Characterisation Measurements

Impurity Concentration, Crystal Axis Orientation, Differential Crosstalk

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10th AGATA week Lyon 2010

Impurity Concentration

B. Birkenbach et. al, submitted to NIM A

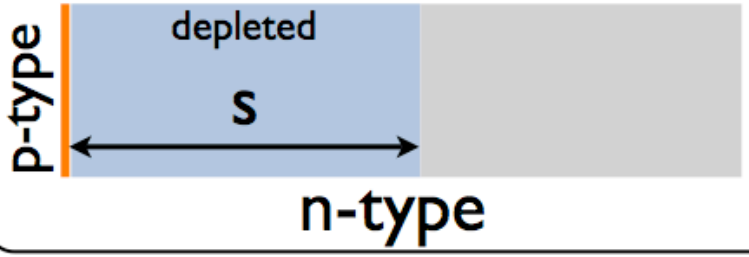
Poisson equation:

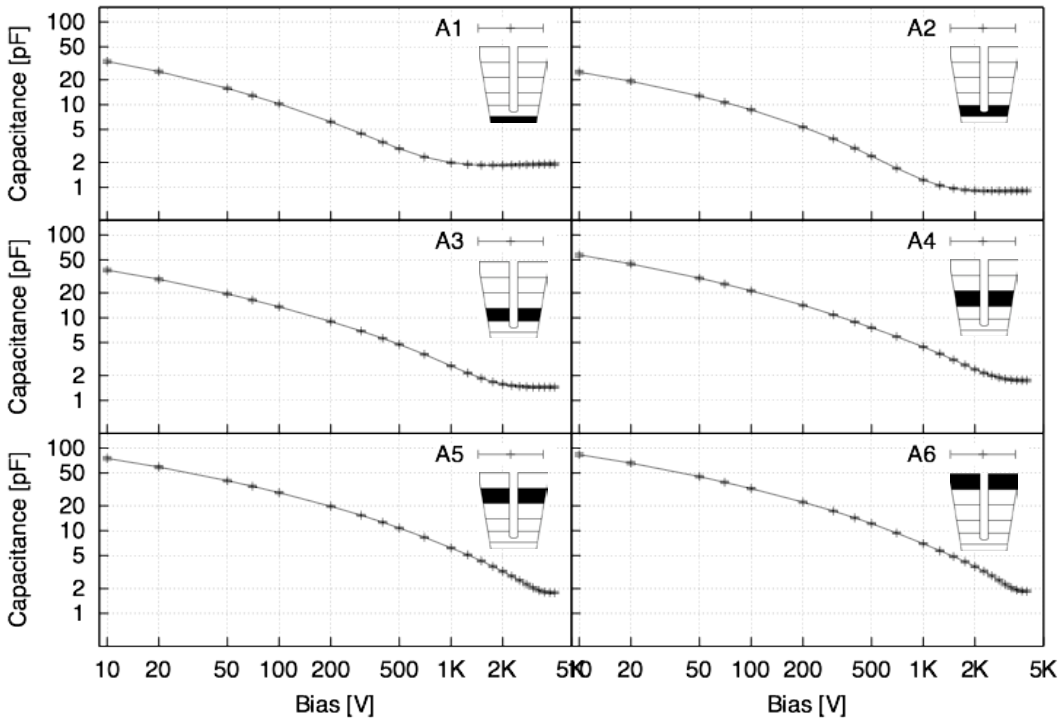
$$\nabla^2 \varphi = -\frac{\rho}{\epsilon}$$

planar diode:

$$C = \frac{\epsilon A}{s}$$

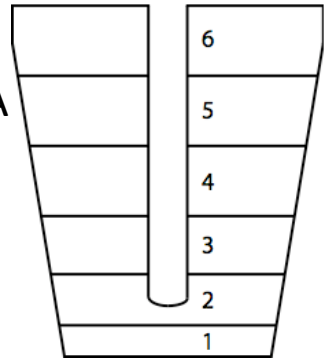
$$N_D = -\frac{C^3}{\epsilon e A^2}\left(\frac{dC}{dV}\right)^{-1}$$



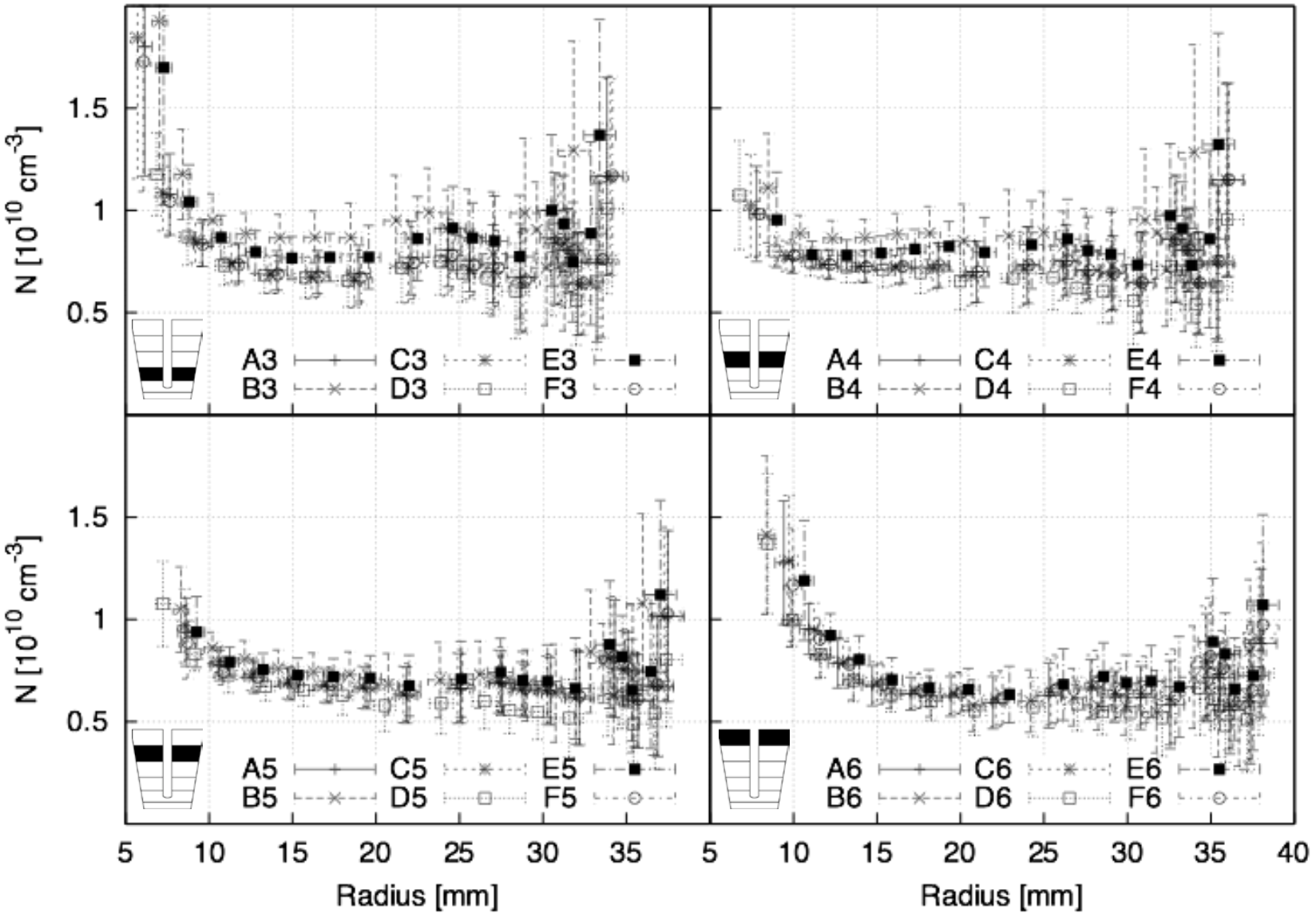


Capacitance of A003

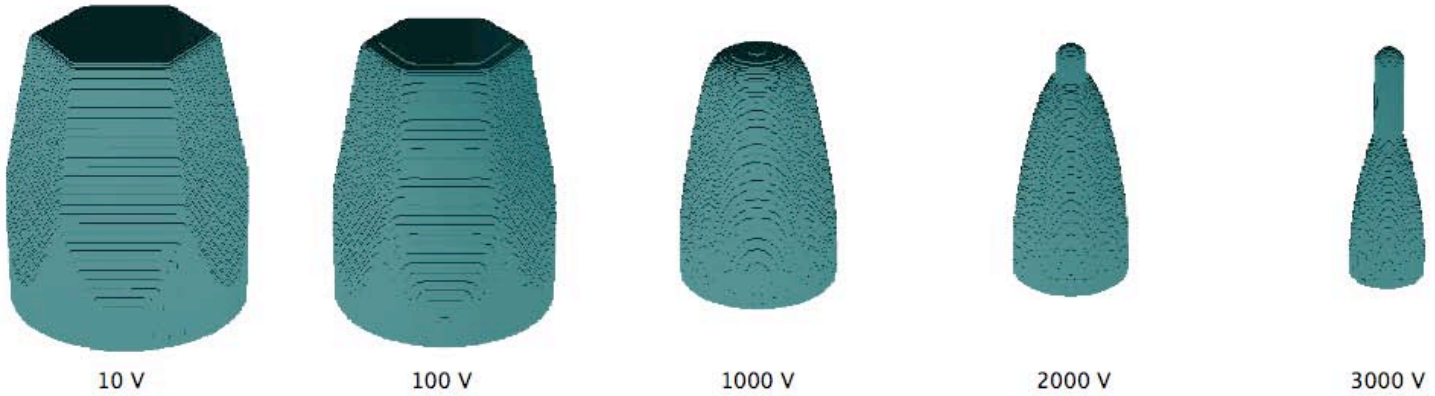
- measured with pulser of AGATA core preamplifier
- controlled by AGATA digitizer
- taken in spring at LNL



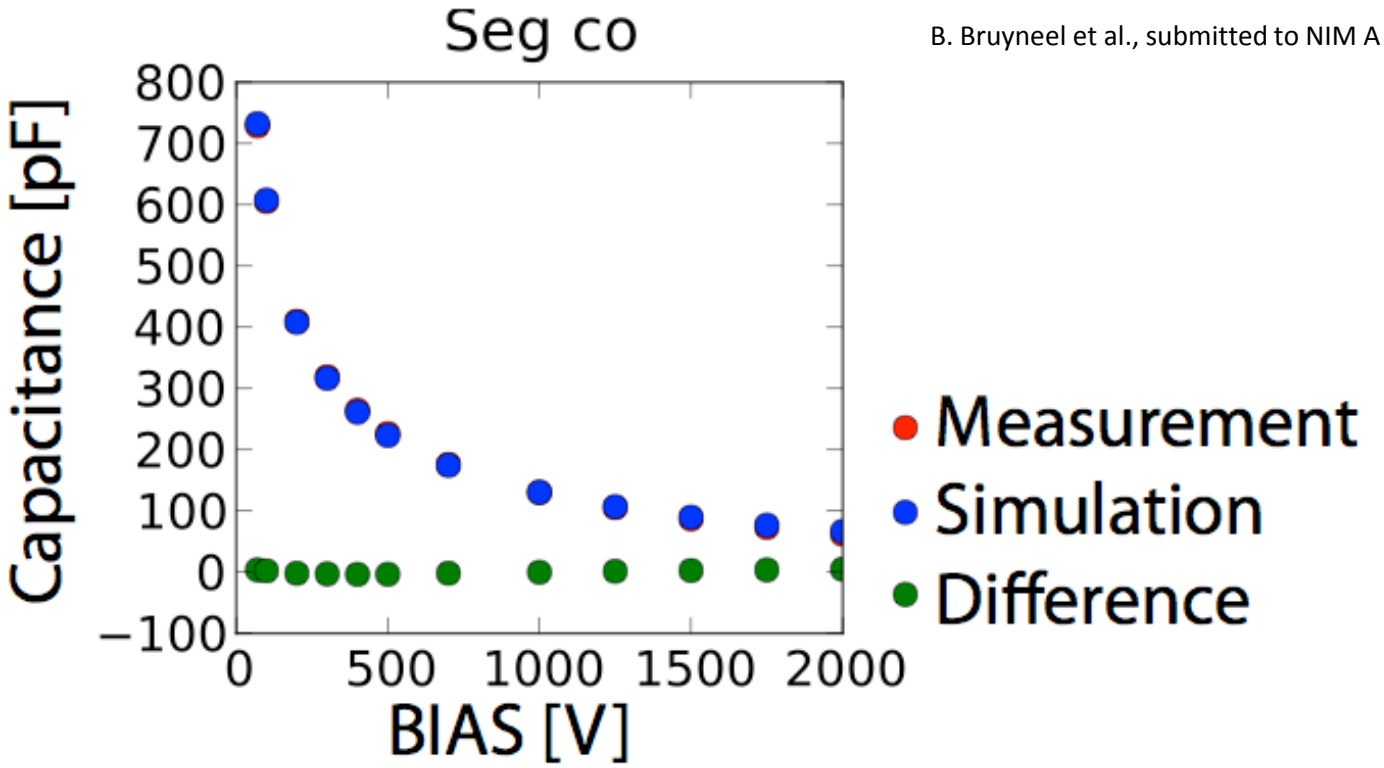
Cylindrical Approximation (B002)

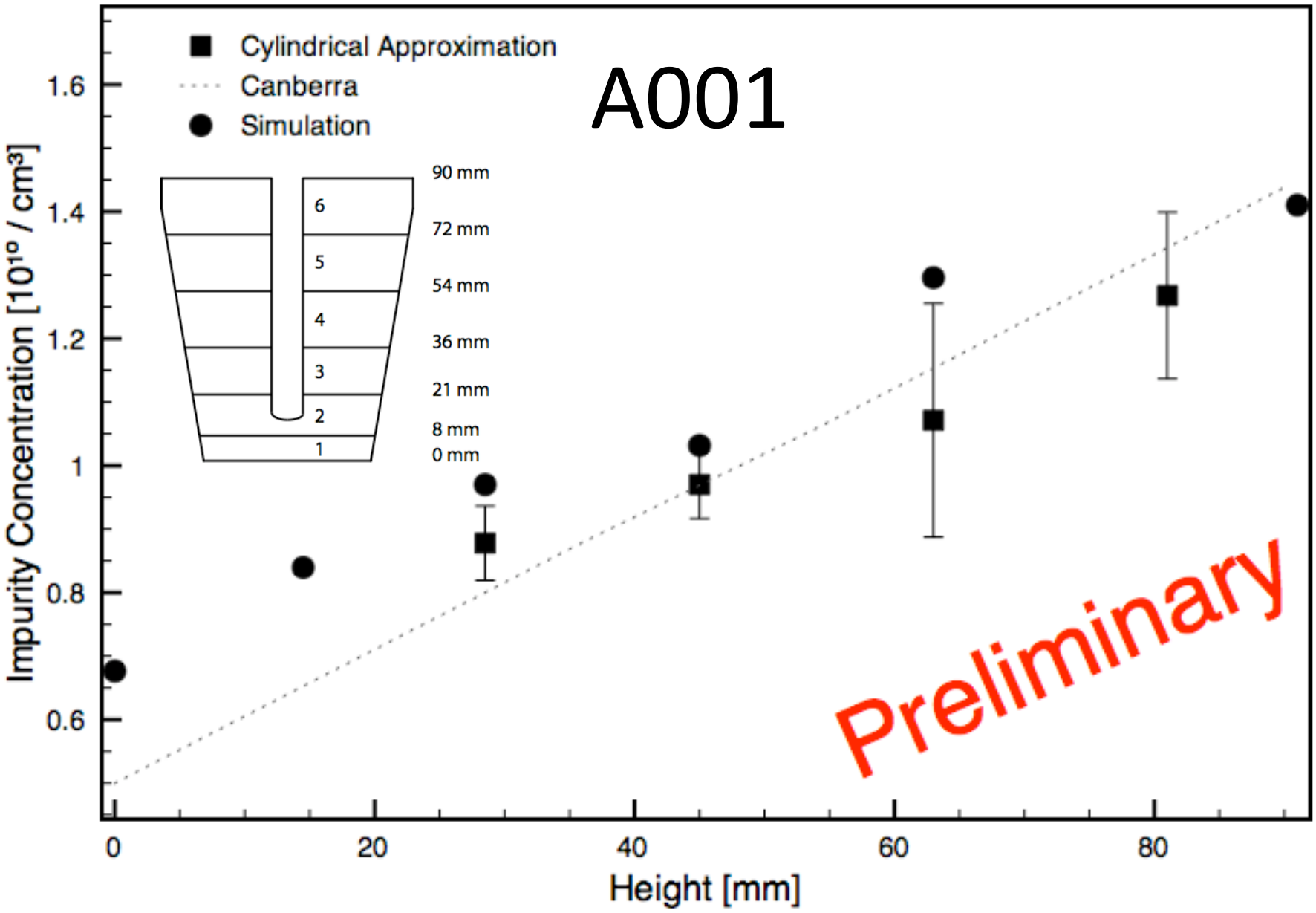


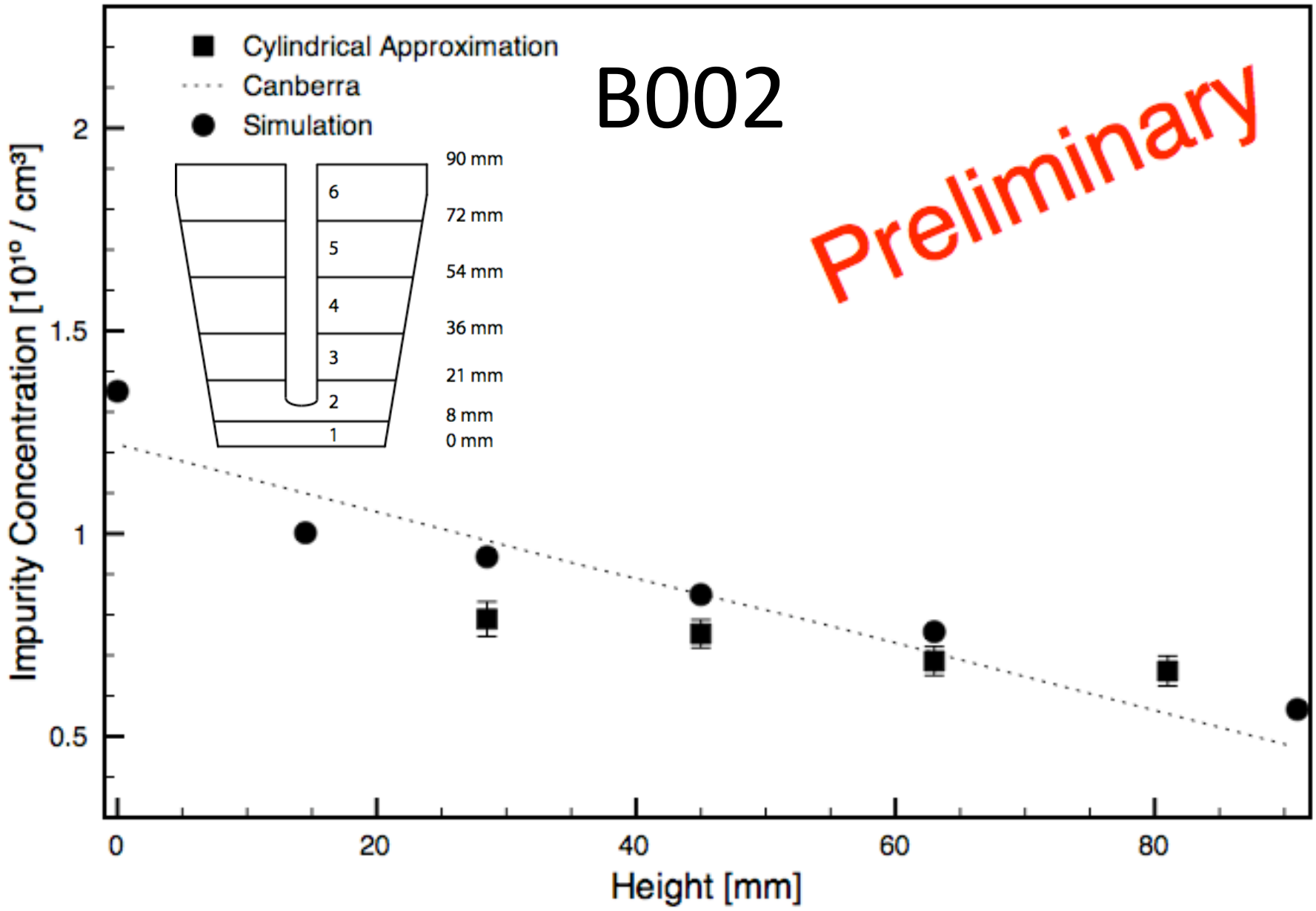
Computer Simulation (A003)

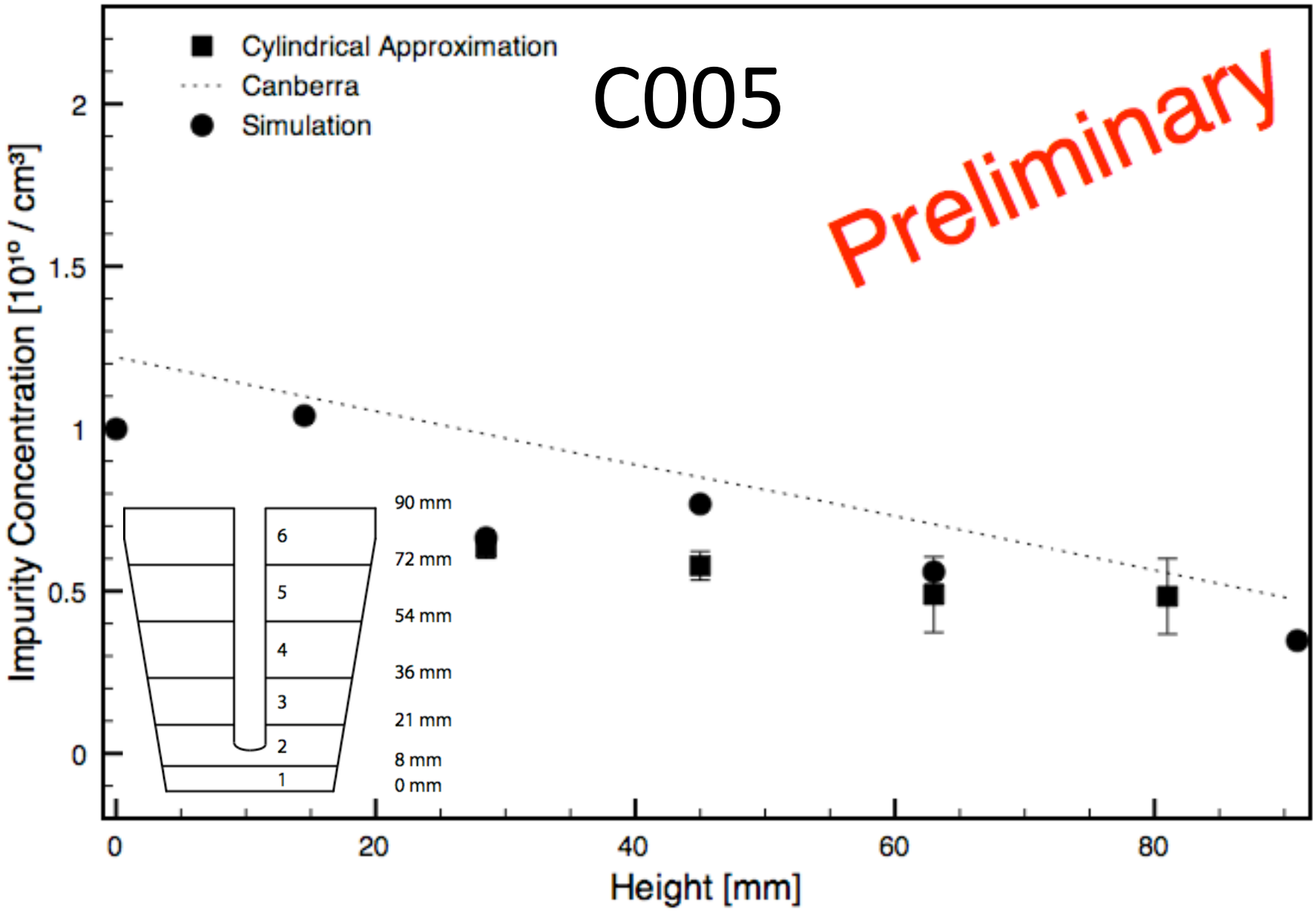


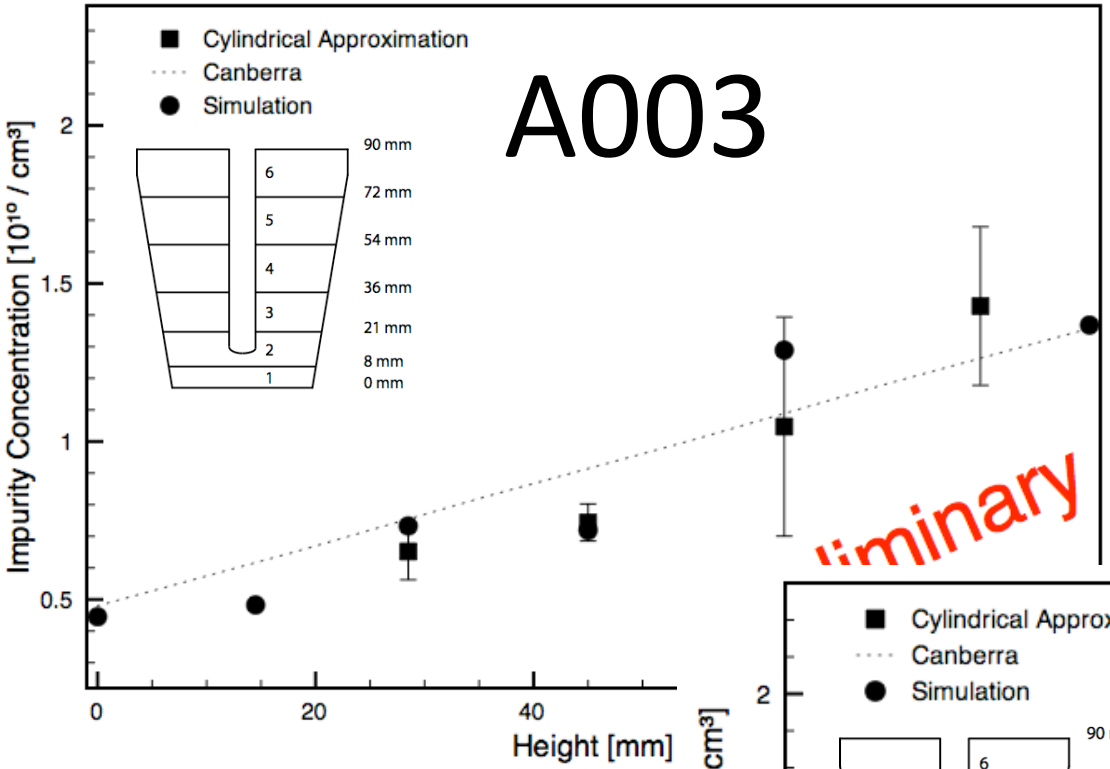
B. Bruyneel et al., submitted to NIM A

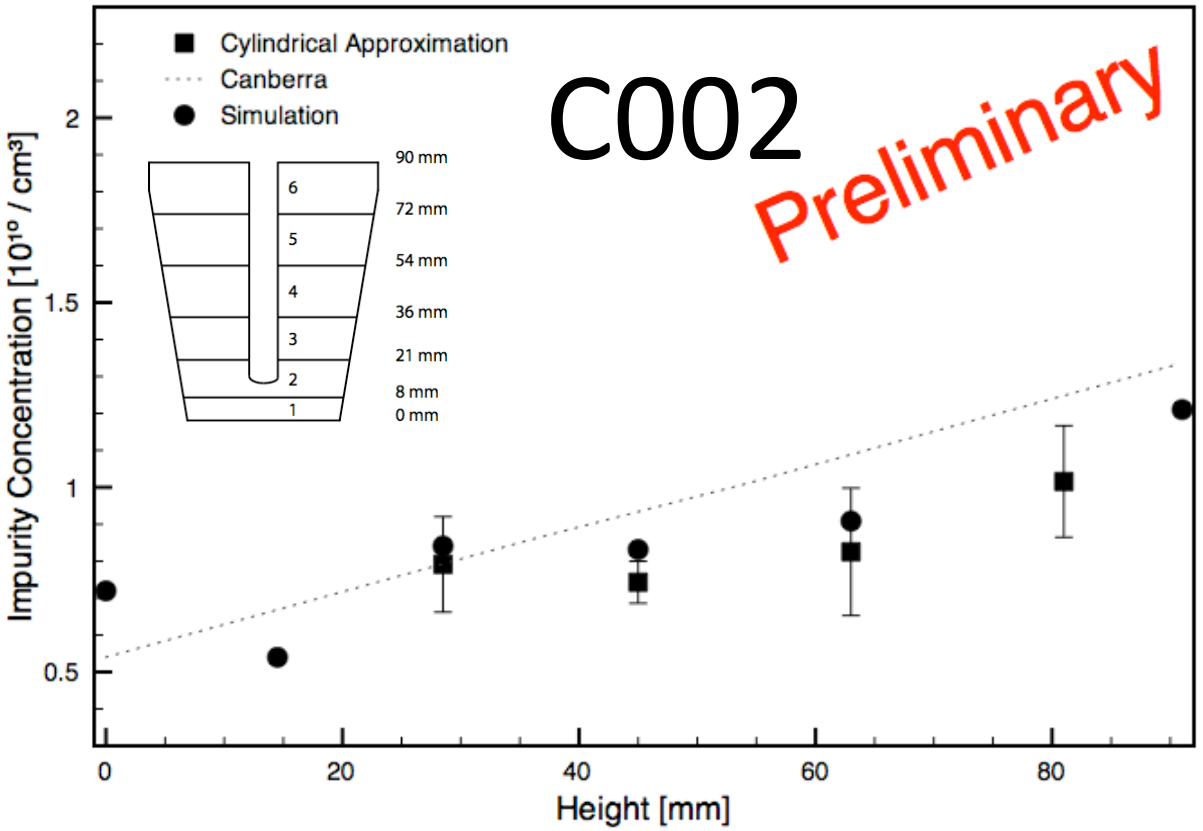



Cylindrical Approximation
Canberra
Simulation
A001
90 mm
72 mm
54 mm
36 mm
21 mm
8 mm
0 mm
6
5
4
3
2
1
Impurity Concentration [10¹⁰ / cm³]
1.6
1.4
1.2
1
0.8
0.6
0
20
40
60
80
Height [mm]
Preliminary


Cylindrical Approximation
Canberra
Simulation
B002
Preliminary
90 mm
72 mm
54 mm
36 mm
21 mm
8 mm
0 mm
6
5
4
3
2
1
Impurity Concentration [10¹⁰ / cm³]
2
1.5
1
0.5
0
20
40
60
80
Height [mm]


Cylindrical Approximation
Canberra
Simulation
C005
Preliminary
Impurity Concentration [10¹⁰ / cm³]
Height [mm]
0
0.5
1
1.5
2
0
20
40
60
80
6
5
4
3
2
1
90 mm
72 mm
54 mm
36 mm
21 mm
8 mm
0 mm


Cylindrical Approximation
Canberra
Simulation
A003
90 mm
72 mm
54 mm
36 mm
21 mm
8 mm
0 mm
6
5
4
3
2
1
Impurity Concentration [10¹⁰ / cm³]
Height [mm]
0
20
40
0.5
1
1.5
2
iminary

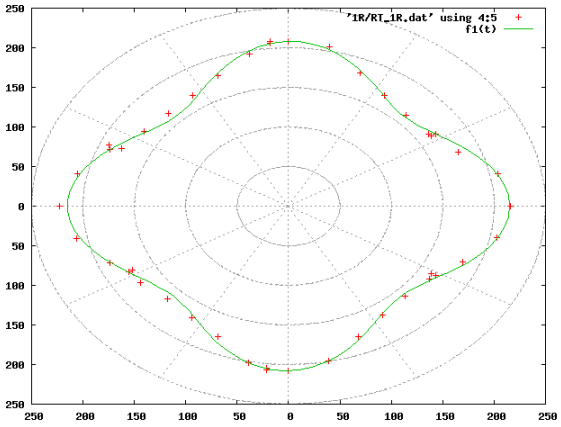
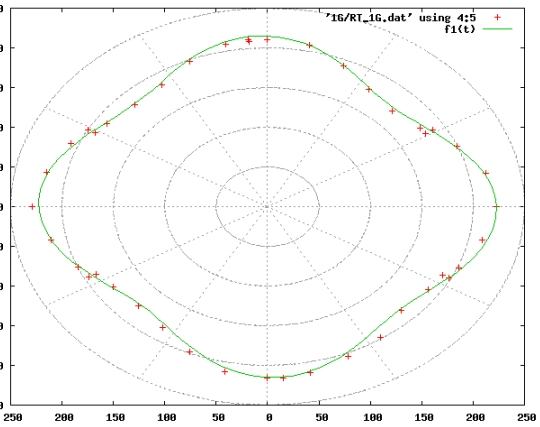
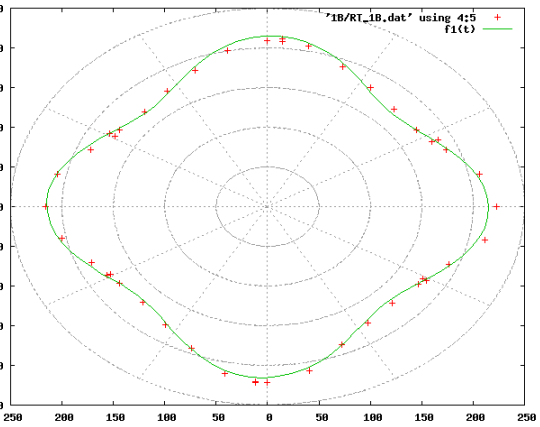
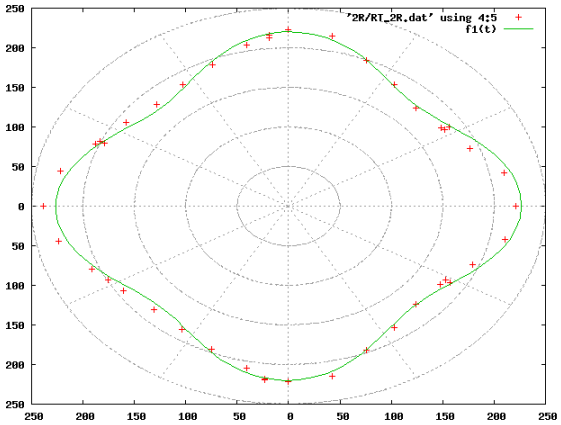
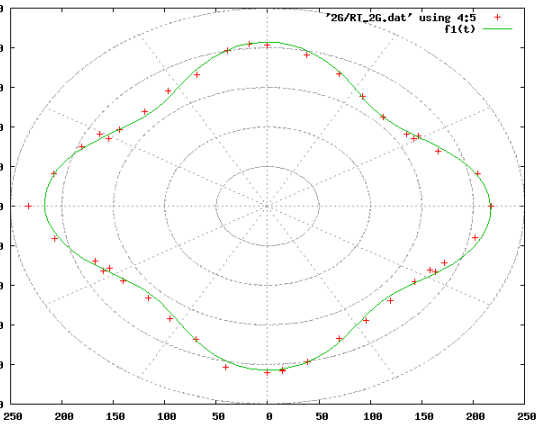
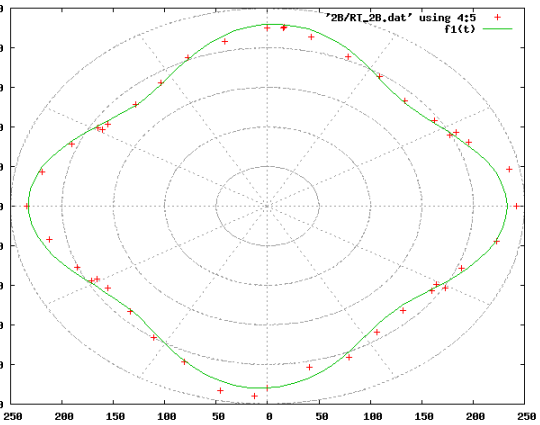
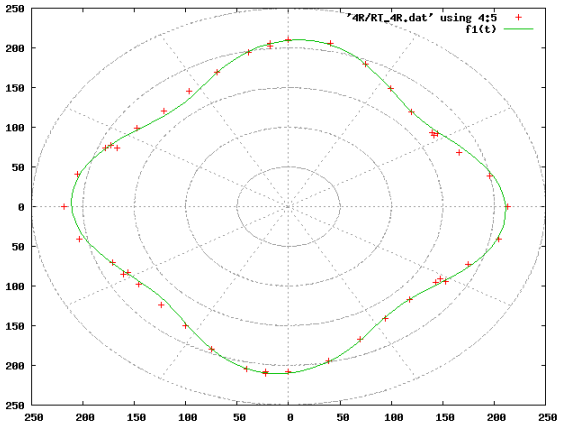
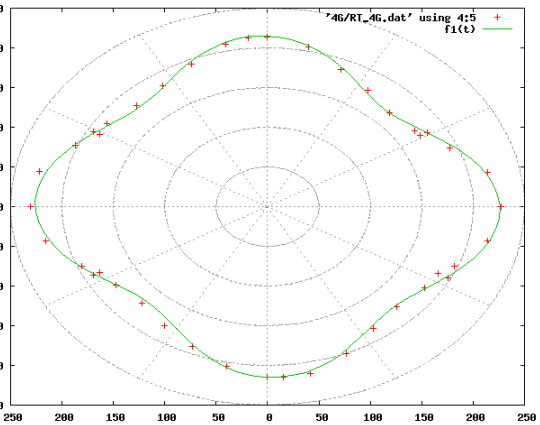
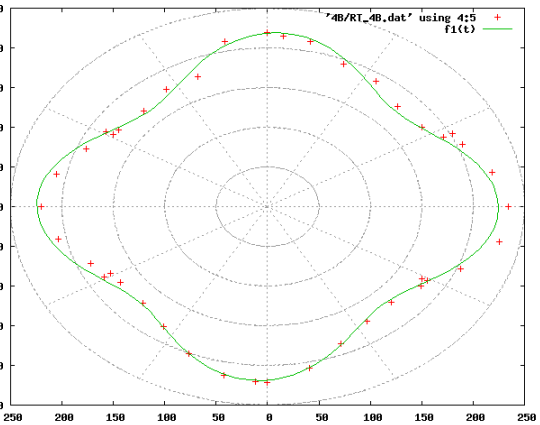

Cylindrical Approximation
Canberra
Simulation
C002
Preliminary
90 mm
72 mm
54 mm
36 mm
21 mm
8 mm
0 mm
6
5
4
3
2
1
Impurity Concentration [10¹⁰ / cm³]
Height [mm]
0
20
40
60
80
0.5
1
1.5
2

Crystal Axis Orientation

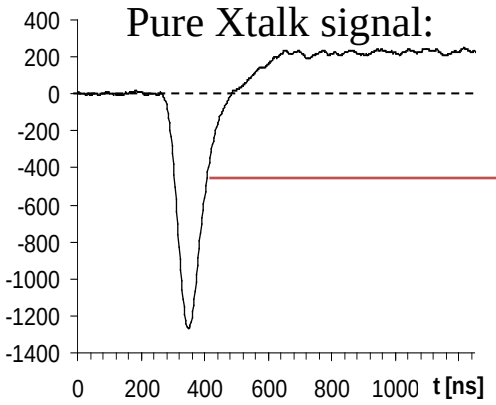
B. Bruyneel, et. al, Nucl. Instr. and Meth. A (2006)

- 400kBq Am source +
- Lead Collimator: ∅ 1.5mm X 1cm
- Front Scan at ∅ 4.7cm: 300 cts/s

Cologne Scanning Table

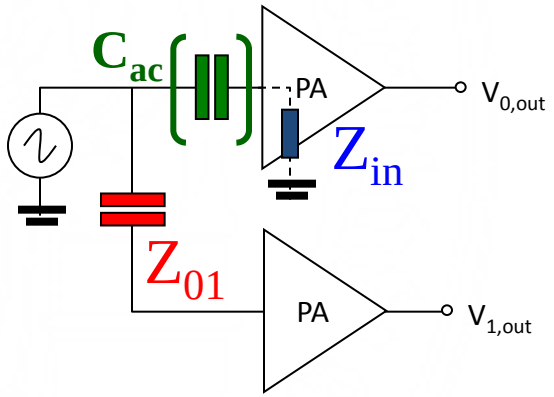
	R	G	B
ATC1			
ATC2			
ATC4			

Xtalk (proportional vs. differential)



Proportional Xtalk (50μs decay) → Energy

Differential Xtalk (only during risetime) → PSA



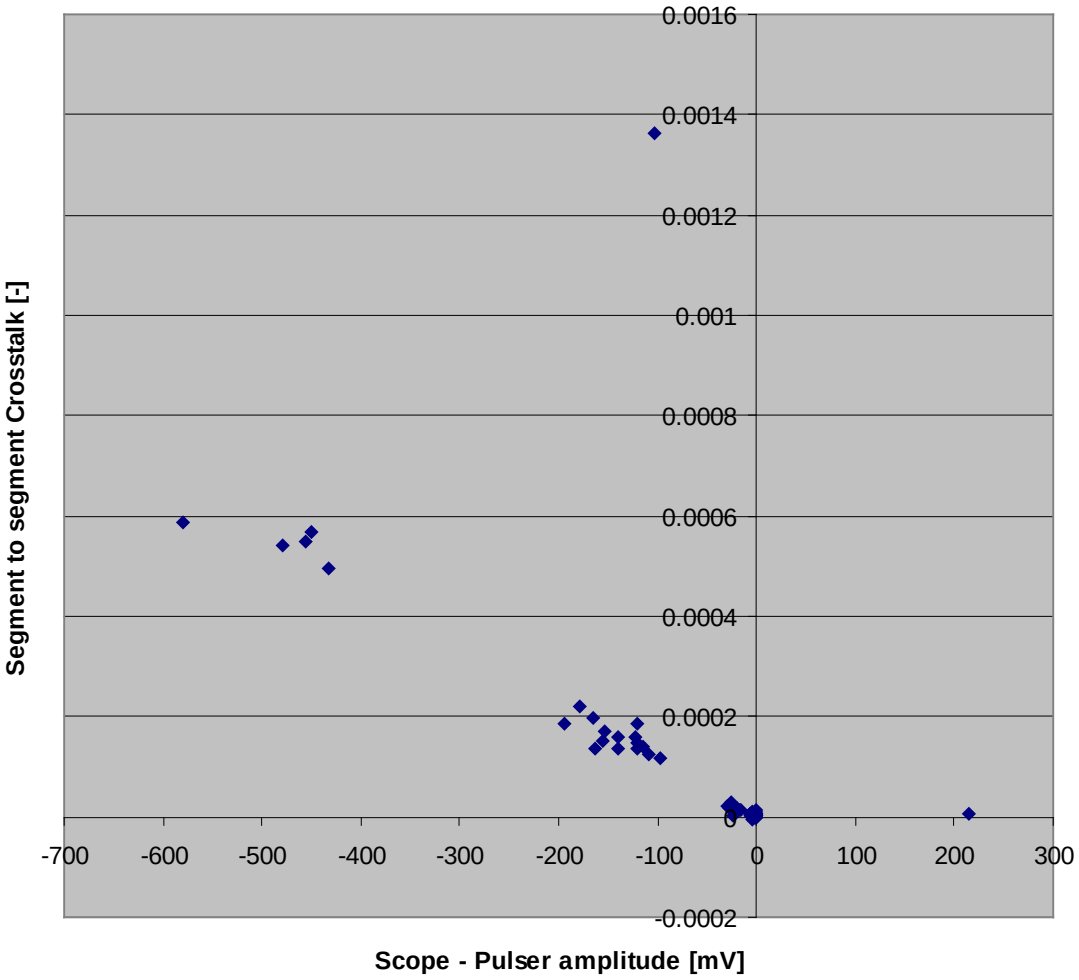
With $Z_{in} = 1/sAC_{fb} + (1/sC_{ac}) + R_{cold}$

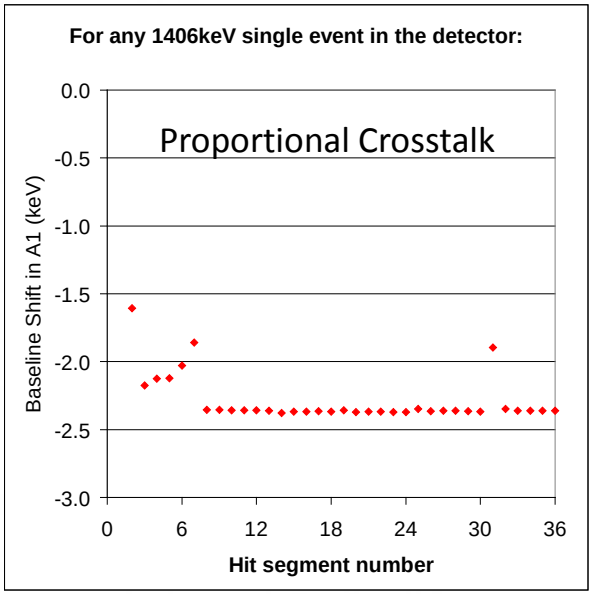
Xtalk ~ Z_{in} / Z_{01}

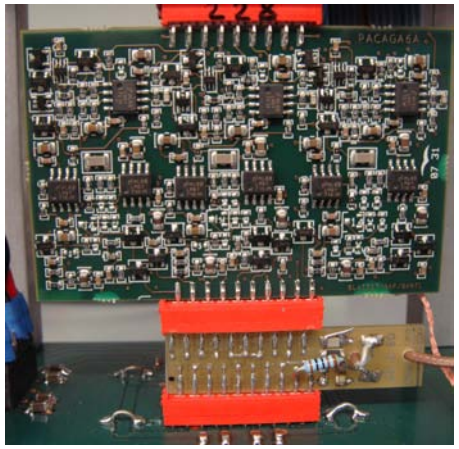
~ $\underbrace{C_{01}/AC_{fb} + (C_{01}/C_{ac})}_{\text{Proportional}} + \underbrace{s \,.\, R_{cold}\, C_{01}}_{\text{Differential Xtalk}}$

!!! Proportional and Differential Xtalk are related !!!

Segment to Segment Coupling



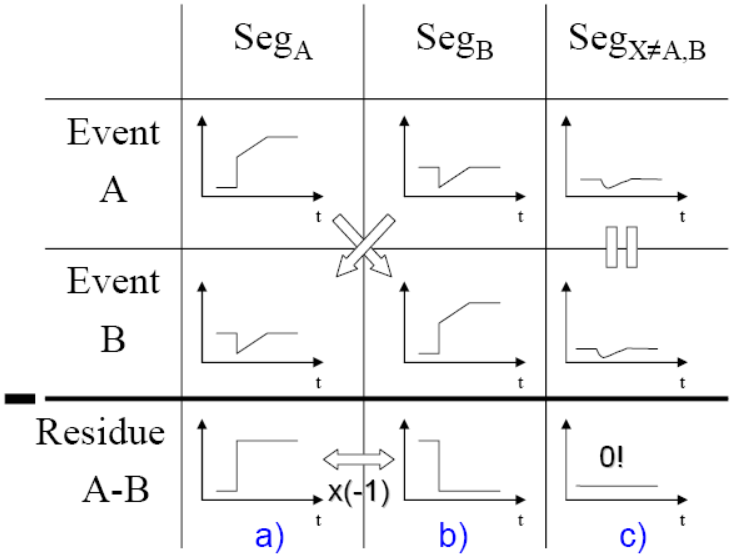


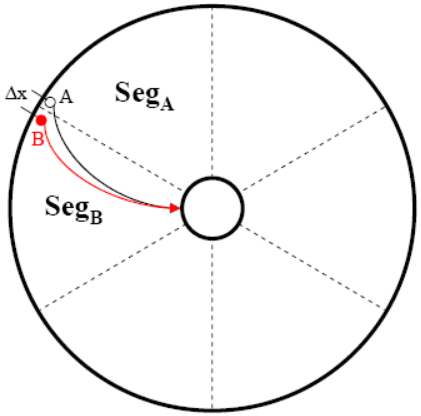


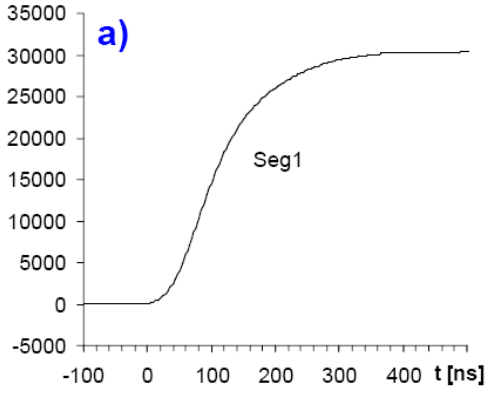
Prop. Xtalk ~ $C_{01}/AC_{fb} + (C_{01}/C_{ac})$

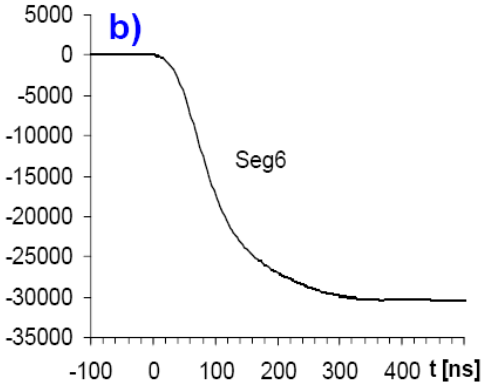
Segment to Segment Capacitance
Pulser over segment

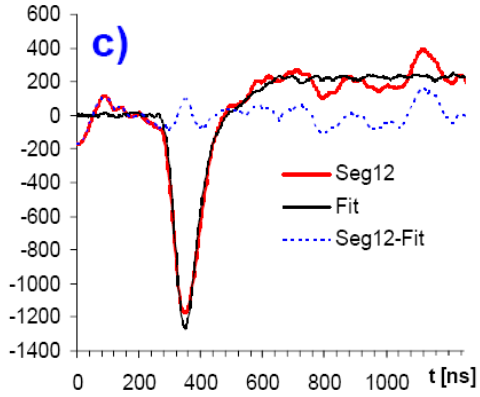
How to measure differential Xtalk?



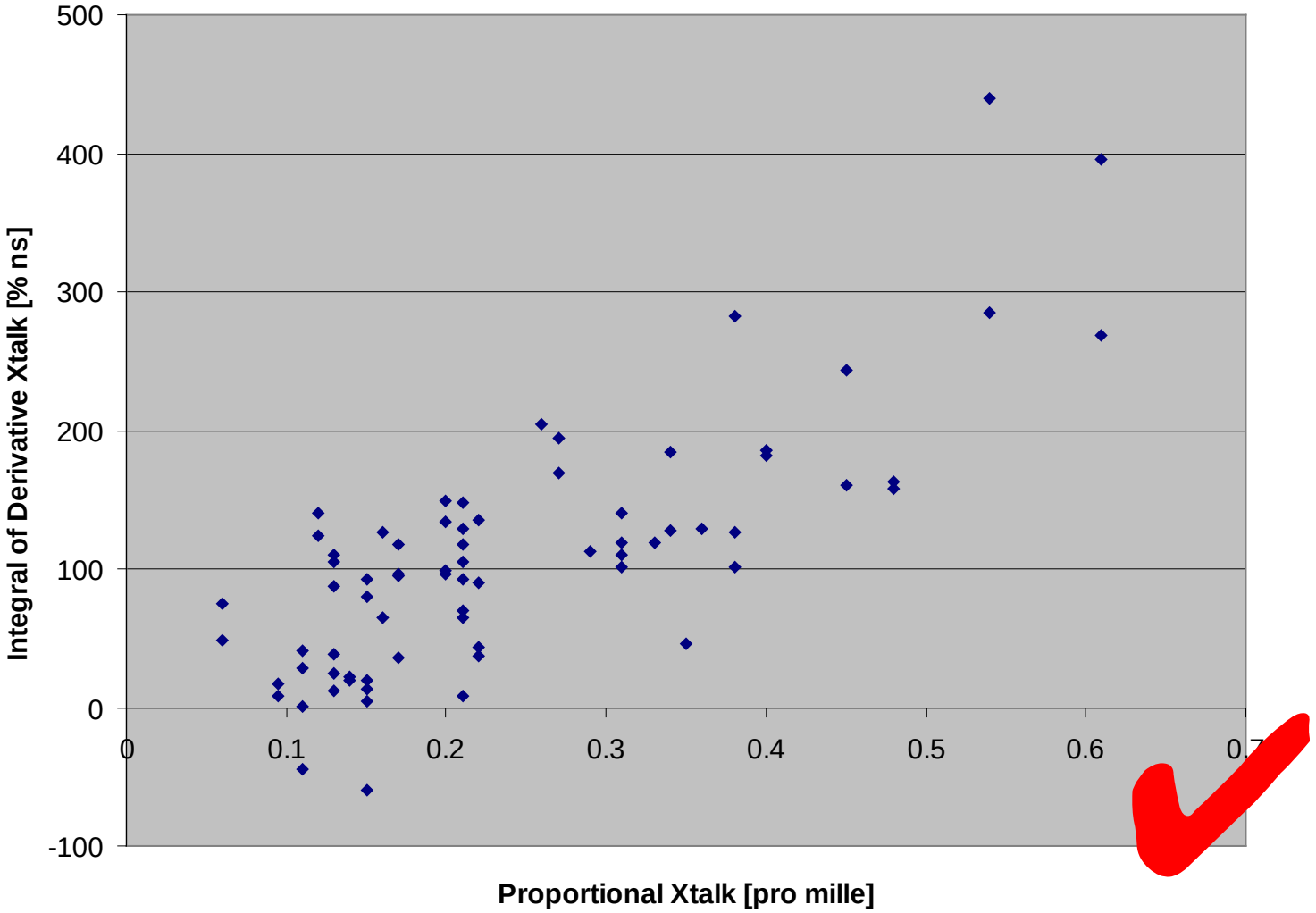








Differential vs. Proportional

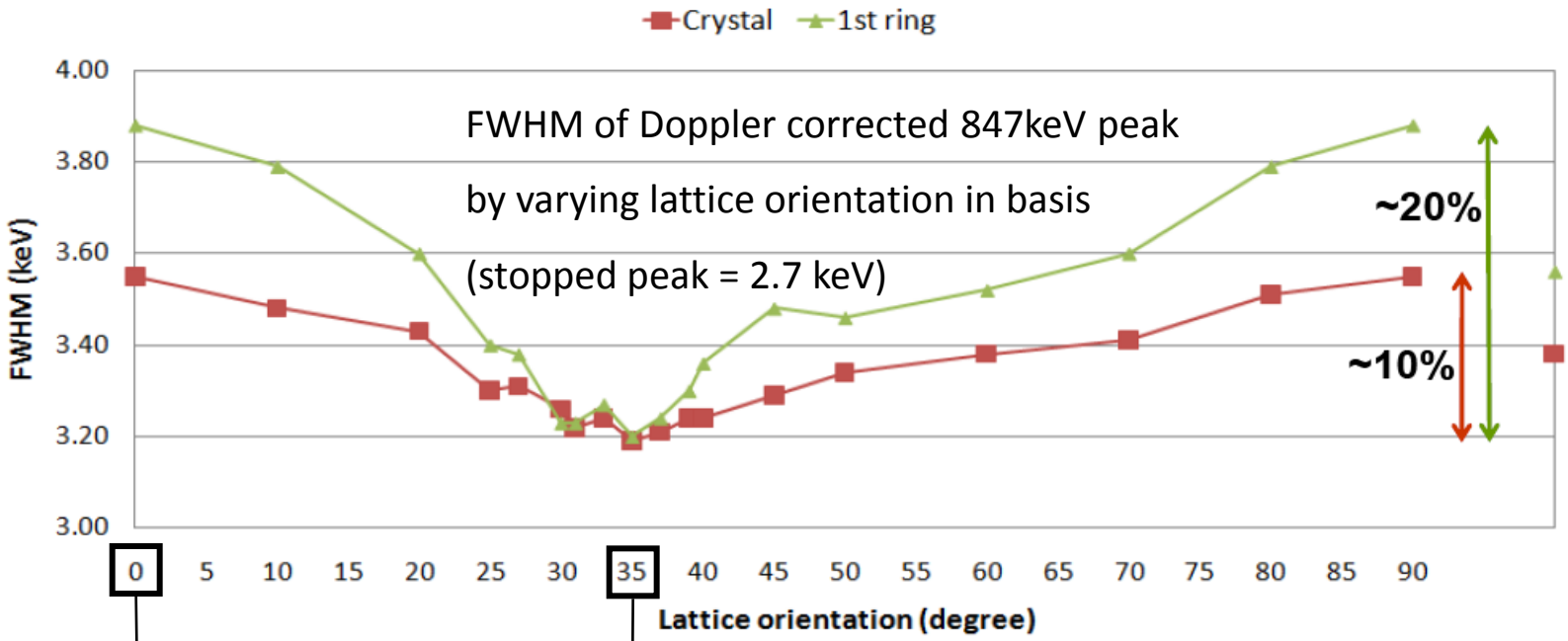


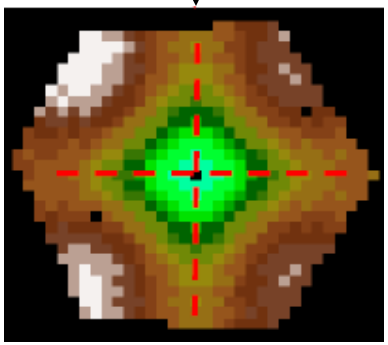
Outlook

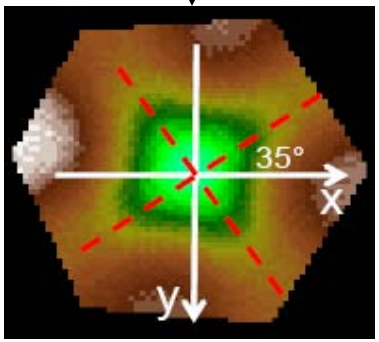
- Finalize Analysis of Impurity measurements and include them in the PSA basis
- Measure and include differential Xtalk in PSA basis
- Publish a paper on the ADL library and provide a new version

Latest news about the work of the Cologne group can be found at our webpage
http://www.ikp.uni-koeln.de/agata

Importance of Characterization





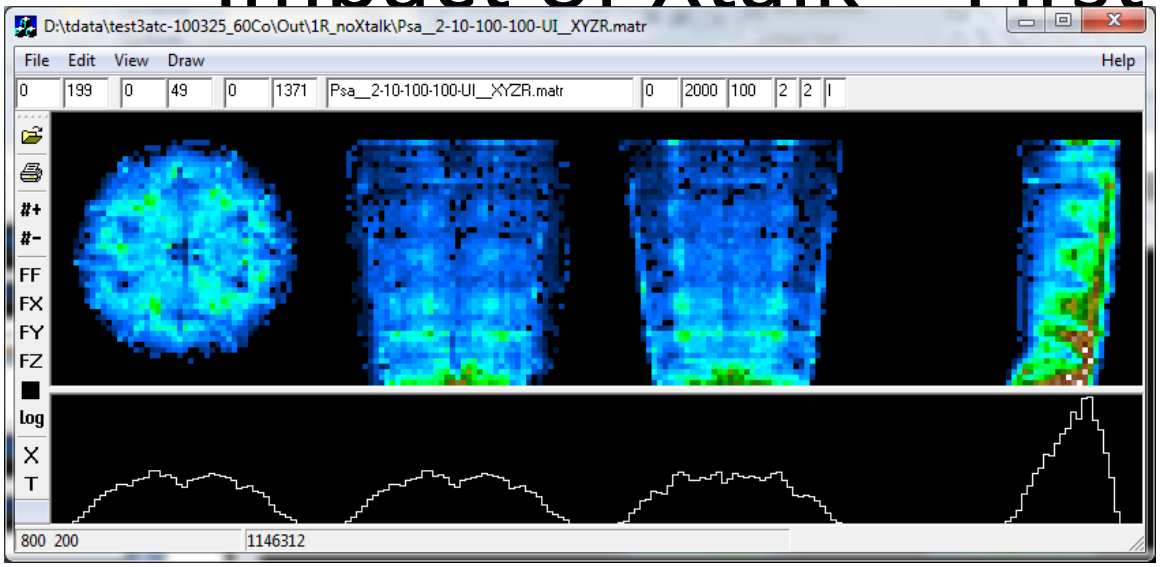


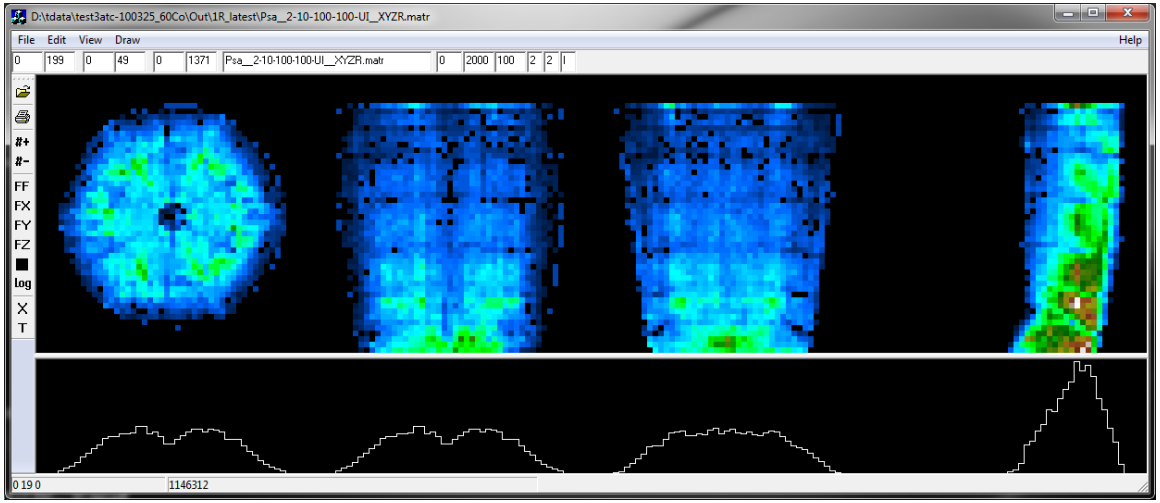
Main improvement from 1st ring

Front view of T_{10-90} simulations

Angles with respect to x-axis

Impact of Xtalk – First results





ATC1-R

Same data,

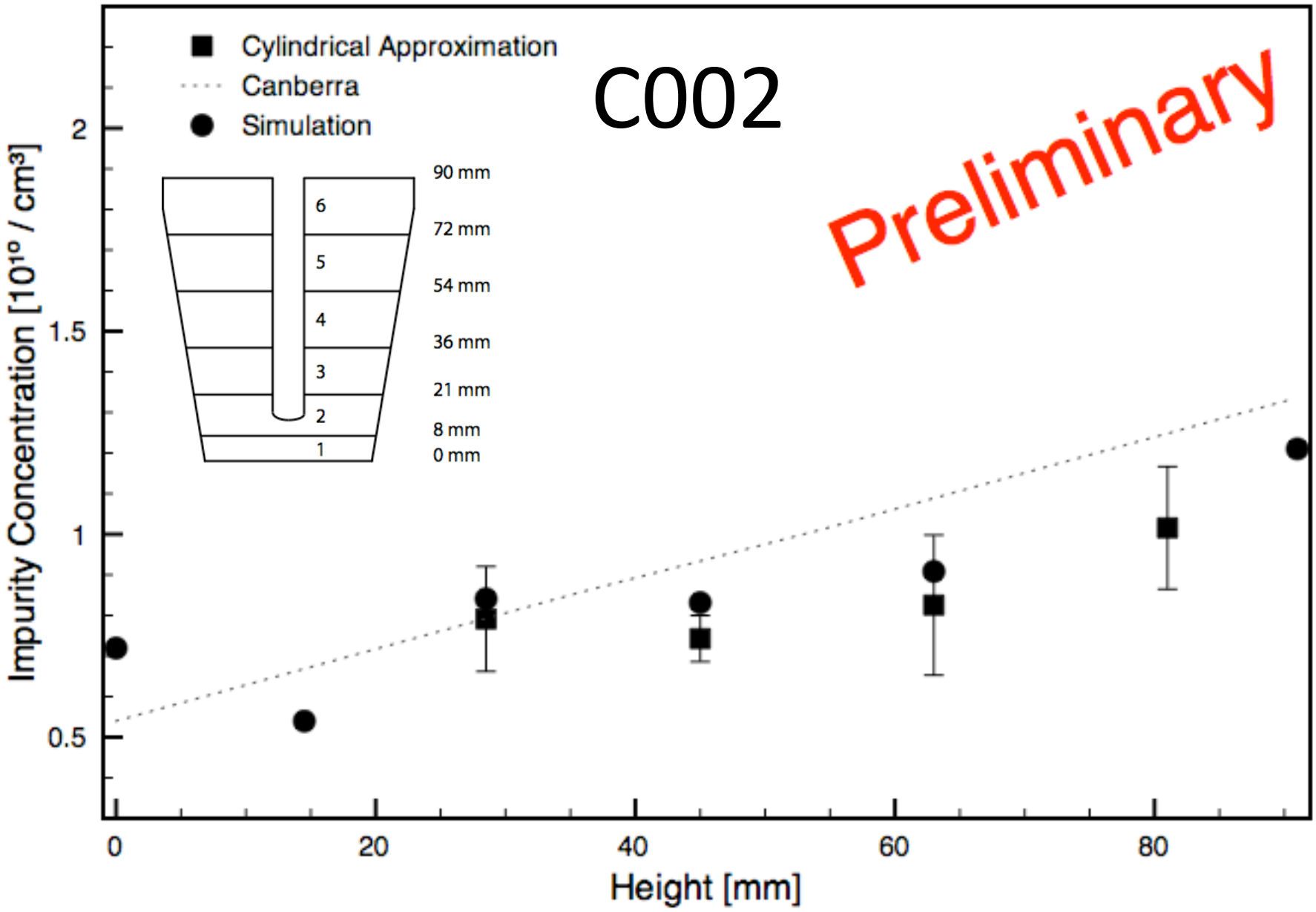
Same analysis

BEFORE…

and

AFTER

implementation of Crosstalk correction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Impurity Concentration [10¹⁰ / cm³]
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2
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20
40
60
80
Height [mm]

Umicore Impurity