RISING Designs Status for Steering Committee Meeting on 7/10/02

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This paper gives a brief summary of the design status following several more months of arranging the Cluster detectors in various configurations and detailing all the facets of the Cluster detectors.

The paper of 11/7/02 posed the following questions.

1) Can we remove the triangular flanges?
Answer. Yes. One flange was cut and removed at Koln and is now back in IReS. Therefore they can be removed if required.

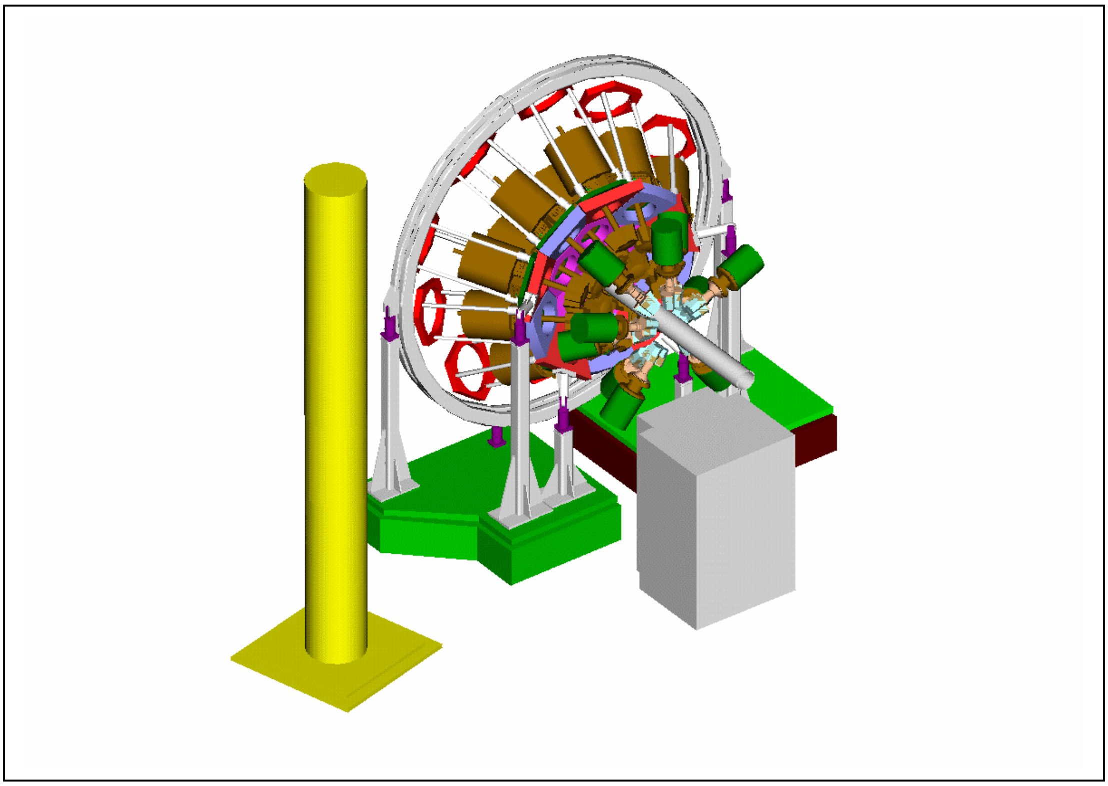
2) Is the position of the dummy connector box the same for all detectors?
Answer. Yes.
3) Confirmation of the exact weight of the Cluster detector
Answer, 66kg.

Options using and removing were considered. J.Eberth has advised that for the manipulation of the Clusters a three point support was required. We have since investigated using the existing manipulator used in IReS on Euroball.

The current idea is now to use the triangular flanges to hold the detectors and enable the existing manipulator (or one very similar) to be used.

The Cluster in the 2nd and 3rd rings will move from 700mm to 1400mm on a three-rod system.

The proposed structure is shown in the picture below.



This results in the following configuration:

Ring 1 @ 15.9^{o} and 700mm
Ring 2 @ 33^{o} and 700mm
Ring 3 @ 36^{o} and 700mm

All the distances quoted are the closest. Rings 2 and 3 will allow distances up to 1400mm.

Performance:

Ring	Efficiency (%)	Resolution (%)
1	1.0	1.00
2	0.91	1.82
3	0.89	1.93
Total	2.81	1.56

The central crystal in the Clusters in the 2nd and 3rd ring has to be removed to 1295mm and 1372mm, respectively for 1% energy resolution at v/c = 43%.

Table 1.
Performance of an array with the Cluster in their 1% energy resolution positions and the Miniball detectors at 400mm.

Detector type	Number of dets	Angle	Distance mm	Energy Resolution %	Efficiency %
Cluster	5	15.9	700	1.00	1.00
Cluster	5	33	1295	1.01	0.28
Cluster	5	36	1372	1.01	0.24
Total Cluster				**1.00**	**1.52**
Miniball	5	46	400	0.35	0.87
Miniball	3	85	400	0.37	0.36
Total Miniball				**0.35**	**1.23**
Total				**0.71**	**2.75**

Table 2.
Performance of an array with the Clusters in the 2nd and 3rd rings moved closer to the target, 700mm.

Detector type	Number of dets	Angle	Distance mm	Energy Resolution %	Efficiency %
Cluster	5	15.9	700	1.00	1.00
Cluster	5	33	700	1.82	0.91
Cluster	5	36	700	1.93	0.89
Total Cluster				**1.56**	**2.81**
Miniball	5	46	400	0.35	0.87
Miniball	3	85	400	0.37	0.36
Total Miniball				**0.35**	**1.23**
Total				**1.19**	**4.04**

Table 3.
Performance of an array with the Clusters in the 2nd and 3rd rings moved closer to the target, 700mm and the Miniball detectors moved to 170mm and 120 mm in the 4th and 5th rings, respectively. This may be possible in certain experiments where the Atomic background is not as severe a problem (lower Z beam, thinner target).

Detector type	Number of dets	Angle	Distance mm	Energy Resolution %	Efficiency %
Cluster	5	15.9	700	1.00	1.00
Cluster	5	33	700	1.82	0.91
Cluster	5	36	700	1.93	0.89
Total Cluster				**1.56**	**2.81**
Miniball	5	46	170	0.7	4.01
Miniball	3	85	120	0.94	2.99
Total Miniball				**0.8**	**7.01**
Total				**1.02**	**9.91**

RISING Designs Discussion document 11/7/02

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This paper gives a brief summary of the design status following several months of arranging the Cluster detectors in various configurations. The original design prior to the inclusion of the triangular flanges and the connector boxes and connectors is also attached.

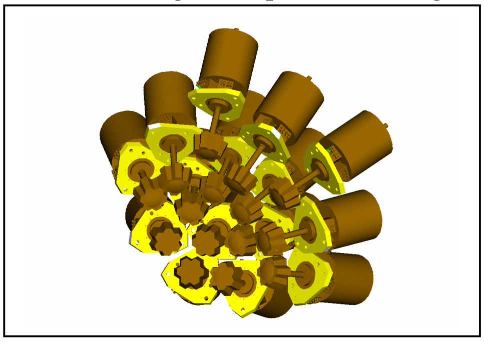
A more detailed summary of the steps in the design is given in the emails I have sent over the last few weeks.

We had to consider the Cluster detectors with one of the Euroball flanges still attached to the cryostat. This triangular flange cannot be removed intact without dismantling the whole cryostat, which is a long and complicated task. Therefore, we looked at keeping this flange, which meant moving the angular positions of the detectors.

The best options at this stage were

A) 5 detectors at 15 degrees at 732mm
   5 detectors at 26.5 degrees at 880mm. Note the second ring overlaps the first ring.
   5 detectors at 34 degrees at 760mm.

B) 5 detectors at 15 degrees at 732mm
   5 detectors at 31 degrees at 732mm.
   5 detectors at 34 degrees at 760mm.

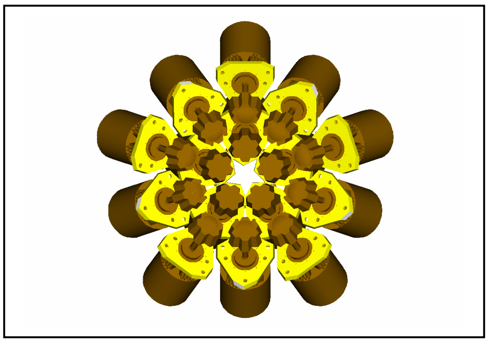


At this stage option B seemed the best giving the greater efficiency.

The next problem we considered was the connector boxes. There are 8 boxes with several connectors attached. These were modeled and found to cause additional clashes.

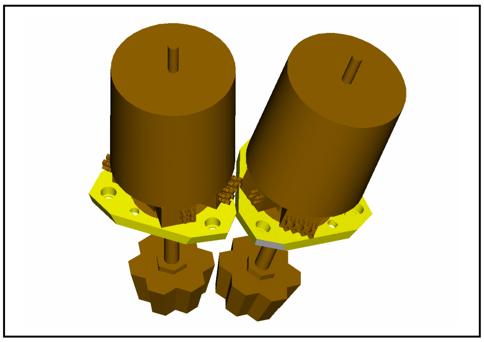
The arrangement of the detectors to get the greatest efficiency was confirmed to be:

Ring 1 @ 15° and 732mm
Ring 2 @ 31° and 732mm
Ring 3 @ 34° and 760mm



Performance:

Ring	Efficiency (%)	Resolution (%)
1	0.92	0.91
2	0.85	1.67
3	0.77	1.72
Total	2.55	1.41



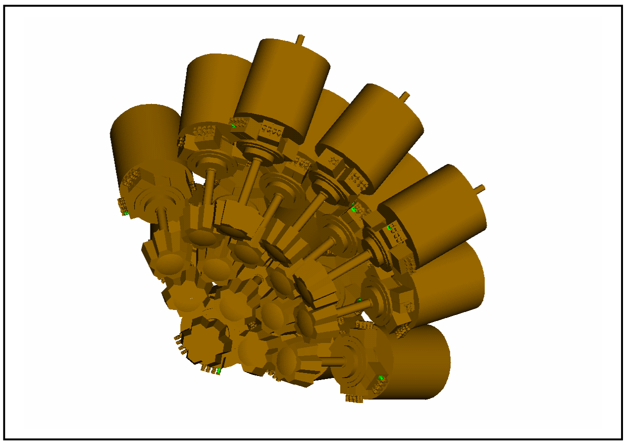
This configuration has the dummy connector box (no connectors present) adjacent to the neighbouring detector in the first ring.

Form a mechanical point of view it is very advantageous to remove the triangular flanges since this make s the connection to the external support frame simpler and easier to design. However, some design work was performed to investigate how to make this connection with the triangular flanges still in place.

We suggested that it may be possible to remove the flanges by cutting a 40mm slot in one of the sides if these flanges. The flanges could be reused in a Euroball configuration if the gap is reinforced.

Juergen Eberth is investigating this option at Koln and indicated (10/7/02) that this should be possible.

Therefore, we have removed the triangular flanges and obtained the following configuration. This is close to the original design.



Ring 1 @ 15^{o} and 700mm
Ring 2 @ 28.5^{o} and 700mm
Ring 3 @ 34^{o} and 680mm

All the distances quoted are the closest. Rings 2 and 3 will allow distances up to 1400mm.

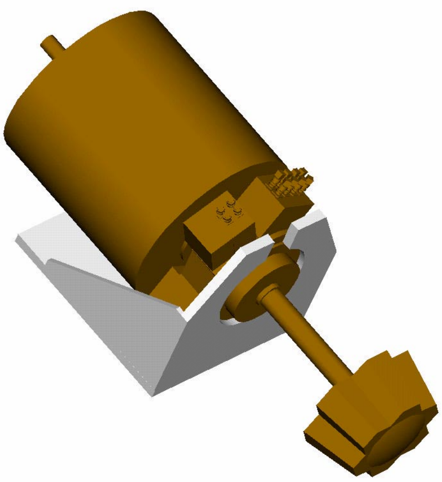
Performance:

Ring	Efficiency (%)	Resolution (%)
1	1.01	0.95
2	0.94	1.64
3	0.96	1.91
Total	2.9	1.49

On the meeting on the 16th July the following questions to be discussed and decisions made.

4) Can we remove the triangular flanges?
5) Is the position of the dummy connector box the same for all detectors?
6) Confirmation of the exact weight of the Cluster detector
7) Can we hold the cryostat as proposed in drawing below?

Answer to these will enable progress on the design to be much faster.



The Original Design

The preferred design as given in the fast beam configuration document is the following:

Ring #1 5 Clusters	@ = 15^0	distance to target fixed at 680 mm
Ring #2 5 Clusters	@ = 26.5^0	distance to target variable 680 –1400 mm
Ring #3 5 Clusters	@ = 34^0	distance to target variable 680 –1400 mm
Ring #4 5 Miniball	@ = 46^0	distance to target variable 180 – 500 mm
Ring #3 5 Miniball	@ = 85^0	distance to target variable 180 –500 mm

A schematic of the detector layout is shown in figure 1.

The performance of RISING is calculated for a 1.3MeV γ ray emitted from a recoil moving at v/c = 0.43. In these calculations the velocity spread in the target and the recoil cone have been ignored. The results are summarised in table 1-3. The total energy resolution is a weighted average energy resolution scaled by the efficiency.

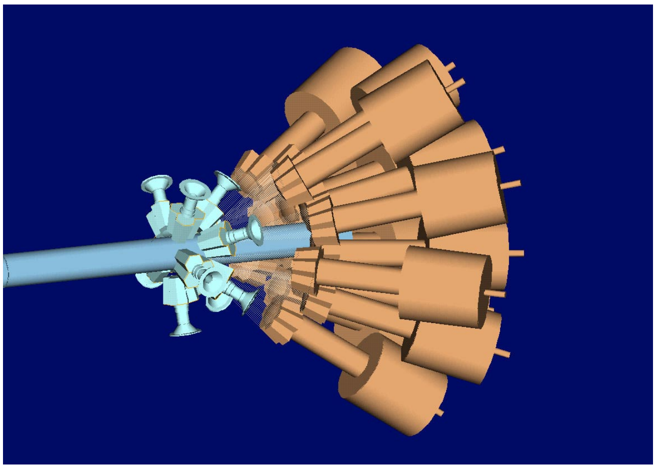


Figure 1. Schematic layout of the Cluster and Miniball detectors in the fast beam Rising configuration. A 160mm diameter beam pipe passes through the array.

Table 1.
Performance of an array with the Cluster in their 1% energy resolution positions and the Miniball detectors at 400mm.

Detector type	Number of dets	Angle	Distance mm	Energy Resolution %	Efficiency %
Cluster	5	15	680	0.98	1.06
Cluster	5	26.5	1119	0.99	0.38
Cluster	5	34	1369	0.98	0.25
Total Cluster				**0.98**	**1.69**
Miniball	5	46	400	0.35	0.87
Miniball	3	85	400	0.37	0.36
Total Miniball				**0.35**	**1.23**
Total				**0.72**	**2.93**

Table 2.
Performance of an array with the Clusters in the 2nd and 3rd rings moved closer to the target, 700mm.

Detector type	Number of dets	Angle	Distance mm	Energy Resolution %	Efficiency %
Cluster	5	15	680	0.98	1.06
Cluster	5	26.5	700	1.55	0.95
Cluster	5	34	700	1.86	0.9
Total Cluster				**1.44**	**2.92**
Miniball	5	46	400	0.35	0.87
Miniball	3	85	400	0.37	0.36
Total Miniball				**0.35**	**1.23**
Total				**1.11**	**4.15**

Table 3.
Performance of an array with the Clusters in the 2nd and 3rd rings moved closer to the target, 700mm and the Miniball detectors moved to 170mm and 120 mm in the 4th and 5th rings, respectively. This may be possible in certain experiments where the Atomic background is not as severe a problem (lower Z beam, thinner target).

Detector type	Number of dets	Angle	Distance mm	Energy Resolution %	Efficiency %
Cluster	5	15	680	0.98	1.06
Cluster	5	26.5	700	1.55	0.95
Cluster	5	34	700	1.86	0.9
Total Cluster				**1.44**	**2.92**
Miniball	5	46	170	0.7	4.01
Miniball	3	85	120	0.94	2.99
Total Miniball				**0.8**	**7.00**
Total				**0.99**	**9.92**