

PHENIX FVTX (Forward Silicon Vertex) Proposal to DOE

Enable a complete onia + open-heavy physics picture

- open-charm constraints on J/ψ regeneration
- consistent gluon saturation picture from onia and charm/beauty
- gluon polarization via charm & beauty over broad x range

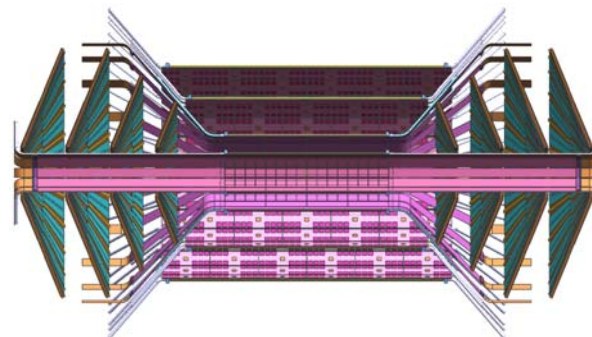
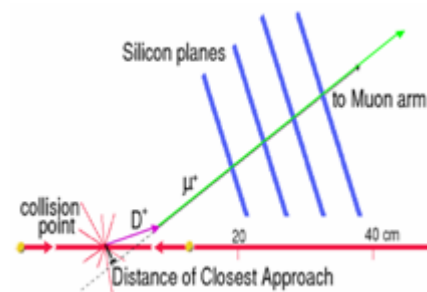
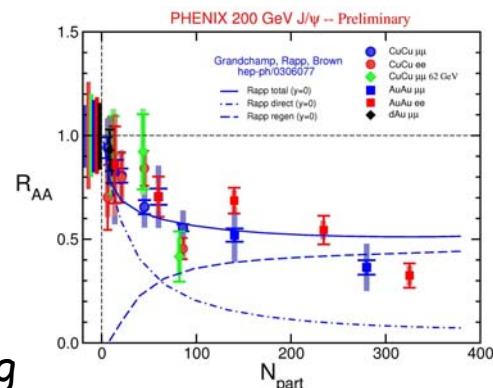
Identification of forward/backward detached vertices:

- rejection of π & K decays to clean single & pair spectra; including enabling continuum physics (e.g. D - Y) and multi-arm dimuons
- $B \rightarrow J/\psi X$ & open-heavy at large p_T
- improved J/ψ , ψ' mass resolution/separation via improved position vector at vertex

Detector/project synopsis:

- $<200\mu\text{m}$ z_{vtx} resolution; $<1.5\%$ central AuAu occupancy
- fast trigger to enrich & enable timely physics
- 4 mini-strip silicon umbrellas in front of each muon arm
 - $50\mu\text{m}$ pitch in radial direction
- $\sim 2\text{M}$ channels with PHX/FNAL chip
- $\$4.5\text{M}$ cost with completion target end FY10

Proposal draft: https://www.phenix.bnl.gov/phenix/WWW/publish/leitch/fvtx/fvtx_xx.doc



Outline of FVTX presentations

- This "executive summary" (15m) - MJL
- Physics & simulation (25m) - Melynda Brooks
- Detector Details (20m) - Gerd Kunde
- Integration (10m) - Walt Sondheim
- Cost, Schedule, Mgmt (20m) - Dave Lee
- Run for the Holiday party...



Highlights of physics advances with FVTX

Study of dE/dx & flow for heavy-quarks into forward/backward rapidity

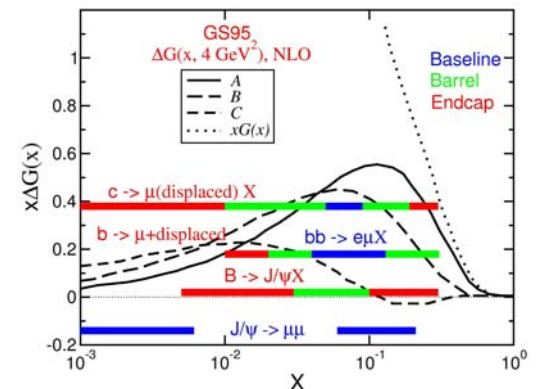
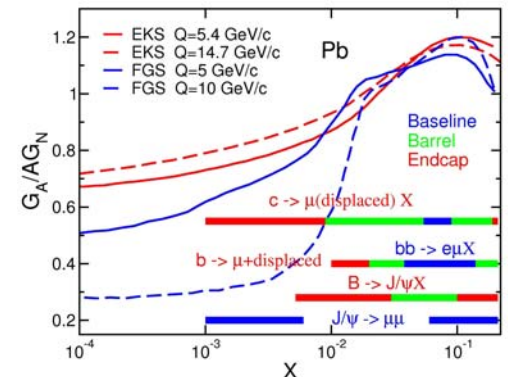
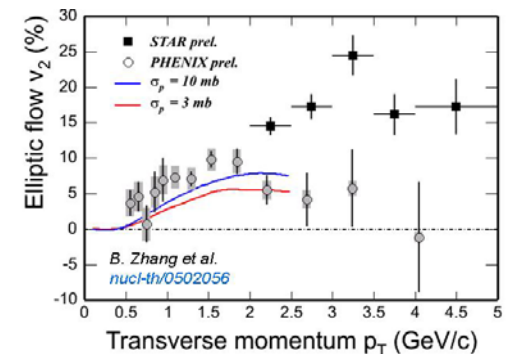
- geometrical and dynamical effects on heavy-quarks (and hadrons) of QGP contrasted with mid-rapidity

Precise comparison of open charm & beauty with onia

- isolation of common effects (e.g. gluon saturation at small- x & initial-state dE/dx)

- from those that are different (e.g. J/ψ absorption)

Pin down the gluon polarization over a broad range in x with charm & beauty measurements

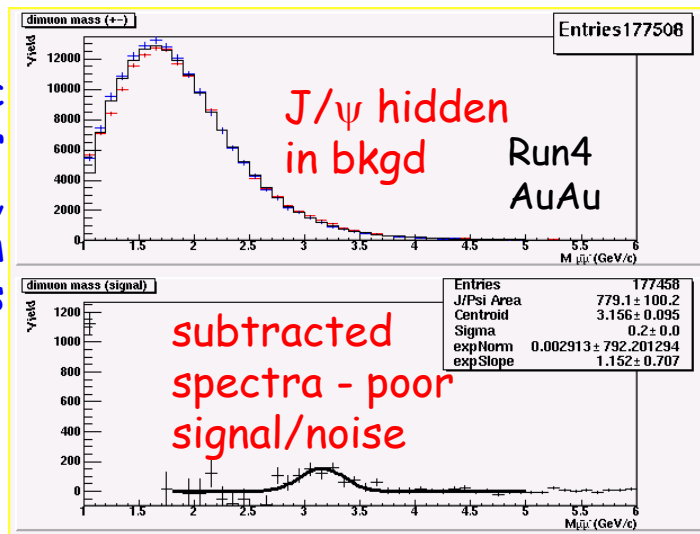


A few of the new or improved physics signals with FVTX

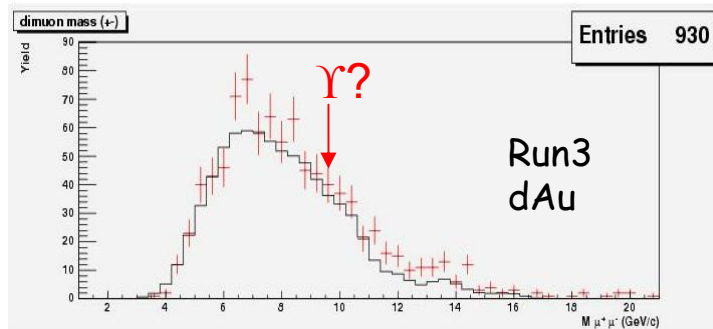
Identification & event-by-event **rejection of long-lived meson (π & K) decays**

- **robust open-heavy measurements** with meson decays eliminated
- **clean dimuon background** allowing more accurate onia measurements, Drell-Yan & direct measurements of Υ s at mid-rapidity

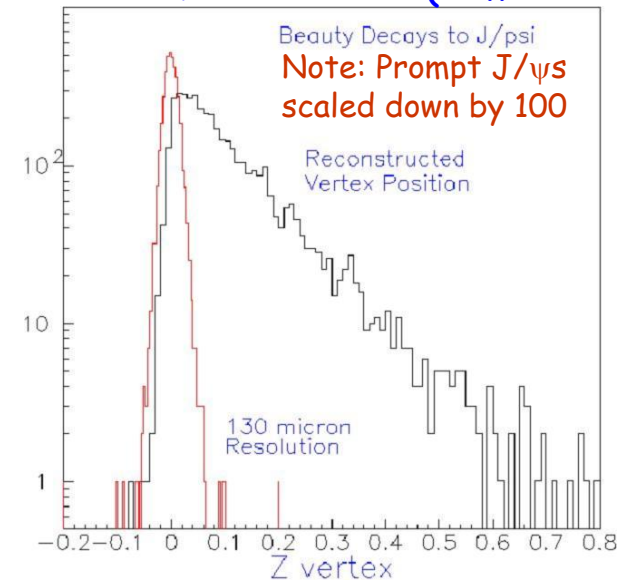
Huge combinatoric backgrounds for J/ψ in AuAu, mostly from π & K decays



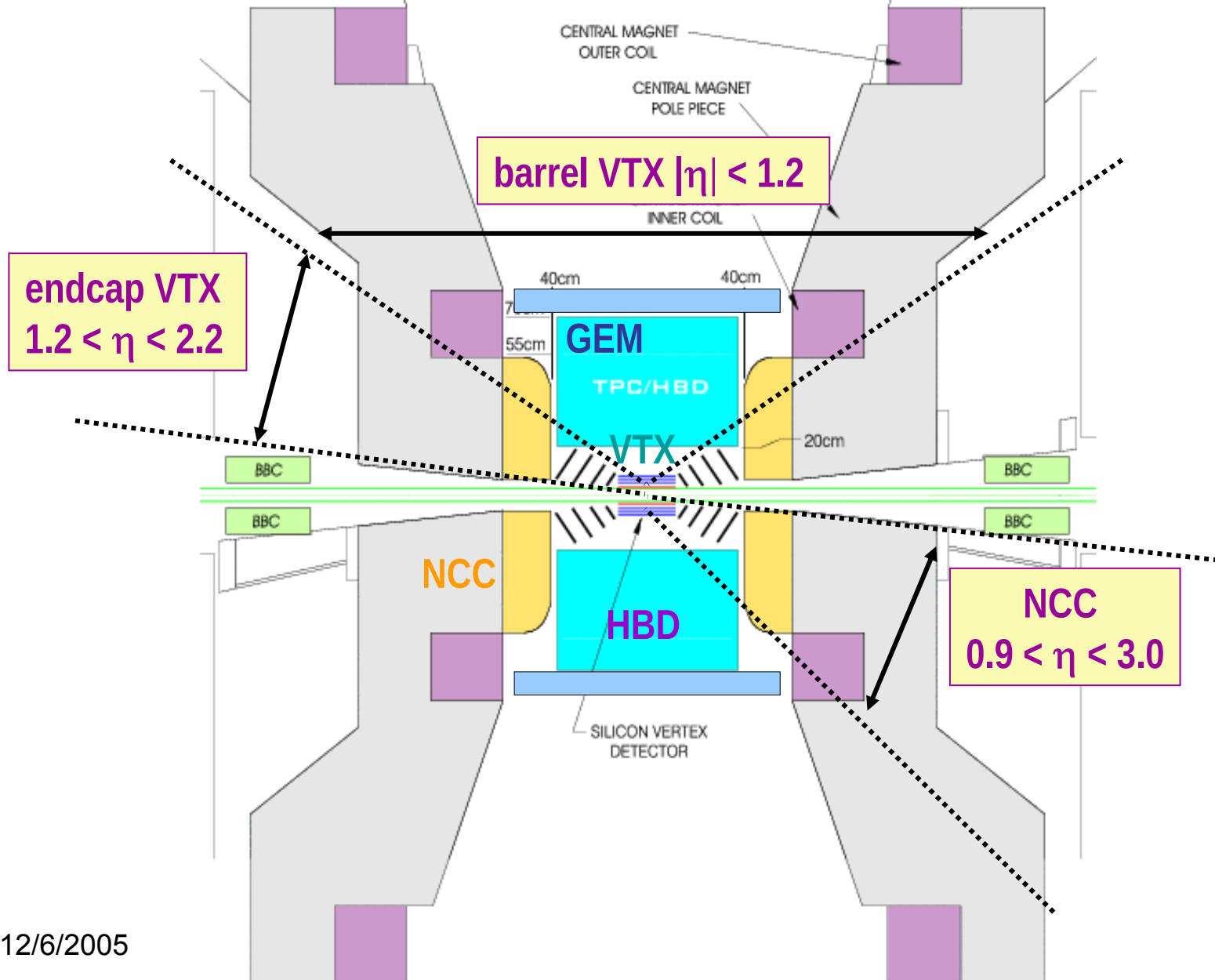
Copious backgrounds for dimuons with one muon in each arm, mostly from π & K decays



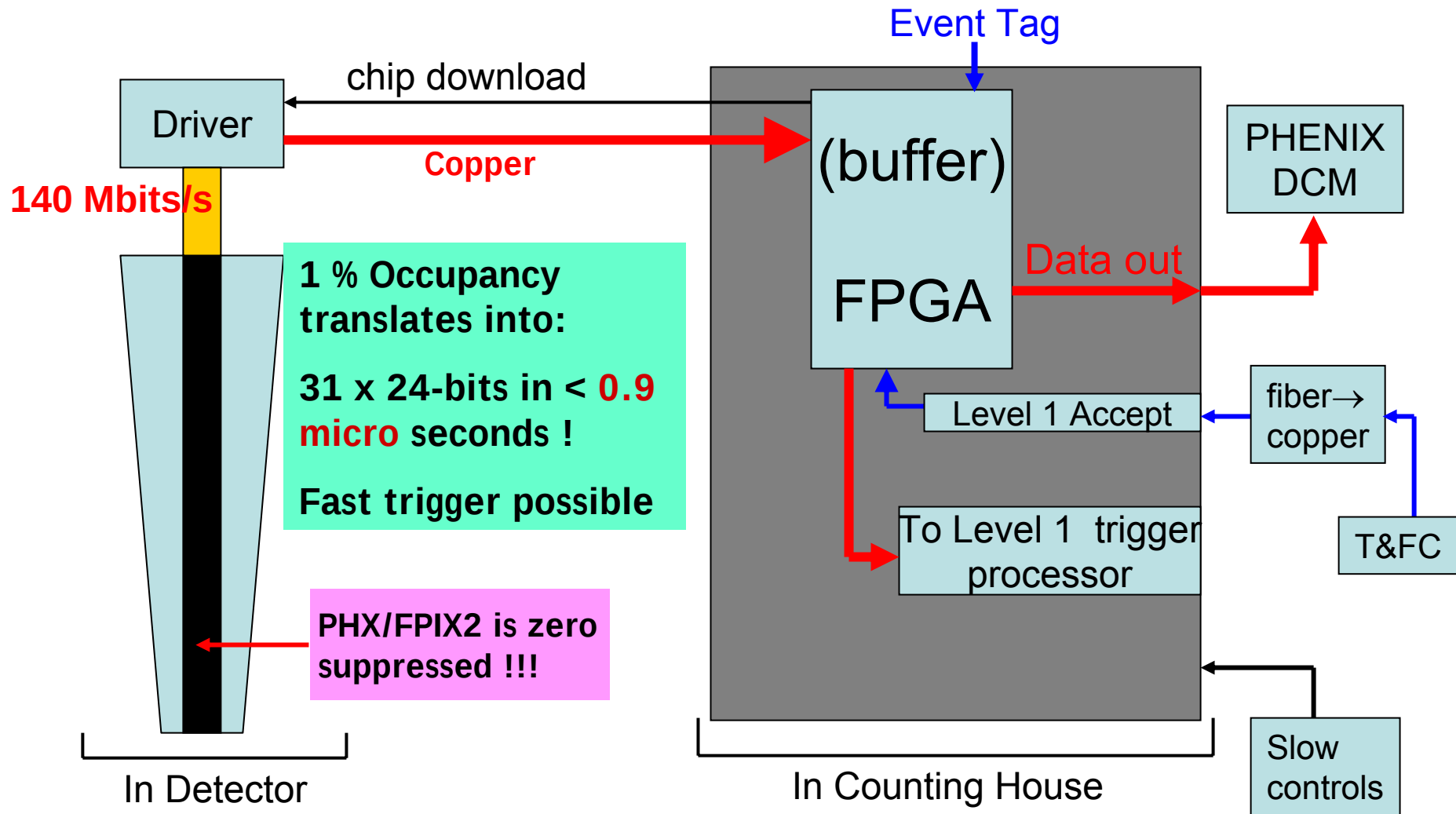
Identification of $B \rightarrow J/\psi X$ & of charm & beauty $\rightarrow \mu$ via detached vertices (simulation)



Provides displaced vertex & jet measurement over $\sim 2\pi$



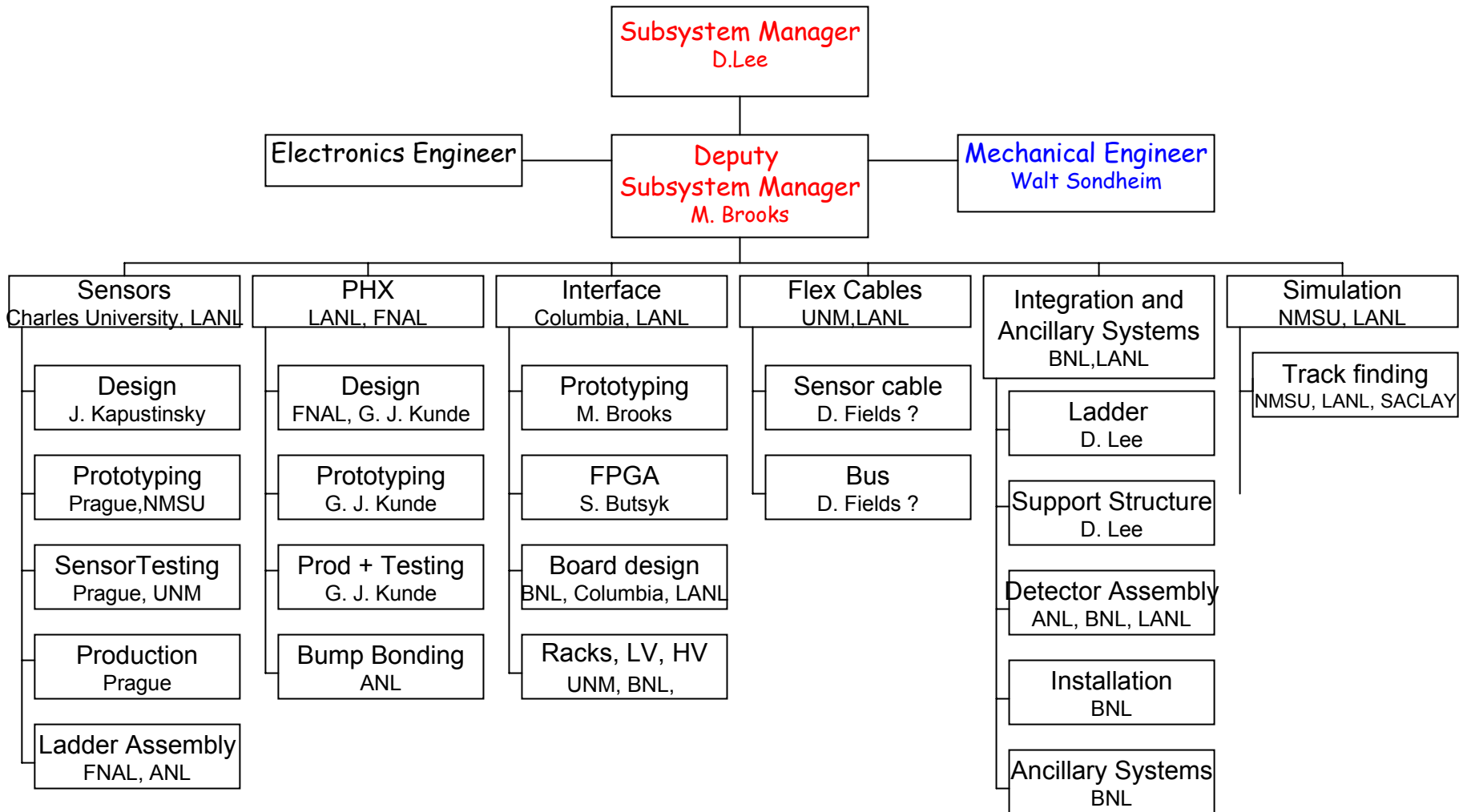
Electronics Readout Concept



The FVTX Team

- LANL - overall lead & LANL/LDRD
- Columbia - DAQ interface
- ISU - triggering
- Charles U., Czech Tech. U., Inst. Phys. Academy Sciences (Prague)
 - ATLAS Si experience & facilities
- NMSU - simulations
- UNM - Si expertise & facilities
- Others who are interested & may join
 - ANL (Paul Reimer et al) - E866/NuSea & Hermes
 - Ecole Polytechnique/LLR - muon arm, electronics
 - FSU - heavy-quark rates
 - Kyoto - muon arm, electronics
 - Saclay (Hugo) - simulations
 - Yonsei U., Korea U. - electronics & software, experience from muon arms
- Add your institution here!

Organizational Chart



FVTX Cost & Schedule Summary

- Cost

- R&D - \$360k LANL + \$495k BNL
- Construction - \$3.56M + 27% contingency → \$4.52M
- LANL/LDRD prototype - \$1.25M/yr for 3 yrs (including theory and includes \$360k above R&D)

- Schedule

- Installed & commissioning by end FY10
- Construction start October 2007 (FY08)
- R&D start January 2006

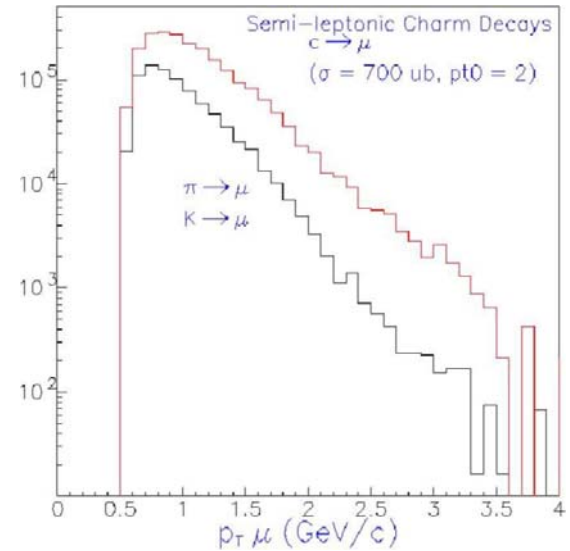
- Proposal schedule

- PHENIX review Dec. 2005
- BNL review ~ Jan 2005
- Submit to DOE for FY08 budget planning ~March 2006

LANL iFVTX LDRD Synopsis

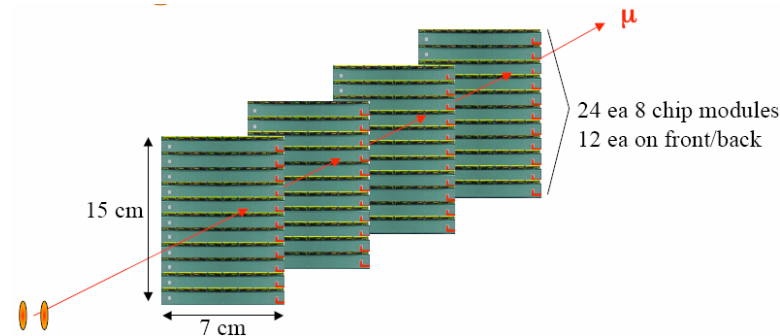
(no details today)

- Cover 1-octant of one muon arm with 200 detector modules
- 2-sectors, 4-planes each, 40 μm x 400 μm pixels
- FPIX 8-chip module from BTev/FNAL
- Inclusive D-Physics by 2008
- Theory component:
 - Vitev & Mottola: dE/dx , viscosity, conductivity, diffusion
 - R. Gupta: Debye screening (Lattice)



Ions	Lumi	$D \rightarrow \mu$ trig cnts	$B \rightarrow \mu$ Trig cnts	$B \rightarrow J/\psi \rightarrow \mu$ (1 μ in iFVTX)
pp	67pb^{-1}	28M	24k	240
AuAu	$760 \mu\text{b}^{-1}$	8M	6k	160

** Rates before vertex cut



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