Status of the MPI Time-Dependent Analysis

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methodological goal: *development of the dt resolution function to make use of PXD*
physics topics: *time-dependent CP asymmetry, lifetimes, mixing & oscillations*
method: *unbinned maximum likelihood fits of Δt=t(Bsig)-t(Btag) distr.*
maximum $\boldsymbol{L} = \prod_i \boldsymbol{P}(\Delta \boldsymbol{t_i}\ , physics\ \&event\ reco\ parameters)$
framework: *RooFit package in Root*

The event probability density function (PDF) is a convolutions of a true physics PDF and a resolution function $\boldsymbol{R}_{\mathbf{sig,\ bkg}}(\Delta \boldsymbol{t} - \Delta \boldsymbol{t}')$:

$$\boldsymbol{P}_{sig,\ bkg}(\Delta \boldsymbol{t}) = \int_{-\infty}^{+\infty} \boldsymbol{d}(\Delta \boldsymbol{t}')\ \ \wp_{\mathbf{sig,\ bkg}}(\Delta \boldsymbol{t}')\ \ \boldsymbol{R}_{\mathbf{sig,\ bkg}}(\Delta \boldsymbol{t} - \Delta \boldsymbol{t}')$$

Status:

1. *First (unrealistic) shots for* $\boldsymbol{R}_{\mathbf{sig}}(\Delta \boldsymbol{t} - \Delta \boldsymbol{t}')$ *with* $\Delta \boldsymbol{t}$*(true) used as a parameter.*
2. *First experience with fits of the time-dependent CP asymmetry for B0 & B0bar*
   - *fit activates only the first free parameter, the others keep initial values*
   - *extreme time consumption to make model distributuion for comparison with data (>50 hours for one histo with 72 bins)*

Model for the Δt Resolution Function

Resolution Function $R_{\mathrm{sig,\ bkg}}(\Delta t - \Delta t')$:

- *defined within the RooFit package in Root*
- *based on event properties, e.g.* $\delta_i(\Delta t)$ *– uncertainty of* Δt_{rec} *in event "i".*
- *obtained by fitting of the* Δt*-pull distributions →* $(\Delta t_{i,rec} - \Delta t_{i,true}) / \delta_i(\Delta t)$
- Δt *resolution function is a transformation of the* Δt*-pull shape description:*

Δt-pull model → Δt resolution function

Gauss: $\Delta t_{Pull} \rightarrow \Delta t * \delta_{ev}(\Delta t)$, $\mu_{Pull} \rightarrow \mu_{Pull} * \delta_{ev}(\Delta t)$, $\sigma_{Pull} \rightarrow \sigma_{Pull} * \delta_{ev}(\Delta t)$

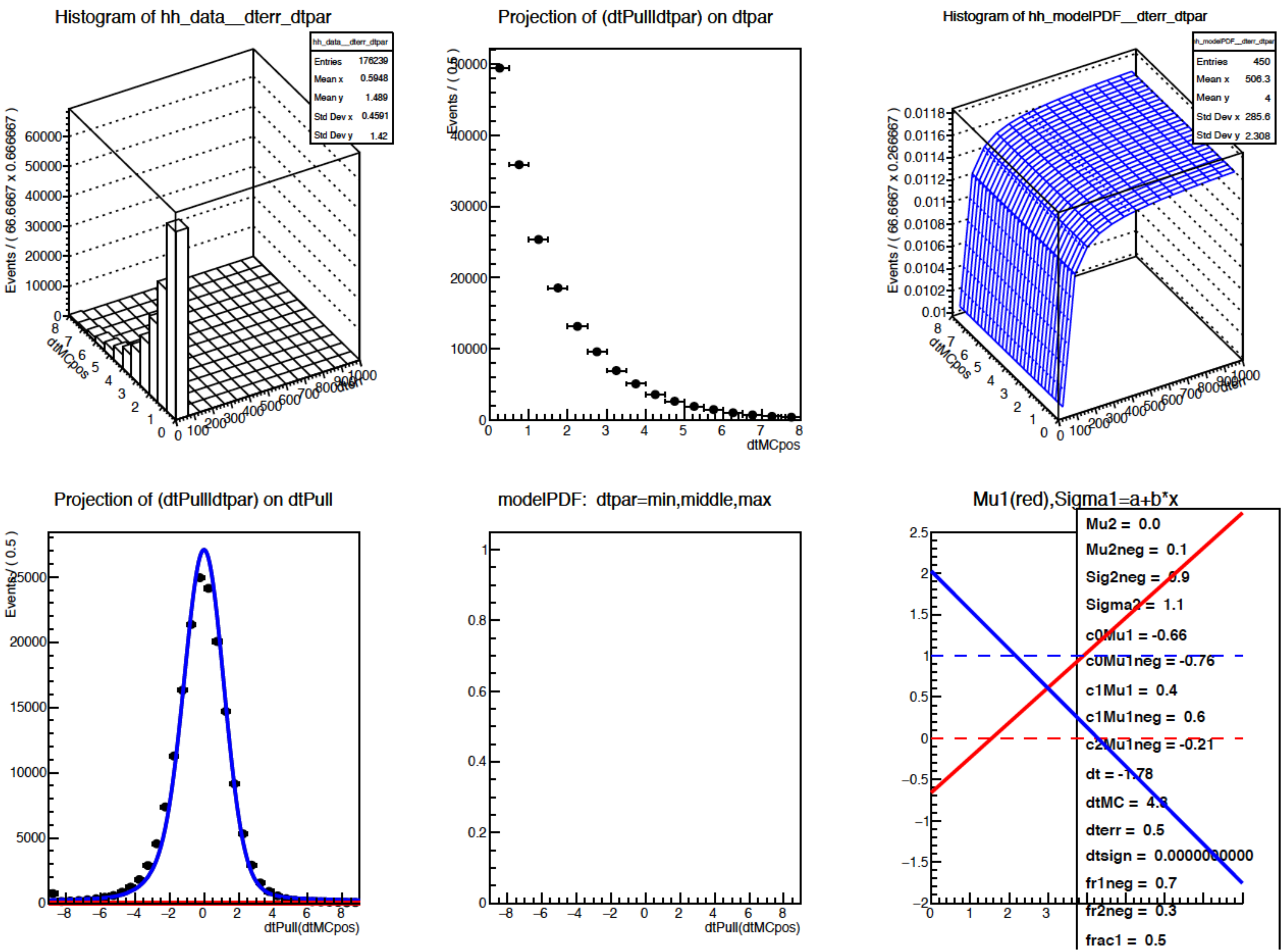
- *Δt-pulls are fitted by three gaussian functions:*

$$f_1 * G_1(\Delta t_{Pull}, \mu_1, \sigma_1) + f_2 * G_2(\Delta t_{Pull}, \mu_2, \sigma_2) + (1 - f_1 - f_2) * G_3(\Delta t_{Pull}, \mu_3, \sigma_3)$$

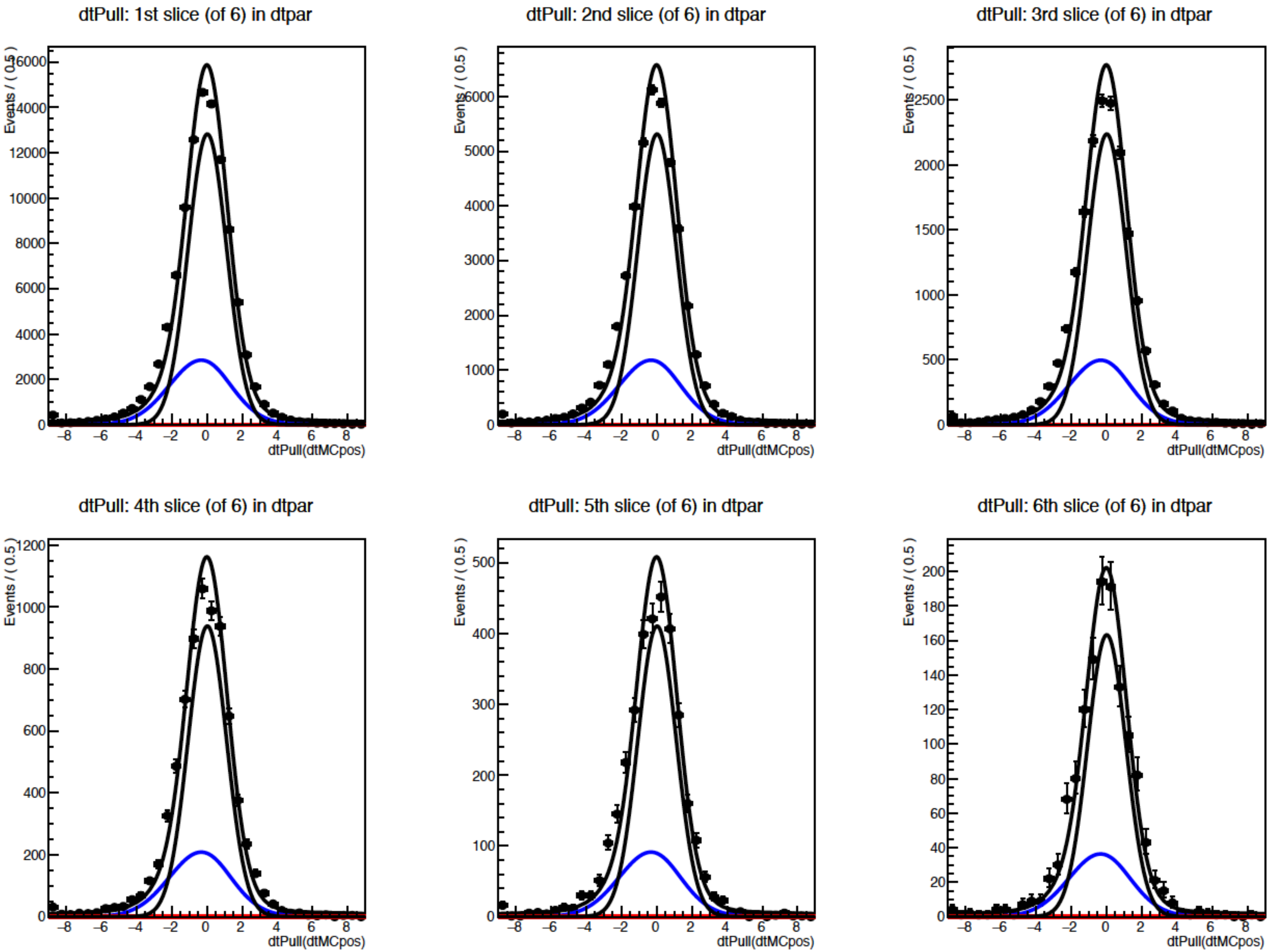
		8 [10] free parameters:
G_1:	$\mu_1 = c0 + c1 * \delta_{ev}(\Delta t)$ [+ $c2 * \Delta t(true)$],	c0, c1, [c2]
	$\sigma_1 = s0 + s1 * \delta_{ev}(\Delta t)$ [+ $s2 * \Delta t(true)$],	s0, s1, [s2]
G_2:		μ_2, σ_2
G_3:	$\mu_3 = 0.$, $\sigma_3 = 8.$ are fixed	
Fractions:		f_1, f_2

→ *Fitted separately in positive and negative Δt(true) domains; c2,s2 are added only for $\Delta t(true) < 0$.*

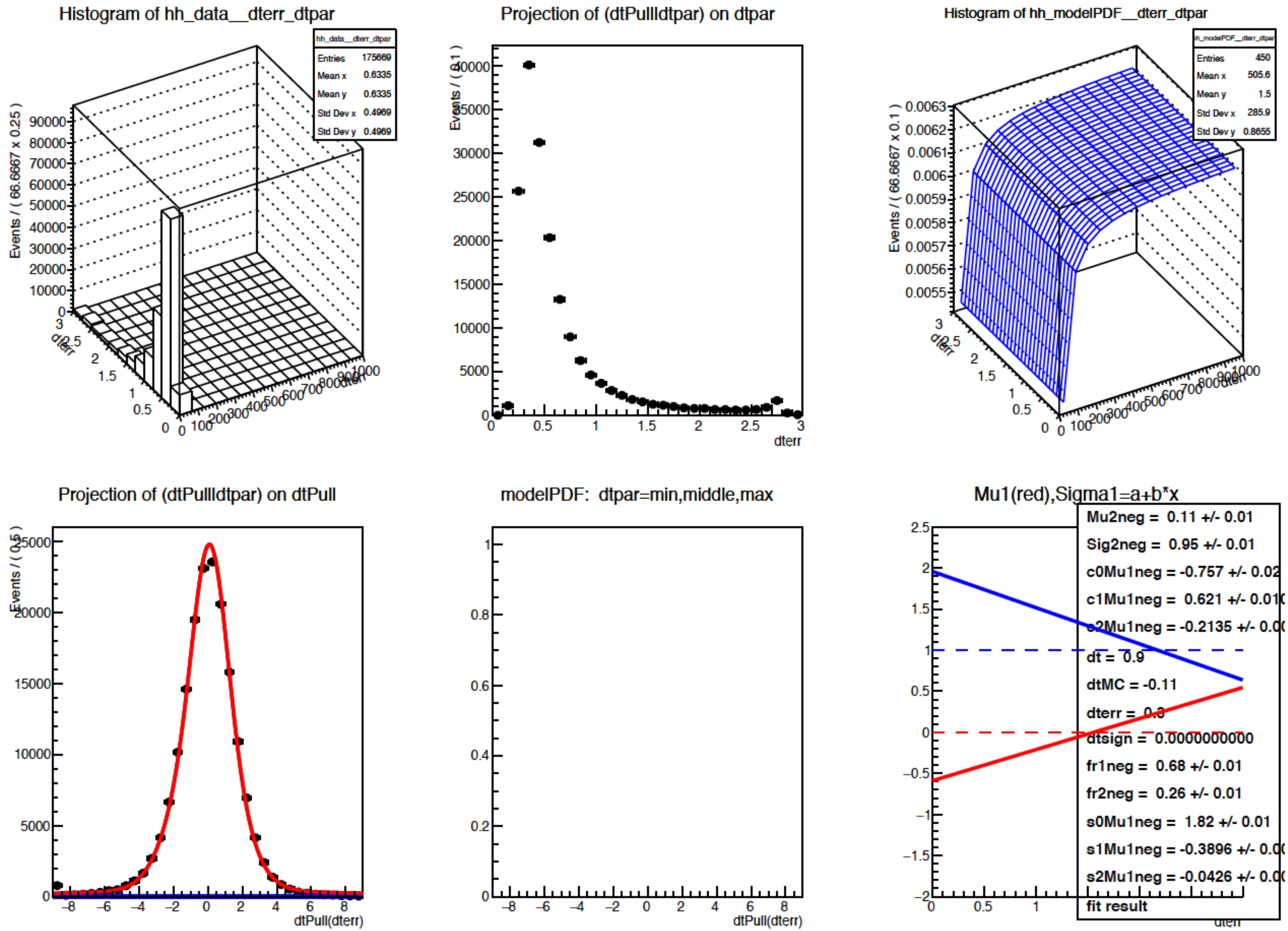
Model for Δt−pull at positive Δt(true)



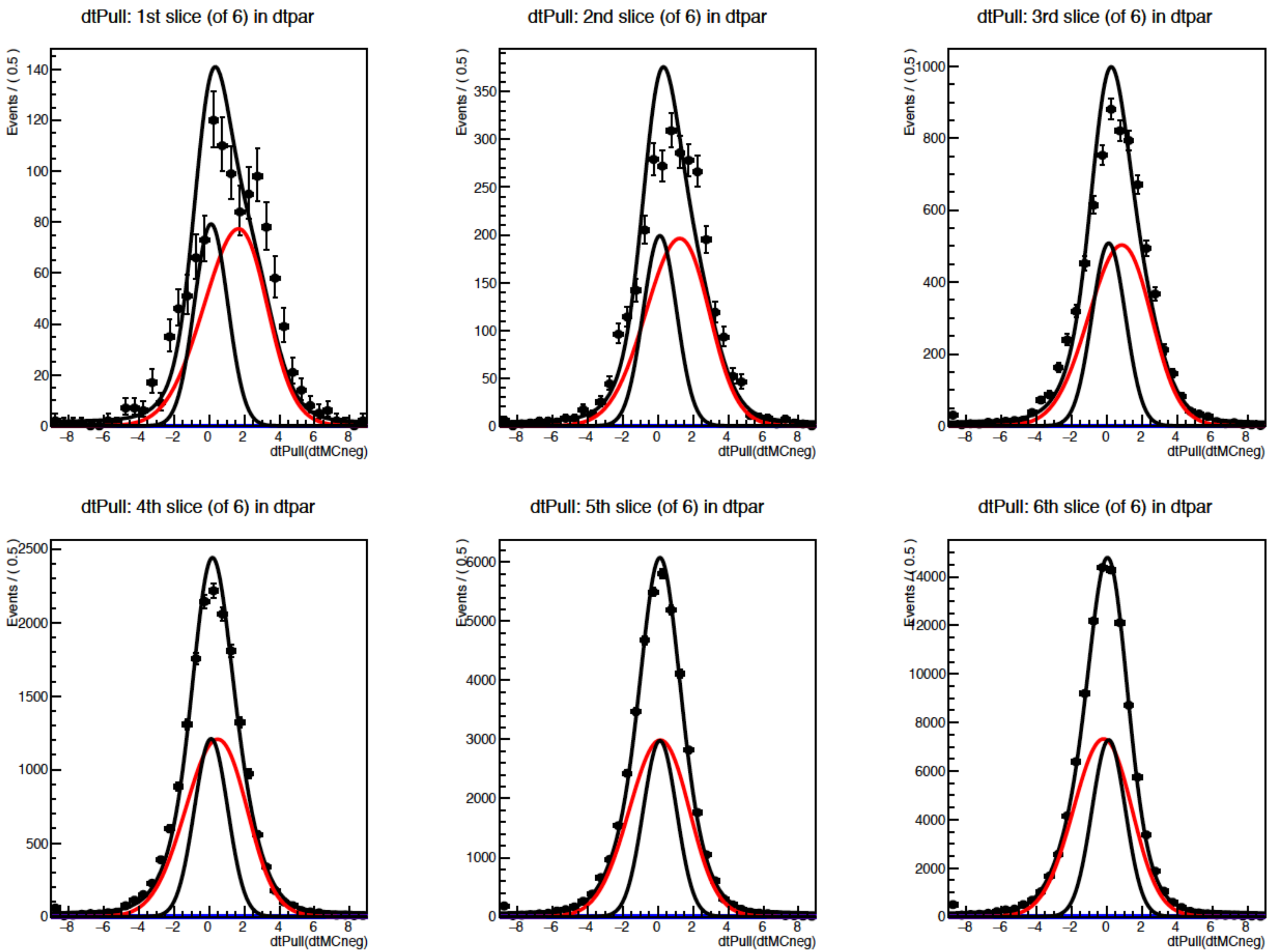
Model for Δt−pull at positive Δt(true)



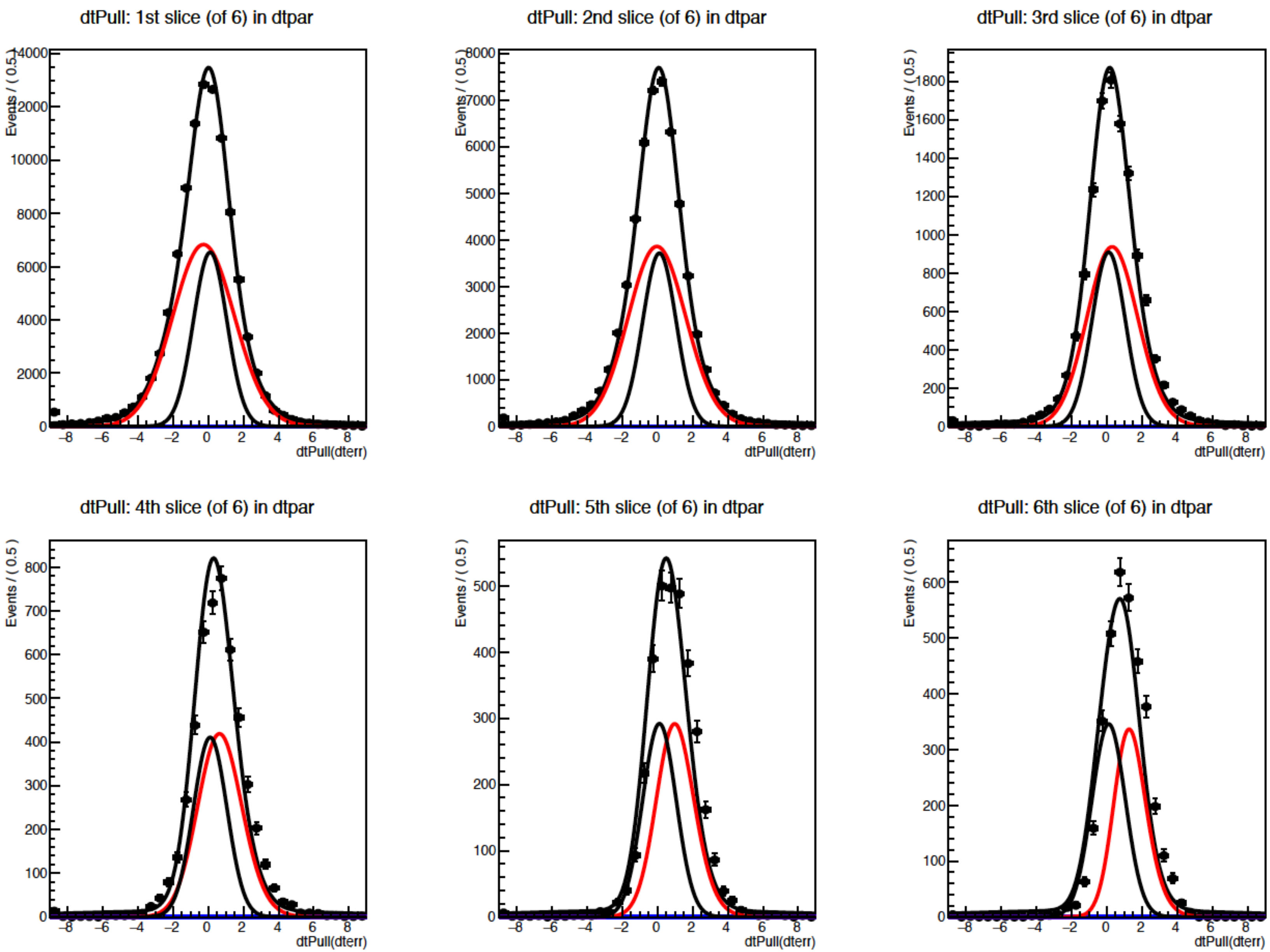
Model for Δt−pull at negative Δt(true)



Model for Δt−pull at negative Δt(true)



Model for Δt−pull at negative Δt(true)



Fit of the Δt Distributions for B0&B0bar

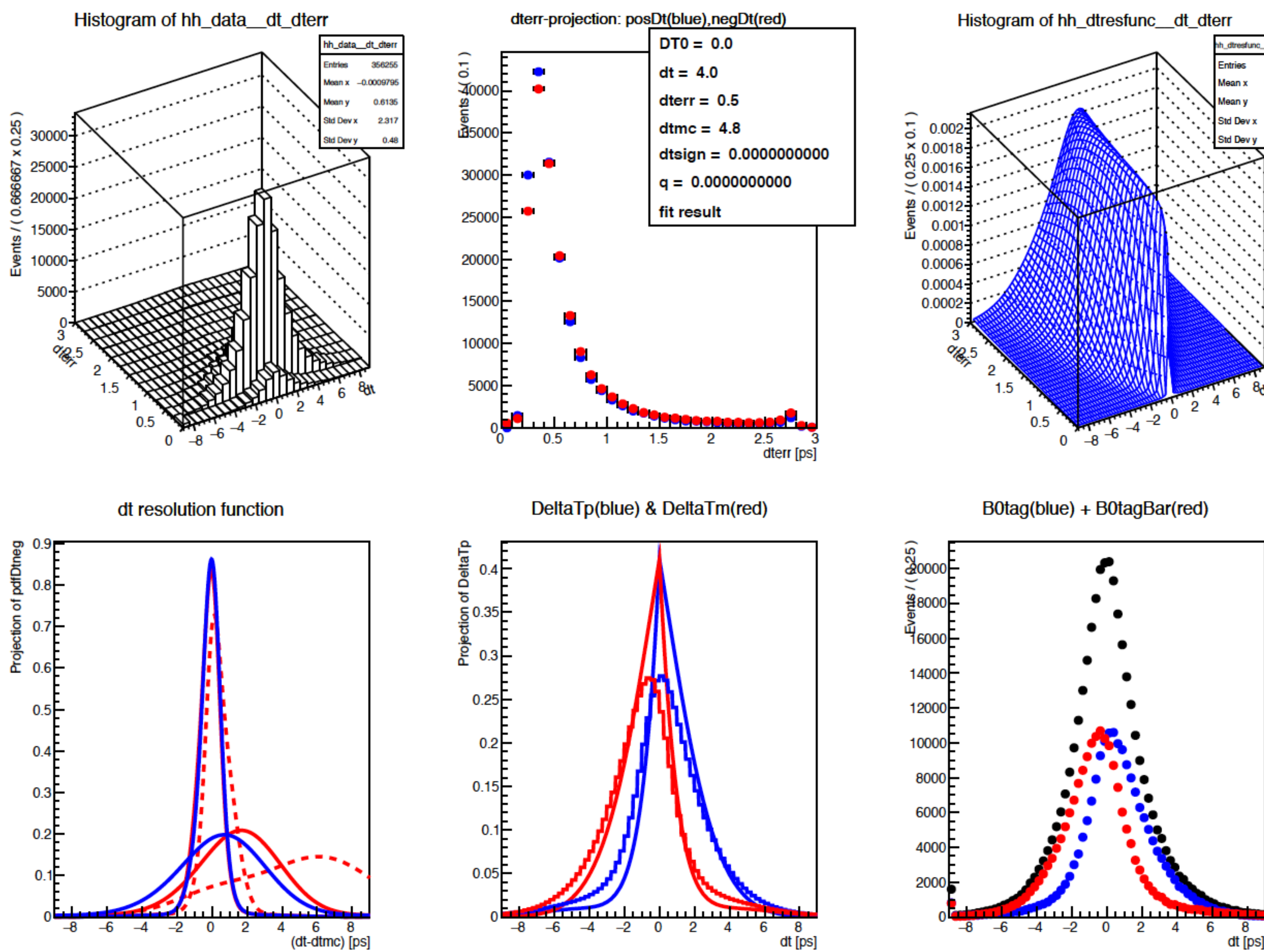
→ **Time dependent analyses:**

unbinned maximum likelihood fit to $\Delta t = t_{Bsig} - t_{Btag}$

maximum $\boldsymbol{L} = \prod_i \boldsymbol{P}(\Delta \boldsymbol{t i}, physics\ \& event\ reco\ parameters)$, *where*

$$\boldsymbol{P}_{sig,\ bkg}(\Delta \boldsymbol{t}) = \int_{-\infty}^{+\infty} \boldsymbol{d}(\Delta \boldsymbol{t}') \ \wp_{\mathbf{sig},\ \mathbf{bkg}}(\Delta \boldsymbol{t}') \ \boldsymbol{R}_{\mathbf{sig},\ \mathbf{bkg}}(\Delta \boldsymbol{t} - \Delta \boldsymbol{t}')$$

Fit of the Δt Distributions for B0&B0bar



Fit of the Δt Distributions for B0 & B0bar