



TOF offline status

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for the ALICE-TOF group



ALICE Offline week
CERN-B40, 5th – 9th July 2010



Outline

- ▶ Calibration
- ▶ MC productions:
 - ▶ OCDB for event simulation and reconstruction
 - ▶ On-the-fly check on TOF time measurements in p-p MC productions
- ▶ QA and DQM
- ▶ Alignment
- ▶ Reconstruction. Open questions:
 - ▶ integrated times
 - ▶ time resolutions
- ▶ Open savannah bugs
- ▶ Planning: status

TOF calibration: update

- ▶ R.Preghenella works on TOF calibration (more details in his passed talks).
- ▶ In the following slides:
 - ▶ the parameters coming from TOF raw data will be shown in **green color**;
 - ▶ the parameters coming from TOF OCDB will be shown in **blue color**.
 - ▶ Legend for used symbols:

$t_{\text{ESD}}^{\text{TOF}}$ -fTOFsignal-	TOF time in AliESDtrack	$t_{\text{raw}}^{\text{TOF}}$	TOF time in raw data	$\sum_{n=0,5} a_n (q_{\text{raw}}^{\text{TOF}})^n$	TOF offline calibration
$t_{\text{cluster}}^{\text{TOF}}$	TOF time in cluster	$t_{\text{L0LI}}^{\text{latency}}$	Latency between L0 and LI	$t_{\text{latencyWindow}}$	Latency window for TOF TDCs
$q_{\text{raw}}^{\text{TOF}}$	TOF tot in raw data	$t_{\text{CTP}}^{\text{latency}}$	Latency window for CTP	t_{fill} (timestamp)	Bunch time vs timestamp

AliESDtrack::fTOFsignal @ pass 1

- $t_{\text{ESD}}^{\text{TOF}} = t_{\text{raw}}^{\text{TOF}} +$
 - $\sum_{n=0,5} (a_n * (q_{\text{raw}}^{\text{TOF}})^n) +$
 - + $t_{\text{LOLIlatency}} +$
 - + $t_{\text{CTPlatency}} +$
 - $t_{\text{latencyWindow}} +$
 - $t_{\text{fill}} (\text{meanValueXrun})$

Measured online in DA/PP
(one value per run)

where:

- a_n are located in OCDB/TOF/Calib/ParOffline [rev39270];
- $t_{\text{CTPlatency}}$ in OCDB/TOF/Calib/CTPlatency [rev38889];
- $t_{\text{latencyWindow}}$ in OCDB/TOF/Calib/Status [rev38058+rev38106+38889];
- $t_{\text{fill}} (\text{meanValueXrun})$ in OCDB/TOF/Calib/RunParams [rev40874].

AliESDtrack::fTOFsignal @ pass2

- $t_{\text{ESD}}^{\text{TOF}} = t_{\text{raw}}^{\text{TOF}} +$
 - $\sum_{n=0,5} (a_n * (q_{\text{raw}}^{\text{TOF}})^n) +$
 - + $t_{\text{LOLI latency}} +$
 - + $t_{\text{CTPlatency}} +$
 - $t_{\text{latencyWindow}} +$
 - $t_{0_{\text{fill}}} \text{ (timestamp)}$

Measured offline in calibrationTask
(typically more than one value per run)
-see Roberto passed talks for more details-

where:

- a_n are located in OCDB/TOF/Calib/ParOffline [rev39270];
- $t_{\text{CTPlatency}}$ in OCDB/TOF/Calib/CTPlatency [rev38889];
- $t_{\text{latencyWindow}}$ in OCDB/TOF/Calib/Status [rev38058+rev38106+38889];
- $t_{0_{\text{fill}}} \text{ (timestamp)}$ in OCDB/TOF/Calib/RunParams [rev40874].

MC productions: OCDB for simulation and reconstruction

- ▶ Idea: use raw OCDB for TOF channel status map, i.e. OCDB/TOF/Calib/Status path.
- ▶ Since 2010 December, the TOF status object contains also one of the time calibration parameters, i.e. $t_{\text{latencyWindow}}$ (see prev. slides).
- ▶ TOF reconstruction code invariant for MC and real data: obviously.
- ▶ In case of positive match with TOF element, the TOF time measurement attached to the matched TOF-track is:

$$t_{\text{ESD}}^{\text{TOF}} = t_{\text{raw/digit}}^{\text{TOF}} - \sum_{n=0,5} (a_n * (q_{\text{raw}}^{\text{TOF}})^n) + t_{\text{L0L1latency}} + t_{\text{CTPlatency}} - t_{\text{latencyWindow}} - t_{\text{0fill}} \text{ (timestamp)}$$

- ▶ So, if we point the raw OCDB for TOF channel status map in MC production only at reconstruction level, we risk to have de-calibrated (wrong) TOF time measurement attached to the matched TOF-tracks.

MC productions: OCDB for simulation and reconstruction

- ▶ To avoid this problem, in case of MC production, we can correctly de-calibrate TOF time measurements at digitization level and then calibrate them at reconstruction level by pointing the same (raw, also) OCDB for TOF detector, as shown in the following:

$$\begin{array}{l}
 \text{De-calibration} \left\{ \begin{array}{l}
 t_{\text{sdigit}}^{\text{TOF}} = t_{\text{geant}}^{\text{TOF}} + \text{smearing} \times \text{timeResolution} \\
 t_{\text{digit}}^{\text{TOF}} = t_{\text{sdigit}}^{\text{TOF}} + \sum_{n=0,5} (a_n * (q_{\text{raw}}^{\text{TOF}})^n) - t_{\text{L0L1latency}} - t_{\text{CTPlatency}} + \\
 \quad + t_{\text{latencyWindow}} + t_{0_{\text{fill}}}
 \end{array} \right. \\
 \text{Calibration} \left\{ \begin{array}{l}
 t_{\text{ESD}}^{\text{TOF}} = t_{\text{cluster}} = t_{\text{digit}} - \sum_{n=0,5} (a_n * (q_{\text{raw}}^{\text{TOF}})^n) + t_{\text{L0L1latency}} + \\
 \quad + t_{\text{CTPlatency}} - t_{\text{latencyWindow}} - t_{0_{\text{fill}}}
 \end{array} \right.
 \end{array}$$

- ▶ In this way the TOF time measurement attached to the matched TOF-track is the expected one (rev.41843).

MC productions: OCDB for simulation and reconstruction

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$$\begin{array}{l}
 \text{De-calibration} \left\{ \begin{array}{l}
 t_{\text{sdigit}}^{\text{TOF}} = t_{\text{geant}}^{\text{TOF}} + \boxed{\text{smearing} \times \text{timeResolution}} \longrightarrow \boxed{\sim 84\text{ps}} \\
 t_{\text{digit}}^{\text{TOF}} = t_{\text{sdigit}}^{\text{TOF}} + \sum_{n=0,5} (a_n * (q_{\text{raw}}^{\text{TOF}})^n) - t_{\text{L0L1latency}} - t_{\text{CTPlatency}} + \\
 \quad + t_{\text{latencyWindow}} + t_{0_{\text{fill}}}
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 \quad + t_{\text{CTPlatency}} - t_{\text{latencyWindow}} - t_{0_{\text{fill}}}
 \end{array} \right.
 \end{array}$$

- ▶ In this way the TOF time measurement attached to the matched TOF-track is the expected one (rev.41843).

MC productions: OCDB for simulation and reconstruction

- ▶ ...and from QA point-of-view:

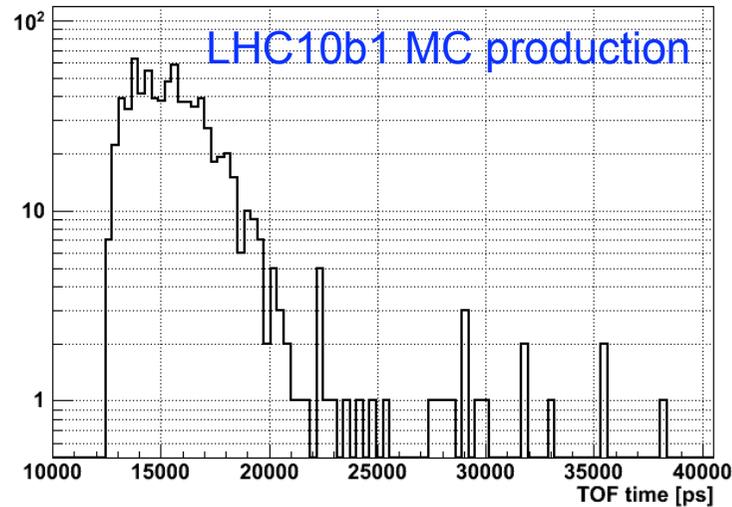
- ▶ $t_{\text{digit}}^{\text{TOF}} \sim t_{\text{raw}}^{\text{TOF}}$

- ▶ $t_{\text{ESD}}^{\text{TOF}} \sim t_{\text{geant}}^{\text{TOF}} + \text{smearing} \times \text{timeResolution}$

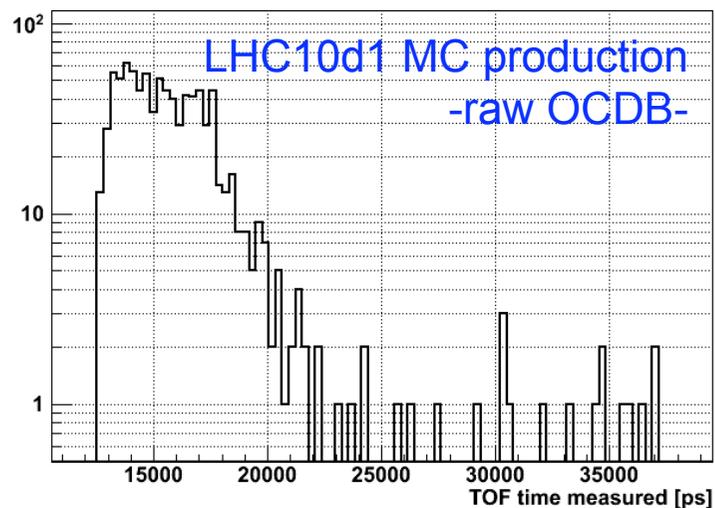
and QA histograms for TOF digits and TOF raw-data can have the same ranges (matching window, latency windows, etc. taken into account).

On-the-fly check of MC productions; only one file analyzed per each MC sample

Tracks.fTOFsignal for matched TOF-tracks and with TOF time measurement

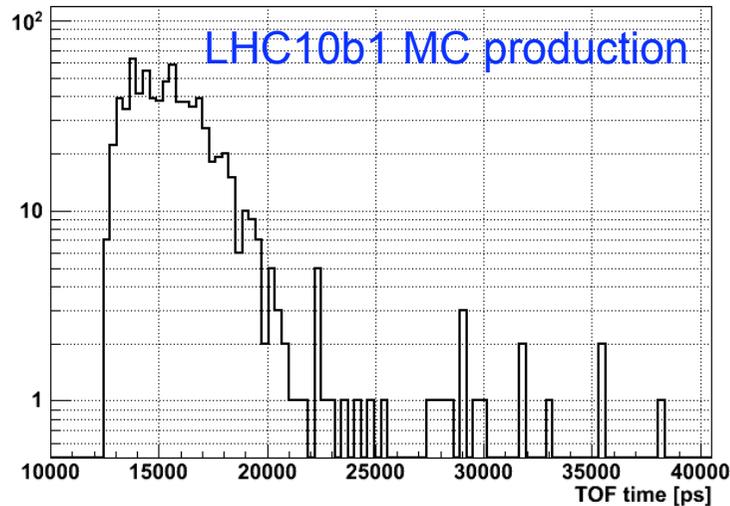


Tracks.fTOFsignal for matched TOF-tracks and with time measurement



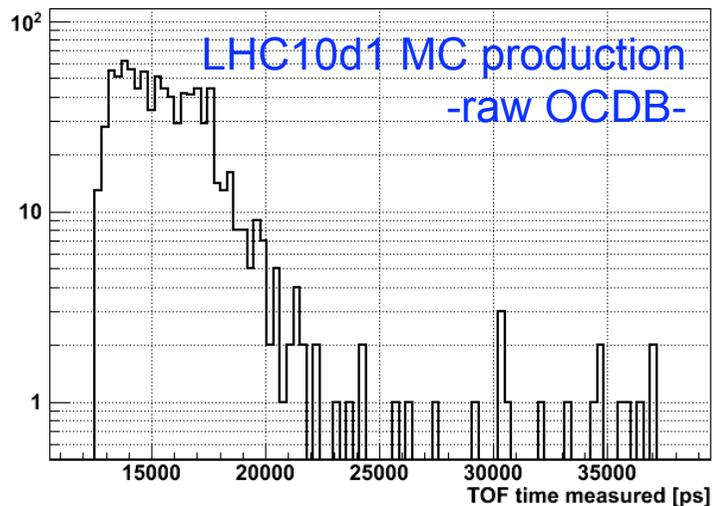
On-the-fly check of MC productions; only one file analyzed per each MC sample

Tracks.fTOFsignal for matched TOF-tracks and with TOF time measurement



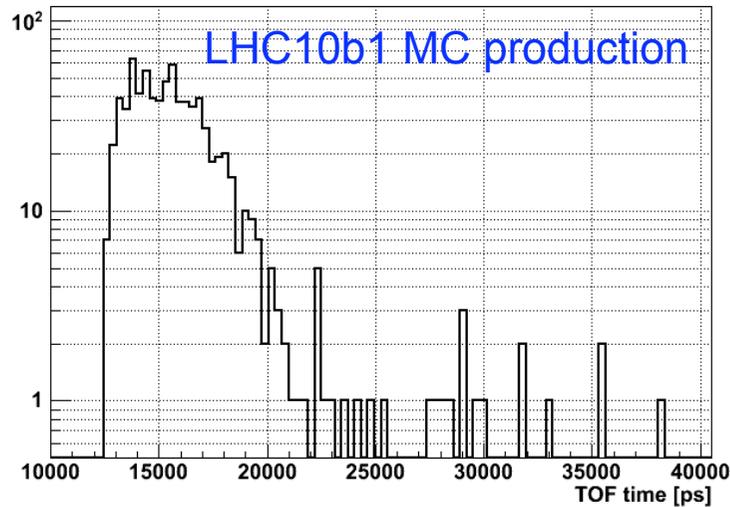
Measured TOF time with
de-calibration and calibration
exercise → fine 😊

Tracks.fTOFsignal for matched TOF-tracks and with time measurement



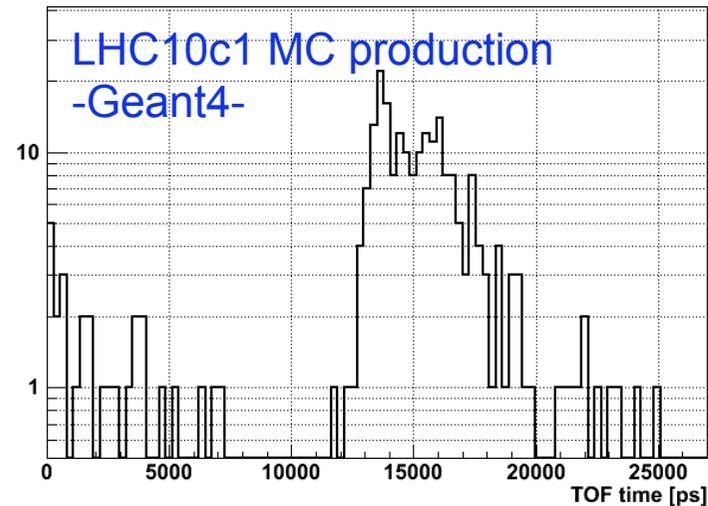
On-the-fly check of MC productions; only one file analyzed per each MC sample

Tracks.fTOFsignal for matched TOF-tracks and with TOF time measurement

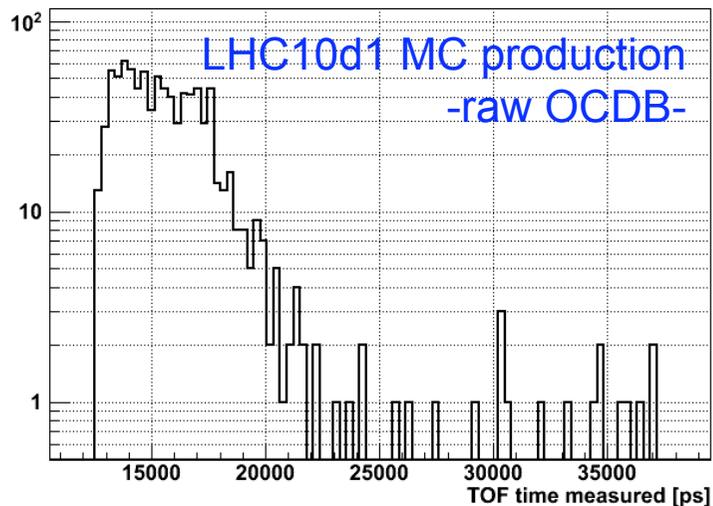


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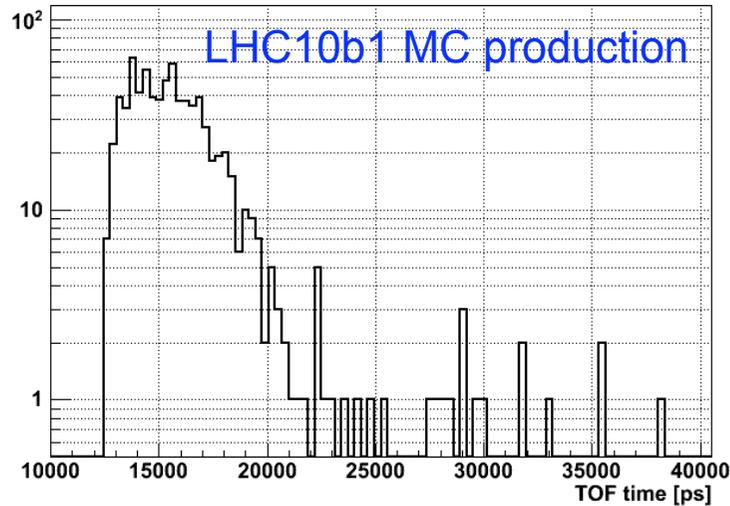


Tracks.fTOFsignal for matched TOF-tracks and with time measurement



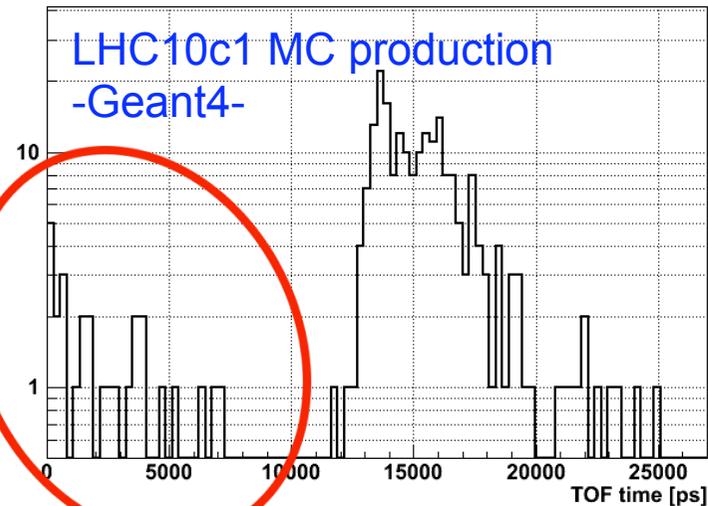
On-the-fly check of MC productions; only one file analyzed per each MC sample

Tracks.fTOFsignal for matched TOF-tracks and with TOF time measurement

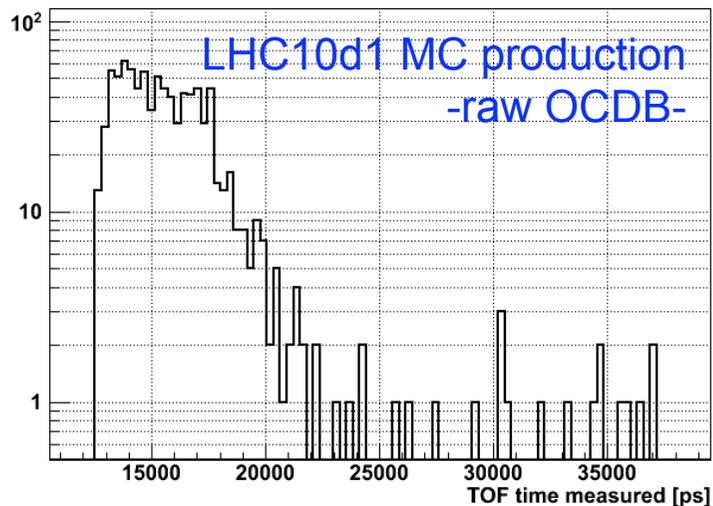


Measured TOF time with
de-calibration and calibration
exercise → fine 😊

Tracks.fTOFsignal for matched TOF-tracks and with TOF time measurement



Tracks.fTOFsignal for matched TOF-tracks and with time measurement



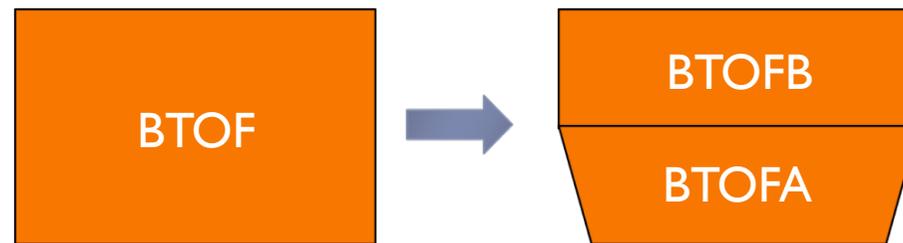
To be checked!

QA and DQM

- ▶ F.Bellini is working on QA for TOF.
- ▶ Details on TOF QA histogram content in her report.
- ▶ Savannah bug #69289:
 - ▶ Francesca fixed the bug (in the trunk with rev.42057);
 - ▶ Asked Peter to port it to the release
- ▶ Reference data:
 - ▶ Created QA OCDB format file for run 115401 (pp@7TeV, ~500k physics events);
 - ▶ ready to commit in \$ALICE_ROOT/QAref.
- ▶ She is implementing an analysis task (let we call it AliAnalysisTaskTOFQA)
 - ▶ we would like to participate into PWG1 QA analysis train.

TOF alignment: status

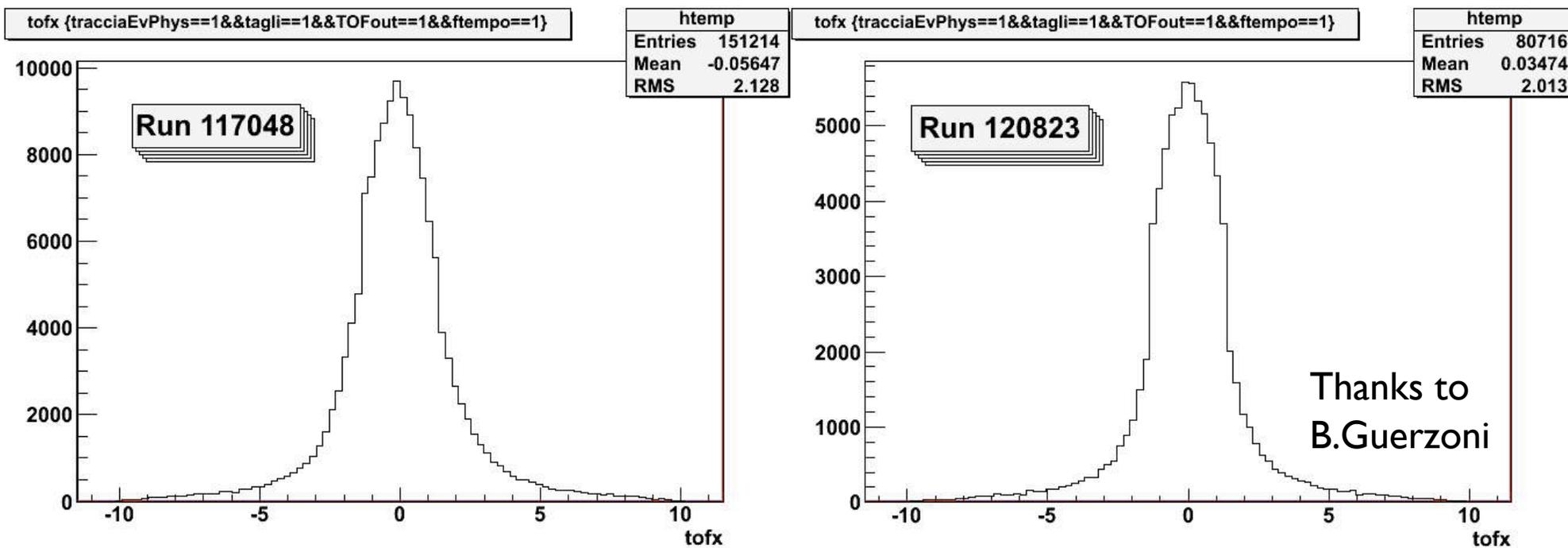
- ▶ B.Guerzoni works on TOF alignment (more details in her passed talks).
- ▶ TOF detector aligned at SM level.
- ▶ Completely removed offset along beam direction (in OCDB/TOF/Align/Data since 2010, May 5th).
- ▶ Completely removed overlaps created by TOF aligned geometry:
 - ▶ enlarged B077 and BSEGMO modules (rev.40888);
 - ▶ changed BTOF module shape (rev.40888):



- ▶ NB: No effects on material budget:
 - ▶ B077, BSEGMO and BTOF → air volumes.

Reconstruction w/o TOF alignment parameters: residuals in $\rho\phi$ direction

- ▶ Run 117048 @ pass I: without TOF alignment parameters;
- ▶ Run 120823 @ pass I: with TOF alignment parameters.
 - ▶ Residual in $\rho\phi$ direction:
 - ▶ Mean value: from -0.0565cm to 0.0347cm
 - ▶ RMS value: from 2.13cm to 2.01cm



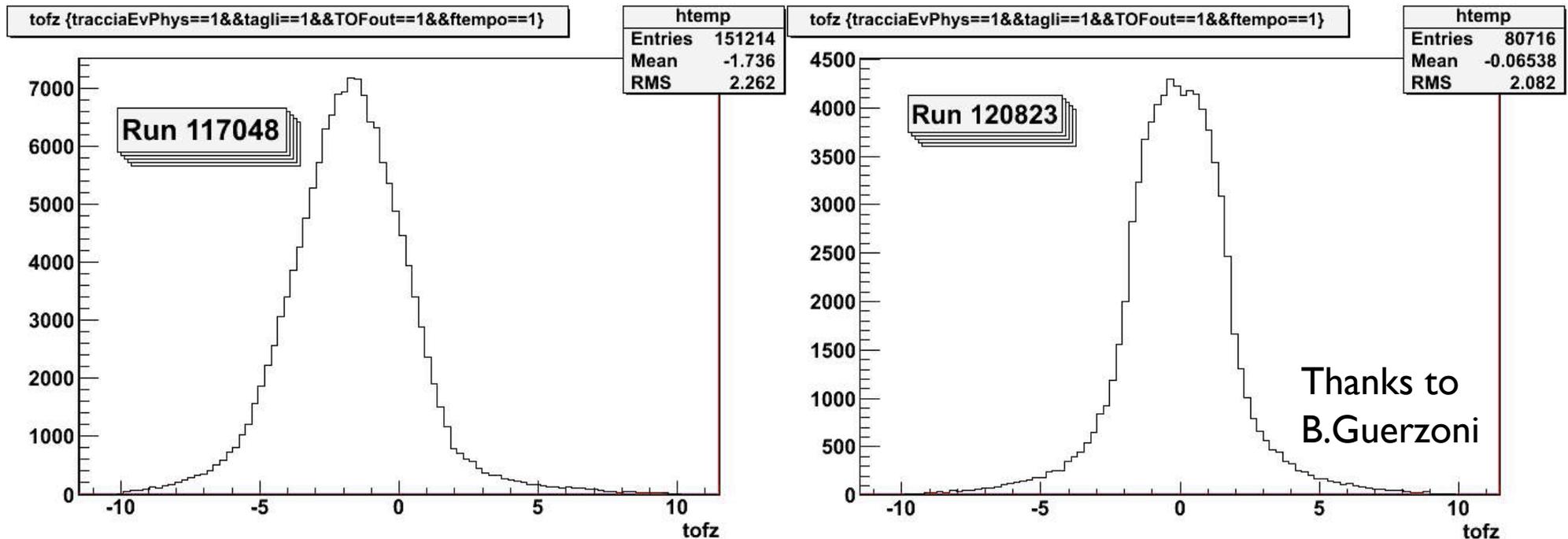
Reconstruction w/o TOF alignment parameters: residuals in z direction

- ▶ Run 117048 @ pass I: without TOF alignment parameters;
- ▶ Run 120823 @ pass I: with TOF alignment parameters.
- ▶ Residual in z direction:

- ▶ Mean value: from **-1.74cm to -0.0654cm**

Completely removed offset along z direction

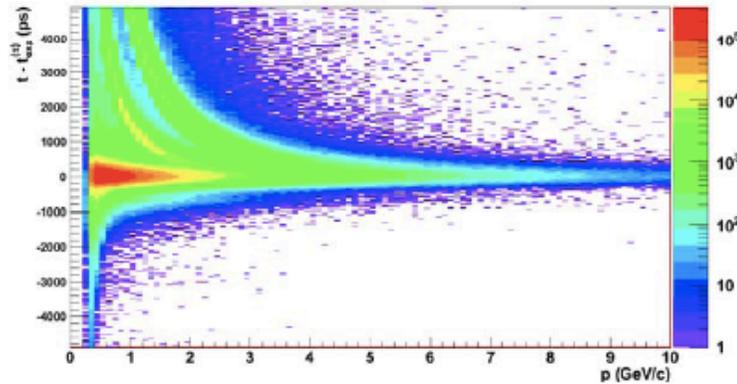
- ▶ RMS value: from 2.26cm to 2.08cm



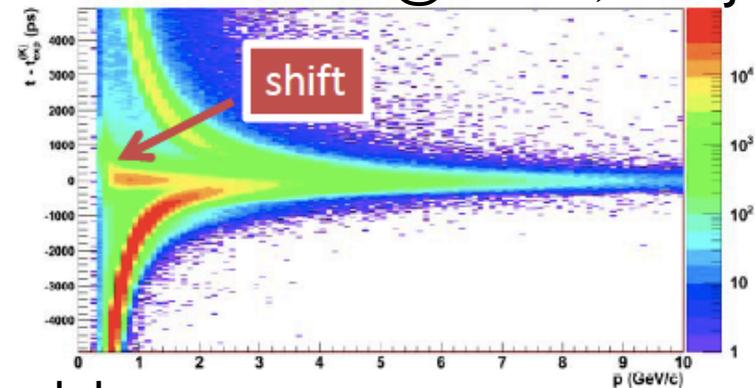
Reconstruction: expected times

F.Noferini @ PWGI, 2010 June 28th

pion PID

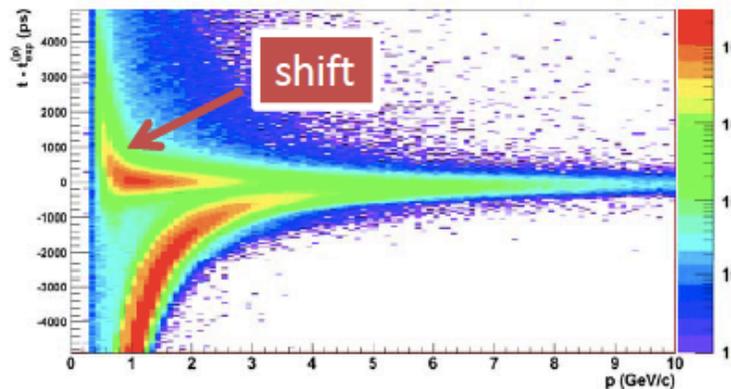


kaon PID

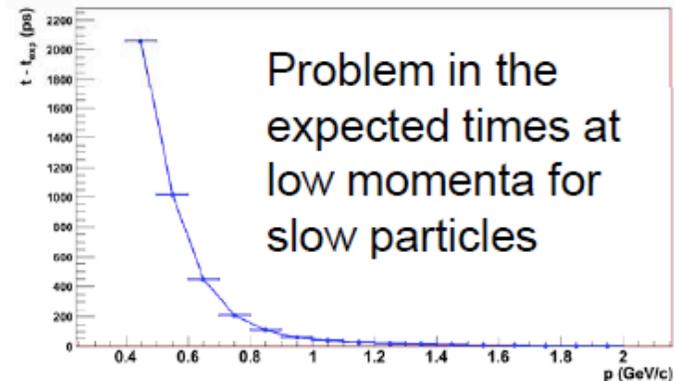


pp@7TeV: real data

proton PID

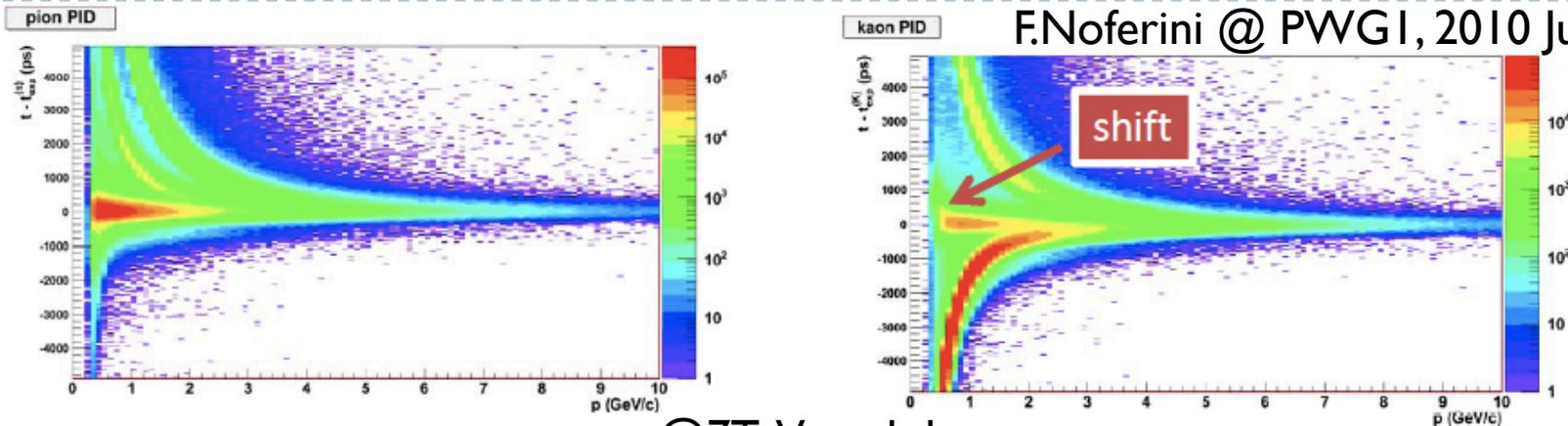


protons

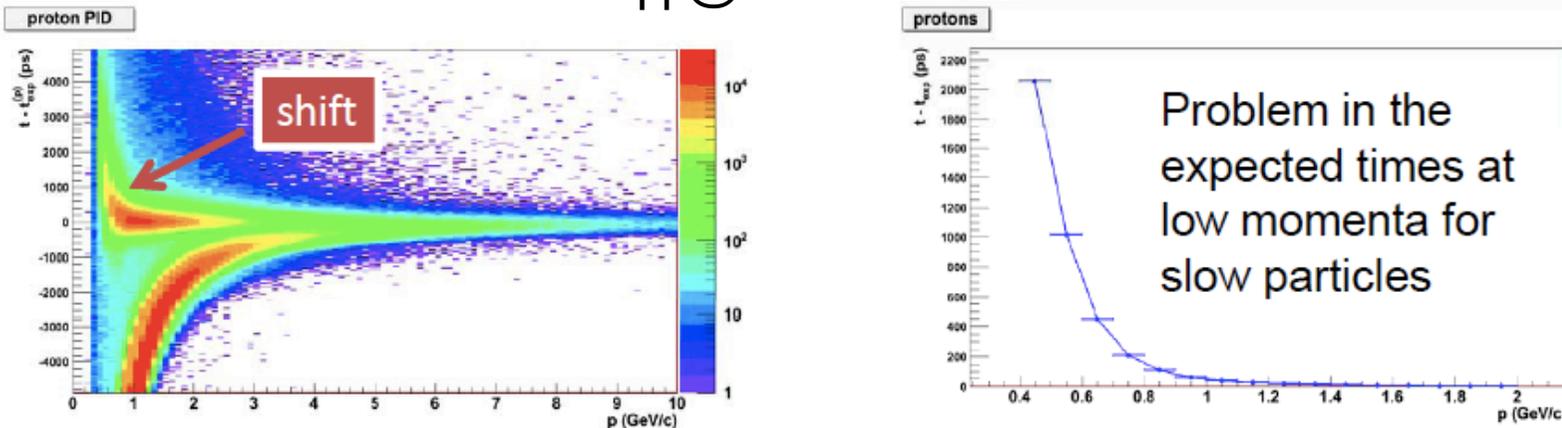


Reconstruction: expected times

F.Noferini @ PWGI, 2010 June 28th



pp@7TeV: real data

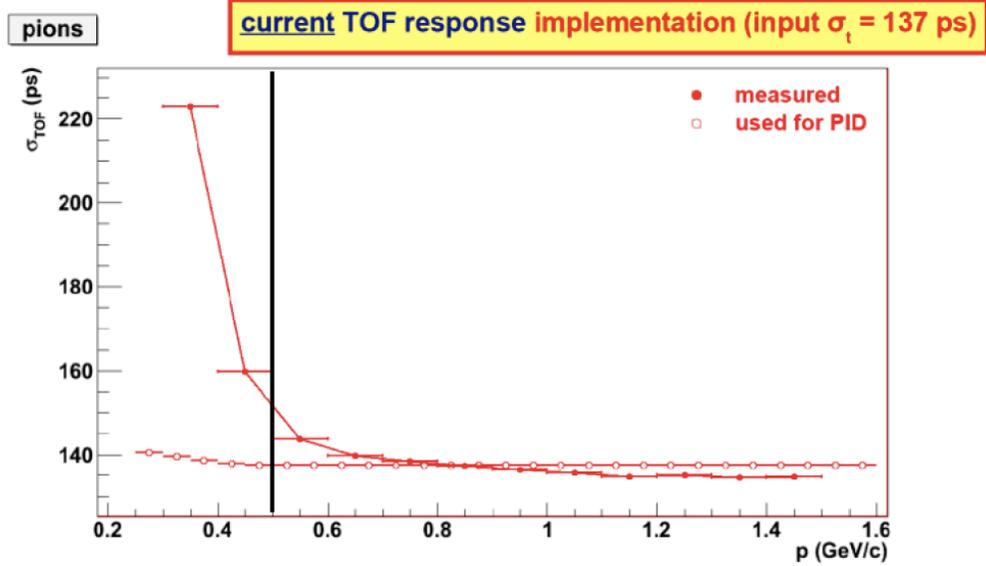


Same deviations observed in MC data also → problem in reconstruction code.

To be investigated; probably due to not correct estimate of energy loss or multiple scattering not taken into account when integrated length and then times have been calculated.

Reconstruction: time resolution

F.Noferini @ PWGI, 2010 June 28th



TOF response function as parametrised in AliROOT:

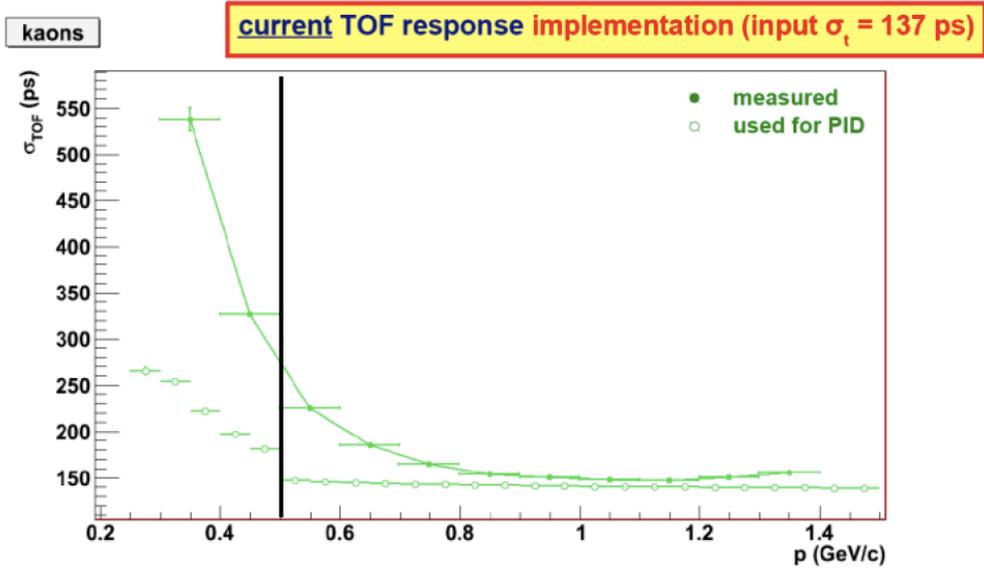
$$\sigma_{TOF}^2 = \sigma_t^2 + \sigma_{tracking}^2$$

$$\sigma_{tracking} = \sigma_p \frac{t}{1 + \frac{p^2}{m^2}}$$

$$\sigma_p = \begin{cases} 0.01, & p < 0.5 \text{ GeV}/c \\ 0.01 * p, & p \geq 0.5 \text{ GeV}/c \end{cases}$$

Reconstruction: time resolution

F.Noferini @ PWGI, 2010 June 28th



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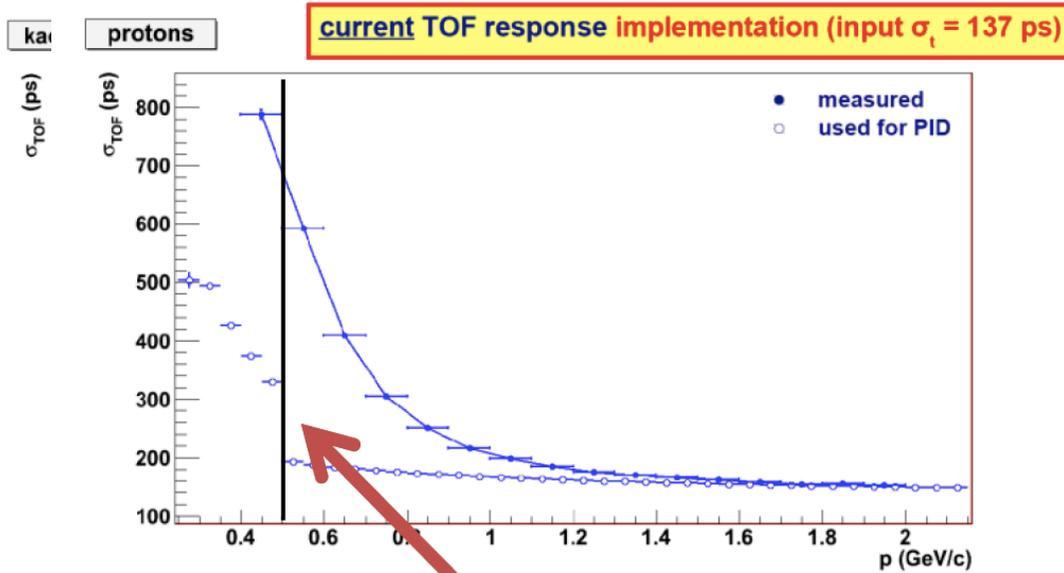
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Reconstruction: time resolution

F.Noferini @ PWGI, 2010 June 28th



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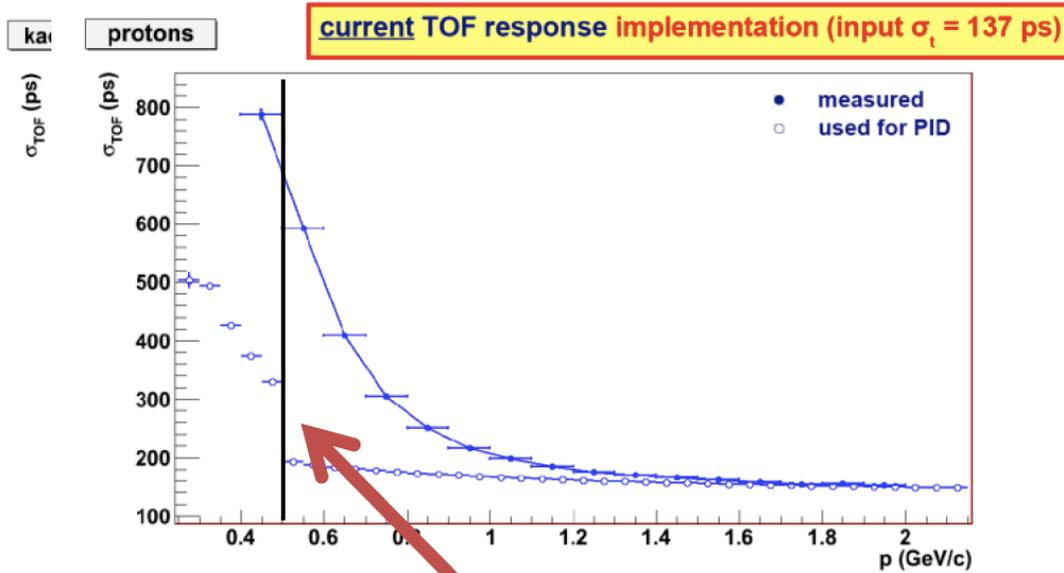
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Discontinuity at 0.5 GeV

Reconstruction: time resolution

F.Noferini @ PWGI, 2010 June 28th



TOF response function as parametrised in AliROOT:

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$$\sigma_p = \begin{cases} 0.01, & p < 0.5 \text{ GeV}/c \\ 0.01 * p, & p \geq 0.5 \text{ GeV}/c \end{cases}$$

Discontinuity at 0.5 GeV

- ▶ Current parameterization underestimate tracking in time resolution.
- ▶ We need a more realistic parameterization.
- ▶ What is the momentum resolution as a function of p_T ?

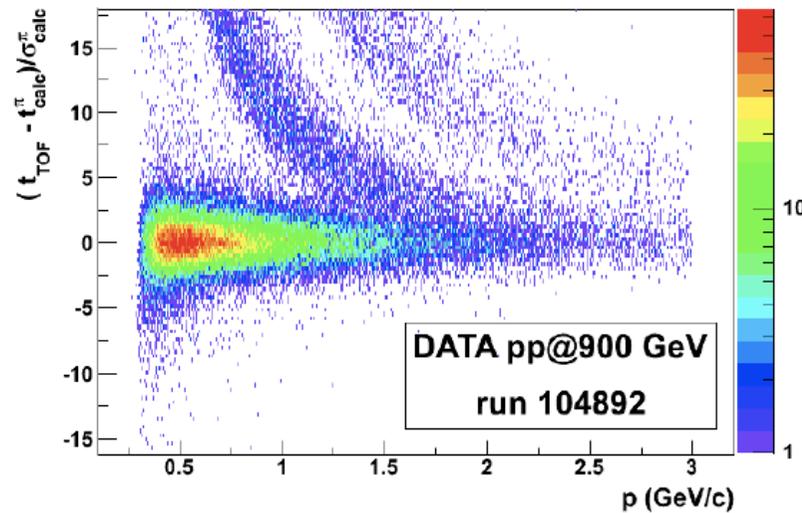
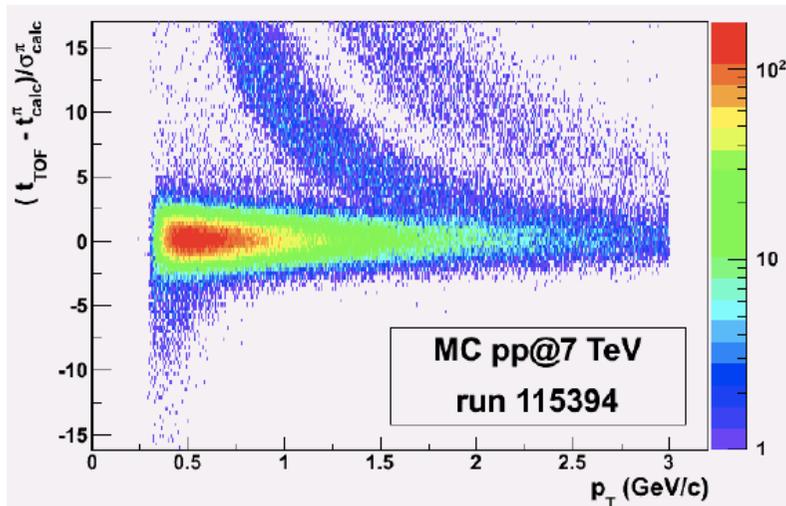
Reconstruction: in the mean time...

- ▶ F.Noferini and R.Preghenella prepared code, macro and parameterized TOFResponse functions to:
 - ▶ apply newest TOF calibration parameters (option –useful for oldest runs);
 - ▶ perform the new T0-TOF (no bias) algorithm –see Francesco talk at last PWGI meeting- track by track (foreseen possibility to add T0 detector information);
 - ▶ correct TOFResponse function, run by run, with right values (event time, expected times and time resolution, in particular);
 - ▶ in case of MC productions, tune simulated data according to the estimated real time resolution ($\sim 100\text{ps}$).

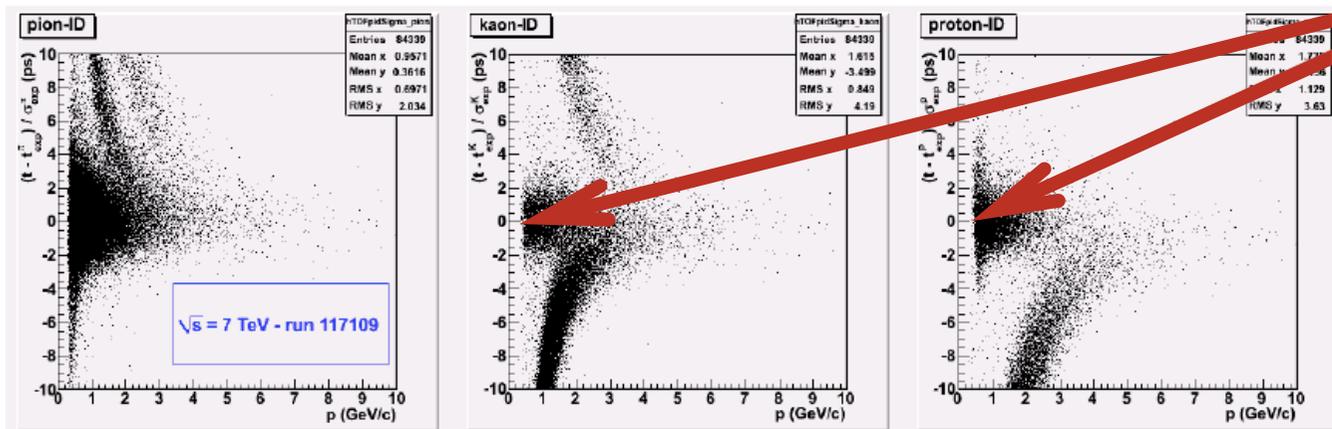
at analysis level (rev.41721).

- ▶ As soon as possible this code will be putted in the reconstruction chain. Work in progress.

New code tested at analysis level: results



Thanks to F.Noferini



Deviation from 0,
previously
clearly visible
for K and p/pbar
at low momenta,
now disappeared

Open savannah bugs

- ▶ [bug #69289](#): Access to a missing histogram in AliTOFQADataMakerRec::EndOfDetectorCycle
 - ▶ Fixed in the trunk; Peter requested to fix in release.
- ▶ [bug #66146](#): Very large memory allocation in TOF
 - ▶ OCDB/TOF/Calib/Status contains TObjArray of 157248 AliTOFChannelOnlineStatus object;
 - ▶ Proposal: convert it in new object, let me call it AliTOFChannelOnlineStatusArray;
 - ▶ Problem of backward compatibility: found solution. To be implemented.
- ▶ [bug #67277](#): Seasonal drift of LHC clock
 - ▶ See C.Cheskov talk
 - ▶ Plan to add t0fill information in GRP.
- ▶ [bug #68826](#): Request to retrieve TOF DCS datapoints for LHC10c runs@900GeV:
 - ▶ Now fixed. Recovered TOF channel HW status maps from TOF QA analysis because of lost TOF DCS datapoint values for early four LHC10c runs.

TOF planning status

Work	Task Name	Start Date	Done Date	Expected Finish Date	Last Update
✓	Material Budget (2358)	-	27/06/2008	18/02/2009	-
✓	Calibration (906)	01/01/2006	18/06/2009	30/05/2009	-
!	Raw Data (942)	01/01/2006	-	15/06/2010	-
!	Write TOF CTTM inputs in the raw data (2636)	18/06/2009	-	15/06/2010	-
✓	Simulation of the TOF CTTM inputs from raw data (2637)	18/06/2009	20/01/2010	31/01/2010	-
!	Quality Assurance (1395)	01/01/2006	-	31/03/2010	-
✓	Reference distribution (2324)	23/05/2008	10/12/2009	15/10/2009	-
✓	Implementation of run type (2450)	16/03/2009	16/12/2009	15/10/2009	-
!	Implementation of reference data (2453)	16/03/2009	-	31/03/2010	-
✓	Extract QA data from large Monte Carlo production (2652)	08/07/2009	15/04/2010	31/01/2010	-
✓	Implement method virtual Double_t * Check(AliQAv1::ALITASK_t /*index*/) (2668)	27/07/2009	15/10/2009	15/10/2009	-
✓	Geometry (1407)	01/01/2006	27/06/2008	29/02/2008	-
✓	Simulation (1412)	01/01/2006	20/01/2010	31/01/2010	-
✓	Reconstruction (1413)	01/01/2006	18/06/2009	30/05/2009	-
!	Trigger (2374)	16/03/2009	-	15/06/2010	-
!	Implementation of the code for trigger parameters for the simulation of the trigger input to the CTP (2449)	16/03/2009	-	15/06/2010	-
✓	Simulation of TOFtrigger starting from LTM outputs/TOF CTTM inputs (2639)	18/06/2009	20/01/2010	31/01/2010	-
✓	Reduced TOF CTTM inputs for TRD (2640)	18/06/2009	15/01/2010	31/01/2010	-

Reference data: ready to put them in \$ALICE_ROOT/QAref directory

Trigger: trigger map to be written in data tree infos as well as in MC raw data

Request to postpone deadline

The end

Thanks all TOF members for their contribute