

**Offline software status for TOF, ANTI and ECAL
subdetectors of AMS02.**

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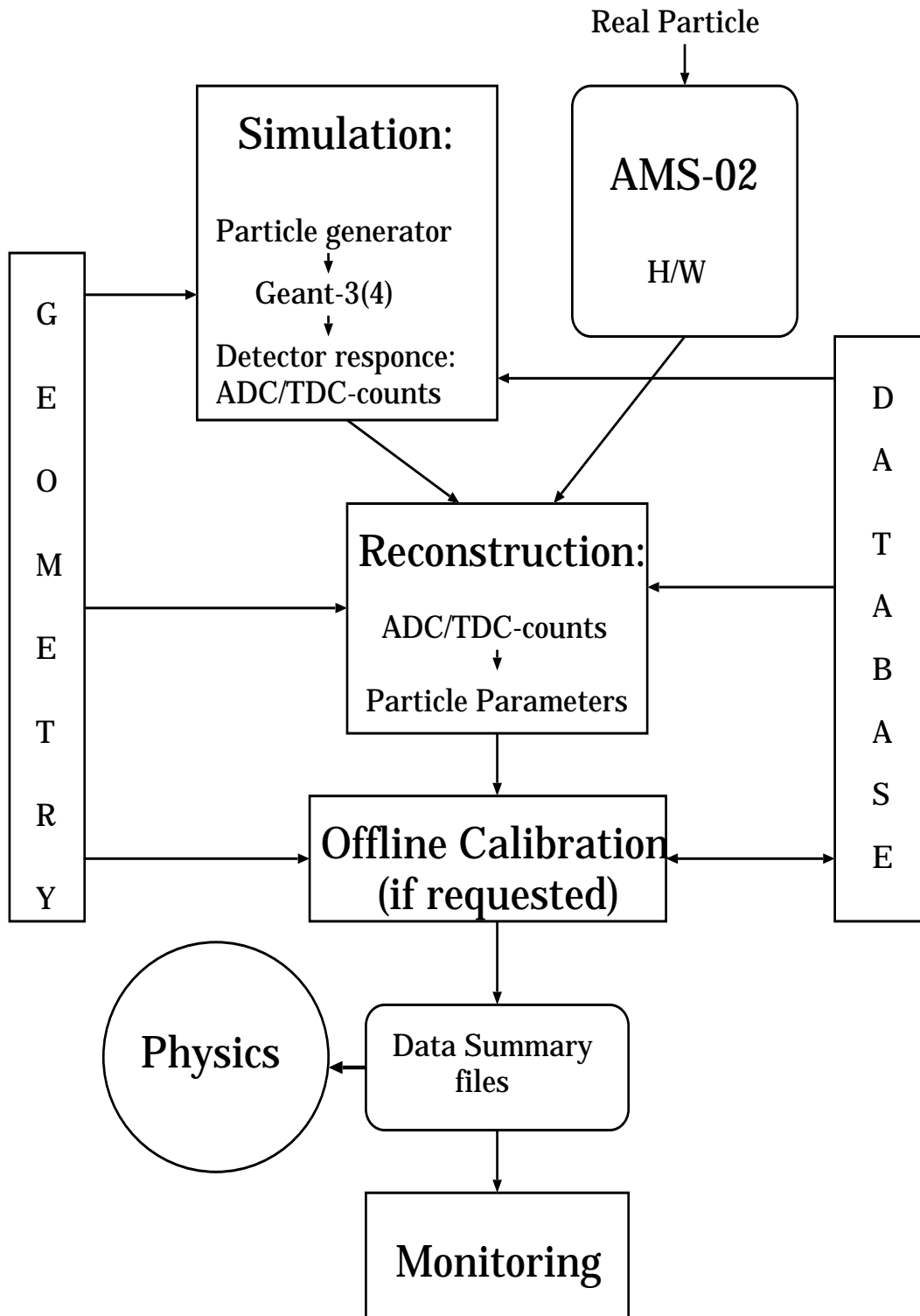


Figure 1: The simplified structure of AMS02 offline software.

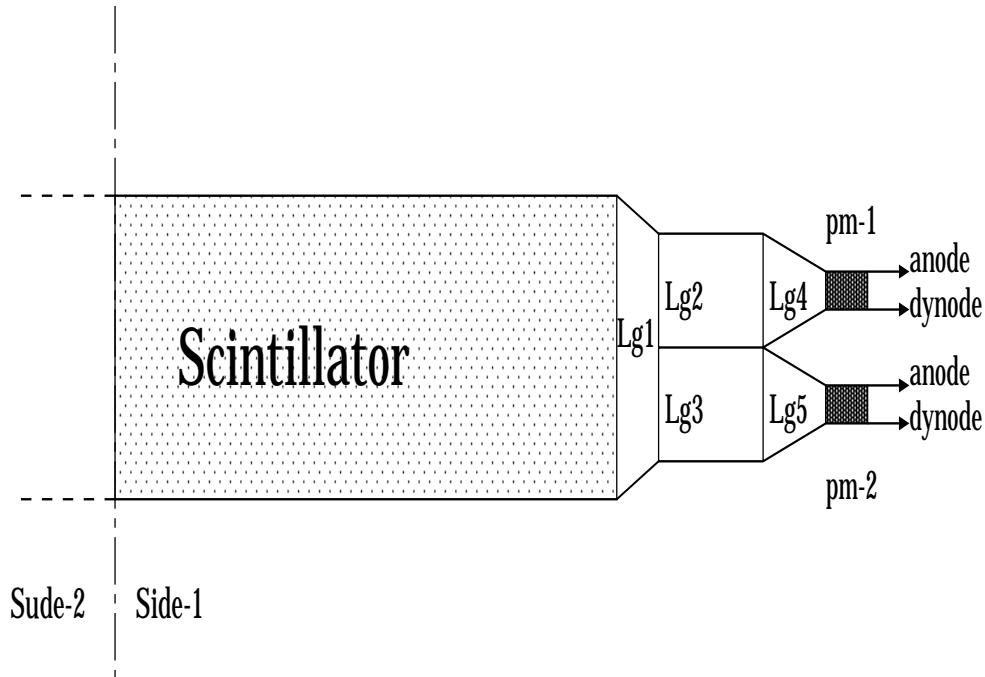
1 TOF software status.

- **Geometry**(TOF and around):
 - Trapezoidal design for external TOF counters is implemented;
 - Counters layout in planes is updated;
 - Inclined tracker radiators : latest flat design is implemented, but the effective density is not final;
 - M-structure now includes 4 anti-vibration bars, but their thickness is not final yet;
- **Simulation:**
 - Light transport program for generation of counter time-distributions according to particle entry point(2D) is updated to implement trapezoidal counters.
Just to remind: output files of this "stand alone" program are used by standard AMS02 simulation program to increase the speed of TOF-simulation part. Some parameters are not final yet:
 - * Light losses in bended light guides;
 - * Realistic spread of sensitivity, gain and transit time of PMTs coupled to one side of the counter(if this spread is essential, the program logic can accept PMT individuality);
 - * The degradation of PMT single electron spectrum due to the influence of local magnetic field(unfortunately counter position sensitive);
 - MC raw event format and simulation logic are updated according to new readout scheme(pulse charge integration ADCs for anode and dynode channels, double gain scales for both anode and dynode);
 - The TOF fast trigger simulation logic was modified to be close to hardware specifications(thank to C.Lin and A.Lebedev for useful discussions);
 - The timing/threshold/noise parameters of PMT + SFET(C) chain are very preliminary, waiting for results of real counter+electronics tests;
- **Reconstruction:** New readout scheme(pulse charge integration ADCs with 2-scale anode and dynode readout) is also implemented;
- **Calibration:** Complete set of programs for TOF-system offline calibration was updated. The current set of calibration parameters is shown below:
 - The counter-to-counter de/dx response corrections and relative timing;
 - "Along the counter" de/dx response corrections;
 - Time slewing correction;
 - Time-stretcher parameters;

- Anode-to-dynode gain ratios;
- Anode(dynode) High-to-Low gain ratios;
- **Monitoring:** Old(AMS01) TOF monitoring program have to be rewritten. Just to remind: it is implied that during the flight this program reads out files created by offline reconstruction program (which in real time mode process about 10% of data arriving to SOC) and informs about dead or hot channels and any other deviations from normal behaviour. This new program should work now with new output files(root-files), manage bigger volumes of information and not only show many tens of distributions but also perform some routine checks and send alarm messages. So one should start its development soon to be ready before the first laboratory/beam tests of complete AMS02 system.

General status : formally ready for MC production runs, but some logic/parameters tuning is needed when more laboratory/beam test results will be available. Unfortunately some hardware elements are not fixed yet (laboratory/beam tests are in progres). So even software logic is not stable. Just example:

the independent readout of each PMT dynode on each counter side is now under consideration(one-side PMTs sum is kept only for anodes).



This modification critically affects simulation, reconstruction and calibration programs, their adaptation will require essential time.

And similar situation may be for any subdetector. I think we should freeze now current software configuration, run necessary MC jobs (acceptance type) and come later (in about 0.5 year) to the "final" updates based on final hardware test results.

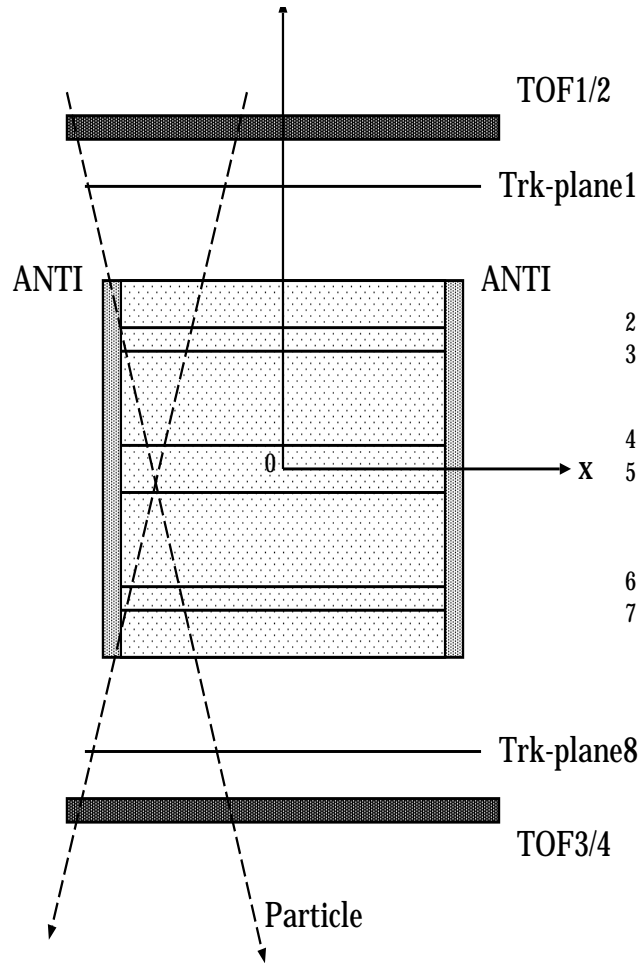
2 ANTI-counters software status.

- **Geometry:** updated to have 16 physical sectors, read out as 8 logical;
- **Simulation:** new readout scheme is implemented (pulse charge integration ADCs for anode Edep measurement, TOF-like time-history channel), some counter parameters are still very preliminary:
 - pulse delay and attenuation by clear fiber light guide connecting sector edge and PMT(individual for each physical sector);
 - physical sector response to MIP in photoelectron units;
 - timing/threshold/noise parameters of PMT + SFEA chain;
- **Reconstruction:** new readout scheme is implemented;
- **Calibration:** Offline calibration program have to be developed (to extract sector-to-sector and "along the sector" de/dx variation corrections). Preliminary study shows a number of problems :
 - very low acceptance for required events (TOF + TRACK matched with fired ANTI-sector), it is about 0.007 of TOF4x acceptance for primary protons and about 0.009 for undercutoff protons;
 - all events are concentrated near the sector edges(top and bottom);
 - sector-to-sector assimetry in number of events ;

One should think about some hardware solution (LEDs, some radioactive sources(?));

- **Monitoring:** program have to be written;

General status : formaly ready for MC production runs, but some logic/parameters tuning is needed befor any reliable backgrounds estimations could be obtained - wait for more laboratory/beam test results.



AMS02 central part (cut view).

Figure 2: Limited acceptance for ANTI-calibration events.

3 ECAL software status.

- **Geometry:** according to official drawings (square shape and 9 complete super layers);
- **Simulation:**
 - Anode(high and low gain channels) and dynode readout is implemented;
 - Fast and level-1 trigger logic is implemented according to INFN design, but thresholds are very preliminary;

- Pedestals/sigmas are temporary (set as in beam-test data);

According to ECAL-group report MC shows good agreement with test beam data.

- **Reconstruction:**

- Anode(double scale) and dynode readout is implemented;
- Fiber attenuation and saturation corrections to pixel signal are implemented;
- Pixel 2D- and 3D-clustering algorithm is implemented (V.Choutko's "shower" procedure), other algorithms are possible and welcome;
- some "standard" e/p separation algorithm is needed (under development in ECAL group)

- **Offline calibration:**

- inter-channel (pixel-to-pixel) calibration algorithm using Helium events is implemented;
- absolute energy normalization algorithm using low energy electrons(up to 10gev) is implemented;
- another algorithms are possible and welcome;

- **Monitoring:** program have to be written;

General status : formally ready for MC production runs, some logic/parameters tuning is needed when more laboratory/beam test results will be available.