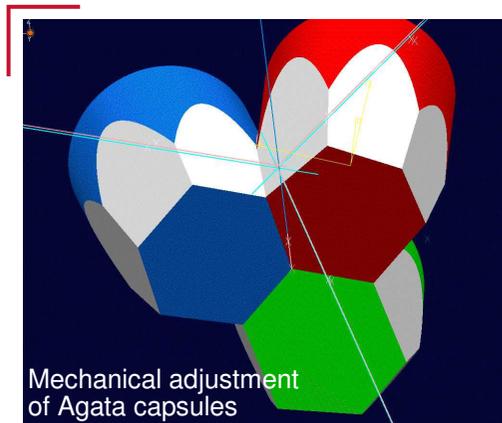




A

CANBERRA

AGATA capsule production at Lingolsheim



D. Quirion, M.O. Lampert

AGATA week at Uppsala, Sweden

July, 7th 2008

Production steps of Agata capsules

▶ Crystal shaping

- ◆ Crystal shape

▶ Standard process

- ◆ Detector capacitance
- ◆ Depletion voltage
- ◆ Full volume collection properties

▶ Segmentation process

- ◆ Leakage current

▶ Encapsulation

- ◆ Leakage current
- ◆ Segmentation quality
- ◆ *Issue: small gap to implantation*

▶ Canister welding

- ◆ Leakage current
- ◆ Segmentation quality
- ◆ *Issue: high T process/vacuum tightness*

▶ UHV cycle and high T cycling

- ◆ Leakage current
- ◆ Segmentation quality
- ◆ *Issue: UHV technique*

▶ Final measurement

- ◆ Full volume characterization
- ◆ Segment FWHM at ^{241}Am
- ◆ Some segments at ^{60}Co
- ◆ *Issue: local crystal performance*

**Complex industrial process
... a lot of hand-craft
and expertise...**

**About 250 capsules
produced by Canberra
Lingolsheim**

AGATA Production Status

Type	Crystal	Customer	Accepted	Comments	
B001	73888	Italy	No	Hole trapping on segments	1
A001	73892	France	No	Hole trapping on segments	2
C001	73899	Italy	Yes		3
B002	73920	France	-	Hole trapping on segments	4
A002	73949	Germany	No	Leakage current	5
A001	73952	France	Yes		6
C002	73951	France	Yes		7
B002	73979	France	Yes		8
A003	74009	UK	No	Leakage current	9
C003	74013	UK	No	Leakage current	10
B003	74026	UK	In test?		11
B001	74034	Italy	No	Leakage current	12
A002	74030	Germany	Yes		13
C004	74036	Turkey	Yes		14
A004	74041	Turkey	No	Collection issue on segments	15
A003	74009	UK	Yes		16
B004	74010	Turkey	No	Missing contact?	17
C005	74033	Sweden	In test		18
A005	73949	Sweden	In test		19
B005	74065	Sweden	In test		20
A006	74064	Italy	No	Collection issue on segments	21
B004	74010	Turkey	In test		22
A004	74095	Turkey	In test		23

AGATA Production Status

▶ Over 23 capsules delivered:

◆ 10 rejected

- 5 for crystal issues: B001, A001, B002, A004 & A006
- 4 for leakage current after delivery: A002, A003, C003 & B001
- 1 missing contact after delivery: B004

◆ 7 accepted:

- 5 in a first shot: C001, A001, C002, B002 & C004
- 2 in two steps: A002 & A003

◆ 6 under test:

- 4 for the first time: B003, C005, A005, B005
- 2 for the second time: B004 & A004

◆ 3 under repair:

- 1 for crystal issues: A006
- 2 for leakage current: B001 & C003

▶ To be delivered: B006, C006 & A007

AGATA Production Status

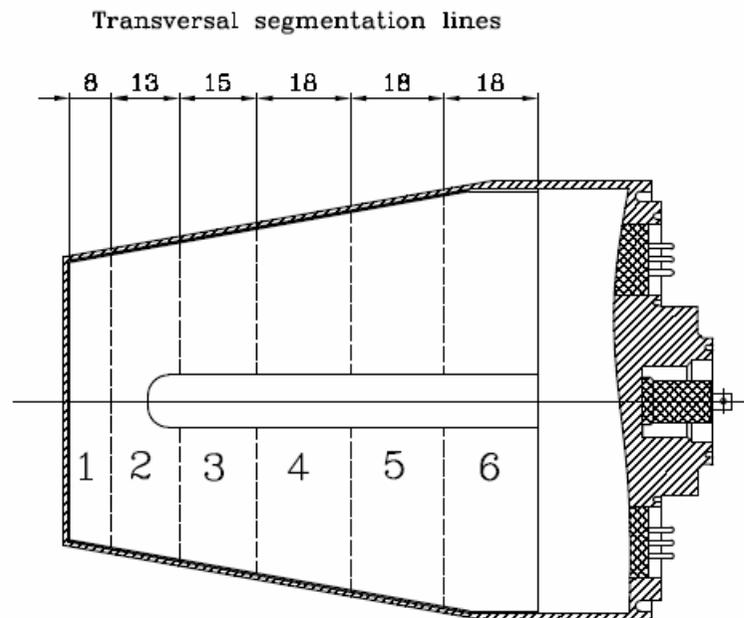
- ▶ **If one overlooks capsules with crystal issues: 18 capsules delivered**
 - ◆ **5 rejected**
 - 4 for leakage current after delivery: A002, A003 & C003
 - 1 missing contact after delivery: B004
 - ◆ **7 accepted**
 - 5 in a first shot: C001, A001, C002, B002 & C004
 - 2 in two steps: A002 & A003
 - ◆ **6 under test**
 - 4 for the first time: B003, C005, A005, B005
 - 2 for the second time: B004 & A004
 - ◆ **2 under repair:**
 - 2 for leakage current: B001 & C003
- ▶ **To be delivered: A006, B006, C006 & A007**

**Yield on accepted detectors: $7/9=78\%$
... if capsules under test work: $13/17=77\%$**

AGATA Production: main issues (1)

► Crystal issues:

- ◆ Higher segmentation yield to higher sensibility on crystal quality.
- ◆ Over 20 crystals used, 5 rejected for crystal issues: 25%! Cost and time issue on both sides!
- ◆ Extra tests added by crystal provider: extra costs!
- ◆ Canberra keeps in close contact with crystal provider for understanding and improvement.



AGATA Production: main issues (2)

▶ Full volume microphonics:

- ◆ **“New” high voltage feedthrough lead to strong microphonics in Agata test cryostat.**
- ◆ **No comparable problem encountered at Canberra.**
- ◆ **New high voltage feedthrough received and validated (vacuum integrity, thermal cycling...) at Canberra: used from C006 and A007 on.**

AGATA Production: main issues (3)

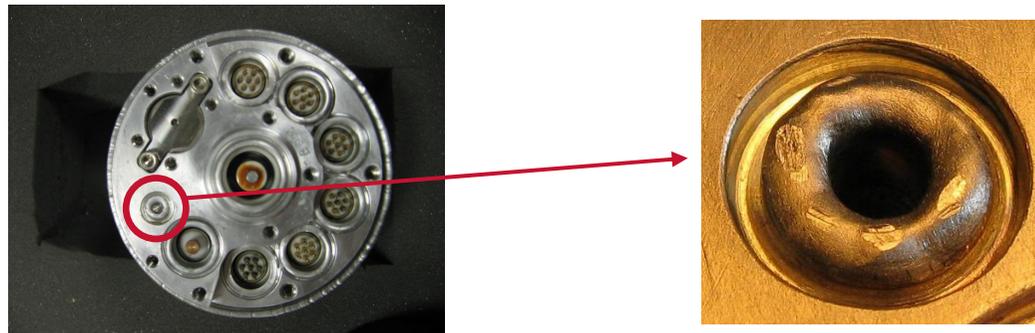
▶ Leakage current after delivery:

◆ Transport condition of AGATA capsules:



In a dedicated suitcase, put in a box filled with foam, carried by special conveyor.

◆ Mechanical stress in mounting in the cryostat?



◆ Further investigations are necessary

Yield calculation

- ▶ **Yield corresponds to the total number of fulfillment needed to achieve one successful fulfillment:**

$$\text{Yield} = \frac{\text{Number of successful fulfillments}}{\text{Number of total fulfillments}}$$

- ▶ **Example:**
 - ◆ 7 detectors accepted, among 5 in one step, 2 in two steps.
 - ◆ Number of successful fulfillment: 7
 - ◆ Total number of steps needed: $1 \times 5 + 2 \times 2 = 9$
 - ◆ Yield = $7/9 = 78\%$