A new experiment of di-electron measurements at the 1st stage of J-PARC Heavy-Ion Project

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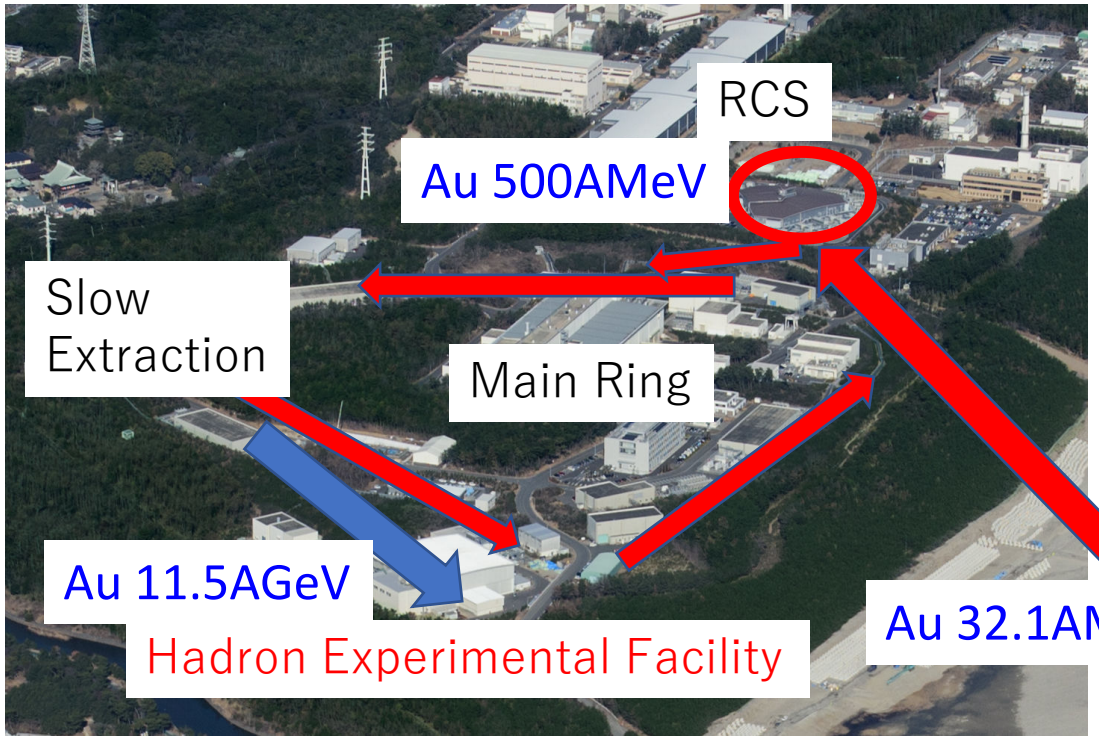
1st stage J-PARC Heavy Ion Project (J-PARC-HI)



J-PARC accelerators

1st stage J-PARC-HI Injector

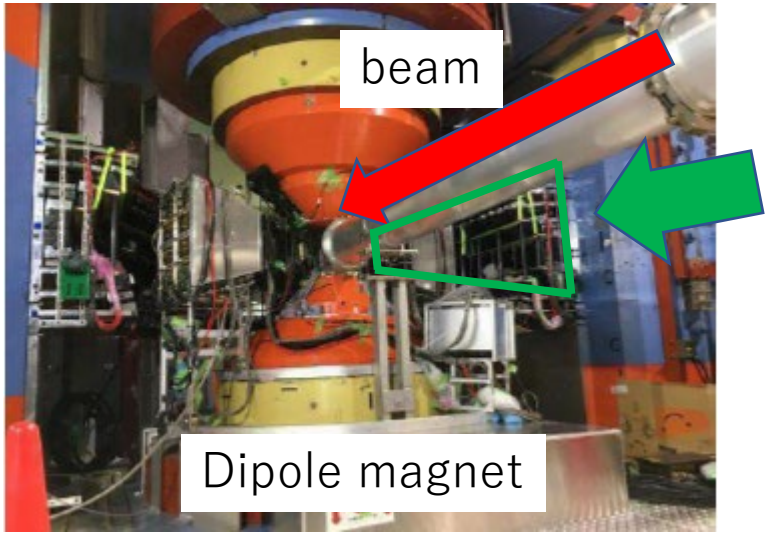
J-PARC acceleration scheme has been established for high intensity proton beam.

- HI injector is necessary
- Reuse of KEK-PS Booster for the 1st stage.

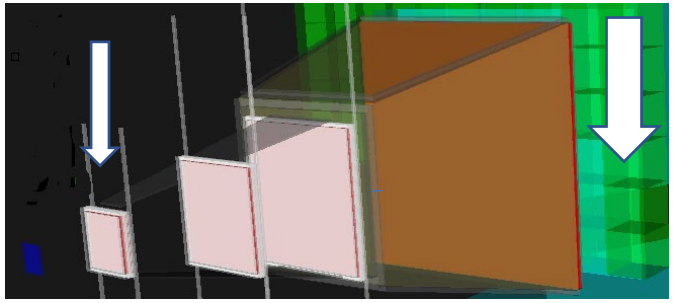
1-12AGeV, 1×10^8 acceleration

Full spec J-PARC-HI is presented by H.Sako 4/8 poster T15-1

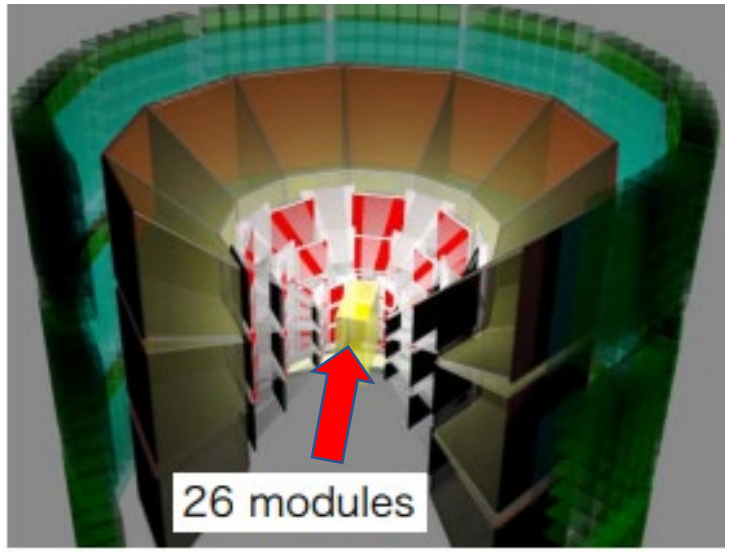
A new Experiment at 1st stage J-PARC-HI



one module



(1xSSD+3xGTR)+HBD+PbGl
→(2xSSD+2xGTR)+HBD+PbWO4
(4 Forward module)

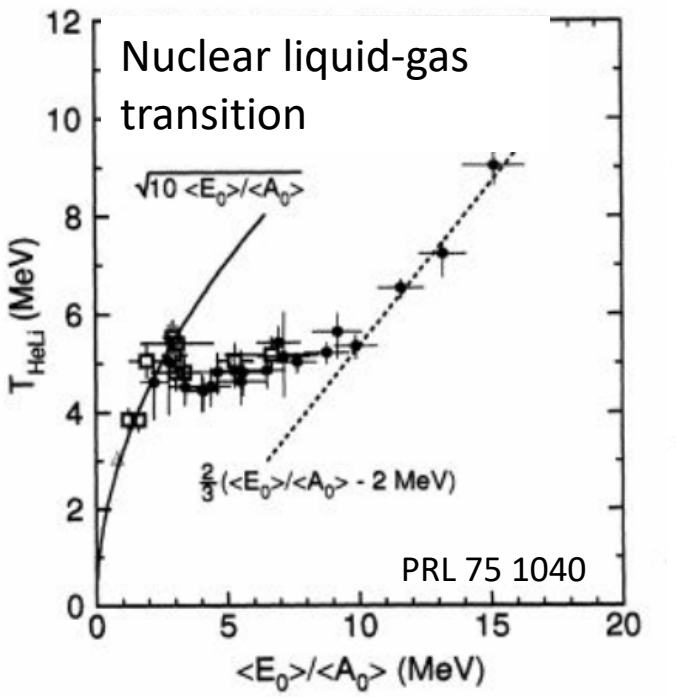


Upgrading J-PARC E16 spectrometer for mid-rapidity di-electron

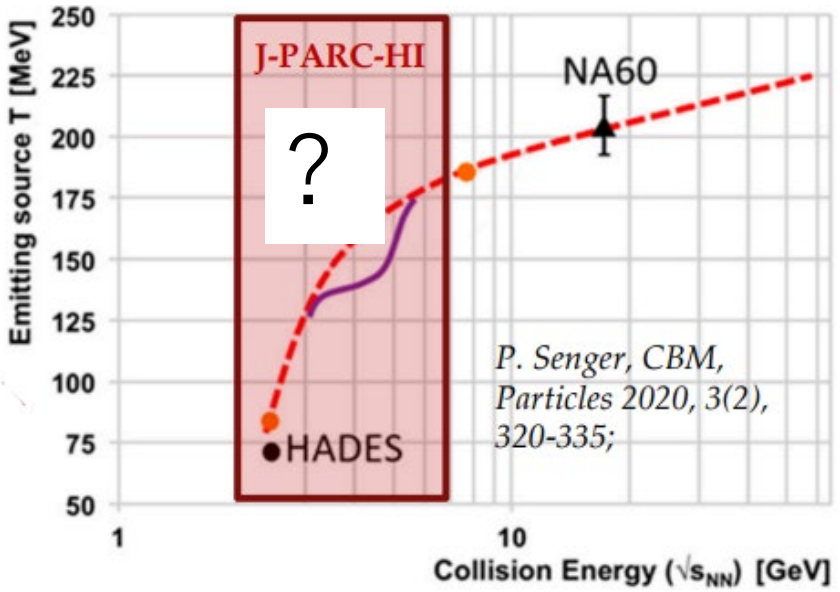
M.Ichikawa T15 4/7 14:40
& S.Sato 4/8 poster T11

- Upgrading granularity of forward modules to handle high-multiplicity.
- Install detectors downstream to characterize collision geometry.
  →Zero degree hadron calorimeter(W-MPPA fiber) + reaction plane detector(Pb-Scnti)
- Upgrading DAQ for ～50kHz interaction rate.
  →Optimizing APV configuration or free streaming data taking.

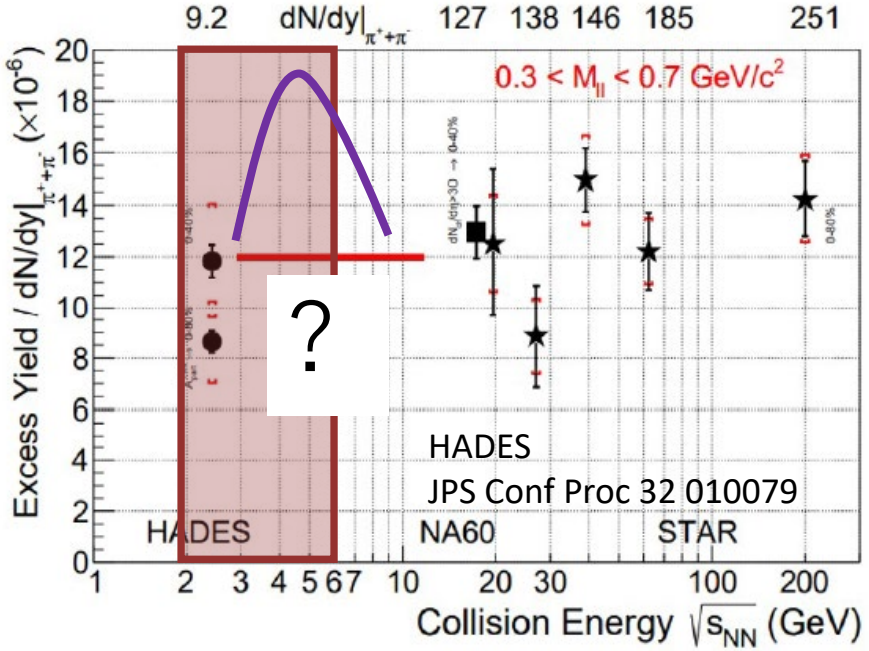
Physics Motivation



Caloric curve



Excess Yield～fireball life time



Current open question is the existence of 1st phase transition at high-density.

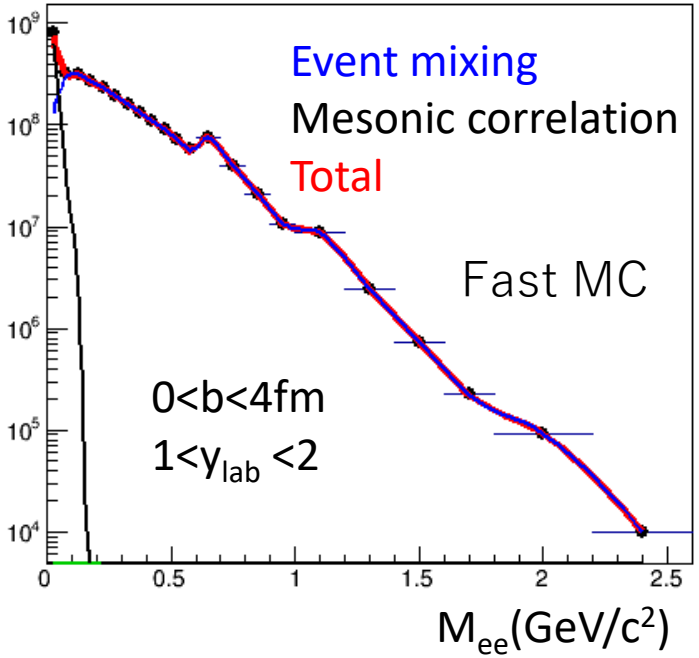
→identification of laten heat with EM probe is the strong evidence of the 1st PT

- "Caloric curve" via di-electron with intermediate mass (mass and/or P_T slope).
- "Long life time" due to the laten heat via di-electron yield with low mass.

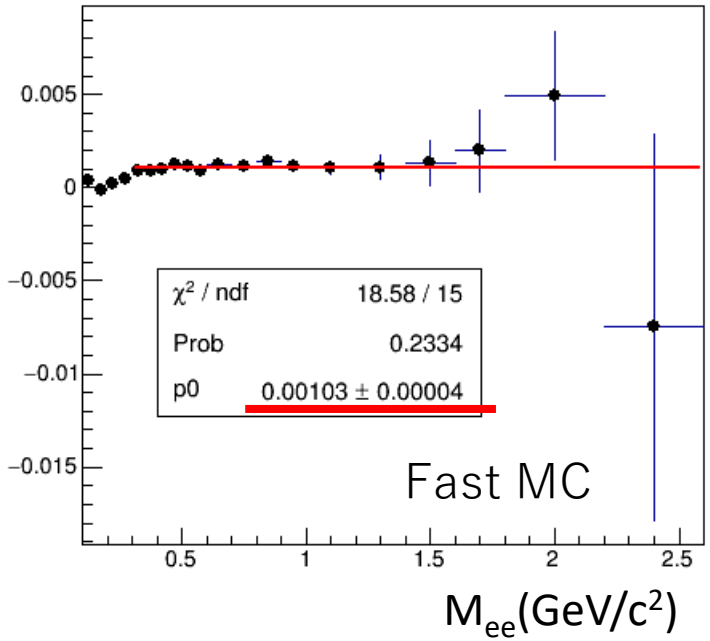
Mass modification of vector meson is also interesting.

Feasibility Study

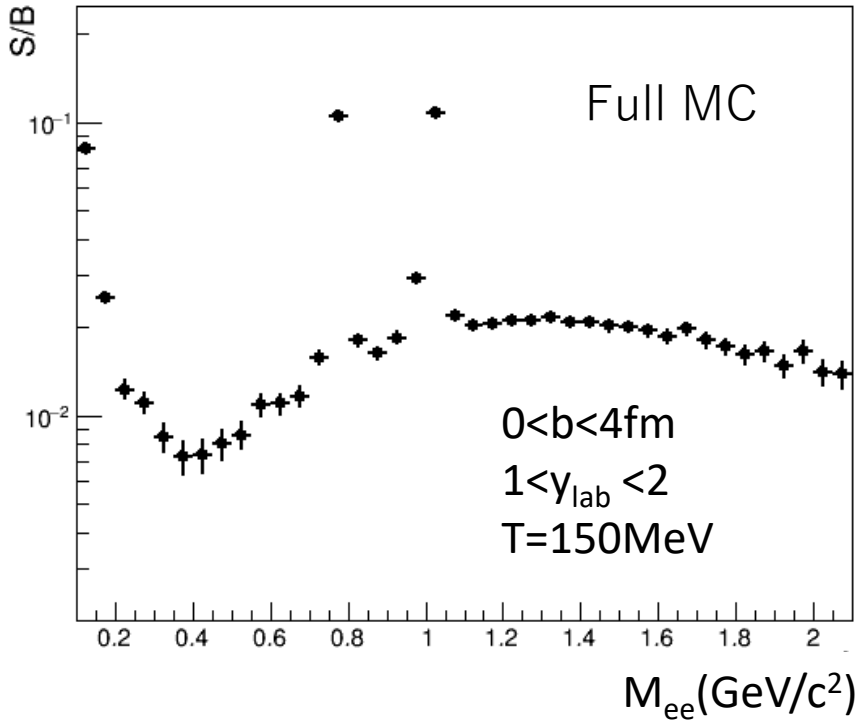
Combinatorial Background



(Calculated/Generated) background



$$\frac{\text{(thermal)+(meson)}}{\text{(combinatorial background)}}$$



Signal statistics & systematics was evaluated with event generator(JAM)&MC

Thermal yield::interpolation of data, meson yield::JAM(almost m_T scaling)

Full E16 acceptance& eID capability, inefficiency due to high multiplicity

- Reproducing background with 0.1% accuracy by event mixing & like-sign normalization
- S/B is about 1～2% at continuum region

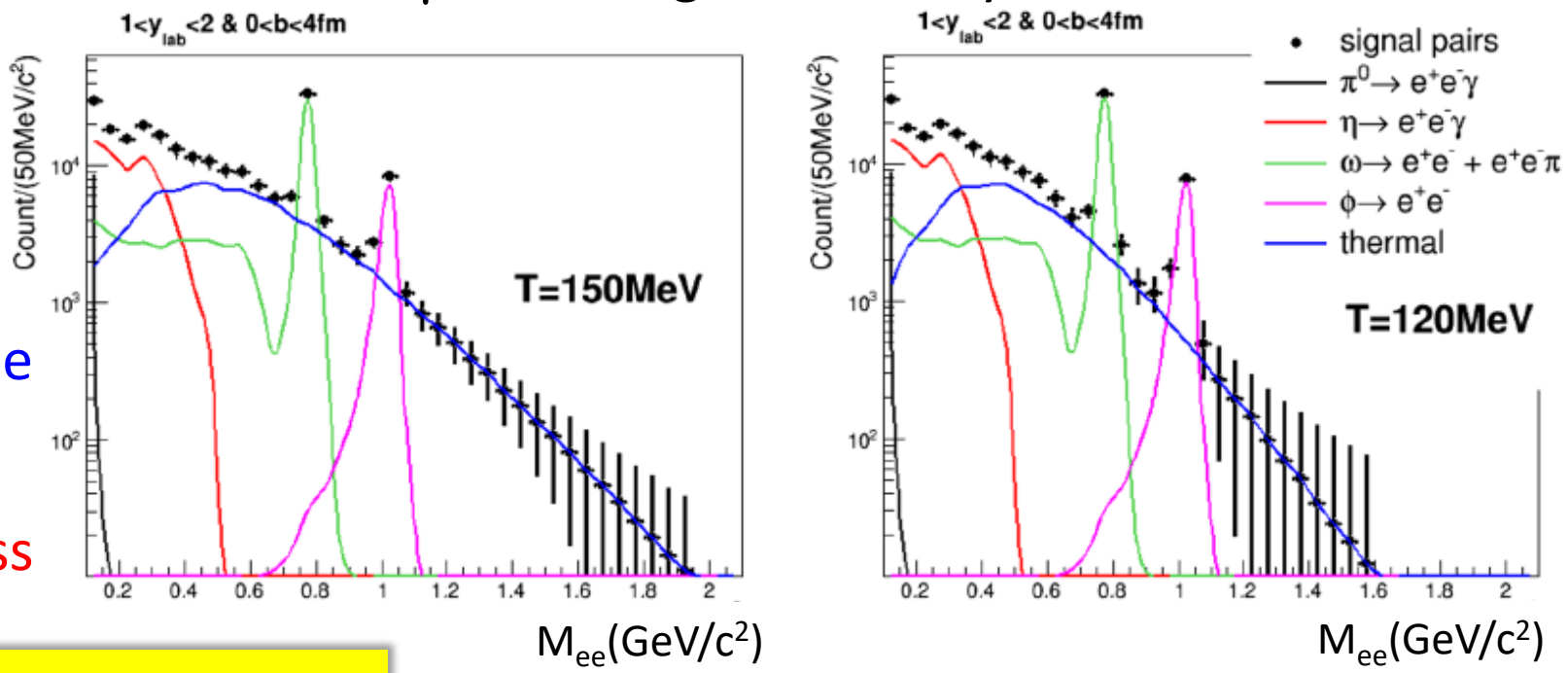
Expected Result

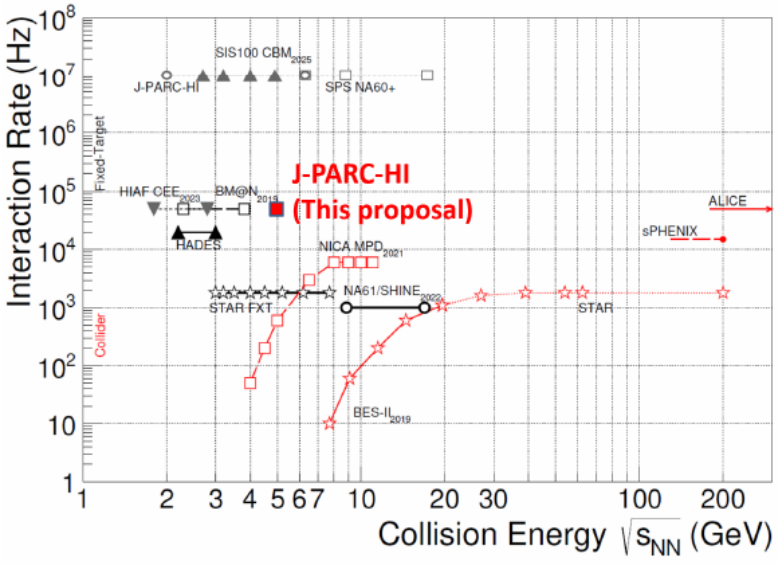
Temperature will be measured with a good accuracy from mass slope at IM region

- about 10%(stat) accuracy in the case T=120-150MeV

About 20%(sys) accuracy for excess yield at LM region.

35μm Au target & 100days run





Summary

- J-PARC Heavy Ion Project is considered with the reuse of KEK-PS Booster. It will achieve 10^8 ions per spill.
- Di-electron measurement with the upgraded E16 spectrometer will be the first experiment of J-PARC-HI.
- The experiment will measure the temperature of the fireball with the accuracy of ～10%