SπRIT Time Projection Chamber: Description and Performances

Clementine Santamaria, NSCL

2016/06/15

1. Description of S**π**RIT

2. Tracking software

3. Preliminary results

Nuclear symmetry energy

SπRIT project: to constrain the symmetry-energy term
in the nuclear Equation of State

- Measurements of the density dependence of the nuclear symmetry energy at supra-saturation densities ($\rho \sim 2\rho_0$).
- Systematic study by changing beams and targets with different Sn isotopes.

T. Murakami, stay tuned !

⇒ Need to reconstruct the momentum distributions of pions and light particles with $Z \leq 3$ emitted in central collisions of neutron-rich nuclei.

SπRIT Time Projection Chamber (TPC)

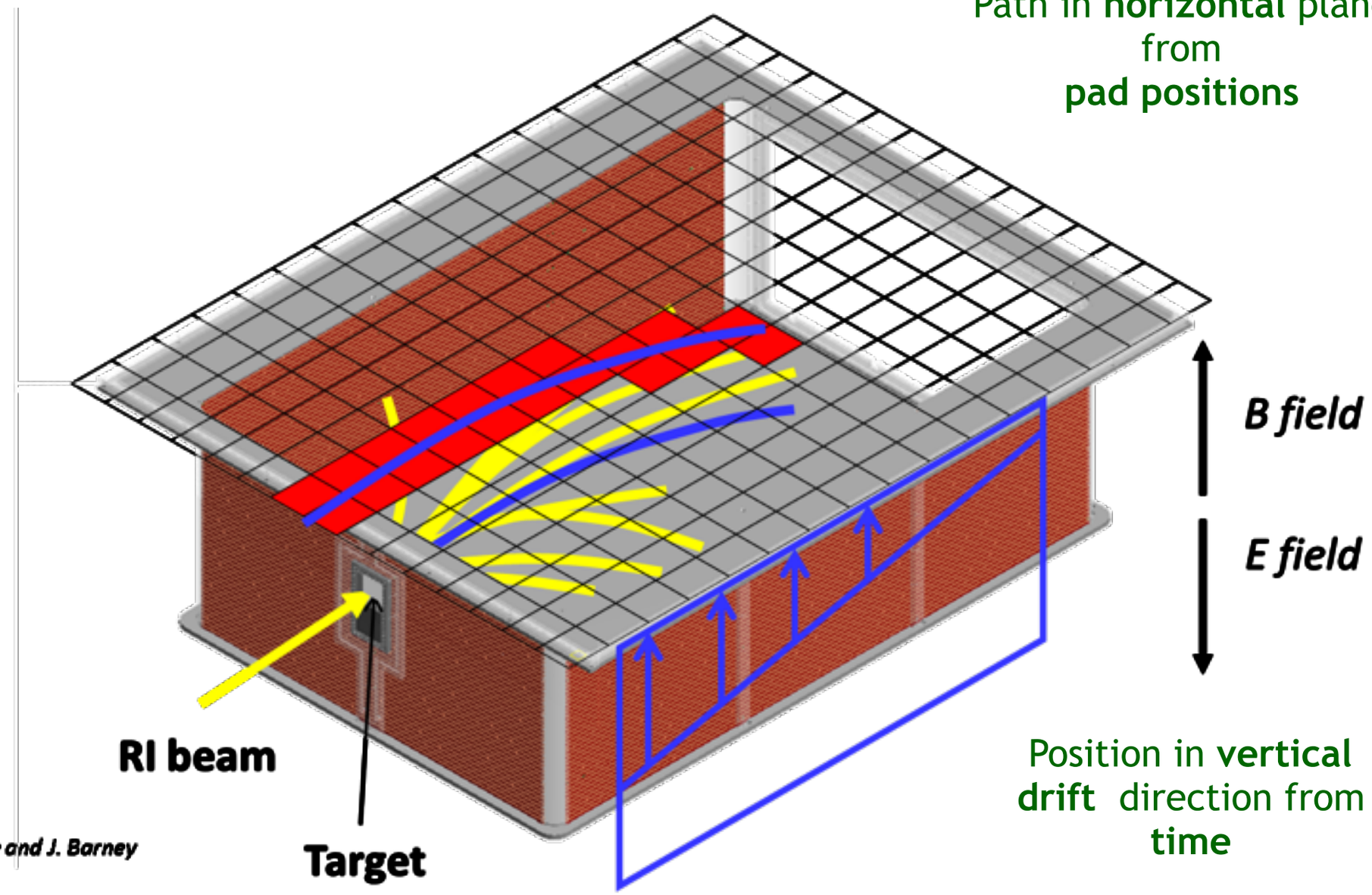


Figure by J. Estee and J. Barney

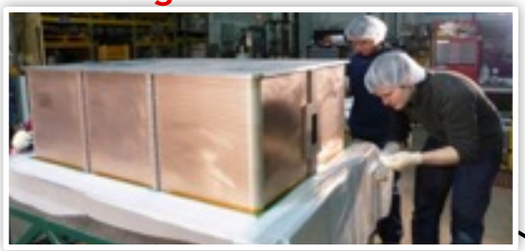
SπRIT TPC Structure

NIM A **784**, 513-517 (2015)

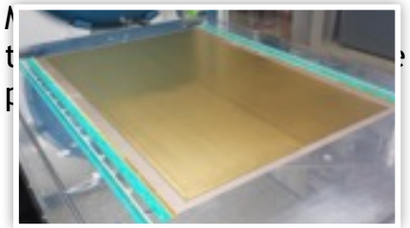
J. Barney's talk 06/13

Front End Electronics

Field Cage



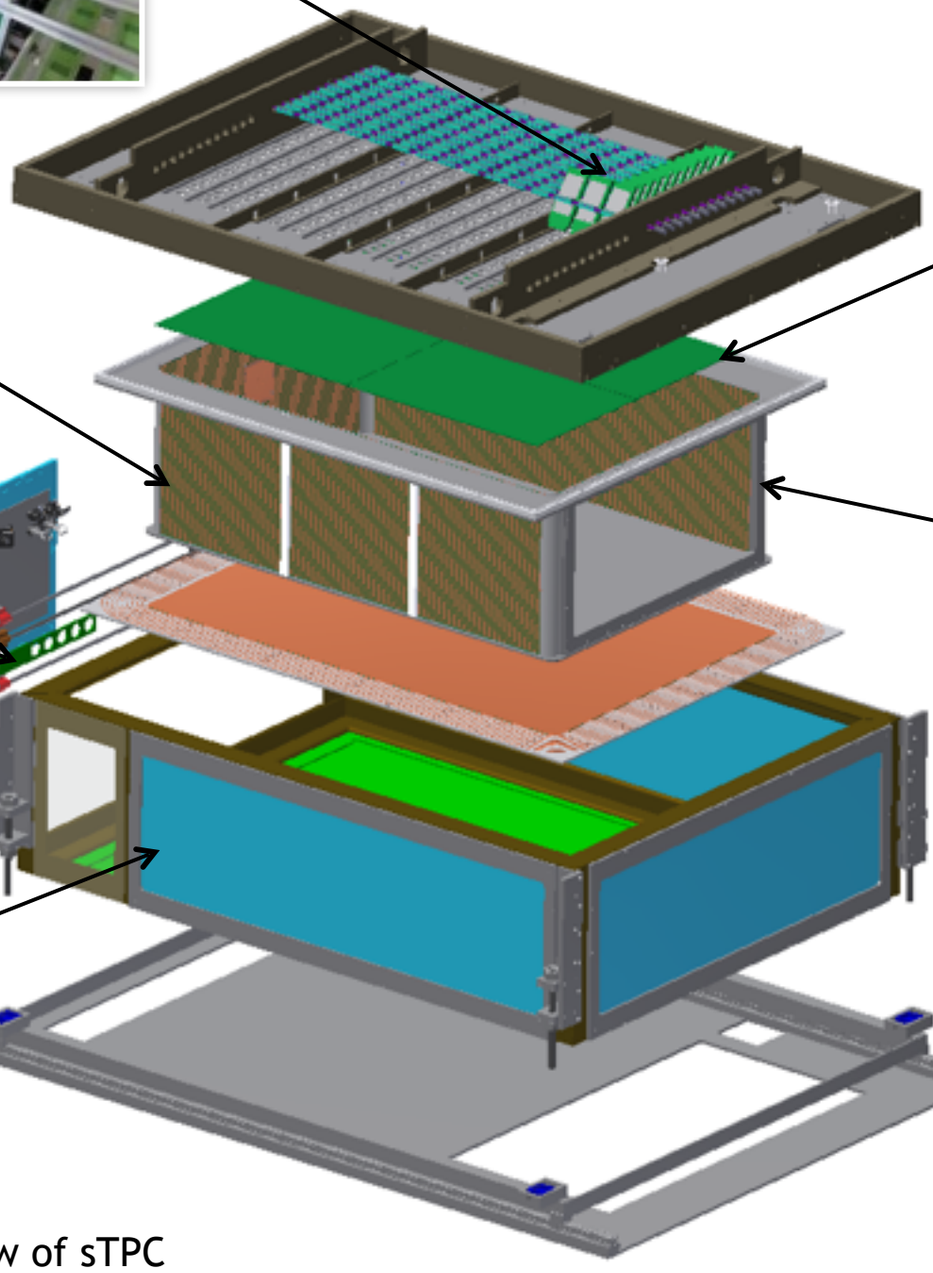
Pad Plane



Target mechanism

Wire Planes

Thin-Walled Enclosure



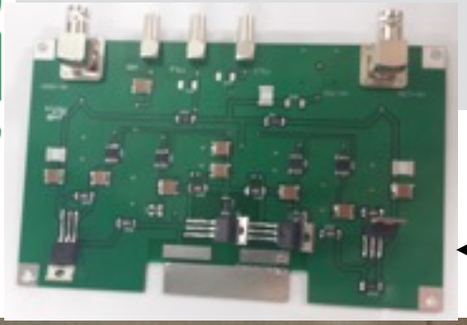
Rails

Rails for smooth, safe insertion of TPC into magnet

Exploded view of sTPC

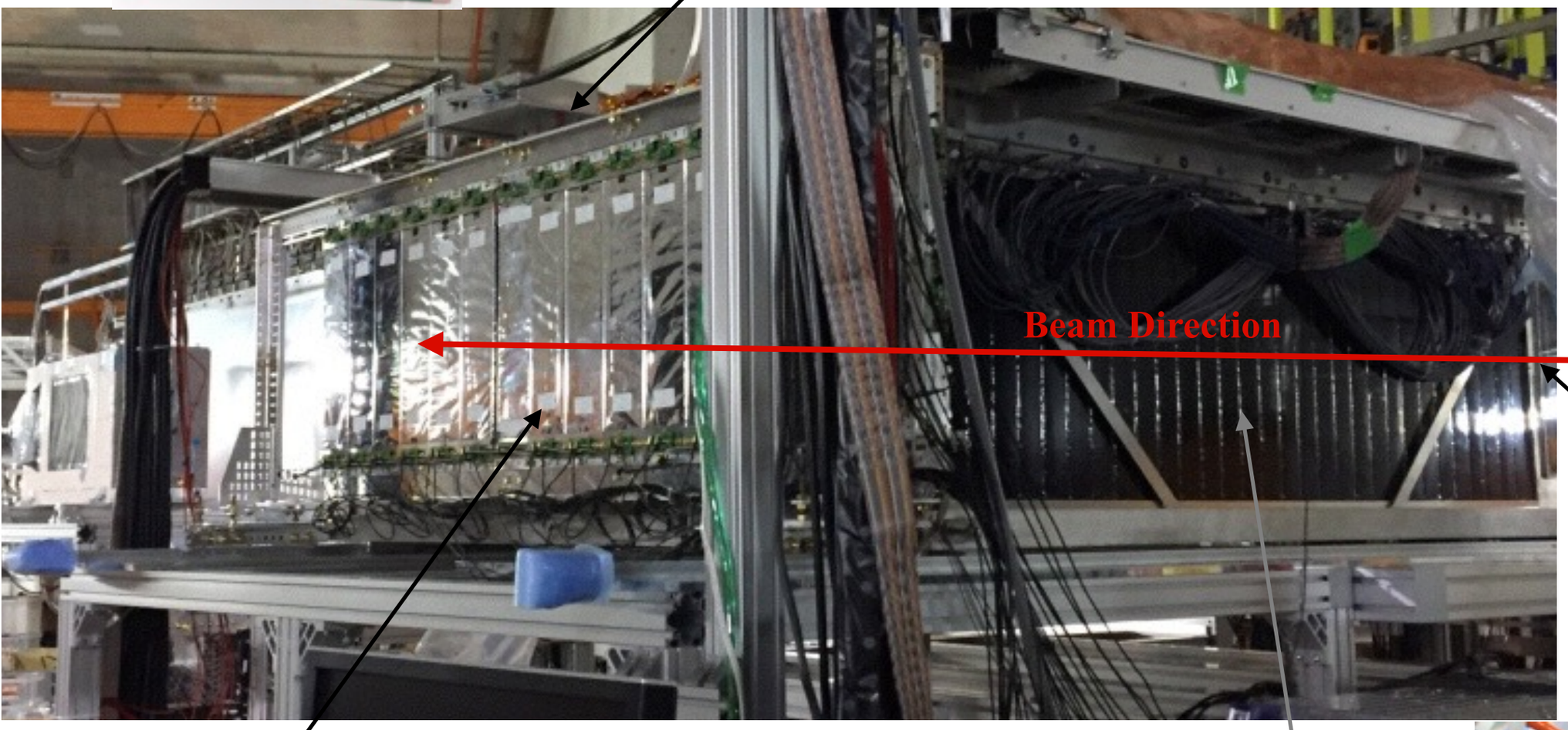
Slide adapted from R. Shane

SπRIT setup



Gating Grid Driver (GGD)
NSCL

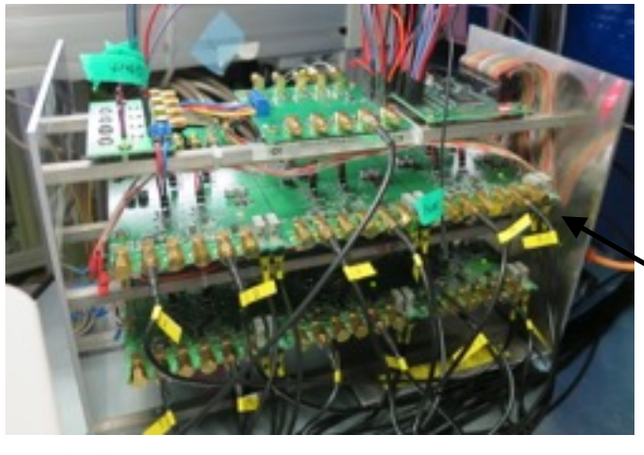
At RIBF facility
Japan



T. Murakami, stay tuned !

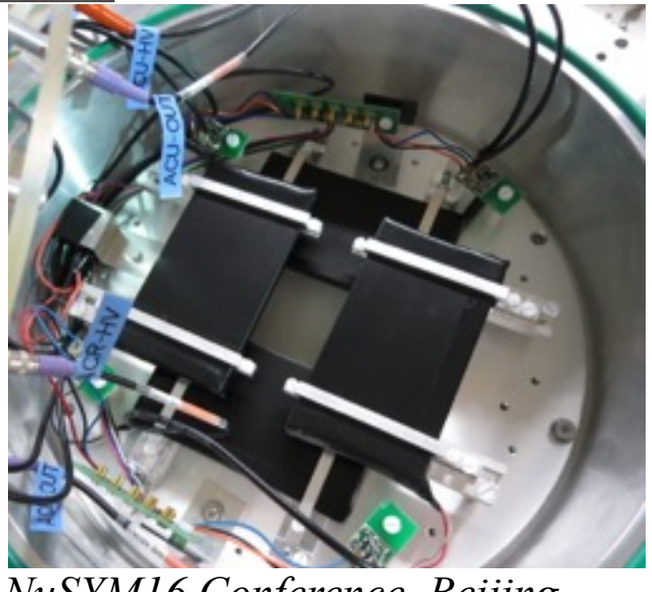
Active Collimator
(Upstream)
Tsinghua University

KATANA
(12 + 3 scintillators)
IFJ Poland



Trigger Box
IFJ Poland

Kyoto array
(30x2 scintillators)
Kyoto University

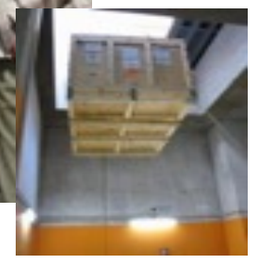


SπRIT Milestones

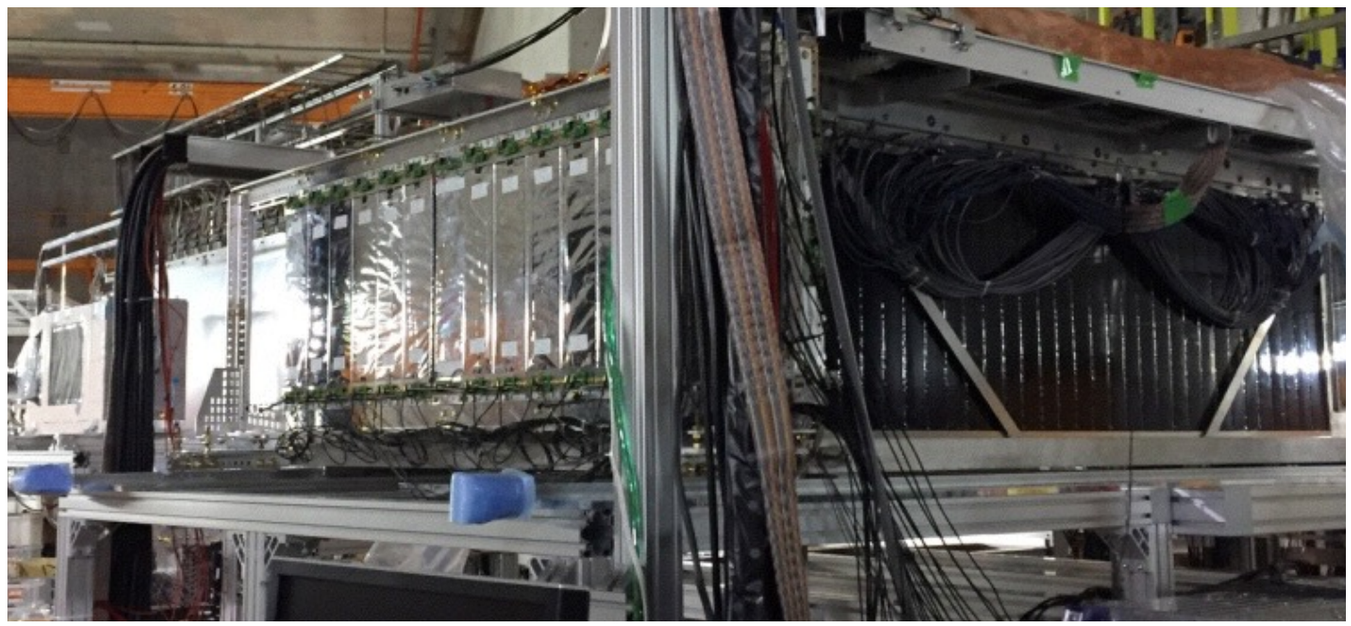
Oct 2010: DOE Funded ($1.2 M)
July 2011: Conceptual design

May, 2013 (MSU)

Feb, 2014
Shipped to RIKEN

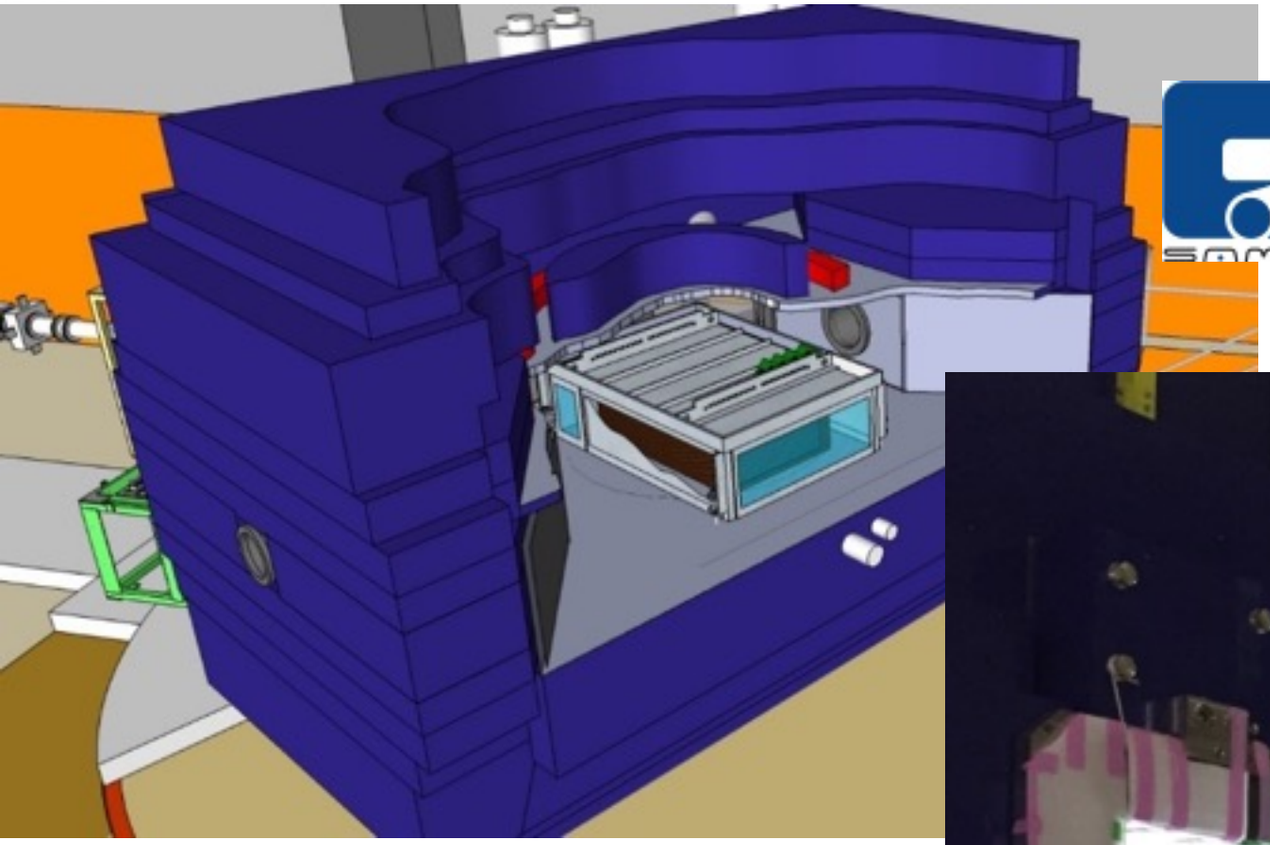


August, 2015
GET electronics installed
(MEXT)

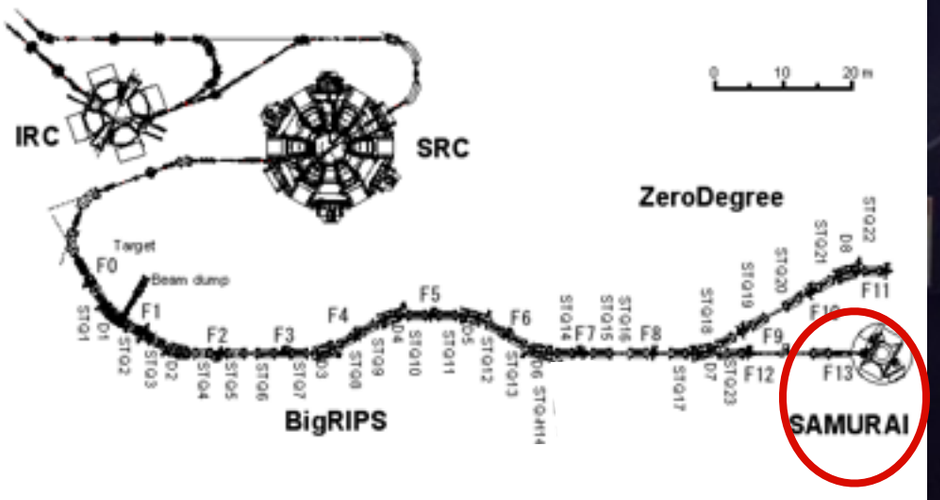


Oct, 2015: Beam test
April 2016: Commission
May 2016: 108Sn+112Sn
May 2016: 132Sn+124Sn

SπRIT TPC: Experimental setup

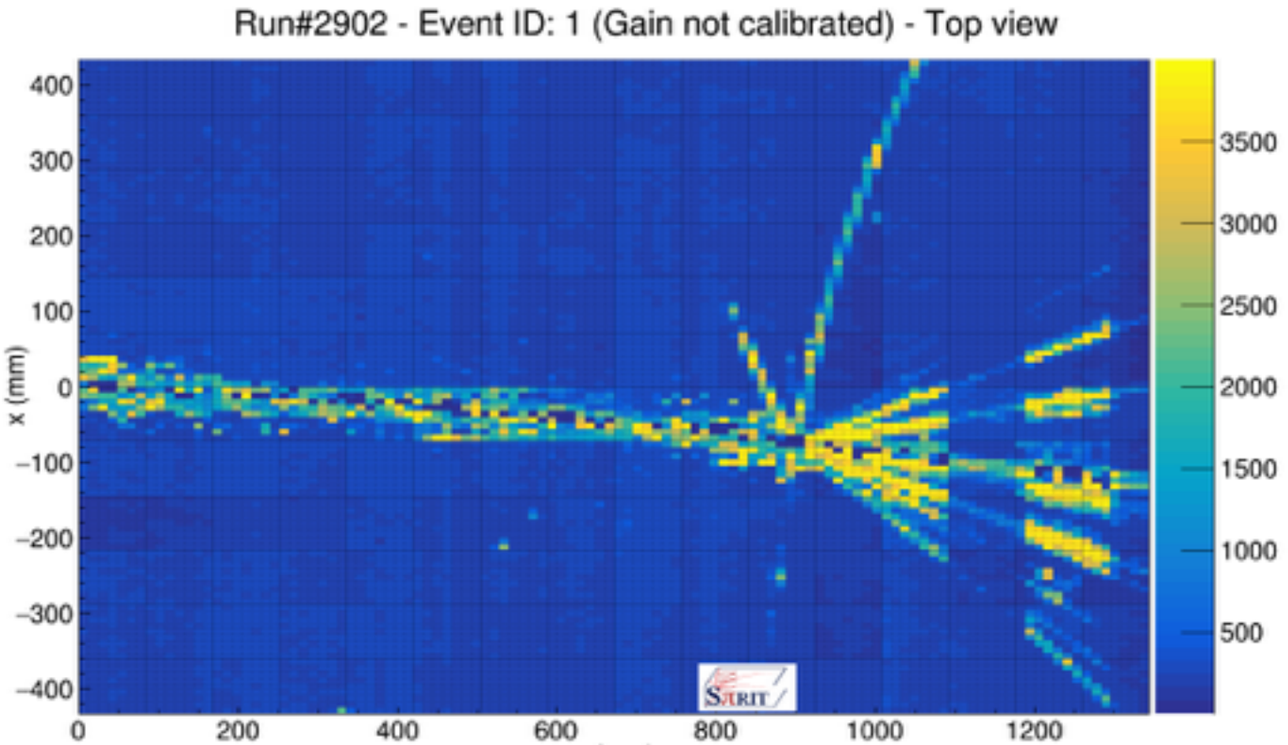


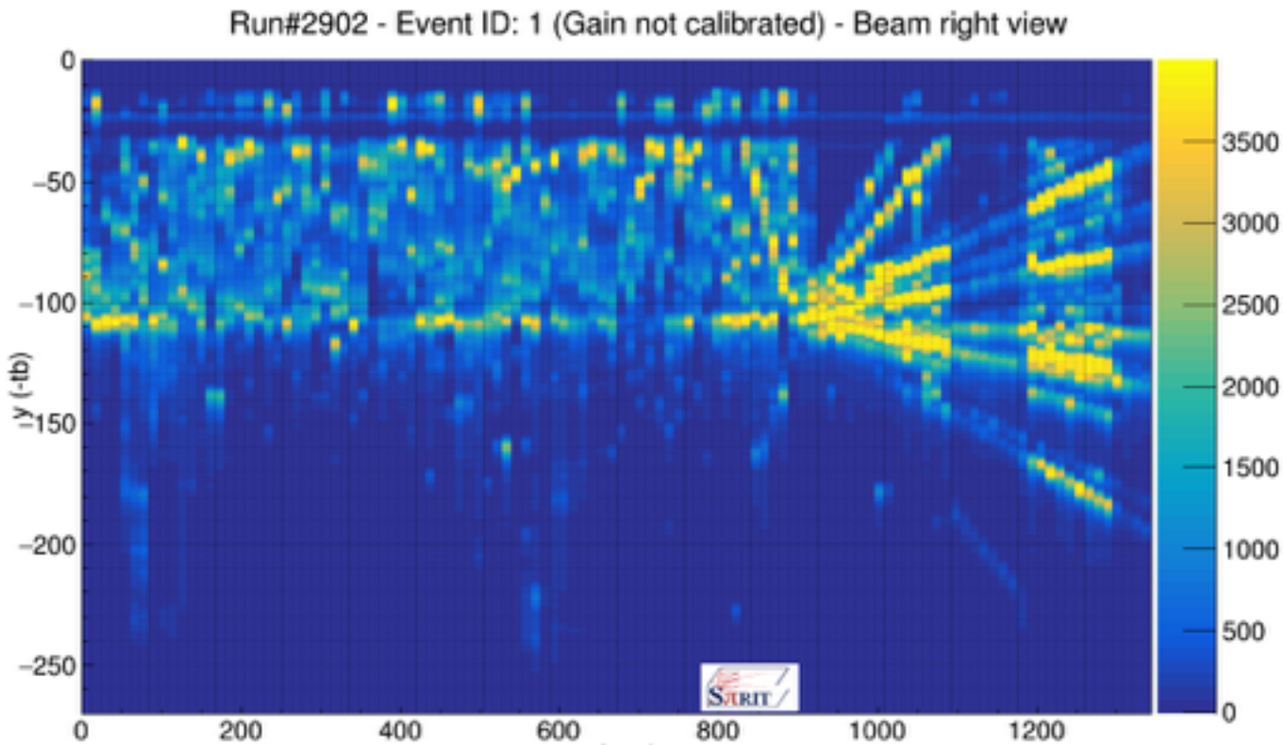
At RIBF facility
Japan

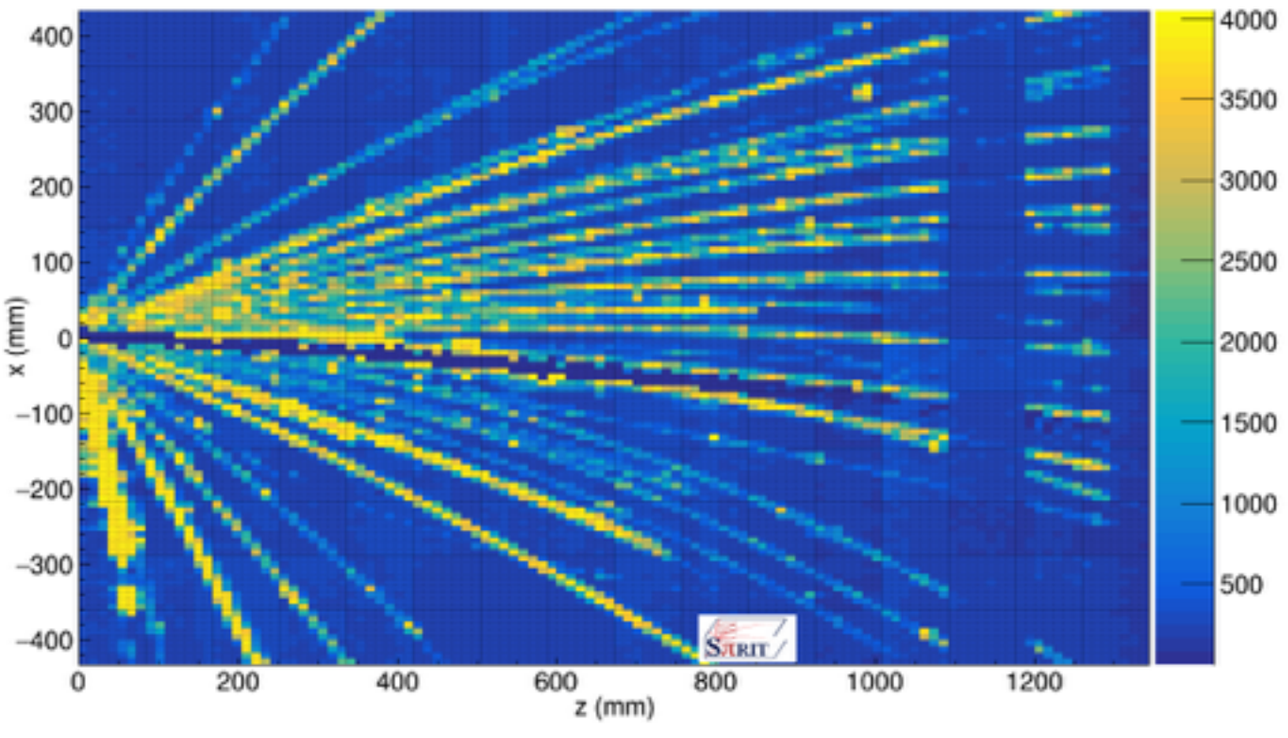


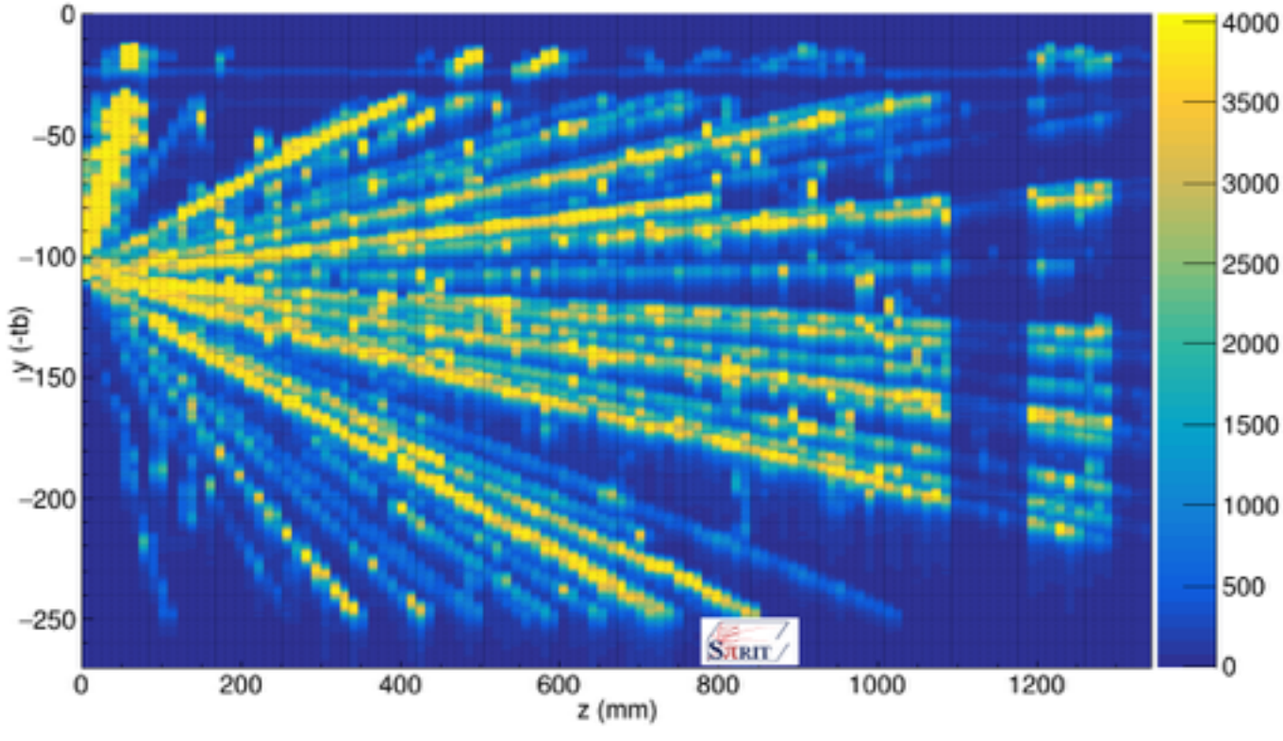
SπRIT TPC: 2D events

$^{132}Sn+^{124}Sn$ E/A=300 MeV (May 2016)





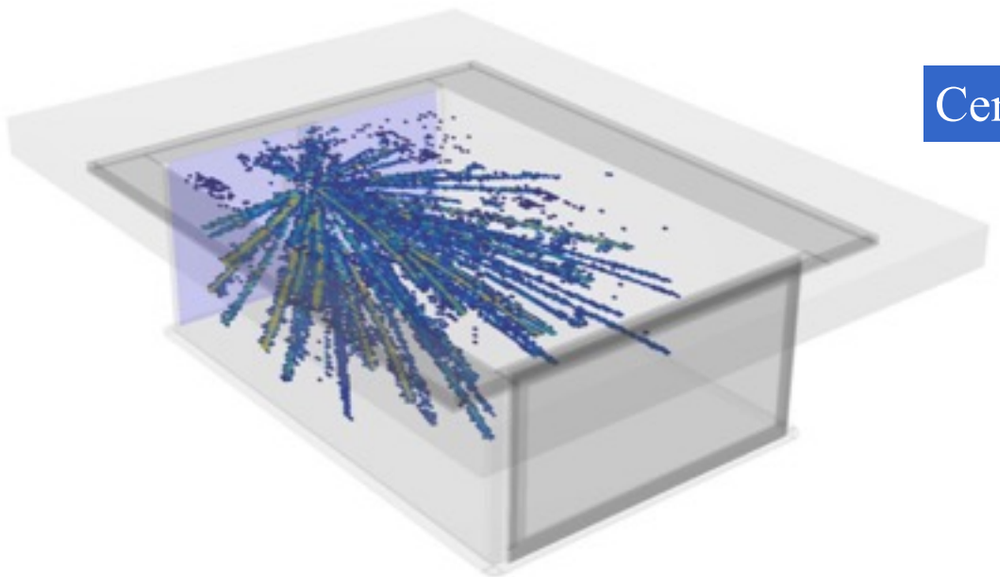


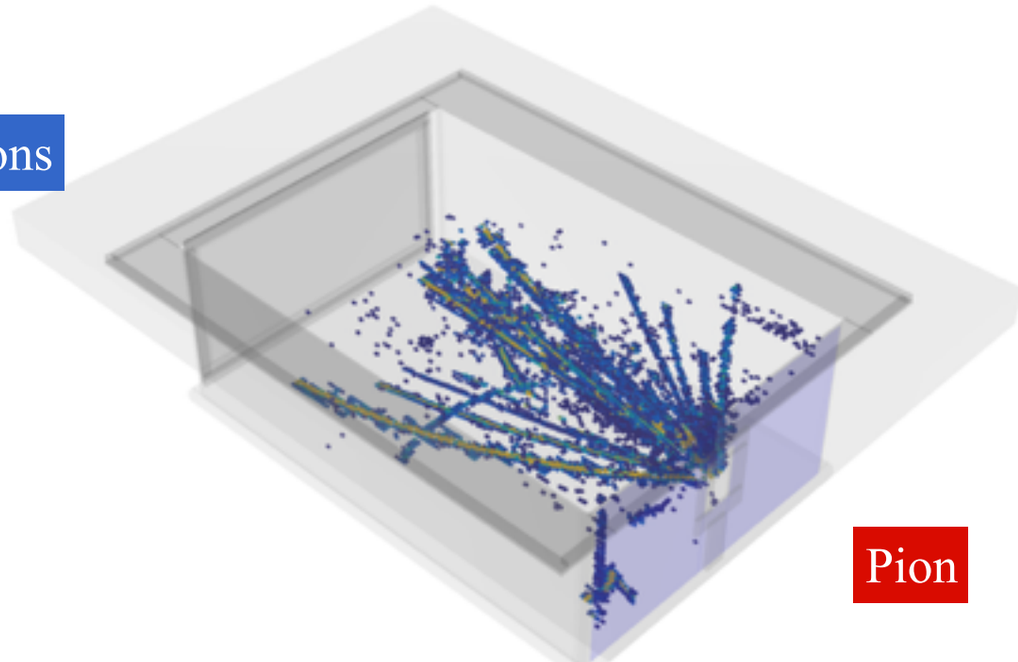


SπRIT TPC: 3D events

$^{132}Sn+^{124}Sn$ E/A=300 MeV (May 2016)

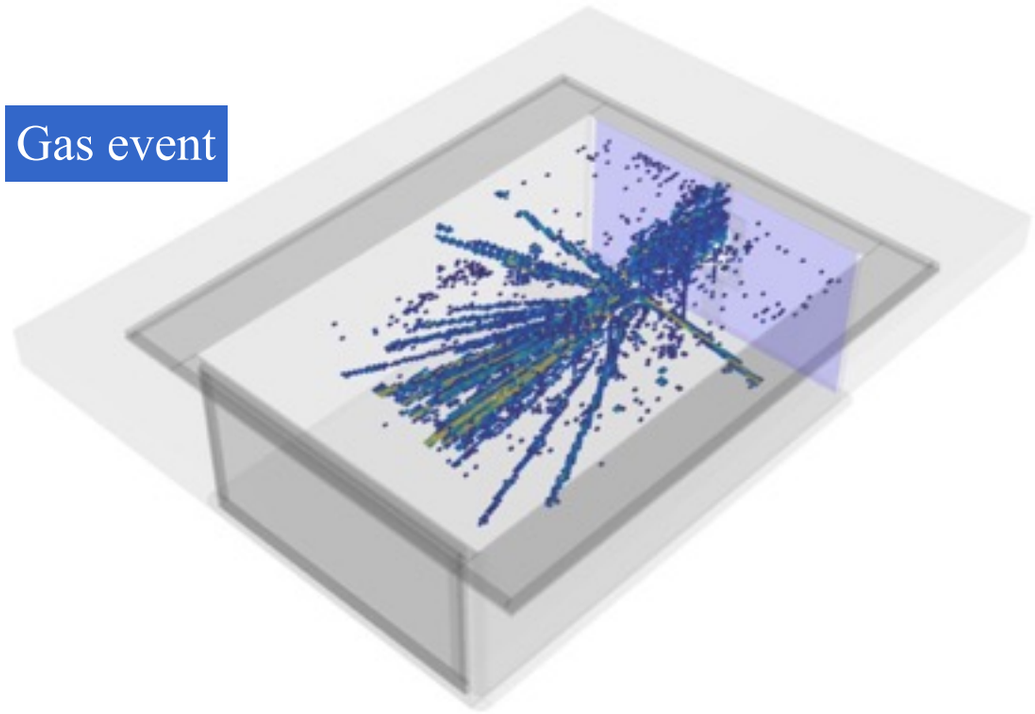
Central reactions



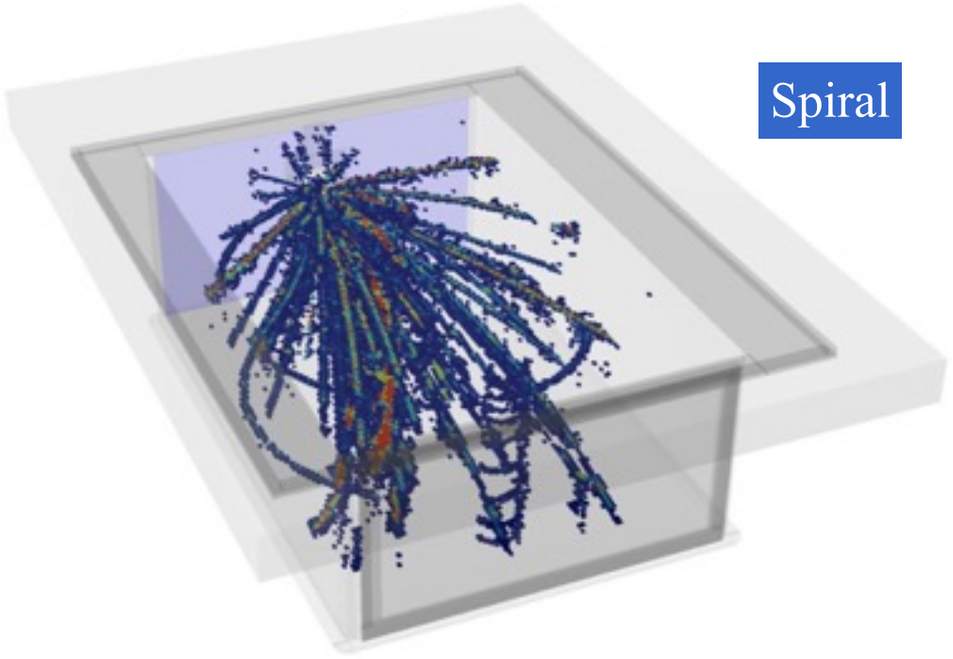


Pion

Gas event



Spiral



SπRIT TPC: Tracking software

Jung Woo Lee,
Genie Jhang,
Giordano Cerizza

Objectives:

- Number of tracks
- For each track, PID and momentum
- Vertex position

Tracking software scheme:

Pulse Shape Analysis (PSA)

1. Curve tracking
2. Clustering
3. ***Riemann tracking**: group clusters into tracklets

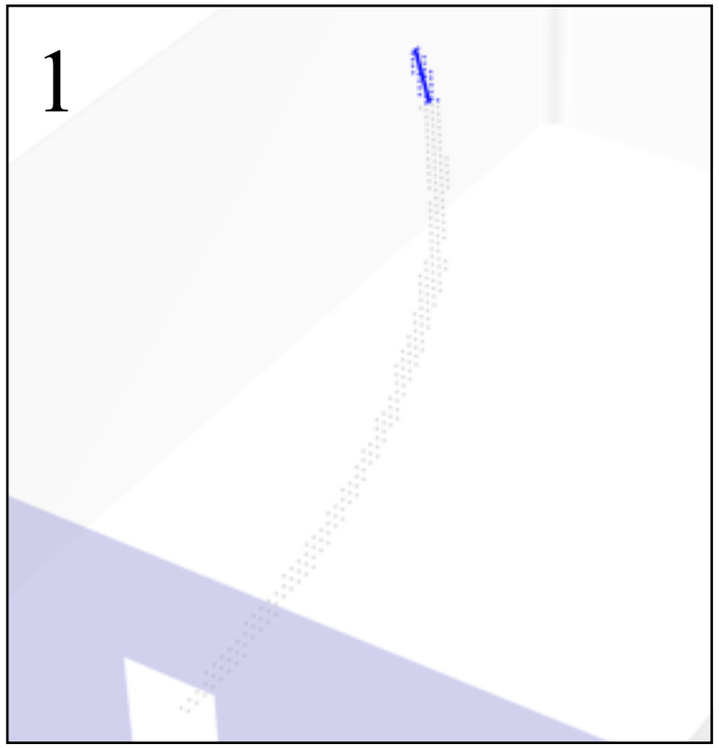
   J. Rauch *for the GEM-TPC Collaboration*, J. of Phys.: Conf. Series **396** (2012) 022042
4. ***GENFIT**: precise fitting (using Kalman filter)

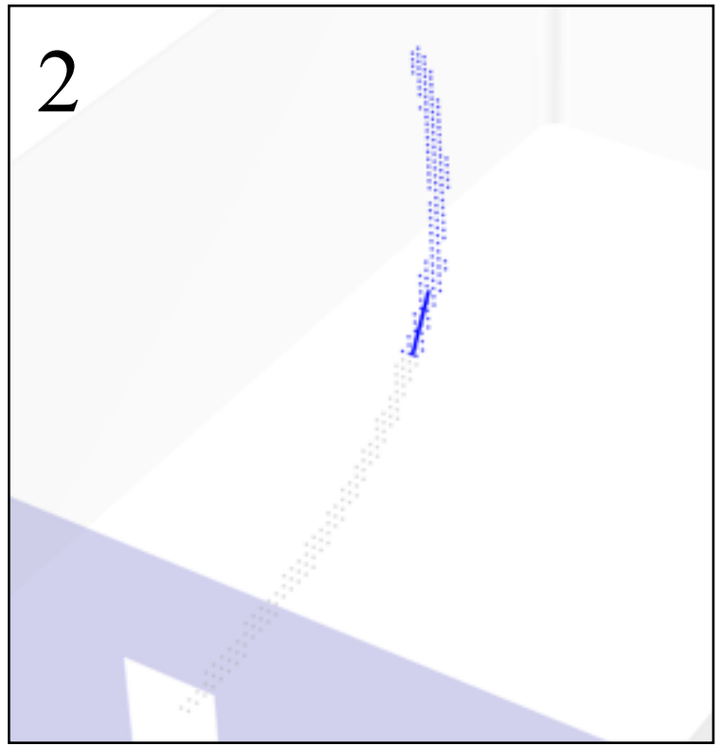
   C. Höppner *et al*, NIM A **620** (2012) 518-525

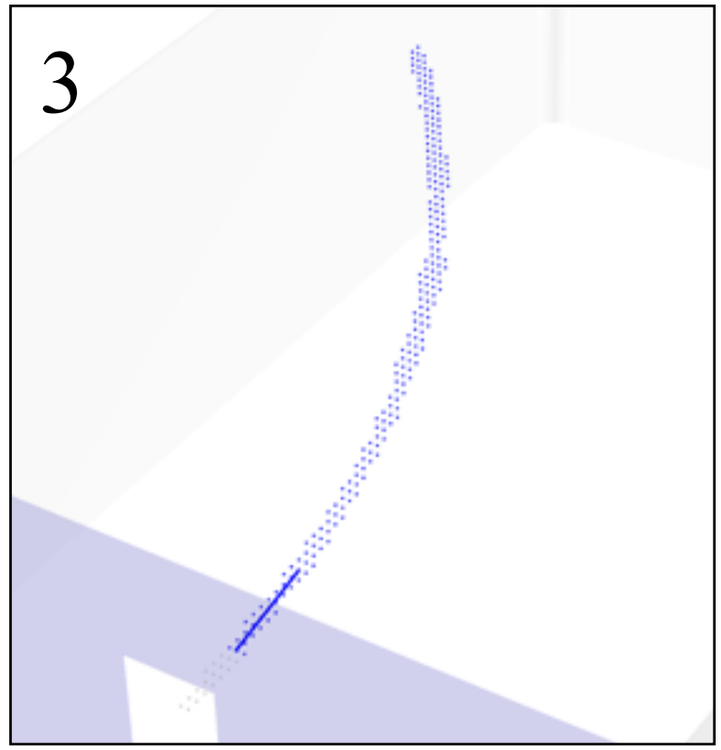
* in development

Curve Tracking

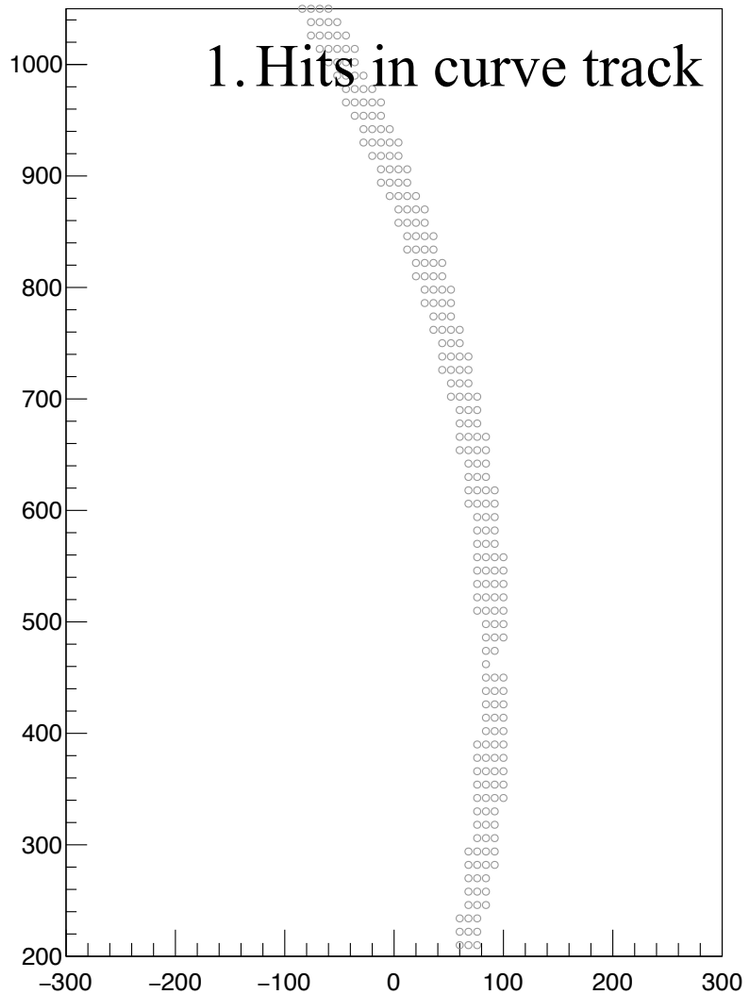
- Purpose: distinguish pieces of the full track.
- We can cluster hits along the curve afterwards.
- Start from downstream where the density of tracks is low.

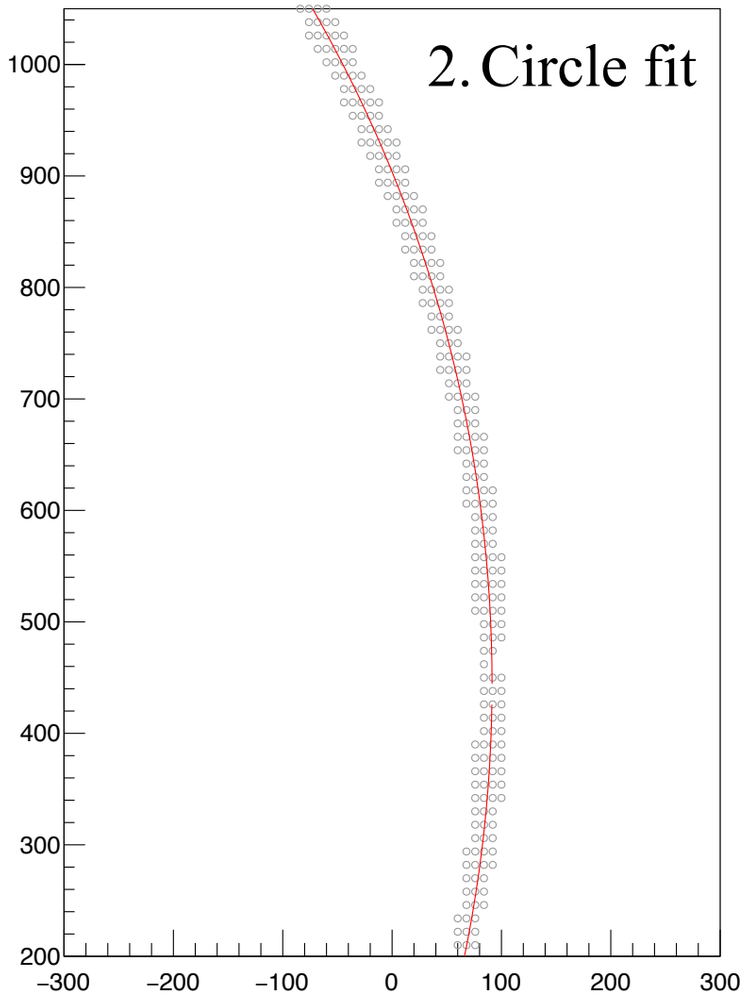


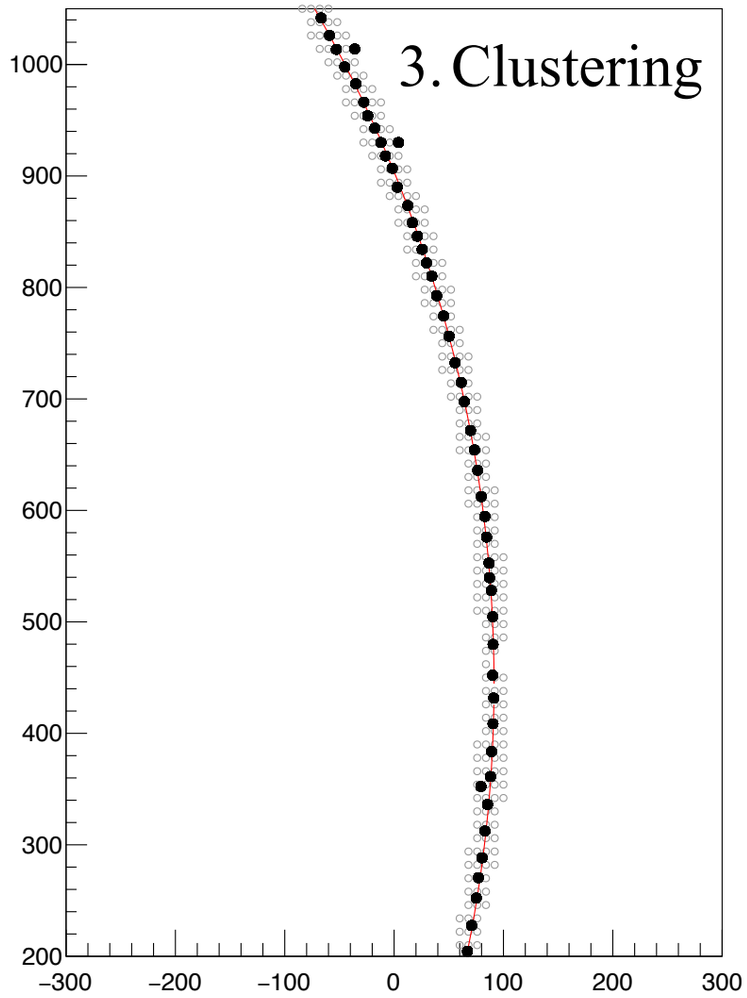




Clustering







- Clusterize hits along the fitted circle.
- Distance between clusters > 12 mm (pad length)

SpiRIT Collaboration

United States: C. Anderson, J. Barney, Z. Chajecki, G. Cerizza, P. Danielewicz, J. Estee, M. Famiano, U. Garg, W. Lynch, A. McIntosh, P. Morfouace, C. Santamaria, H. Setiawan, R. Shane, M. B. Tsang, T. Tsang, S. Tangwancharoen, G. Westfall, S. Yennello, M. Youngs

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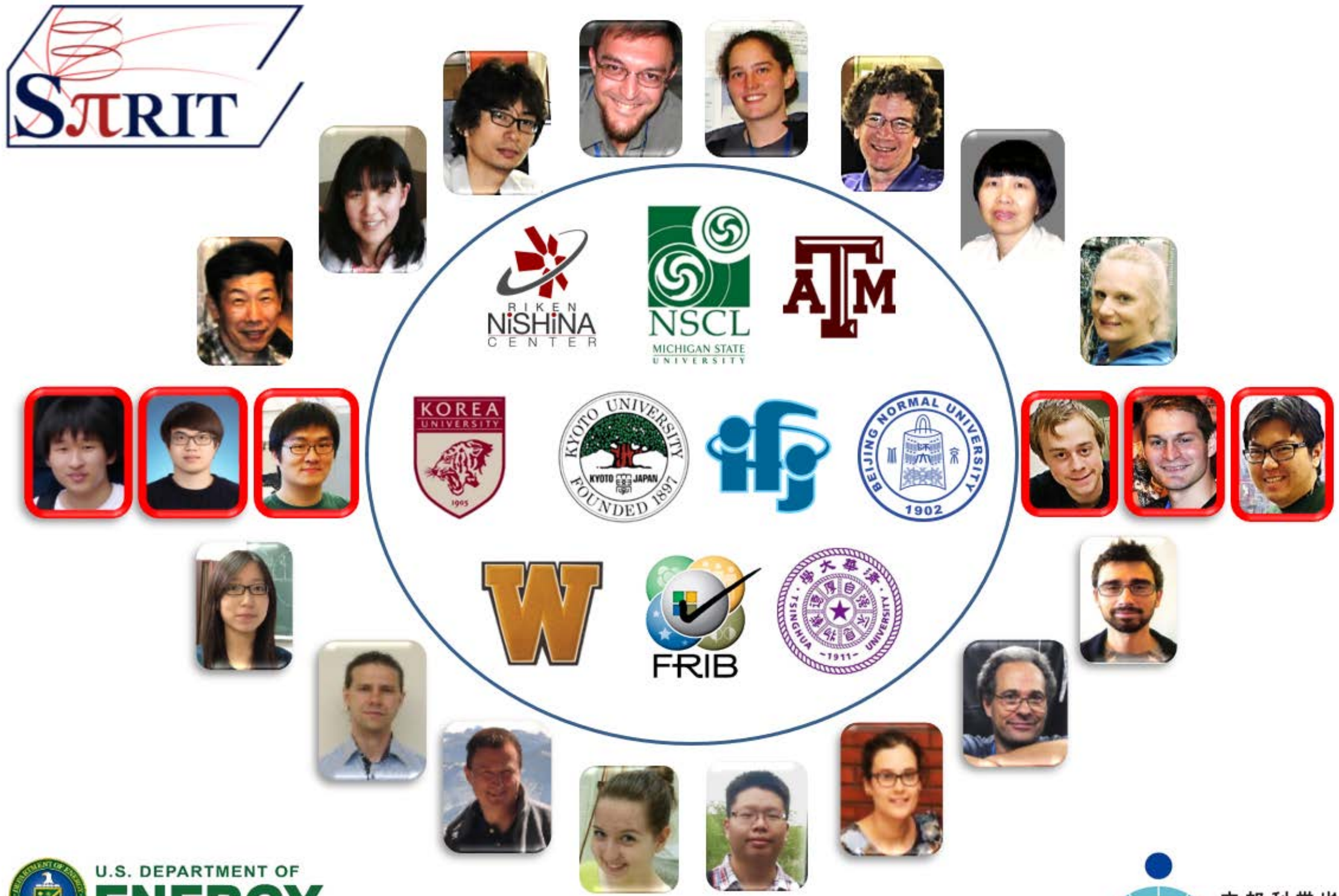
Poland: P. Lasko, J. Lukasik, P. Pawlowski, K. Pelczar

Thank you for your attention !



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