pt LUT assignment for CSCTF

By Anna Kropivnitskaya

- One bug is fixed
- Some results of the pt LUTs test:
  ptLUT was created (Anna's method)
  and was compared with previous one (Darin's method)
- Conclusion

Bug is fixed

We are interested in finding of the minimum Likelihood: L = min

1. I've solved equation $\partial \ln(L)/\partial pt = 0$ numerically
2. I didn't check that $\partial^2 \ln(L)/\partial^2 pt > 0$

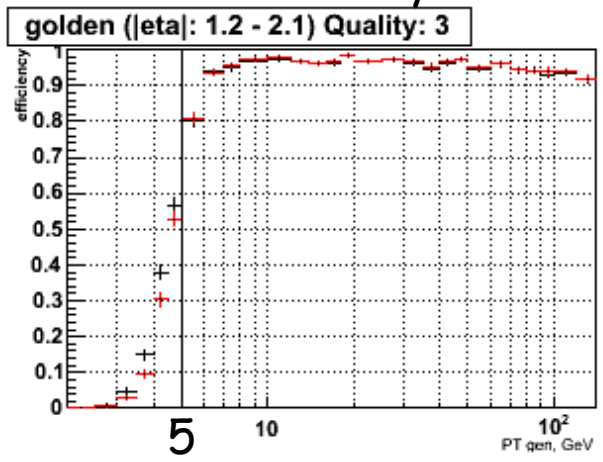
When I've check 2nd derivative than a lot of track
with low generated PT become reconstructed with low PT (not high)

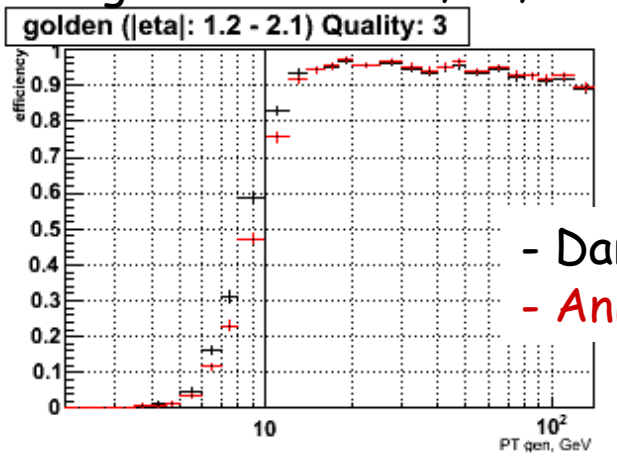
See next slides with update efficiency and resolution (new ptLUT)

Pt efficiency for Quality = 3 and 1.2 < |η| < 2.1

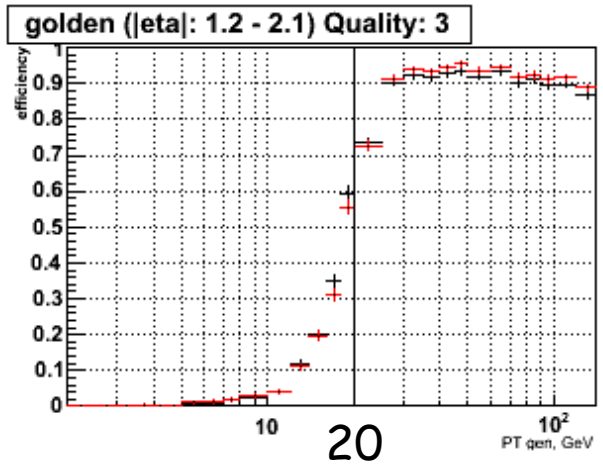
$$\varepsilon_{threshold}(pt_{gen},\eta_{gen}) = \frac{N^{gen\&\&rec}(\eta_{gen\&\&rec}, pt_{gen} with\ pt^{rec} > pt_{threshold})}{Ngen(\eta_{gen}, pt_{gen})}$$

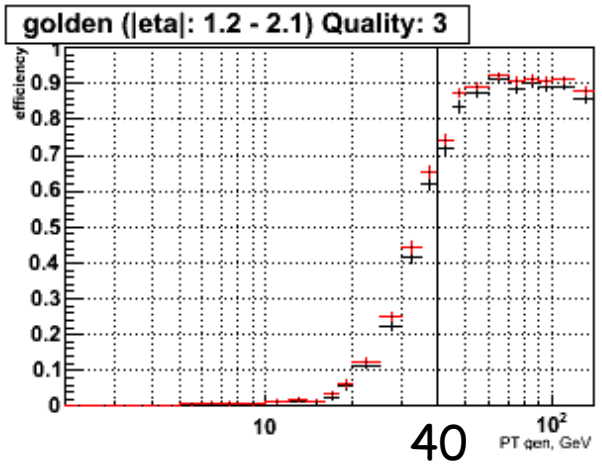
Calculate efficiency for the following thresholds: 5, 10, 20 and 40 GeV



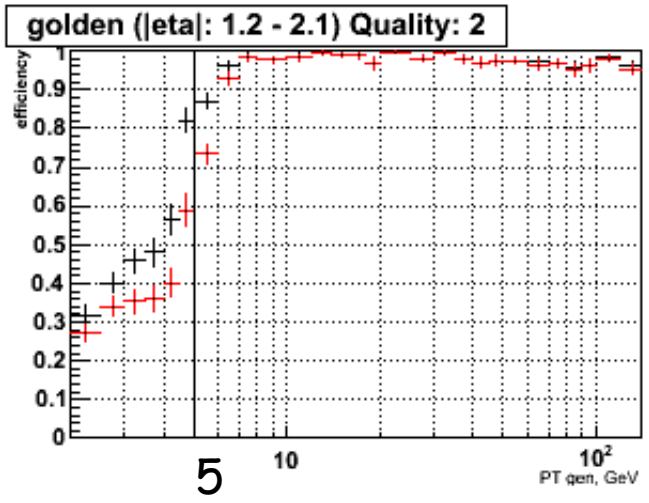


- Darin's method
- Anna's method





Pt efficiency for Quality = 2 and 1.2 < |η| < 2.1



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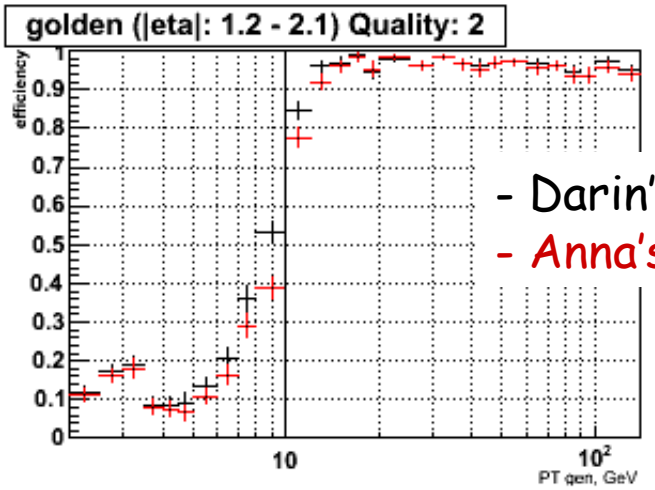

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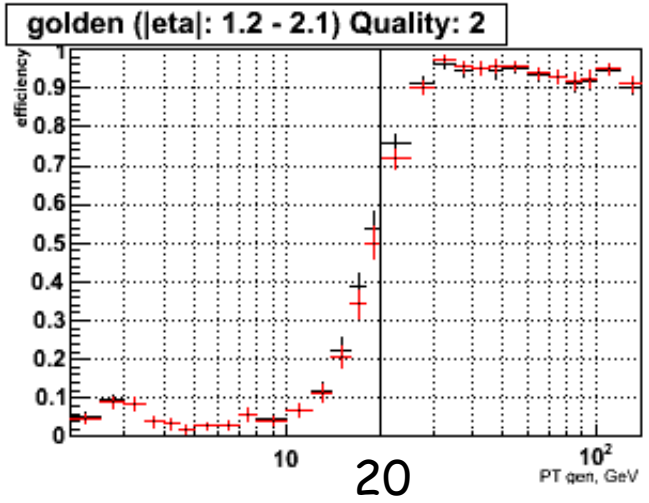
- Anna's method



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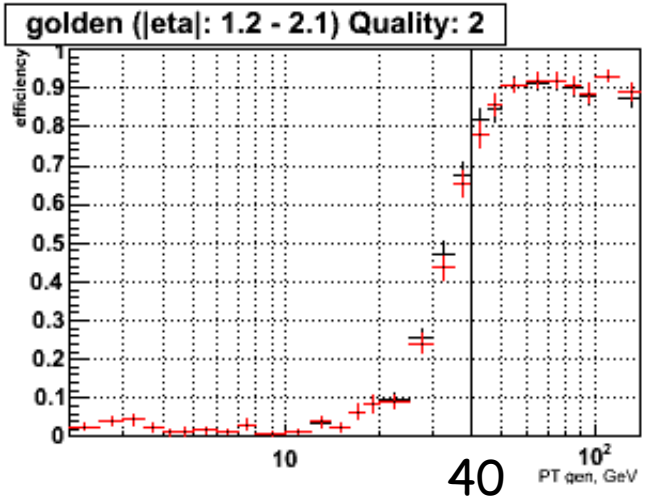

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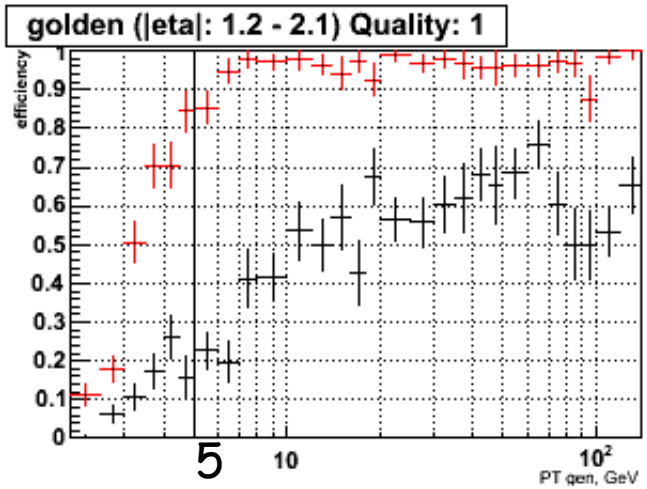
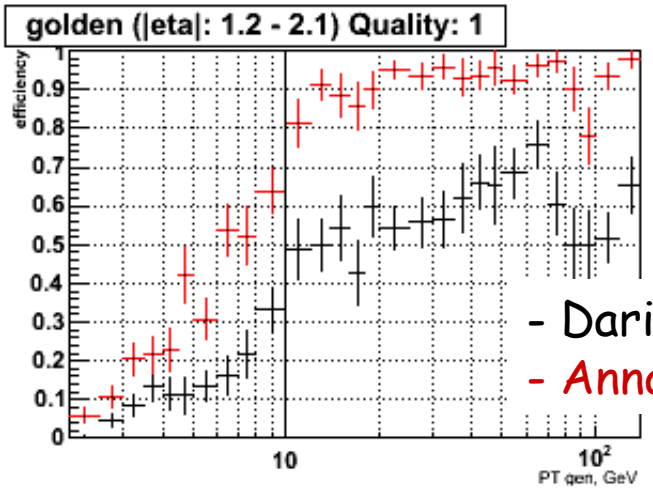
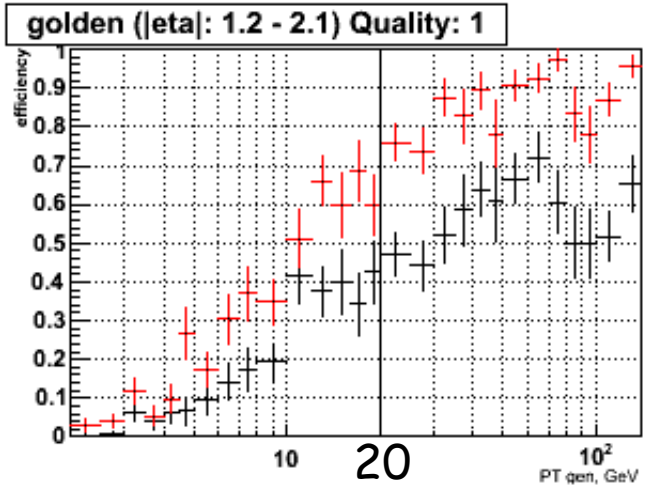
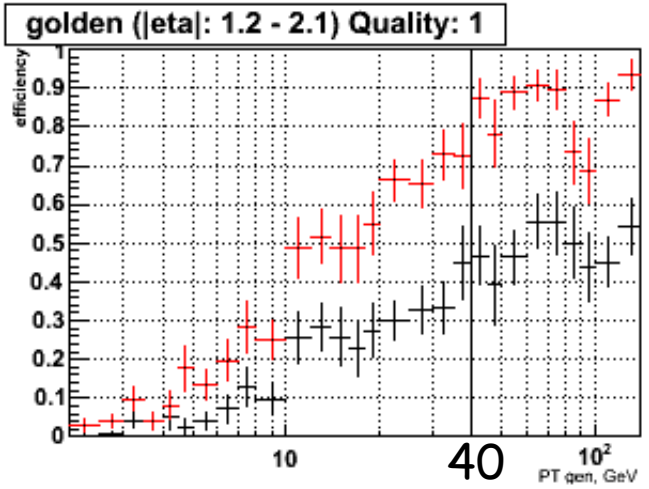
Pt efficiency for Quality = 1 and 1.2 < |η| < 2.1





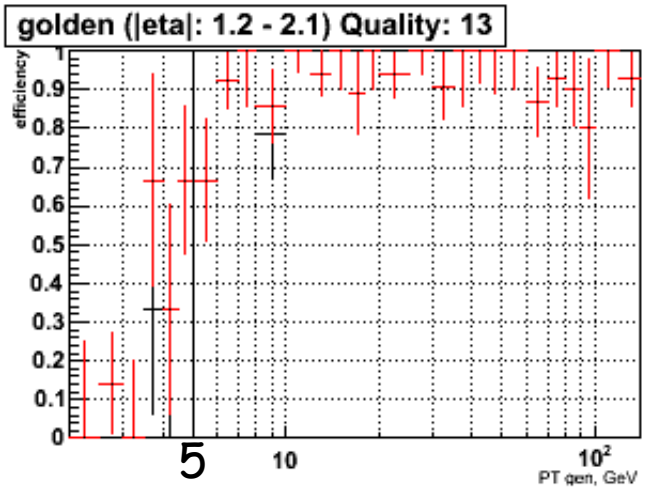
- Darin's method
- Anna's method

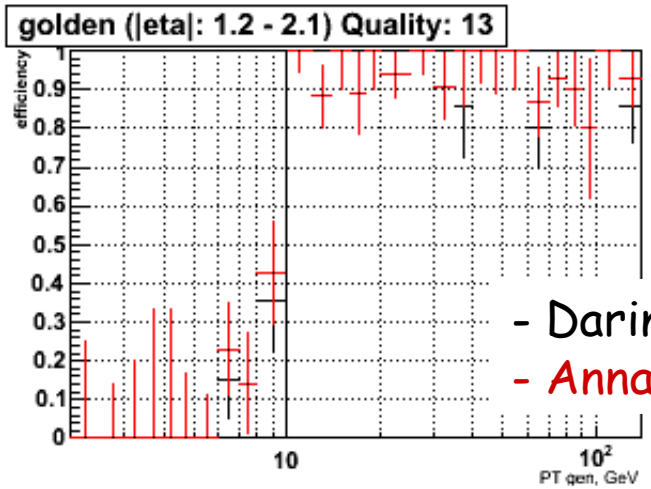




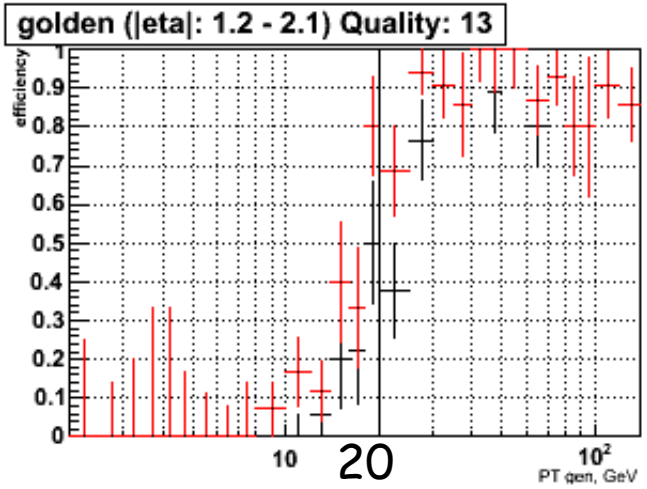
Anna's method works better?

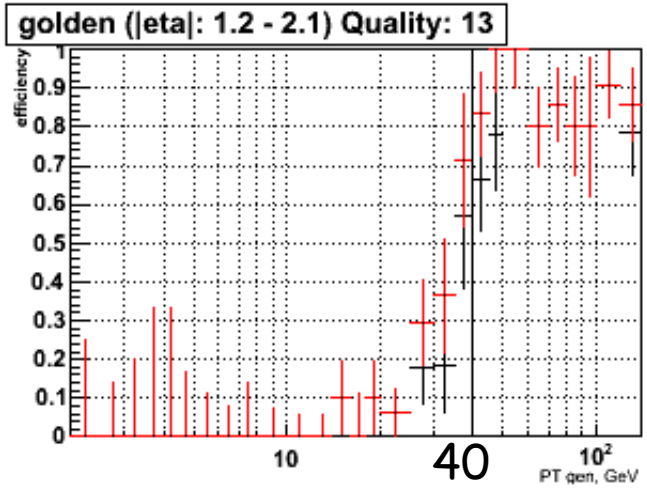
Pt efficiency for Quality = 3 and |η| > 2.1





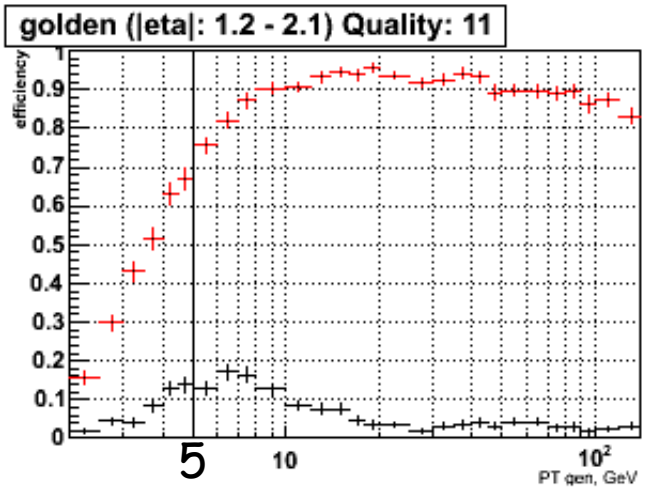
- Darin's method
- *Anna's method*

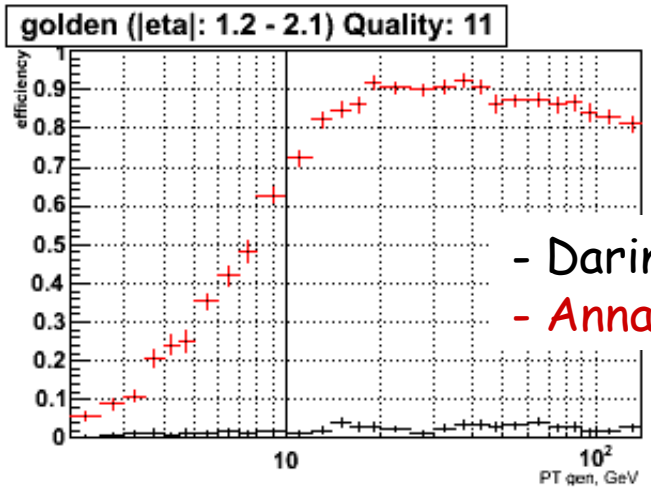




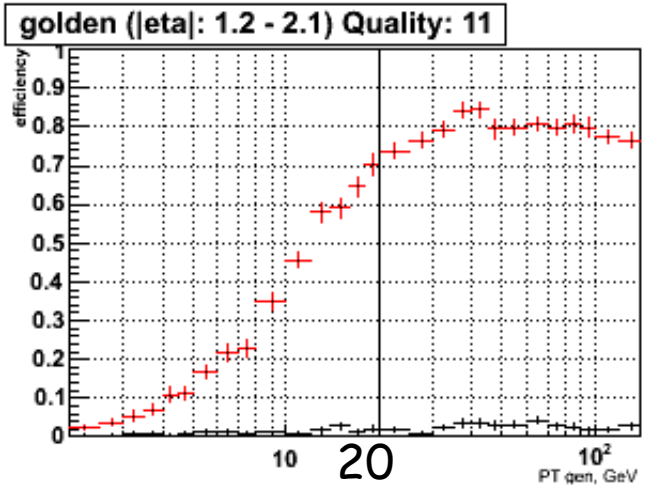
For high eta range Quality = 2 is not defined (no such tracks)

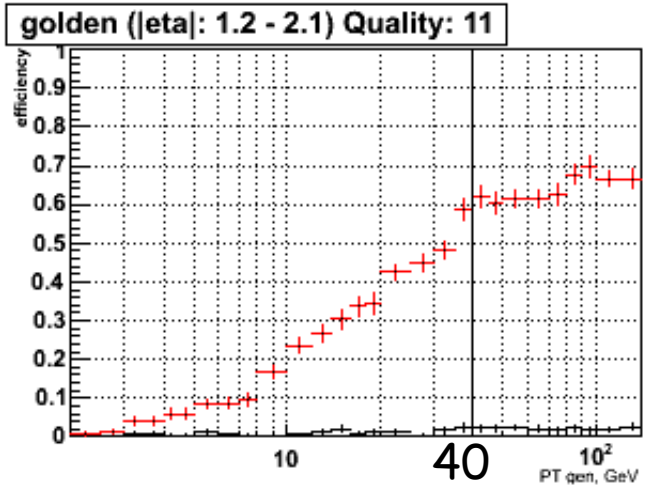
Pt efficiency for Quality = 1 and |η| > 2.1





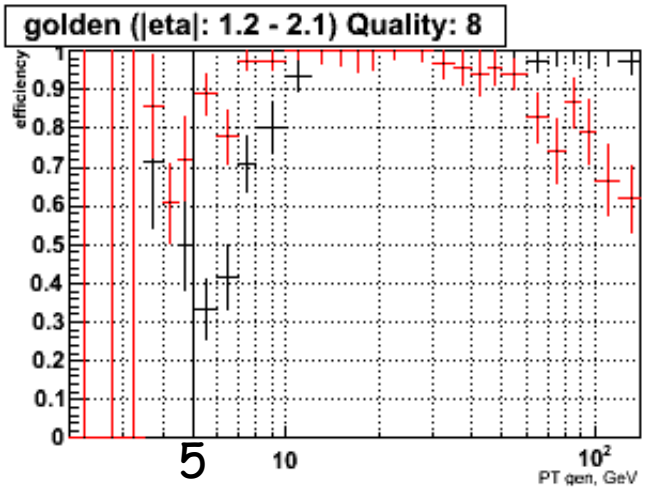
- Darin's method
- Anna's method

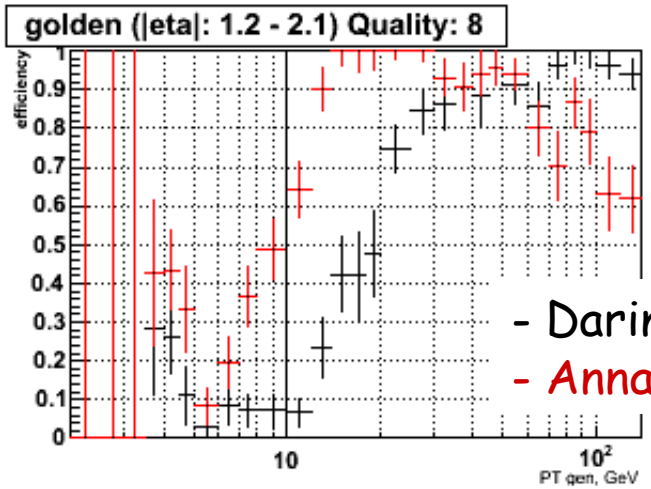




Anna's method works better?

Pt efficiency for Quality = 3 and |η| < 1.2





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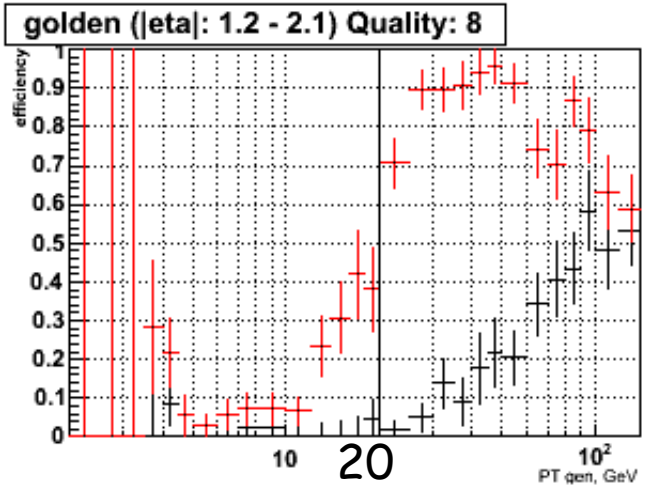
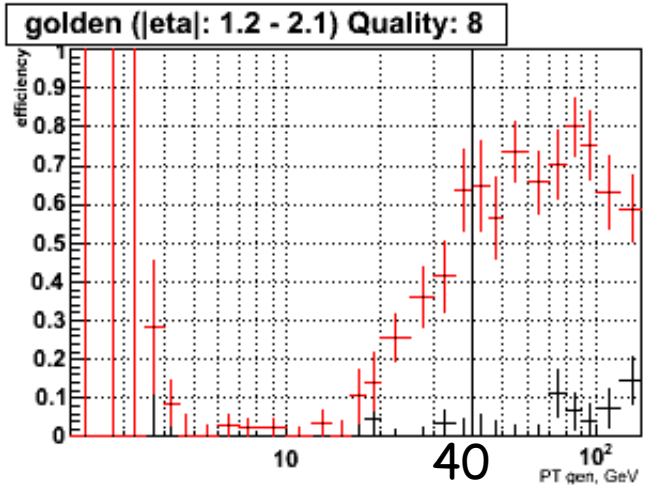
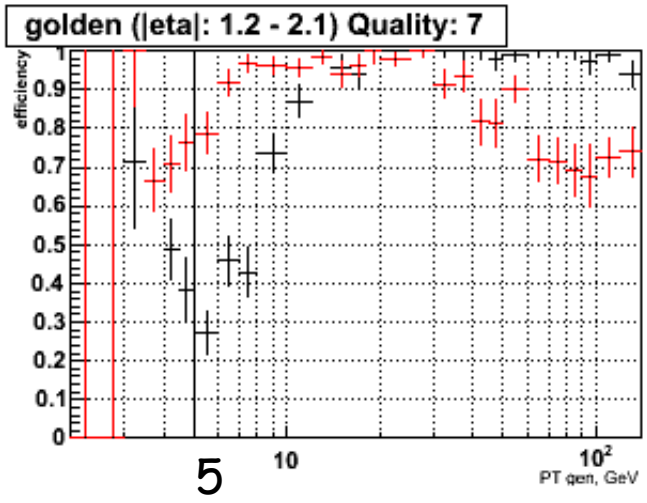




Problem with high PT muons?

Pt efficiency for Quality = 2 and |η| < 1.2



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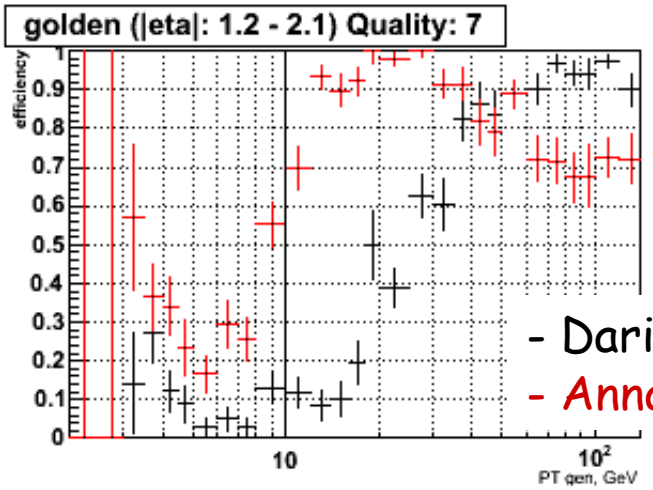
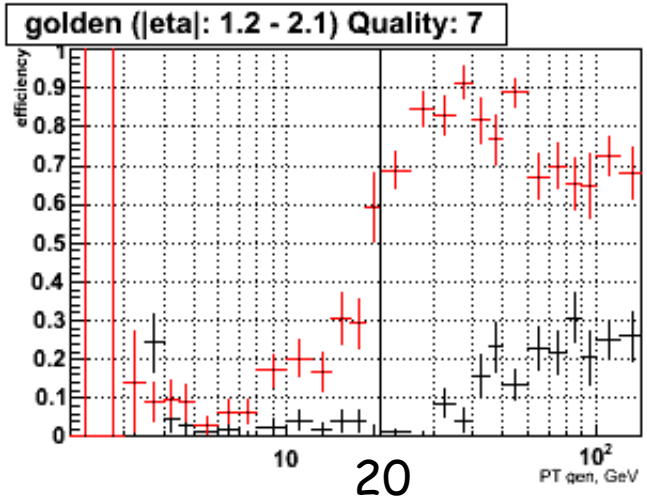


- Darin's method
- *Anna's method*



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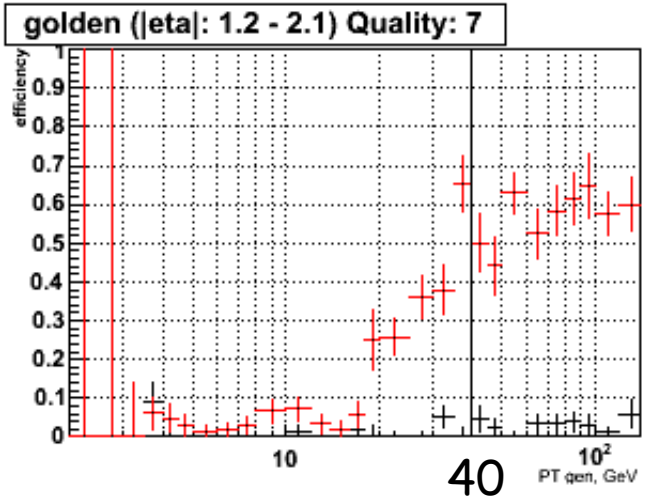

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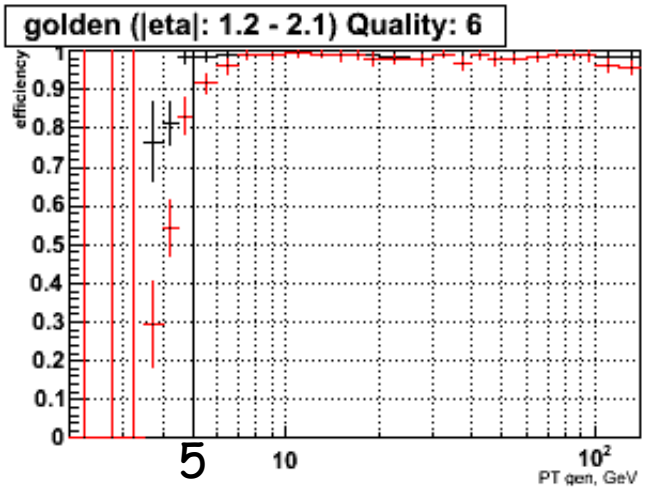
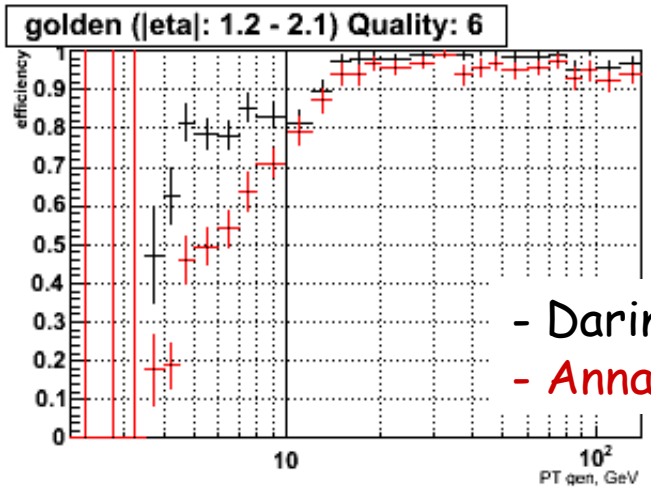
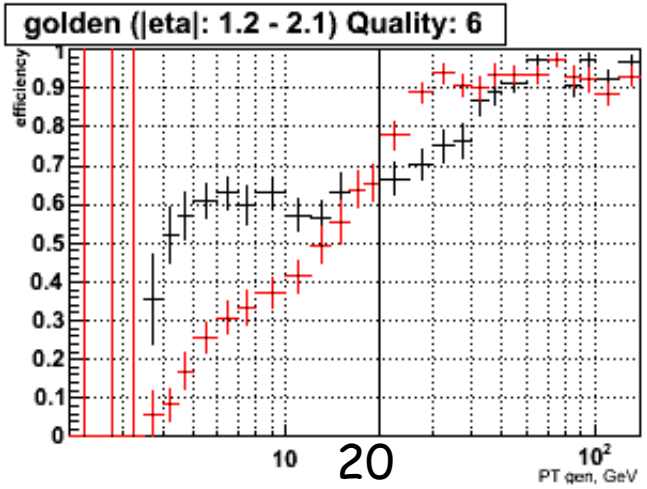
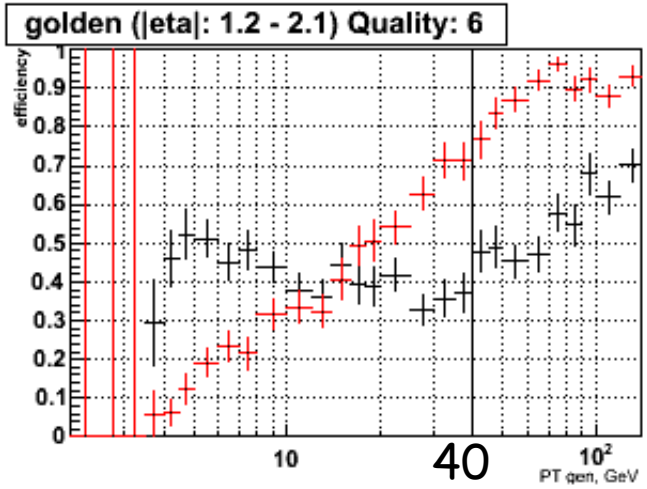
Pt efficiency for Quality = 1 and |η| < 1.2





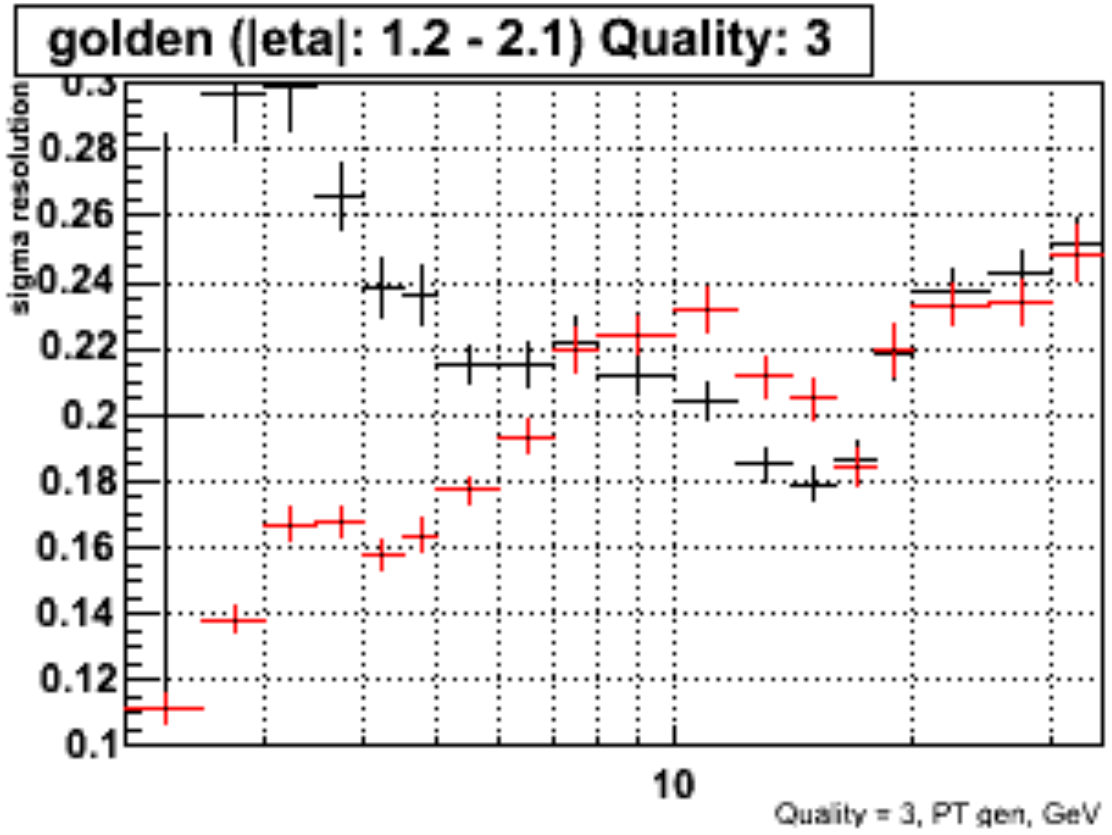
- Darin's method
- *Anna's method*





Sigma of Resolution (1/pT – 1/pTgen)*pTgen

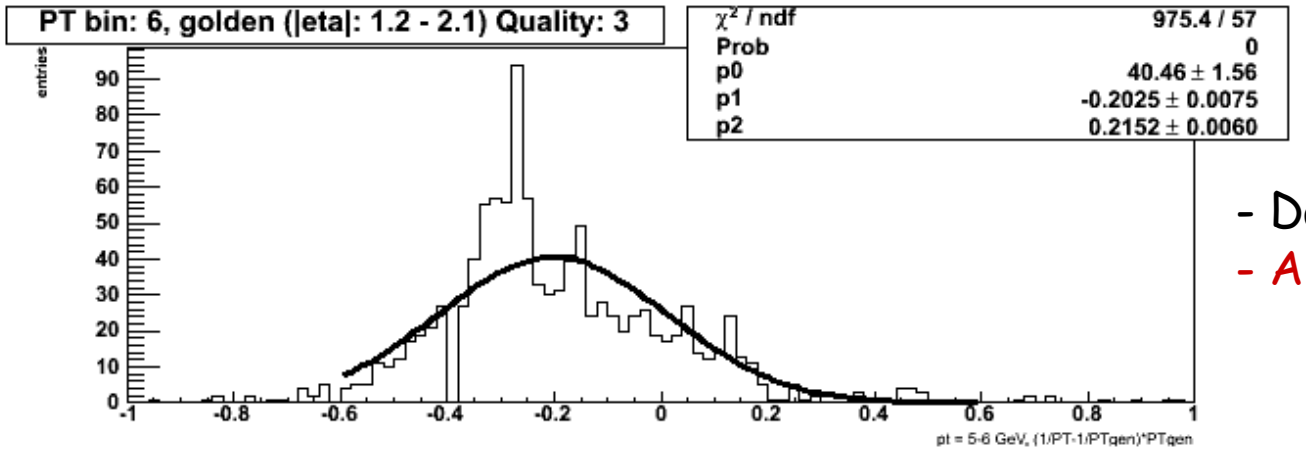
Quality = 3 and 1.2 < |η| < 2.1

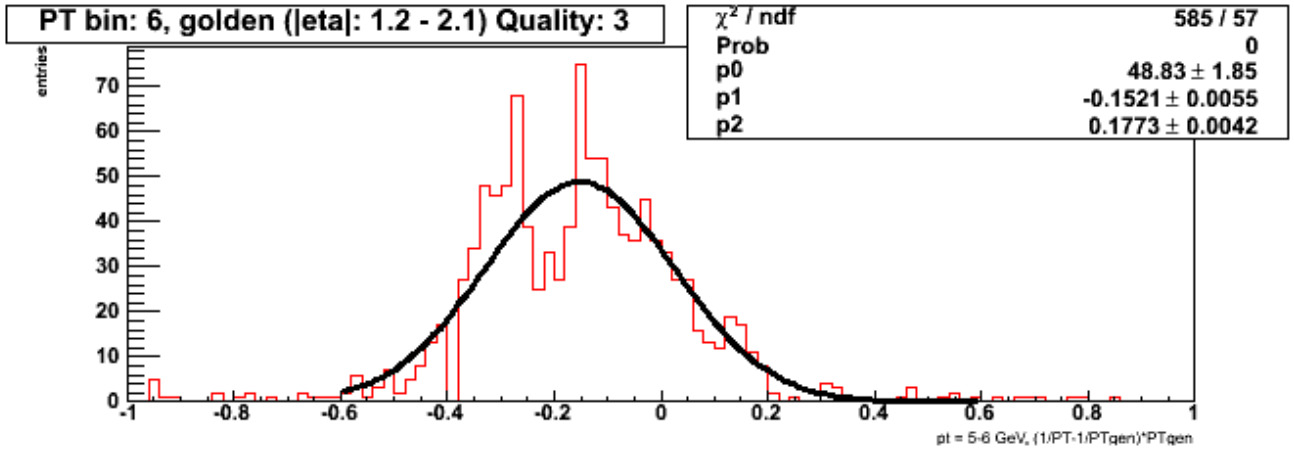


- Darin's method
- *Anna's method*

Resolution (1/pT – 1/pTgen)*pTgen for 1.2 < |η| < 2.1, 1-2-3

5 < PTgen < 6 GeV





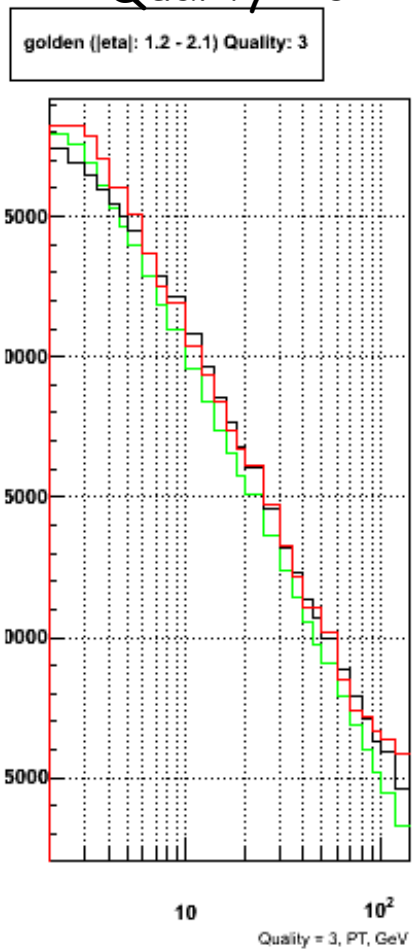
- Darin's method
- Anna's method

In Anna's method low pt muons assign to the low pt muons with better resolution (peak near -1 is disappeared)

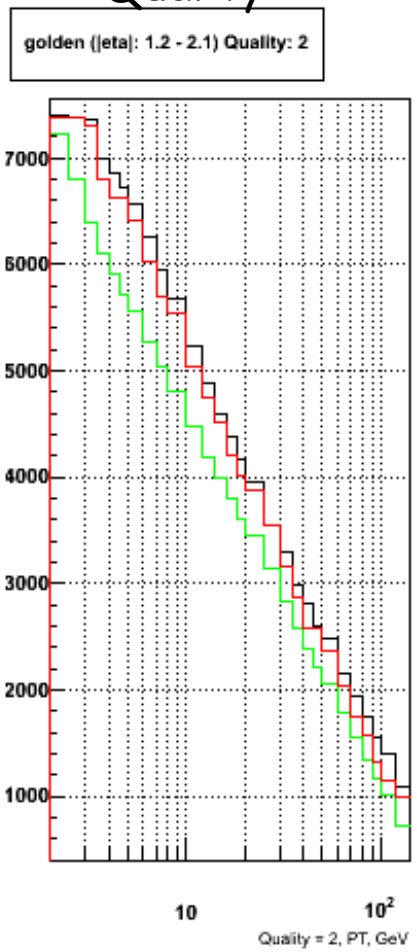
Pt Rate for Gen and Rec Muons

This rate is plotted only for **1.2 < |η| < 2.1**

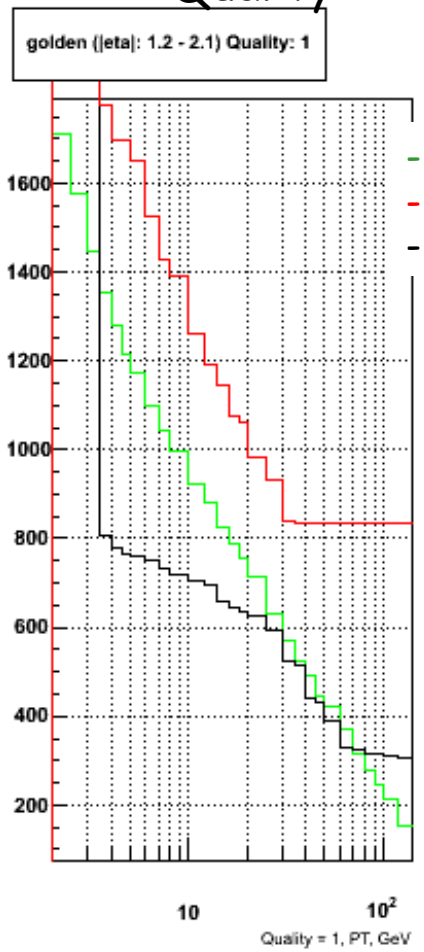
Quality = 3



Quality = 2



Quality = 1



- gen
- Rec Anna's method
- Rec Darin's method

Conclusion

What was done:

- comparison between the pt LUT (Anna's method) and pt LUT (Darin's method) => some improvements are observed for some qualities

To do list:

✓ try investigate other improvements

Backup slides

Likelihood for 2 and 3 Station Methods

$$L_{2\ Station} = \frac{1}{\sqrt{2\pi}\sigma_{12}} \times \exp\left\{-\frac{(\Delta\phi_{12} - \mu_{12})^2}{2\sigma_{12}^2}\right\}$$

$$L_{3\ Station} = \frac{1}{2\pi\sigma_{12}\sigma_{23}\sqrt{1-\rho^2}} \times \exp\left\{-\frac{1}{2(1-\rho^2)}\left[\frac{(\Delta\phi_{12} - \mu_{12})^2}{\sigma_{12}^2} - \frac{2\rho(\Delta\phi_{12} - \mu_{12})(\Delta\phi_{23} - \mu_{23})}{\sigma_{12}\sigma_{23}} + \frac{(\Delta\phi_{23} - \mu_{23})^2}{\sigma_{23}^2}\right]\right\}$$

- Mean values μ_{12} and μ_{23} and there sigma σ_{12} and σ_{23}, extracted from the Gauss fit of the $\Delta\phi_{12}$ and $\Delta\phi_{23}$ distributions correspondingly, are parameterized with smooth functions:

$$\mu = \frac{a_0}{(pt - a_3)} + \frac{a_1}{(pt - a_3)^2} + a_2; \quad \sigma = \frac{b_0}{pt} + \frac{b_1}{pt^2} + b_3$$

- Correlation ρ between $\Delta\phi_{12}$ and $\Delta\phi_{23}$ is calculated and parameterized with smooth function:

$$\rho = (c_0 + c_1 \log pt + c_2 \log^2 pt + c_3 \log^3 pt) \times \exp\{-c_4 \log pt\}$$

- pt is found solving equation: ∂ln(L)/∂pt = 0 numerically.

- pt = (maximum solution of this equation)*1.2
  1.2 (20%) correction is taking to have efficiency > 90% in CSCTF triggering

Possible track combinations

All mean values and sigmas are described for following Δϕ combinations:

Q	LCT in Station	Possible |η| range η_{low} - η_{high}
1	1-2	1.0 – 2.1
2	1-3	1.1 – 2.1
3	1-4	1.8 – 2.1
4	2-3	1.1 – 2.4
5	2-4	1.8 – 2.4
6	3-4	1.8 – 2.4
7	DT-1	0.9 – 1.2
8	DT-2	1.0 – 1.2
9	DT-3	1.1 – 1.2
11	1-2-3	1.1 – 2.1
12	1-2-4	1.8 – 2.1
13	1-3-4	1.8 – 2.1
14	2-3-4	1.8 – 2.4
22	DT-1-2	1.0 – 1.2
23	DT-1-3	1.1 – 1.2
24	DT-2-3	1.1 – 1.2

If ($\eta < \eta_{low}$) take parameterization of μ and σ from η_{low} bin for ptLUTs
If ($\eta > \eta_{high}$) take parameterization of μ and σ from η_{high} bin for ptLUTs