E70 meeting

2020/06/08

大橋　翼

BLのAnalyzer TransferMatrix CalcDeltaD2Uにバグ

- Analyzerにバグ
  - K18TM::CalcDeltaD2U
- 2013年に報告済みだったらしいが、頂いたAnalyzerには反映されていなかった
- 前回報告した値が変更
  - δ^{o2}(TMを用いて出したδ)

```
*/
{
  double alpha, beta, gamma;
  double x, a, y, b;
  x = xin; a = uin; y = yin; b = vin;
  alpha = Xpar[TT] + Xpar[XTT]*x + Xpar[ATT]*a;
  beta  = Xpar[T] + Xpar[XT]*x + Xpar[AT]*a + Xpar[XXT]*x*x + Xpar[XAT]*x*a
    + Xpar[AAT]*a*a + Xpar[TYY]*y*y + Xpar[TYB]*y*b + Xpar[TBB]*b*b;
  gamma = Xpar[X]*x + Xpar[A]*a + Xpar[XX]*x*x + Xpar[XA]*x*a + Xpar[AA]*a*a
    + Xpar[YY]*y*y + Xpar[YB]*y*b + Xpar[BB]*b*b + Xpar[XXX]*x*x*x
    + Xpar[XXA]*x*x*a + Xpar[XAA]*x*a*a + Xpar[XYY]*x*y*y + Xpar[XYB]*x*y*b
    + Xpar[XBB]*x*b*b + Xpar[AAA]*a*a*a + Xpar[AYY]*a*y*y + Xpar[AYB]*a*y*b
    + Xpar[ABB]*a*b*b - xout;

  double p, q;
  p = -(alpha*alpha)/3 + beta;
  q = (2*alpha*alpha*alpha)/27 - (alpha*beta)/3 + gamma;

  double hanbetu = -((q/2)*(q/2) + (p/3)*(p/3)*(p/3));
  if(hanbetu > 0){
    double r = sqrt(-4*p/3);
    double s1, s2, s3;
    double theta = (1/3.)*std::acos(3*q/(r*p));
    s1 = r*cos(theta) -alpha/3;
    s2 = r*cos(theta + 2*PI/3.) -alpha/3;
    s3 = r*cos(theta - 2*PI/3.) -alpha/3;

    double tmpans = s1;
    if(fabs(tmpans-ans1) > fabs(s2-ans1)){
  tmpans = s2;
    }
    if(fabs(tmpans-ans1) > fabs(s3-ans1)){
  tmpans = s3;
    }
    delta2 = tmpans;
    //      std::cout << "ans1 " << ans1 << std::endl;
    //      std::cout << delta2 << std::endl;
  }else{
    double s1;
    s1 = cbrt(-q/2 + sqrt(-hanbetu)) + cbrt(-q/2 - sqrt(-hanbetu))
  -alpha/3;
    delta2 = s1;
    //      std::cout << "ans1 " << ans1 << std::endl;
    //      std::cout << delta2 << std::endl;
  }
}

return true;
```

```
402     x = xin; a = uin; y = yin; b = vin;
403     alpha = Xpar[TT] + Xpar[XTT]*x + Xpar[ATT]*a;
404     beta  = Xpar[T] + Xpar[XT]*x + Xpar[AT]*a + Xpar[XXT]*x*x + Xpar[X
    AT]*x*a
405       + Xpar[AAT]*a*a + Xpar[TYY]*y*y + Xpar[TYB]*y*b + Xpar[TBB]*b*b;
406     gamma = Xpar[X]*x + Xpar[A]*a + Xpar[XX]*x*x + Xpar[XA]*x*a + Xpar
    [AA]*a*a
407       + Xpar[YY]*y*y + Xpar[YB]*y*b + Xpar[BB]*b*b + Xpar[XXX]*x*x*x
408       + Xpar[XXA]*x*x*a + Xpar[XAA]*x*a*a + Xpar[XYY]*x*y*y + Xpar[XYB
    ]*x*y*b
409       + Xpar[XBB]*x*b*b + Xpar[AAA]*a*a*a + Xpar[AYY]*a*y*y + Xpar[AYB
    ]*a*y*b
410       + Xpar[ABB]*a*b*b - xout;
411
412     alpha /= Xpar[TTT];
413     beta  /= Xpar[TTT];
414     gamma /= Xpar[TTT];
415
416
417     double p, q;
418     p = -(alpha*alpha)/3 + beta;
"MyK18TM.cc" 451L, 12334C written                    413,5         92%
```

3次方程式の係数ミス

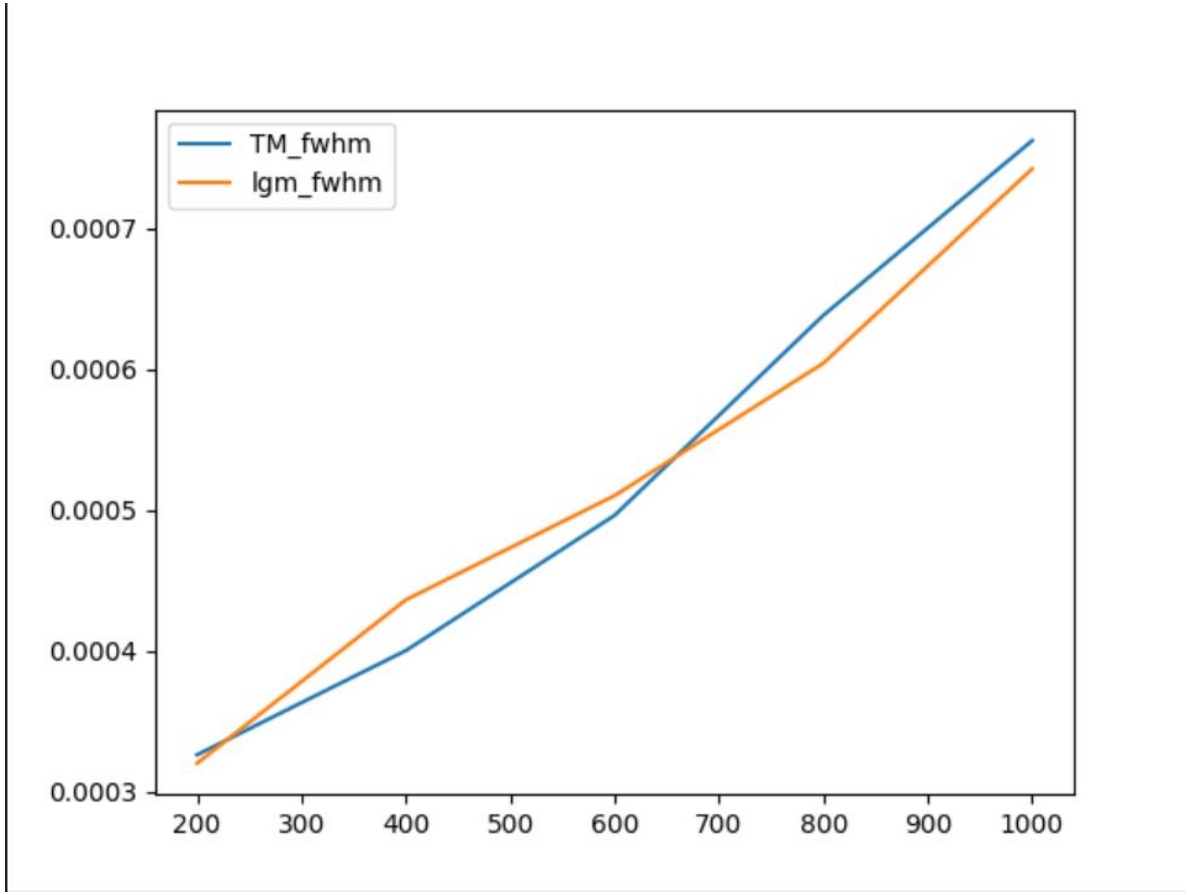
TM vs lgb(ML)

- 真の値（輸送行列を満たす）$x_{in}^{t}(BFT), X_{out}^{t}, \delta^{t}$
- 観測誤差加味
  - $x_{in}^{o} = x_{in}^{t} + \delta x_{BFT}$
  - $X_{out}^{o} = X_{out}^{t} + \delta X_{out}$
- 観測値からδ^{o}を求める
  - $x_{in}^{o}, X_{out}^{o} --(TM)\rightarrow \delta_{TM}^{o}$
  - $x_{in}^{o}, X_{out}^{o} --(lgb)\rightarrow \delta_{lgb}^{o}$
    - ただしlgbは$x_{in}^{t}, X_{out}^{t} --(lgb)\rightarrow \delta^{t}$として学習済
- $\delta^{o} - \delta^{t}$をTMとlgbで比較

$\delta^{o}_{TM\ or\ lgb} - \delta^{t}$

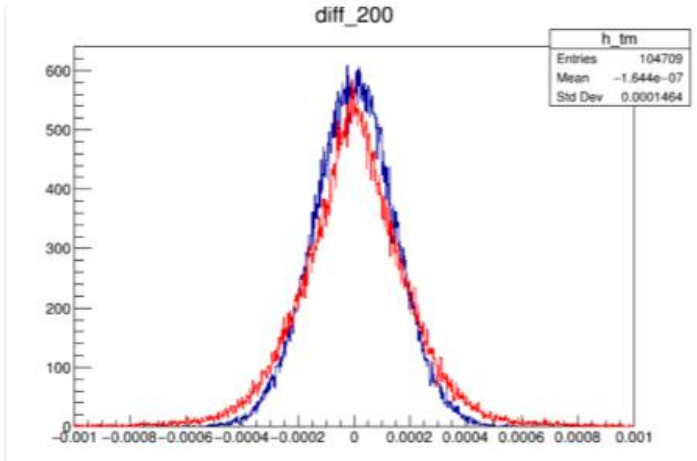
- δX_{out}固定
- $\delta x_{BFT} = 200, 400, \ldots, 1000\ [\mu m]$

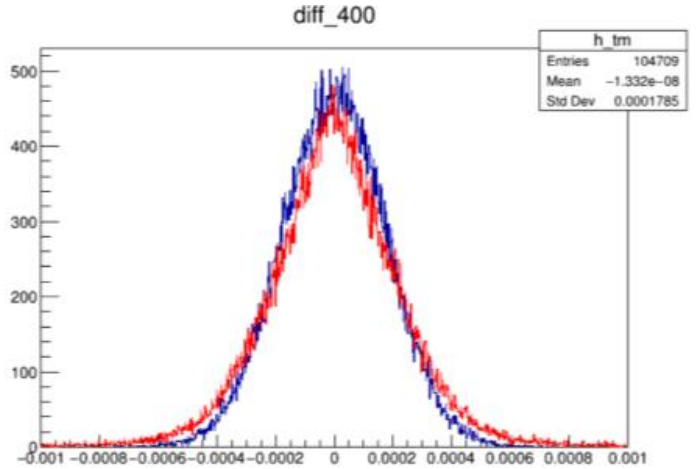
- fwhmの差は有意とは言い難い
- チューニングしてどこまでよくなるか？
- どのパラメータが一番効くか

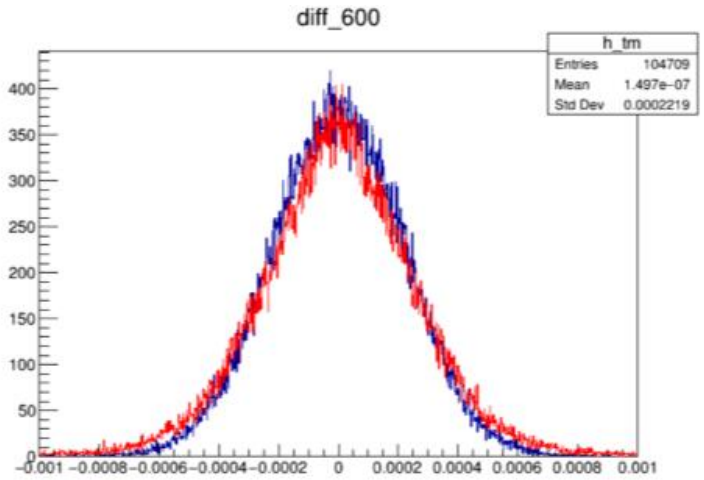


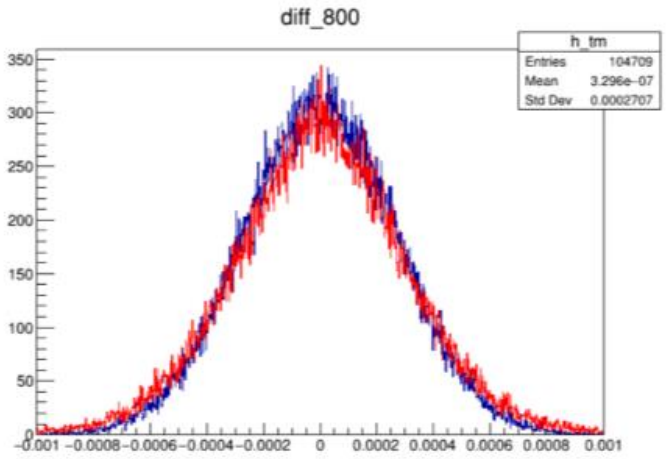
	TM_fwhm	lgm_fwhm
200	0.0003260000000000…	0.0003199999999999…
400	0.0003999999999999…	0.0004359999999999…
600	0.0004959999999999…	0.00051
800	0.0006379999999999…	0.000604
1000	0.0007619999999999…	0.0007419999999999…

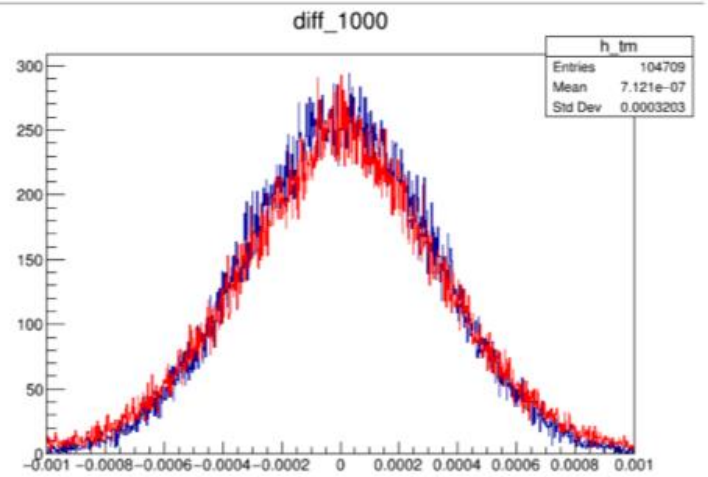
$$\delta^{o}_{TM\ or\ lgb} - \delta^{t}$$









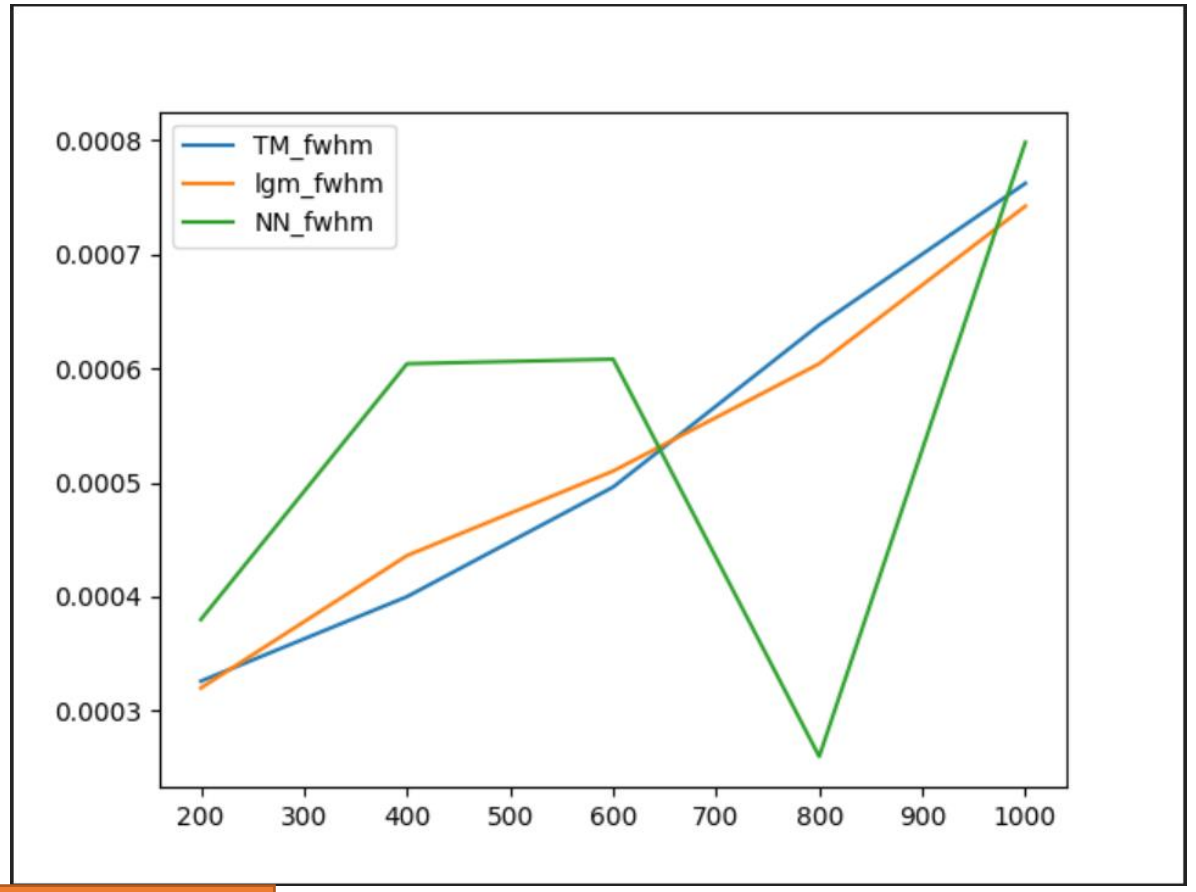


青：TM
赤：lgb

TM, lgb, NN

- Lgbと同様にNNでも$\delta^o_{NN} - \delta^t$
- 試しに一つのパラメータについて

```
32 NUM_UNITS = [128]
33 NUM_LAYERS = [5]
34 BATCH_SIZE = [128]
35 OPTIMIZER = ['adam']
```

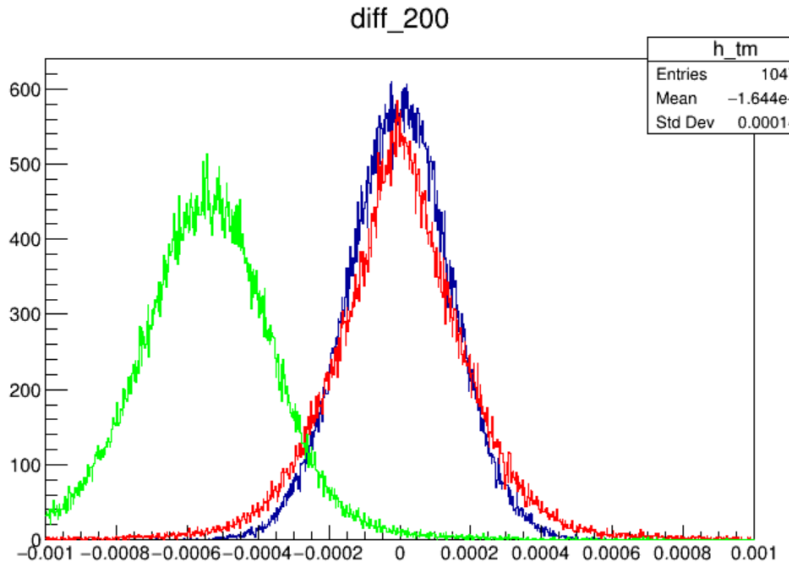


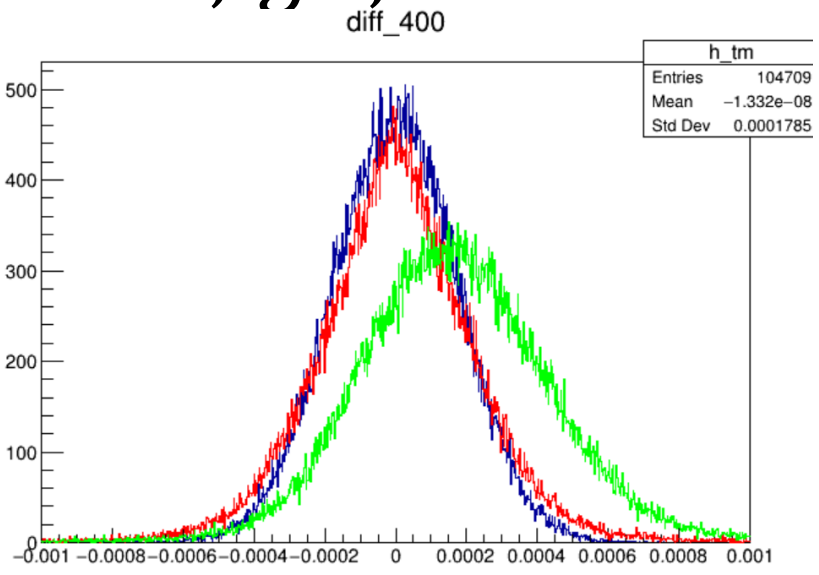
NN_fwhm800は誤り

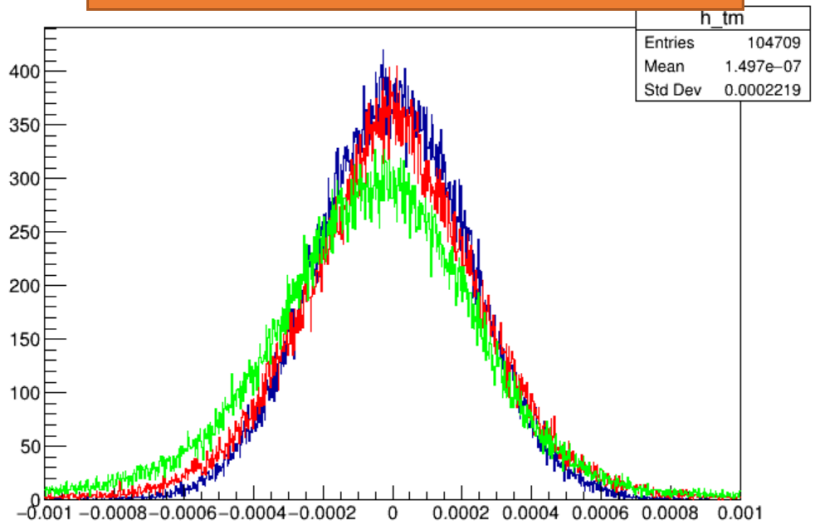
	TM_fwhm	lgm_fwhm	NN_fwhm
200	0.000326	0.000320	0.000380
400	0.000400	0.000436	0.000604
600	0.000496	0.000510	0.000608
800	0.000638	0.000604	0.000260
1000	0.000762	0.000742	0.000798

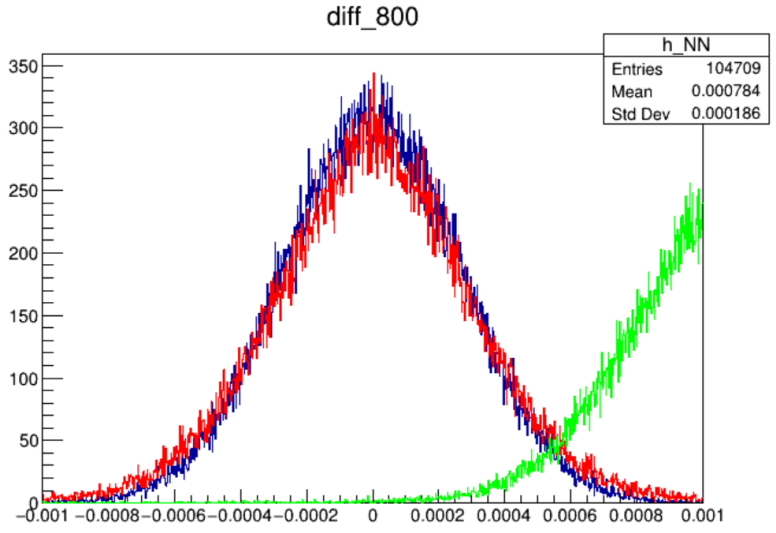
$\delta^{o}_{TM,lgb,NN} - \delta^{t}$

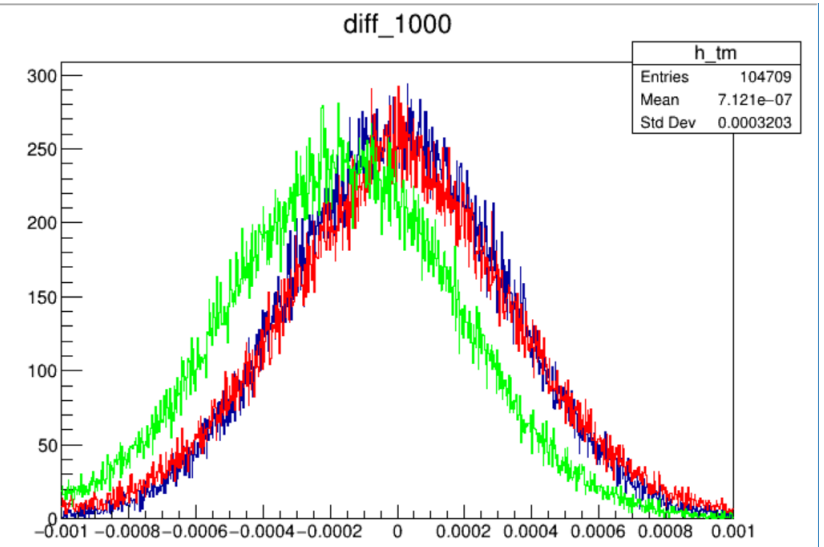
NN_fwhm800は誤り











	TM_fwhm	lgm_fwhm	NN_fwhm
200	0.000326	0.000320	0.000380
400	0.000400	0.000436	0.000604
600	0.000496	0.000510	0.000608
800	0.000638	0.000604	0.000260
1000	0.000762	0.000742	0.000798

青：TM、赤：lgb、緑：NN
実装ミスの可能性も考慮して改善すべき

y, u, v_{in}の効果

- BC1, 2時代の解析法と比較
- Analyzer該当箇所発見、移植中

- 物質による多重散乱効果
- <x|theta>はあまりきかないはず

backup

NN補足

- 収束性の改善が必要
  - 1000epochでは不足