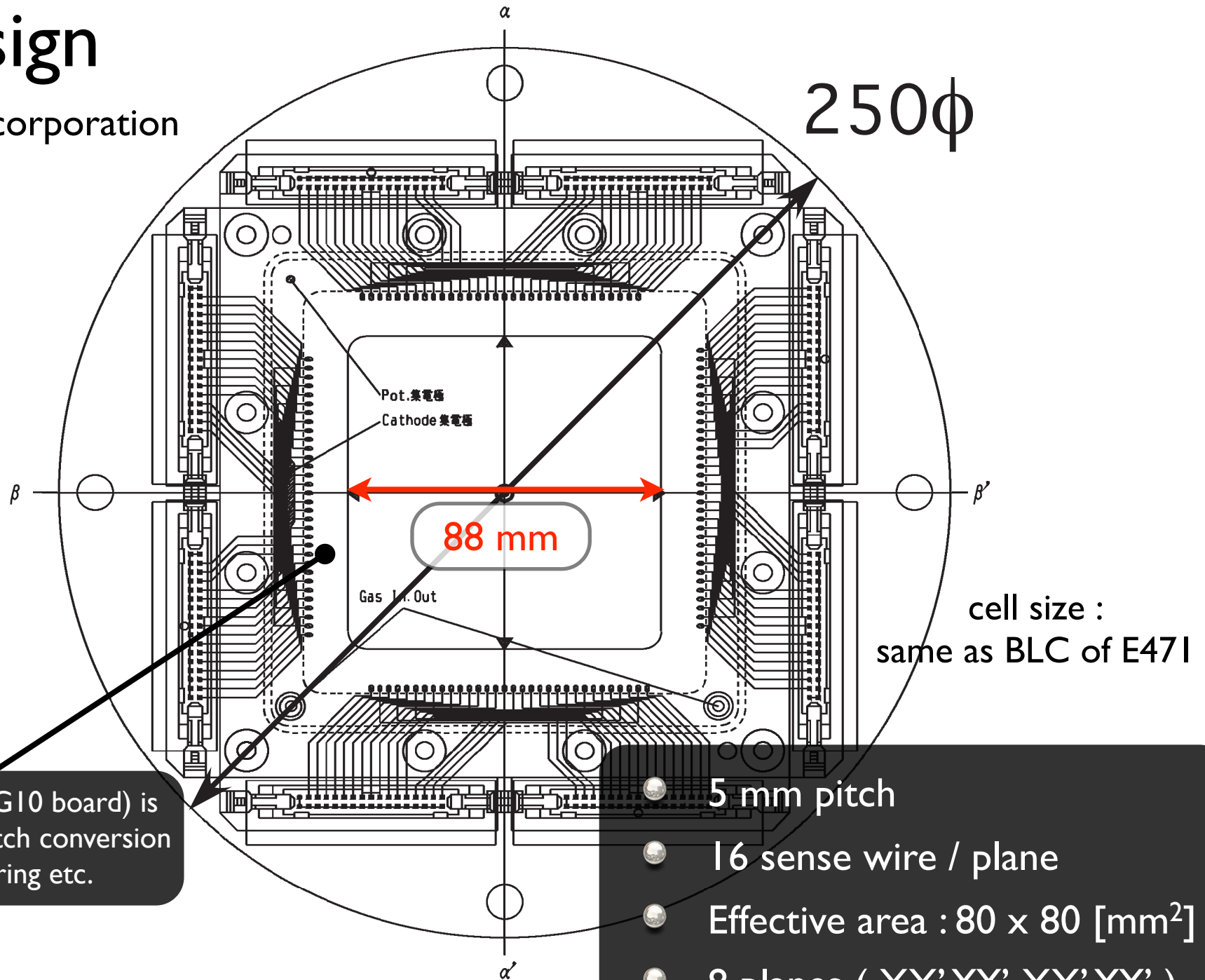
Aug 20, 2007 S.Okada

# Requirements

	E17	CDC Calibration w/ stopped K- reaction	E15
Reaction	stopped K-		in-flight K-
Magnetic field	OFF	ON	
Size	<p style="text-align: center;"><b>within 250 mm<math>\Phi</math></b>            (end cap hole=300m<math>\Phi</math>, space for cables=250~300m<math>\Phi</math>)</p>		No restriction (if the chamber will be installed outside of CDC)
Magnetic field	No restriction	<p style="text-align: center;"><b>operable with magnetic field (0.7 T@max)</b></p>	

# Design

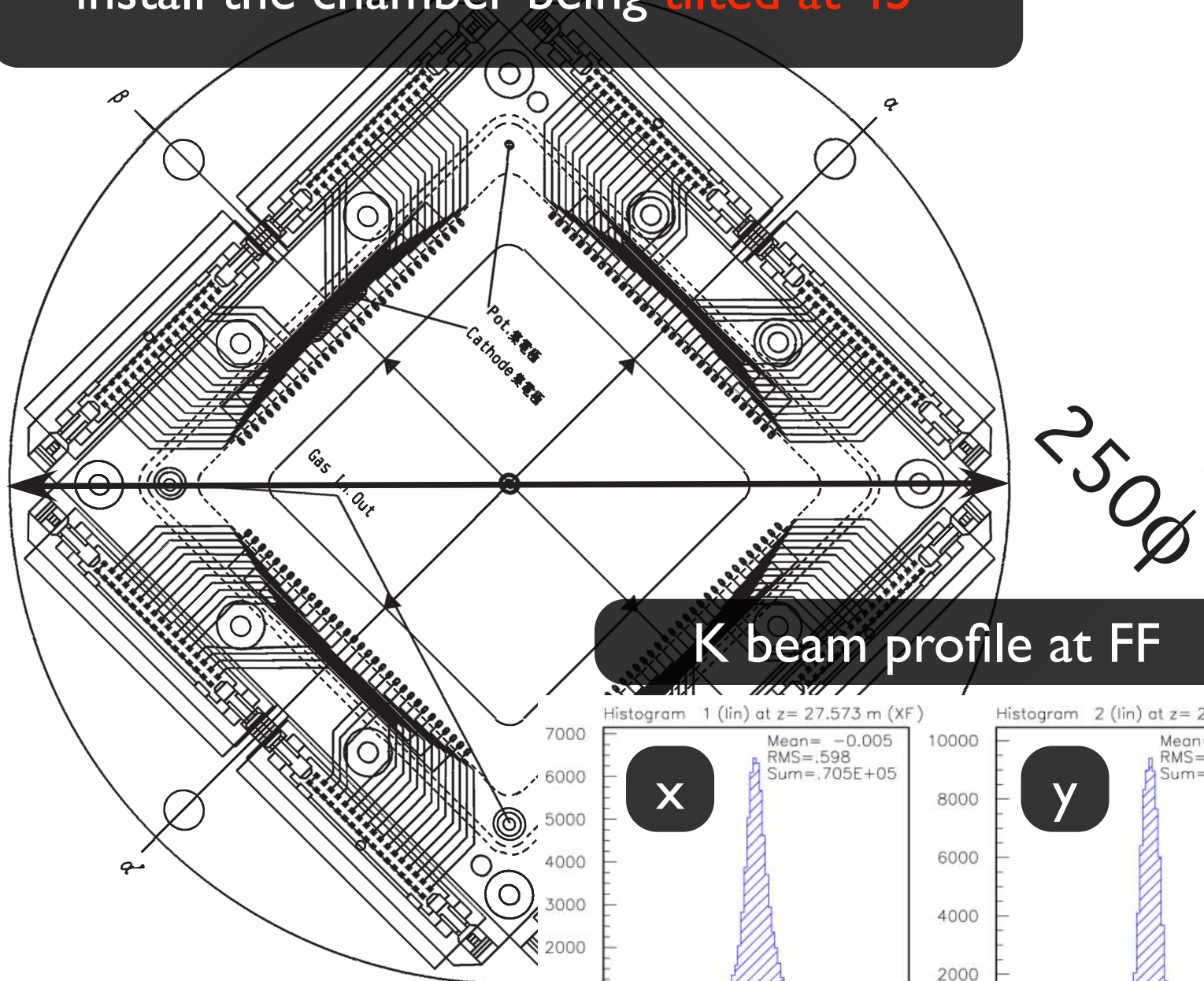
Technoland corporation



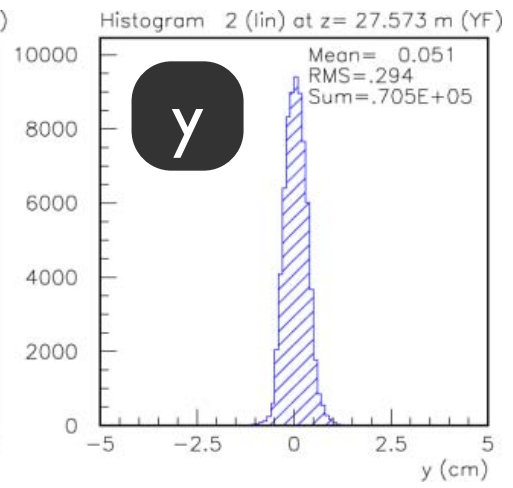
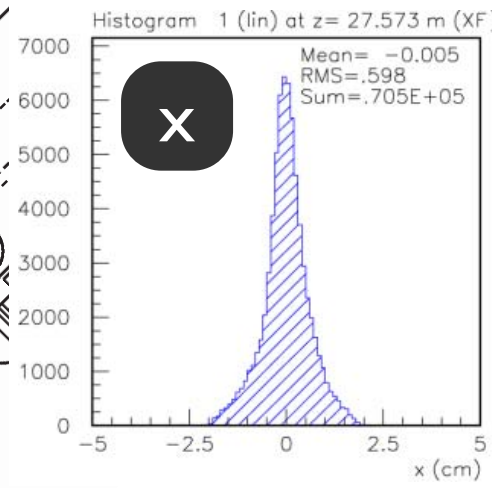
~ 40mm space (G10 board) is needed for the pitch conversion and the O-ring etc.

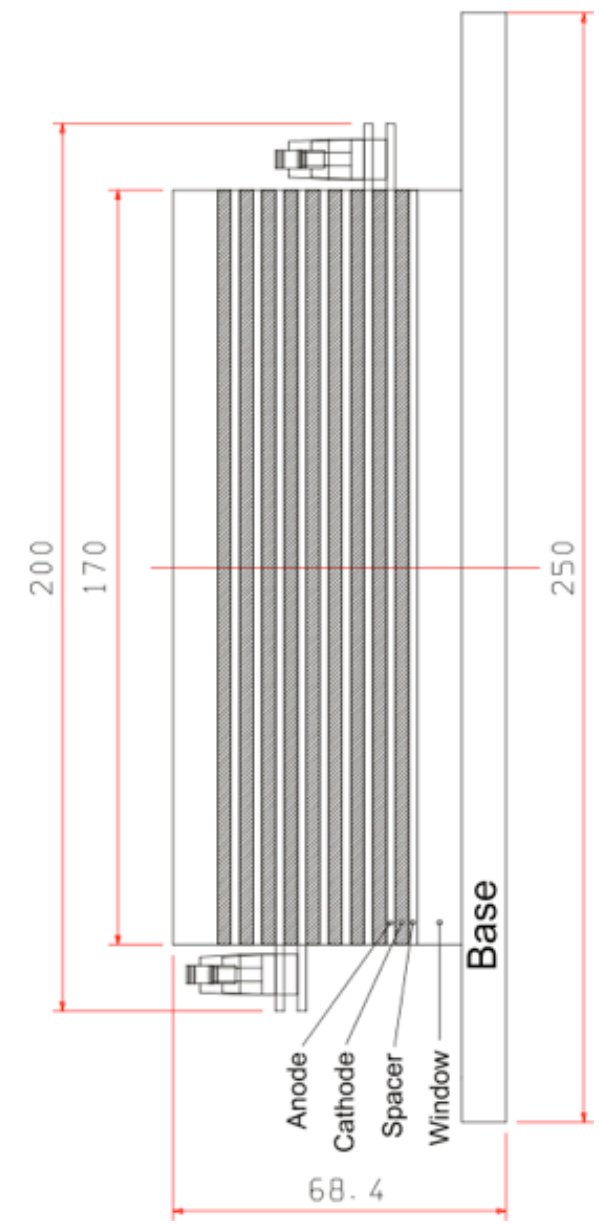
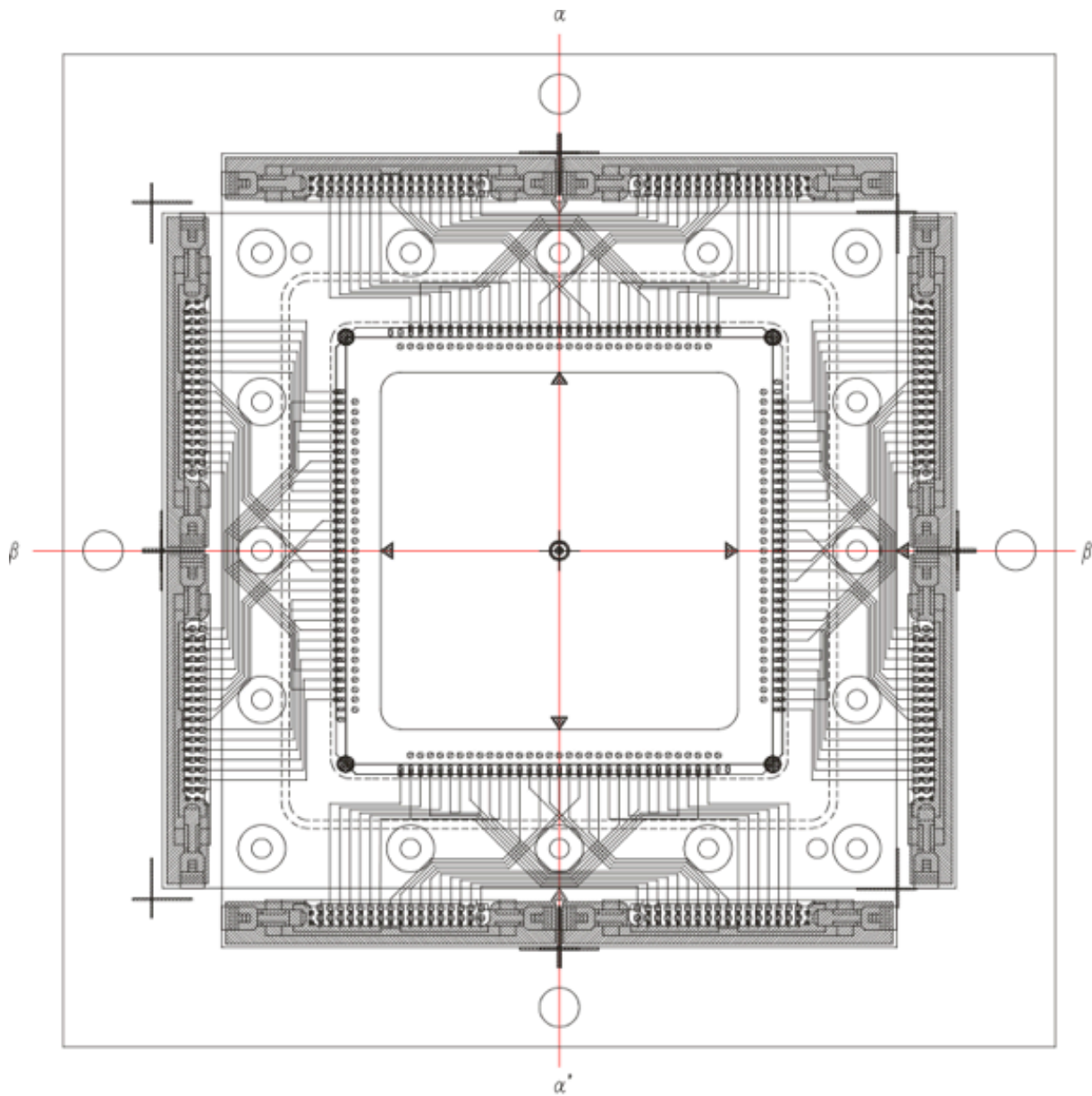
- 5 mm pitch
- 16 sense wire / plane
- Effective area : 80 x 80 [mm<sup>2</sup>]
- 8 planes ( XX'YY' XX'YY' )

install the chamber being **tilted at 45°**



**K beam profile at FF**



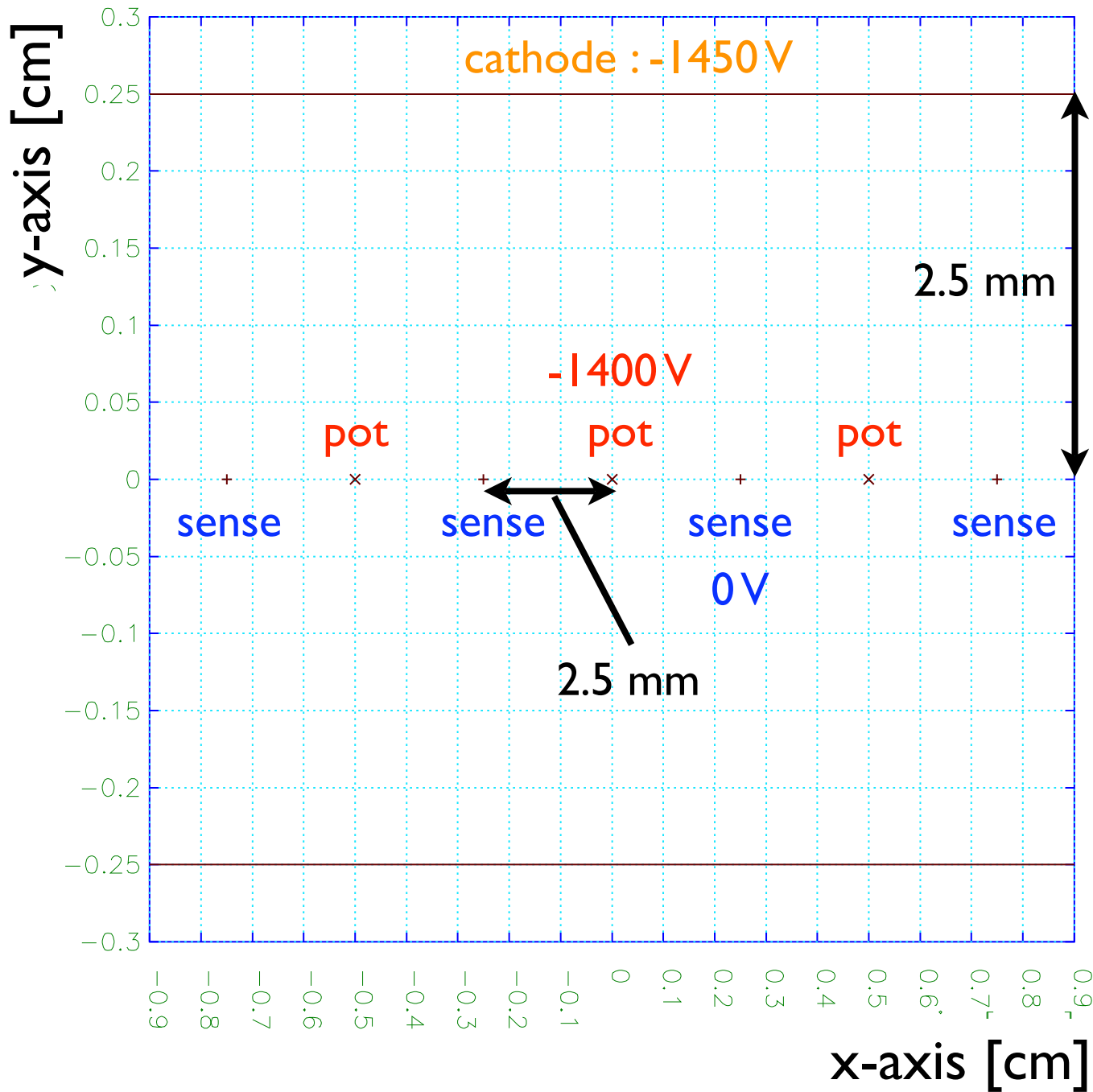


Cost : 2.0M yen (XX'YY'XX'YY')  
 Delivery date : ~ 3 month

( Cost : 3.1M yen for XX'UU'VV'XX'UU'VV' )

# Study of the magnetic field effects with Garfield

# Layout of the cell



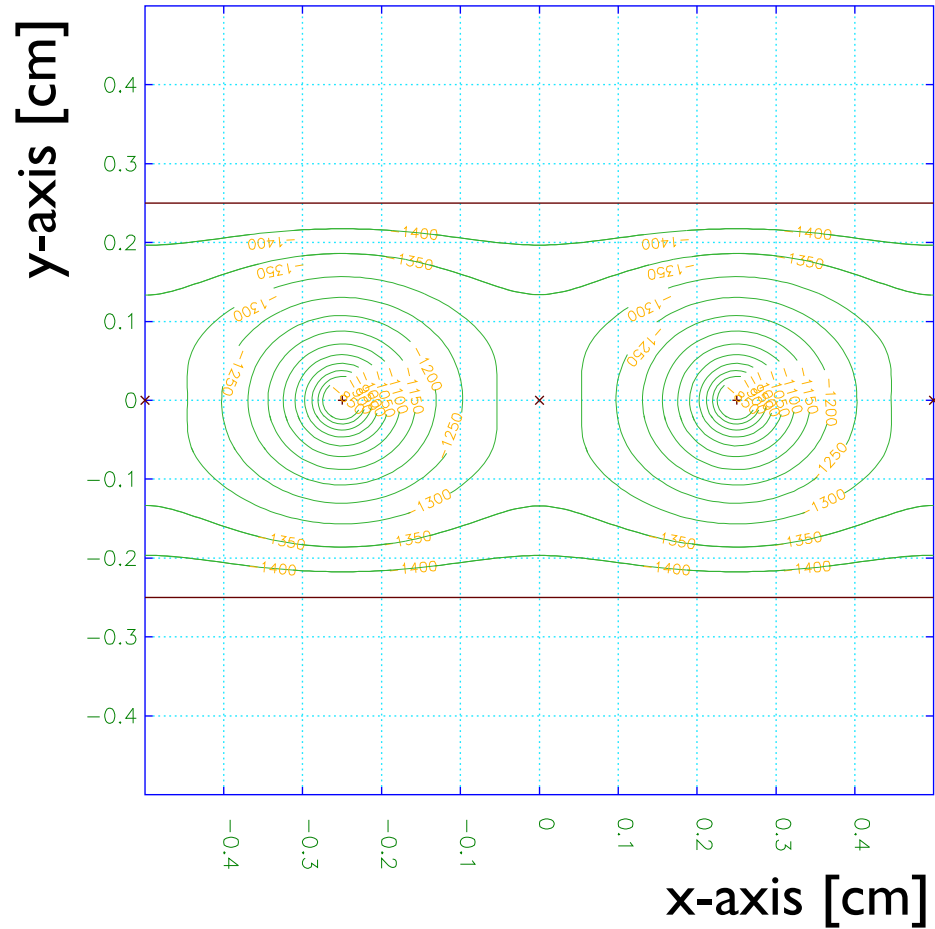
Plotted at 13.1.1.42 on 17/08/07 with Garfield version 6.34.

pot. wire :  $75\mu\text{m}\Phi$   
sense wire :  $12\mu\text{m}\Phi$

# 0 Tesla

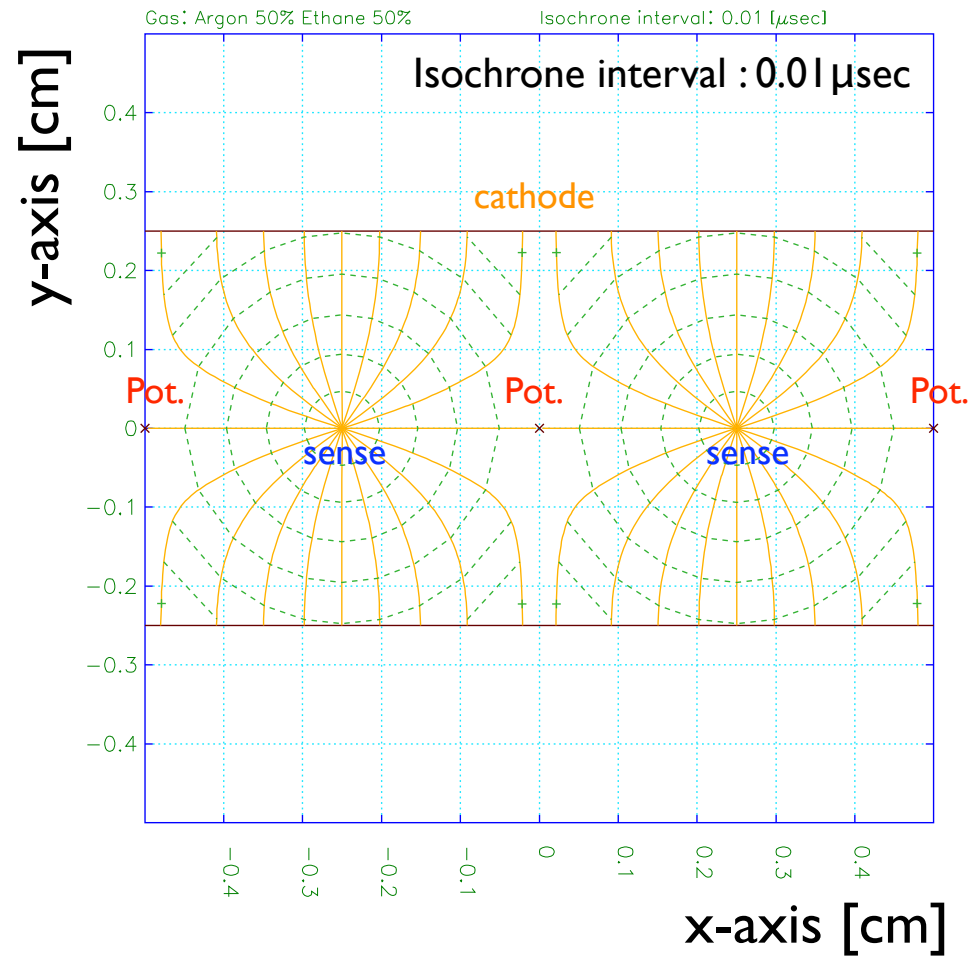
Gas mixture :  
Ar 50%, Ethane 50%

## Contours of V



Plotted at 13.11.42 on 17/08/07 with Garfield version 6.34.

## Positron drift lines from a wire



Gas: Argon 50% Ethane 50%

Isochrone interval: 0.01  $\mu\text{sec}$

Isochrone interval : 0.01  $\mu\text{sec}$

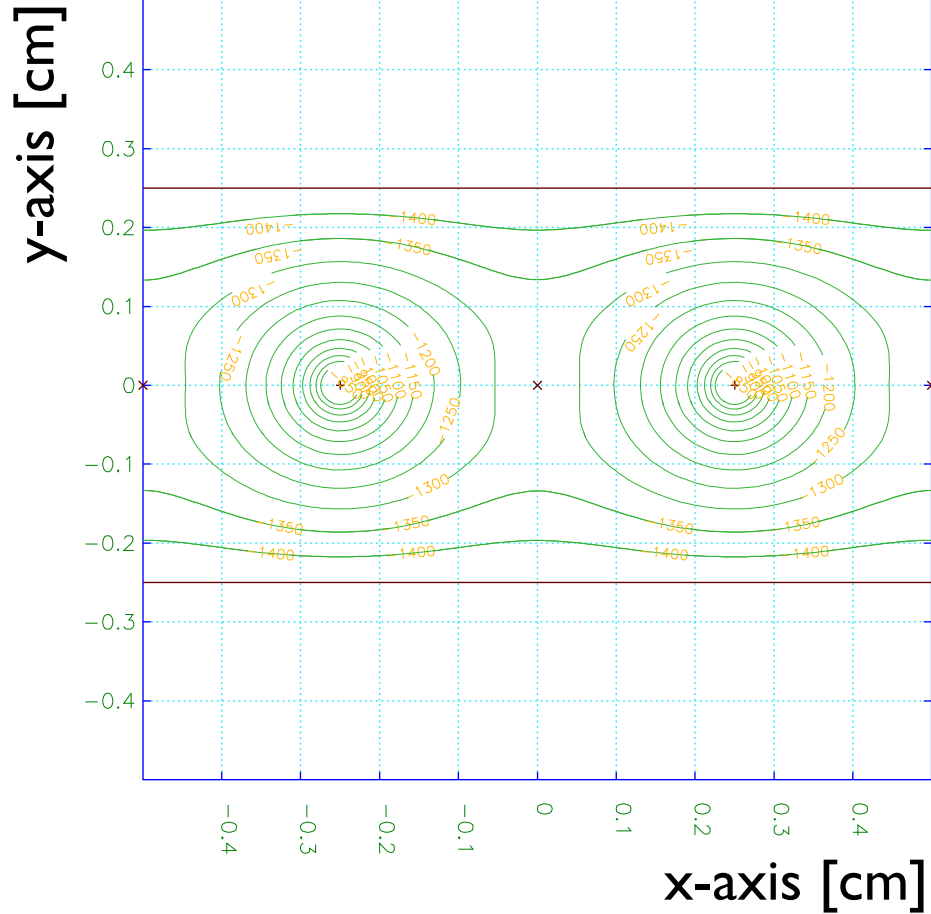
Plotted at 13.11.42 on 17/08/07 with Garfield version 6.34.



# 0.7 Tesla

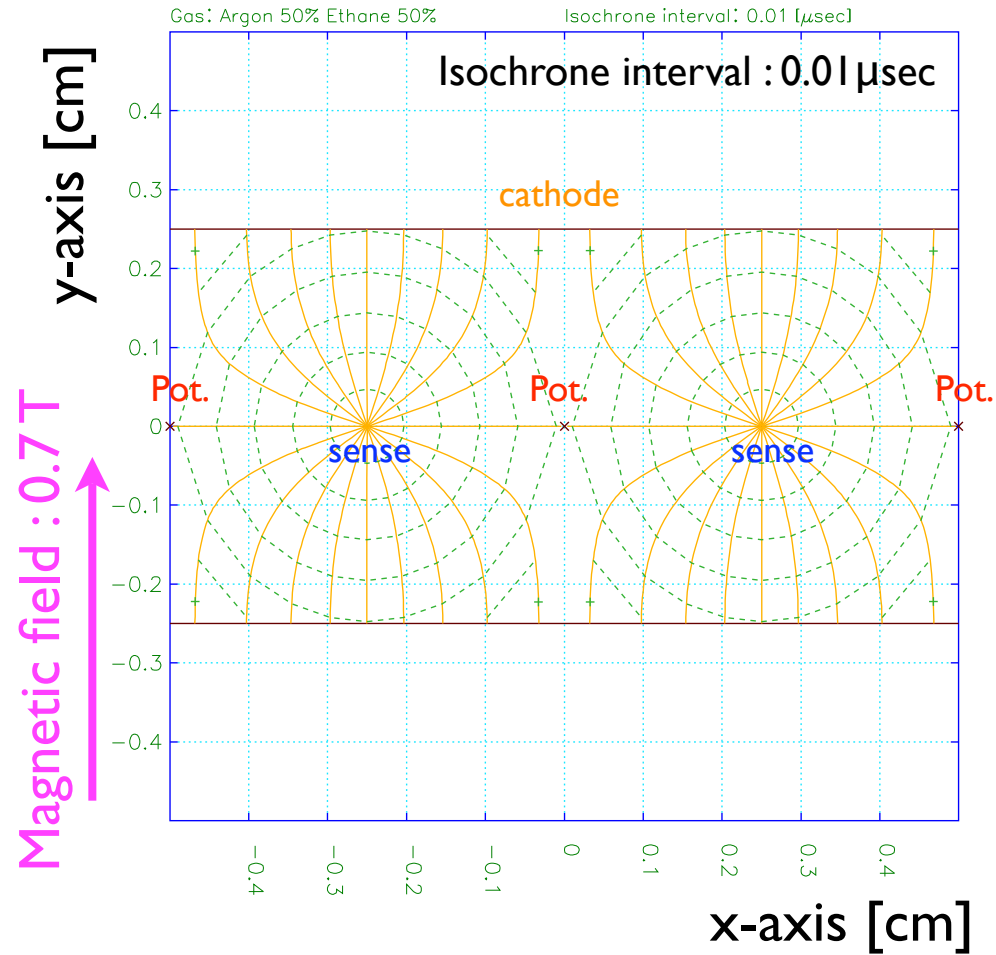
Gas mixture :  
Ar 50%, Ethane 50%

### Contours of V



Plotted at 13.15.09 on 17/08/07 with Garfield version 6.34.

### Positron drift lines from a wire

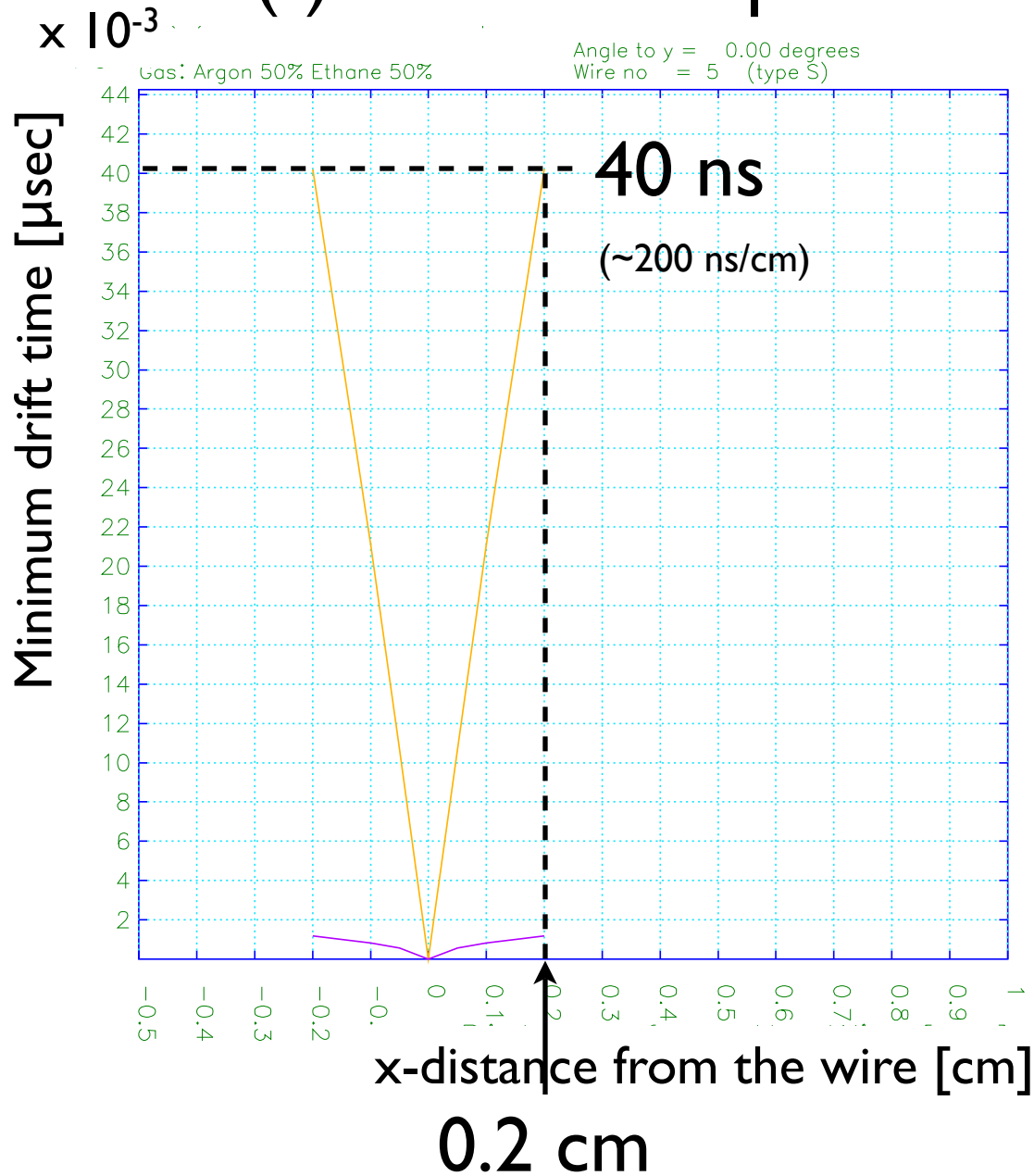


Plotted at 13.15.09 on 17/08/07 with Garfield version 6.34.

# OT

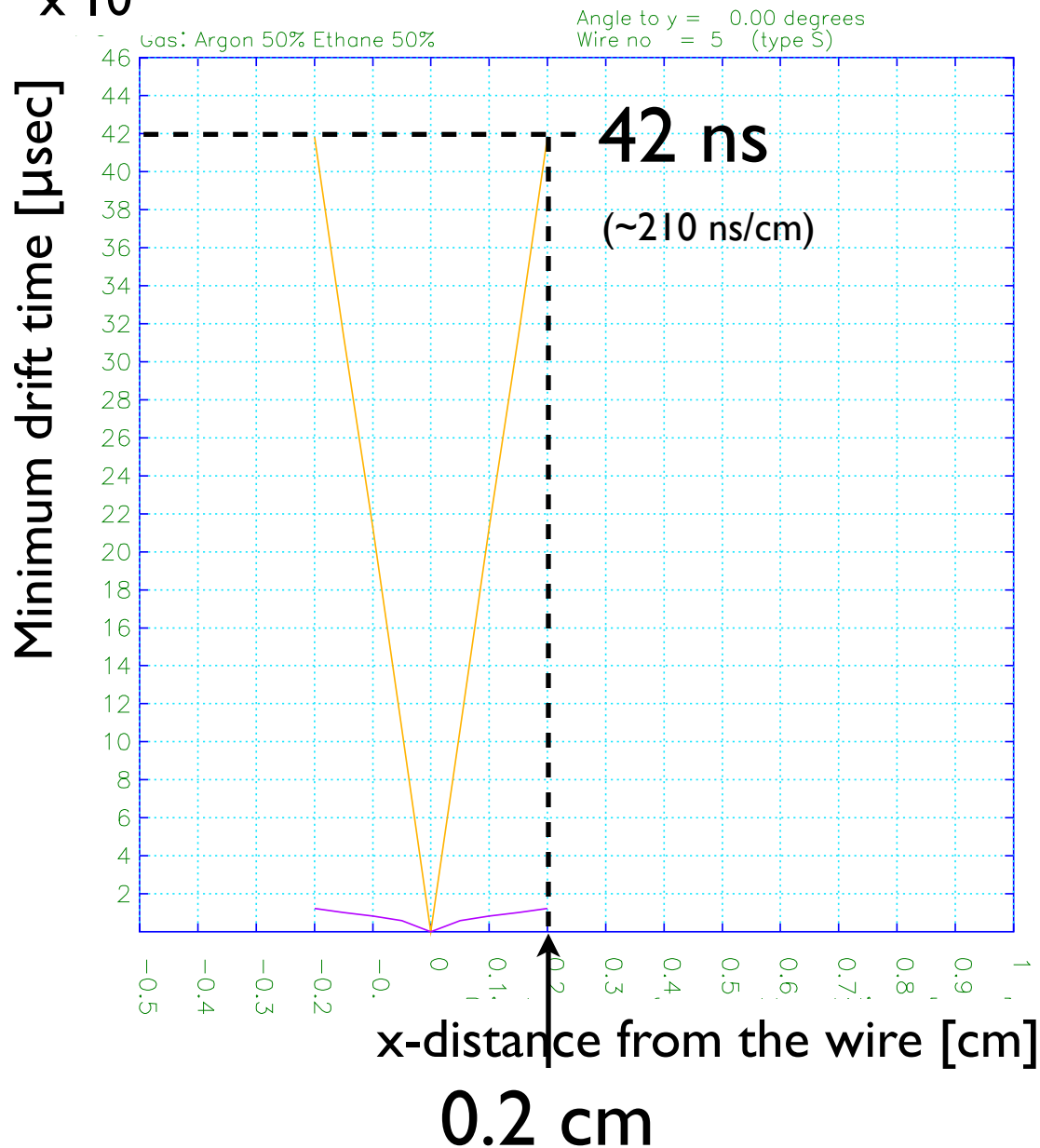
## x(t)-correlation plot

Gas mixture :  
Ar 50%, Ethane 50%



# 0.7 T<sub>x</sub> 10<sup>-3</sup> x(t)-correlation plot

Gas mixture :  
Ar 50%, Ethane 50%



tted at 13.15.09 on 17/08/07 with Garfield version 6.34.

# Summary

## • Requirements for beamline chamber

- ▶ Size : within 250 mm $\Phi$
- ▶ Operable with magnetic field of 0.7 T @ max (beam direction)

## • A small beamline chamber was designed.

- ▶ 5 mm pitch, 16 sense wire/plane, 80 x 80 [mm<sup>2</sup>], 8 planes (XX'YY'XX'YY')
- ▶ install the chamber being tilted at 45°

## • Magnetic field effects for the drift time was studied.

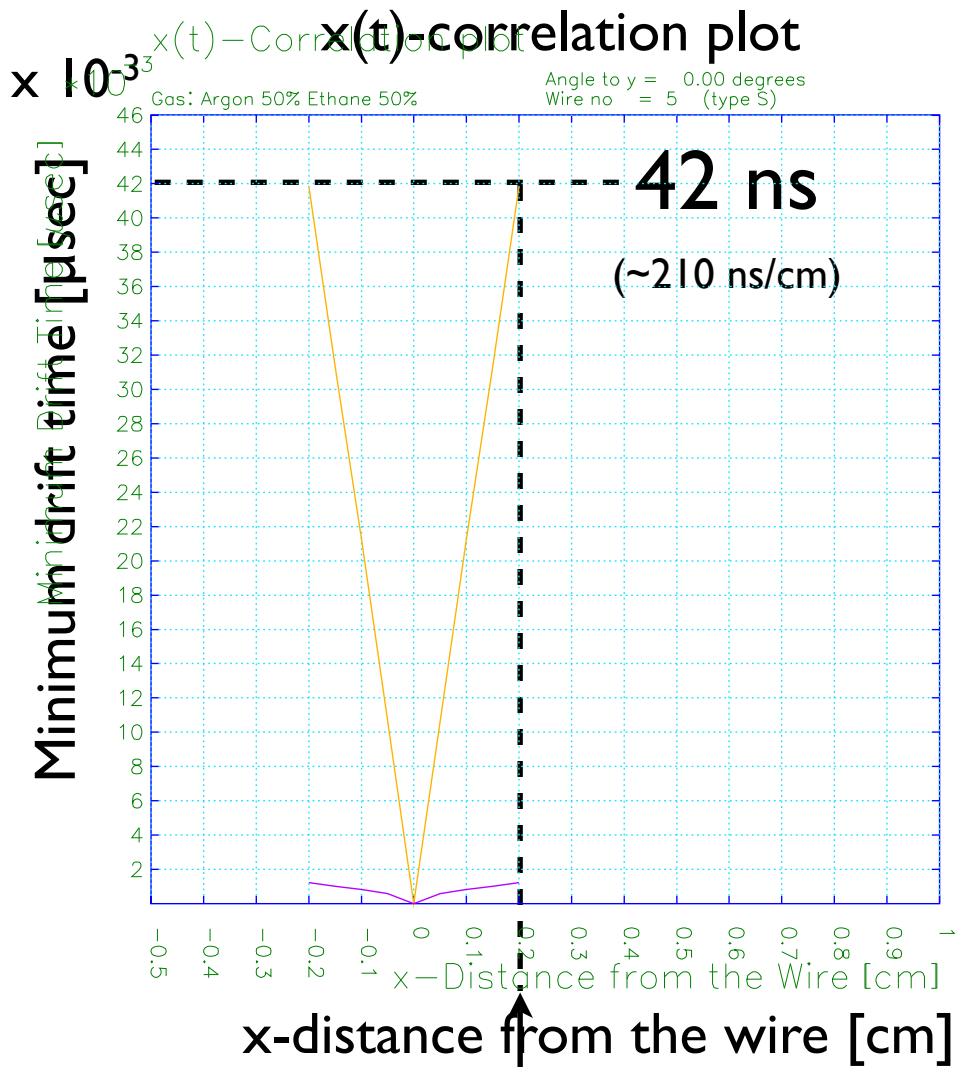
- ▶ Minimum drift time : 200 [ns/cm] for 0 T, 210[ns/cm] for 0.7 T
- ▶ Difference of the drift time for 0 T and 0.7 T was only ~ 5 %.

# additional slides

in the cases that the magnetic fields (0.7 and 7 Tesla)  
are applied for X, Y, and Z directions

**Magnetic field effect  
(y-direction)**

# 0.7 T (y-direction)

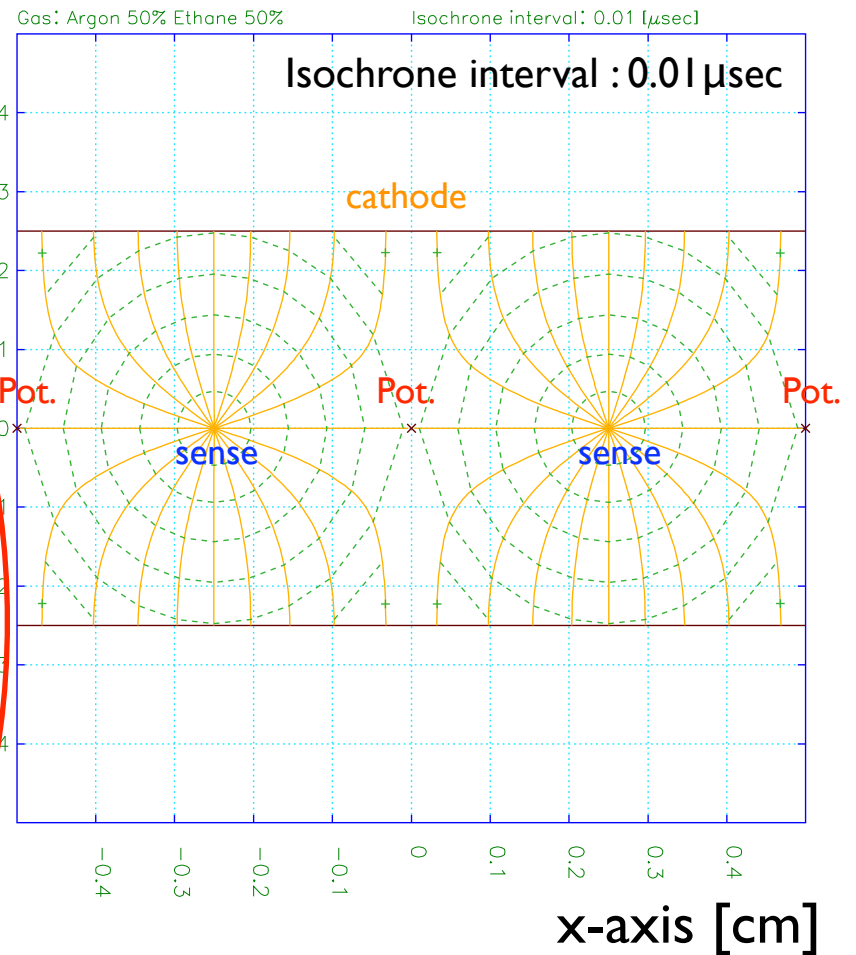


0.2 cm

Plotted at 13.15.09 on 17/08/07 with Garfield version 6.34.

**Magnetic field : 0.7 T**

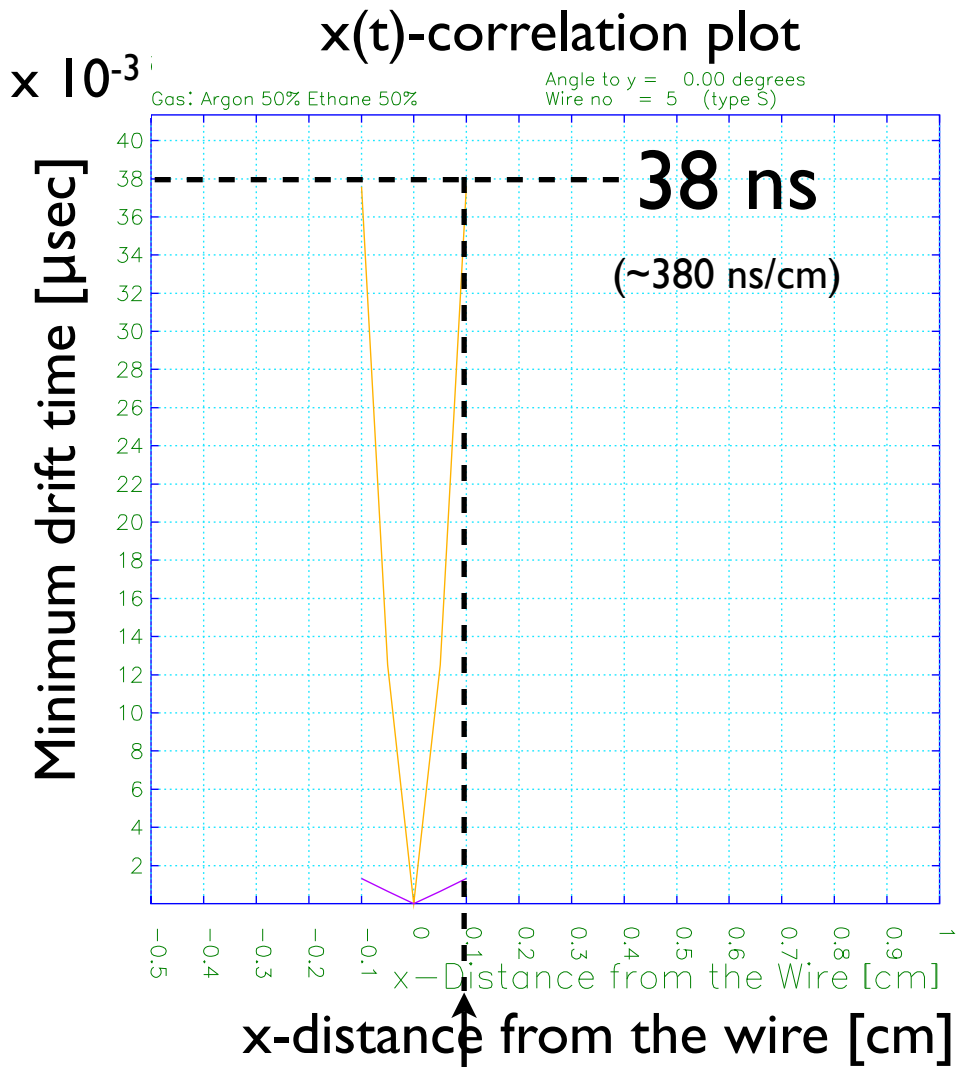
### Positron drift lines from a wire



Gas mixture :  
Ar 50%, Ethane 50%

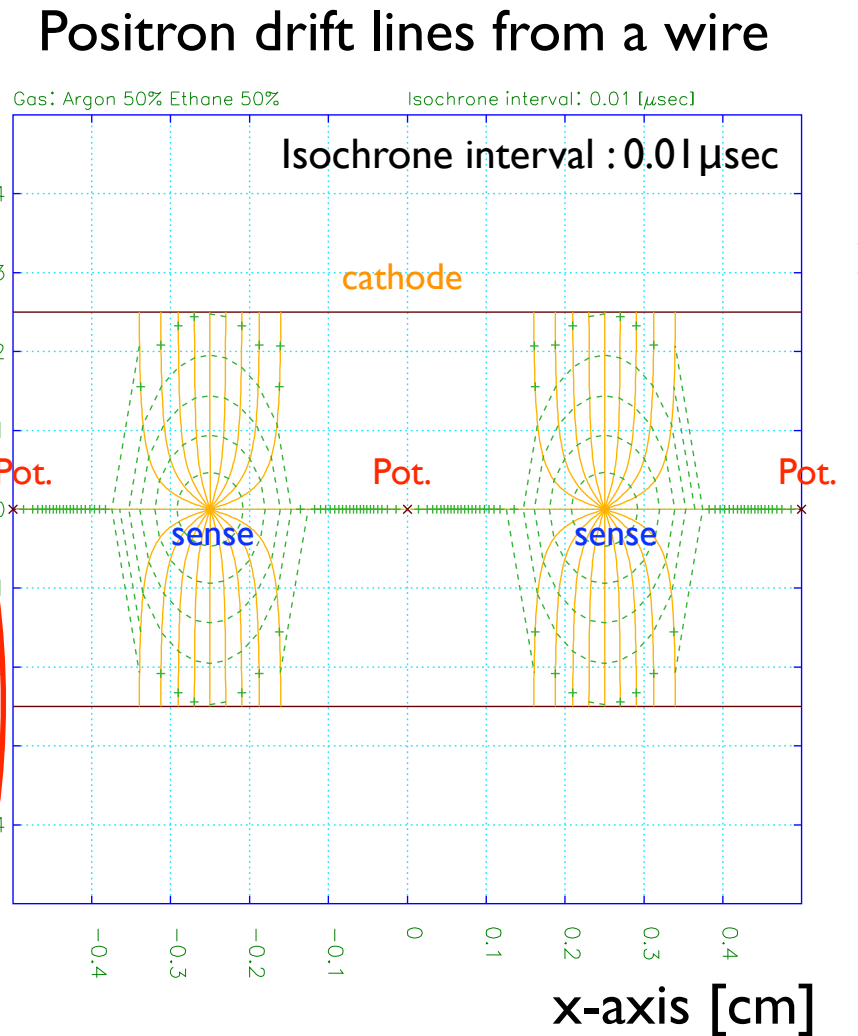
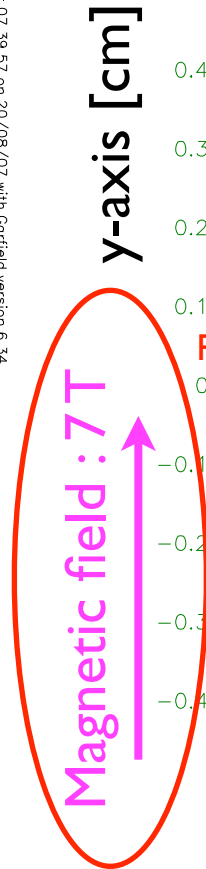
Plotted at 13.15.09 on 17/08/07 with Garfield version 6.34.

# 7 T (y-direction)



0.1 cm

Plotted at 07:39:57 on 20/08/07 with Garfield version 6.34.



Gas mixture :  
Ar 50%, Ethane 50%

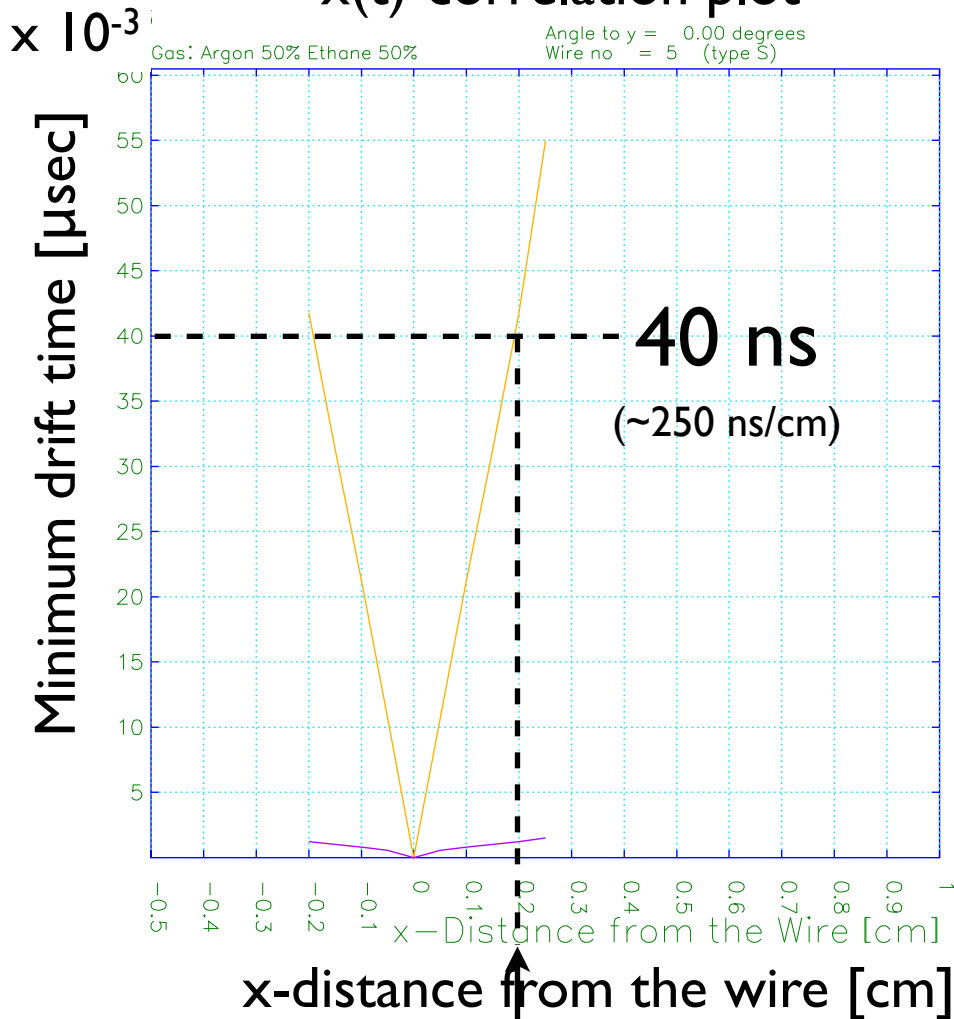
Plotted at 07:39:58 on 20/08/07 with Garfield version 6.34.



**Magnetic field effect  
(z-direction)**

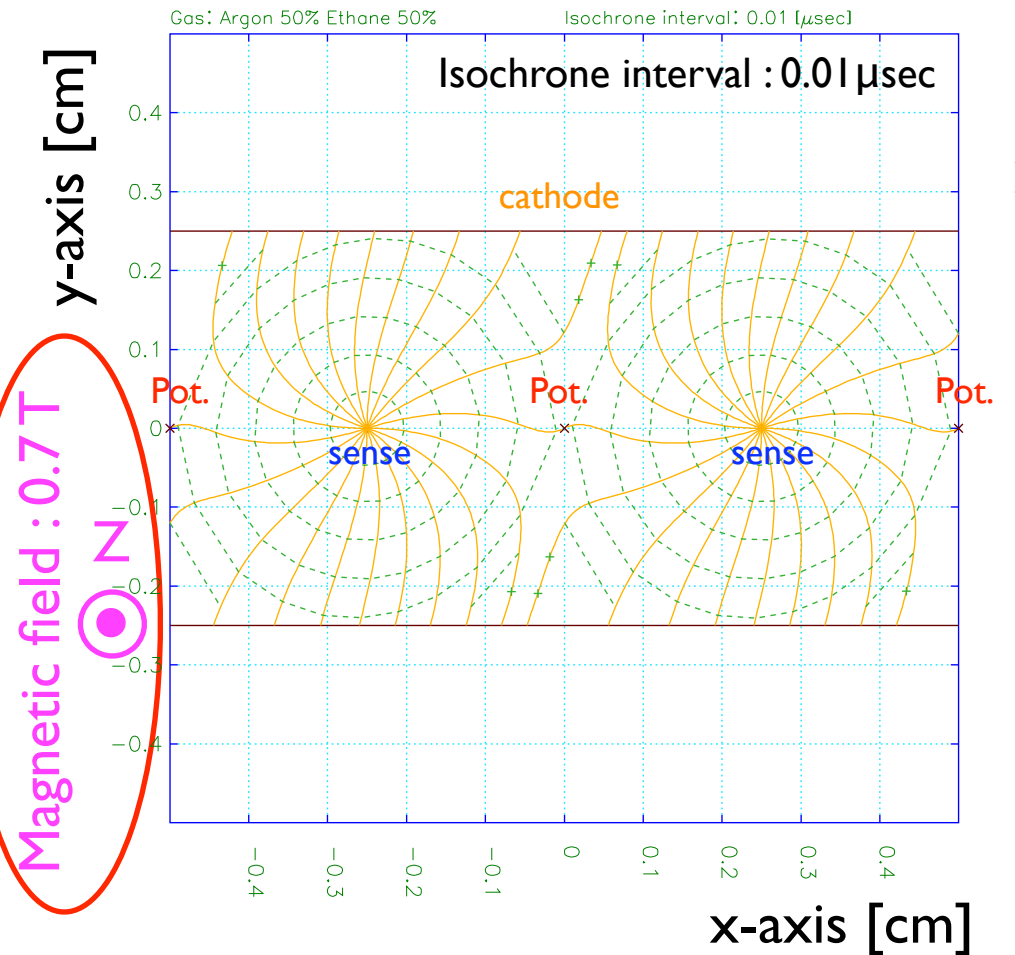
# 0.7 T (z-direction)

## x(t)-correlation plot



Plotted at 07:55:17 on 20/08/07 with Garfield version 6.34.

## Positron drift lines from a wire

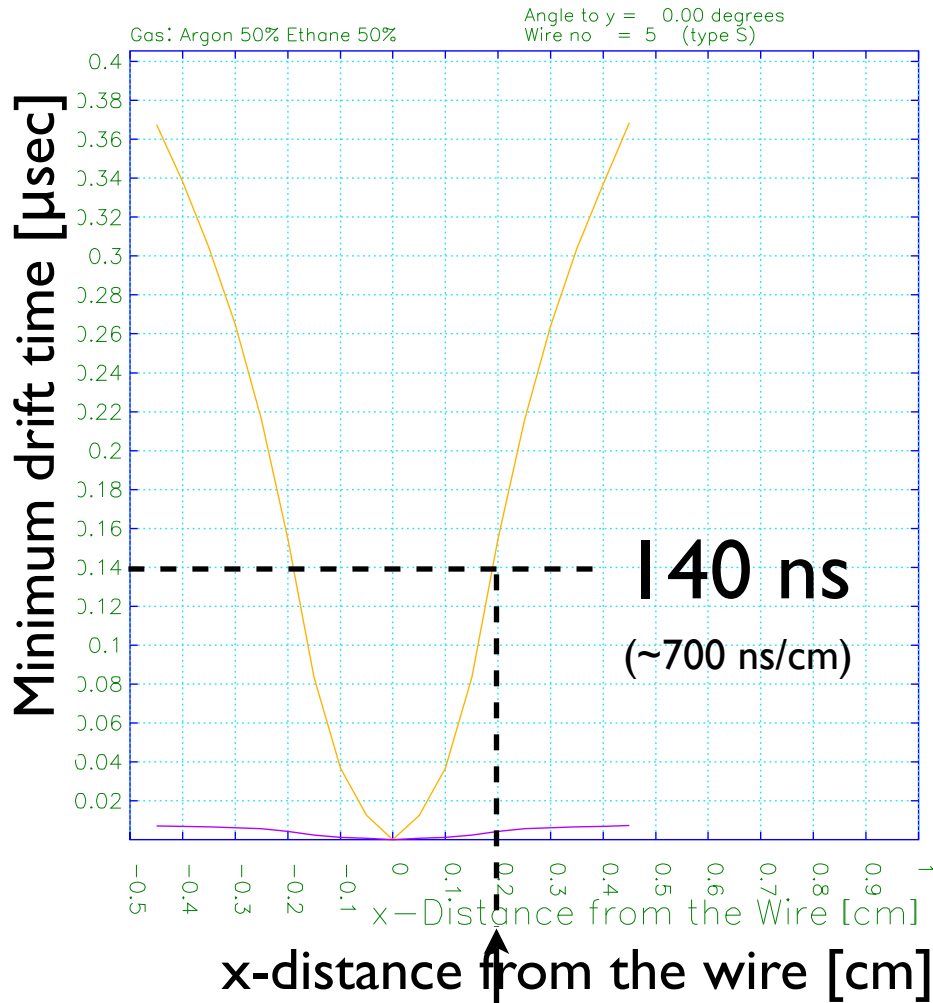


Plotted at 07:55:17 on 20/08/07 with Garfield version 6.34.

Gas mixture :  
Ar 50%, Ethane 50%

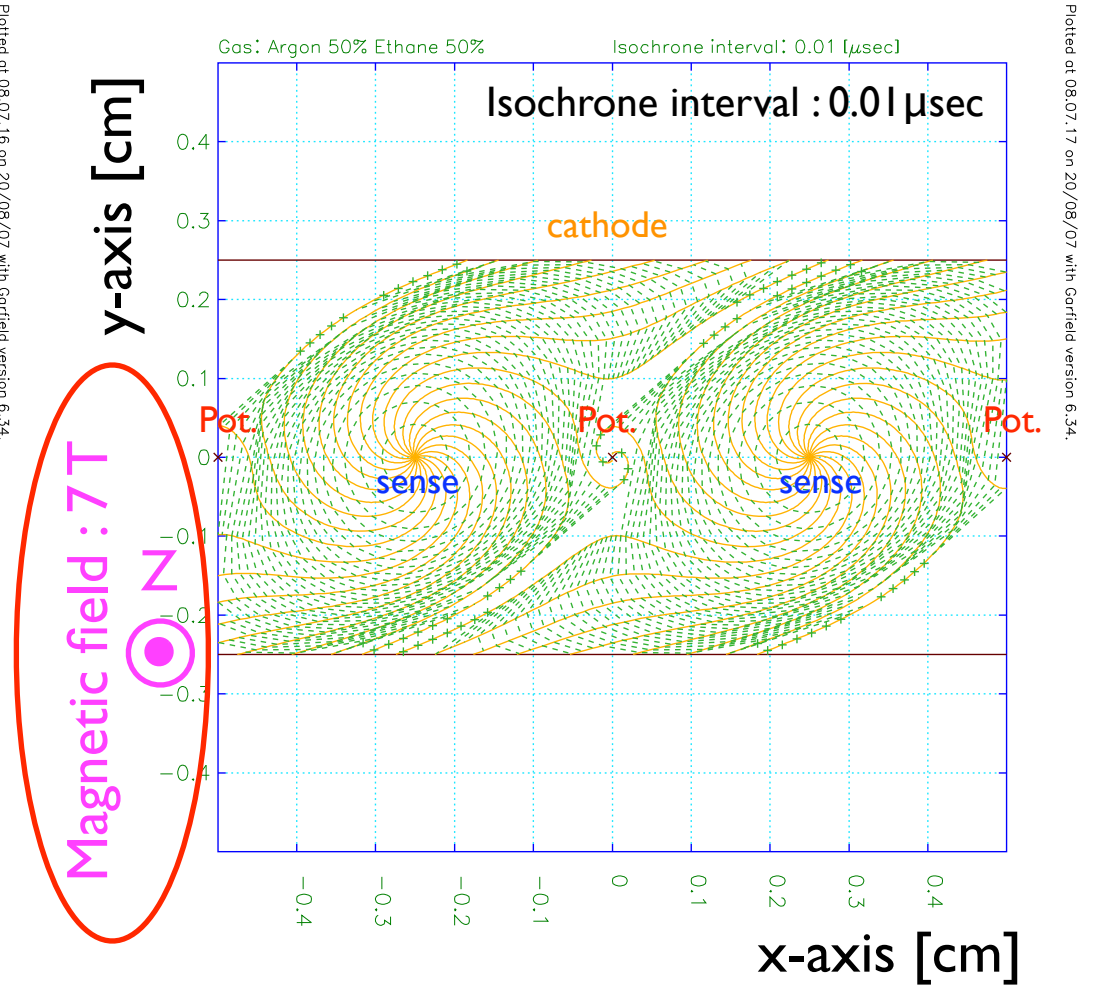
# 7 T (z-direction)

## x(t)-correlation plot



Plotted at 08/07/16 on 20/08/07 with Garfield version 6.34.

## Positron drift lines from a wire

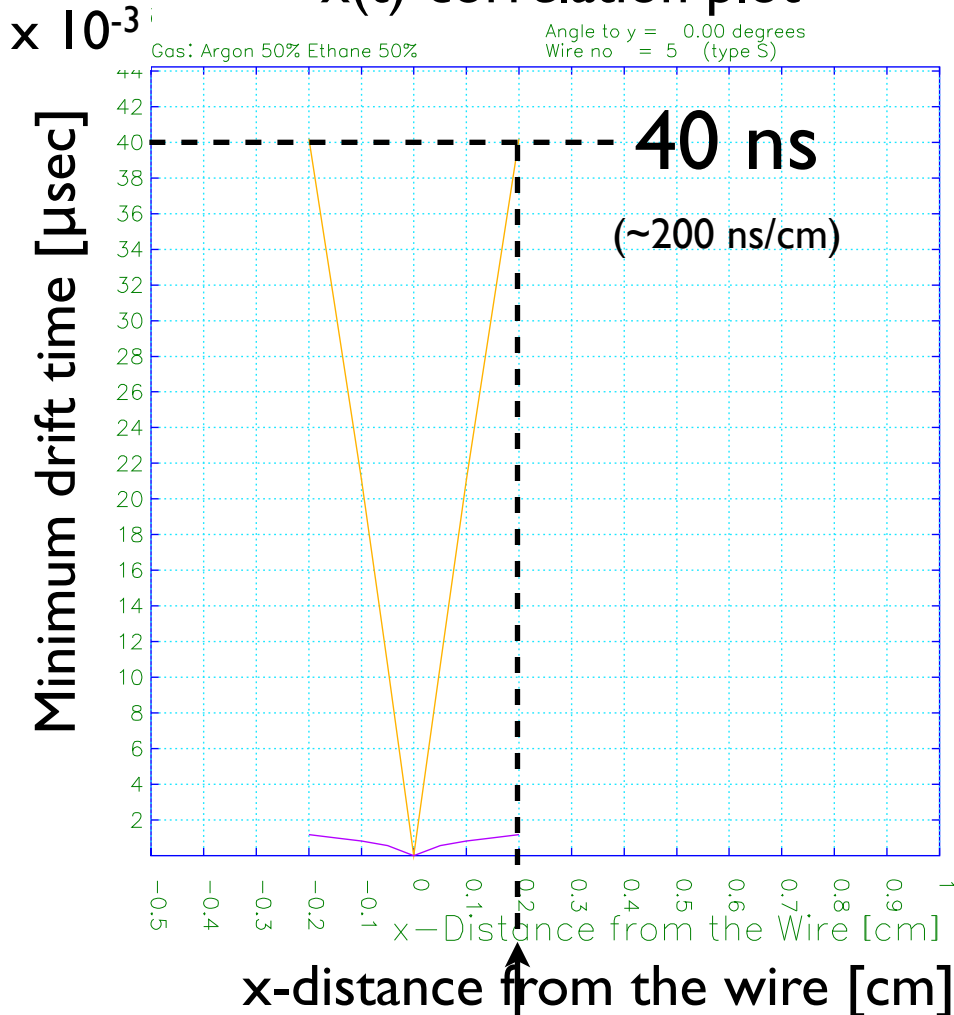


Plotted at 08/07/17 on 20/08/07 with Garfield version 6.34.

**Magnetic field effect  
(x-direction)**

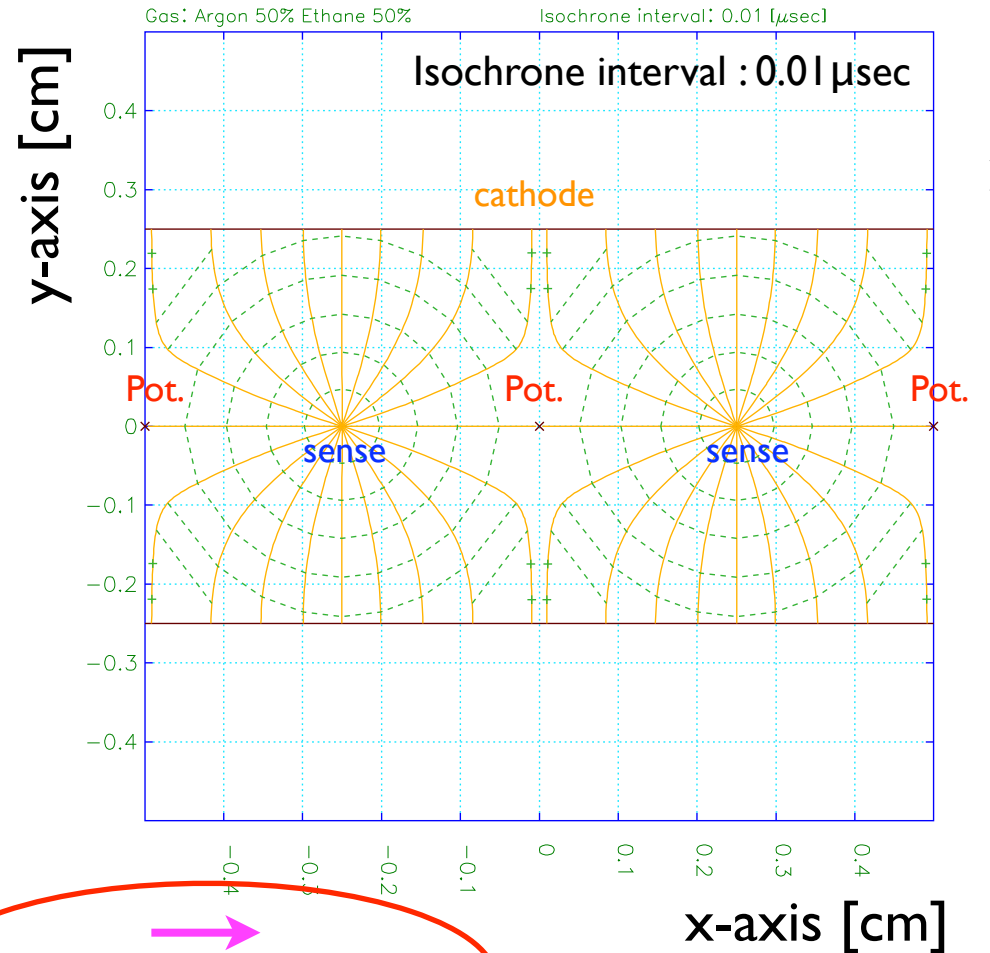
# 0.7 T (x-direction)

## x(t)-correlation plot



Plotted at 08:38:42 on 20/08/07 with Garfield version 6.34.

## Positron drift lines from a wire



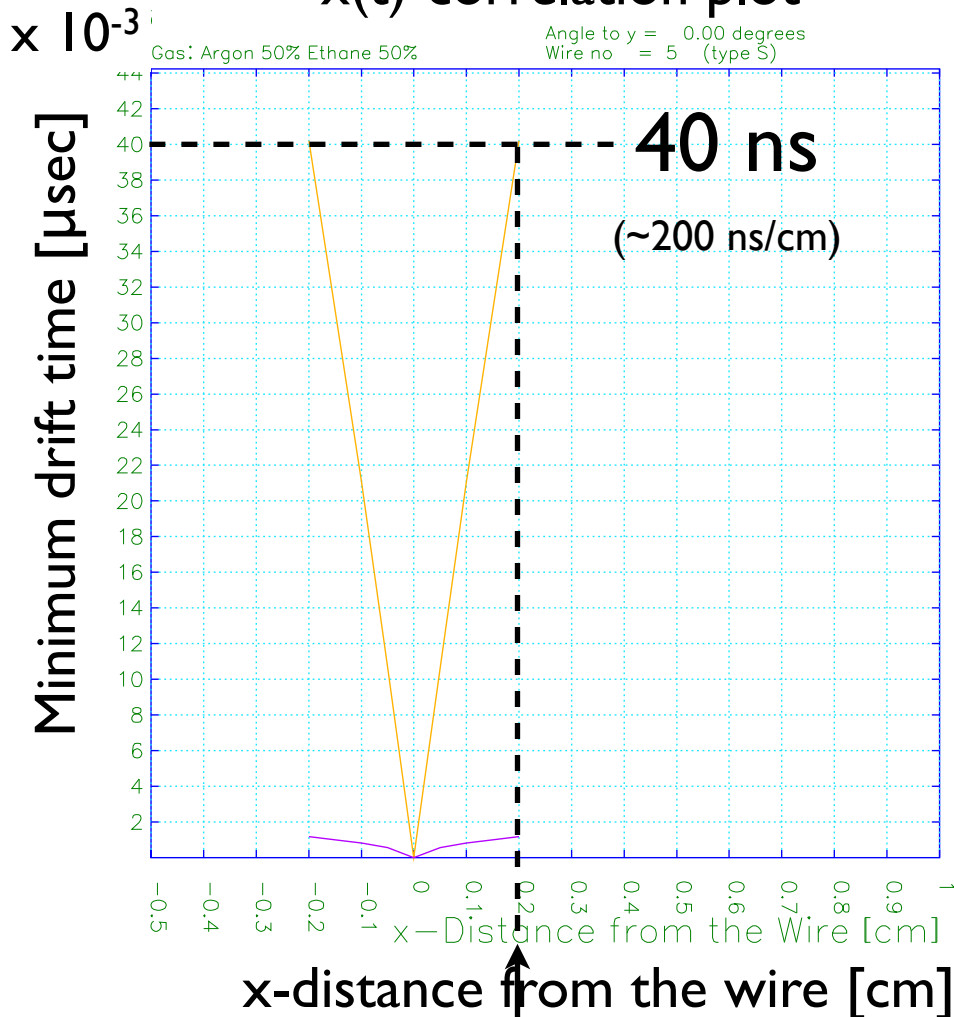
Plotted at 08:38:42 on 20/08/07 with Garfield version 6.34.

→  
Magnetic field : 0.7 T

Gas mixture :  
Ar 50%, Ethane 50%

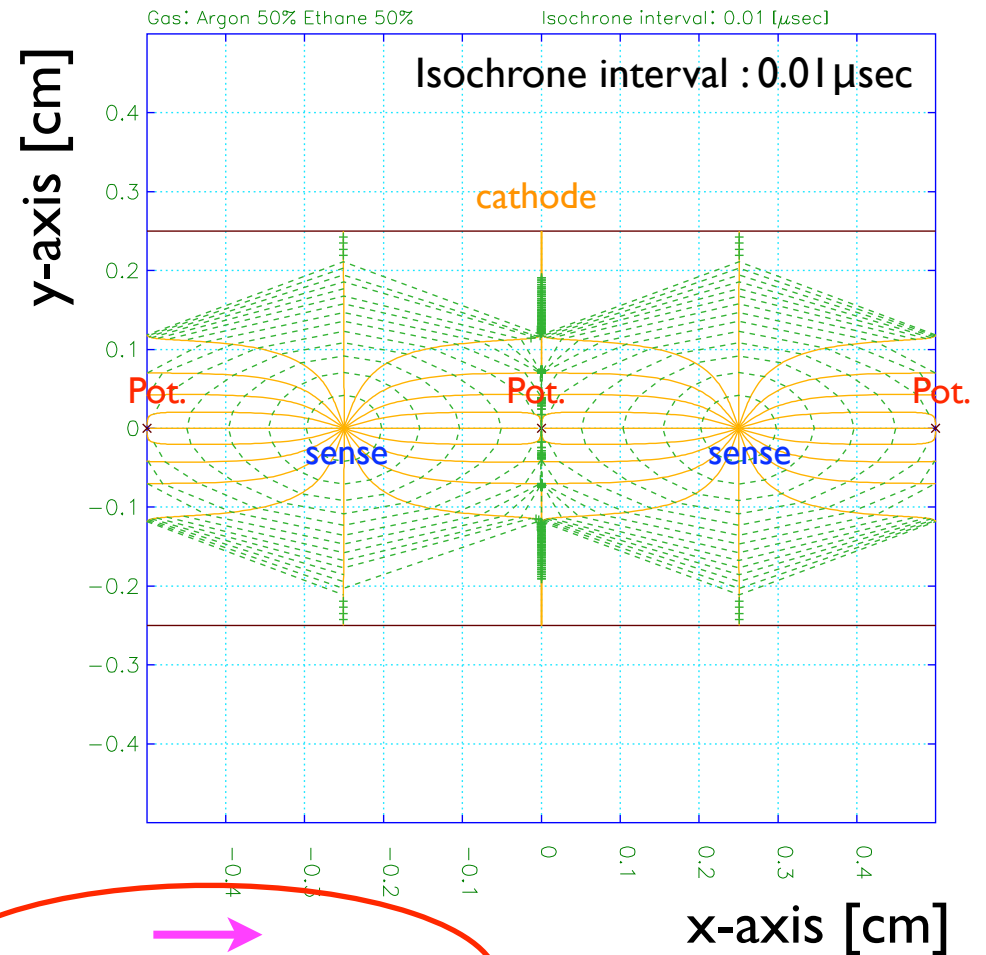
# 7 T (x-direction)

## x(t)-correlation plot



Plotted at 08:45:07 on 20/08/07 with Garfield version 6.34.

## Positron drift lines from a wire



Plotted at 08:45:07 on 20/08/07 with Garfield version 6.34.

Gas mixture :  
Ar 50%, Ethane 50%

# Magnetic field effect for the drift time

Minimum drift time per 1 cm (x-distance) far from a wire

	0.7 T	7 T
x - direction	200 ns/cm	200 ns/cm
y - direction	210 ns/cm	380 ns/cm
z - direction	250 ns/cm	700 ns/cm (non-linear)

without magnetic field : 200 ns/cm