sPHENIX/MAPS Pre-Proposal Outline

- Executive Summary (1~2 pages)
  - Science highlights
  - Mission Need
- Physics Goals (~2 pages)
  - B-jet physics at intermediate pT (>10 GeV)
  - B-hadron physics at low pT (<10 GeV)
- Detector Requirements (~2 pages)
  - Tracking impact parameter resolutoin
  - B-tagging in AuAu
  - Readout rate
- Physics Performance (~2 pages)
  - B-tagging
- Technical Scope and Deliverables (~2 pages)
  - Stave assembly and testing
  - Readout
  - Mechanical structures
- Organization and Collaboration (1~2pages)
- Schedule and Cost Baseline (3~5 pages)

Tasks and Timeline

- Pre-proposal writing
  - Identify required resources and timeline
    - Intended contributions from each institution
  - Electronics and readout – LANL
  - Mechanic system, cooling and integration – MIT
  - Mechanical carbon structures and simulations – LBNL?
  - Ancillary and other systems – other collaborators
  - Frist draft by mid December 2016, for sPHENIX collaboration meeting, discuss future path
  - A draft by January 2017? Discussions with DOE during Feb budget meeting

- MAPS detector subgroup to identify and work on:
  - Tasks, Resources and Responsibilities for each institution
  - Agreement on each institution's interest and available resource
  - Starting joint R&D on critical tasks
    - LDRD, associate members and other R&D fund etc
    - readout

- More communications with DOE
  - Based on updated resource loaded Cost and Schedule from pre-proposal
  - Then decide on next step
    - either go forward or not, work out a plan with DOE
  - Get more support from ALD & DOE on CERN-SPHENIX agreement etc.
  -

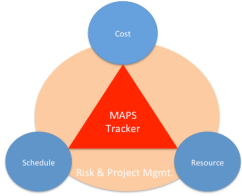
- Full proposal writing after discussion with DOE in Feb 2017?
  - Submission, ~May 2017?
  - Reviews, by CD-1
  - Aiming for Fed. Budget FY2020 start up?
- Can we do it for an earlier startup, FY19?
  - MOU/Agreement with CERN on MAPS production ? ---- DOE – CERN Agreement?

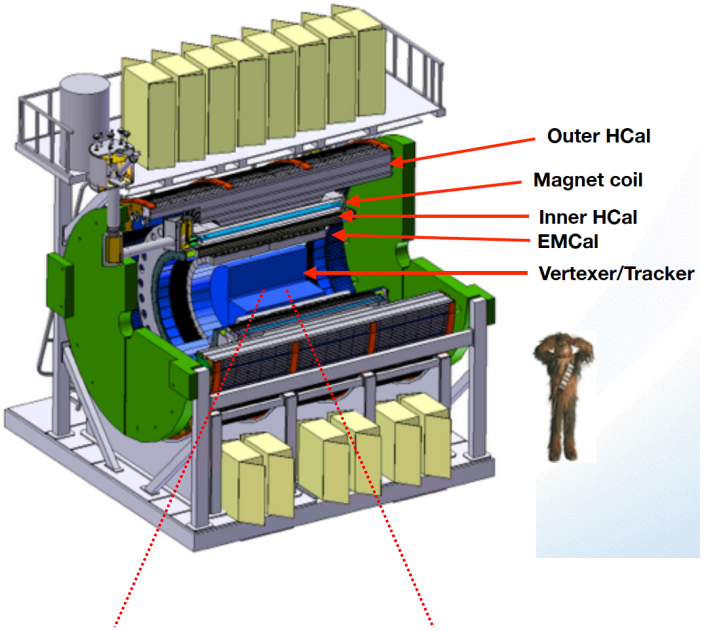
CERN-BNL "MoU" for sPHENIX Production: a Proposal

- Defined the minimal scope of the project in the MoU
  - A 3-layer MAPS detector identical to ITS/IB
    - 48 staves + 40% spares = 68
  - MAPS chips
    - 68 fully tested staves, 68x9=612 chips
    - 20% fully tested spare MAPS chips, 612x20% = 122 chips
    - Total 734 MAPS chips
  - Flexible PC boards (FPC) with connectors and cables
    - One per stave, 68 of them
    - Cables and connectors customized to meet CERN safety rules
      - Luciano/CERN will send documents to confirm they also meet BNL safety standards
  - Fully assembled and tested Staves
    - Preparation and cleaning of MAPS, FPCs and frames etc.
    - Alignment and gluing
    - Wire bonding
    - Assembly work mostly done by CERN techs
    - Final testing mostly by sPHENIX students/postdocs/techs
  - Mount staves on the ITS/IB space frame, ship fully tested space frame to BNL
    - Space frames to mount staves
    - Cold plates
    - Electrical connectors etc.
    - Mechanical tubes/connectors
    - Metrology done at CERN
  - Setup a construction DB for sPHENIX production
    - Traveler documents

- All produced at CERN by ALICE ITS production lines
  - CERN technicians and facilities
  - With help frpm sPHENIX students/postdoc + some Techs

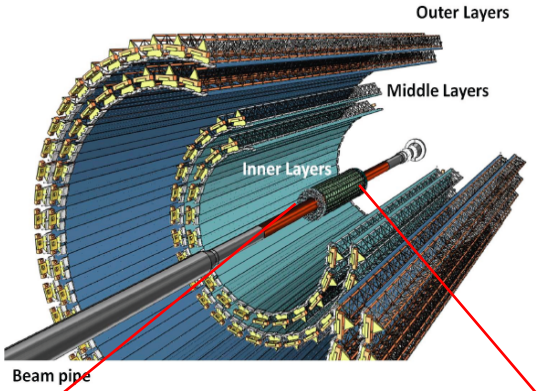
sPHENIX MAPS Inner Tracker

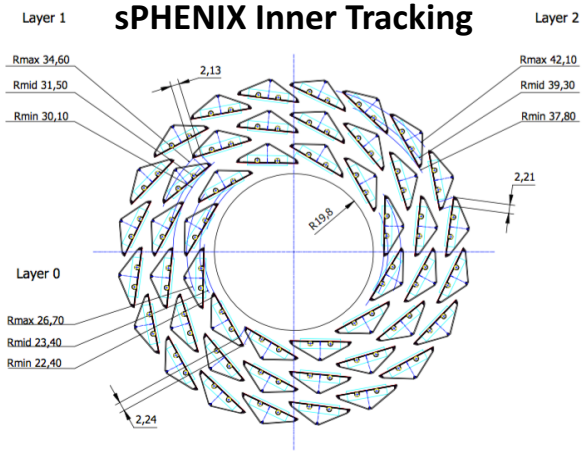


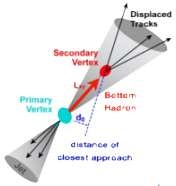


Key issues:
- Readout
- Mechanics

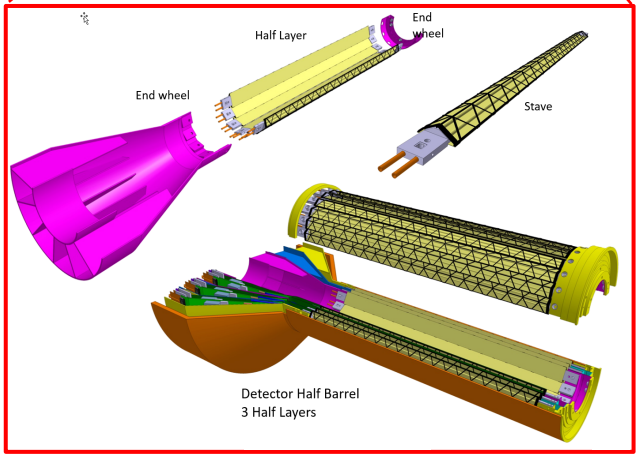
ALICE ITS;
Inner Tracker System



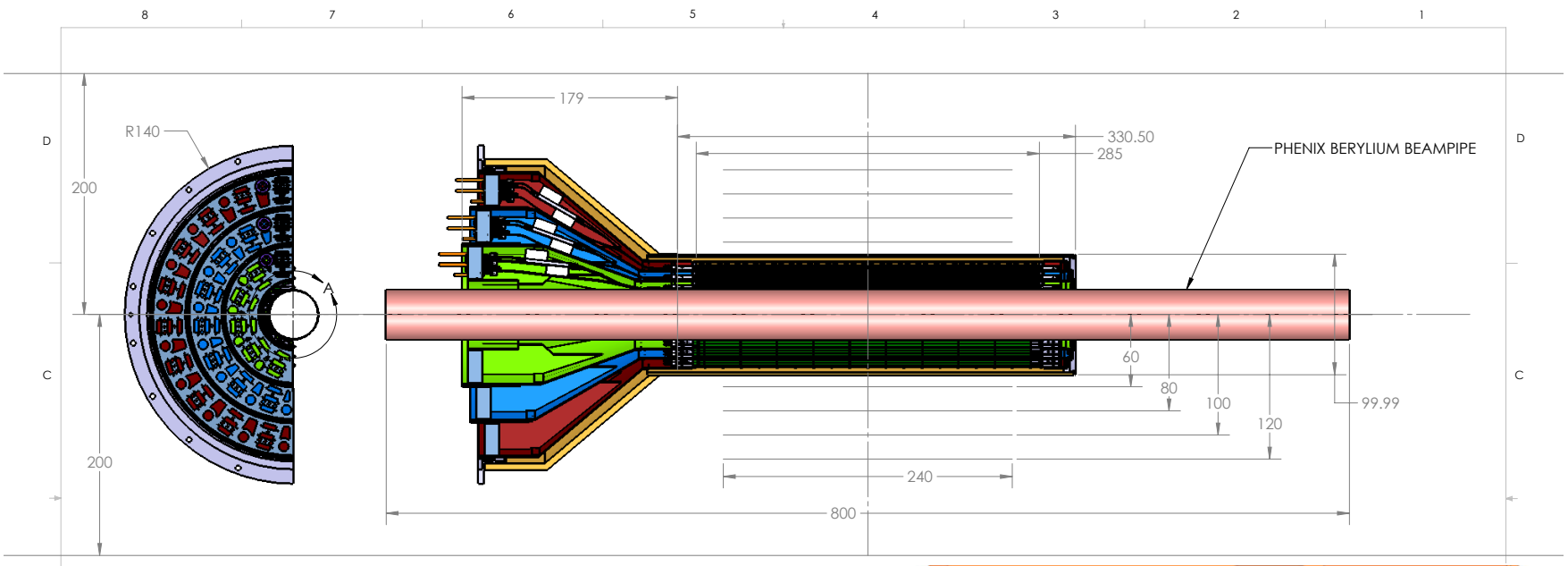




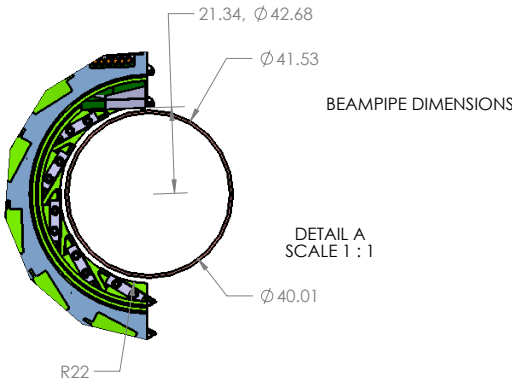
Copy of ITS
Inner Tracker

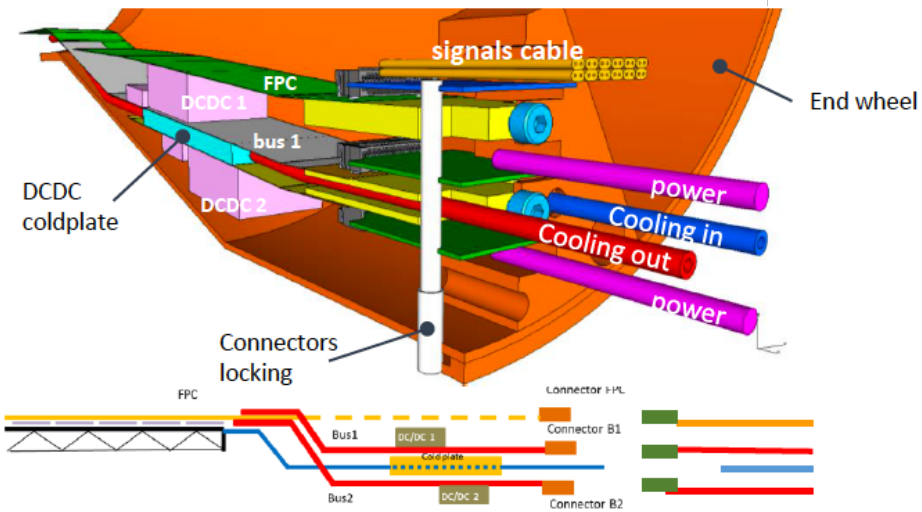


sPHENIX MAPS Inner Tracker

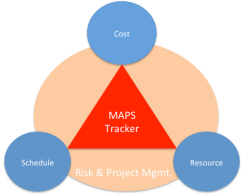


~1mm gap in R



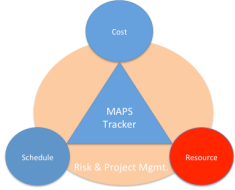


Scope of the Project



- MAPS & Electronics
  - MAPS Detectors
    - MoU to build 68 ITS MAPS staves (40% spares)
    - No modification
  - Readout Electronics
    - Use ALICE/ITS, RDO + CRU
    - Modify/reprogram CRU for sPHENIX
      - Plan-B: build a custom board to convert ALICE/ITS into sPHENIX DAQ format
    - R&D by LANL LDRD
  - Production
    - Extend ALICE/ITS MAPS stave production
    - Train sPHENIX personnel for assembly and testing staves at CERN
    - Reproduce additional ALICE RDO+CRU for sPHENIX
  - Ancillary systems
    - LV, cables, crates, racks etc.
    - Slow control, safety and monitoring
- Mechanics & Cooling
  - No/(some) changes to ALICE/ITS inner tracker mechanical structures
    - End Wheels
    - Cylindrical structure shells
    - Detector half barrels
    - Service half barrels
    - Detector and Service half barrels
    - Half support structures
  - Mechanics Integration
    - Conceptual design by LANL LDRD
    - Prototype by sPHENIX R&D
    - Design integration frames
    - Cage etc.
    - Installation tooling etc.
  - Copy ALICE cooling plant design
    - Minor modification to fit sPHENIX
    - Smaller heat load than ALICE ITS
  - Metrology and Survey

Participating and Interested Institutions

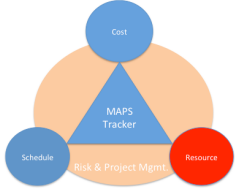


- LANL - Readout & FEMs, Mechanics
- MIT - Assembly and testing, cooling…
- LBNL – Mechanical carbon structures, simulations
- BNL – Integration and services, safety and monitoring
- UT-Austin – MAPS readout electronics and testing
- Univ. of Colorado – sPHENIX DAQ/DCM-II integration
- Univ. of New Mexico – LV, cabling & connectors
- New Mexico State University – Tracking algorithm and simulations
- Univ. of IL of Chicago – Stave assembly and testing, offline analysis
- Iowa State University – Assembly and testing, simulations
- Georgia State University - Slow control and monitoring
- Florida State University - Offline and simulations
- Univ. of California, Los Angeles – Assembly and testing, simulations
- Univ. of California, Riverside – Assembly and testing, simulations
- RIKEN/RBRC, Japan – Assembly and testing, integration
- Yonsei, Korea – MAPS QA and readout, simulations

- Czech Republic - Miroslav/Mike Finger, Caclav Vrba et al , tasks TBD
- Peking Univ. – many good students (already on CMS)
- CCNU – already working on ALICE/ITS 5th layer, many students

Potential collaborators

Organization Chart



From Sep. 2016 Tracker Review

BNL Program Manager

sPHENIX Project Office
Manager: Ed O'Brien

sPHENIX MAPS Project Office
Project Manager: *Ming Liu (LANL)*
Deputy Project Manager: *Mike McCumber (LANL)*
Electrical Engineer:TBD
Mechanical Engineer: Walt Sondheim? /MIT?

sPHENIX Management
Spokespersons
Gunther Roland
David Morrison

- *Readout* *UT/LANL*
  - *FEM* *M. Prokop LANL*
  - *Slow Control & Monitoring* *BNL*
  - *DCM Integration* *Colorado*
- *MAPS Sensor* *ALICE*
  - *Sensor Design* *ALICE*
  - *Sensor Production* *TowerJAZZ*
  - *Sensor QA* *Yonsei(Korea)*
- *Stave* *ALICE*
  - *Stave Design* *ALICE*
  - *Stave Assembly* *MIT/UIC/LANL*
  - *Stave QA* *MIT/ISU*
- *Cabling* *UNM*
  - *High density cables* *UNM*
  - *LV* *UNM/NMSU*
  - *Fibers* *UNM*
- *Mechanics* *LBNL/MIT*
  - *Structure Design* *LBNL/MIT*
  - *Assembly* *LBNL/MIT*
  - *Installation* *MIT/LBNL*
- *Integration* *MIT*
  - *Cooling* *MIT*
  - *Alignment* *BNL/UIC*
  - *Mechanical Stability* *BNL*
  - *Safety System* *BNL*
- *Electrical* *BNL*
  - *Low Voltage* *UNM/NMSU*
- *Software* *UIC/FSU*
  - *Simulation* *ISU/GSU/LBNL*
  - *Offline* *NMSU/FSU*
  - *B-jet tagging* *LANL,NMSU*