Study of delayed hit in DeeMe MWPC

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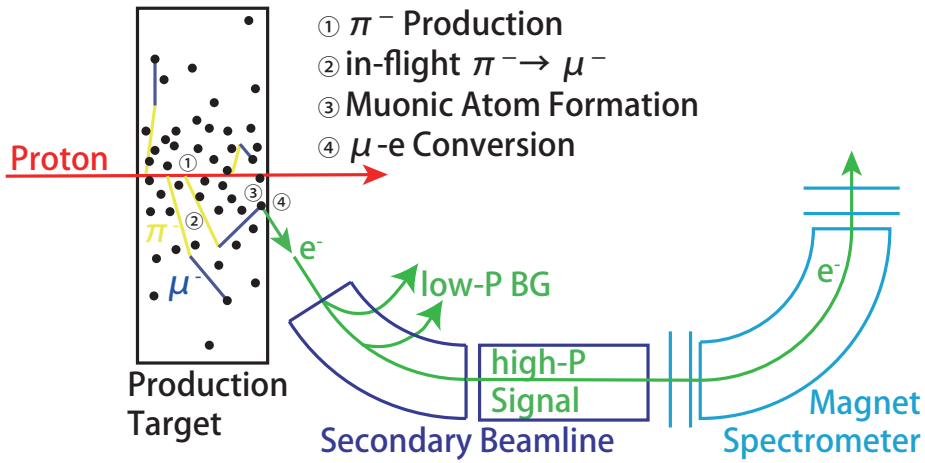
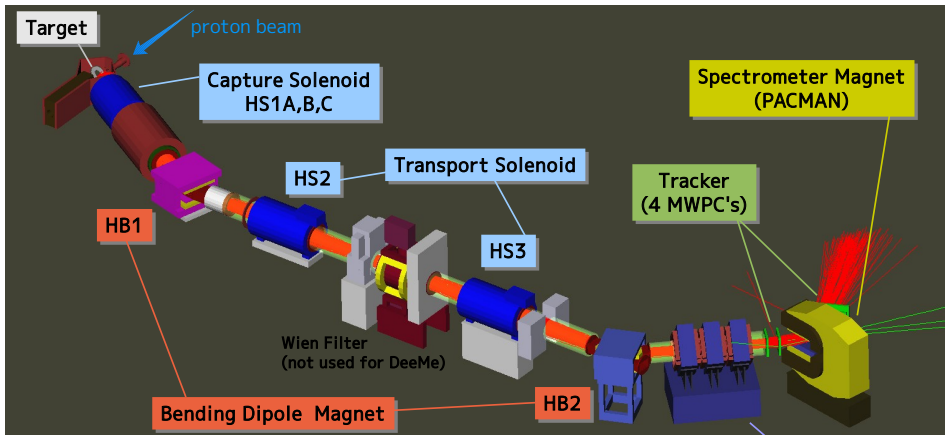
outline

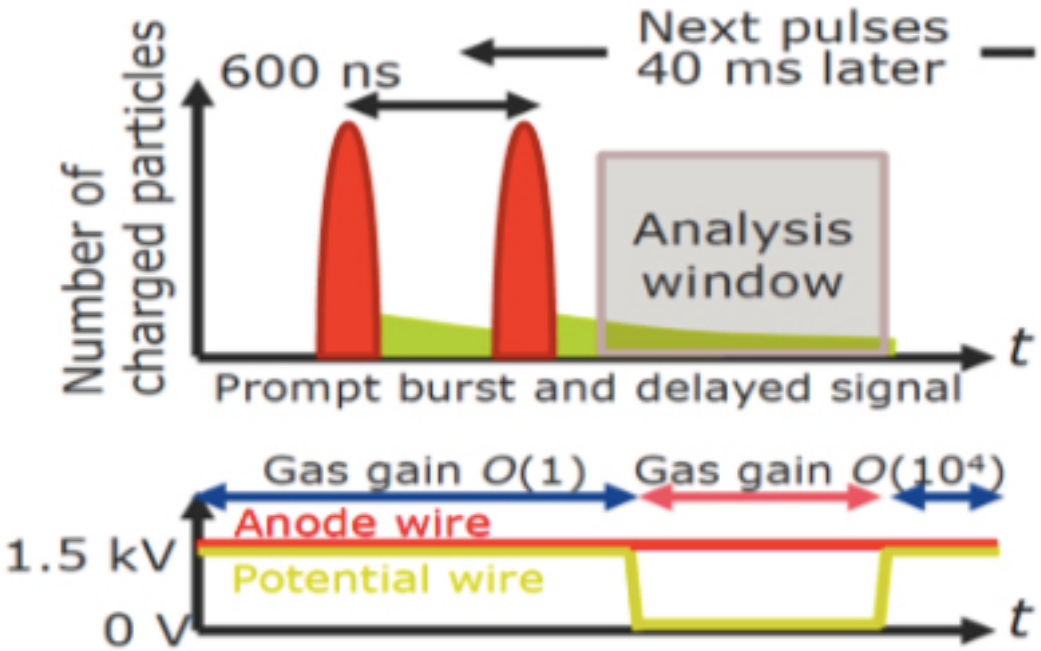
DeeMe

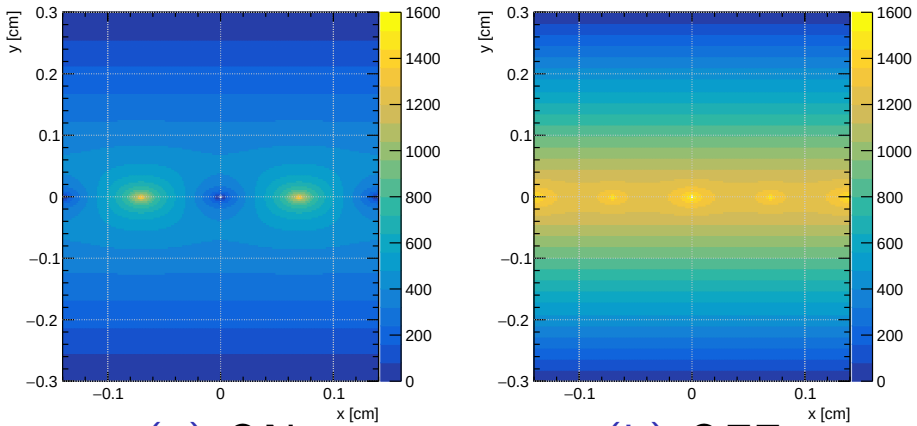
- Process : $\mu^- + (A, Z) \rightarrow e^- + (A, Z)$
  - A single mono-energetic electron
    - ★ 105MeV
    - ★ Delayed : $\sim 1\mu S$
- High-Power High-Purity Pulsed Proton from J-PARC RCS
- Single Event Sensitivity
  - 1×10^{-13} (Graphite, 2×10^7sec)
  - 2×10^{-14} (SiC, 2×10^7sec)



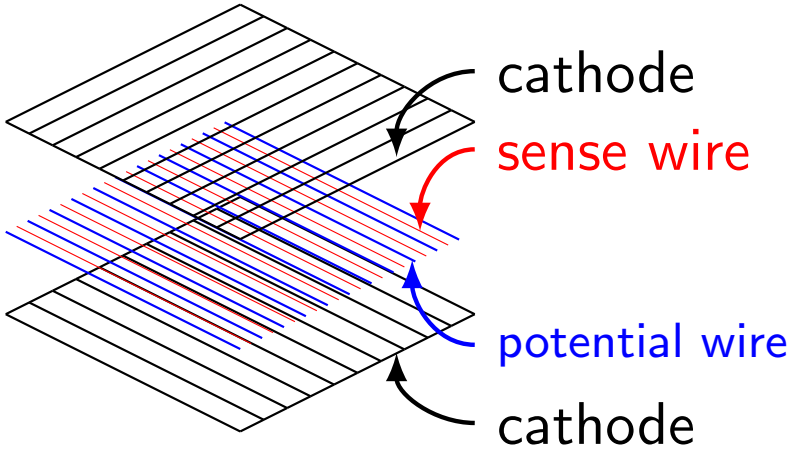


HV-Swiching MWPC





(a) ON (b) OFF



- Cathode strip read out
  - X : 3mm strip
  - Y : 5 × 3 mm strip
- Wire diameter
  - Anode wire : $\phi 15 \mu m$
  - Potential wire : $\phi 50 \mu m$

gas amplification

ionization

$$A + e^- \rightarrow A^+ + e^- + e^-$$

excitaion • deexcitation

$$A + e^- \rightarrow A^* + e^-$$

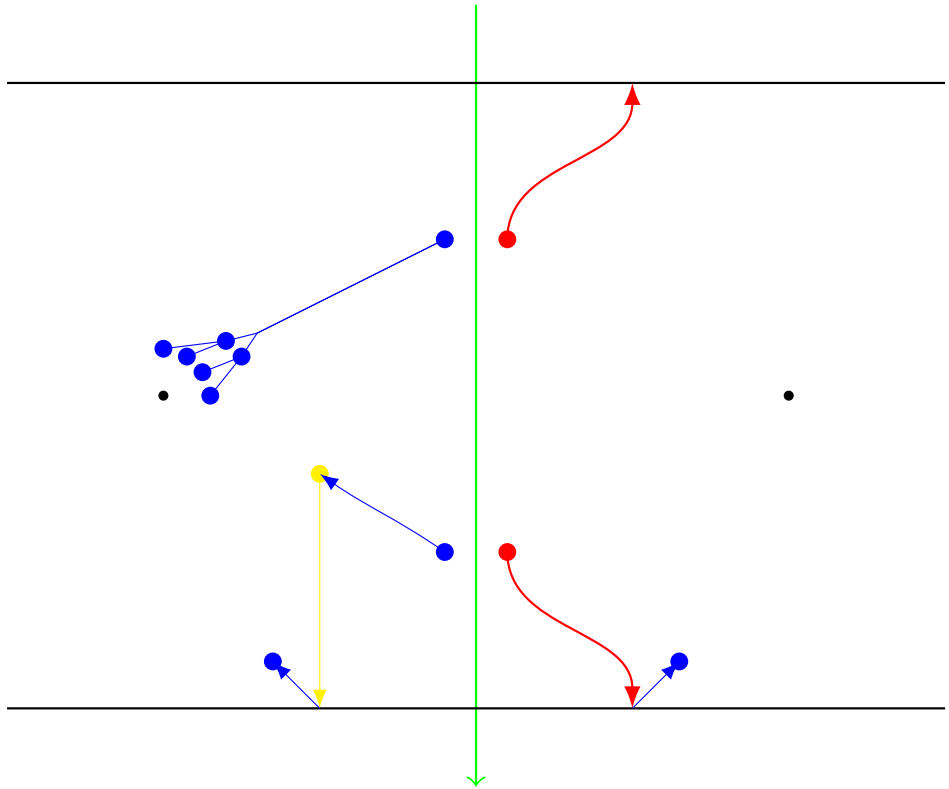
$$A^* \rightarrow A + \gamma$$

electron attachment

$$A + e^- \rightarrow A^-$$

charge transfer

$$A^+ + B \rightarrow A + B^+$$



suppression of delayed hit

purposs

To suppress delayed hit

plan

- suppression of electron from cathode
- suppression of ion reaching cathode

We used several kinds of gases

- c2H4, iC4H10, SF6, HFC-134a,etc

Let's use methylal !

- but, methylal is liquid

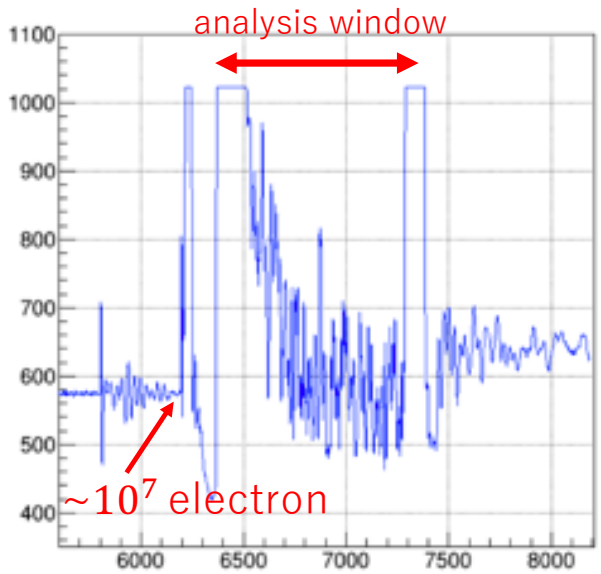
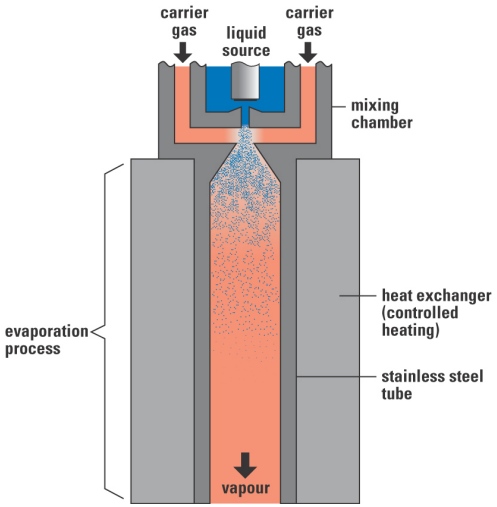


Figure: Ar:80 iC4H10:20

outline

gas system

(a) controlled evapolator system



(b) evaporation process

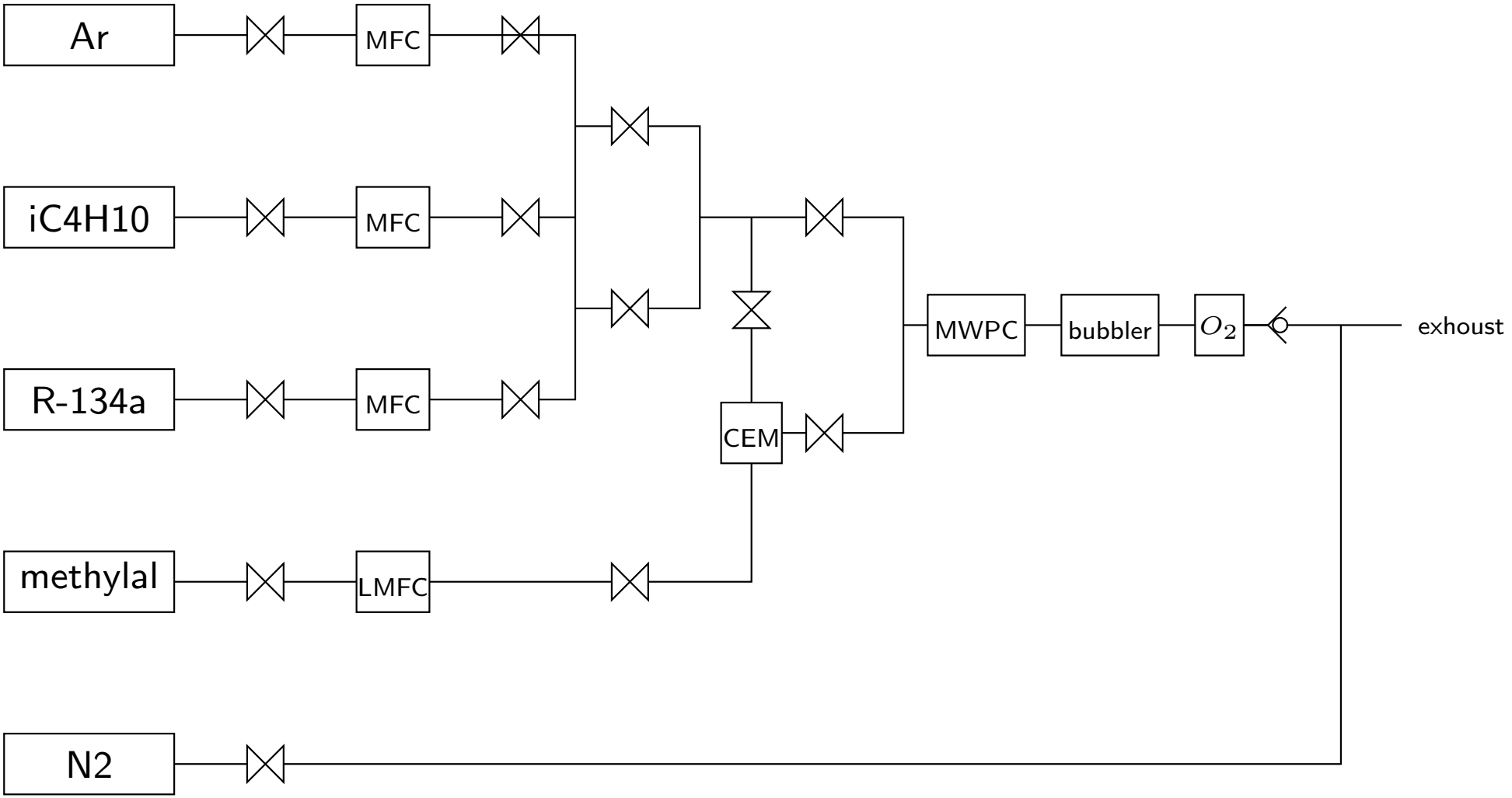
Figure: gas system

- Advantage
  - precise control
  - available for low vapor pressure liquid

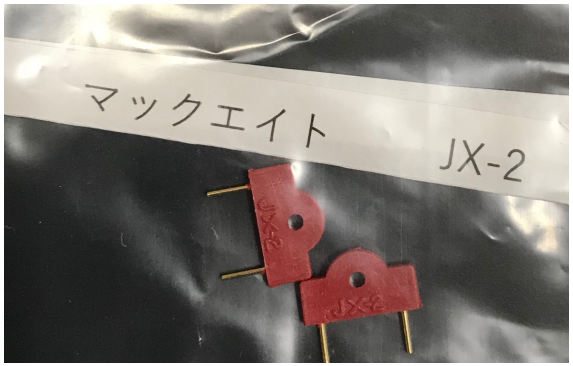
Figure: side view

gas system

gas circuit



tolerance test



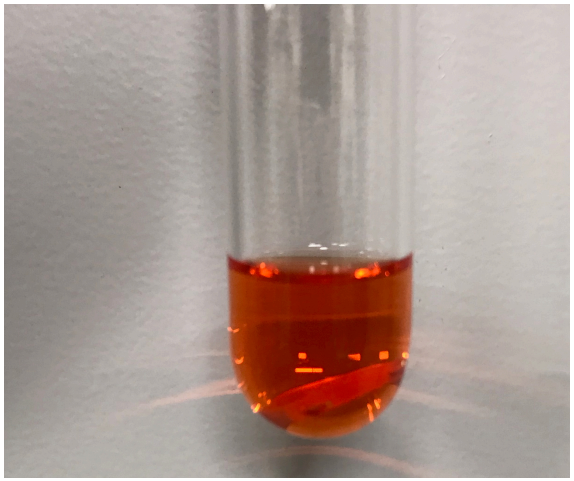


Figure: jummper pin

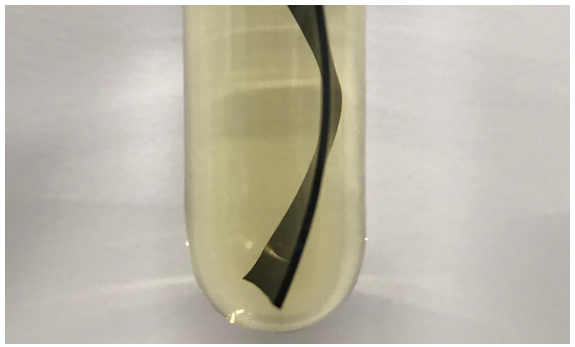
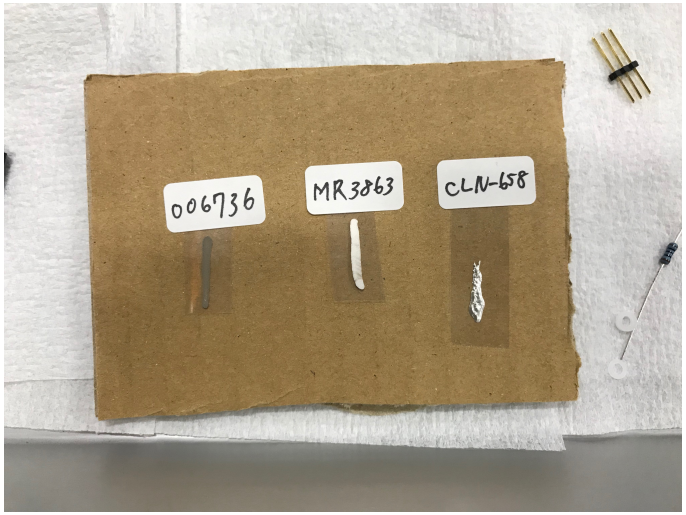
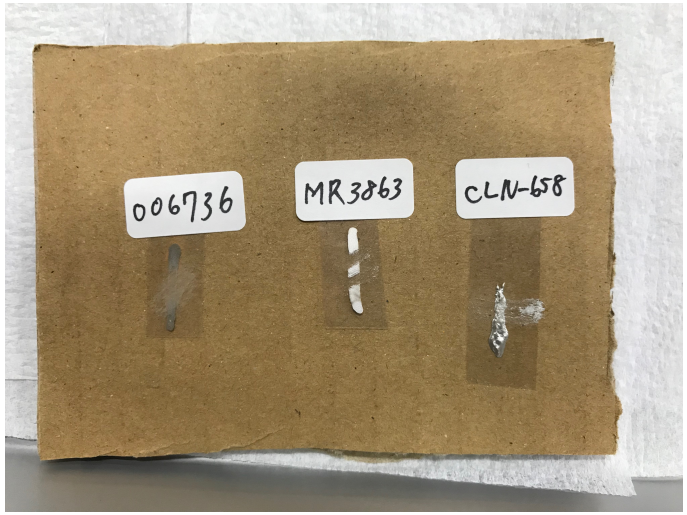


Figure: rubber sheet

tolerance test



(a) before



(b) after

Figure: conductive adhesive

solution

- jummper pin → non-isolate
- rubber → silicon
- conductive adhesive → caulking

2019/11 beamtest

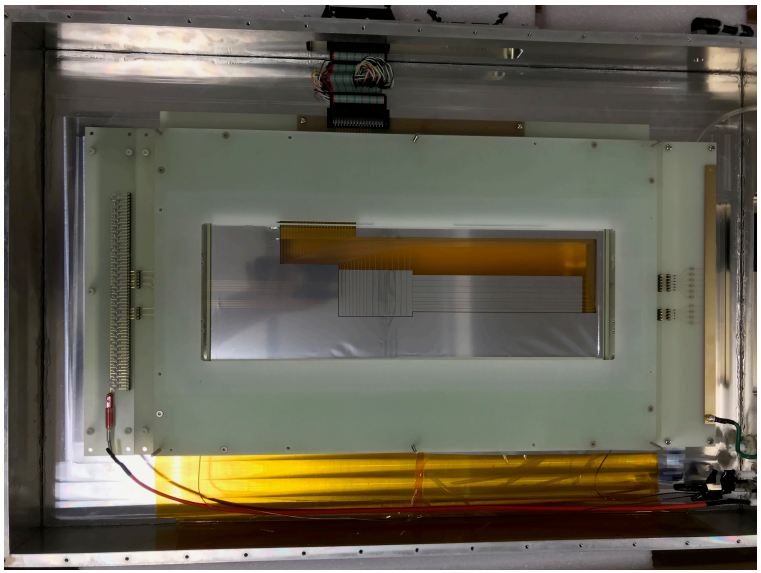


Figure: prototype

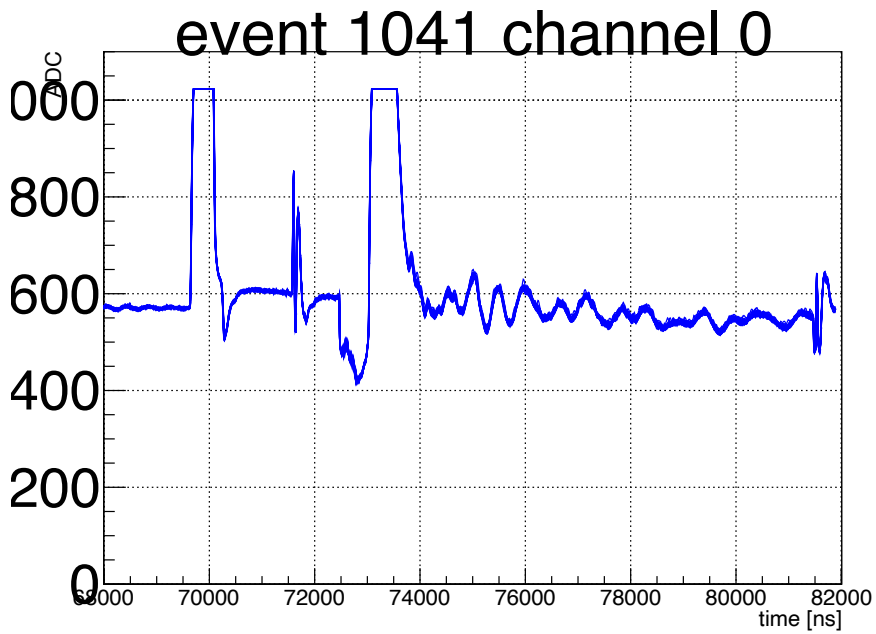


Figure: Ar:70 iC4H10:20 C3H8O2:10

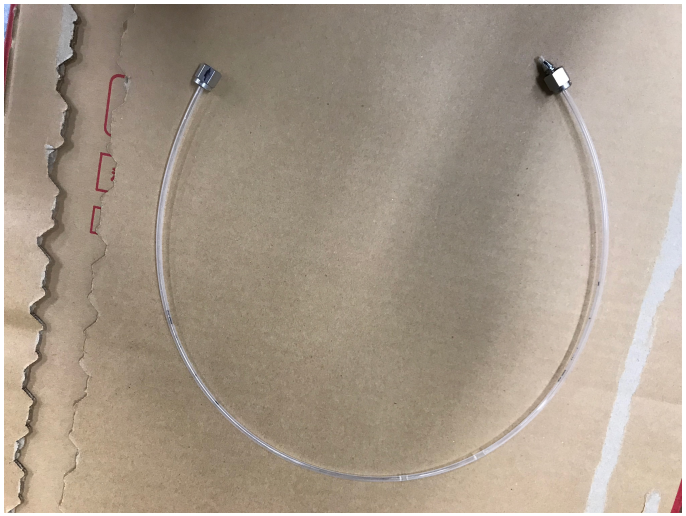
For stable operation

problem

accumlation of unknown liquid in the tube from cem

plan

- analysis of component
  - liquid trap ... etc



(a) tube

(b) enlarged view

outline

Garfield++ simulation

purpose

Decision of the best gas proportion

- ratio of the numbers of ion that reach cathode
- reappearance of the results of the past experiments

outline

summary

- We want to suppress delayed hit
- modification of gas system
  - We can use liquid for MWPC gas
  - We should solve a problem for stable operation
- Garfield++ simulation

Back up

Table: parts

22-SHV-50-0-2	PFA PTFE	564R30GAT10	epoxy resin
HIF3BA-34PA-2.54DS	PBT	MOS1CT52A10R0F	
flat cable		film	
ERJ-8ENF2004V		WL-8-11	PBT
ERJPA3F1001V		AW106 HV953V	epoxy resin
CC1812KKX7RDBB103		conductive film	
22BNC-50-0-16	PFA PTFE	tygon tube	tygon
HTC-50-1-1,0.5/1.5,CEH50	XPE	LH-0425-M3	POM
heat shrink tube		SBD-J3-13	duracon
PM-14-20	PPS	SPA-M3-N	PENY
JX-2	PBT	SPE-M3-50-C-FT	PEEK
JK-1	nylon	SPS-M3X30-P	PPS
JM-1	nylon	PACK-SWSJJ8-3-0.5	polyacetal
DEBF33D103ZA2B	epoxy resin	viton sheet	viton
MF1/4CC1000F		resist substrate	
kapton tube	kapton	silicon sheet	silicon
nylon tube	nylon	urethan tube	urethan
CLN-658	conductive adhesive	006736	conductive adhesive
MR3863	conductive adhesive		