

Some Remarks on LC TPC Resolution Studies

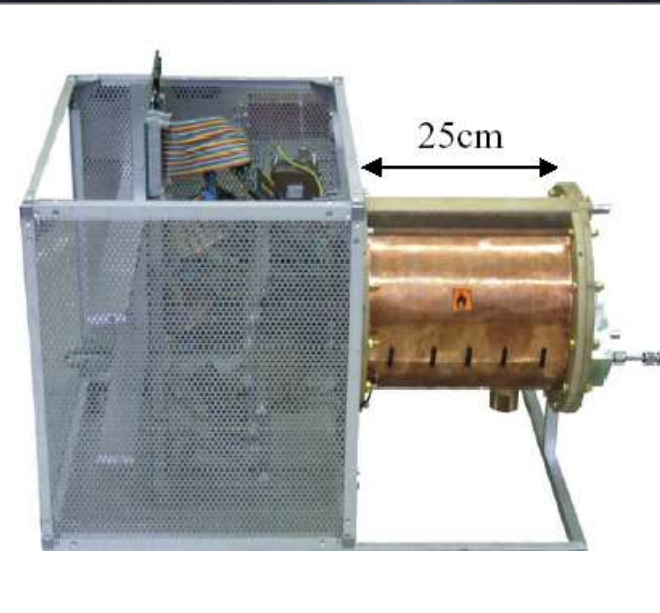
- Request for Comments -

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DESY

LC TPC Workshop
LAL, Orsay, France
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Achievements



Achievements

- Many groups have built TPCs with GEMs, Micromegas or wires and made them work
- Numerous interesting first results from the data presented during workshops

Problems of Resolution Studies

Comparisons between results of different groups are difficult:

- different pad geometries
- different analysis methods
- different sets of cuts
- (partly) different gases

Too many differences to (easily) check consistency

Need for Consistency Checks

Consistency checks needed to:

- convince ourselves
- convince review bodies
- eventually have a common basis for design decisions

Pad Geometries

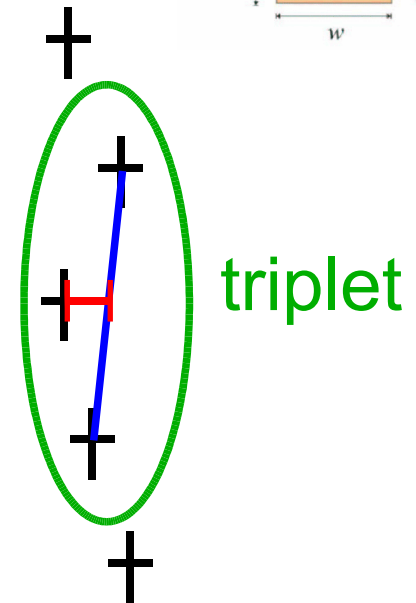
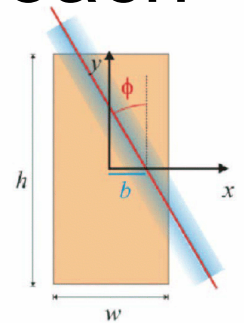
Note difference between pad size and pitch (~ 15 %):

Horiz. x vertical dimension	Spacing	Pad size	Pitch	Group
2 mm x 7 mm, 1.2 mm x 7 mm	0.2 mm	X	X	Victoria
2 mm x 6 mm				Hamburg
2 mm x 6 mm	0.3 mm	?	X	Aachen
1.27 mm x 15.5 mm, etc.			?	Karlsruhe
2 mm x 6 mm			X	Carleton
2 mm x 10 mm, 1 mm x 10 mm	0.3 mm	X	?	Berkeley/Orsay/Saclay
2 mm x 6 mm				Munich/KEK

In addition different pad alignments (staggered, non-staggered)

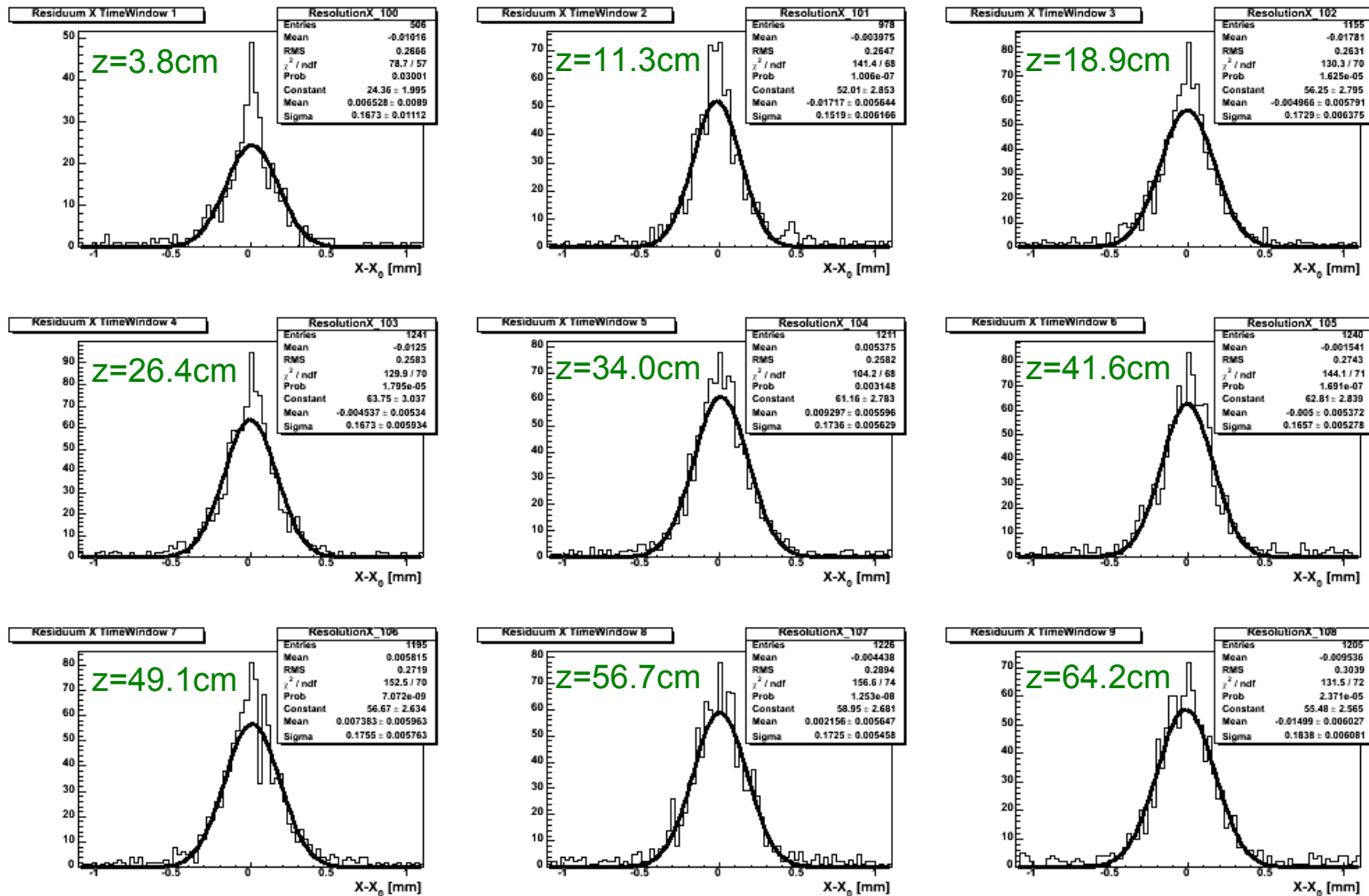
Analysis Methods

- modular reconstruction \leftrightarrow monolithic approach
hit finding, track finding, track fitting
- global track fit \leftrightarrow local triplet method
- different implementations
(including different ways of
exception handling (FADC overflows,
broken pads, numerical instabilities, ...), etc.)
- different definitions of resolution



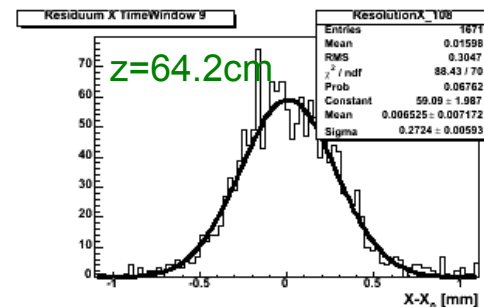
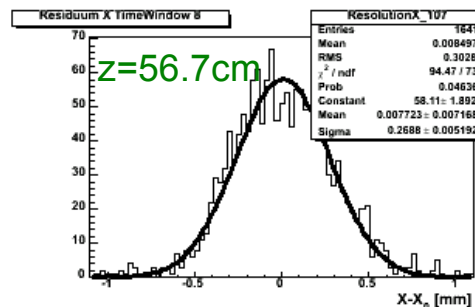
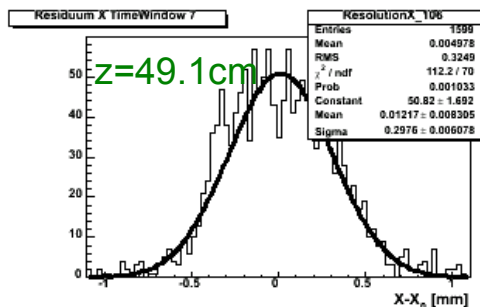
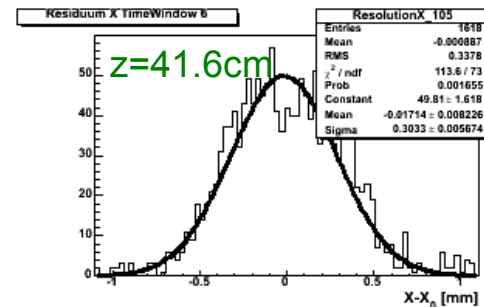
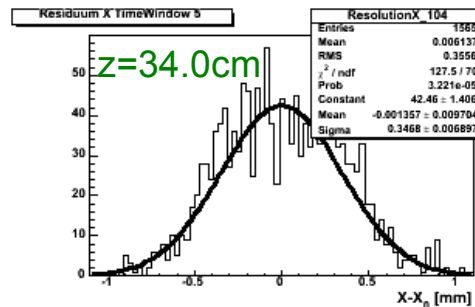
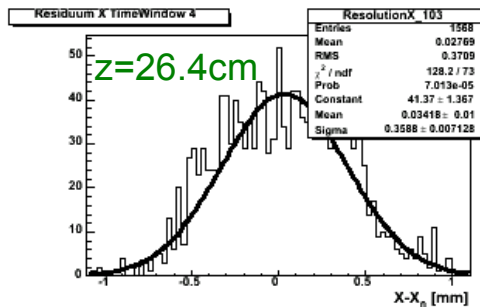
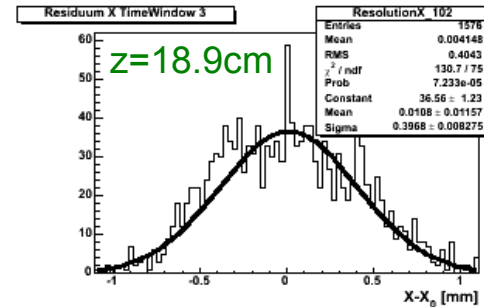
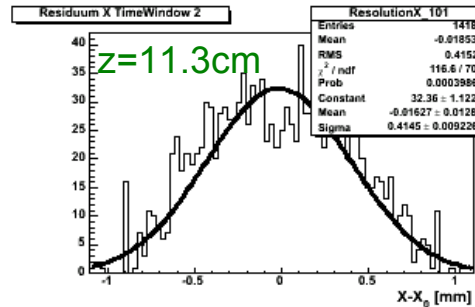
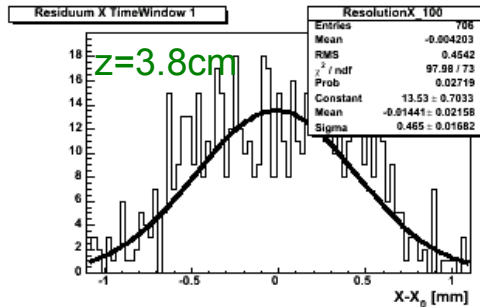
Definition of Resolution?

Residual distributions (2 mm wide, non-staggered pads, $B = 4$ T):



Definition of Resolution?

Residual distributions (2 mm wide, staggered pads, $B = 4$ T):



Cuts

Cuts have large influence on **resolution**:

90 μm - 160 μm (at short drift distances, $B = 4 \text{ T}$)

So far no consensus which cuts are legitimate

Useful: # tracks, ϕ angle, θ angle, horizontal position (no charge loss on left or right), # active rows, etc.

Prohibited: Any kind of cuts on charge sharing

Gases

Many different gas mixtures are in use:

- Ar-CH₄-CO₂ (93-5-2)
- Ar-CH₄ (90-10)
- Ar-CH₄ (95-5)
- Ar-CF₄ (97-3)
- Ar-IsoC₄H₁₀ (95-5)
- Ar-CO₂ (70-30)
- Ar-CO₂ (90-10)

Proposals

Start discussions about:

- What cuts are considered legitimate for a reference analysis?
The cuts must be universally applicable.
- What analysis method could serve as reference?
A consensus should cover a common definition of resolution and even exception handling.
- What is a reasonable pad geometry which could serve as a reference to which other geometries could be compared?
It must be reasonable for various gas candidates.

Proposals

- Is it sensible to exchange data sets between groups for cross-checks and comparisons? Data grid infrastructure might be useful for this.
- If yes, a common data format would be desirable (→ LCIO, *de facto* standard).
- A common modular reconstruction and analysis software might be fruitful (→ Marlin). A particular set of modules could serve as a reference analysis.
- Review references regularly and modify them if required.