Status of
The 3rd Test Beam Experiment @ELPH in Tohoku Univ.

Only 31 days left

G. Nukazuka (RBRC)

Purpose

Determination of the detection efficiency

Past beam experiments showed 96% efficiency. But it must be almost 100%.

Mismatch of the BCO phase and beam can explain the reason.

We are ready to take the external trigger information and BCO phase with the CAMAC system.

Cosmic-ray measurements with the CAMAC system showed 98% efficiency. More improvements are not easy since statistics are limited, optimization of the geometry is so delicate.
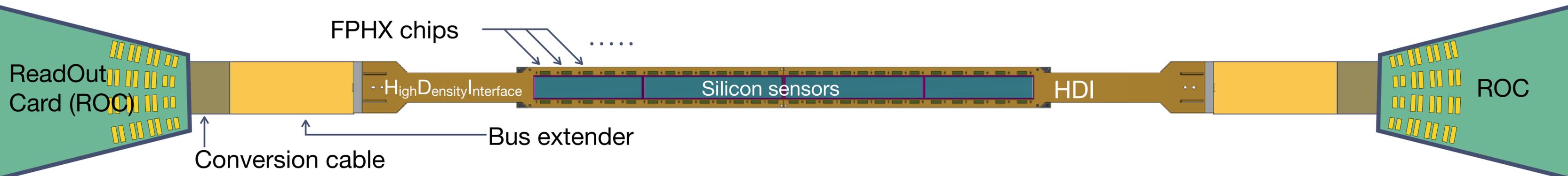
→We need test beam measurements with the CAMAC system to proof ~100% efficiency

Beam measurements with the production ladders

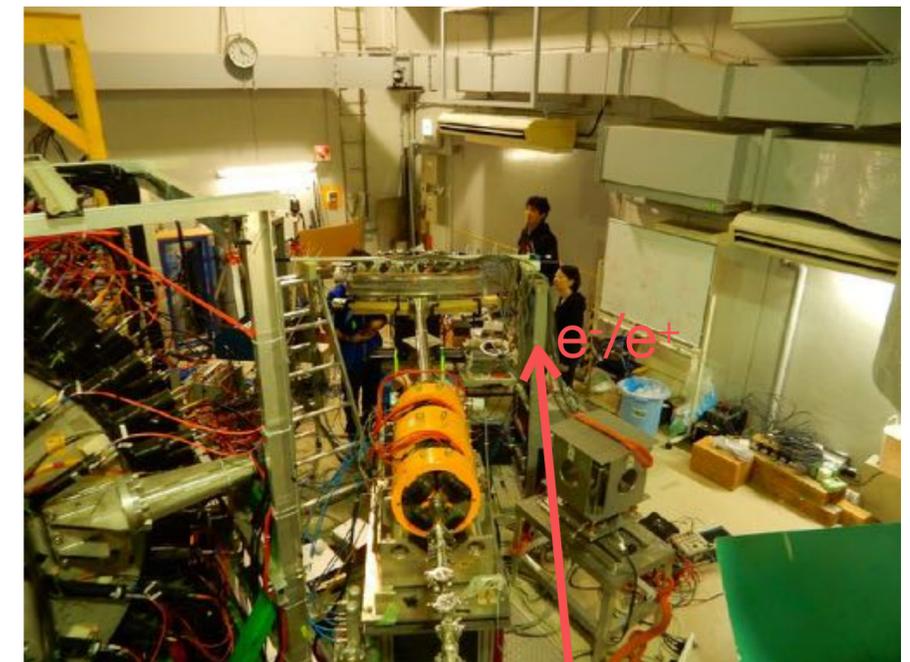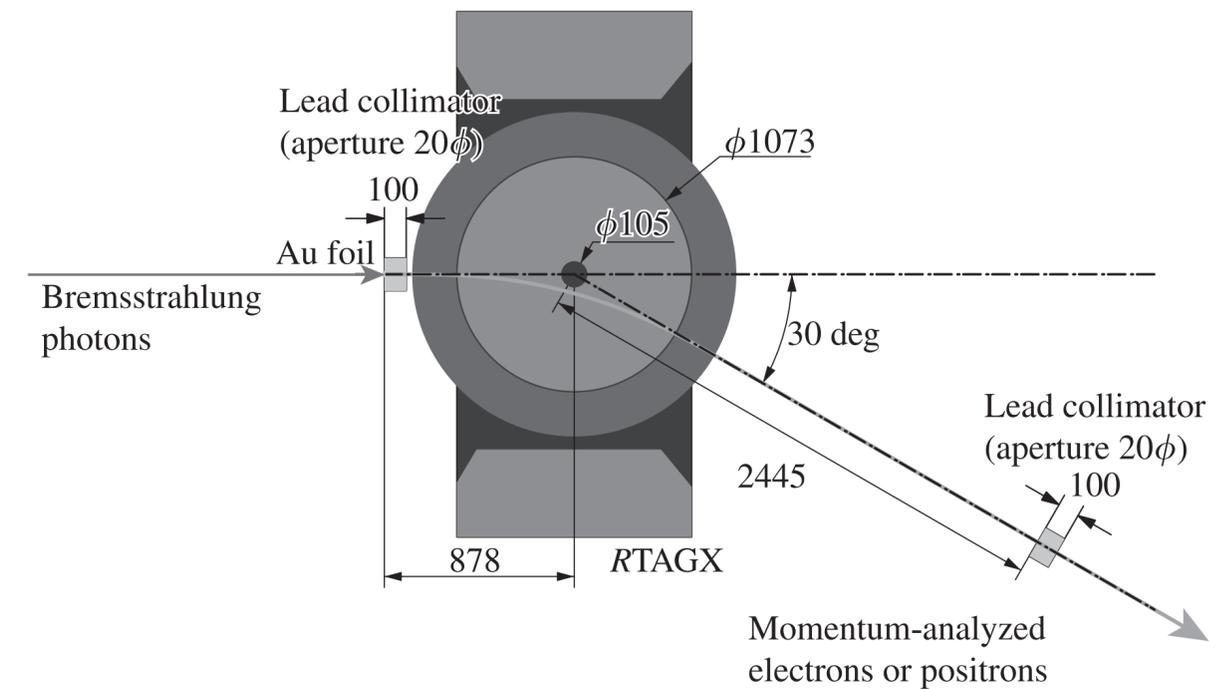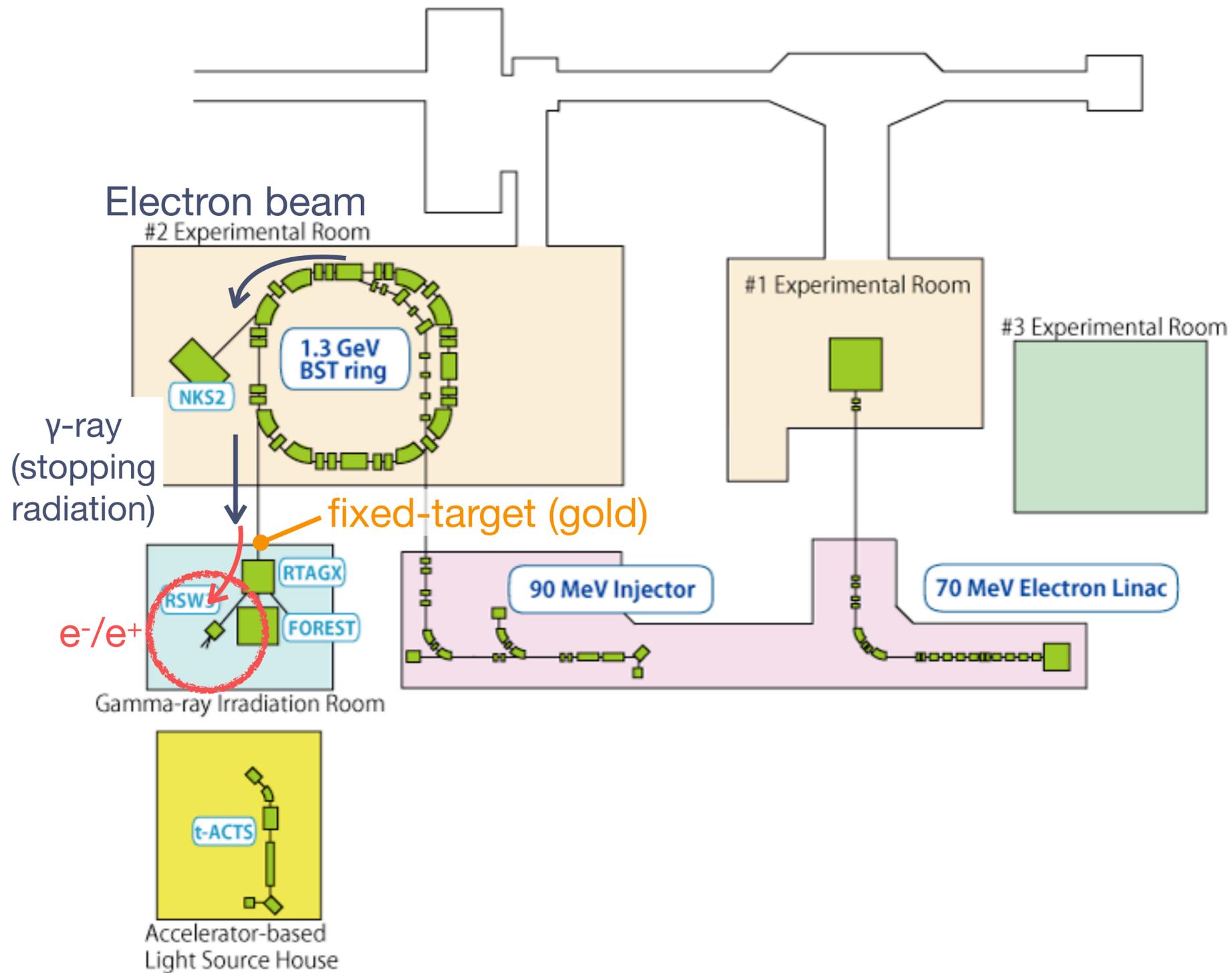We need to see performance of the production ladder with a beam.

Beam measurements with the latest bus extenders and the co-axial conversion cables

The design of the bus extender was finalized. We will get the co-axial conversion cable some moths later. So they should be tested with a beam.

ReadOut Card (ROC)

FPHX chips

HighDensityInterface

Silicon sensors

HDI

ROC

Bus extender

Conversion cable

Research Center for ELectron PHoton Science (ELPH)

Electron beam

#2 Experimental Room

1.3 GeV BST ring

NKS2

#1 Experimental Room

#3 Experimental Room

γ-ray (stopping radiation)

fixed-target (gold)

e⁻/e⁺

RTAGX

RSW3

FOREST

90 MeV Injector

70 MeV Electron Linac

Gamma-ray Irradiation Room

t-ACTS

Accelerator-based Light Source House

Lead collimator (aperture 20ϕ)

100

Au foil

Bremsstrahlung photons

$\phi 105$

$\phi 1073$

30 deg

Lead collimator (aperture 20ϕ)

100

878

RTAGX

2445

Momentum-analyzed electrons or positrons

e⁻/e⁺

Beam features@ELPH GeV-γ area

Electron test beam

Beam	Beam line	Maximum beam energy
Positron / Electron	± 30 deg	~840 MeV
Positron	-23 deg	~1000 MeV

HomePage

Tagged gamma-ray beam

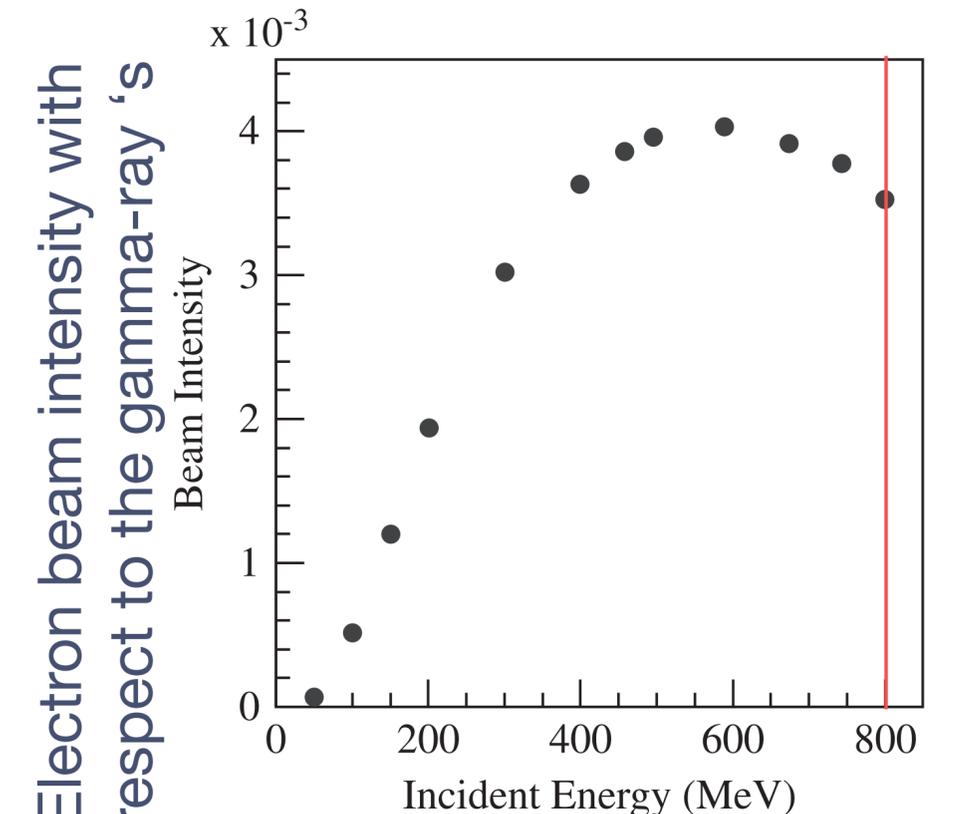| Beam line	Energy Range (R_{int} Energy: 1.3 GeV)	# of Bins	Intensity	Duty
BST-Tagger-I	0.8 ~ 1.26 GeV	160	TBC	~60% (NKS2)
BST-Tagger-II	0.9 ~ 1.25 GeV	116	TBC	~50% (FOREST)

HomePage
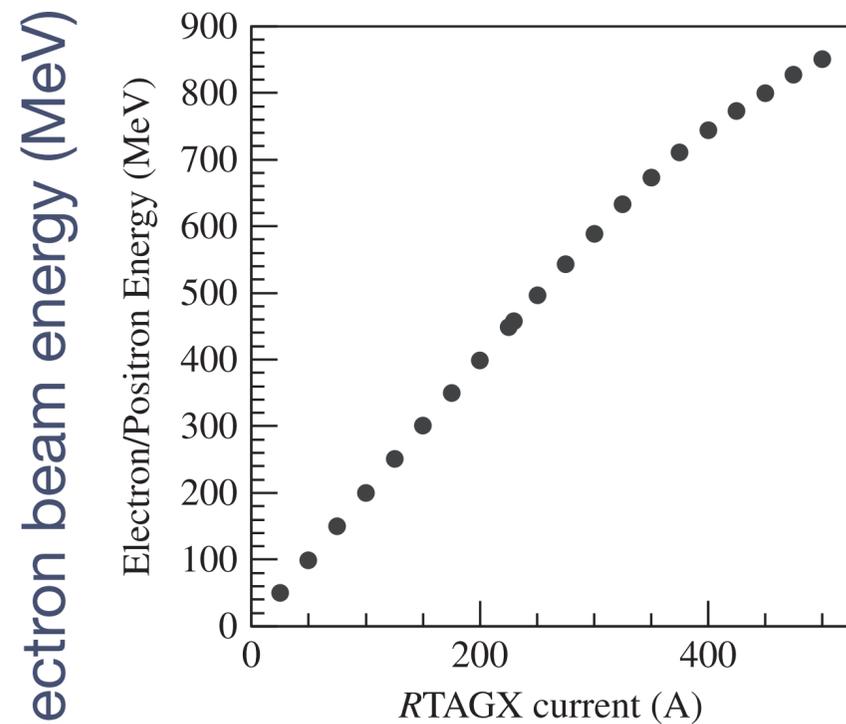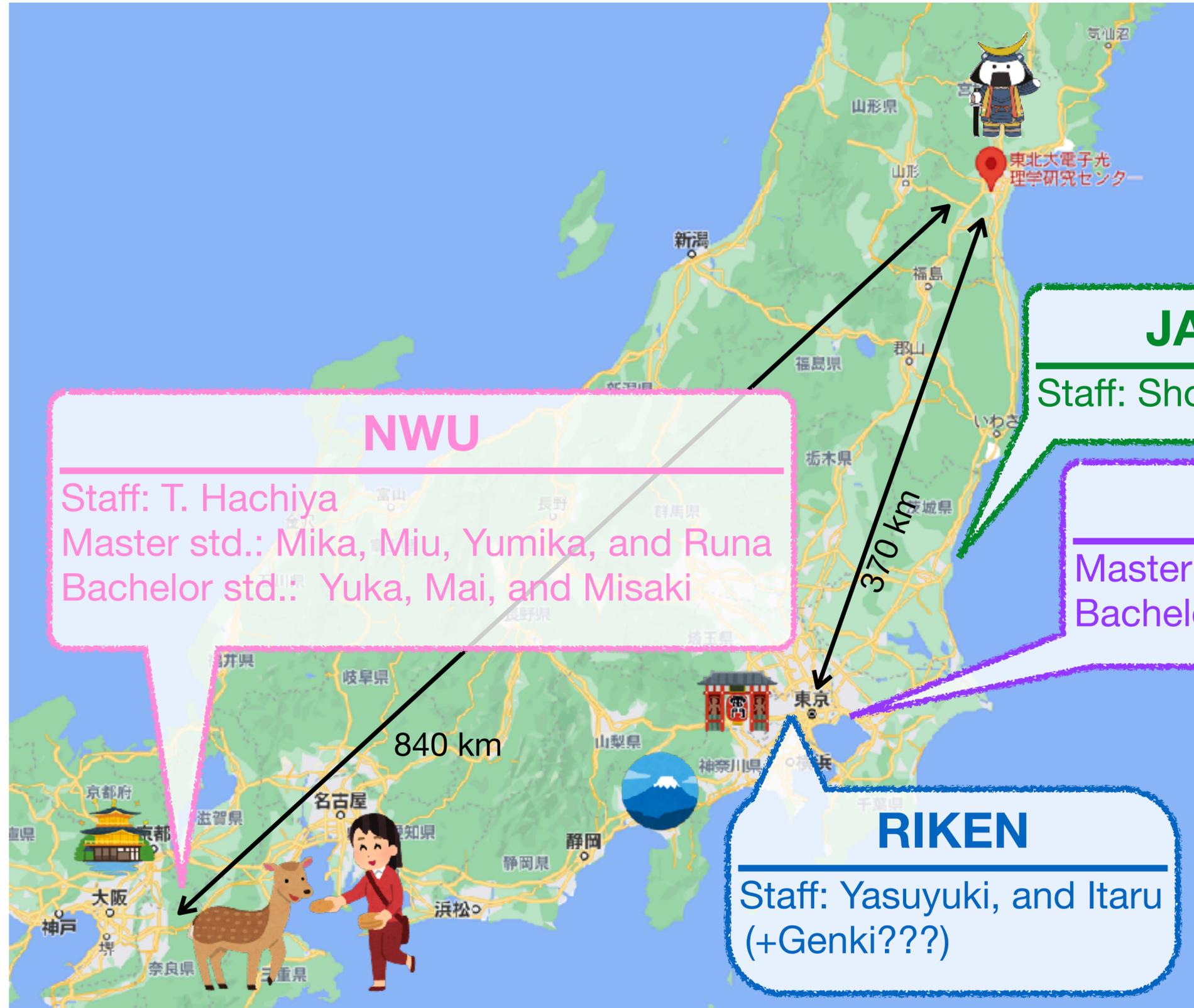

Current for the magnet (A)
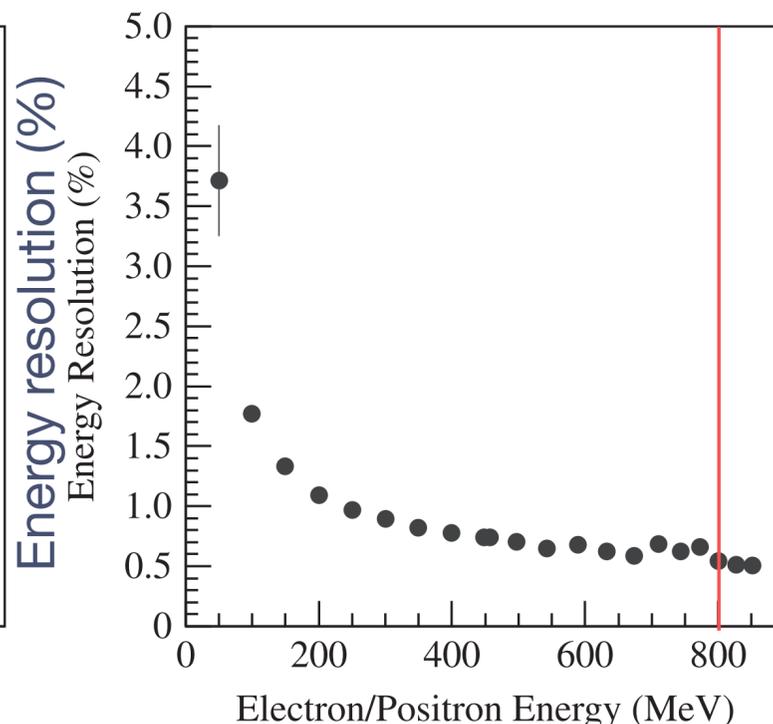
Electron beam energy (MeV)

Gamma-ray energy (MeV)

4

Tentative Member

NWU

Staff: T. Hachiya
Master std.: Mika, Miu, Yumika, and Runa
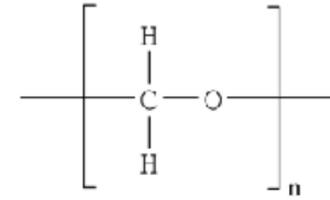Bachelor std.: Yuka, Mai, and Misaki

JAEA

Staff: Shoichi

Rikkyo Univ.

Master std.: Hikaru
Bachelor std.: Yusuke & Genta

RIKEN

Staff: Yasuyuki, and Itaru
(+Genki???)

370 km

840 km

Under current self quarantine policy for people from overseas, it's hard to come. Recently I heard the rumor that the policy may be loosen. No official statements were made for the moment.
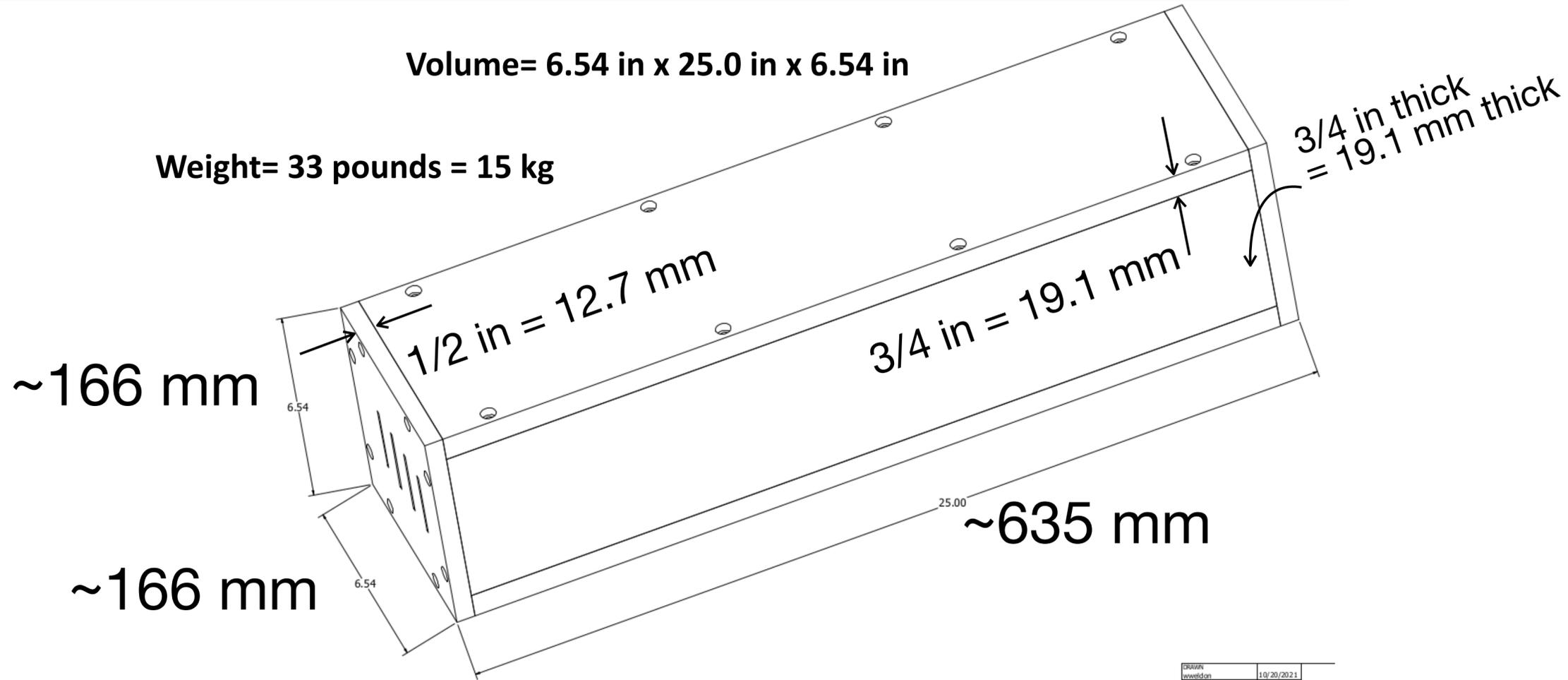Cheng-Wei?

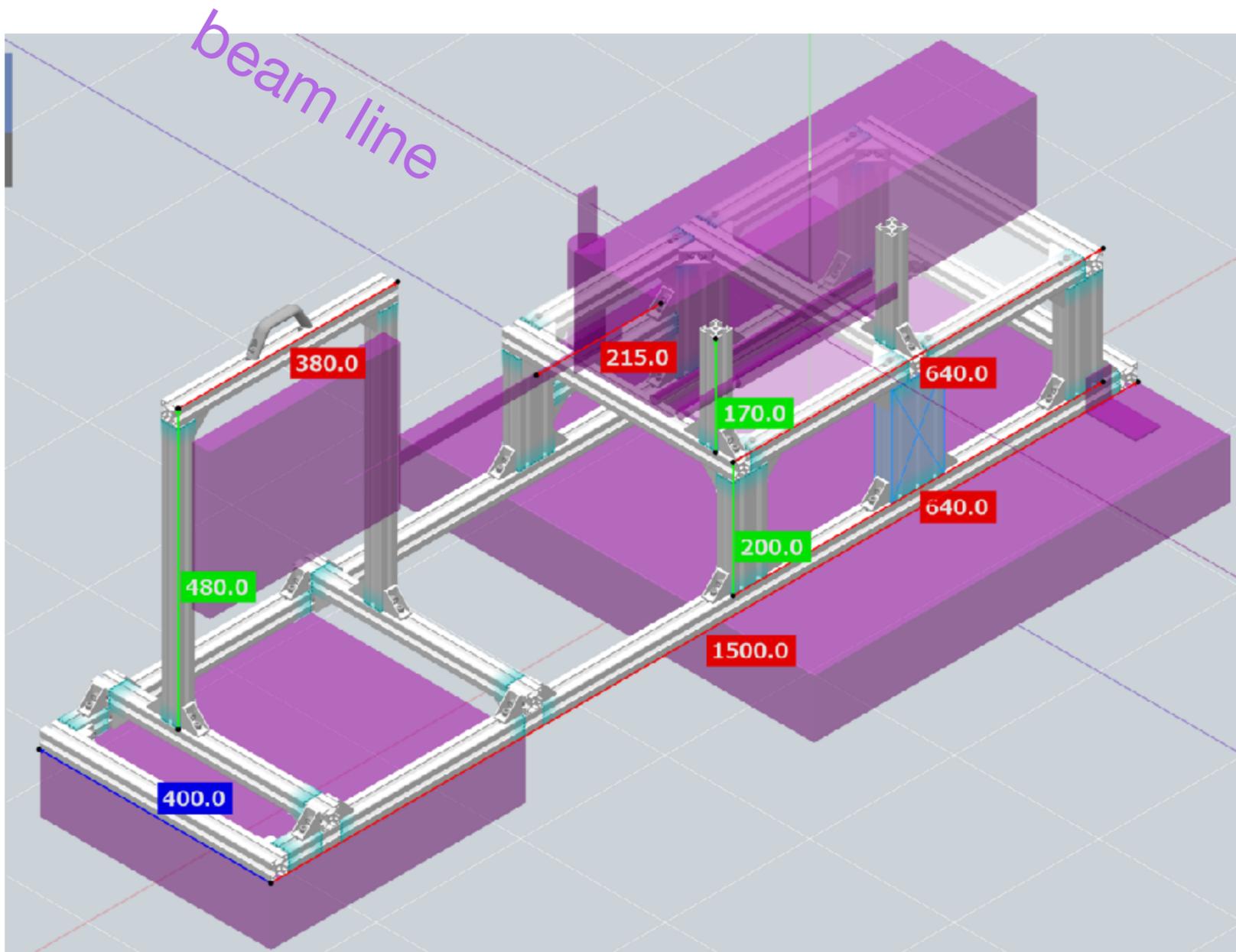# Dark box (BNL)

Material：Dupont Delrin® (polyacetal, 1.42 g/cm³)

Volume= 6.54 in x 25.0 in x 6.54 in

Weight= 33 pounds = 15 kg

1/2 in = 12.7 mm

3/4 in = 19.1 mm

3/4 in thick = 19.1 mm thick

~166 mm

~166 mm

~635 mm

6.54

6.54

25.00

DRAWN
wweldon   10/20/2021

The dark box was already produced.
It should depart from BNL this week.

The frame structure for the dark box and the ROC (Genki)

The basic design was established as already shown last week.
Some minor updates were made:
- thicker frames to stand the weight of the dark box
- additional frames for PMT fixations
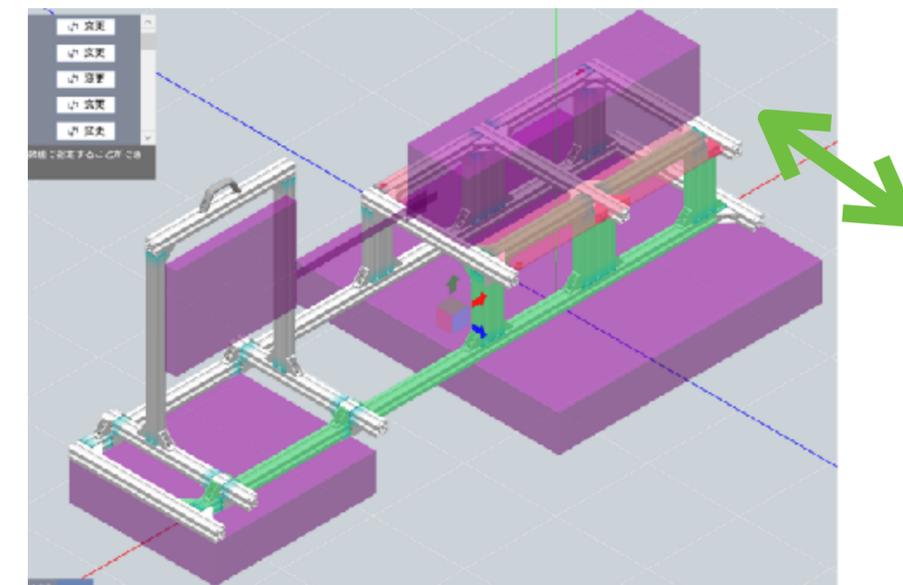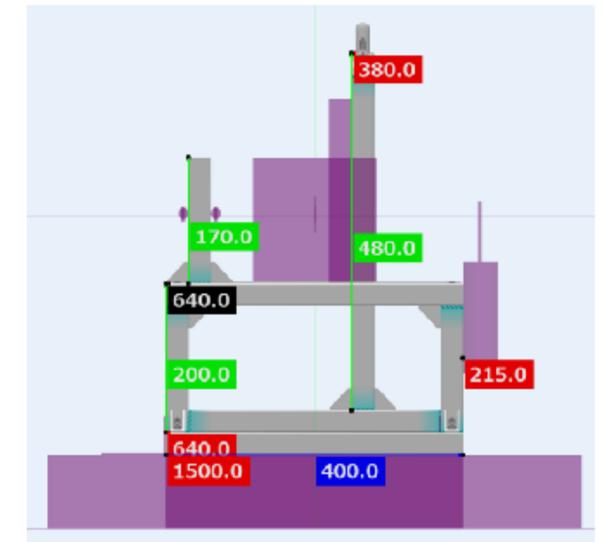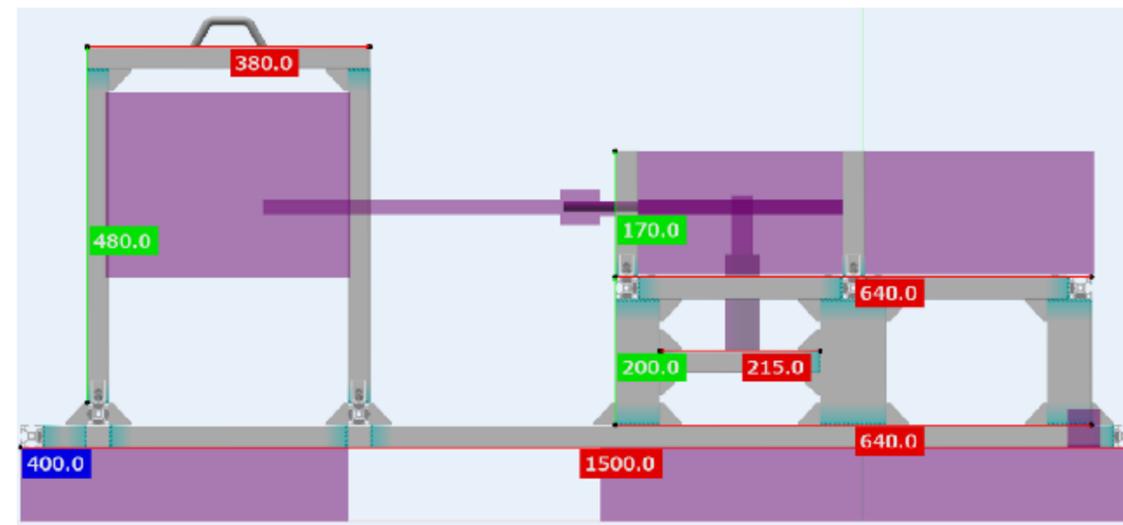- width flexibility to fit the stage below this structure

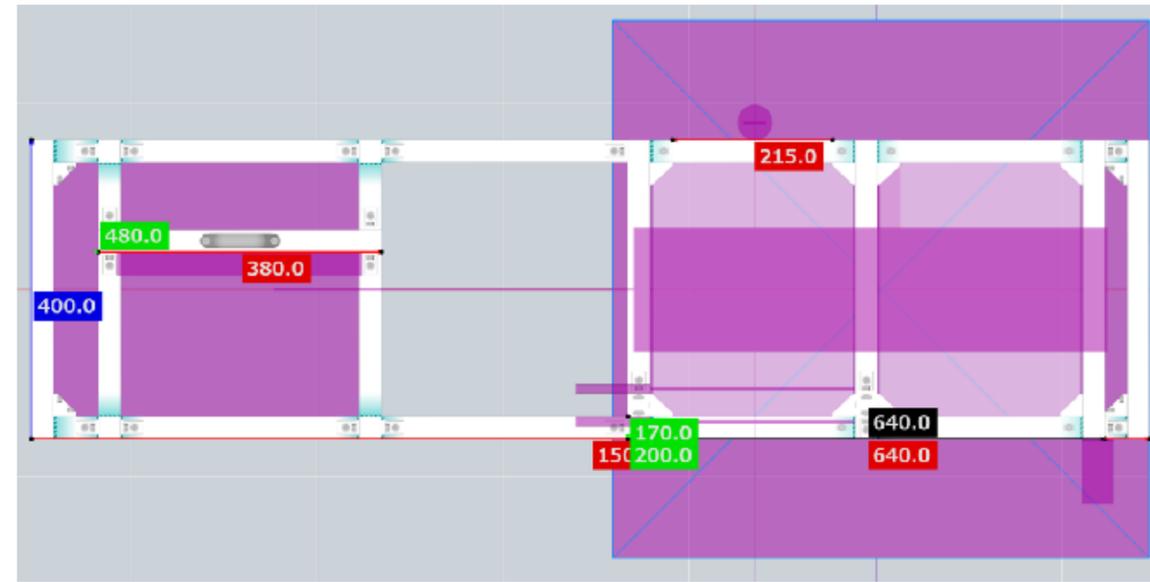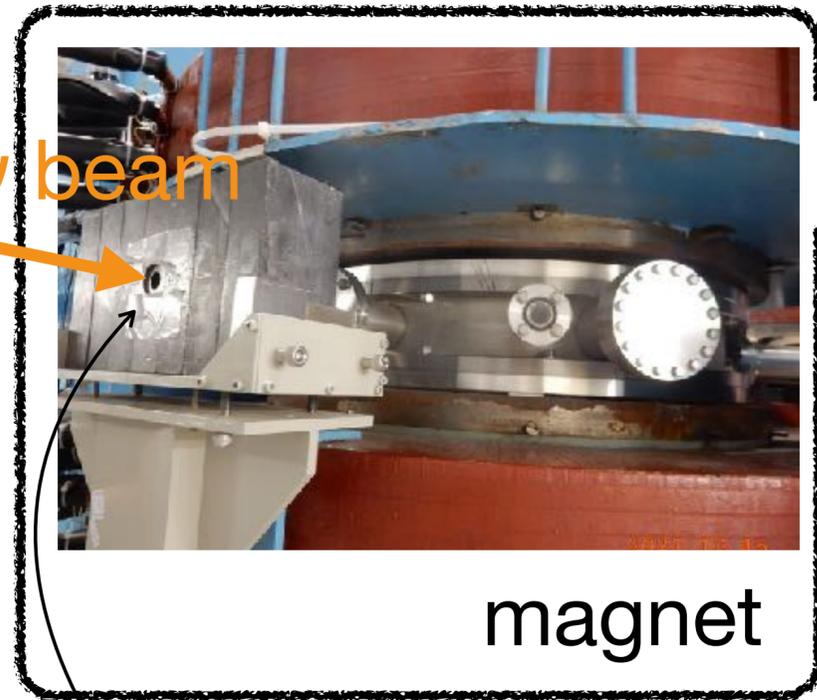# The frame structure for the dark box and the ROC (Genki)
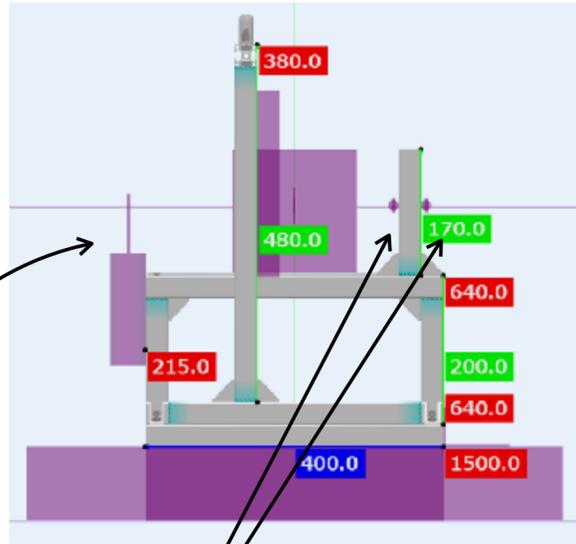
trigger scintillators

The setup

γ beam

magnet

Production targets
Au 20 μm
W 200 μm
Cu 8mm
etc.

e+/e- beam line
up to 1 GeV/c
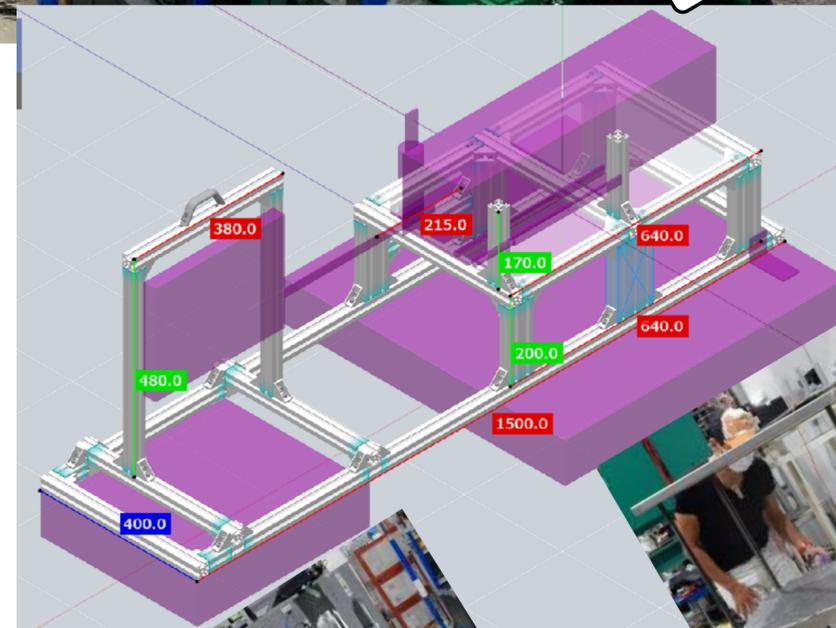
The setup

The setup

beam height:
1610 mm ± 10 mm

166 mm

~102 mm

310 mm

167 mm

227 mm
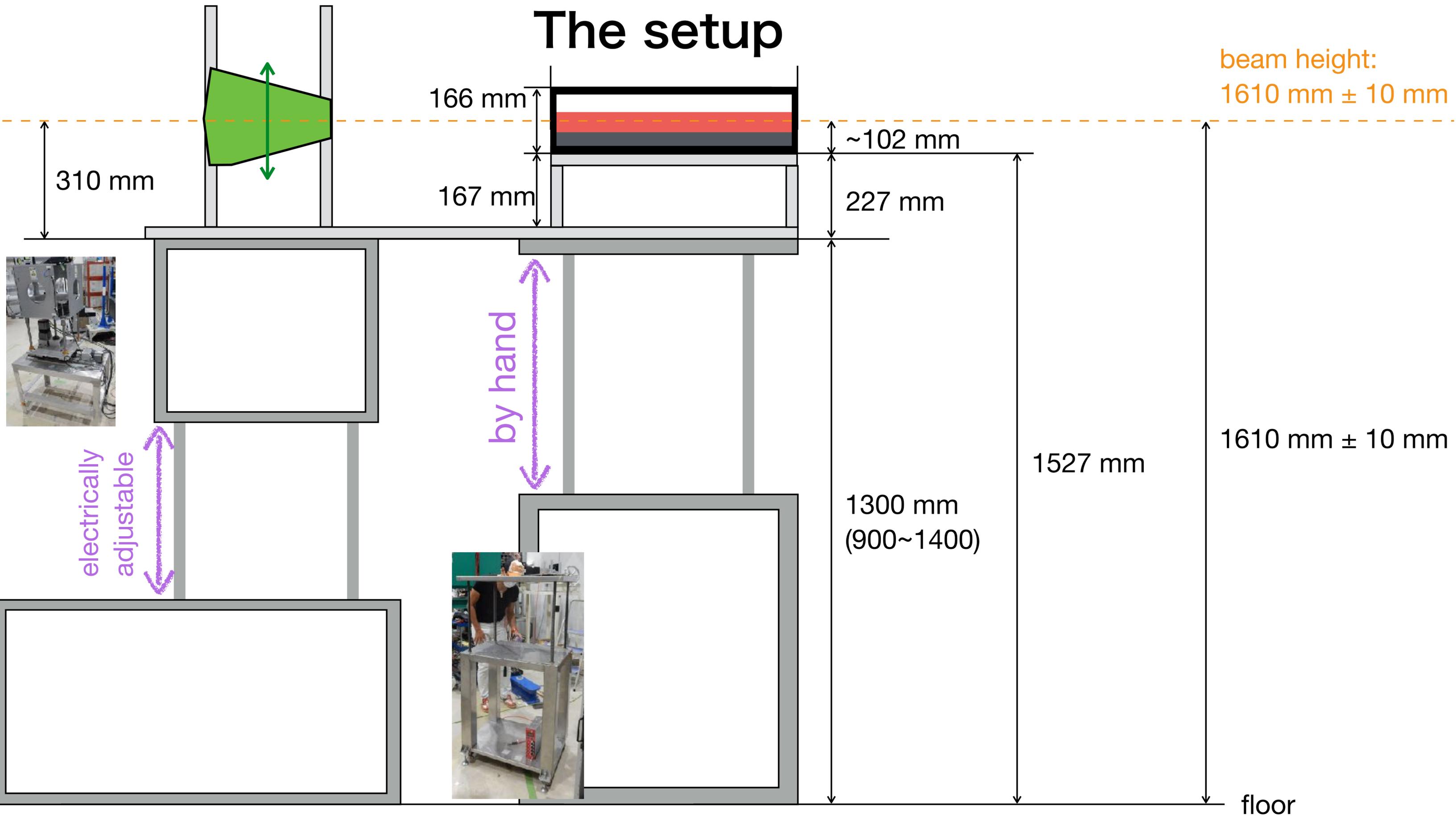
by hand

electrically adjustable

1610 mm ± 10 mm

1527 mm

1300 mm
(900~1400)

floor

Migration to Windows10 (Hikaru, Genki, & Itaru)

Since we need to operate the testbench in the experimental area in underground floor from the control room in the ground floor, remote access to the DAQ PC is mandatory.
→ Migration to Windows10 needed.
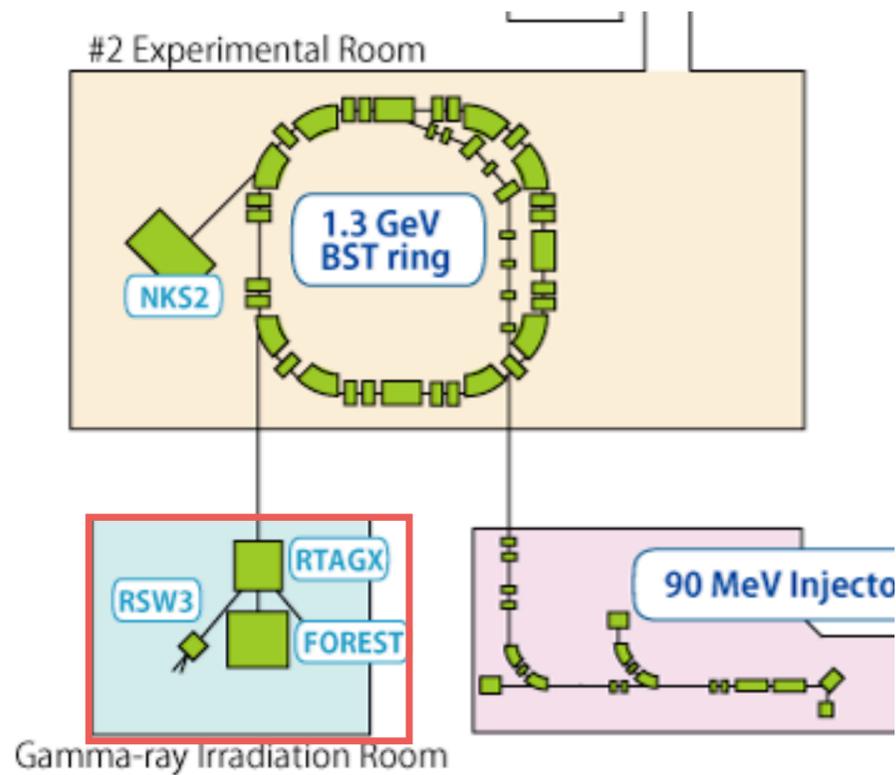
↑ground floor:
control room

↑underground:
experimental area

Hikaru's report shown in INTT JP meeting.

Some processes were needed:
- FTD2XX.dll changed for 64 bit OS
- readDAQ.exe compiled again

Calibration data were taken successfully.
Once migration is completed, codes will be distributed via GitHub, and Hikaru will report about it.

Testbench operation with the new CAMAC DAQ system (Yumika & Yuka)

Yumika's slide
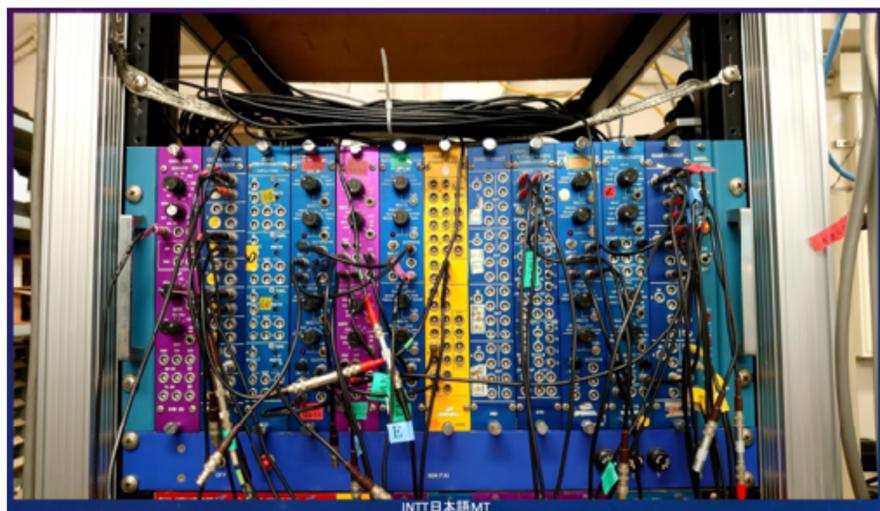
- Detection efficiency as a function of BCO phase is the main purpose of this experiment
- The new testbench DAQ made by Genki, which consists of the standard testbench DAQ and new CAMAC DAQ, demonstrated the measurement with cosmic ray in March/2021.
- Yumika and Yuka succeeds reconstruction of the circuit, maintenance, tuning, and optimization. **Most parts of the NIM + CAMAC circuit were made**. She is working for remains, which is for the BCO phase measurement. (n.b. Yumika is also working for the ladder quality assurance)
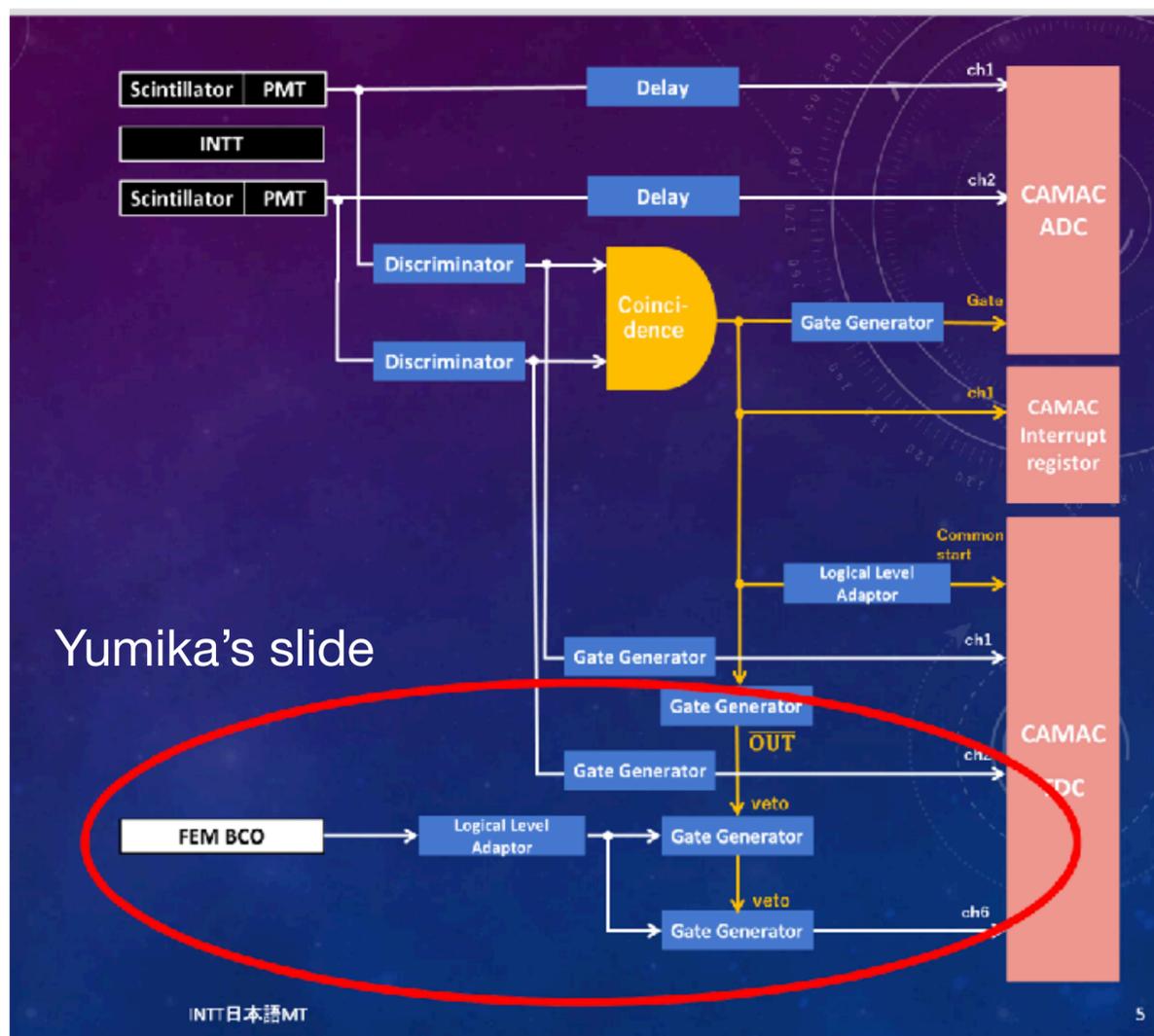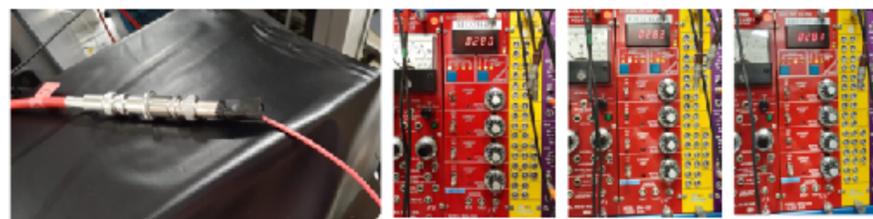
Yuka's first report about light leak of the scintillators and investigation for leakage from PMTs' HV line (not confirmed, but Genki got electrical shock before…)

Multi-ladder operation (Yumika & Yuka)

ビームテスト準備:複数ラダーの読み出し確認

- 理研から3本目の電源ケーブルが届いたので、3つのラダーを接続してキャリブレーションテストを行った
- 使用したポートはA2,C1,C3
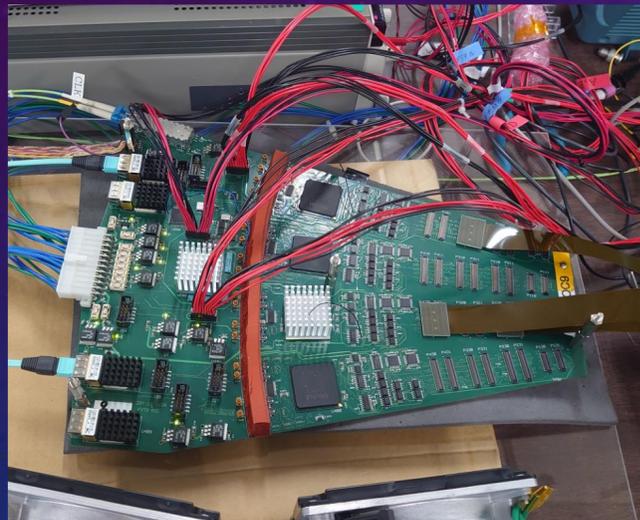
2021/11/4　　　　　　　　　INTTJPMT　　　　　　　　　4

Multi-ladder operations were demonstrated in calibration mode successfully (no bias since not enough cables available at that time).

Conversion cables and bas extenders

	RIKEN	NWU
short conv. cable	1	1
long conv. cable	1	2
bas extender	many	5, 6

RIKEN & NWU have enough bias cables. The conversion cables are not enough.

- A2 : L5S

- C1 : Taiwan ladder

- C3 : L6S
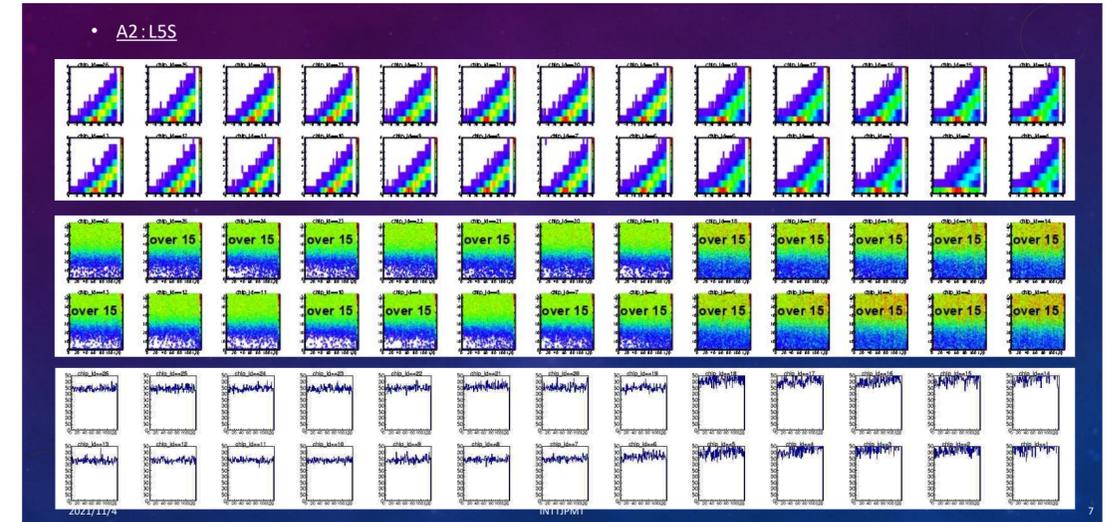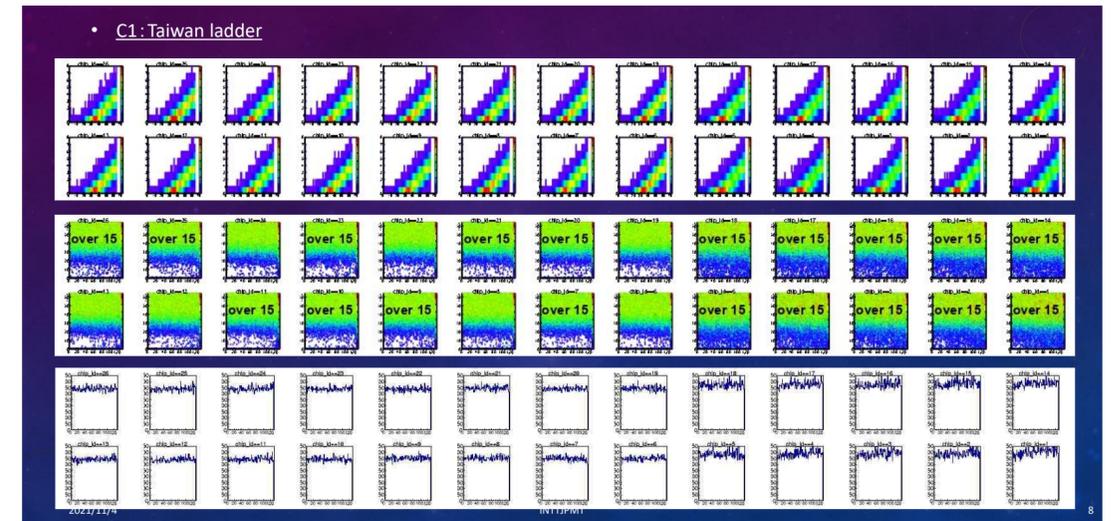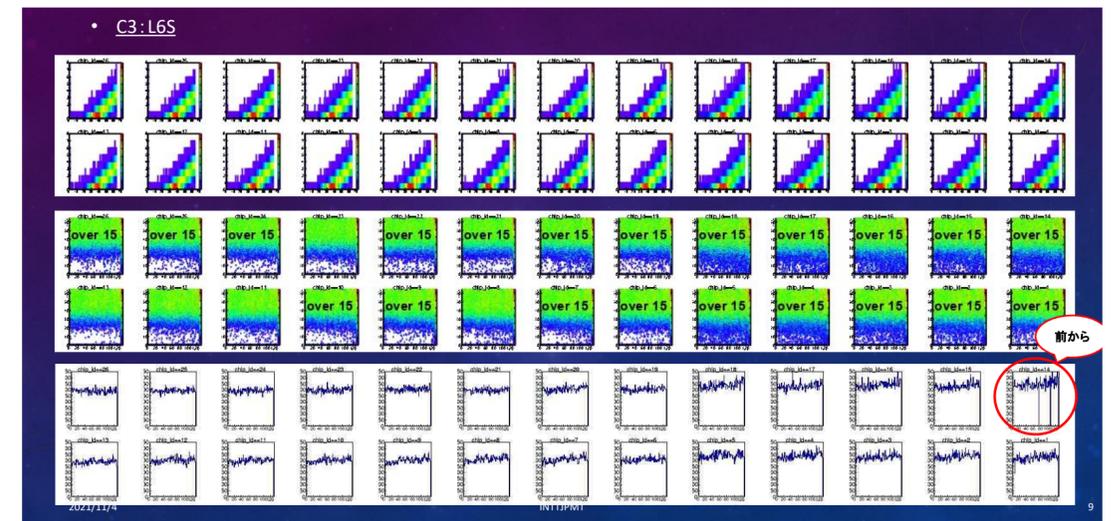
Yumika's report at INTT JP meeting

Checking macro for the multi-ladder operation (Genki)

The checking macro (check_chip_prototypeMaximam6.c) was upgraded to work for data from multi-ladder operation (check_chip_prototypeMaximum7.c). It was announced in the mailing list and found in our GitHub repository:
https://github.com/sPHENIX-Collaboration/INTT


```
Previous version
int check_chip_prototypeMaximum6(
    string fname, int    usemod,
    string mode,  string cut
)
```

```
Latest version
int check_chip_prototypeMaximum7(
    string fname, string usemod,
    string mode,  string cut
)
```

Module IDs to be analyzed are given as a string. Commas and spaces can be used as seprators.

The Nevis GUI in the Windows10 PC at RIKEN was also modified to use the latest checking macro. Updates on the GUI will be committed to the GitHub repository as well

Geant4 simulation, and data analysis (Genki, Miu, Cheng-Wei, & Yuka)
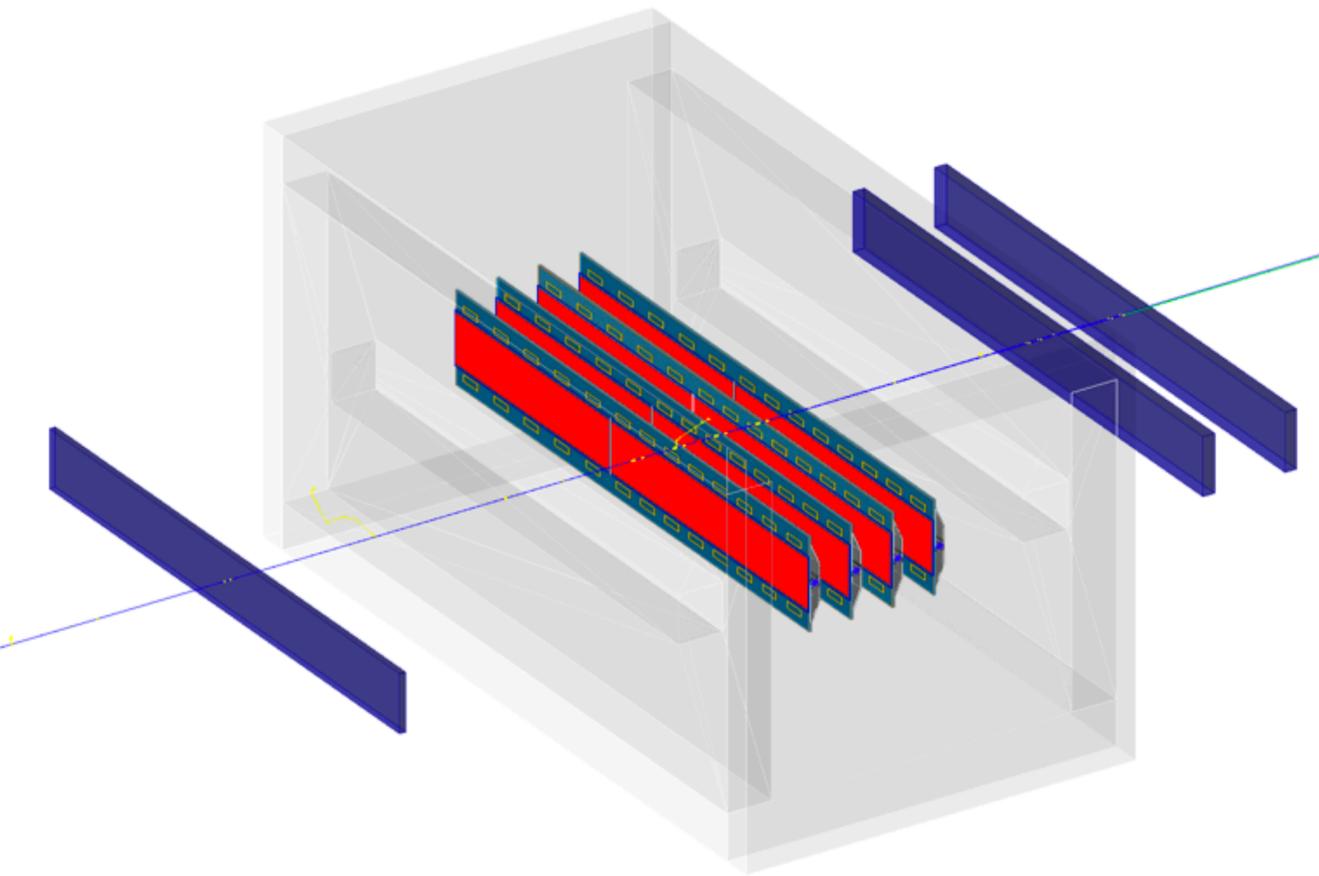
MC data

Cheng-Wei's conversion codes

Geometry was almost done.
The codes are ready to use:
https://github.com/sPHENIX-Collaboration/
INTT/tree/main/Testbeam_G4_code

data as format as those

from the testbench

(online)
Analysis

Data from experiment
(31 days later)

Geant4 simulation, and data analysis (Genki, Miu, Cheng-Wei, Yuka, & Genta)

Analysis

- Online analysis (checking macro): done
- Online analysis (tracking?): who?
- Online analysis (something else?): ?

- Detection efficiency: Miu (as a part of her Master thesis), Genki (this is my proposal)
- ADC distribution (perpendicular beam, tilted beam): Yuka, Genta
- Study to have inputs to the sPHENIX simulation
  - charge diffusion between strips: ?
  - acceptance edge effects: ?
  - track angle dependence: ? (Yuka & Genta???)
- Performance check for the setup
  with bus extenders: the checking macro does enough?
- more topics?

Task	Sub-tasks			BeenDone	LeftToDo/Notes	Resolution
Geant4	Detector component	Ladders		Done		
Genki Nukazuka		the inner and the outer skins		not yet	Will be implemented once the design is settled (soon)	
		Support structure (support pipe)		not yet	Will be implemented once the design is settled (soon)	
		Bus extender		effective model	it should be enough	
		Support structure		not yet	Will be implemented once the design is settled (soon)	
		Cabling		not yet	To be implemented for the pieces may not be negligible	
		Anything else?				
(mis)Misalignment	Ladder level					
?	wrt other data					
x-Calibrations	beam-test data	adc		To be analyzed	Will be implemented after December 2021 beam test	
Rikkyo Univ. & NWU		charge diffusion between strips		To be analyzed	Will be implemented after December 2021 beam test	
		acceptance edge effects		To be analyzed	Will be implemented after December 2021 beam test	
		track angle dependence		To be analyzed	Will be implemented after December 2021 beam test	
Dead/noisy maps	cosmic data w/ barrel				Can be started from fake mapping. To be updated after barrel assembly	
Purdue Univ.						
Monitor stability	cosmic data w/ barrel			Studied CMS silicon online monitor	Learn sekematic framework for sPHENIX and start developing the monitor for cosmic ray data taking of the assembled barrel in Spring, 2022.	
Purdue Univ.						
Relevant num. for Alignm.	Time for each step					
	No. events needed					
	Initial t-x calibrations					
	Calibs. filesize					
	Estimated frequency					

https://docs.google.com/spreadsheets/d/1PLKeqPAMxUJHRuPtY2yB_B-sZHPz8cDxUHkBgDfO4Zg/edit#gid=1908115135
https://indico.bnl.gov/event/10538/contributions/56794/attachments/38045/62692/211102_CalibrationSoftware.pdf

Data management (Genki, Yusuke, Genta, & Yuka)

Experiment data, documents, etc. are shared with Google Drive. A new google account "intt.sphenix" was made for the management.

You can see the shared materials: Google Drive.

If you let me know your google account, I'll invite you for the sharing.

→ Dynamical data sync to your local PC possible. The data sync test with our bachelor tests already done.

Data conservation for long term should be done at servers in BNL.

Information will be summarized in the wiki page.

```
├─── analysis
├─── data
│    └─── mock_data
├─── data_MC
│    ├─── G4data_from\ Cheng-Wei
│    ├─── data
│    └─── on_demand
├─── documents
│         ├─── template
│         └─── \230\205\210\201
│    ├─── ELPH\226\202
│         ├─── beam
│    ├─── NIM_CAMAC_\207\226\231
│    ├─── ROC_frame
│    ├─── log_note
│         ├─── log_note_ELPH
│         ├─── log_note_NWU
│         └─── log_note_RIKEN
├─── pictures
│    └─── 20211016_ELPH
└─── test
```
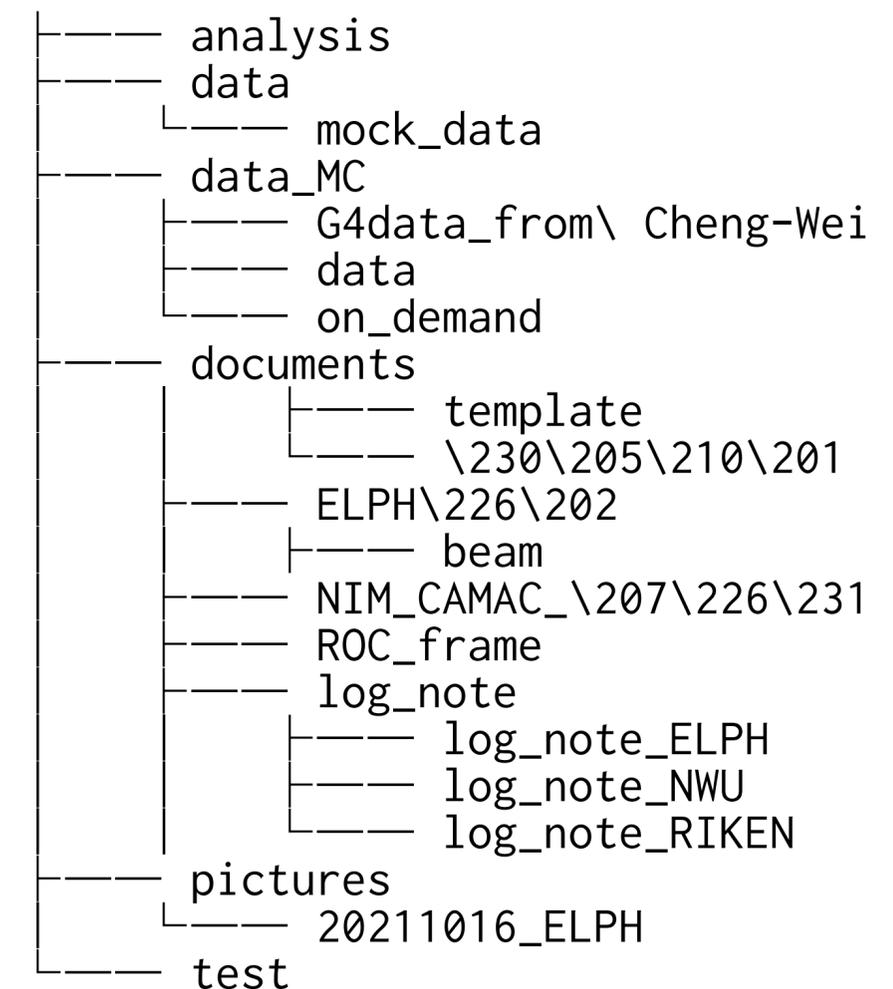
Schedule

2021後期ビームタイム　　加速器メンテナンス　A部運転　　第二実験室(NKS)　GeV-γ 実験室　　同時運転不可　本体室　　2021/9/1 更新

October / November / December / January / February / March

we are here

preparation

our beam time

RIKEN APR deadline around here

Bachelor&Master defense season at Rikkyo

Master defense season at NWU

Bachelor defense season at NWU

JPS annual meeting

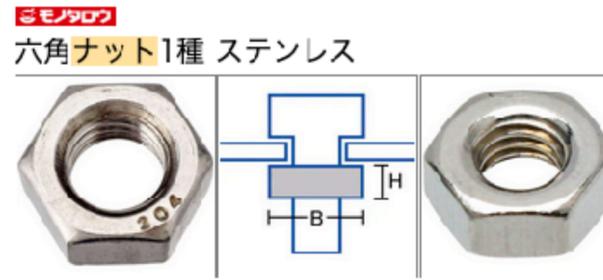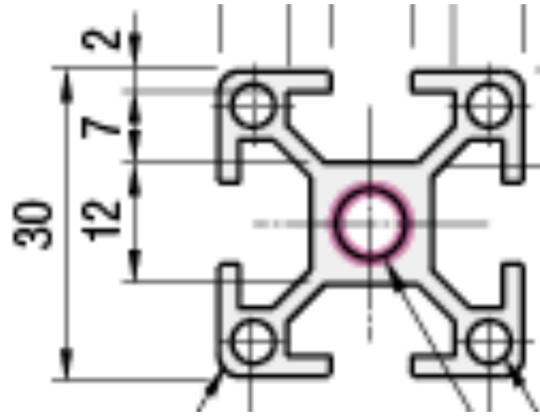| 2021 10月		2021 11月		2021 12月		2022 1月		2022 2月		2022 3月	
1 金		1 月	昼 金田(2982)	1 水		元日 1 土	冬期休業	1 火		1 火	
2 土		2 火	中瀬(2989)	2 木		2 日		2 水		2 水	
3 日		文化の日 3 水		3 金	夜 永尾(2981) 共同研究H	3 月		3 木		3 木	
4 月	RIPF-U	4 木	昼 永尾(2981)	4 土		4 火	予備日	4 金		4 金	
5 火	菊永(2947)	5 金	昼 永尾(2981)	5 日	全 永尾(2981)	5 水		5 土		5 土	
6 水	昼 末原(2975) RI候補日	6 土		6 月	昼 本多(2973)	6 木		6 日		6 日	
7 木	昼 末原(2975) RI候補日	7 日		7 火	昼 本多(2973)	7 金		7 月 昼 白鳥(2976) RI候補日		7 月	RIPF-K
8 金	昼 末原(2975) RI候補日	8 月	RIPF-F	8 水	昼 本多(2973)	8 土		8 火 昼 白鳥(2976) 菊永(2947)		8 火 夜 永尾(2981) 菊永(2947)	
9 土		9 火	RI候補日	9 木	昼 本多(2973)	9 日		9 水 昼 白鳥(2976) RI候補日		9 水 全 永尾(2981)	
10 日		10 水	RIPF-U	10 金	昼 本多(2973)	人の日 10 月		10 木 RI候補日		10 木 全 永尾(2981)	
11 月		11 木 昼 蔵満(2988) RI候補日		11 土		11 火		建国記念の 11 金		11 金	後藤(2967)
12 火	共同研究H	12 金 昼 蔵満(2988) RI候補日		12 日		12 水	長谷川(2985)	12 土		12 土	
13 水	後藤(2967)	13 土		13 月		13 木	RIPF-U	13 日		13 日	
14 木	昼 金田(2982)	14 日		14 火	昼 佐藤(2980)	14 金	菊永(2947)	14 月		14 月	A部予約
15 金	豊嶋(2987)	15 月	昼 本多(2973)	15 水	昼 佐藤(2980)	15 土		15 火	菊永(2946)	15 火	
16 土		16 火	昼 本多(2973)	16 木	昼 佐藤(2980)	16 日		16 水	RI候補日	16 水	
17 日		17 水	昼 本多(2973)	17 金		17 月		17 木	RI候補日	17 木	
18 月		18 木	昼 本多(2973)	18 土		18 火		18 金	豊嶋(2987)	18 金	
19 火	施設見学	19 金	昼 本多(2973)	19 日		19 水		19 土		19 土	
20 水	昼 中村(2977)	20 土		20 月 昼 青木(2974) RI候補日		20 木 昼 大西(2979) 秋山(2986)		20 日		20 日	
21 木	昼 中村(2977)	21 日		21 火 昼 青木(2974) RI候補日		21 金 昼 大西(2979) RI候補日		21 月	昼 本多(2973)	春分の日 21 月	
22 金	昼 中村(2977)	22 月		22 水 昼 青木(2974) 菊永(2947)		22 土		22 火	昼 本多(2973)	22 火	菊永(2946)
23 土		勤労感謝の日 23 火		23 木 昼 青木(2974) 秋山(2986)		23 日		天皇誕生日 23 水	昼 本多(2973)	23 水	RIPF-K
24 日		24 水	大浦(2968)	24 金	後藤(2967)	24 月	RIPF-F	24 木	昼 本多(2973)	24 木	菊永(2947)
25 月		25 木	菊永(2947)	25 土		25 火 昼 糠塚(2984) RI候補日		25 金	昼 本多(2973)	25 金	RI候補日
26 火	昼 山田(2972)	26 金	昼 永尾(2981)	26 日		26 水 昼 糠塚(2984) 大浦(2968)		26 土		26 土	
27 水	昼 山田(2972)	27 土		27 月	予備日	27 木 昼 糠塚(2984) RI候補日		27 日		27 日	
28 木	長谷川(2985)	28 日		28 火	冬期休業	28 金 昼 糠塚(2984) RI候補日		28 月		28 月	予備日
29 金		29 月 昼 大西(2963) RI候補日		29 水		29 土				29 火	
30 土		30 火 昼 大西(2963) 秋山(2986)		30 木		30 日				30 水	
31 日				31 金		31 月	予備日			31 木	

backup

ROC fixation
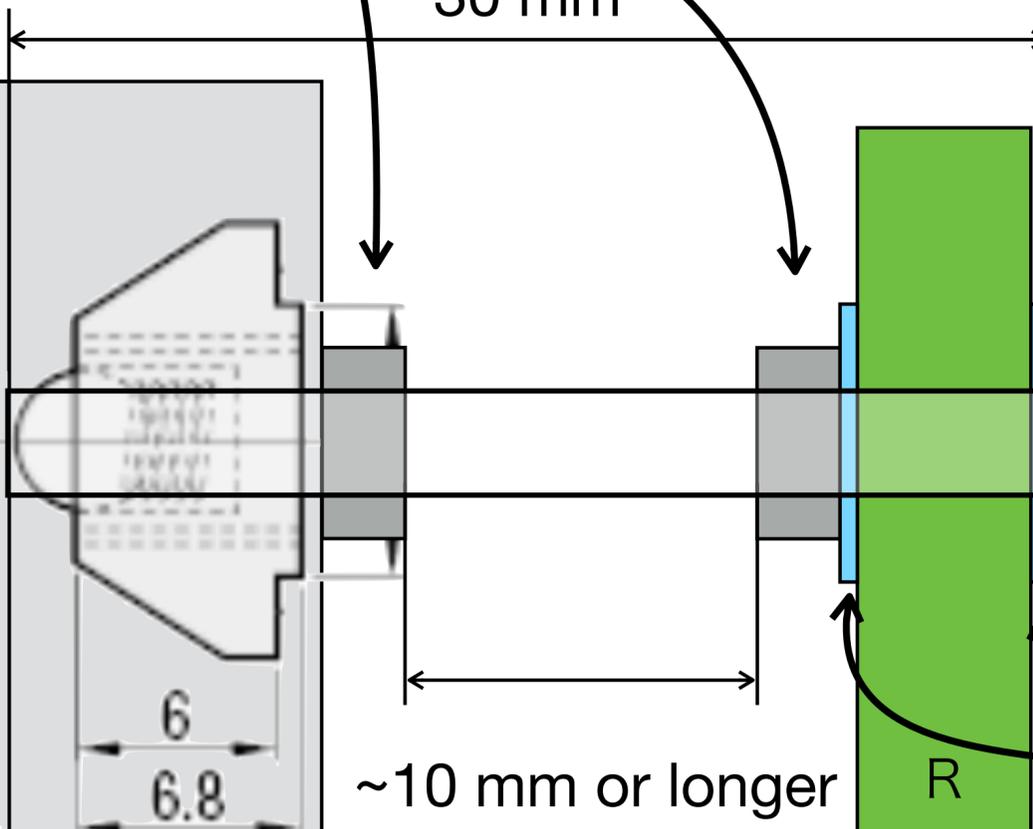

六角ナット1種 ステンレス

六角ナット1種 ステンレス ★★★★★ (4件の商品レビュー)
一般的な八角ナットです。
ステンレス(SUS304)材質を使用しており、耐食性があります。
より購入しやすい人数にしました。

六角穴付ボルト(ステンレス) 全ねじ

六角穴付ボルト(ステンレス) 全ねじ ★★★★☆ (229件の商品レビュー)
六角レンチで締めつけられるので機械組立に最適。
ねじ込み場所が狭い所にも使用できます。

6シリーズ(溝幅8mm)30・60角アルミフレーム用先入れバネナット

★★★☆☆ 平均満足度 4.3 この商品のレビューをみる(35件)
ミスミ

通常単価(税別):	49円~
(税込単価):	54円~
通常出荷日:	在庫品1日目　当日出荷可能　17:00まで受付

バネ機能により、仮止め機能が付いたアルミフレーム用先入れバネナットです。手で軽く押さえると

ナイロン 丸ワッシャー(ナイロン)(バック品)

ナイロン 丸ワッシャー(ナイロン)(バック品) ★★★★★ (2件の商品レビュー)

Nut
M3
2.4 mm thick

30 mm

Al frame

~10 mm or longer

R O C

Screw (Hex socket head)
M3
30 mm thick

Washer made of Nyron
Outer diameter 8 mm
0.5 mm thick

テストビーム実験@ELPH, もちもの

- ☐ INTT フルラダー（3台？、理研・奈良女）
- ☐ コンバージョンケーブル（short, long, 同軸ケーブル版？）
- ☐ バスエクステンダー（最終版、いくつ？）
- ☐ ラダー用架台
- ☐ 暗幕（？）
- ☐ ROC（2 台くらい？どれ？）
  - ☐ ROC 用電源（4~5 台、どこから？）
  - ☐ 電源用ケーブル（+ 予備、どこから？）
  - ☐ ROC - FEM, FEM-IB 通信用光ファイバー（+ 予備、どこから？）
  - ☐ BCO distributing ボード
  - ☐ ROC - BCO ボード用ケーブル（+ 予備、蜂谷版？）
  - ☐ 冷却ファン
- ☐ VME クレート（モジュール入れた状態、奈良女）
  - ☐ FEM
  - ☐ FEM-IB
  - ☐ FEM, FEM-IB テストアウトピン用ケーブル（いくつ？、どこから？）
  - ☐ FEM, FEM-IB FPGA 書き込み用ケーブル（どこから？）
  - ☐ NI ケーブル（どこから？）
- ☐ NIM ビン（実験室の状態そのまま、奈良女）
  - ☐ NIM モジュール（奈良女）
  - ☐ NIM ケーブル（奈良女）

- ☐ CAMAC クレート
  - ☐ CAMAC モジュール
  - ☐ クレートコントローラー用 PC インターフェース
  - ☐ USB ケーブル
  - ☐ 電源ケーブル
- ☐ DAQ PC（Windows10 がよい、理研？）
  - ☐ マウス
  - ☐ キーボード
  - ☐ Web カメラ
  - ☐ 電源ケーブル
  - ☐ ディスプレイ（地下で使う）
- ☐ 実験ノート
- ☐ カメラ