Common Analysis Tools

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This talk is about analysis only.

Reconstruction is up to the groups.
Full reconstruction chains are available for both technologies.

Tracking is a common task.
Many new tools have become available during the last year:

- GBL + Millepede:
  LC-TOOL-2014-008, "Track fitting and alignment for a TPC with General Broken Lines", Claus Kleinwort

- Fast Hough Transformation:
  LC-TOOL-2014-006, "A track finding method for a TPC based on fast Hough transformation", Claus Kleinwort

Common Analysis

Goal: Common definitions, rules, cuts → comparable result plots

Cuts
- Single track events
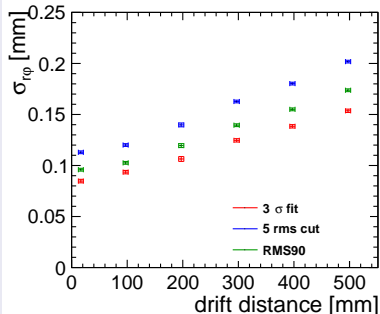- Number of hits on track > 80% of active rows

Performance Plots:
- Resolution
- Distortions
- Diffusion/PRF
- Hit Efficiency

Quality Plots: (a selection)
- Hit charge vs drift distance
- Over-range and dead channel hits
- Fraction of events left after cuts vs drift

Different definition of evaluating width of distribution for resolution:

→ large differences possible

New Common Analysis Tools

Common input: `lcio::Track`

Several processors to analyze the data:

- AnalysisCutSelectorProcessor
- TrackParametersDistributionProcessor
- HitQualityProcessor
- ChargeQualityProcessor
- DistortionPerformanceProcessor
- ResolutionPerformanceProcessor
- TripletResolutionPerformanceProcessor
- PRFPerformanceProcessor
- TrackHitEfficiencyProcessor

All available in $MARLINTPC/analysis.

Common svn Repository

Common svn repository for analysis results available to collaboration:

https://svnsrv.desy.de/desy/flctpcsw/public/LPDataAnaResults

- README with instructions
- Template for the analysis processors

Currently available data sets in the svn:

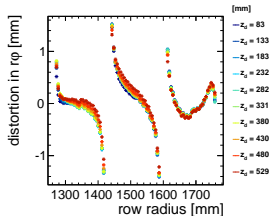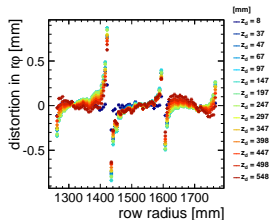| Module	B=0 T	B=1 T
Micromegas	2013 2014	2013 2014
Asian GEM	2012	2010 2012
DESY GEM	2013	2013

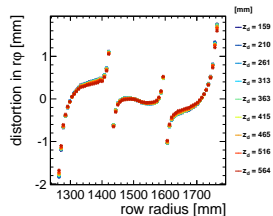Thanks to Peter, Junping and Felix for analyzing the data and making them available.
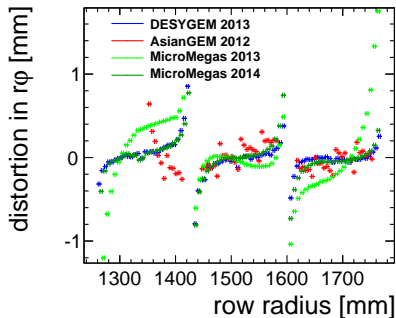
ASIAN GEM 2010/2012

MICROMEGAS 2013/2014

DESY GEM 2013
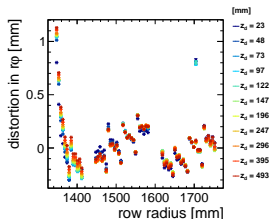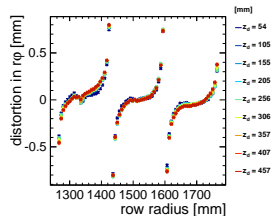
Distortion in $r\varphi$
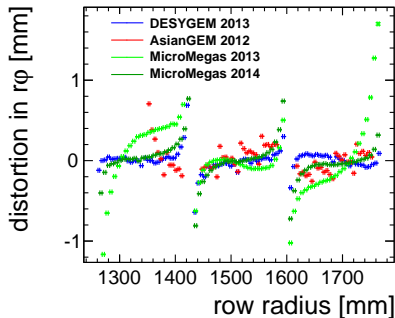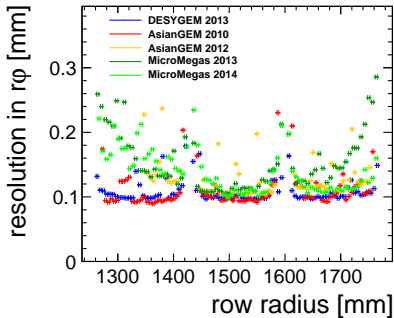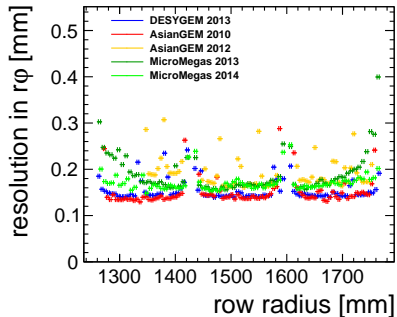
small drift

large drift

Asian distortion are mirrored, due to different y axis direction.

Larger distortions and offsets in Micromegas data 2013. What changed (field shaper, gearfile)? Has the potential to learn something here.
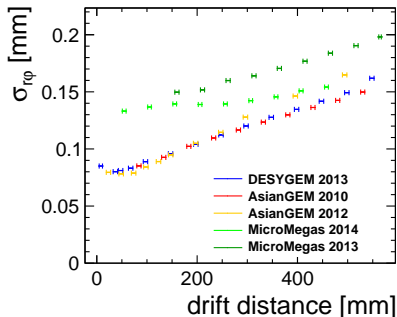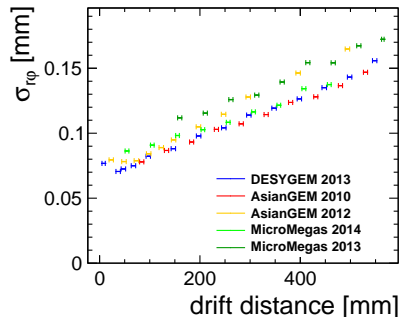
Resolution in $r\varphi$ vs Row
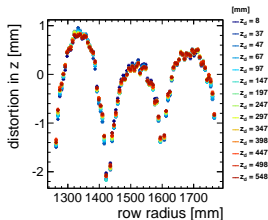

small drift

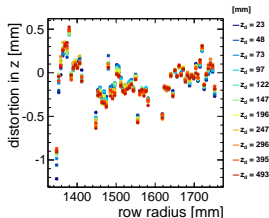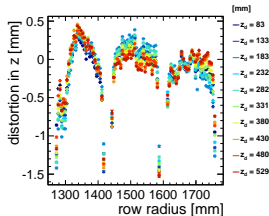large drift

Mean all rows

Best row

Distortions introduce track angle which effects resolution at the border of the modules.
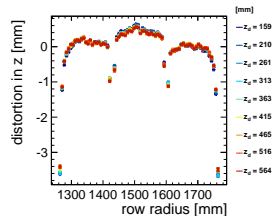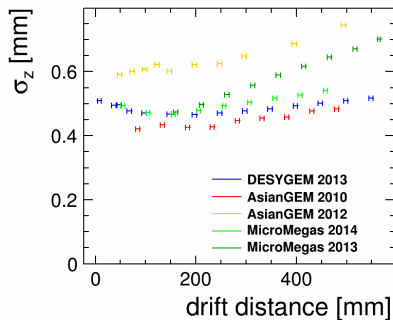
Distortion in z

ASIAN GEM 2010/2012

MICROMEGAS 2013/2014

DESY GEM 2013
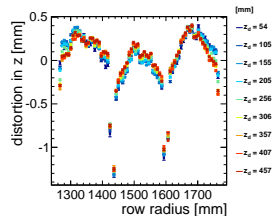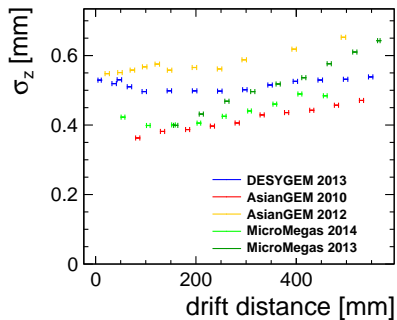
Mean all rows

Best row

Also z resolution shows large reaction to gain.
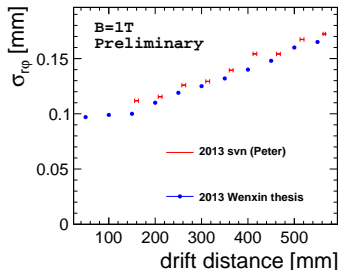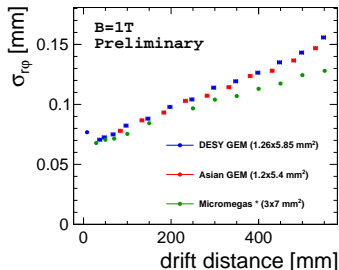Also here the slope in z resolution is different in MM 2013 and 2014 data.

Resolution Discussion

Important Step: Run MM 2010 data through common analysis!

Two possible outcomes:

1. Agreement: Great → confidence in common analysis and MM data set and comparable results
2. Disagreement: Find out why
   - Definition or cut in analysis → easy fix, understandable
   - Maybe already in the reconstruction → more work needed

Personal opinion:

- Resolution very similar
- Difference smaller than variation within data sets of one technology
- Single point resolution will not be the deciding plot for technology choice

B=1T Preliminary

- DESY GEM (1.26x5.85 mm²)
- Asian GEM (1.2x5.4 mm²)
- Micromegas * (3x7 mm²)

B=1T Preliminary

- 2013 svn (Peter)
- 2013 Wenxin thesis
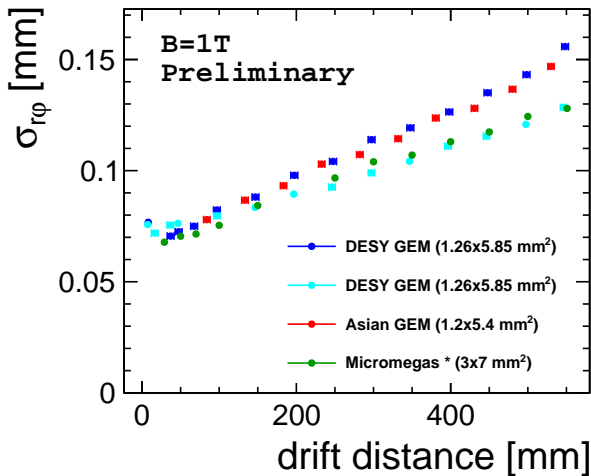
Not only common analysis but also common data runs are important for a fair comparison (e.g. drift field)!

Missing Items

- Pad response correction for GEMs
- Treatment of dead and overrange channels in a hit
- Detailed simulation of resistive anode, in view of double hit resolution (both rphi and z)

Next Steps

- Correction of Distortion: only poor mans solution so far.
  $\rightarrow$ External reference essential
- Simulation of LP with the known field maps to get a distortion map for correction
- Calibration: Difference in time order of runs can be seen
  $\rightarrow$ influence of temperature, pressure, etc...

In my opinion made good progress on the analysis site this year.

Initiated at the KEK analysis workshop many common tools where developed.

We took first steps to producing comparable results with well defined procedures.
It is important that we process all data sets with these tools as soon as possible!

But we also have some way to go in terms of corrections!