

Brief Overview of N-ken

Toru Iijima



Nagoya University
High Energy Physics
名古屋大学大学院理学研究科 高エネルギー素粒子物理学研究室 - N研

N-ken @ Nagoya Univ.



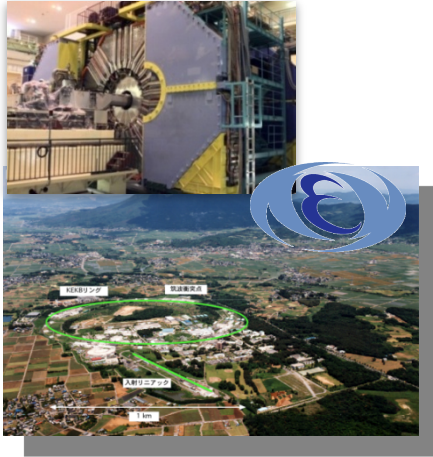
- Members as of 2017.10
 - Prof. 1, Assoc. Prof. 2, Assist. Prof. 1, Lec. 1
 - DC5, MC11, B4:6
 - Secretary 1

- KMI
 - Assoc. Prof. 3, Assist. Prof. 1, Postdoc 1
 - Secretary1

Research at N-ken

Energy Frontier (LHC) + Luminosity Frontier (B-factory)

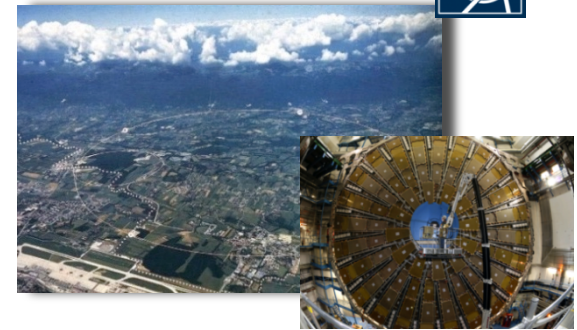
KEK Belle → Belle II



3rd generation

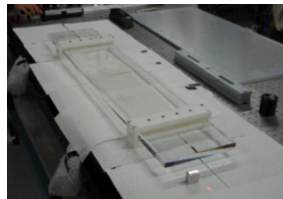


LHC ATLAS



Development of advanced detectors

TOP Counter



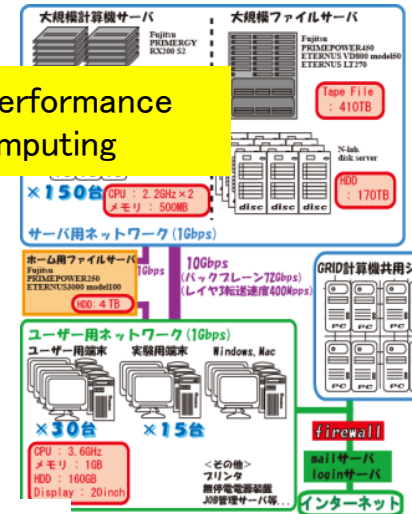
Photodetector



Trigger



High Performance Computing



Cooperation w/ Theory

→ Tau-Lepton Physics Research Center (2008)



Two Approaches to NP

2005

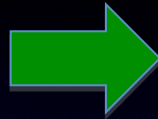
2010

2015

2020

2025

**Confirmation of SM
(KM + Higgs)**



**BSM: Physics beyond the SM
(SUSU, e-DIM, ...)**

High Energy Frontier

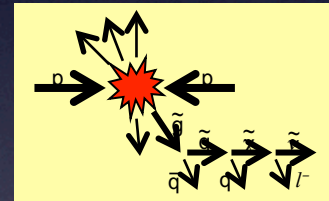
LHC

7-8 TeV

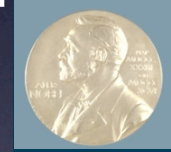
13-14 TeV



Direct search



Nobel prize for experimentalists !



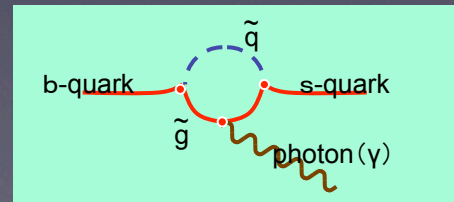
High Intensity Frontier

KEKB $2.1 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$

Super KEKB $8 \times 10^{35} \text{cm}^{-2}\text{s}^{-1}$



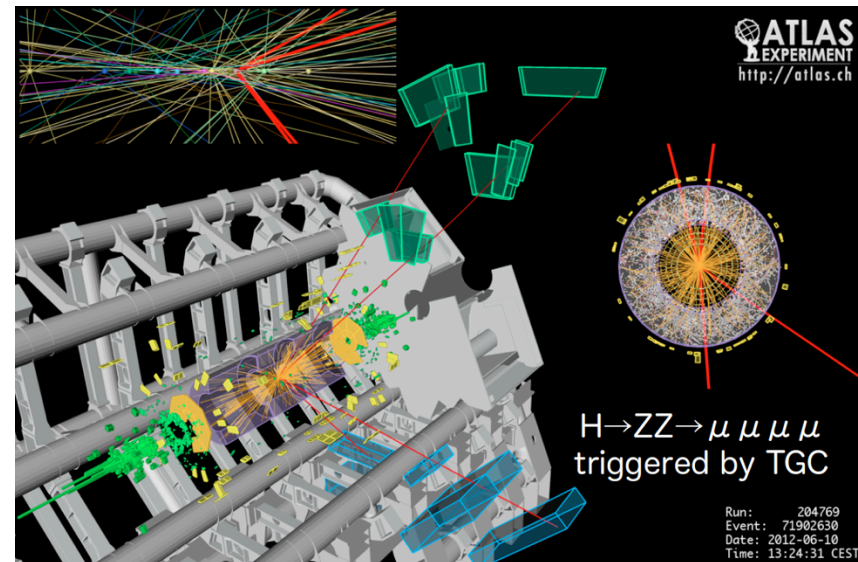
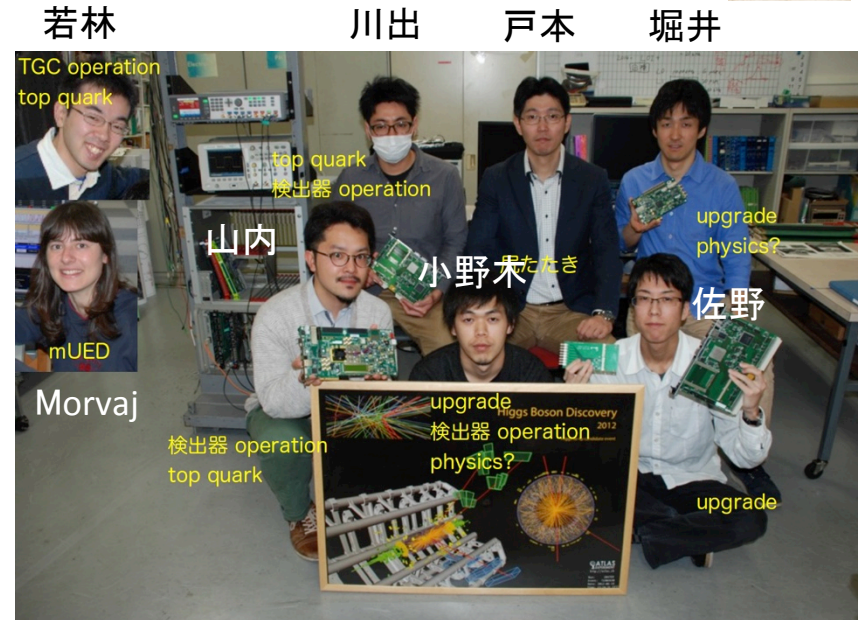
Indirect search (loop)



ATLAS - Nagoya

- ATLAS-Nagoya started in 2006, and grown-up to one of leading teams in Japan.
- Major contributions
 1. Installation/commissioning/operation of detectors
 - Endcap muon trigger (TGC)
 2. Physics analysis of Run1 data
 - Top quark physics
 - New Physics searches
 3. Upgrade towards high luminosity LHC
 - Advanced muon trigger system

"Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC", Phys. Lett. B 716 (2012) 1-29 (cite:4343)



Belle/Belle II - Nagoya

- One of the largest university groups in Belle/Belle II
- Major contributions

1. Tau physics

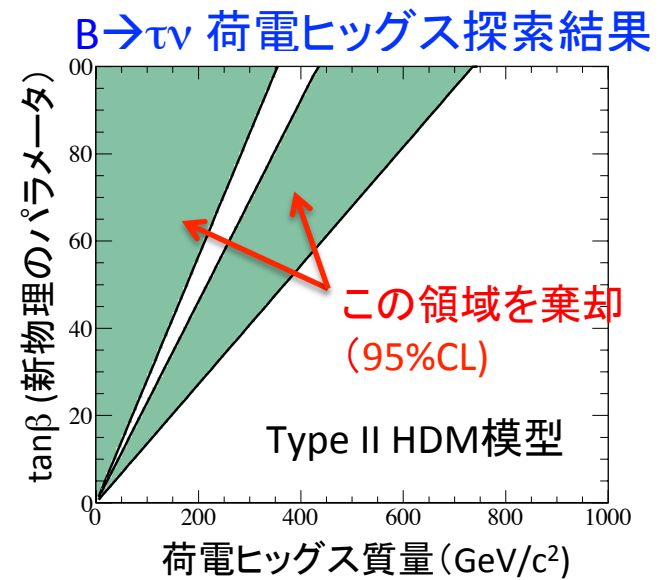
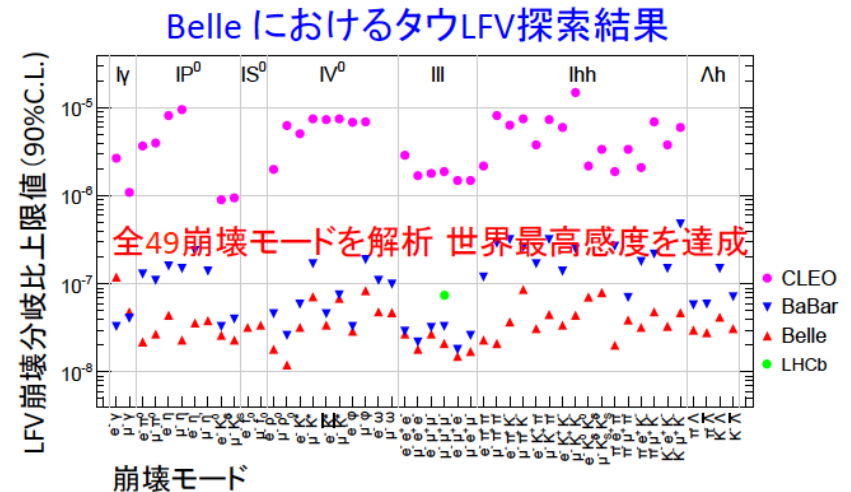
- LFV decays
- Tau EDM
- Hadronic decays

2. B physics

- Semileptonic decays $\rightarrow Vxb$
- Tauonic decays ($B \rightarrow t n, D t n$)

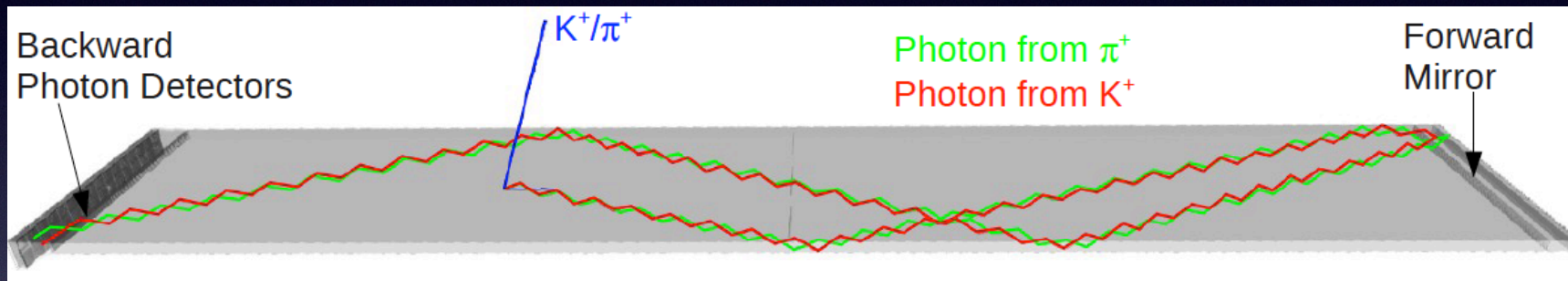
3. Barrel PID (TOP) for Belle II

4. Computing

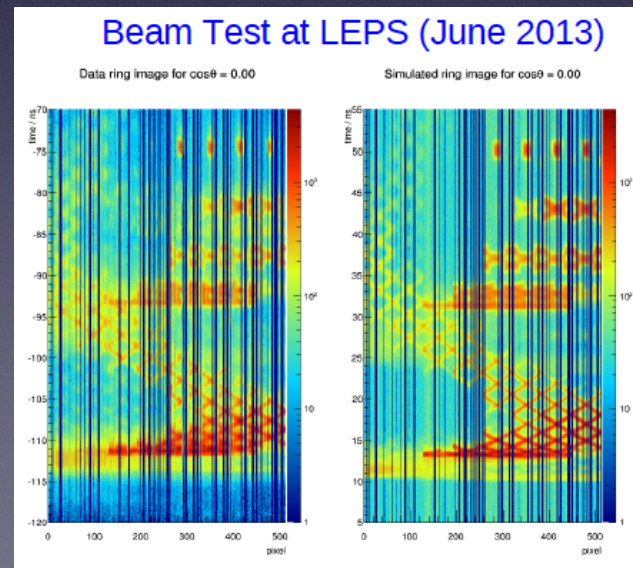


TOP Counter (PID)

- Time-Of-Propagation (TOP) technique: precision timing of internally reflected Cherenkov photons produced in accurately polished quartz radiator ($\sim 50\text{ps}/\text{photon}$).



- Key technologies;
 - MCP-PMT and electronics to detect single photon with $\sim 50\text{ps}$ resolution.
 - Accurately polished quartz optics, and mechanics.
- Performance has been demonstrated with a beam test at Spring-8.



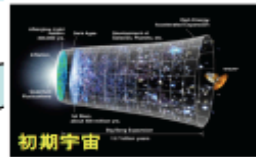
Research at KMI

Early universe Dark energy Black-hole

Matter – antimatter asymmetry

物質・反物質

初期宇宙



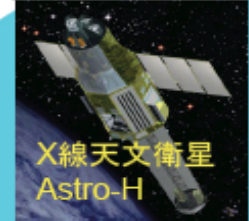
暗黒エネルギー

ブラックホール
時空理論

Dark matter

暗黒物質

ブラックホール
天体観測



X線天文衛星
Astro-H

Instrument
Development lab.

Tau-lepton

Data analysis lab.

素粒子宇宙起源研究機構

新しい物理法則？
新しい粒子？

数値実験を通して
生き残るモデルを探す

理論計算物理室

標準模型を超える理論

6つのクォーク

小林・益川理論

(1973)

三田の提案

KEK-B Factory

実験で確認(2003)

ノーベル賞2008

標準模型完成



標準模型を超える実験

KEK-B

Belle Detector



Super KEKB

高速ネットワーク

大型高速計算機

大容量ストレージ

精密実験の
大量データ
高速解析

データ解析室

最新の多量データを
超高速で解析する

Computational
Theoretical physics

これまでにな
超高エネルギー
衝突実験

LHC加速器

世界最高14TeVの
陽子・陽子衝突



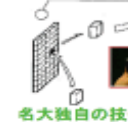
標準模型を超える実験

OPERA(2007)

$\nu_\mu \rightarrow \nu_\tau$ 振動
反応の解析

OPERA

名大独自の技術



CERN(LHC/ATLAS)名大担当

2008年
稼働開始



標準理論を超える物理世界
超対称性？、余剰次元？
→ 力の大統一の可能性

Center for
Theoretical
Studies

基礎理論
研究センター

現象解析
研究センター

Center for Experimental Studies

World Research Unit for Heavy Flavor Particle Physics

- 名古屋大学研究大学強化促進事業 最先端国際研究ユニット
- N.U. Program for Promoting the Enhancement of Research Universities (Menu B-I, WPI-next)
- Exploring new physics beyond the standard model by using experimental data on heavy flavor particles, expected in the coming years, and related theoretical studies.

B factory (Belle/Belle II)



Toru Iijima
• B & Tau physics
• Exotic hadron physics



LHC-ATLAS



Makoto Tomoto
• Top physics
• Higgs physics

Theory

Junji Hisano
• Flavor physics
• Dark matter physics



Foreign Researcher
Peter Krizan (Ljubljana)
(Visiting Professor)



Also will boost KMI Research and Globalization