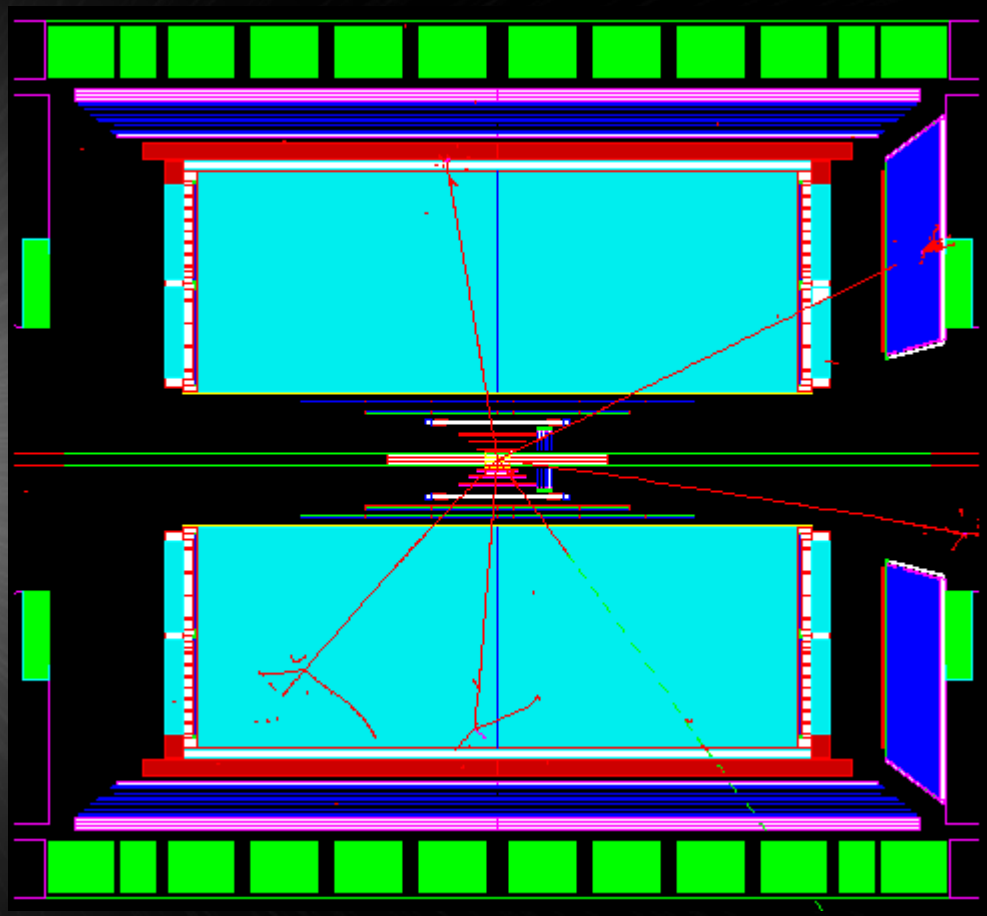
STAR tracking upgrade



IGT
SSD
IST FST FGT
HFT

Gerrit van Nieuwenhuizen
RHIC & AGS Users' Meeting
BNL, June 22, 2005

Physics

STAR pp/spin

Probing the proton sea

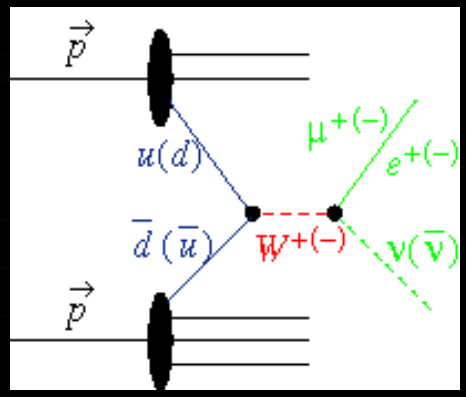
Gluon contribution to the proton spin:

Inclusive- and di-jet production

Inclusive pi-zero production

Prompt photon production

Heavy-Flavor production



Flavor decomposition of quark and anti-quark polarization in W production

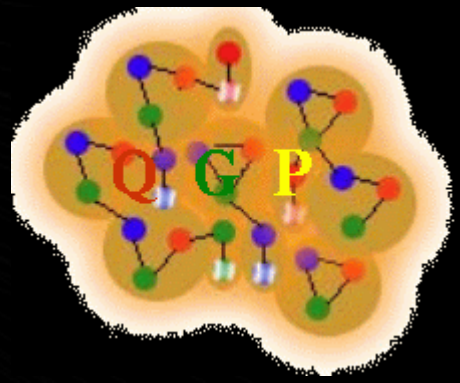
STAR Heavy-Ion

Heavy-Flavor physics

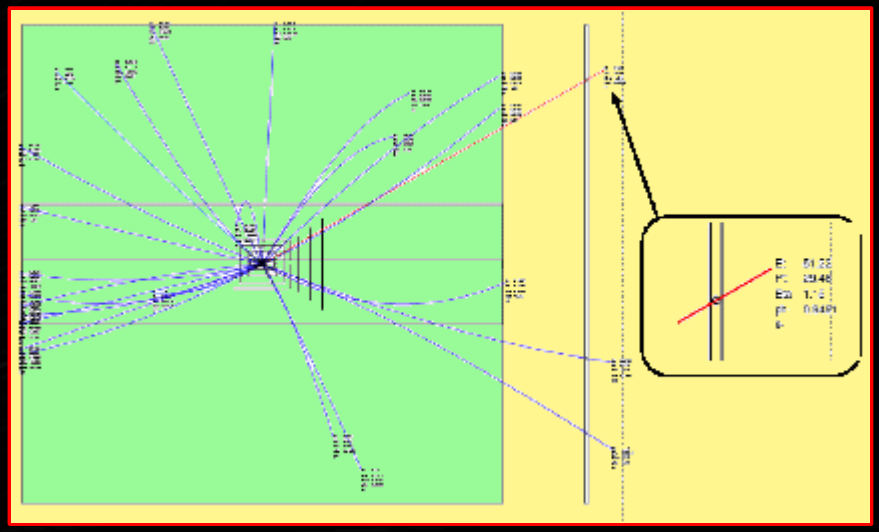
Spectra

Elliptic flow

Heavy-Flavor energy loss



Tracker requirements

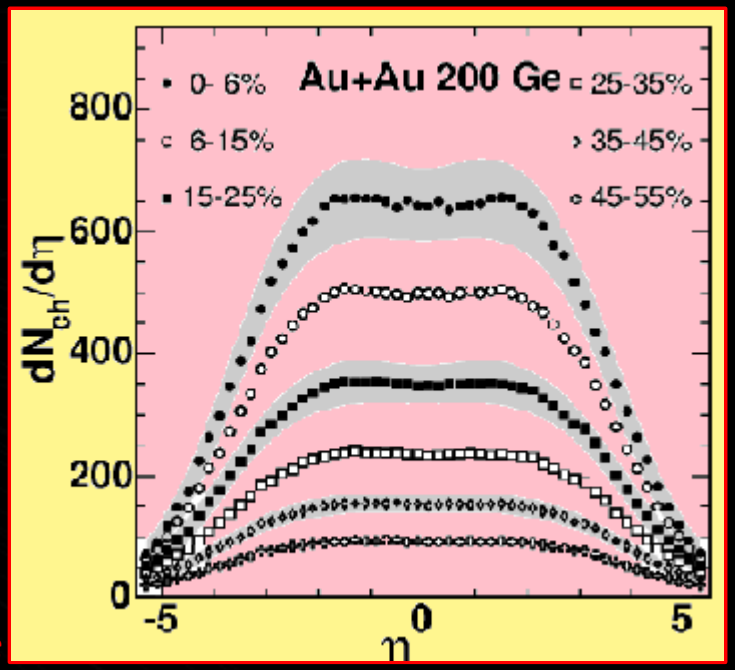


W production

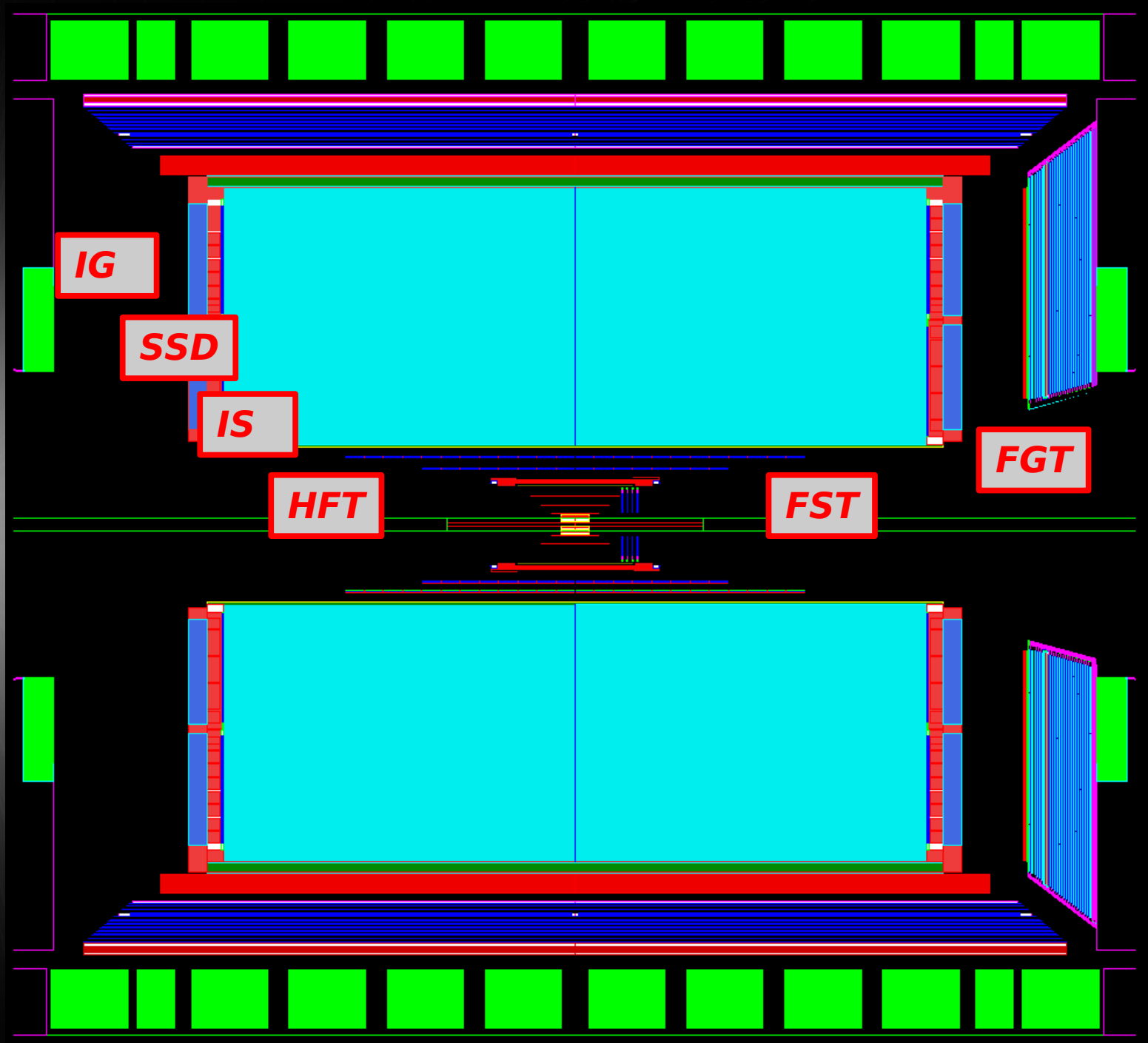
Tracking in forward direction, 1<eta<2
e+/e- charge discrimination, sagitta ~2.5mm for Pt~30GeV/c

Heavy Ion program (& pp Heavy-Flavor)

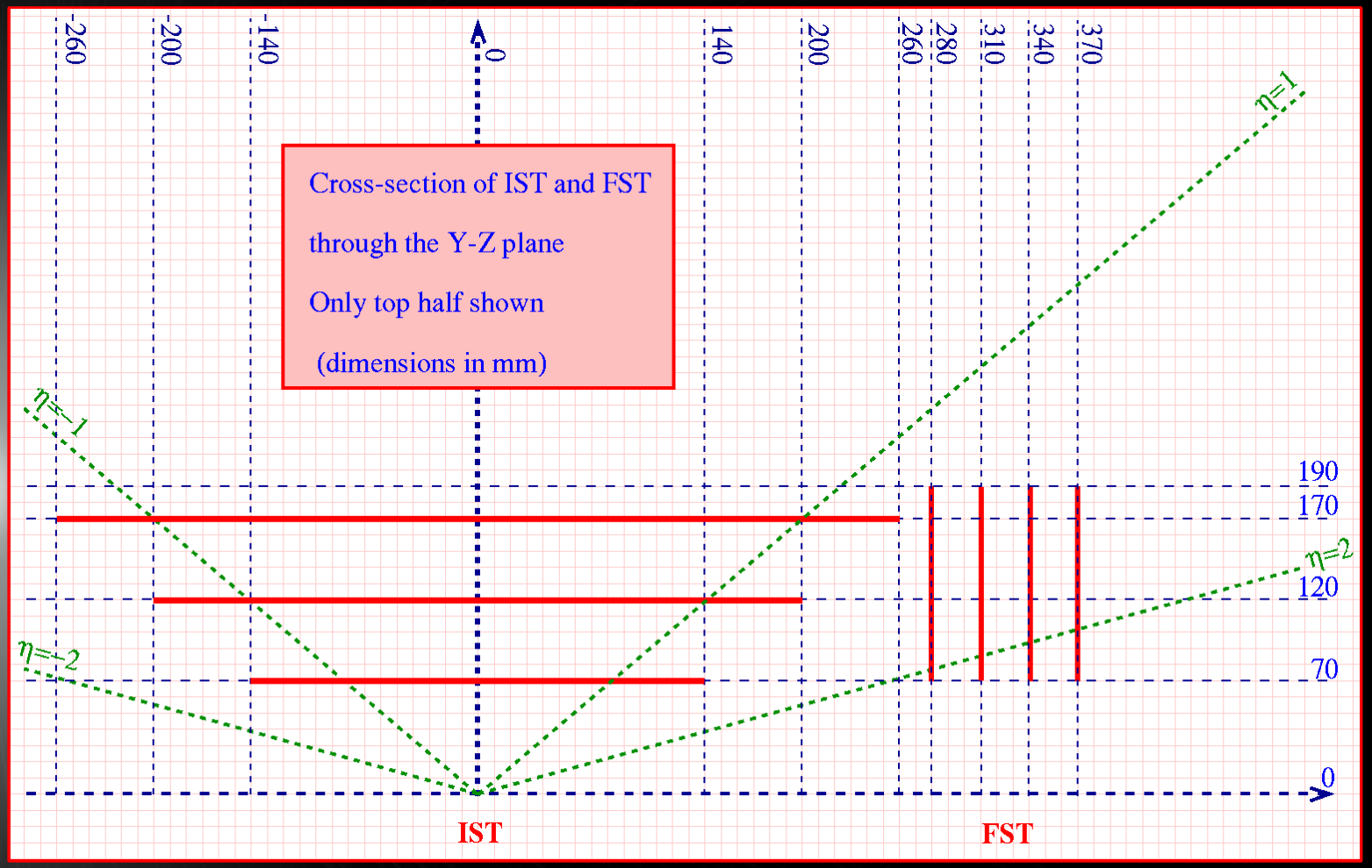
High precision tracking
DCA resolution of ~20um
Low mass
Connect uvertex detector with TPC
Deal with overlapping events with high multiplicities



STAR Tracking Upgrades

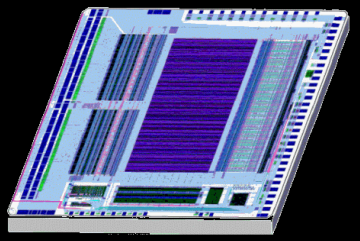


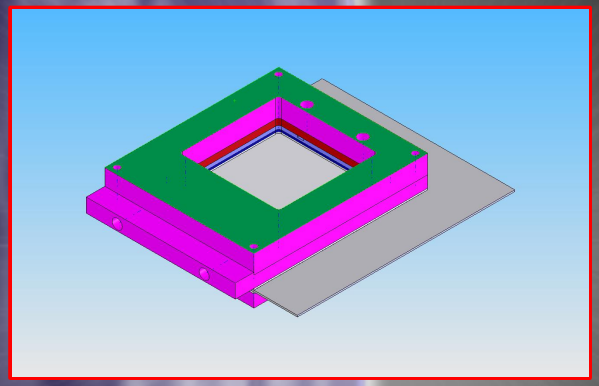
Required layout for Silicon Tracker



3 layer barrel & 4 forward disks of stereo angle silicon strip pairs 100% 3-hit efficiency for -5 < Zvertex < +5cm (for hermetic layers)

Technology choices for IST,IGT,FST and FGT



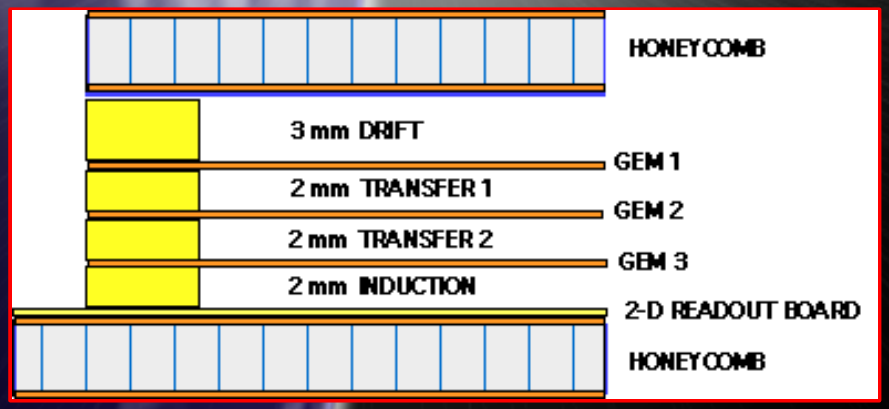


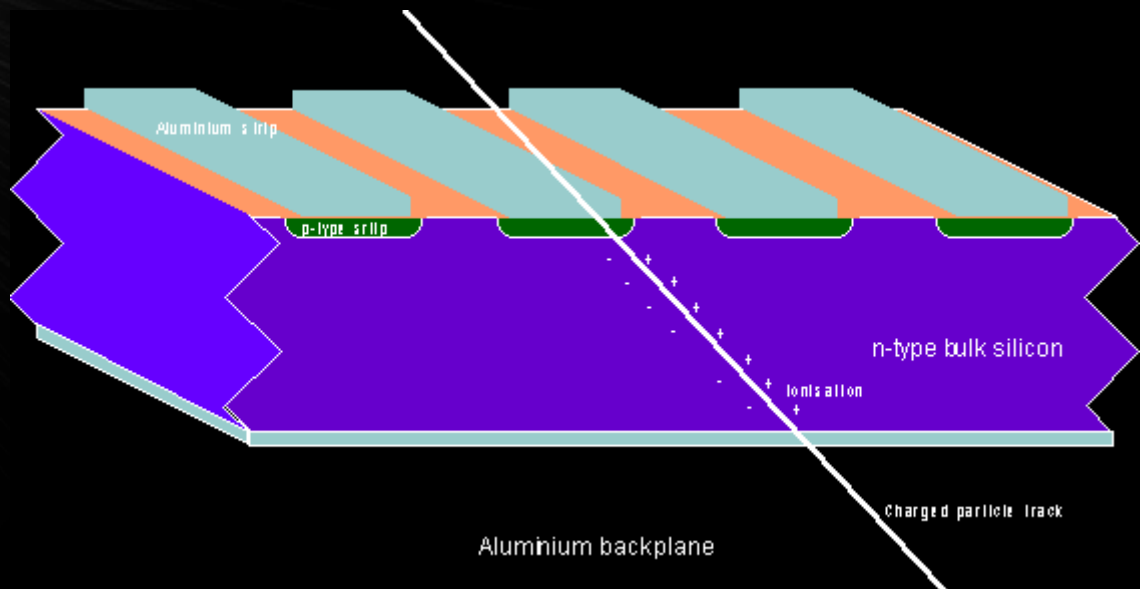
Conservative

Existing APV25-S1 readout chip (CMS) everywhere

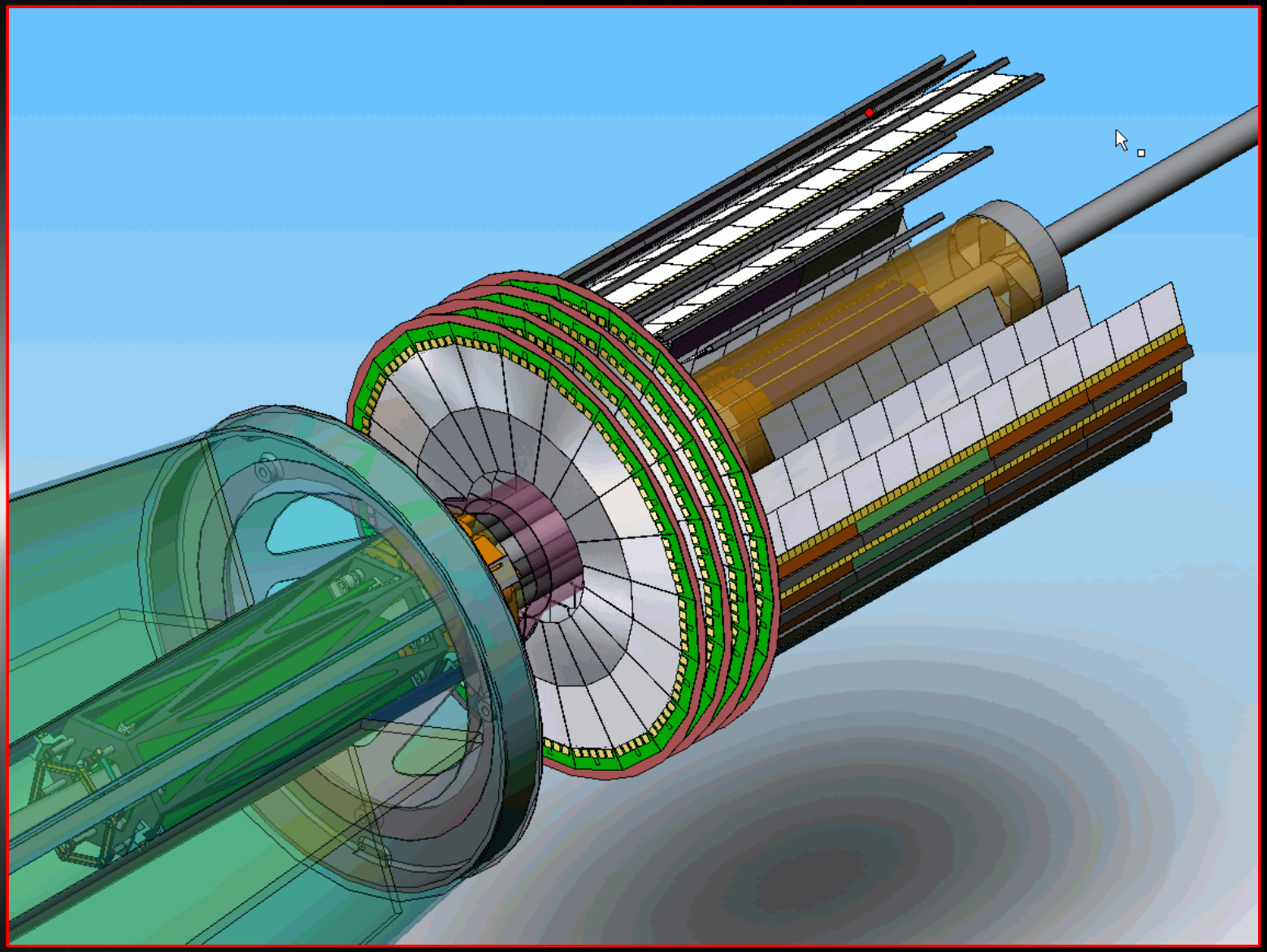
Single sided ac-coupled silicon strip sensors
(quotes from Hamamatsu received)

Triple foil GEM detectors



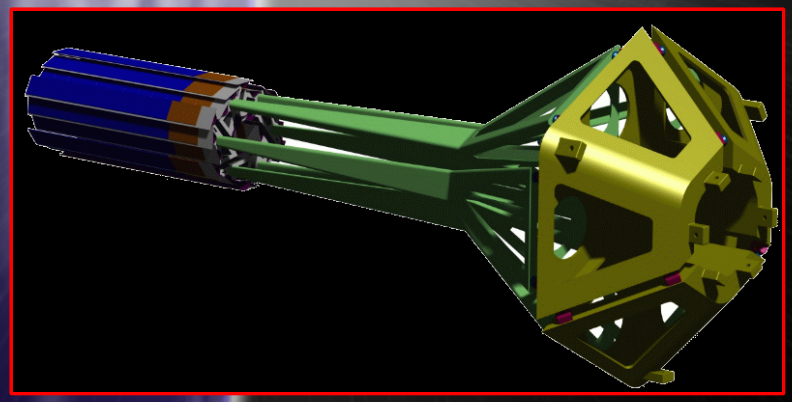


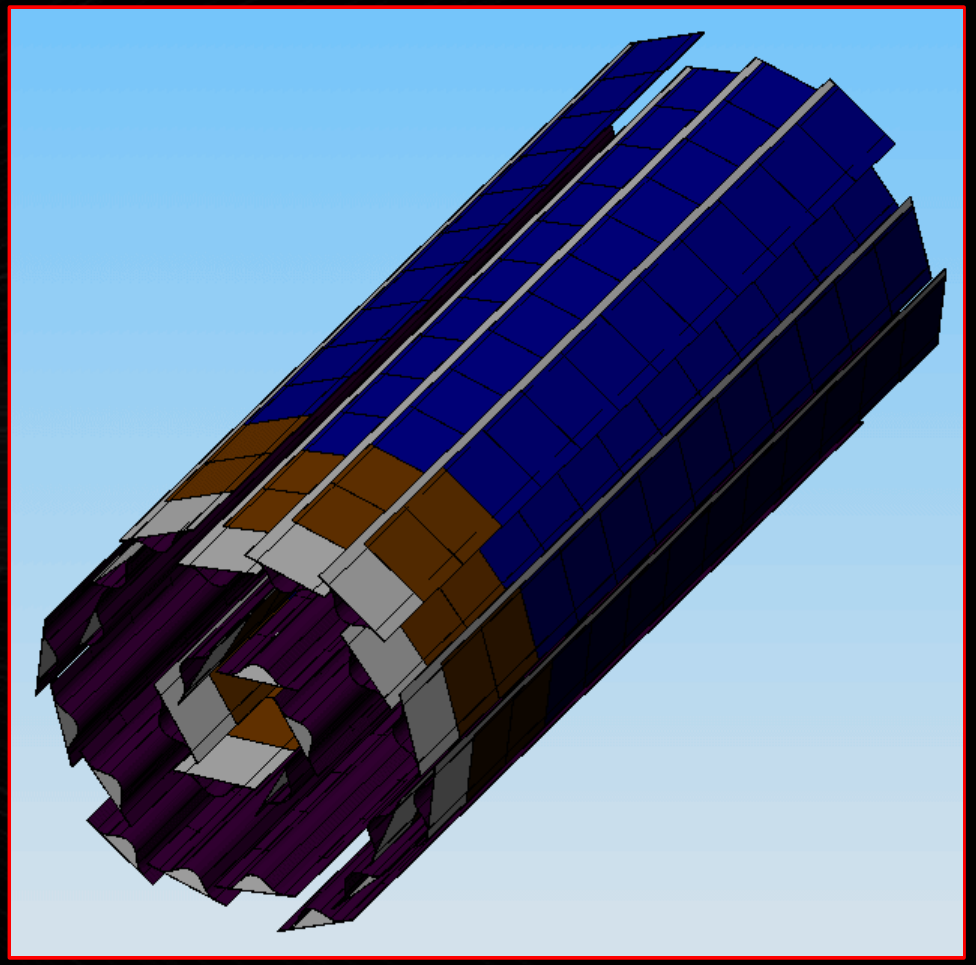
Inner Tracking design



MIT BATES responsible for mechanical integration

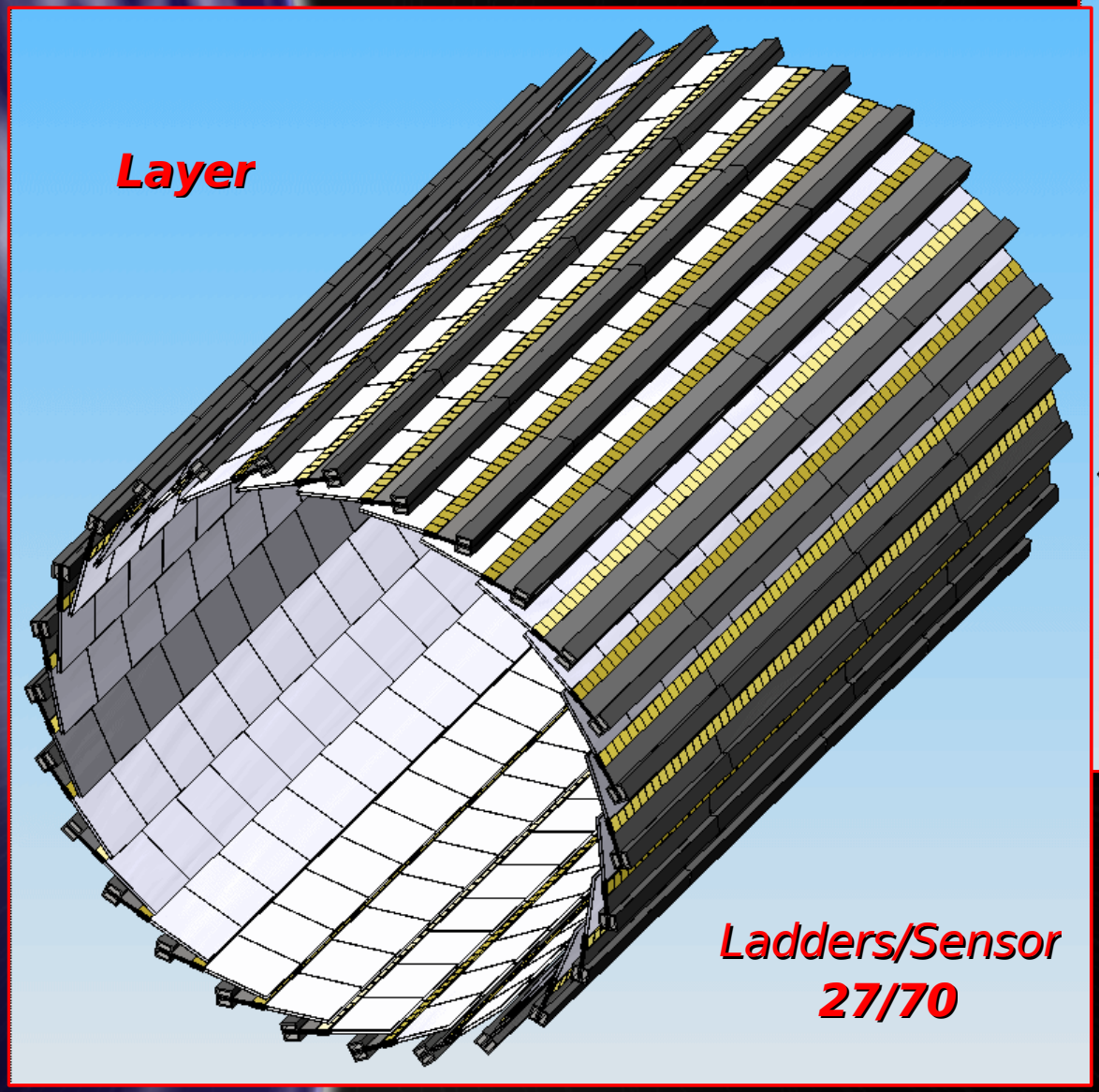
Heavy-Flavor Tracker

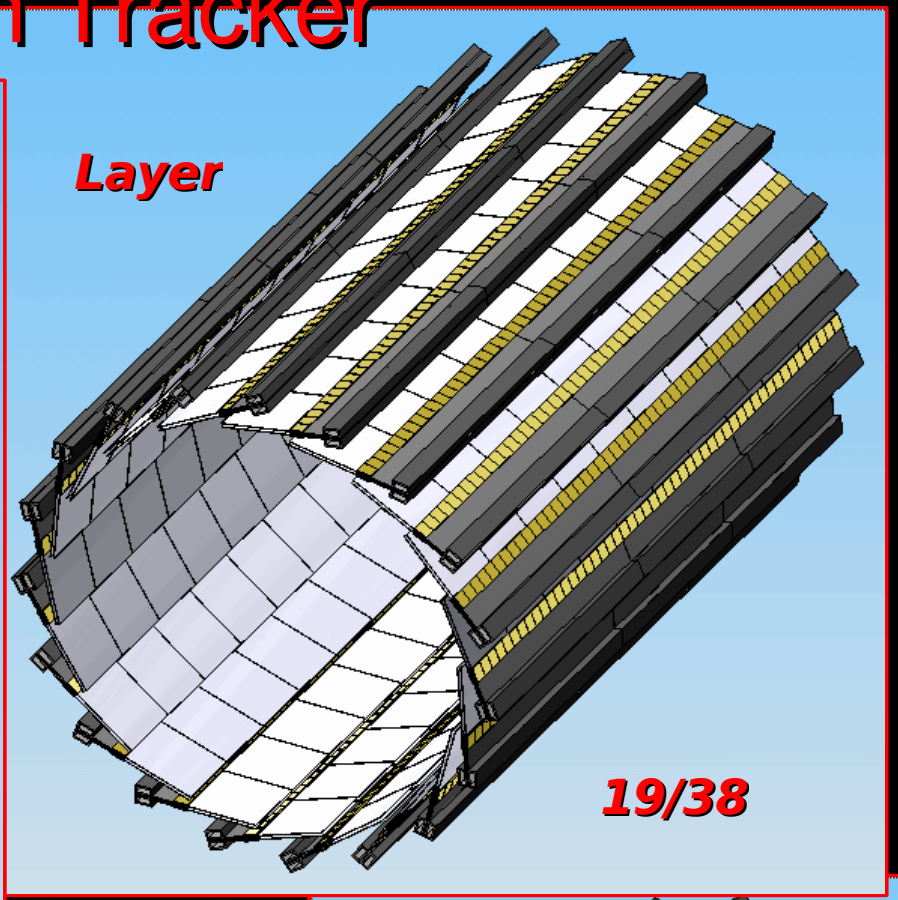


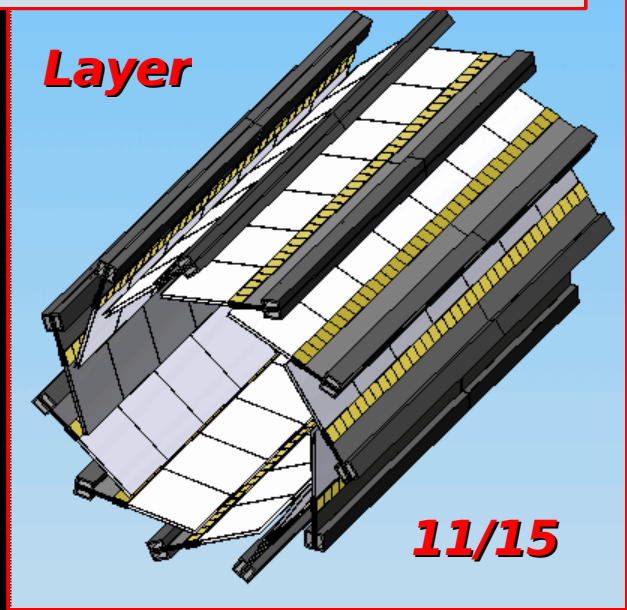


See Jim Thomas' talk

Inner STAR/Silicon Tracker



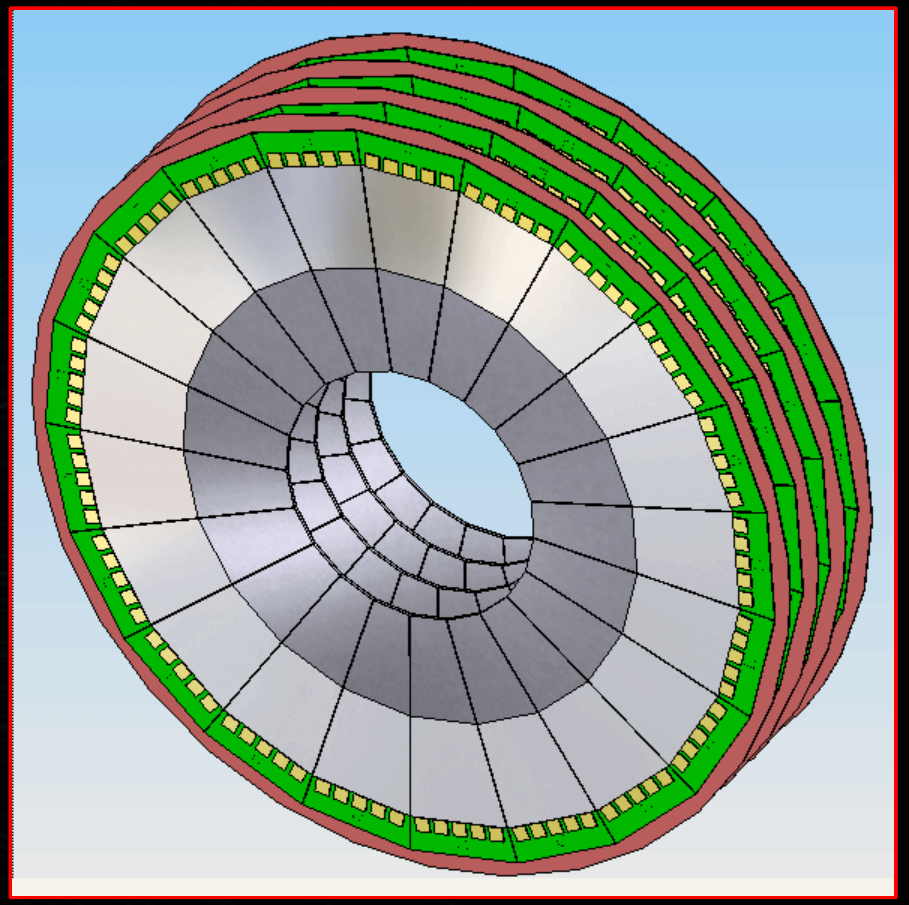


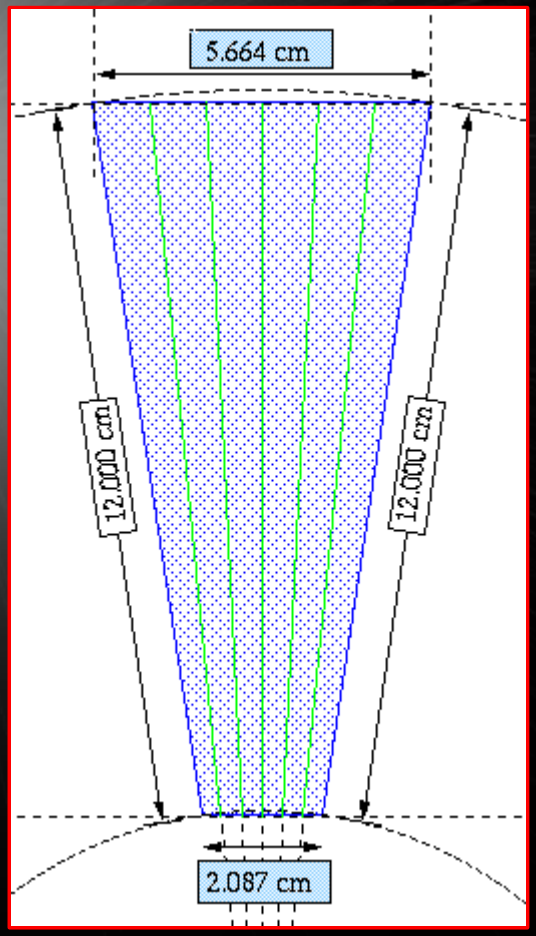


Using 40x40 mm^2 single sided silicon strip sensors arranged in stereo pairs (~ 2 m^2)

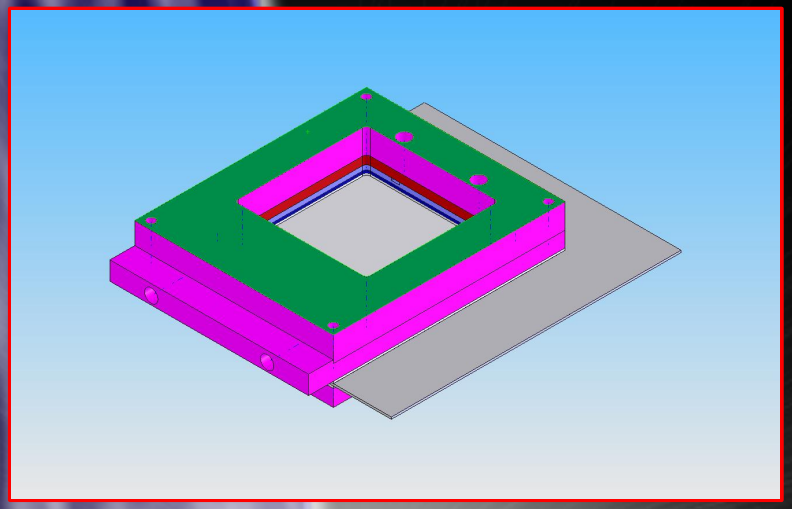
Forward STAR/Silicon Tracker

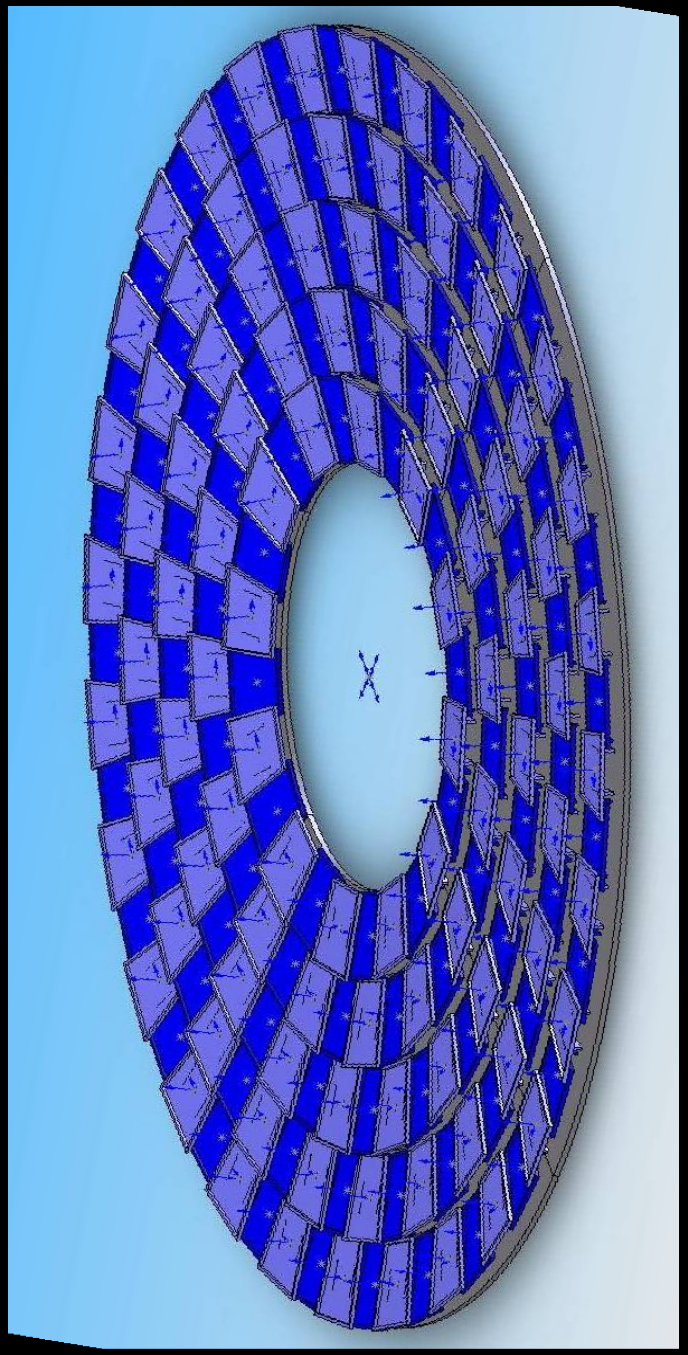
4 disks
21 sectors per disk
2 sensors per sector
(stereo, back-to-back)
336 silicon sensors total





Forward GEM Tracker





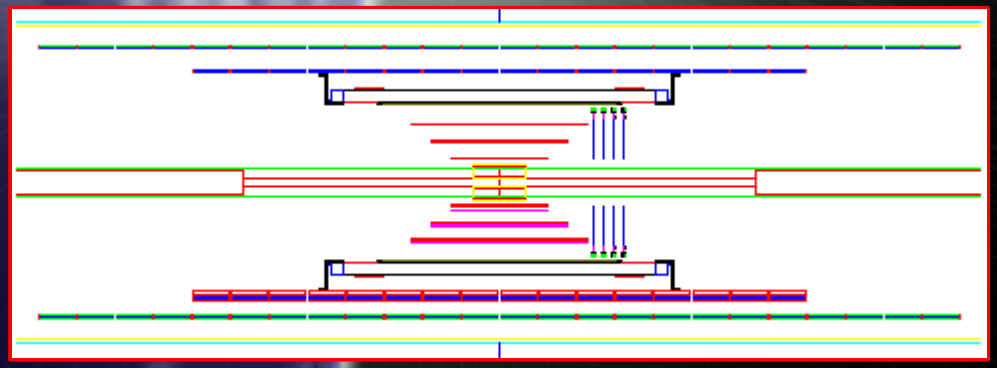
180 identical(!) triple GEM

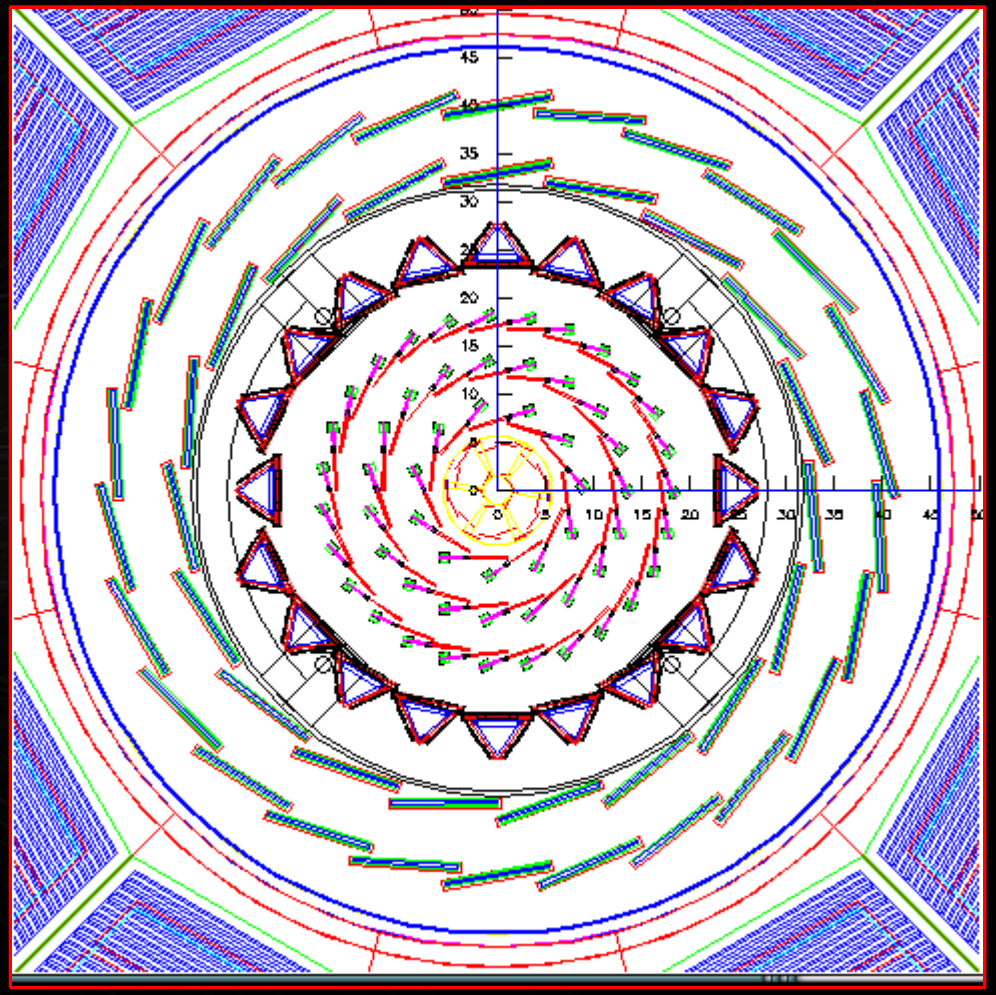
Mechanical design by MIT BATES

Current Central Simulation geometry

From the inside out:

- ***Heavy Flavor Tracker***
- ***Inner STAR Tracker***
- ***Silicon Strip Detector***
- ***Inner GEM Tracker***
- ***Time Projection Chamber***





Simulation geometry has been finalized
Simulations will start next week

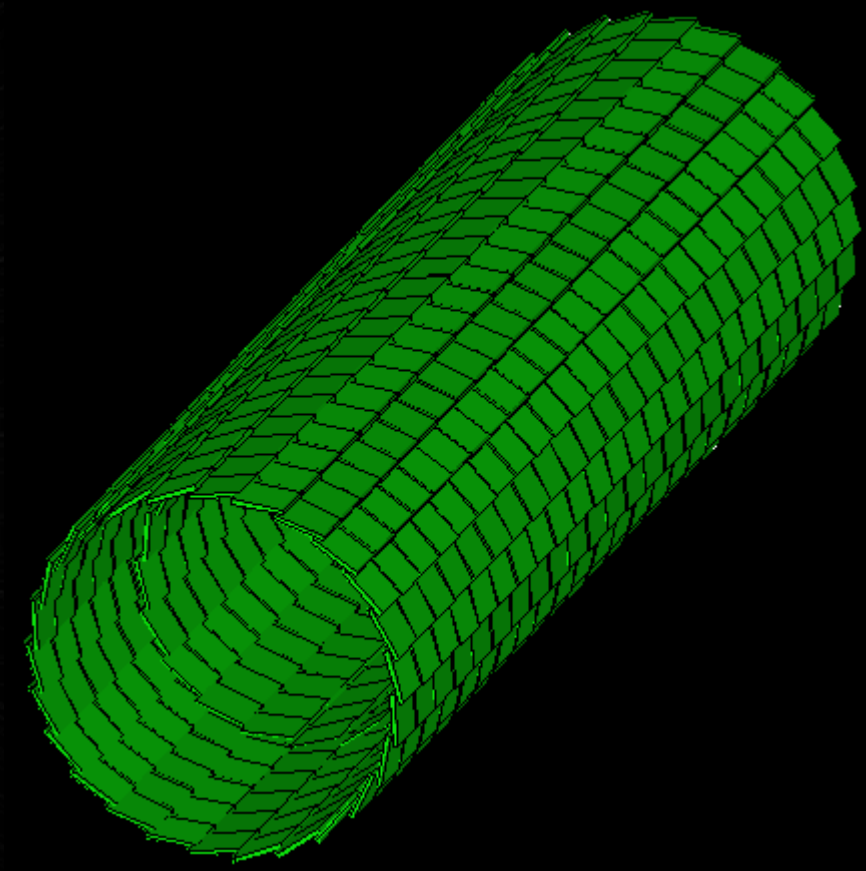
Inner GEM Tracker

Each module 10 x 10 cm

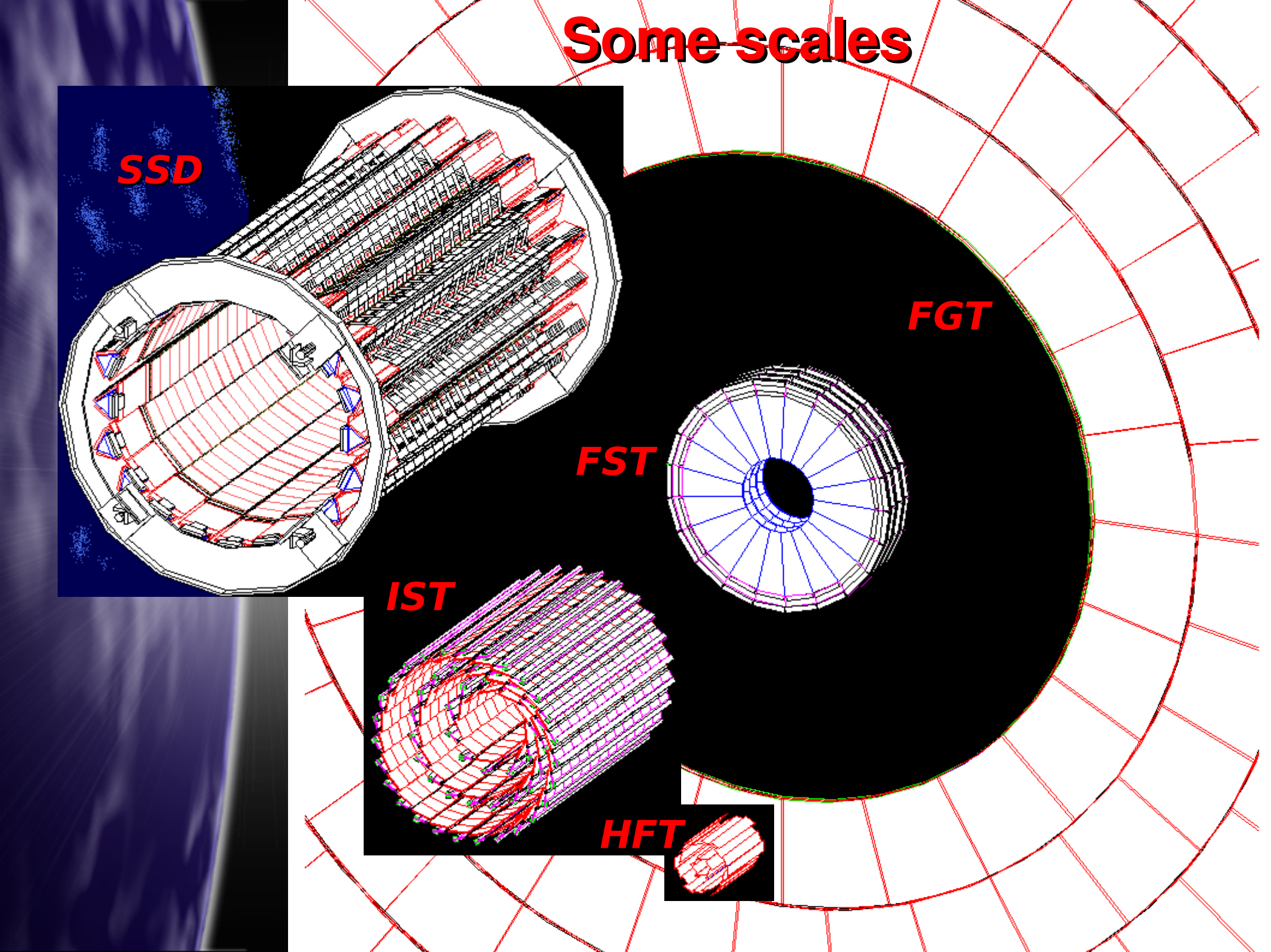
2 barrels

928 GEM modules

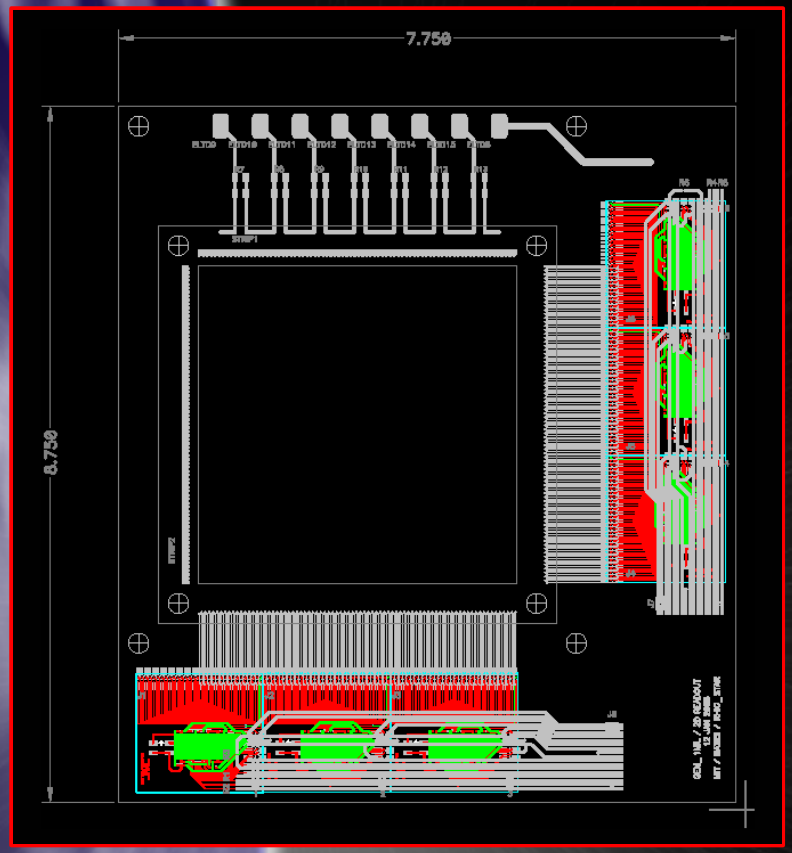
About 2.5 m long



Some scales

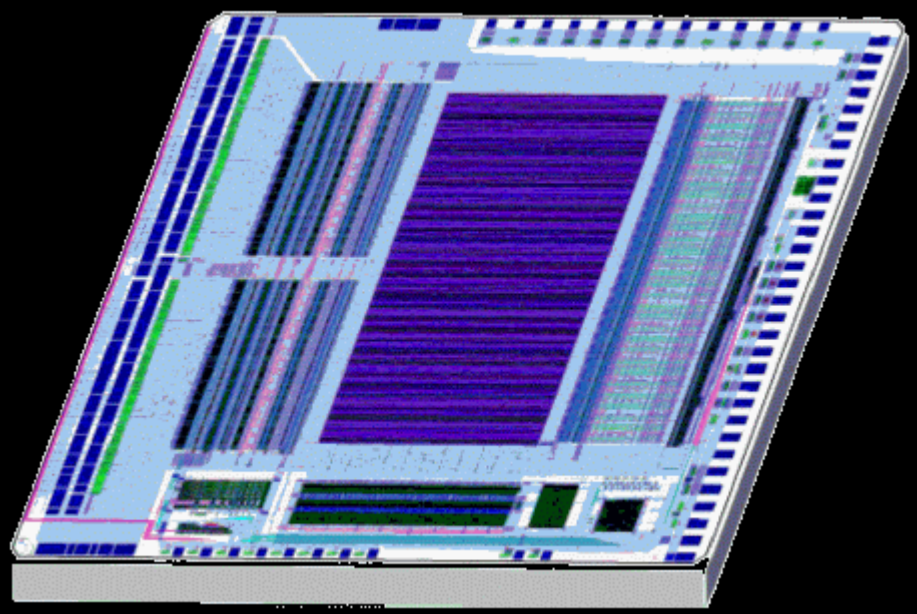


Readout R&D

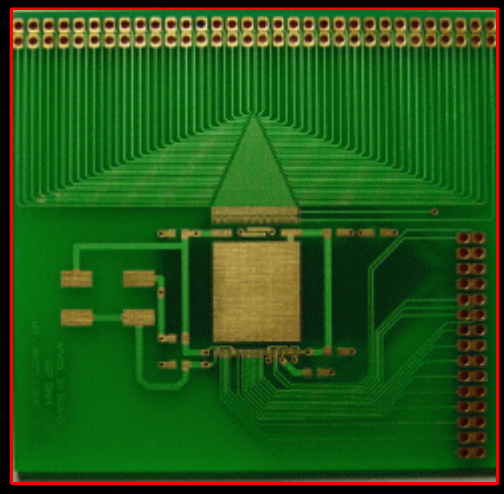


GEM readout board with chip piggy-backs
20 boards ordered

APV25-S1 readout



Single chip readout board



Same readout system for IST, IGT, FST and FGT!
DAQ1000 compatible
Profiting from TOF developments

GEM prototype

Participating institutions, so far....

ARGONNE NATIONAL LABORATORY

INDIANA UNIVERSITY CYCLOTRON FACILITY

BERKELEY LAB

UNIVERSITAS STUDIORUM ZAGRABIENSIS MDCLXIX

BROOKHAVEN NATIONAL LABORATORY

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LNS LABORATORY FOR NUCLEAR SCIENCE

Massachusetts Institute of Technology
Bates Linear Accelerator Center

YALE UNIVERSITY

Active human resources

DAQ & chip readout

Miro Plesko

Dave Underwood

Mechanical design

Gerrit van Nieuwenhuizen

Jim Kelsey

Doug Hasel

Silicon procurement

Gerrit van Nieuwenhuizen

GEM R&D

Doug Hasel, Bernd Surrow

Dick Majka, Nicolai Smirnov

Hal Spinka, Dave Underwood

Kerry Kernie (Tech Etch)

GEANT geometries

Maxim Potekhin

Gerrit van Nieuwenhuizen

Dave Underwood (TPC endcap)

Simulations

Mike Miller

Mirko Planinic

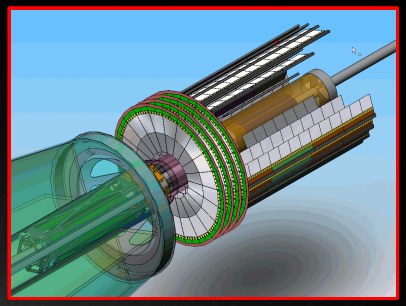
Willie Leight

System integration

TBA

Coordination

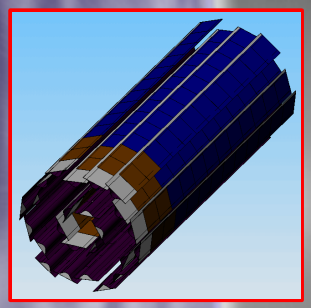
Bernd Surrow, Ernst Sichterman

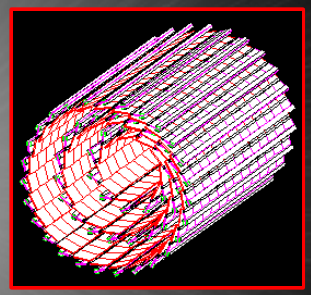


Time lines

Current scenario

Stage 1: Active pixel HFT with a minimal IST based on silicon strip technology



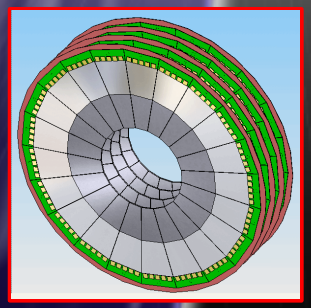


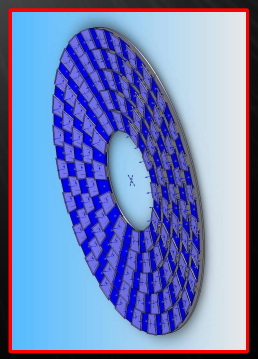
Proposal HFT in beginning of 2005

Proposal IST in fall 2005

Installation in summer 2008

Stage 2: Upgrade forward tracking with IST and FGT





Proposal FST and FGT in summer 2006

Installation in summer 2009

Note: IGT not yet incorporated