S-2S project MEMO

Toshiyuki Gogami

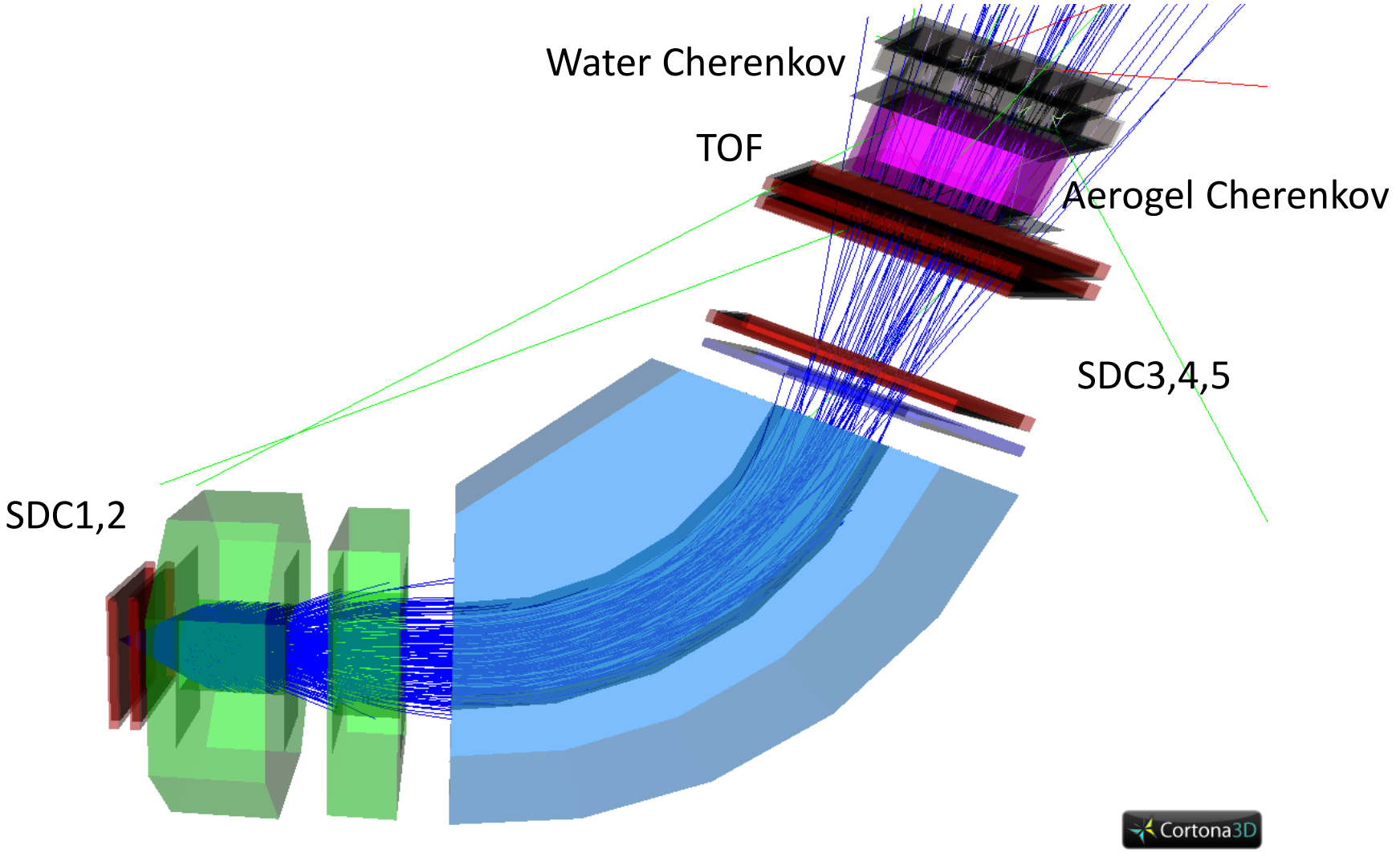
1Dec2014

@醍醐寺

Contents

TOF zigzag design

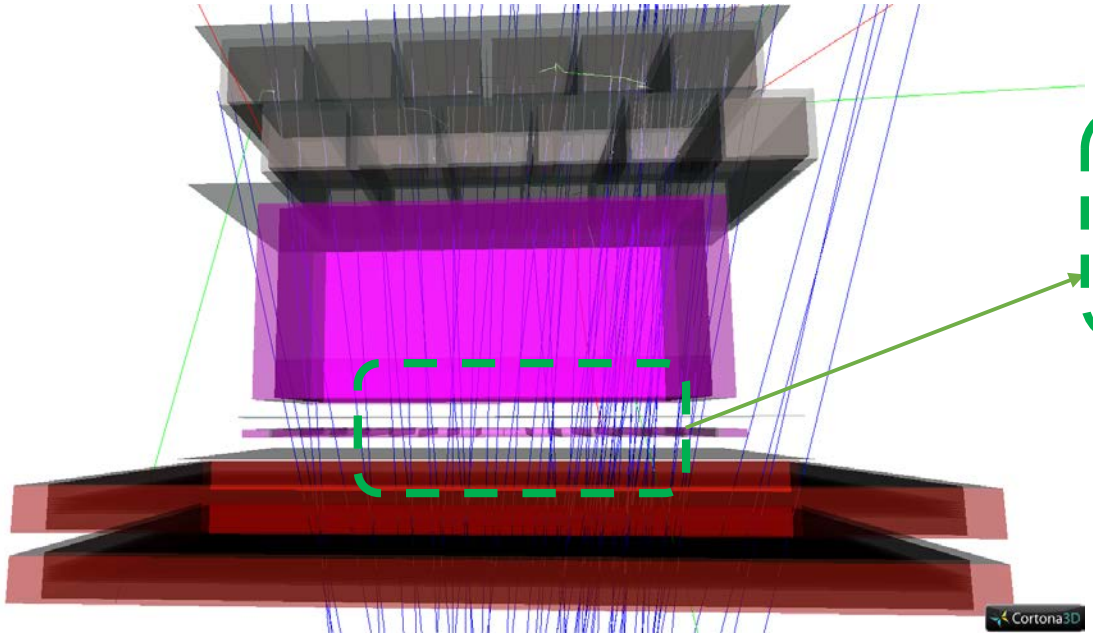
S-2S Geant4 simulation

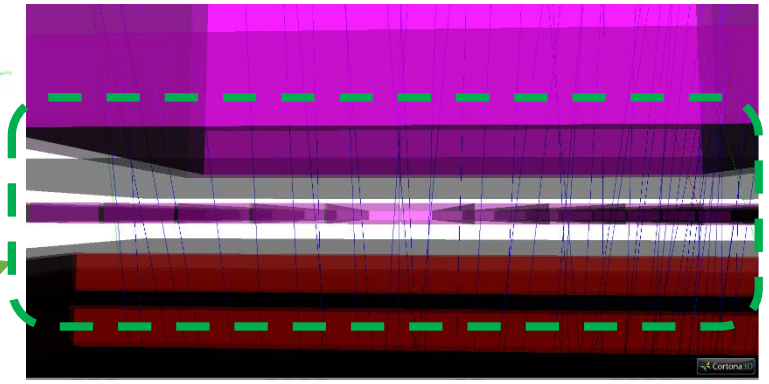


目下の目標 (Geat4を使って)

- ☐ TOF design → ***This presentation***
- ☐ Water Cherenkov detector
  - ✓ Realistic *p* rejection efficiency
- ☐ Optics study

Gap problem of TOF detector

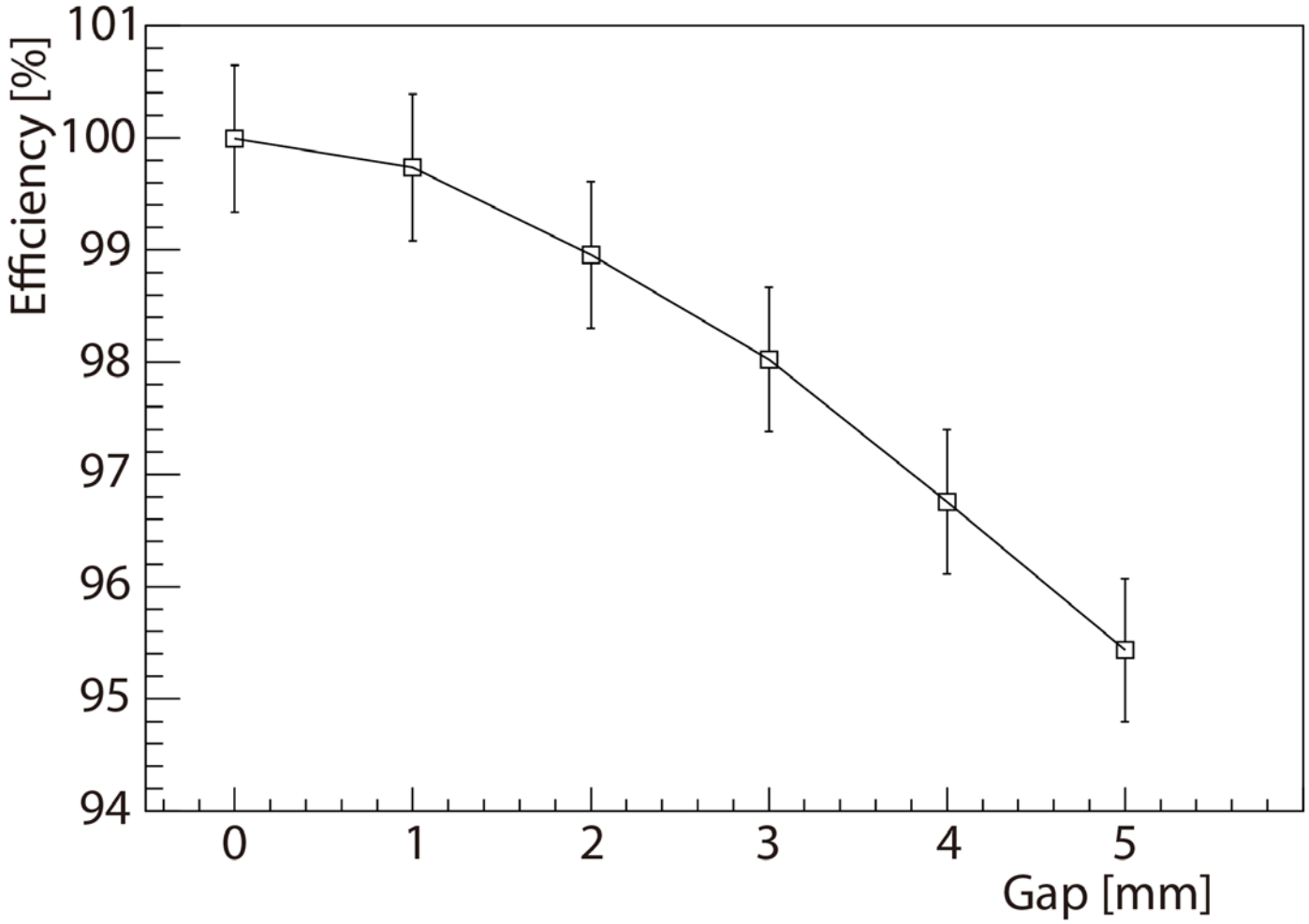




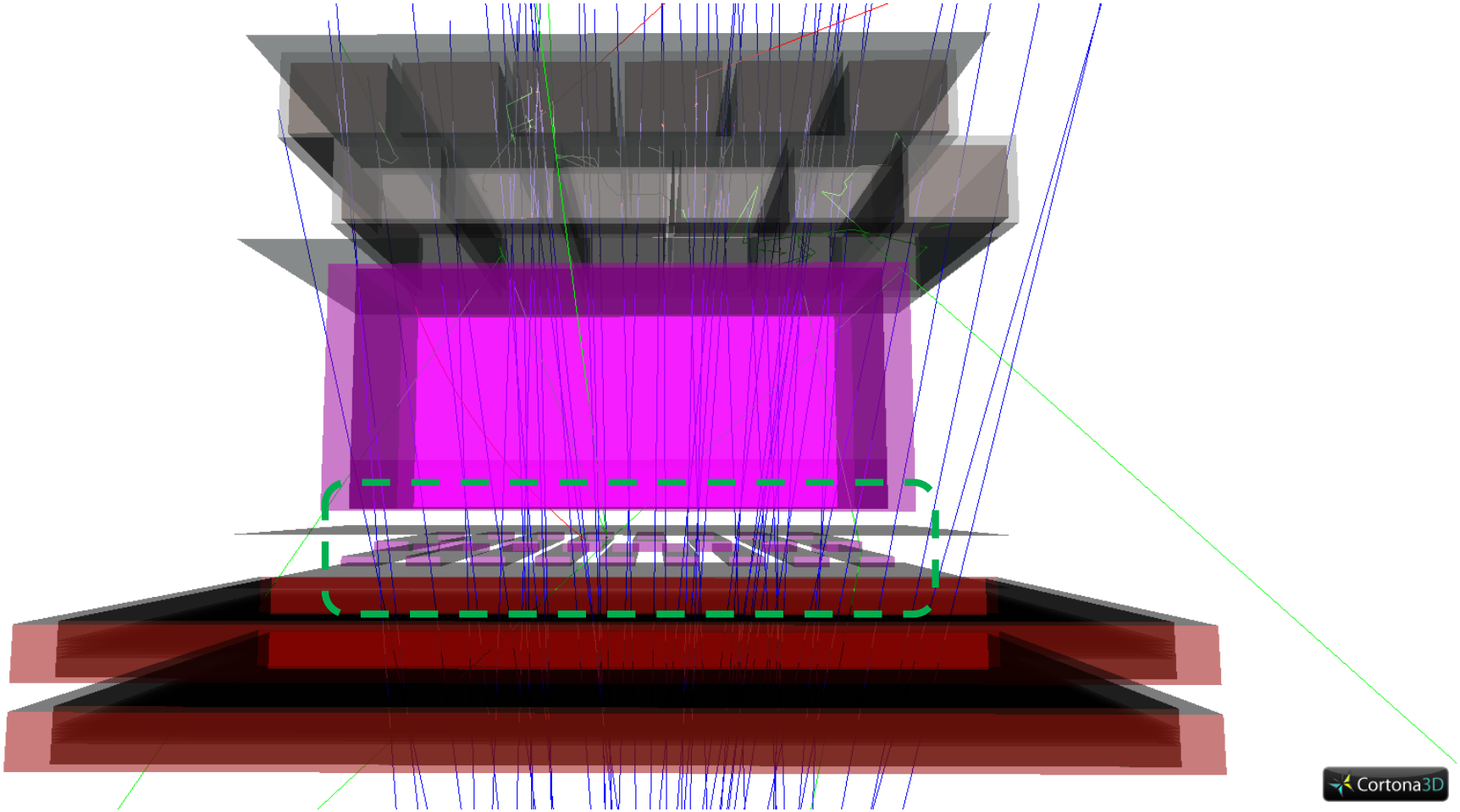
≥1 mm gaps between scintillators (due to black sheet)

➡ EVENT LOSS …

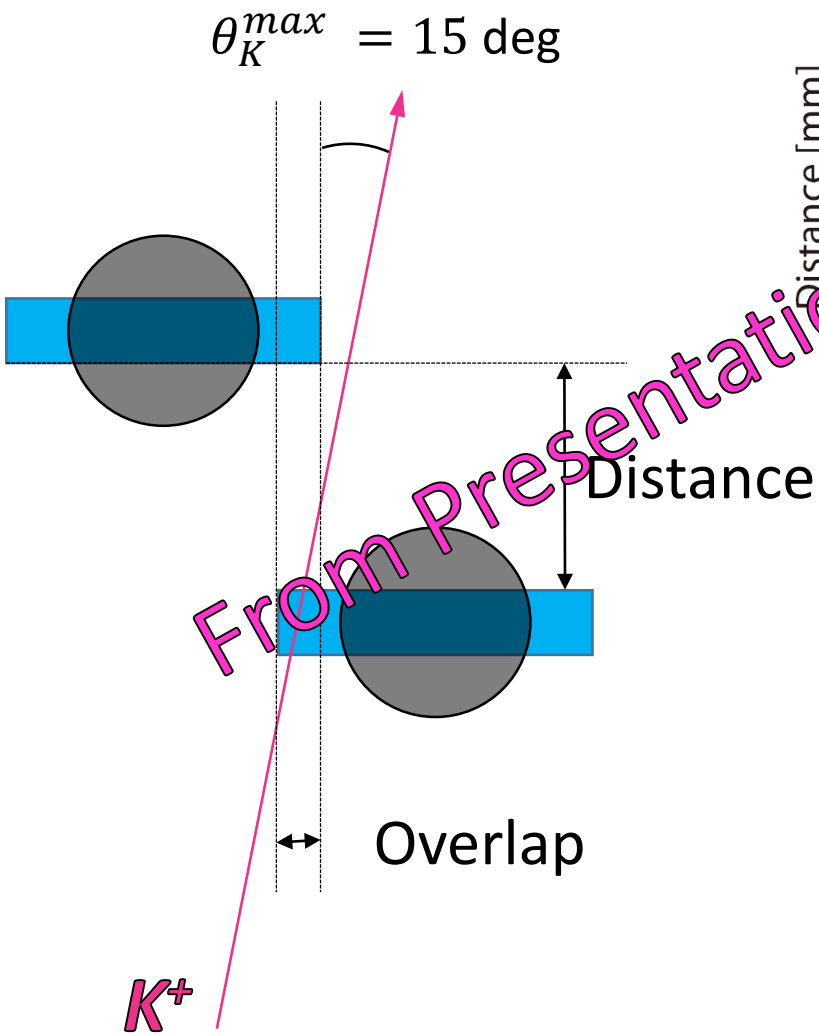
Efficiency vs. gap (Plane type)

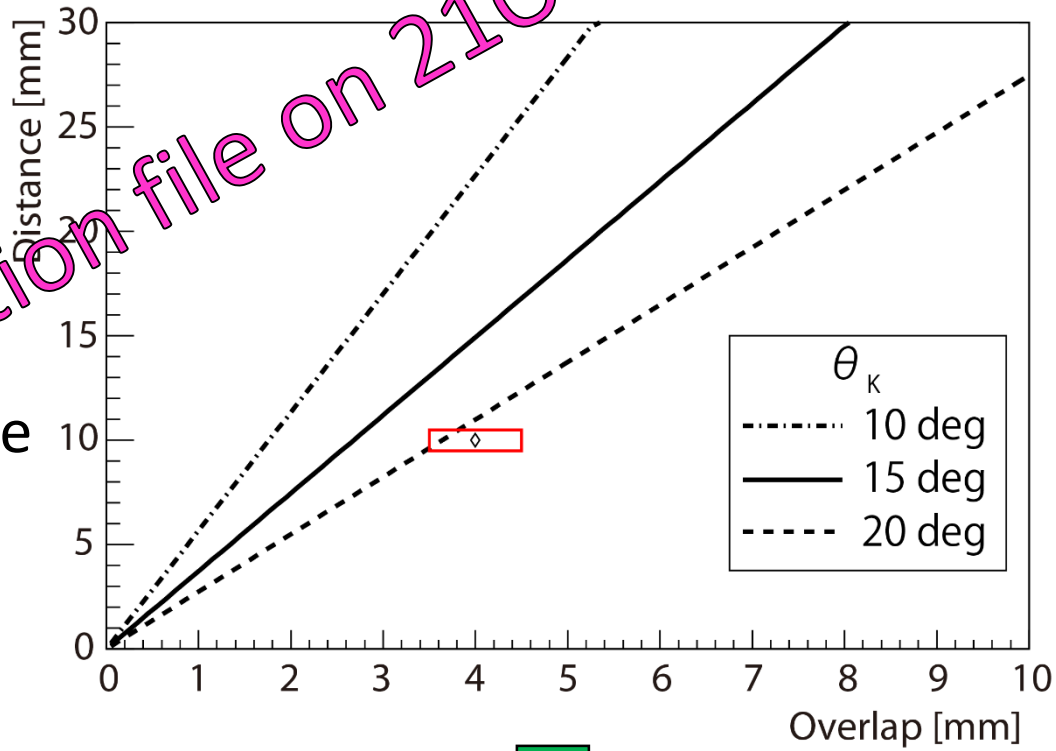


Plane → Zigzag configuration



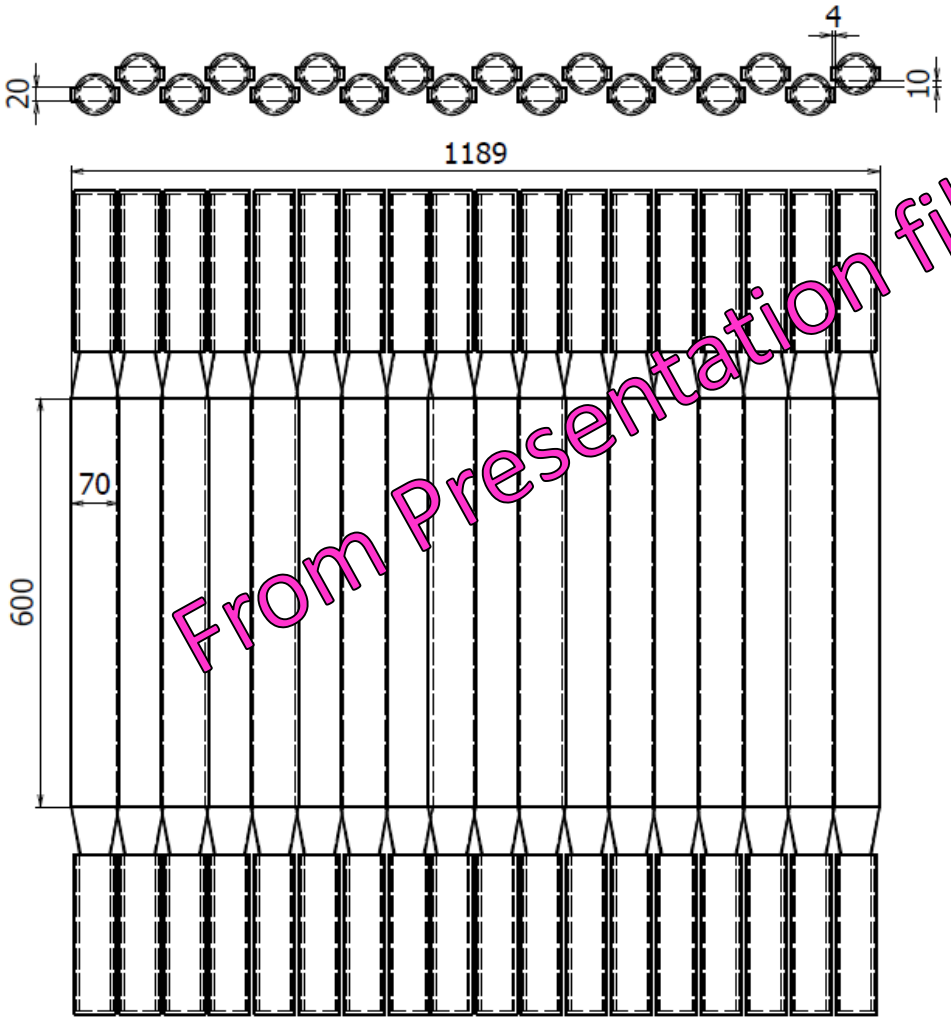
Overlap and distance (TOF detector)





(Overlap, Distance) = (4 mm, 10 mm)

CAD drawing of TOF detector (zigzag)



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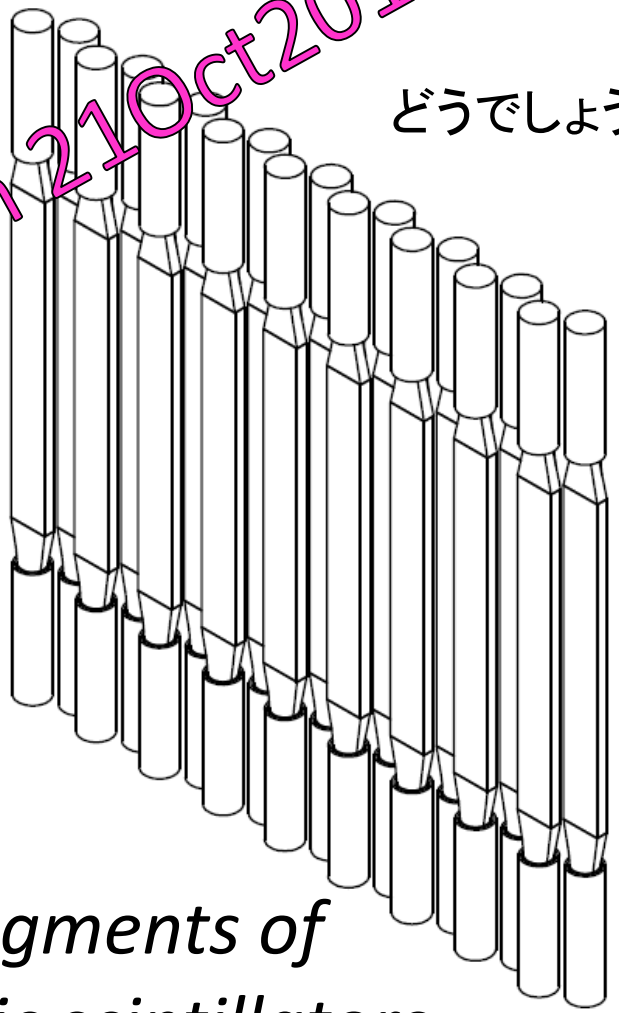
どうでしょう？



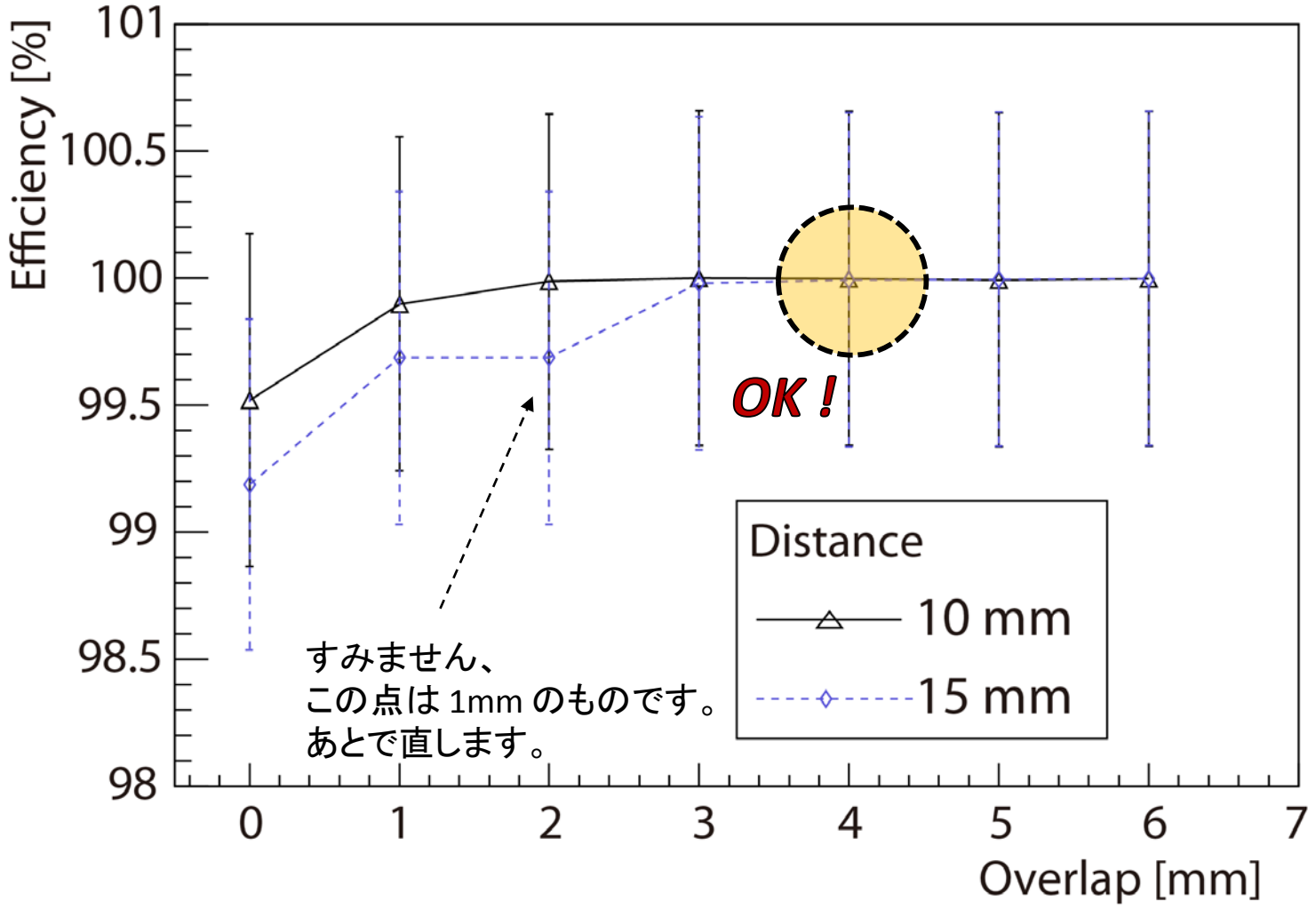
18 segments of plastic scintillators

Want to confirm whether a configuration of

(Overlap, Distance) = (4 mm, 10 mm)

is ***OK*** or ***not*** by Geant4 simulation.

Efficiency vs. overlap (zigzag type)



Things in progress
(will be done soon !! Please wait for a while…)

- 既存の17本(4 mm overlap, 10 mm distance)での図面
  (前回は18本のデザイン)

- フレームの図面

Backup

loss.cc

```
/*
 "loss.cc"

 Toshi Gogami , 28Nov2014
*/

void loss(){
 // ======== General conditions ===============
 gROOT->SetStyle("Plain");
 gStyle->SetOptStat(0);

 // ======== Open ROOT file ===================
 //TFile* f1 = new TFile("tof_line_gap-0mm.root"); // gap-0mm (NO zig-zag)
 //TFile* f1 = new TFile("tof_line_gap-1mm.root"); // gap-2mm (NO zig-zag)
 //TFile* f1 = new TFile("tof_line_gap-2mm.root"); // gap-2mm (NO zig-zag)
 //TFile* f1 = new TFile("tof_line_gap-3mm.root"); // gap-3mm (NO zig-zag)
 //TFile* f1 = new TFile("tof_line_gap-4mm.root"); // gap-4mm (NO zig-zag)
 //TFile* f1 = new TFile("tof_line_gap-5mm.root"); // gap-4mm (NO zig-zag)
 //TFile* f1 = new TFile("tof_dist-10mm_over-0mm.root"); //
 //TFile* f1 = new TFile("tof_dist-10mm_over-1mm.root"); //
 //TFile* f1 = new TFile("tof_dist-10mm_over-2mm.root"); //
 //TFile* f1 = new TFile("tof_dist-10mm_over-3mm.root"); //
 //TFile* f1 = new TFile("tof_dist-10mm_over-4mm.root"); //
 //TFile* f1 = new TFile("tof_dist-10mm_over-5mm.root"); //
 //TFile* f1 = new TFile("tof_dist-10mm_over-6mm.root"); //
 //TFile* f1 = new TFile("tof_dist-15mm_over-0mm.root"); //
 //TFile* f1 = new TFile("tof_dist-15mm_over-1mm.root"); //
 //TFile* f1 = new TFile("tof_dist-15mm_over-2mm.root"); //
 //TFile* f1 = new TFile("tof_dist-15mm_over-3mm.root"); //
 //TFile* f1 = new TFile("tof_dist-15mm_over-4mm.root"); //
 //TFile* f1 = new TFile("tof_dist-15mm_over-5mm.root"); //
 TFile* f1 = new TFile("tof_dist-15mm_over-6mm.root"); //
 TTree* t1 = (TTree*)f1->Get("tree");

 //TCut cutcommon = "abs(vdx[7])<500.0 && abs(vdy[7])<200.0";
 //TCut cutcommon = "abs(vdx[7])<500.0 && abs(vdy[7])<200.0 &&
abs(vdx[8])<500.0 && abs(vdy[8])<200.0";
 TCut cutcommon = "abs(vdx[7])<500.0 && abs(vdy[7])<200.0 && WCTrig";
 //TCut cutcommon = "WCTrig";

// ======== Create Histogram ================
 double xmin = -800.0 , xmax = 800.0;
 double ymin = -500.0 , ymax = 500.0;
 int xbin = 100;
 int ybin = 100;
 TH2F* hist1 = new TH2F("hist1","",xbin,xmin,xmax,ybin,ymin,ymax);

 TH2F* hist2 = (TH2F*)hist1->Clone("hist2");
 hist2->SetMarkerColor(2);
 hist2->SetMarkerStyle(1);

 t1->Project("hist1","vdy[7]:vdx[7]","VDTrig"&&cutcommon);
 t1->Project("hist2","vdy[7]:vdx[7]","TOFTrig"&&cutcommon);

 // ========= Draw histograms ==================
 TCanvas* c1 = new TCanvas("c1","c1");
 hist1->Draw();
 hist2->Draw("same");

 // ===== Comments =====
 double n1 = 0.0 , n2 = 0.0;
 double eff, effer;
 n1 = hist1->GetEntries();
 n2 = hist2->GetEntries();
 eff = n2/n1;
 effer = eff * sqrt(1./n1 + 1./n2);
 cout << endl;
 cout << " n1=" << n1 << " +/- " << sqrt(n1) << endl;
 cout << " n2=" << n2 << " +/- " << sqrt(n2) << endl;
 cout << "  --> Efficiency = " << eff*100.0
    << " +/- " << effer*100 << " %" << endl;

 cout << " " <<  f1->GetName() << " " << eff*100.0
    << " " << effer*100 << endl;
}
```

Results of gap study

tof_line_gap-0mm.root 99.9936 0.655013
tof_line_gap-1mm.root 99.7384 0.653521
tof_line_gap-2mm.root 98.957 0.65474
tof_line_gap-3mm.root 98.0236 0.644698
tof_line_gap-4mm.root 96.7549 0.640469
tof_line_gap-5mm.root 95.4357 0.636397

tof_dist-10mm_over-0mm.root 99.5202 0.65508
tof_dist-10mm_over-1mm.root 99.8987 0.656111
tof_dist-10mm_over-2mm.root 99.9869 0.659818
tof_dist-10mm_over-3mm.root 100 0.658786
tof_dist-10mm_over-4mm.root 99.9978 0.657102
tof_dist-10mm_over-5mm.root 99.9935 0.656437
tof_dist-10mm_over-6mm.root 99.9978 0.657486

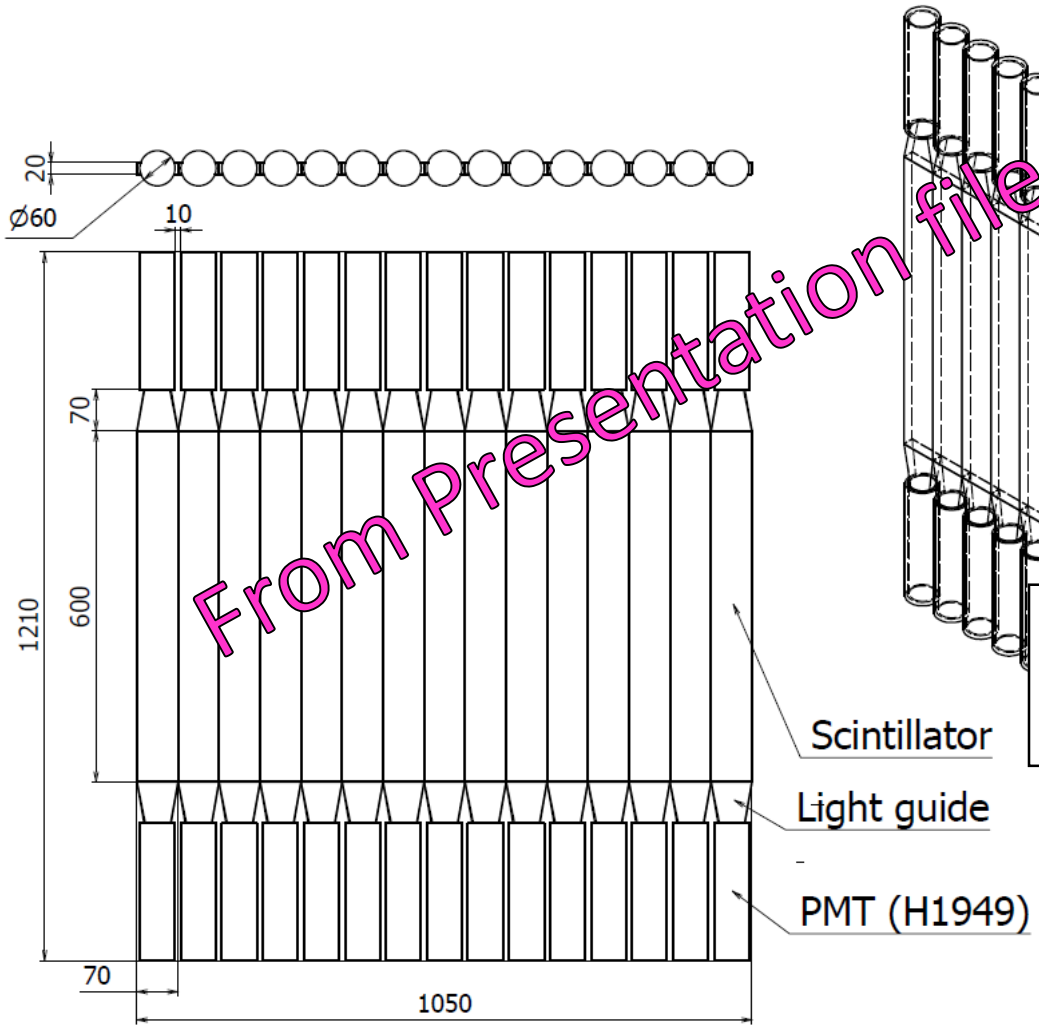
tof_dist-15mm_over-0mm.root 99.1879 0.650635
tof_dist-15mm_over-1mm.root 99.6873 0.655225
tof_dist-15mm_over-1mm.root 99.6873 0.655225
tof_dist-15mm_over-3mm.root 99.9806 0.656805
tof_dist-15mm_over-4mm.root 99.9935 0.657372
tof_dist-15mm_over-5mm.root 99.9957 0.65729
tof_dist-15mm_over-6mm.root 99.9978 0.656946

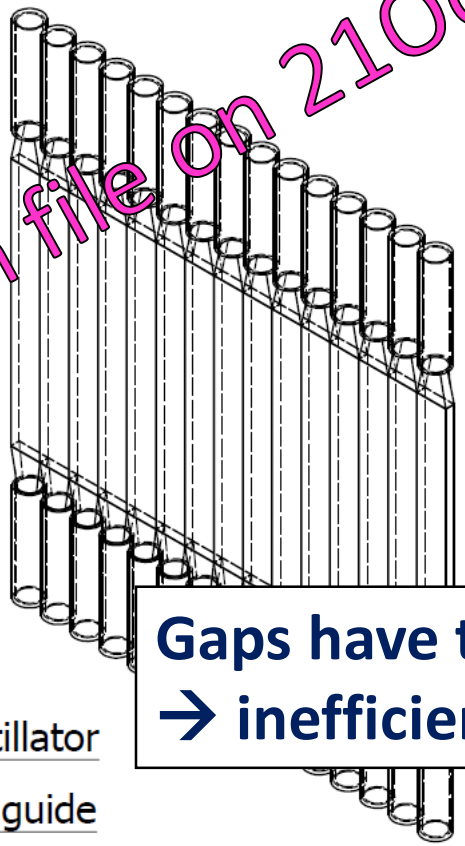
hyperdragon3@~/S2S/analysis/root/TOF_gap/loss.cc
Toshiyuki Gogami , 29Nov2014

Cut conditions

1. |x|<500 mm && |x|<200 mm @Virtual detector just before TOF
2. Water Cherenkov

CAD drawing of TOF detector (plane)





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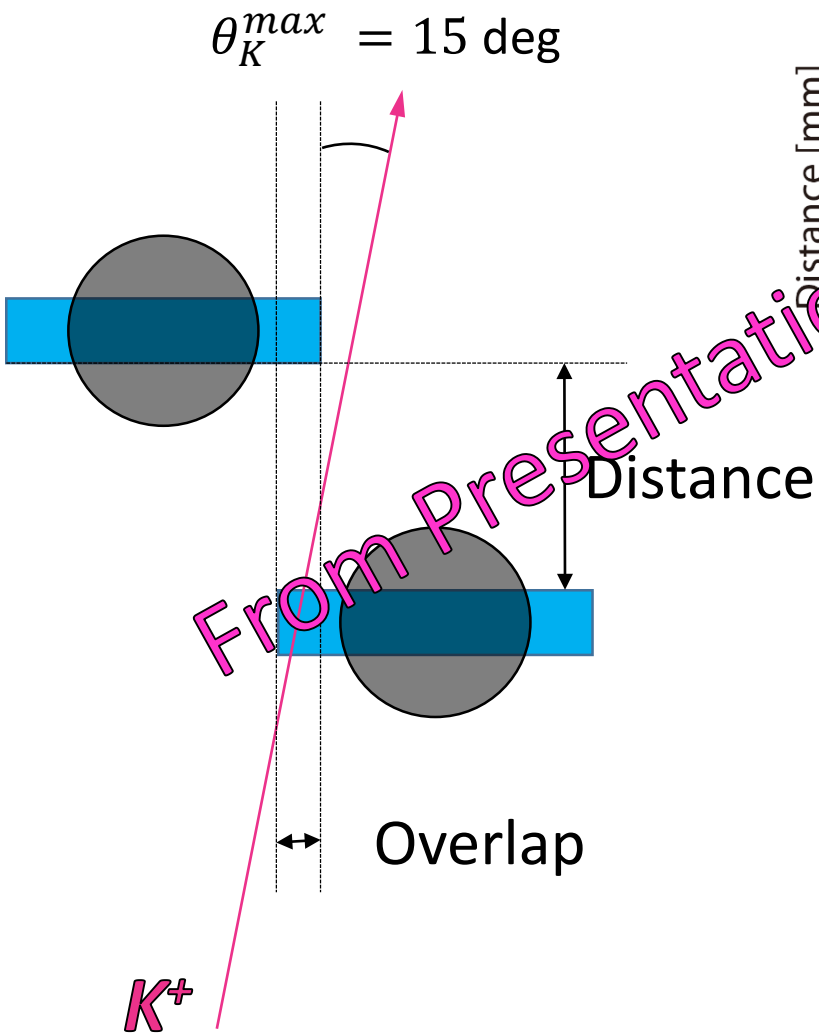
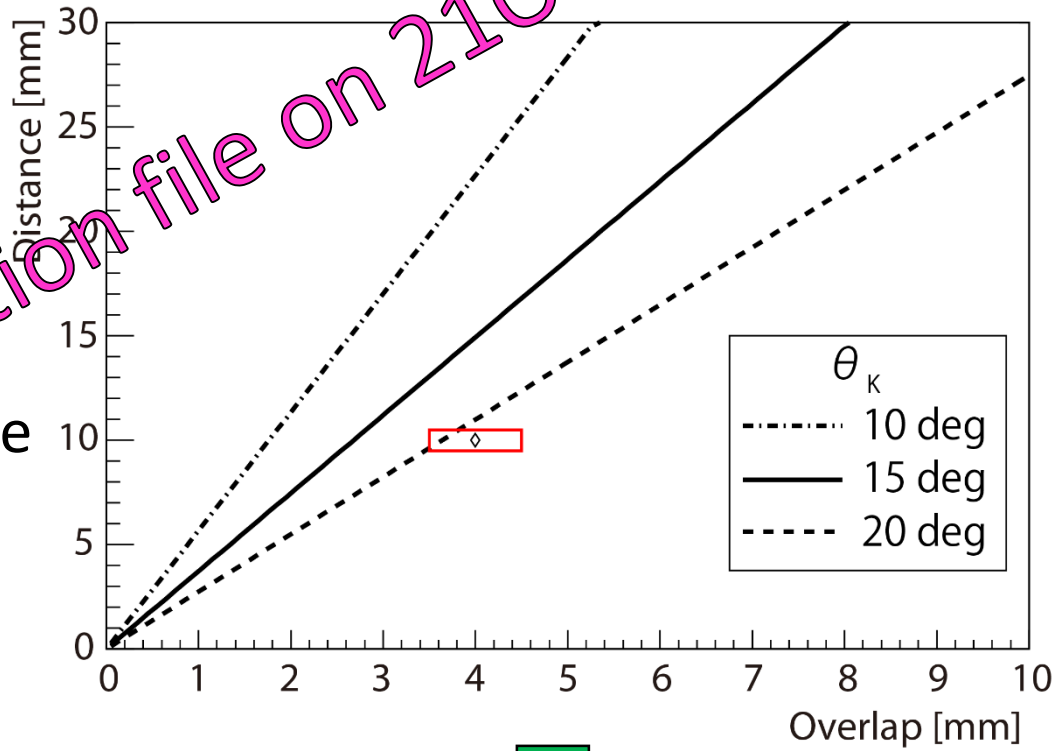
Gaps have to be appeared.
→ inefficient

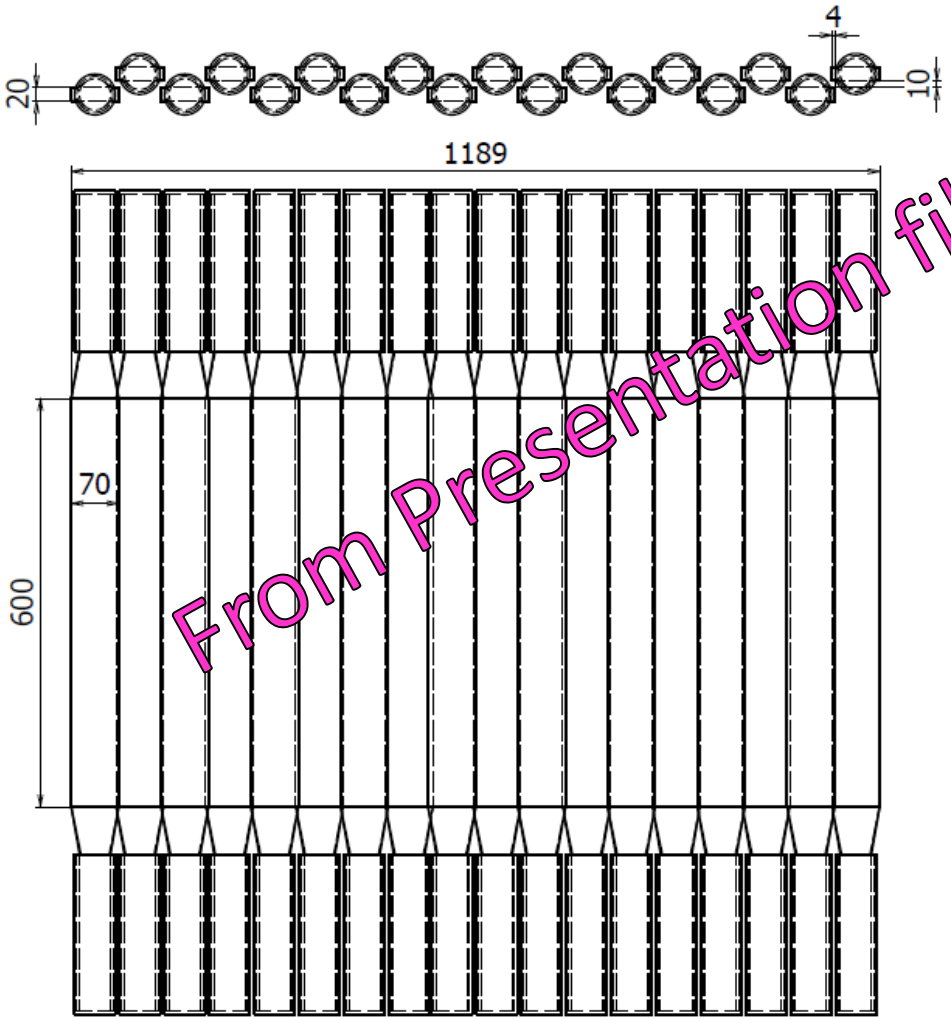
Overlap and distance (TOF detector)





(Overlap, Distance) = (4 mm, 10 mm)

CAD drawing of TOF detector (zigzag)



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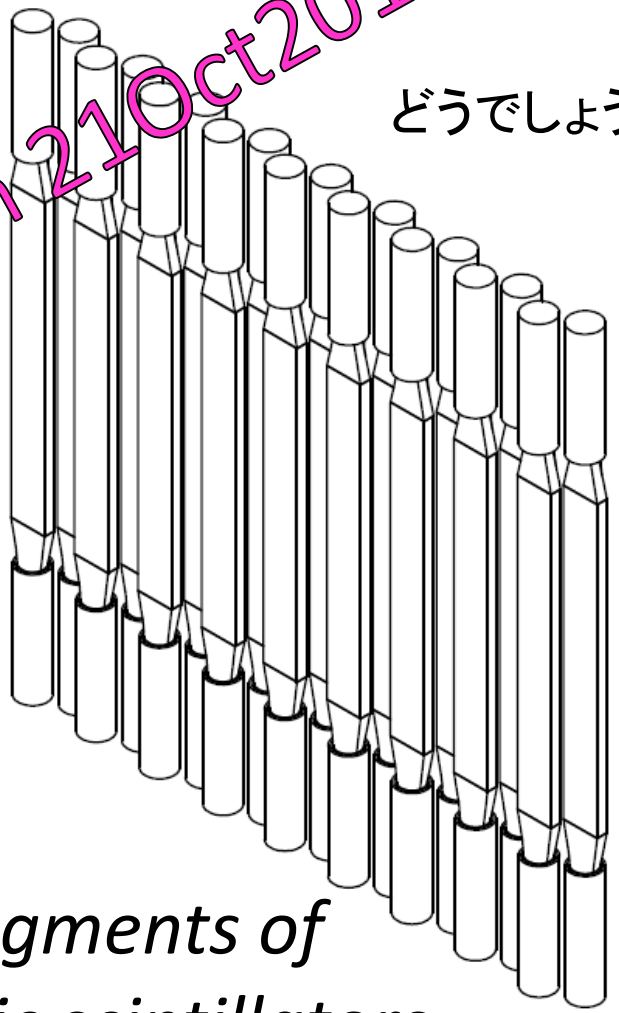
どうでしょう？



18 segments of plastic scintillators

元場さんの論文から

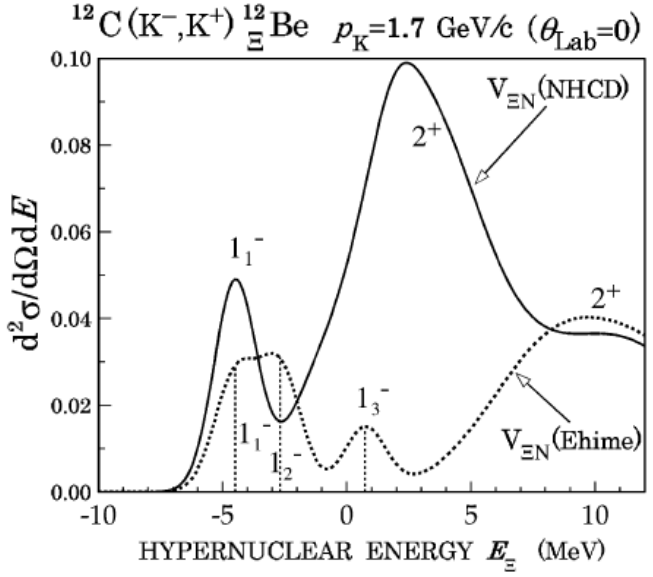


Figure 6: DWIA spectra with NHC-D and Ehime.

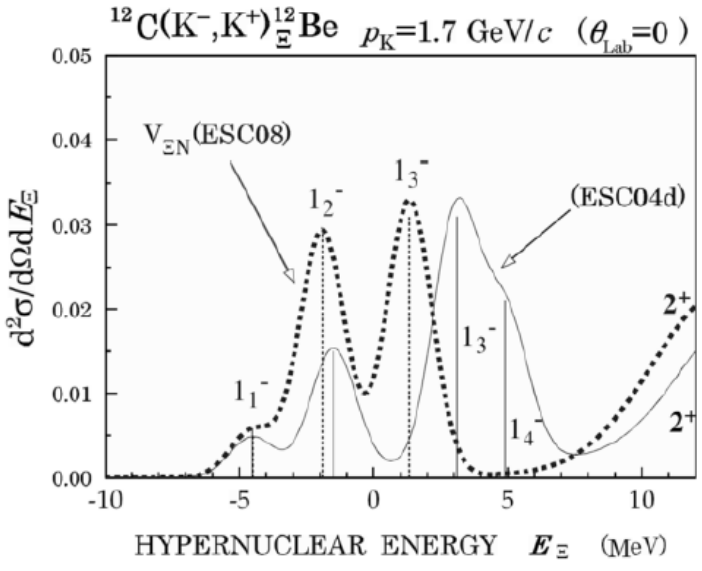


Figure 7: DWIA spectra with ESC04d and ESC08a.

// ESC08	
-4.54	5.57
-1.91	29.4
1.26	32.8
// ESC04	
-4.54	4.53
-1.53	15
3.06	30.7
// EHIME	
-4.53	27.9
-2.65	30.6
0.706	14.8

5 MeV FWHMでの絵