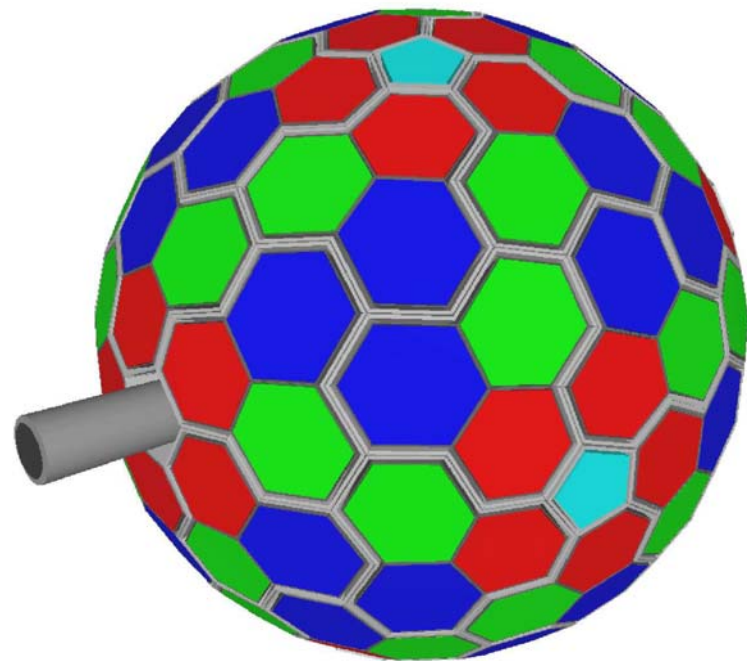


AGATA

Jürgen Gerl, GSI

4π segmented Ge detector shell
17 cm inner radius
80% Ge solid angle
12 regular pentagons
180 irregular hexagons (3 types)



Advanced
Gamma
Tracking
Array

Photo-peak efficiency	P_{ph} ($E=1.0$ MeV, $M_{\gamma}=1$, $\beta<50\%$)	50%
	P_{ph} ($E=1.0$ MeV, $M_{\gamma}=30$, $\beta<50\%$)	25%
	P_{ph} ($E=10$ MeV, $M_{\gamma}=1$)	10%
Peak-to-total ratio	P/T ($M=1$)	60%
Angular resolution	$\Delta\theta_{\gamma}$	$< 1^{\circ}$
Event rates	for $M_{\gamma}=1$	3 MHz
	for $M_{\gamma}=30$	0.3 MHz

Future Gamma Array

Increase sensitivity by $10^2 \dots 10^3$

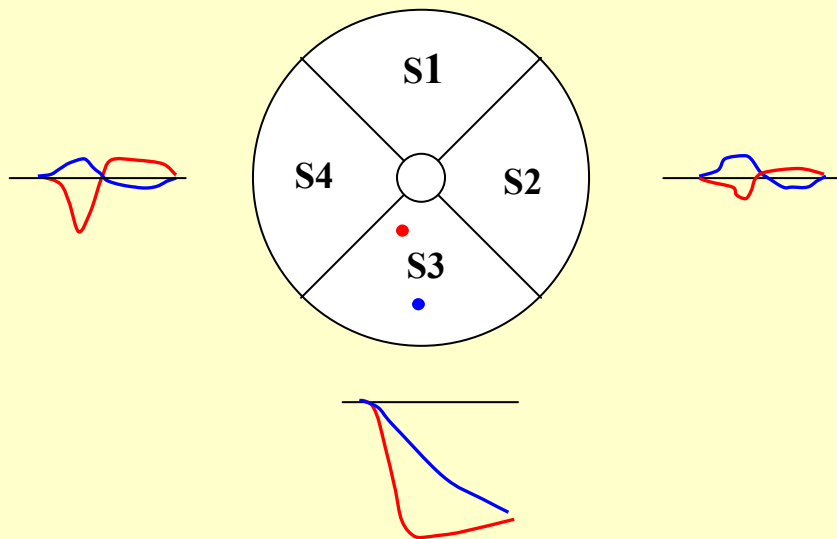
- Increase detection efficiency
- Disentangle multiple hits
- Determine first interaction point
- Increase count rate



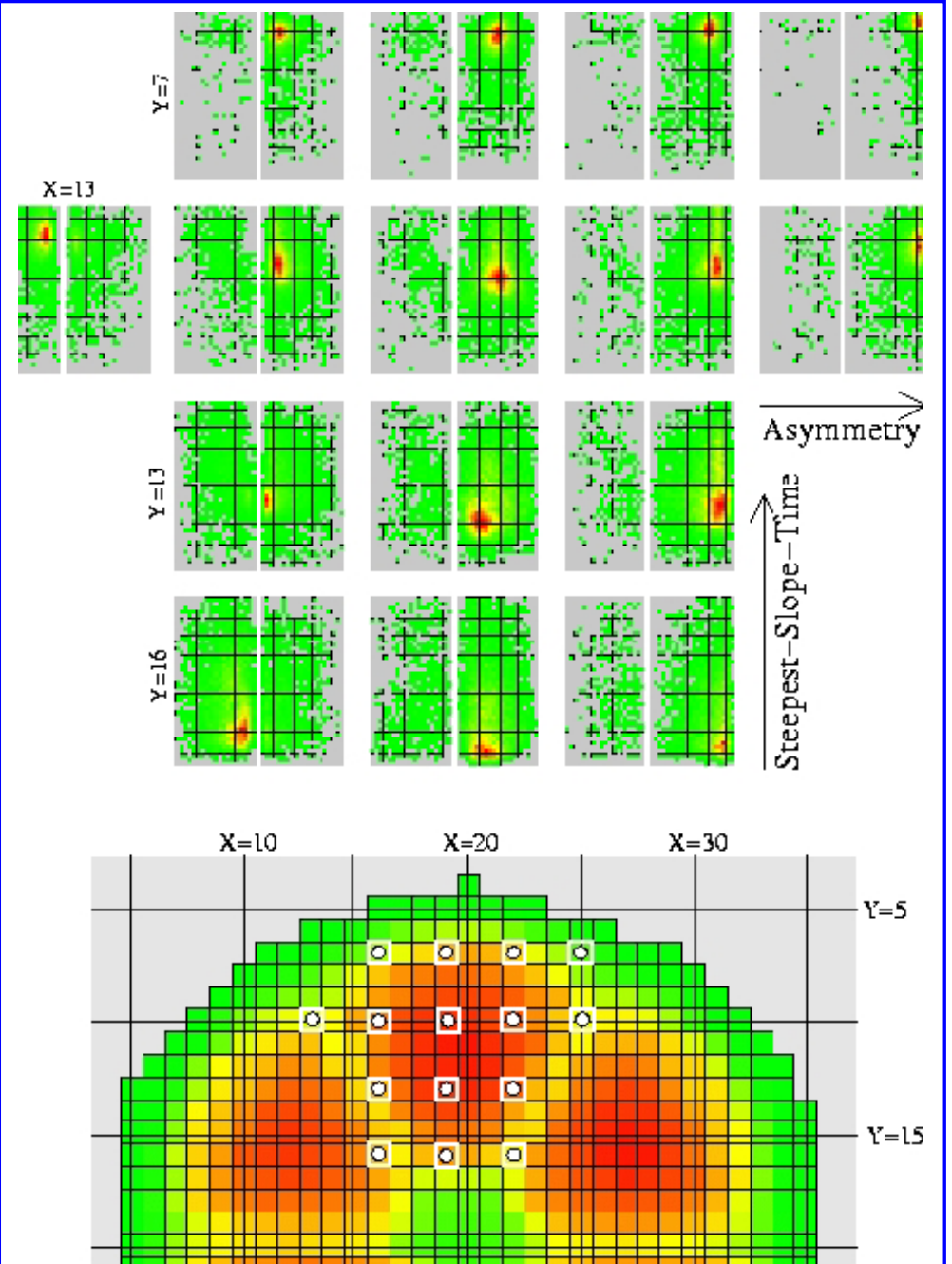
**Ge shell
 γ -ray tracking**

Pulse Shape Analysis

Segmented detector signals

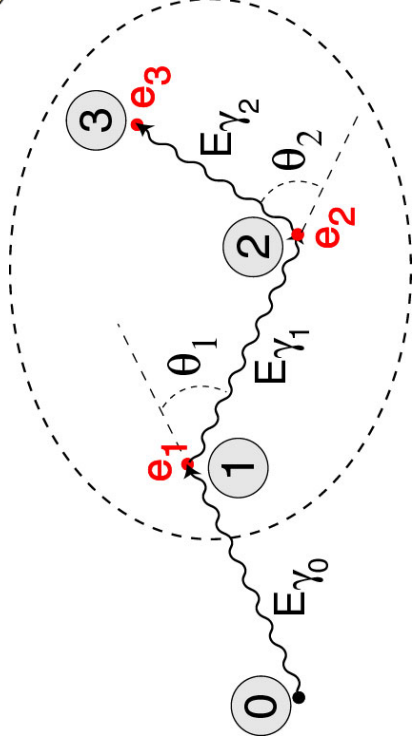
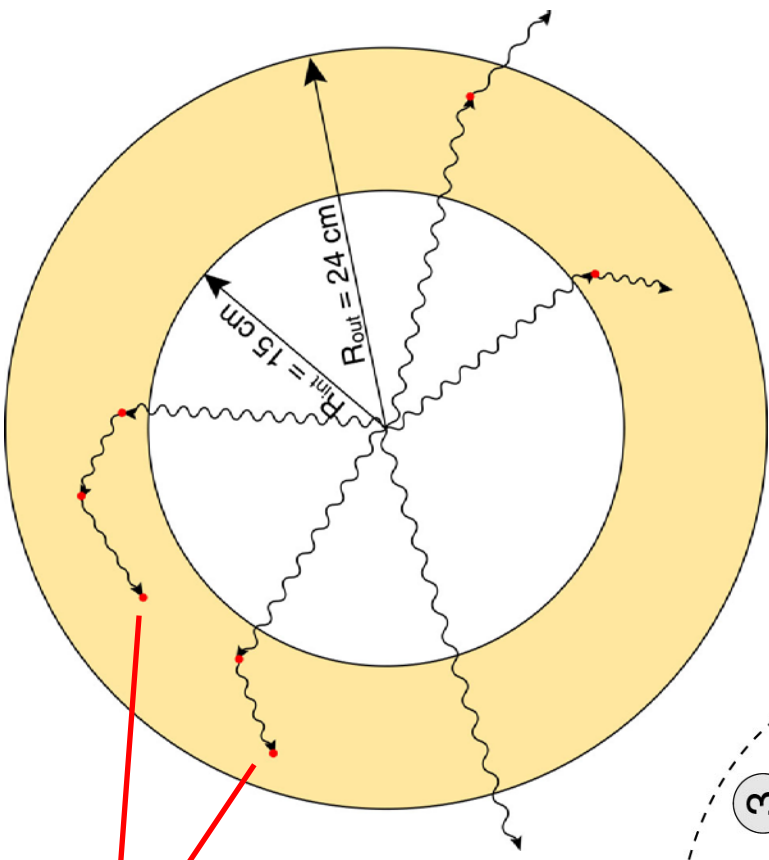


Radius: S3 signal rise time
Azimuthal angle: $S4-S2/(S4+S2)$ Asymmetry



γ -Multiplicity $\leftrightarrow$ Multiple Interactions

Individual γ -ray or
Compton scattering?



$$E_{\gamma_{N+1}} = \frac{E_{\gamma_N}}{1 + \frac{E_{\gamma_N}^2}{m_0 c^2} (1 - \cos \theta_{N+1})}$$

Compton scattering

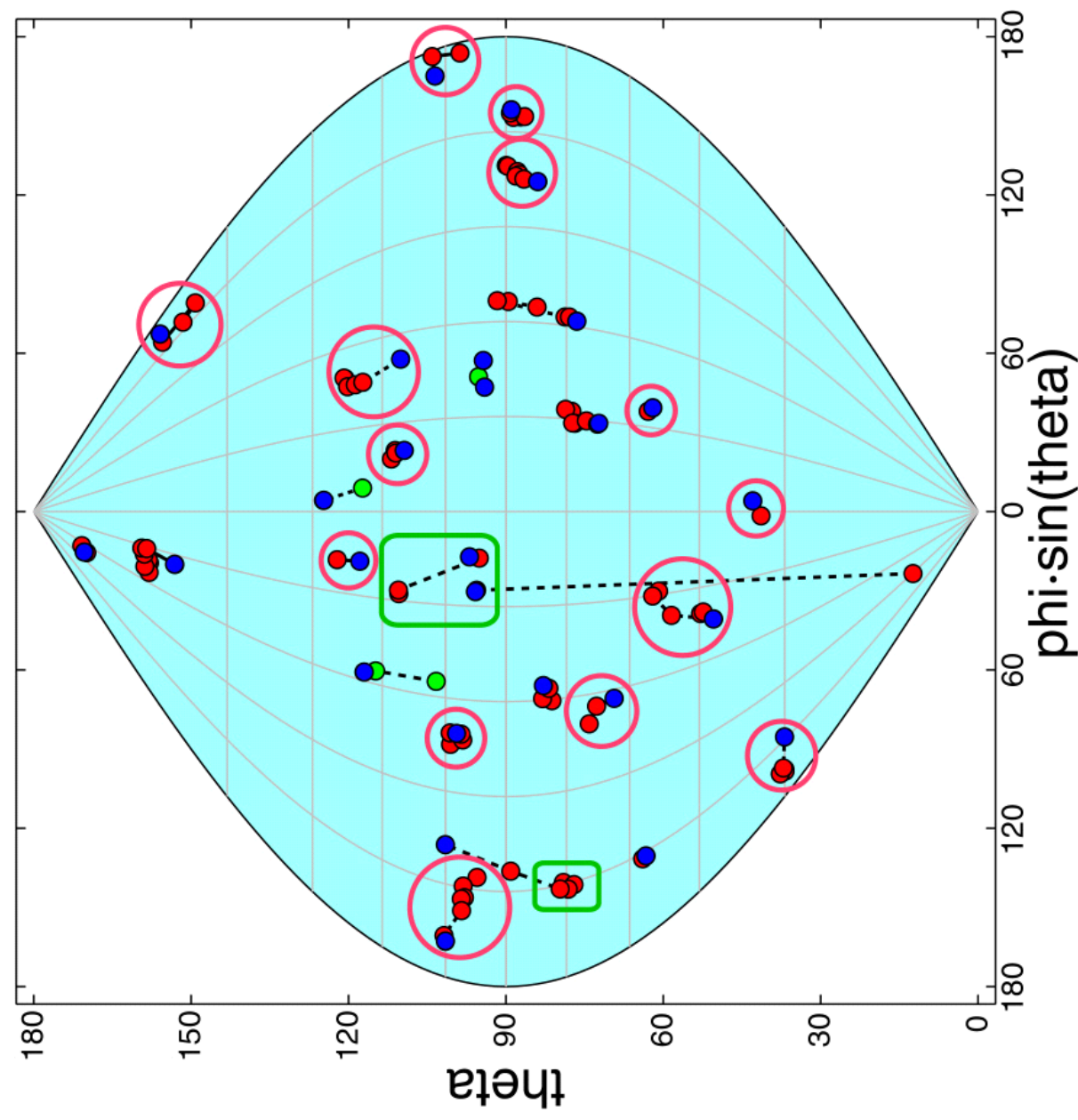
$e_N, \theta_N \rightarrow$ Associated Interaction Points

Gamma Ray Tracking

Clusterisation

Back-Tracking

Compton scattering formula
Statistical considerations



Realization of AGATA

- 2003 – 2006

R&D phase: development and construction of a scaled-down system as a demonstrator of the γ -ray tracking concept

- 10 % of detectors (5 triple clusters)
- Electronics with full pulse shape processing
- DAQ & Tracking

- 2006 – ...

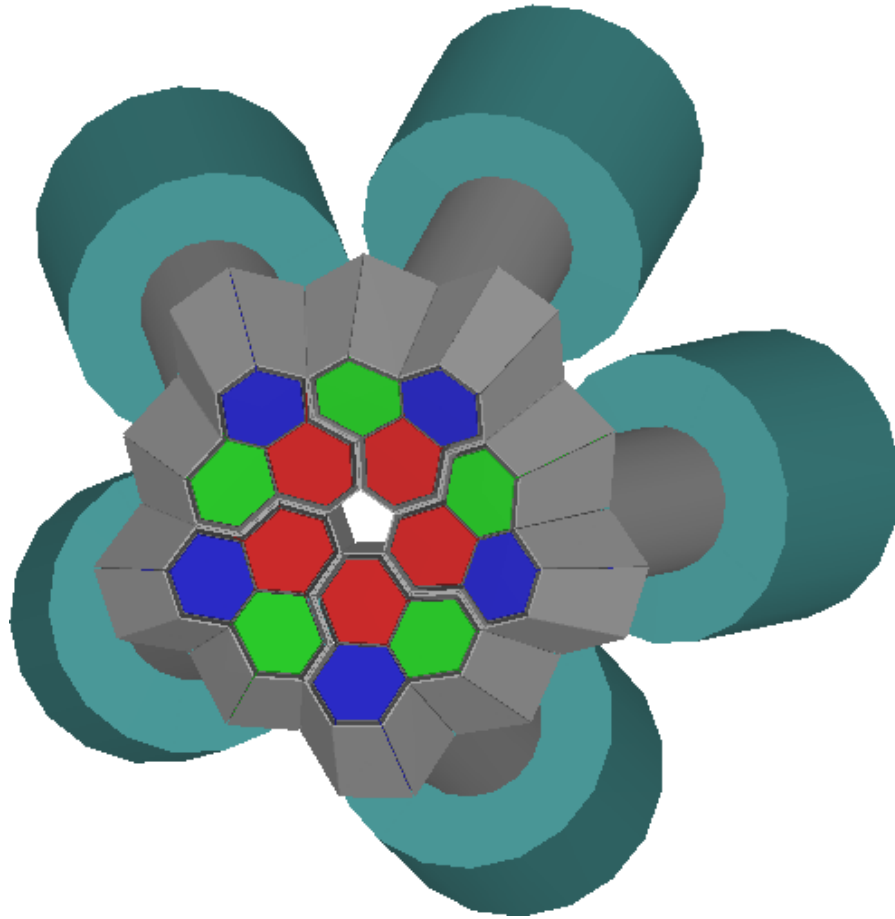
Construction of the full array

AGATA R&D Phase

- 1.** Design and construction of a detector module with regular crystals
- 2.** Development and test of local signal processing electronics and implementation of pulse shape algorithms
- 3.** Design of the array
- 4.** Design and construction of four detector modules with the final irregular crystal shape
- 5.** Construction of processing electronics and the data acquisition system
- 6.** Development and test of fast and efficient tracking algorithms

The AGATA Demonstrator

Objective of the R&D phase 2002-2006



5 Triple clusters

15 crystals

36-fold segmented

540 segments

555 digital-channels

Full electronics and ACQ

with (on line) pulse shape
analysis and γ -ray tracking

AGATA

Advanced
Gamma
Tracking
Array

Collaborating Institutions

HMI Berlin, Germany

Univ. Bonn, Germany

NIPNE Bucharest, Romania

Univ. Brighton, UK

GANIL, Caen, France

Univ. Camerino, Italy

NBI Copenhagen, Denmark

Univ. Cracow, Poland

CLRC Daresbury, UK

GSI Darmstadt, Germany

TU Darmstadt, Germany

MPI Heidelberg, Germany

FZ Jülich, Germany

Univ. Jyväskylä, Finland

Univ. Keele, UK

Univ. Köln, Germany

INFN Legnaro, Italy

Univ. Liverpool, UK

Univ. Lund, Sweden

Univ. Manchester, UK

INFN/Univ. Milano, Italy

LMU München, Germany

TU München, Germany

CSNSM Orsay, France

IPN Orsay, France

INFN/Univ. Padova, Italy

Univ. Paisley, UK

FZ Rossendorf, Germany

CEA Saclay, France

Univ. Sofia, Bulgaria

TSL Stockholm, Sweden

IRES Strasbourg, France

Univ. Surrey, UK

Univ. Swierk, Poland

Univ. Warsaw, Poland

Univ. Uppsala, Sweden

Univ. York, UK