Dear reviewers and editor:

Thank you for the issues you have addressed and the changes you recommended. I have viewed and responsed all the comments below and added them to my revised manuscript.

Reviewer: 1

Thank you for your approval.

Reviewer: 2

Q:Throughout the paper the assumption has been made, apparently, that an event causes a signal on a strip, thus on one strip only. Since this assumption is not argued nor clarified, the bases of the 'reconstruction' vanishes.

A: If two or more adjacent anode strips are directly encoded together, the decoding will have faults because the signal has a certain width and more than one strip is hit. To solve this problem, Packet Coding techniques are proposed. As shown in attached Fig. 1, the adjacent anode strips are assigned to different groups, which are encoded and decoded individually. In this way, an event with a certain width will not hit more than one strip of one group. The number of group is decided on the width of the signal and the width of the strip. Besides, by using Packet Coding method, higher position resolution can be obtained by applying finer strips.

This part has been added into the latest revision.

Q: A strip signal is split in two parts with a certain ratio. This ratio has probably an optimum, since it does not work if the ratio is 1 or 0. This issue is not addressed at all.

A: This part has been added in the paper.

In order to study the relationship between the two induced strips, we used ANSYS's software Designer and SIwave to simulate magnitude of induced signals. The relationship between the larger signal and the smaller signal at different width ratios have been shown in attached Fig. 2. It's necessary to ensure that not only the signals from the two induced strip have enough difference, but also the smaller signal can be distinguished easily from crosstalk and noise. It's reasonable to take 2 as the ratio of the two strips, considering the production process of Printed Circuit Board (PCB). Attached Fig. 3 shows the output signal of each channel when the width ratio is 2. It can be seen from Fig. 3 that the smaller signal has enough recognition degree from crosstalk. Of course, it’s much larger than the noise.

Q:From the raw data of an event in fig 4, the signal distribution over the strips is claimed to be possible. This reconstructed event should have been shown. From that, the width of the distribution over the strips would at least have been indicated.

A: Attached Fig. 4 shows the signals recorded on all 15 electronic channels when an event hit. There are 47 anode strips, which are divided into 3 groups to be encoded and decoded individually, and the width of each strip is 1.07mm. The baseline noise is about 2.5fC. We take 2σ of 5fC as the noise threshold to filter the valid signals. It can be inferred that the hit channels are channel 2, channel 4, channel 12 and channel 14. Channel 2 and channel 4 belong to group A, from which the hit strip of strip 25 can be decoded. The Channel 12 and channel 14 means that strip 26 is hit, too. According to the distribution of charge on the two strips, the true hit point is strip 25.25, and the width of the event is about 2 strips, which means 2.14mm.

Q: Fig. 5 shows spatial resolution, but is has no meaning since no info is available

about issues determining this spatial resolution. The same is true for figs 6 & 7.

A: This part has been added to revision.

Attached Fig. 5 shows the decoded spatial resolution result of the detector. The width of anode strip is 1.07mm. A large number of statistics have been made for a fixed X-ray incidence location. The root-mean-square (RMS) of the statistical histogram is 1.69 strips, which mean the resolution is 1.8mm.

Attached Fig. 6 shows the results of linearity in the position scanning test. The test setup has been shown in Fig. 6 in latest version. During the test, the detector was moved with a step of 0.5mm every time. The X-axis of Fig.6 represents the No. of the scanning, and Y-axis means the decoded anode strip of each time. P0 shows the slope of the fitted red line, which means the step of every movement is 0.464 strips (0.496mm). It's very close to the ideal step of 0.5mm.

Attached Fig. 7. shows the variety of spatial resolution on every position during scanning test. Fig. 7 has been cancelled since it does not have much help to this paper.

Reviewer: 3

Q:Page1, In the footnote, you should show the authors’ affiliations.

A: The authors’ affiliations have been added in the footnote:

“Shubin Liu is with State Key Laboratory of Particle Detection and Electronics, University of Science and Technology of China, No.96, Jinzhai Road, Hefei, Anhui, China (e-mail: liushb@ustc.edu.cn).”

Q:Page 1, right, line around 22,

“Thick GEM, and verification …”

should write like this “Thick Gas Electron Multiplier (THGEM), and verification …”

A: This place has been rewrite.

“Thick Gas Electron Multiplier (THGEM), and verification”

Q:Page2, left, line around 6

“could be uniquely decoded as seen in Table I”

should be “Could be uniquely decoded as seen in Table I.”

Q:Page2, left, line around 59,

“According to the Table 2,”

should be “According to the Table II”

A: This place has been rewrite.

“According to the Table II”

Q:Page2, right, line around 39,

“As shown in Fig.3., verification tests …”

should be “As shown in Fig. 3, verification tests …”

A:This place has been rewrite.

“As shown in Fig. 3, verification tests …”

Q:Page2, right, line around 40,

“THGEN detector using a 8keV Cu X-ray and Ar/iC4H10 (97:3) gas mixture.”

This sentence is very confusable. You should separately explain the gas used in THEGEM detector, and the X-ray source.

A: This place has been rewrite.

“As shown in Fig. 3, verification tests were carried out on a THGEM detector, which is filled with Ar/iC4H10(93:7) gas mixture. A 100 μm slit in a thin brass sheet was used to produce a miniaturized X-ray beam.”

Q:Page2, right, line around 55,

“platform was used for the postion scanning test.”

should be “ platform was used for the position scanning test.”

A:This place has been rewrite.

“platform was used for the position scanning test.”

Q:Page2, Fig.3.

In the picture, you show “X-ray”, but it should be written as “X-ray source” .

A: This figure has been modified, as shown in attached Fig. 8.

Q:Page 3. from left line 59 to right line around 3,

“channel 2 and 4” … “the detector is 0.4 strip (0.43mm).”

around here, I find English mistakes. Please correct.

A: This place has been rewrite.

“The channel 2 and 4 are hit, and it can correctly decode the hit position by the encoding formula.”

Q:Page 3, right around 6,

“position scanning test”, what is the position scanning test? It is the same as verification test as explained before?

A: Explanation

The test setup has been shown in attached Fig. 8. During the test, the detector was moved with a step of 0.5mm every time. Attached Fig. 9 shows the results of linearity in the position scanning test. The X-axis of Fig.9 represents the No. of the scanning, and Y-axis means the decoded anode strip of each time. P0 shows the slope of the fitted red line, which means the step of every movement is 0.464 strips (0.496mm). It's very close to the ideal step of 0.5mm. “

Q: In Fig 4. what is the unit of Y axis. Please show on the figure or explain in the text.

A:The unit of Y-axis is fC and the unit of X-axis is the No. of electronic channel, as shown in attached Fig. 10.

Q: Fig 5. It seems, you simple fit the Gaussian function. However, this spectrum is not a Gaussian distribution. In general, you should use RMS (root-mean-square) to discuss resolutions.

A: I have added the RMS in the figure to discuss the resolutions. The figure is shown at the next answer.

Q:What is the meaning of “events/n” in the Y-axis, and “position/strip” in the X-axis? Please explain.

A: The X-axis of attached Fig. 11 means the No. of decoded strip. The unit event/n of Y-axis means the statistical counts of event on each anode strip. The histogram of Fig. 11 is to show the position resolution if illuminating the same location of the detector with X-rays. The RMS (root-mean-square) of position resolution is 1.69 strips, which means 1.80mm.

Q: Fig 6.

what is the meaning of “times” in the X-axis? What is the unit of Y-axis, mm? or the strip number? What is the red line? What is the values of p0,p1 in the figure?

A: In attached Fig. 8, the “times” in the X-axis means the number of scanning time. We move the detector 0.5mm every time. The Y-axis means the decoded strip number. The width of the strip is 1.07mm.P0 shows the slope of the fitted red line, which means the step of everymovement is 0.464 strips (0.496mm). It's very close to the real step of 0.5mm.

Q: what is the blue line?

Fig 7, what are the X and Y axes?

A: Attached Fig. 7. shows the variety of spatial resolution on every position during scanning test. Fig. 7 has been cancelled since it does not have much help to this paper.

Q:Before Conclusion,

I couldn’t any discussion. For example, “The test results indicate that the method can correctly decode the hit position, and have a good spatial resolution and linearity in its position response.” is written in the conclusion. You have to quantitatively describe “how good the spatial resolution is?” using some numerical numbers or some other ways.

A:The quantitative resolution has been added to the conclusion.The decoding accuracy rate which is used to describe the performance of this encoding method has been added to the article.

“The test results indicate that the method can decode the hit position. If the threshold is set to twice the noise, the correct rate of decoding can reach 94%. Concerning the correct rate of decoding, the RMS of the position resolution is 1.69 strips, which means 1.808mm.”

Q:In the references, you should include the paper of Bin-Xiang Qi et al., Chinese Physics C 40, 056102 (2016). This work is quite similar to yours. Please explain the difference between previous paper and your paper to us (editors and reviewers).

A: The research of this method is very different from that in Bin-Xiang Qi’s paper (Bin-Xiang Qi et al., Chinese Physics C 40, 056102 (2016)), though they have some similarities in coding ideas and verification tests. This paper shows induced encoding method, while that paper introduced direct encoding method.

The most important difference is that these two methods have different bases of assumptions. This paper is based on the assumption that the event hit only one anode strip. If the event hit more than one strip, the decoding will have fault. While at the same time, the other method is based on the assumption that one event hit more than one strip. Only in this case can the event be decoded correctly.

Another difference is that the anode plates have different structures. As is shown in attached Fig. 12, the direct encoding method's anode strip is connected to amplifiers directly, but in my method, the induced strips instead of anode strip are connected to amplifier, as shown in attached Fig. 13, which means the induced charge is sent to amplifier, not the charge from detectors. What's more, the encoding and decoding of the two methods are different. In my method, n electronic channels can handle up to "A2 n" strips, but his method handles up to "C2 n" strips.

By the way, Bin-Xjiang Qi and I belong to a team and have the same advisor. We all study the coding direction, but the coding methods are different.

Editor's Comments

Editor: Bohm, Christian

Comments to the Author:

I am sorry but unless you find good reasons to refute the concerns of the reviewers we must reject your paper in the next round. It is especially the question of what happens if two adjacent strips are hit by the same event, which happens most of the time.

A: I have proposed Packet Coding techniques to solve the problem.

“ If two or more adjacent anode strips are directly encoded together, the decoding will have faults because the signal has a certain width and more than one strip is hit. To solve this problem, Packet Coding techniques are proposed. As shown in Fig. 1, the adjacent anode strips are assigned to different groups, which are encoded and decoded individually. In this way, an event with a certain width will not hit more than one strip of one group. The number of group is decided on the width of the signal and the width of the strip. Besides, by using Packet Coding method, higher position resolution can be obtained by applying finer strips.

This part has been added into the latest revision.”