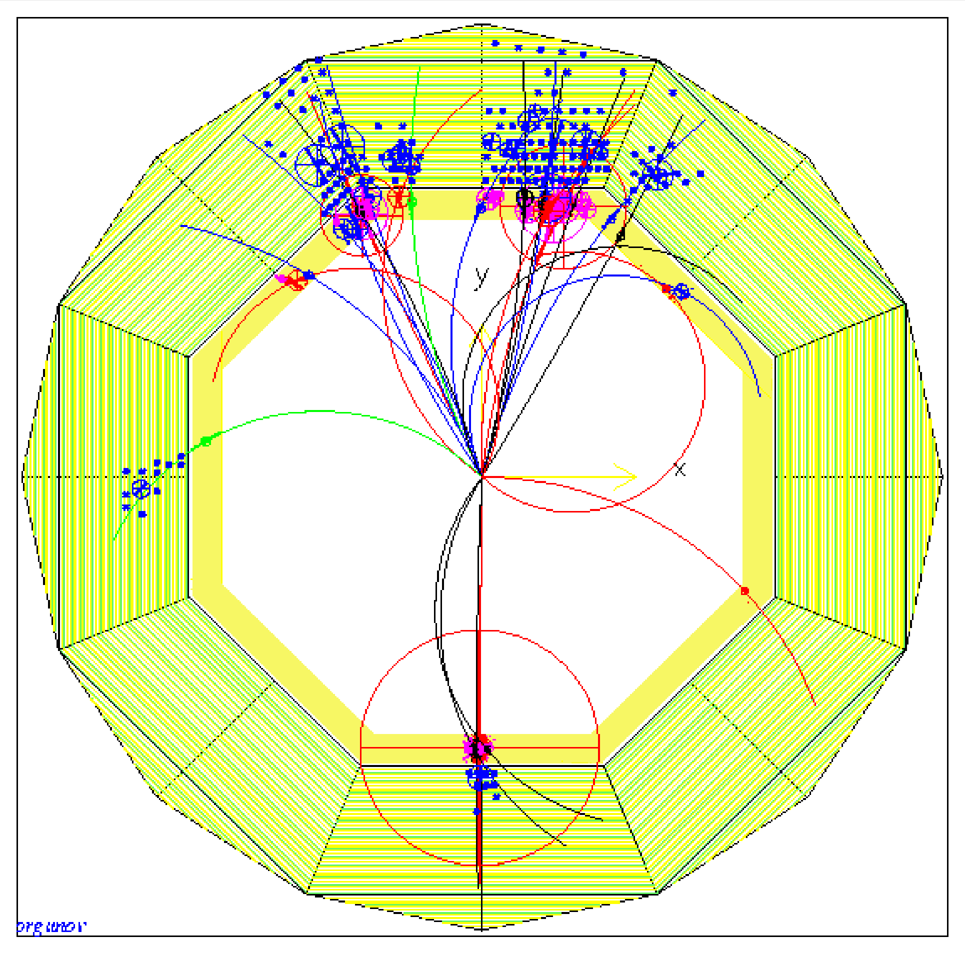
Status of Simulation in the ECFA/ DESY study

Ties Behnke, DESY

- BRAHMS: the current standard
- MOKKA: the new system
- SIMDET: the fast alternative



Status Report BRAHMS

T. Behnke, DESY

- Goal: prepare a final version of BRAHMS
  - provide a stable platform for analysis
  - make the way ready for the migration to GEANT4

- What were our goals:
  - full tracking, including background simulation
  - full calorimeter reconstruction
  - full merging of tracker and calorimeter
  - full energy flow object reconstruction
  - Separation of simulation and reconstruction
  - Some tools (ZVTOP, interface to Jet finders, event shape variables) etc.

Where are we:
- full tracking is implemented
- calorimeter reconstruction (ECAL and tile HCAL) implemented
- merging is implemented
- energy flow reconstruction implemented
- Separation into Simulation and Reconstruction part nearly done

Current Status

Tracking:

- Full tracking implemented
- Runs stable, excellent efficiency
- Speed needs to be optimised:

current performance:

CPU/ event	57.9s	
track reconstruction	35.20%	
VTX		29.55%
TPC		63.07%
FCH		2.84%
merging, ambiguity		5.68%

Calorimeter:

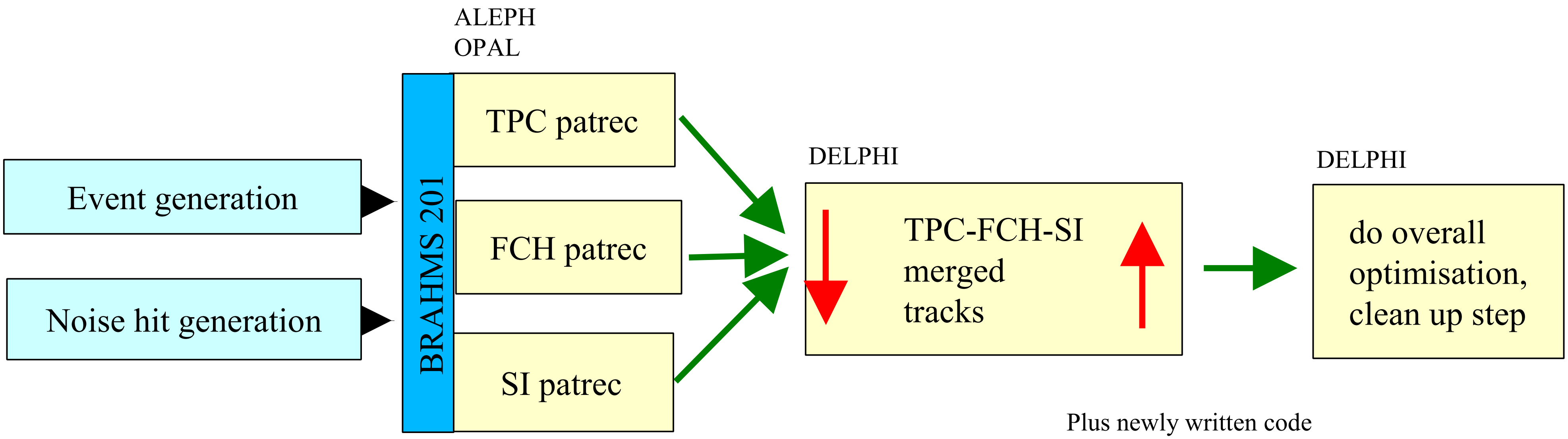
- First version of calorimeter reconstruction software implemented
- First energy flow object reconstruction available
- needed: parameter tuning
- needed: comprehensive testing

System:

- At the moment not stable
- Some internal memory problems (Fortran!)

Pattern Recognition

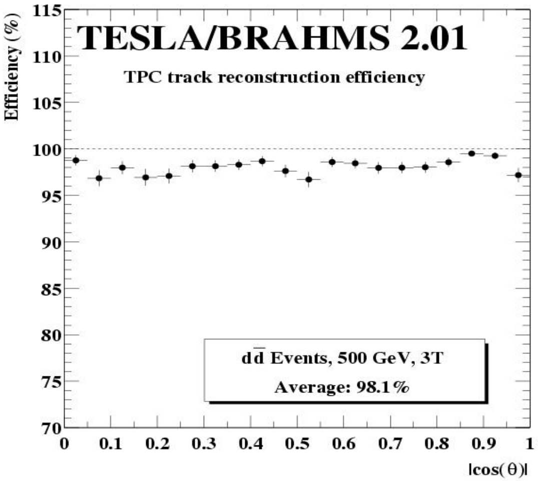
- Intense simulation effort within the ECFA DESY study:
  - Based on standard technology: GEANT3, Fortran, etc.
  - Complete simulation framework BRAHMS has been developed
    - Full simulation
    - Pattern recognition for central detector
  - Event visulation tool based on open GL
  - Reuse as much as possible existing software tools (LEP/ SLD/ ...)



Pattern Recognition

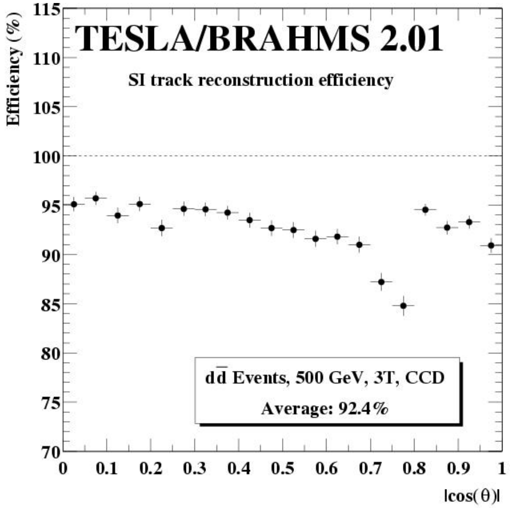
Pattern recognition efficiencies in BRAHMS

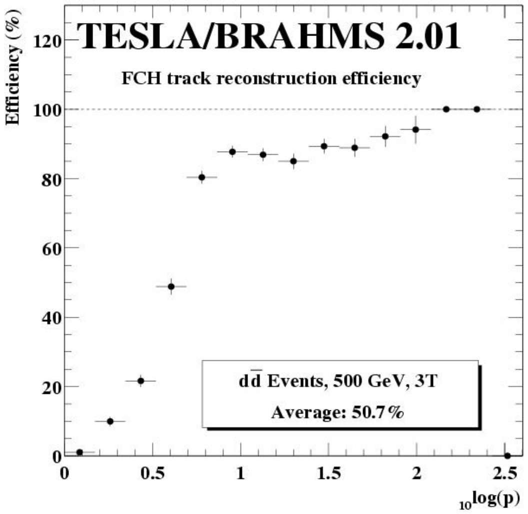
TPC alone



All plots are including background (realistic background rate)

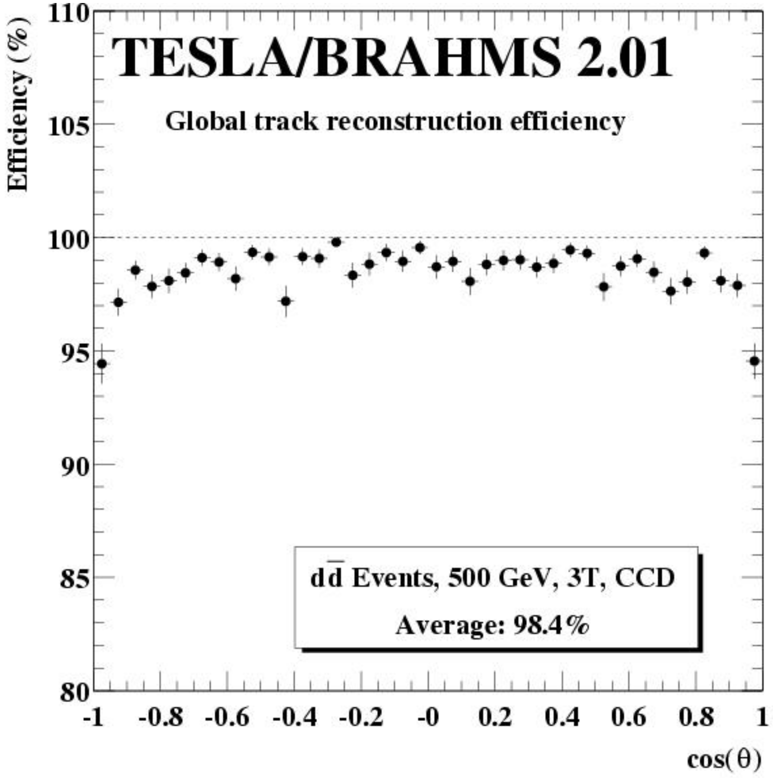
SI CCD alone





FCH alone

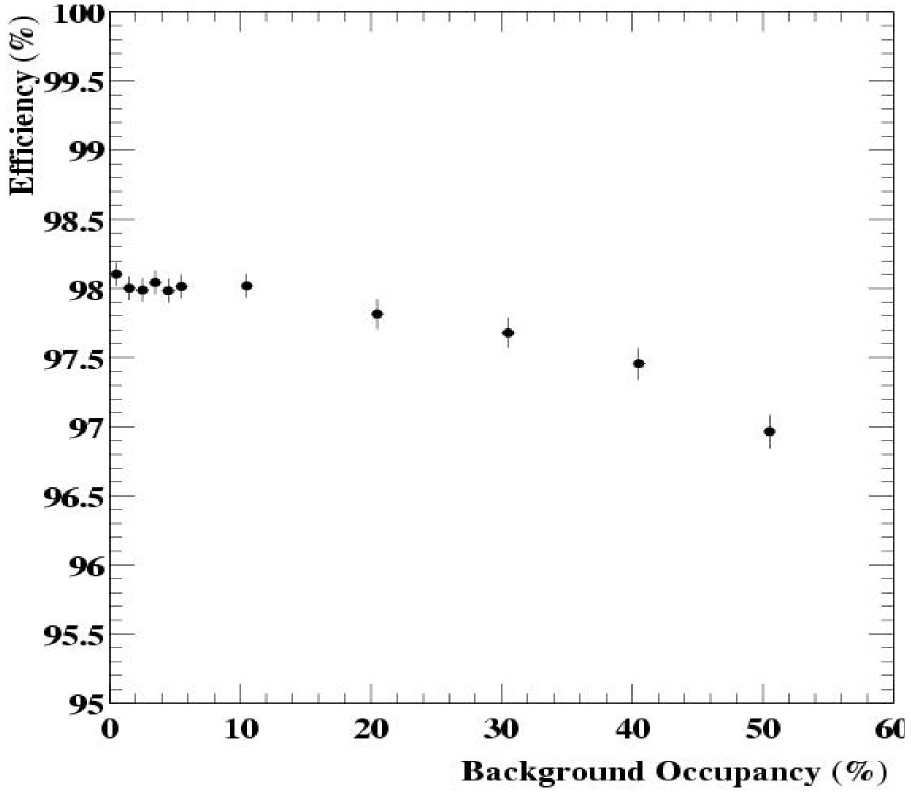
combined all detectors (except SET)

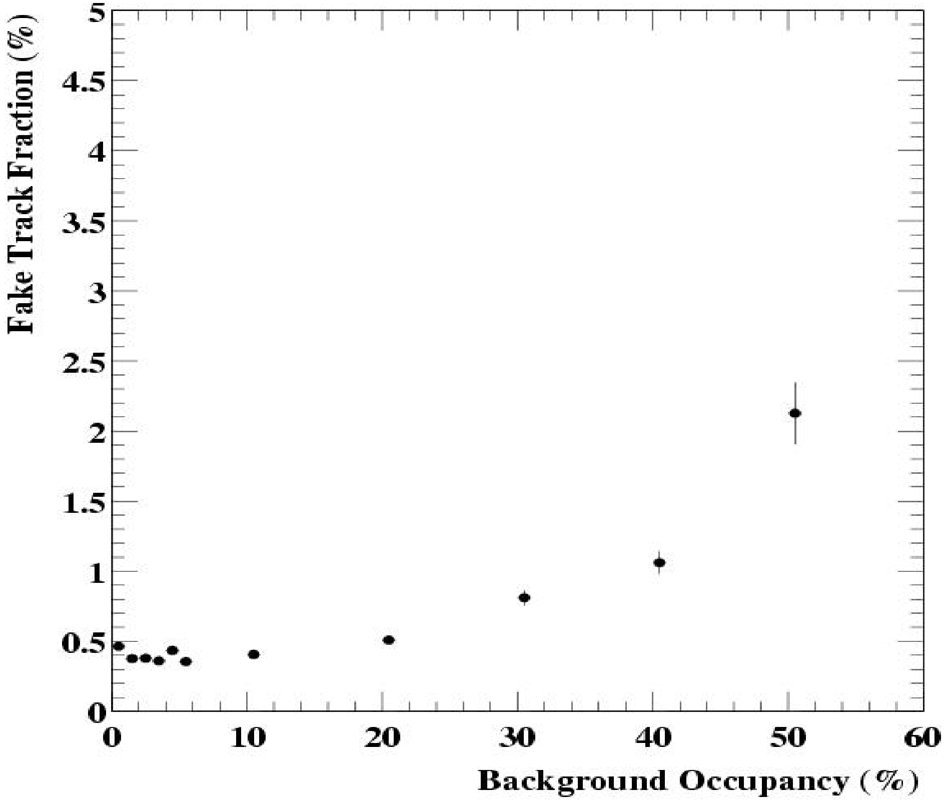


Dependence on background rates:

0%	98.4%
1%	98.4%

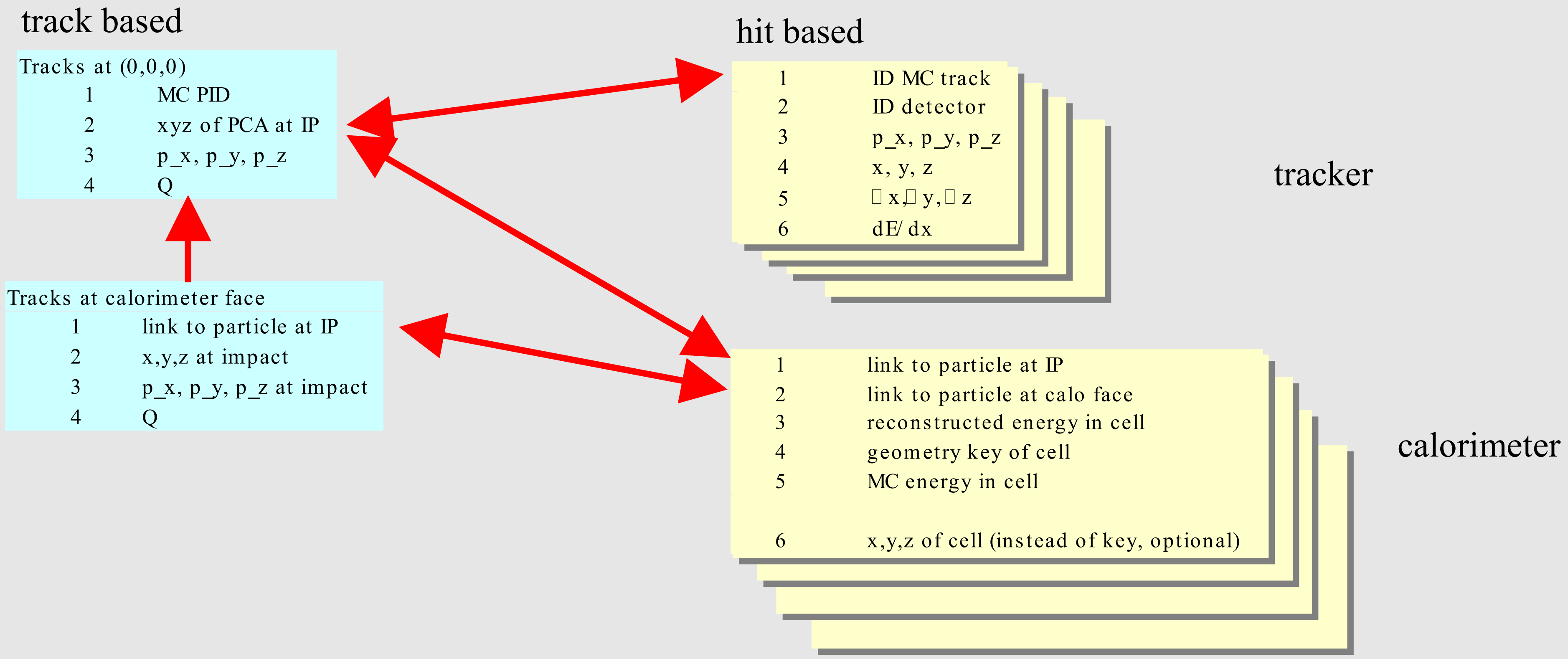
Backgrounds in the tracking system





Things to be done

- Separation of Simulation and Reconstruction
  - tracker: have to define a hit format.
  - proposal:
  - Calorimeter: a version of the hits record has been defined
  - proposal:



track based

Tracks at (0,0,0)	
1	MC PID
2	xyz of PCA at IP
3	p_x, p_y, p_z
4	Q

Tracks at calorimeter face	
1	link to particle at IP
2	x,y,z at impact
3	p_x, p_y, p_z at impact
4	Q

hit based

tracker

1	ID MC track
2	ID detector
3	p_x, p_y, p_z
4	x, y, z
5	□ x,□ y,□ z
6	dE/ dx

calorimeter

1	link to particle at IP
2	link to particle at calo face
3	reconstructed energy in cell
4	geometry key of cell
5	MC energy in cell
6	x,y,z of cell (instead of key, optional)

GEANT4 in Europe: MOKKA

- Simulation system based on GEANT4
  - developed in Paris by P. Mora de Freitas and collaborators
  - started as pure calorimeter simulation, has since expanded to include other detectors

¥ Able to simulate several detector models.

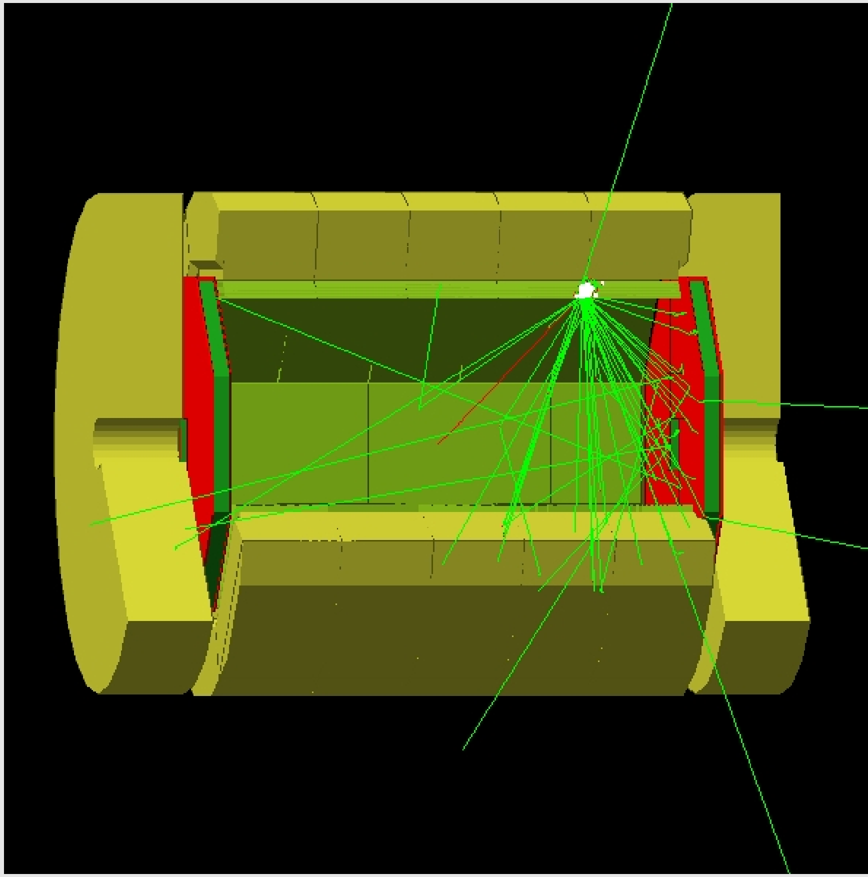
¥ But also several prototype models

¥ Use and development in collaboration

- Documentation and sources available via Web
- CVS repository (at Lyon, waiting for the DESY one)

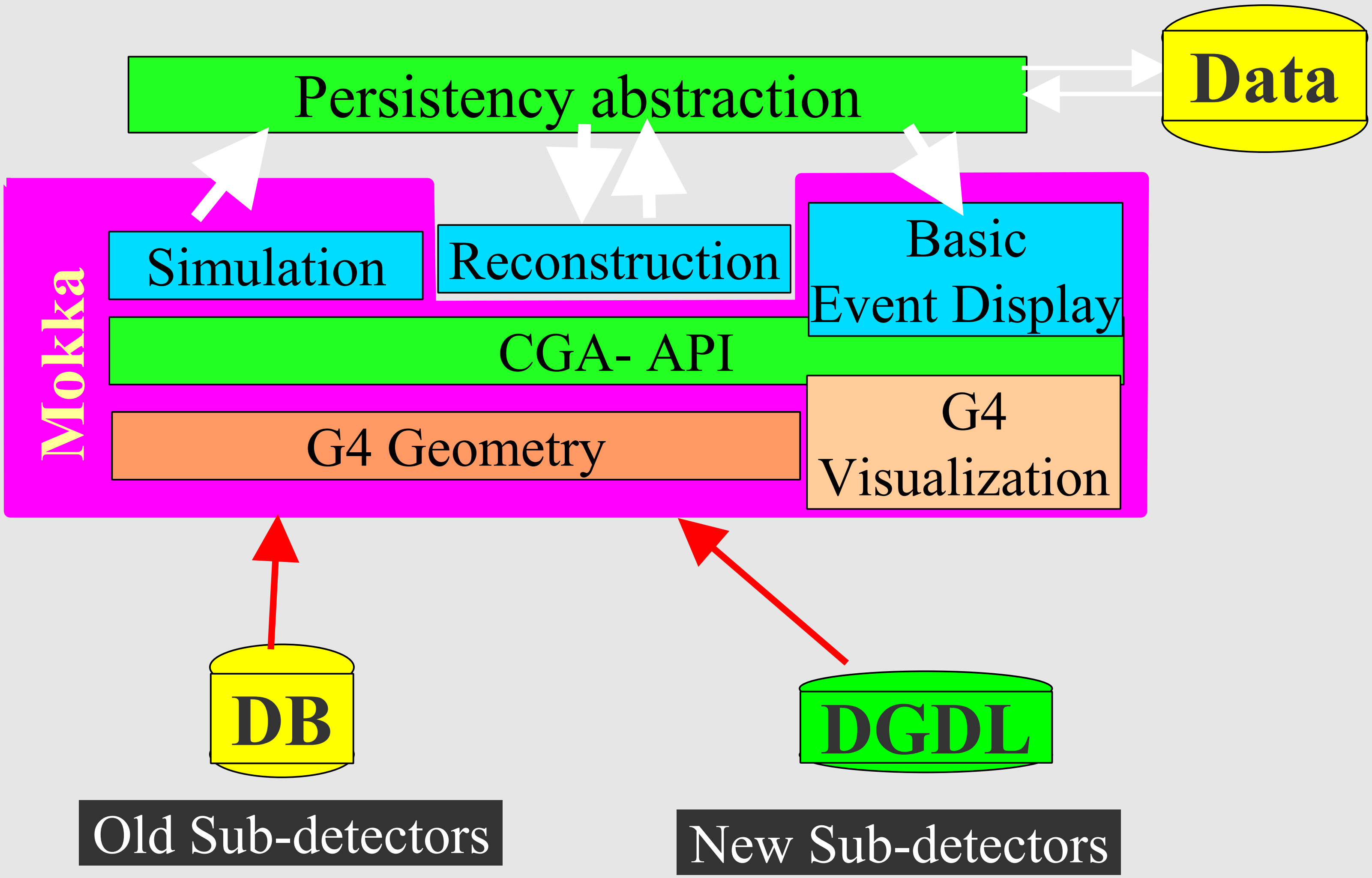
¥ Almost 12500 lines of C++ code

http://polype.in2p3.fr/geant4/tesla/www/mokka



Paolo Moras de Freitas

MOKKA: new structure



Attempts to standardise

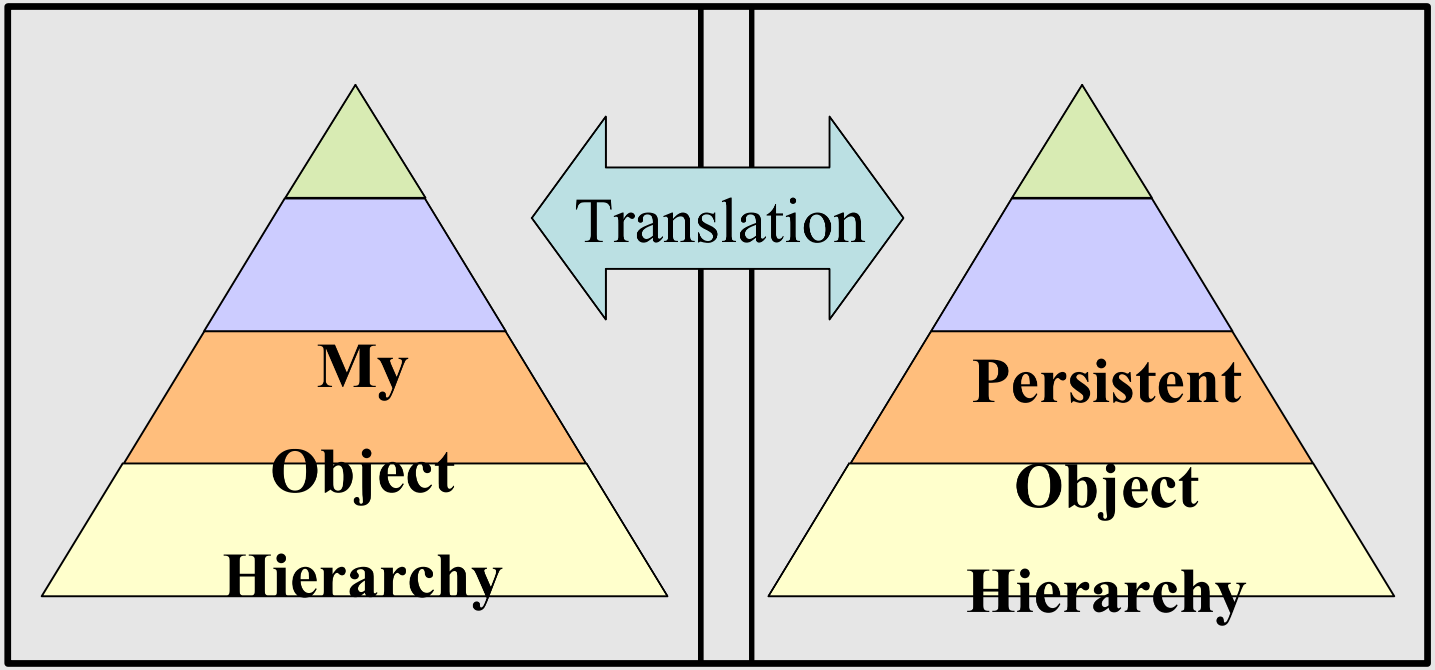
- how shall we define the geometry
  - hardcoded
  - XML based approach
  - the new root geometry system? (to be released this fall)
  - a custom Geometry Description Language?

- agree on some common code standards
  - first draft of such a standard is circulating
  - need feedback for this to make any sense

An example: The Persistency Models

Transient Persistency Split:

Application



Lets be more specific

- Basic Ideas
  - Transients have a persistent counterpart
  - Transients know nothing about it
  - Persistent object know how to create/connect to transients
  - Objects register with a ConversionManager
  - ConversionManager is tied to a “stream”
  - ConversionManager triggers specific conversion on out/input.

Tobias Haas, DESY, at St Malo

Example implementation of such a model is under development for the simple GEANT4 TPC model developed
at DESY.

SIMDET Status

- SIMDET: fast parametric simulation program developed in the context of the ECFA/DESY study
- Version 4 was just released
  - Full implementation of the TDR detector
  - Improved treatment of error matrices in the tracking
  - Improved dE/dx treatment
  - b-tagging fully implemented (based on ZVTOP algorithmus + neural nets a la LEP)
    - Many small bug fixes and improvements

technically:

- ➡PATCHY as code “manager” is replaced by c-preprossor
- ➡Available from a CVS depository in DESY
- ➡For the time being also available in the old format.

Conclusion

- Useful simulation tools are very important
- Existing tools are coming close to being “final”
- Release of SIMDET 4 has happened
- BRAHMS final version might be out this summer
- Step into the new world of GEANT4 is being done
  - MOKKA looks like a good starting point
  - Many technical detail still need to be worked out
  - Standardisation?
  - Goal: much closer collaboration with our colleges this side of the atlantic