

AGATA Detector Library - ADL 3

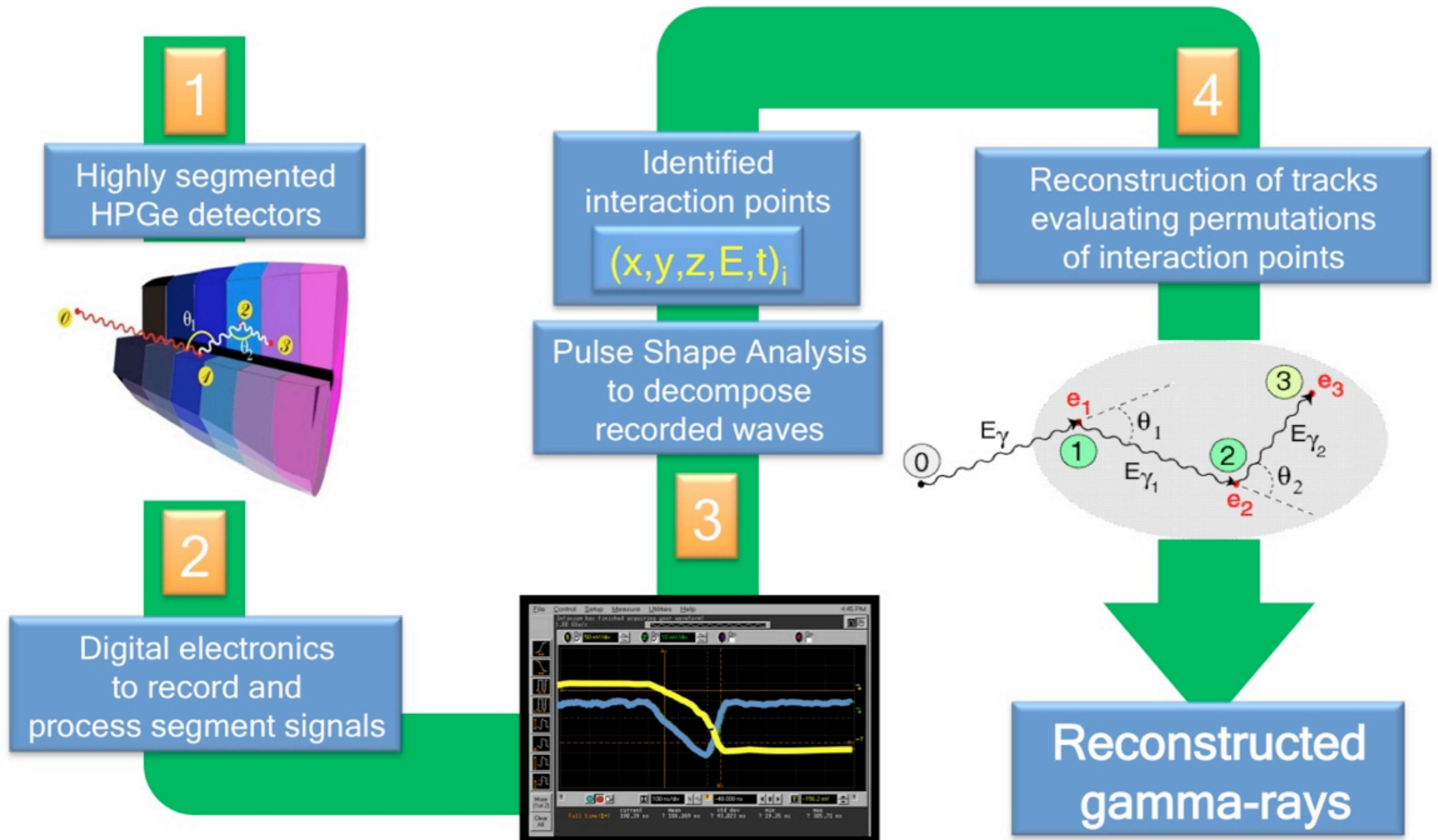
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Universität
zu Köln



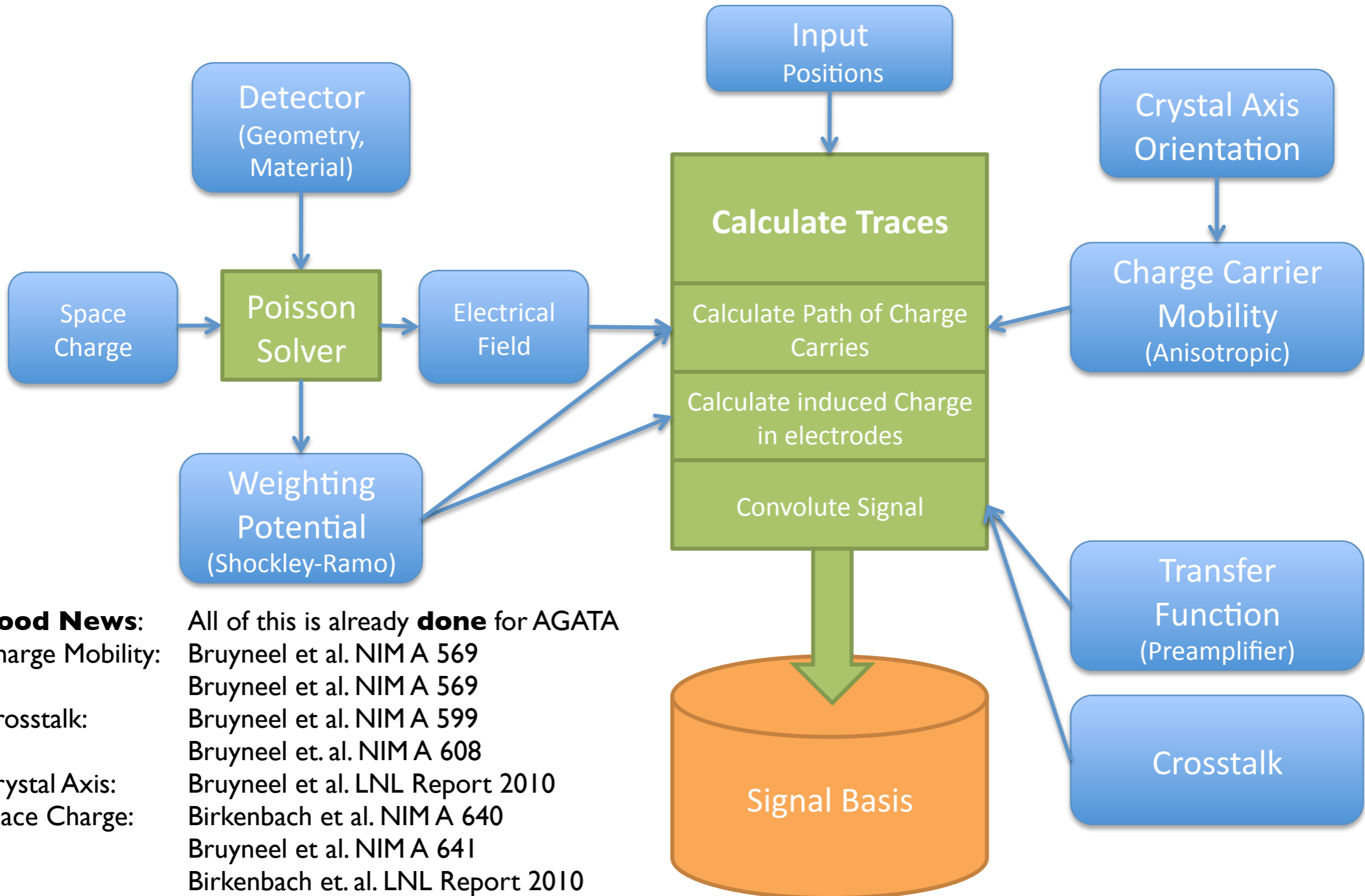
Ingredients of Gamma-Ray Tracking



ADL

- realistic simulations of pulses in semiconductor detectors
- calculate depletion and capacitance of semiconductor detectors
- calculate trapping sensitivity of charge carriers
- geometries and potential arrays of all AGATA crystals are available
- easy to use and to extend
- library written in C running on  Windows  

Ingredients needed for a realistic simulation



Good News: All of this is already **done** for AGATA

Charge Mobility: Bruyneel et al. NIM A 569
Bruyneel et al. NIM A 569

Crosstalk: Bruyneel et al. NIM A 599
Bruyneel et al. NIM A 608

Crystal Axis: Bruyneel et al. LNL Report 2010

Space Charge: Birkenbach et al. NIM A 640
Bruyneel et al. NIM A 641
Birkenbach et al. LNL Report 2010

Trapping: Bruyneel et al. LNL Report 2010

You need:

- Software
- Potentials

To create your own potential arrays,
use tools from the SIMION webpage:
<http://simion.com/sl/>

<http://www.ikp.uni-koeln.de/agata/>

AGATA - Download

Detector Simulation Software ADL

To access the files you will need a password. Please [contact us](#) to get acc

Download Software:

Latest Version	ADL 3.0	
Version 2.0	ADL 2.0	ReadMe.pdf

Weightin Potentials (SIMION)

potentials S00X	S00X.zip	ReadMe.txt
potentials A00X	A001.zip	ReadMe.txt
potentials B00X	B001.zip	ReadMe.txt
potentials C00x	C001.zip	ReadMe.txt

If you only want to read libraries, this is overkill. Then Look at this:

Read/Write help	ReadWrite.zip	Read About It
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How to choose space charge parameters for your simulation:

Read/Write help	SpaceChargeEst.xls	Read About It
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Download restricted contact:
agata@ikp.uni-koeln.de

Build the software

```
storm:/Volumes/BEAST/AGATA bene$ tar xzf ADL3.tar.gz
storm:/Volumes/BEAST/AGATA bene$ cd ADL3
storm:/Volumes/BEAST/AGATA/ADL3 bene$ ./configure --prefix=/Volumes/BEAST/AGATA/
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes
checking for a thread-safe mkdir -p... ./install-sh -c -d
```

Unzip &
Configure

```
storm:/Volumes/BEAST/AGATA/ADL3 bene$ make /install -c
/bin/sh ./libtool --tag=CC --mode=compile gcc -DPACKAGE_NAME=\"ADL\" -DPACKAGE_TARNAME=
\"adl\" -DPACKAGE_VERSION=\"3.0\" -DPACKAGE_STRING=\"ADL 3.0\" -DPACKAGE_BUGREPORT=\"bene
@ikp.uni-koeln.de\" -DPACKAGE_URL=\"\" -DPACKAGE=\"adl\" -DVERSION=\"3.0\" -DSTDC_HEADERS=
1 -DHAVE_SYS_TYPES_H=1 -DHAVE_SYS_STAT_H=1 -DHAVE_STDLIB_H=1 -DHAVE_STRING_H=1 -DHAVE_MEMO
RY_H=1 -DHAVE_STRINGS_H=1 -DHAVE_INTTYPES_H=1 -DHAVE_STDINT_H=1 -DHAVE_UNISTD_H=1 -DHAVE_D
LFCN_H=1 -DLT_OBJDIR=\".libs/\" -I. -g -O2 -MT ADL.lo -MD -MP -MF .deps/ADL.Tpo -c -o
ADL.lo `test -f 'src/ADL.c' || echo './'`src/ADL.c
```

Make

(might take some time)

```
storm:/Volumes/BEAST/AGATA/ADL3 bene$ make install
test -z "/Volumes/BEAST/AGATA/lib" || ./install-sh -c -d "/Volumes/BEAST/AGATA/lib"
/bin/sh ./libtool --mode=install /usr/bin/install -c libADL-3.la '/Volumes/BEAST/AGAT
A/lib'
libtool: install: /usr/bin/install -c .libs/libADL-3.0.dylib /Volumes/BEAST/AGATA/lib/libA
DL-3.0.dylib
```

Make Install

```
storm:/Volumes/BEAST/AGATA bene$ ls lib bin
bin:
SimEXAMPLE*      SimLibrary*      paViewer*
lib:
libADL-3.0.dylib*  libADL-3.dylib@
libADL-3.a*       libADL-3.la*
```

bin, include & lib

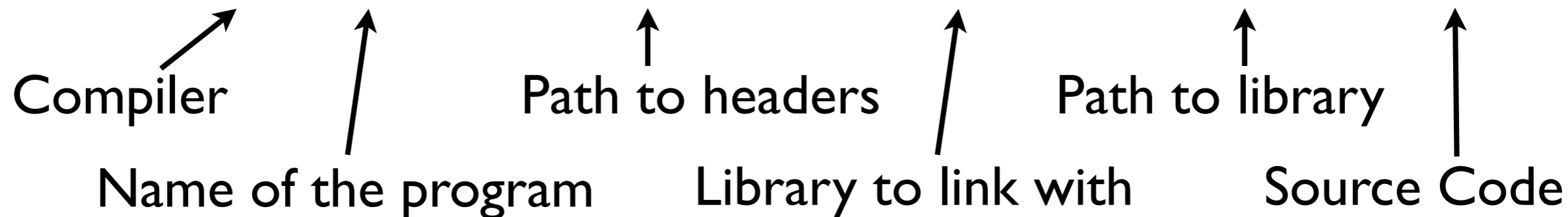
Example Program

```
1  #include "ADL.h"
2
3  int main (void) {
4      FILE *output;
5      struct ADL_EVENT *evt;
6
7      ADL_Setup("/Volumes/BEAST/AGATA/Config/Template_ADL.txt");
8      ADL_Status();
9
10     //lets create a new event structure:
11     evt = new_event();
12     //Fill in the Hit Pattern (HP):
13     evt->HP.Eint[0]=10.0;    //Energy of interaction 0 (we only simulate a single interaction here)
14     evt->HP.T0= 0.010;    //Time the interaction occurs in the trace
15     evt->HP.Pos[0][0]=2.0;    //Position where this interaction occurs
16     evt->HP.Pos[0][1]=2.0;
17     evt->HP.Pos[0][2]=8.0;
18
19     //On basis of the HP, here the traces are generated
20     //Traces are stored in the Trace Data (TD) part of the event:
21     ADL_G_CalculateTraces(evt);
22
23     //Write the event to file:
24     output = fopen("/Volumes/BEAST/AGATA/output.txt", "w");
25     ADL_G_WriteEvent(output, evt);
26     fclose(output);
27     return 0;
28 }
```

Just 28 lines of code to calculate an interaction at a given point and save the result into a file.

Compile Example Program

```
/Volumes/BEAST/AGATA $gcc -o simulation -I/Volumes/BEAST/AGATA/include -ladl-3 -L/Volumes/BEAST/AGATA/lib example.c
```



The Paths to the headers and the library are defined by the prefix option of the configure script!

Configuration using text files

Setup of:

Event

Convolution

Mobility

Fields

Read / Write

Calculation

Trapping

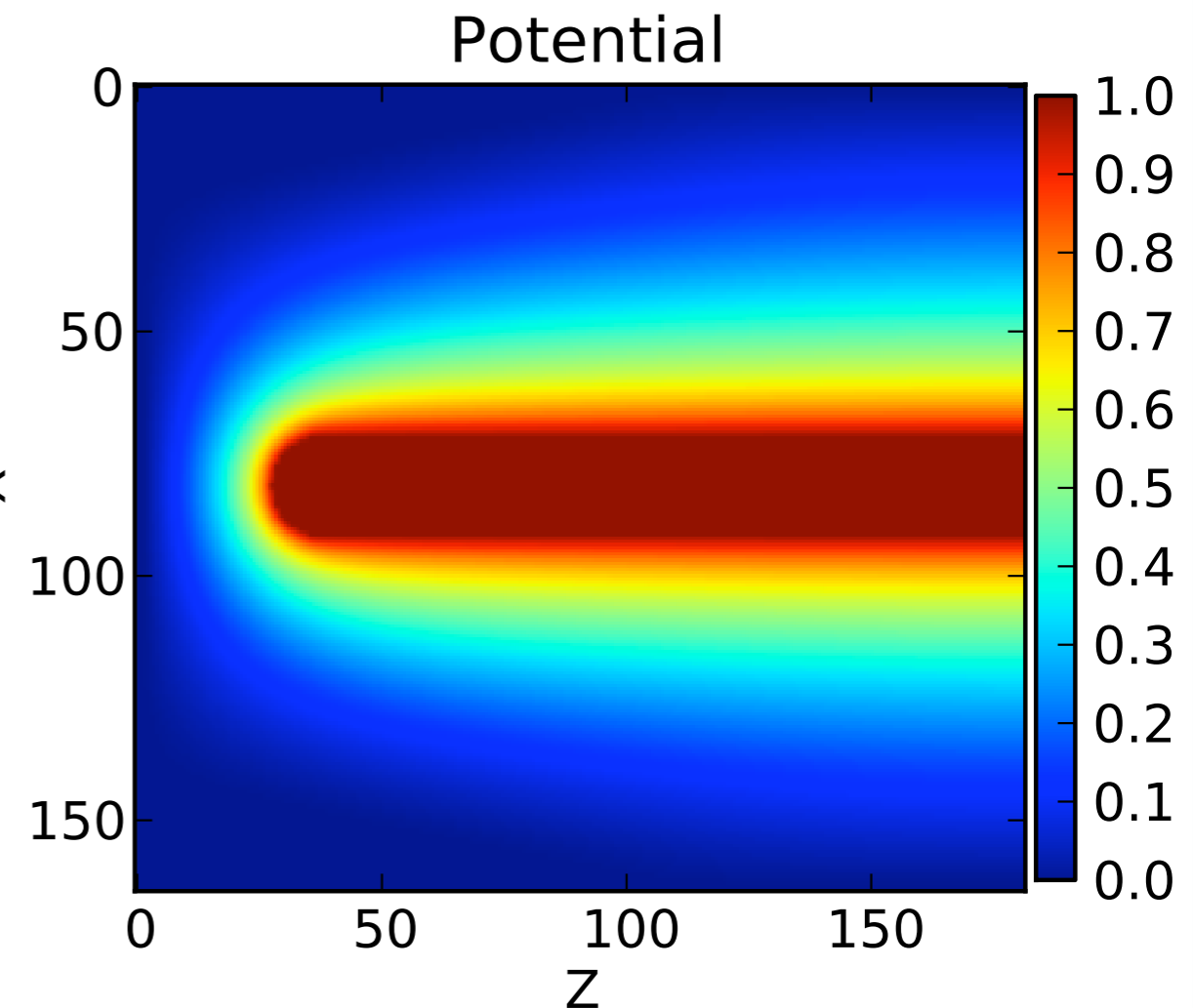
```
1
2 # This file is written for ADL version 3.0:
3 ADL_G_VERSION 3.0
4
5 # The debugin mode is switched off:
6 ADL_G_DEBUG 0
7
8 # Here you define the event structure - this should be done first:
9 # How many interactions maximum in an event, how many samples in the traces, how many segments...
10 ADL_EVENT /Volumes/BEAST/AGATA/Config/Template_EVENT.txt
11
12 # Response function for your preamp,
13 # convolution is setup here to be a dummy function:
14 ADL_CONVL_DUMMY /Volumes/BEAST/AGATA/Config/Template_CONVL_DUMMY.txt
15
16 # Here you define the drift velocity parameters
17 ADL_DRIFT_GE /Volumes/BEAST/AGATA/Config/Template_DRIFT_GE.txt
18
19 # We want to use PA files
20 ADL_FIELDS_SIMION /Volumes/BEAST/AGATA/Config/Template_FIELDS_SIMION.txt
21
22 # Here we define how events will be read in and written out:
23 # Choices are binary "BIN", text "TXT", dino's tkt "TKT" (write only)
24 ADL_READWRITE /Volumes/BEAST/AGATA/Config/Template_READWRITE.txt
25
26 # Here the settings for the routine which finally does all the work:
27 # These settings should normally not be altered, but the library always has to be setup:
28 ADL_TRACES_NUMRES /Volumes/BEAST/AGATA/Config/Template_Traces_NUMRES.txt
29
30 # Set up calculation of paths for trapping correction
31 ADL_TRAPPING /Volumes/BEAST/AGATA/Config/Template_TRAPPING.txt
```

One Example: The Fields for S002

```

1 #####
2 #This file is an example for the setup of the file
3 # ADL_FIELDS_SIMION
4 #####
5
6 #Keywords:
7 ADL_G_SIMION_GridSize  0.05    ![cm/gridunit] sets common dimensi
8 ADL_G_SIMION_SmallPot  1e-6    ![V] Small potential, Defines e.g.
9
10 #Here we specify where to find the weighting potentials:
11 ADL_G_Wpot             /Volumes/BEAST/AGATA/S001/S001.pa%d
12
13 #Here we specify where to find the electrical potentials:
14 ADL_G_Epot             /Volumes/BEAST/AGATA/S001/charge_S002_%d.pa
15 #A list with scaling factors for the electrical potentials follow:
16 #(This depends on the meaning of the fields you loaded)
17 ADL_SCALE_0           5000     !corresponds usually to the bias voltage
18 ADL_SCALE_1           1.0     !scaling space charge 1 (not used here)

```



The geometry of S001/2/3 is identical, but the space charge changes!

Run the program

```
/Volumes/BEAST/AGATA $./simulation
```

Start the program

Parser call returned:

KEYWORD LIST:

```
12          FILENAME = /Volumes/BEAST/AGATA/Config/Template_ADL.txt
9           KEYWORDS = -----
3           ADL_G_VERSION = 3.0
6           ADL_G_DEBUG = 0
10          ADL_EVENT = /Volumes/BEAST/AGATA/Config/Template_EVENT.txt
15          ADL_CONVL_DUMMY = /Volumes/BEAST/AGATA/Config/Template_CONVL_DUMMY.txt
18          ADL_DRIFT_GE = /Volumes/BEAST/AGATA/Config/Template_DRIFT_GE.txt
21          ADL_FIELDS_SIMION = /Volumes/BEAST/AGATA/Config/Template_FIELDS_SIMION.txt
25          ADL_READWRITE = /Volumes/BEAST/AGATA/Config/Template_READWRITE.txt
29          ADL_TRACES_NUMRES = /Volumes/BEAST/AGATA/Config/Template_Traces_NUMRES.txt
32          ADL_TRAPPING = /Volumes/BEAST/AGATA/Config/Template_TRAPPING.txt
0           ERRORS = -----
```

Config files
used

**** Reading Electric Potential Arrays ****

```
SIMION_READ detected 37 files for mask /Volumes/BEAST/AGATA/S001/S001.pa%d
/Volumes/BEAST/AGATA/S001/S001.pa0: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa1: x165 y165 z182, symm: x0 y0 z0, maxv: 100000.000000
/Volumes/BEAST/AGATA/S001/S001.pa2: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa3: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa4: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa5: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa6: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa7: x165 y165 z182, symm: x0 y0 z0, maxv: 100000.000000
/Volumes/BEAST/AGATA/S001/S001.pa8: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa9: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa10: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
/Volumes/BEAST/AGATA/S001/S001.pa11: x165 y165 z182, symm: x0 y0 z0, maxv: 10.000000
```

Fields read
in

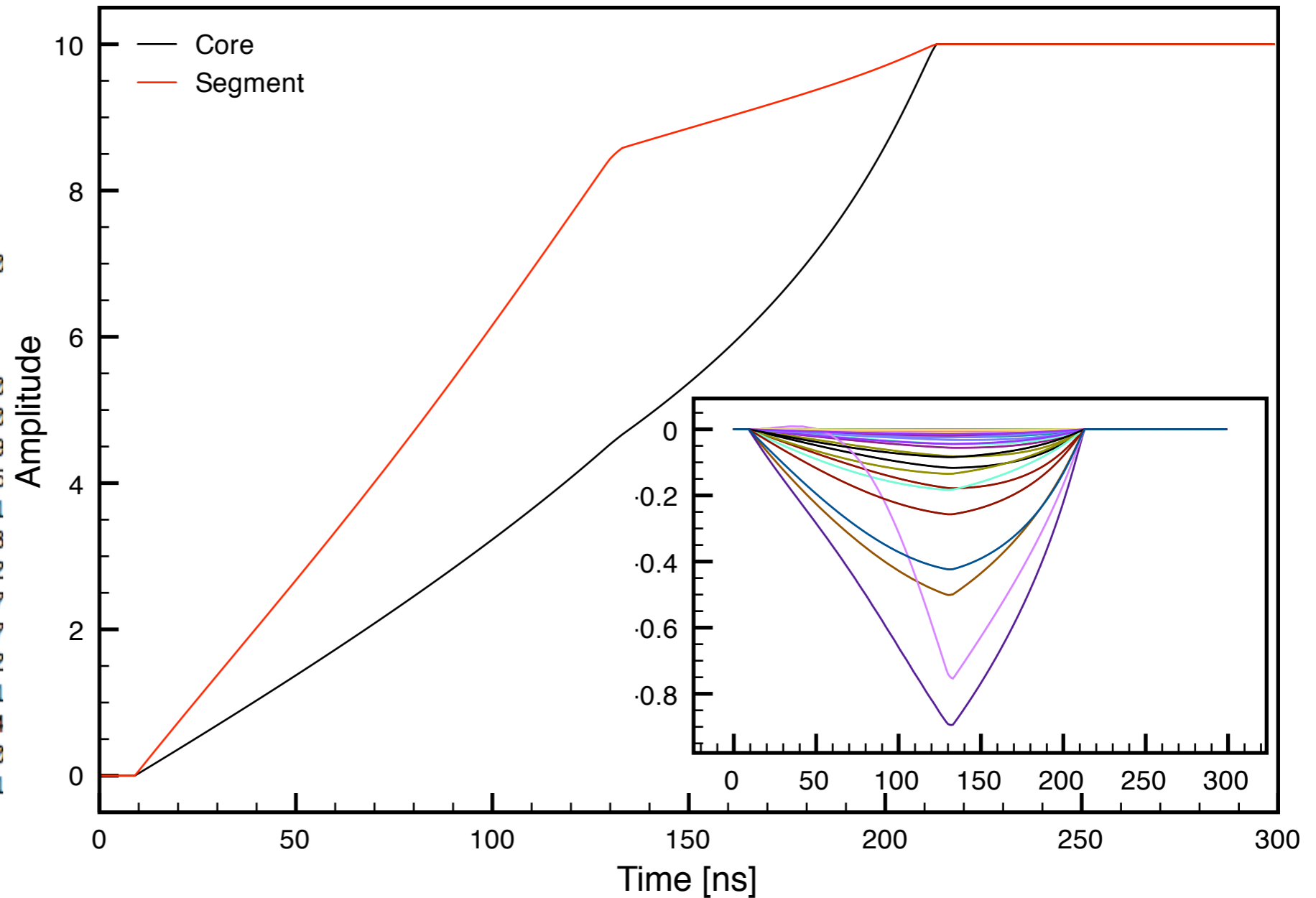
...

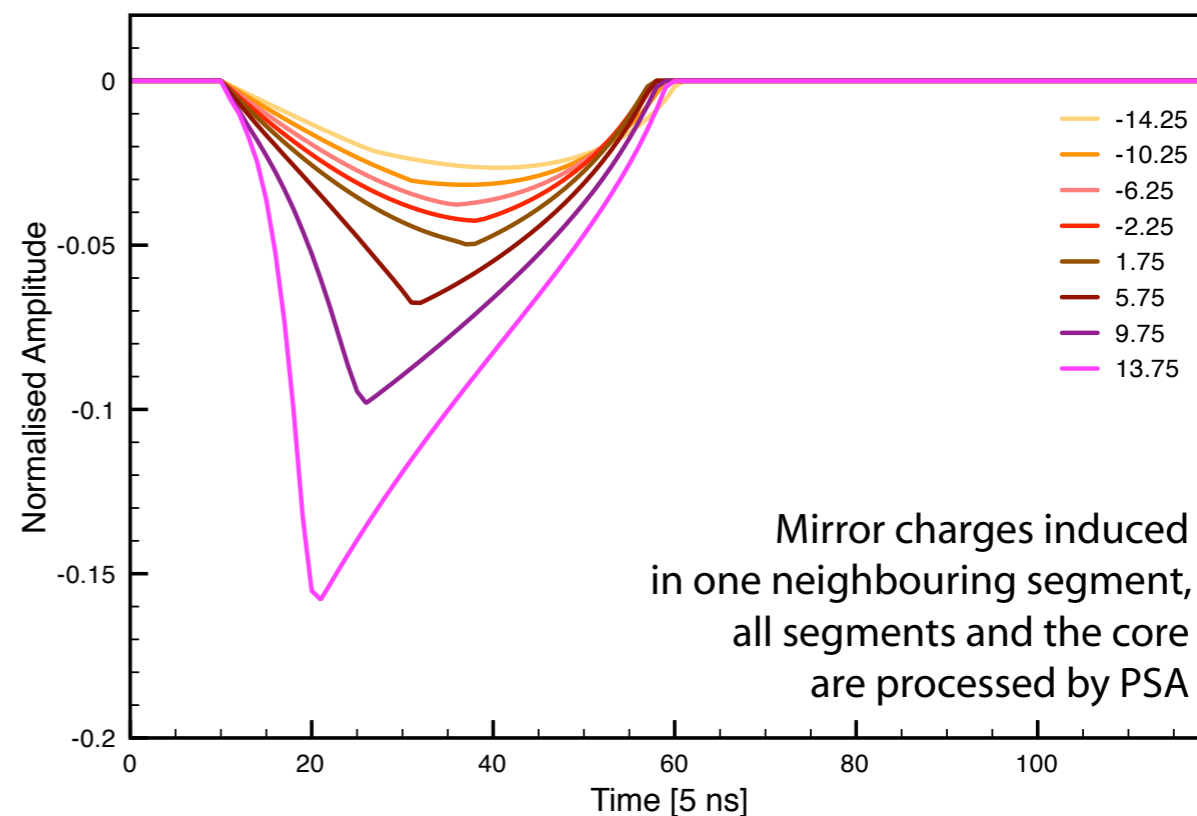
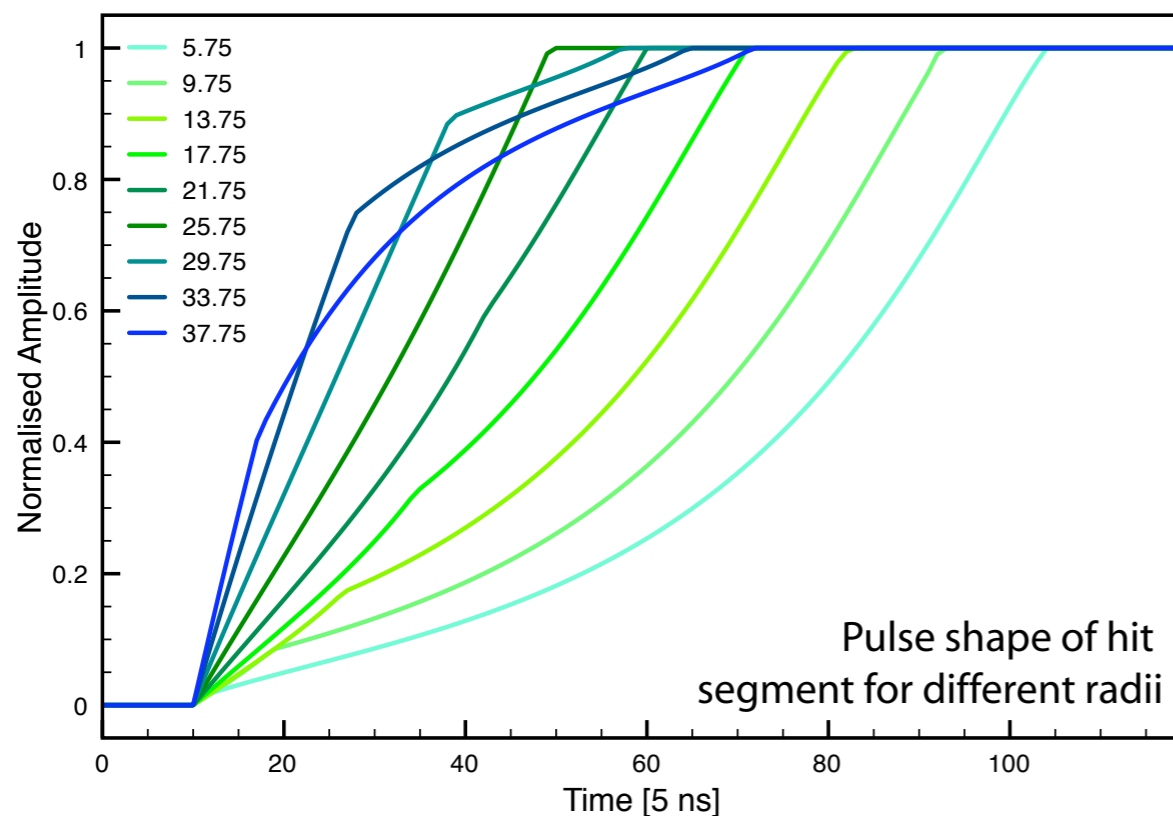
Output / Results

```

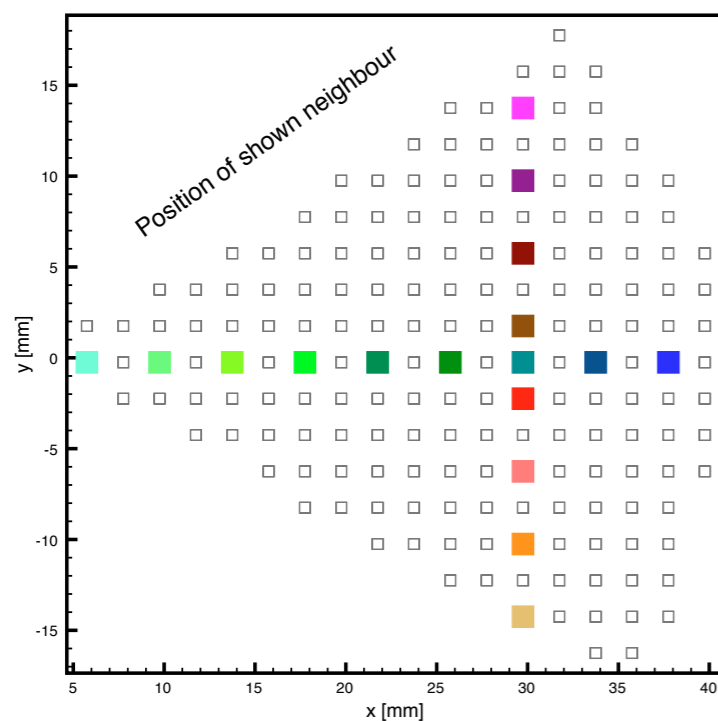
1 .....
2 # HITS
3 # TIME T0 [us]
4 0.010000
5 # ENERGIES OF THE nInt INTERACTIONS
6 10.000000
7 # POSITIONS OF THE nInt INTERACTIONS
8 2.000000 2.000000 8.000000
9
10 # TRACES
11 # TRIGGER TIME
12 21
13 # ENERGY OF THE nSeg SEGMENTS
14 9.999995 0.000000 0.000000 0.000000 0
15 # TRACES OF THE nSeg SEGMENTS
16 -0.000000 0.000000 0.000000 0.000000
17 -0.000000 0.000000 0.000000 0.000000
18 0.327086 -0.000066 -0.000140 -0.000060
19 0.658523 -0.000131 -0.000277 -0.000120
20 0.995161 -0.000194 -0.000411 -0.000179
21 1.337979 -0.000254 -0.000540 -0.000236
22 1.687994 -0.000312 -0.000664 -0.000291
23 2.046448 -0.000366 -0.000781 -0.000343
24 2.414861 -0.000416 -0.000890 -0.000392
25 2.794955 -0.000461 -0.000989 -0.000437
26 3.188905 -0.000501 -0.001077 -0.000477
27 3.599508 -0.000534 -0.001152 -0.000512
28 4.030435 -0.000561 -0.001213 -0.000541
29 4.486329 -0.000580 -0.001259 -0.000564
30 4.898672 -0.000571 -0.001244 -0.000560
31 5.324136 -0.000545 -0.001194 -0.000541

```



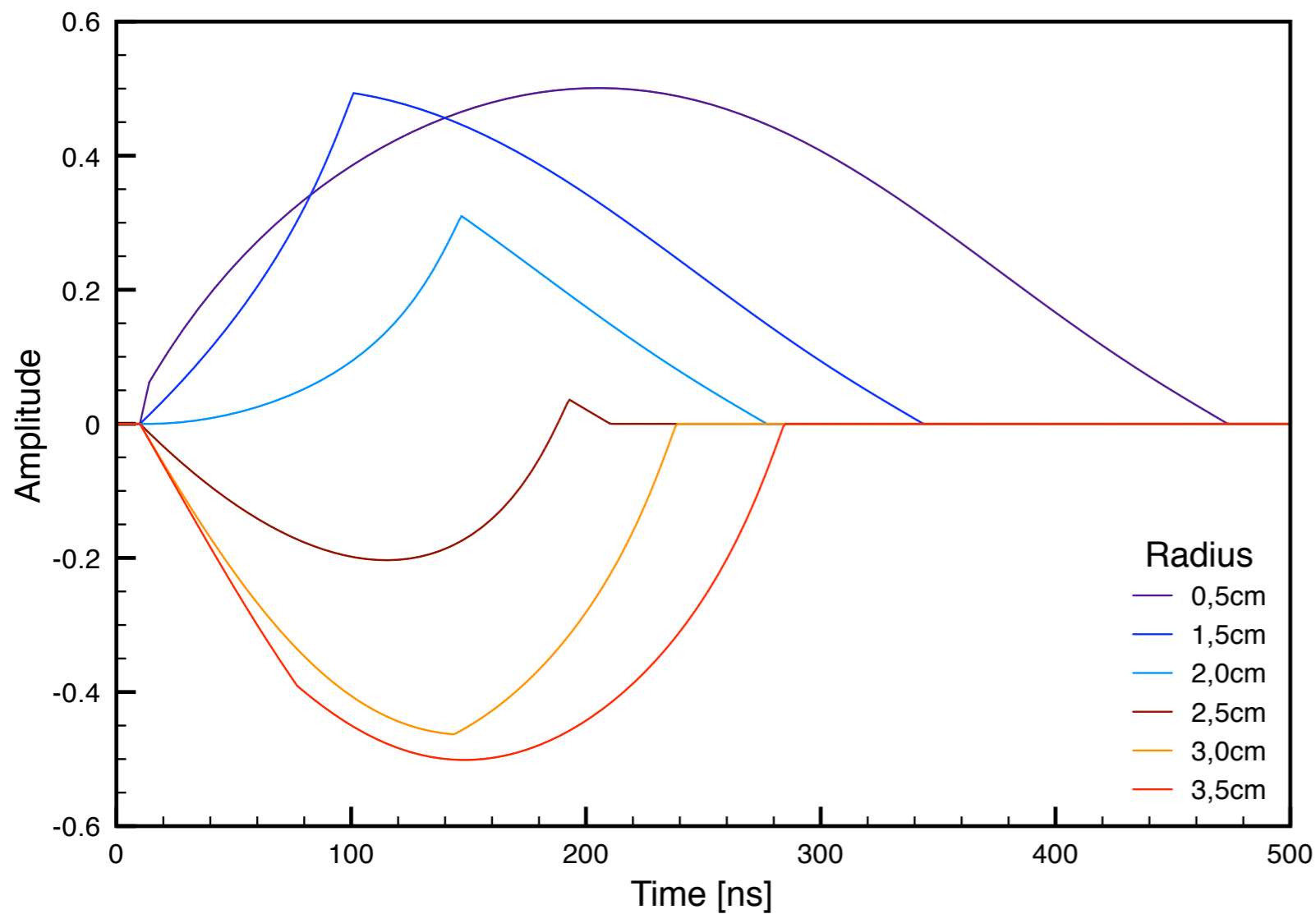


PSA basis created with ADL

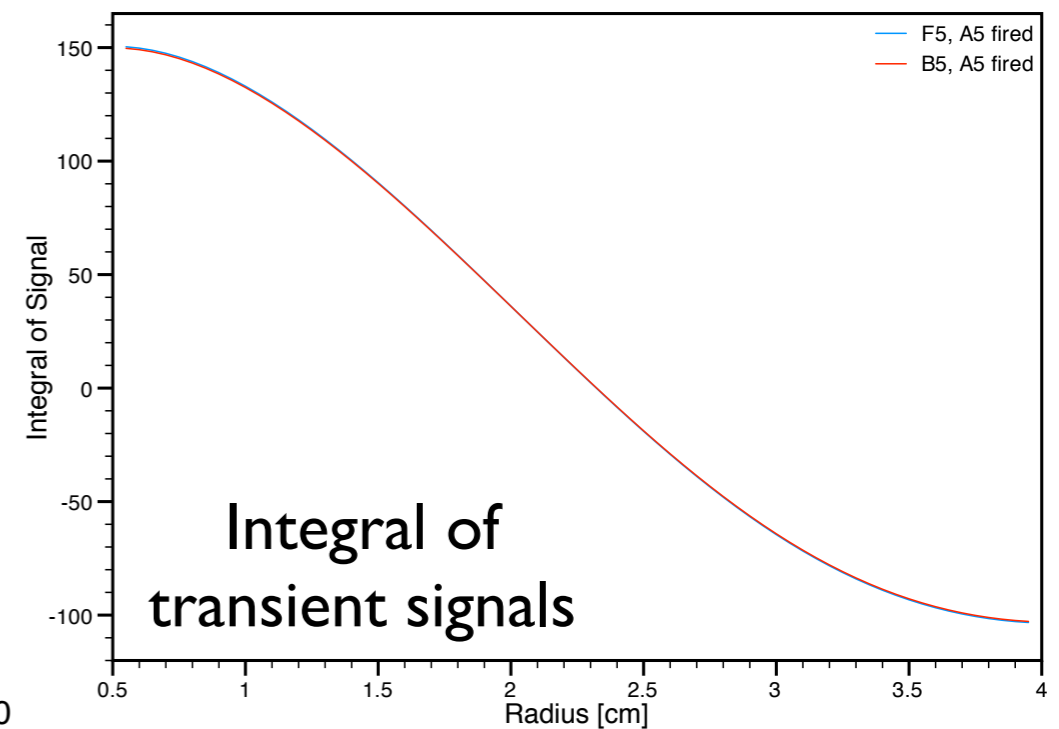


Basis used by online analysis created with ADL

Howto - Behavior of neighboring segments



Different radii in the center of Segment A5



Outlook:

- Implementation of depletion process (already available with ADL 2)
- User and Reference documentation
- Other detectors (geometries, materials)

Howto - Behavior of neighboring segments

