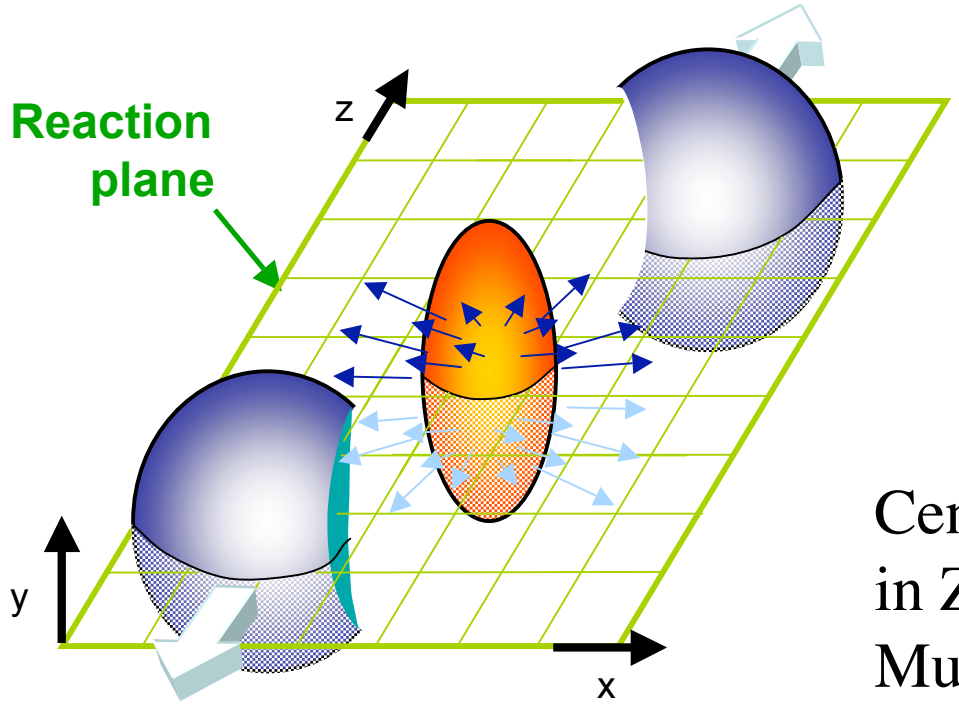
# ZDC roadmap

- ZDC physics at RHIC and LHC
- ZDC design and construction plan
- Current status, finances and ATLAS steps

Documents at
www.phenix.bnl.gov/~swhite/Atlas
  – Project file
  – "ATLAS ZDC" draft document

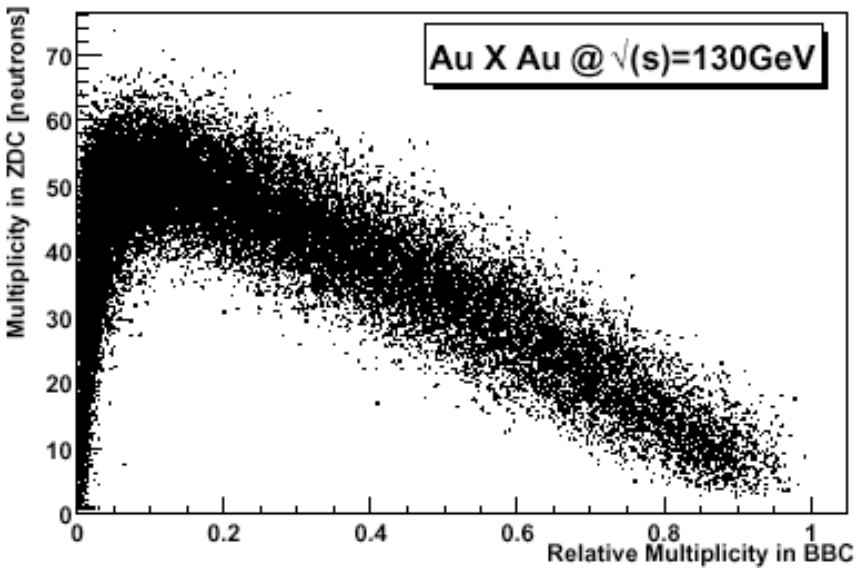



Centrality from neutron multiplicity in ZDC (~spectators) vs charged Multiplicity in BBC(~participants)

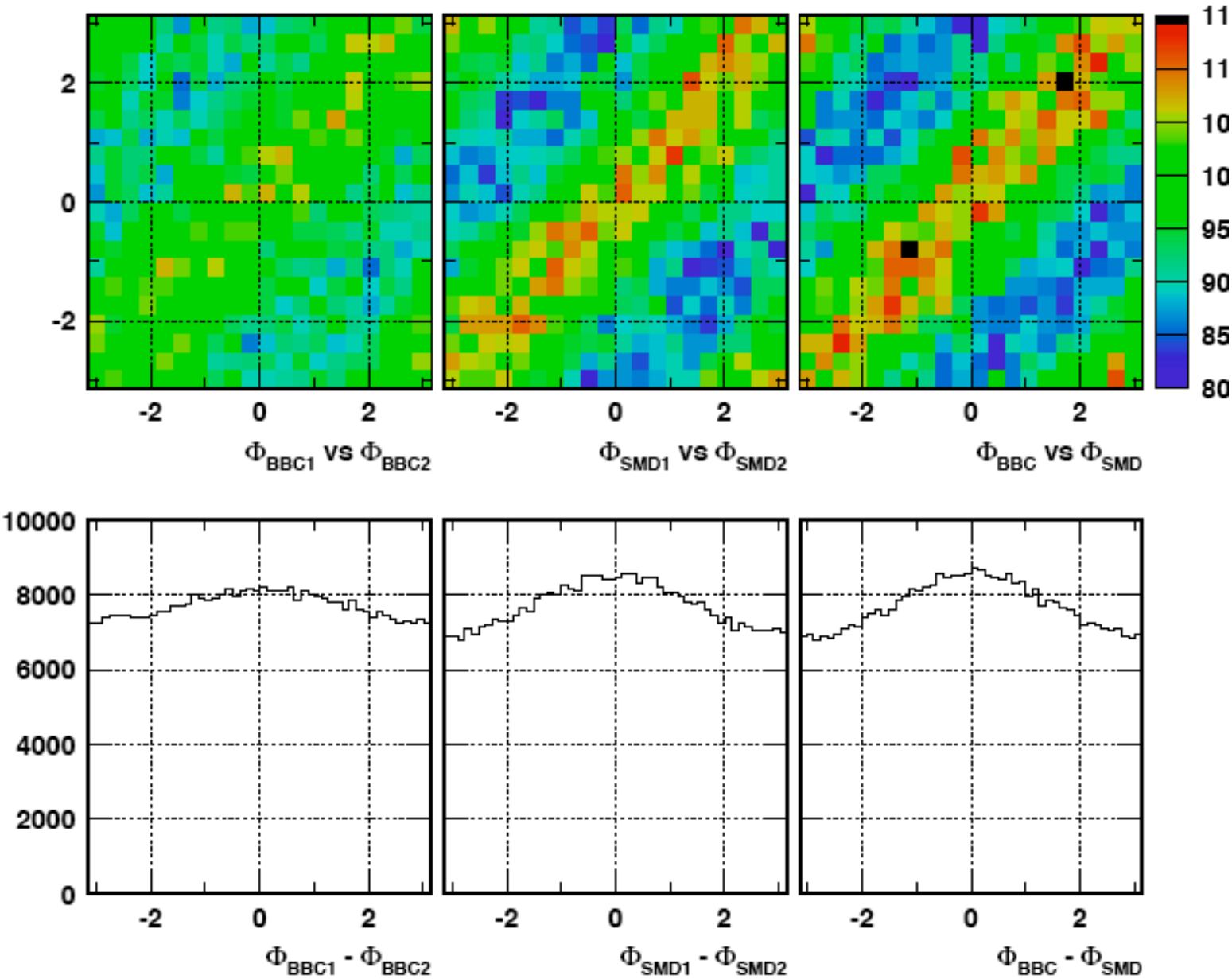
ZDC inefficiency for BBC trigger

< few per mil

Useful for analyzing peripheral Control sample.



# Directed flow, $v_1$, is largest at ZDC location

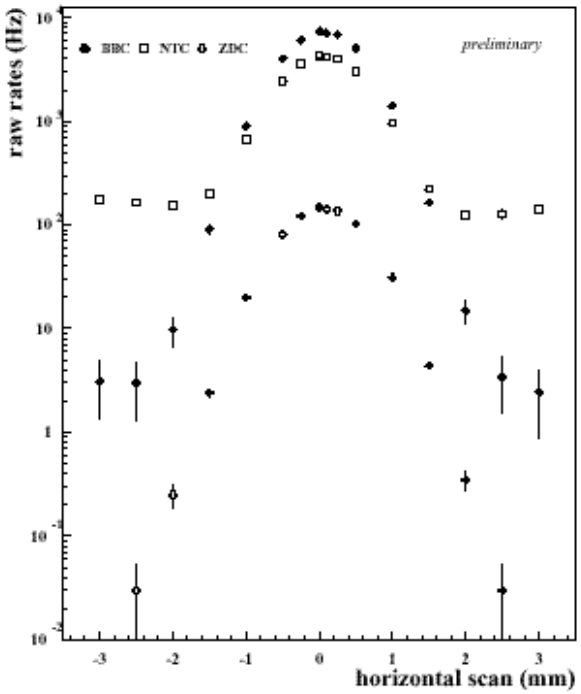


# SMD provides r.p. from v1

| Centrality | Event plane resolution |
|---|---|
| $70\% - 80\%$ | $0.179 \pm 0.005$ |
| $60\% - 70\%$ | $0.185 \pm 0.004$ |
| $50\% - 60\%$ | $0.176 \pm 0.005$ |
| $40\% - 50\%$ | $0.167 \pm 0.005$ |
| $30\% - 40\%$ | $0.138 \pm 0.006$ |
| $20\% - 30\%$ | $0.110 \pm 0.008$ |
| $10\% - 20\%$ | $0.081 \pm 0.010$ |

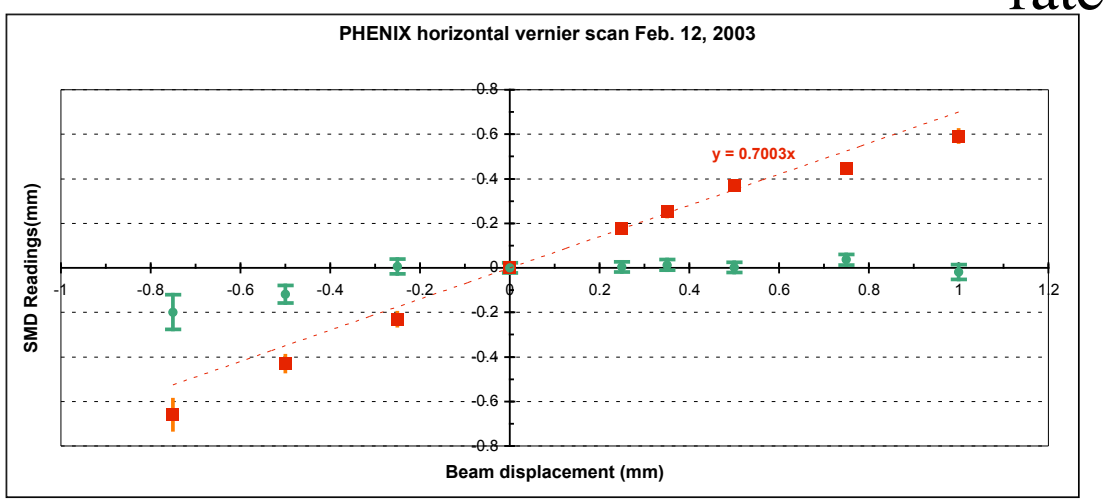
- Originally built for PHENIX (run III)
- Now also in STAR and Brahms(runs 4 &5)
- Resolution vs reaction

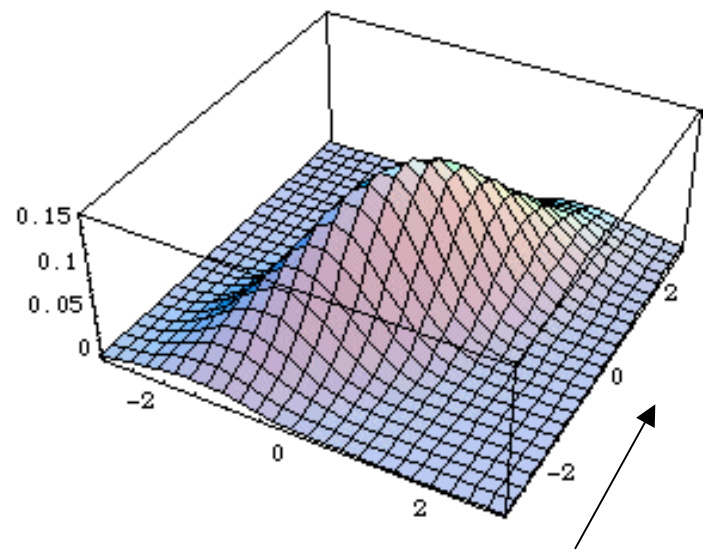
Plane in nucl-ex/0510053




Accelerator application:
vernier scan Rates for ZDC,BBC, NTC
No background beyond accidental coinc.

Shower max detector pos'n vs. vernier rate



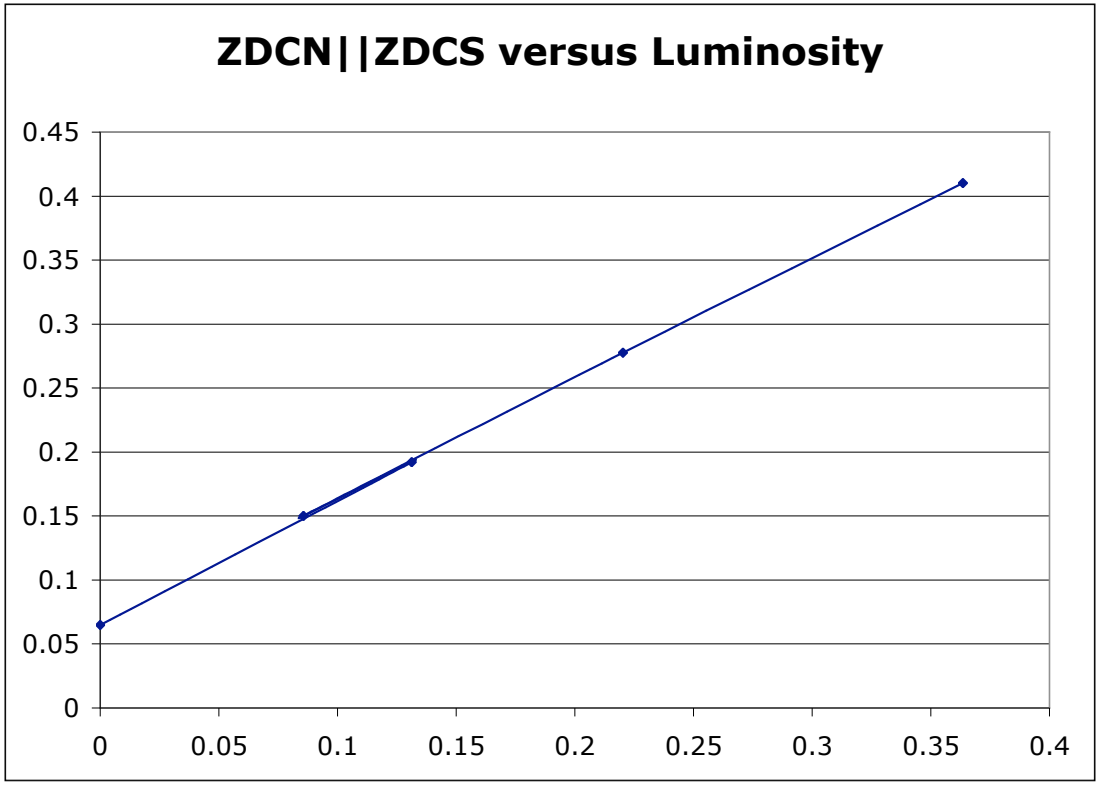




Measured Beam x(mm)

Vernier bump

# Vernier scan used to measure lumi background

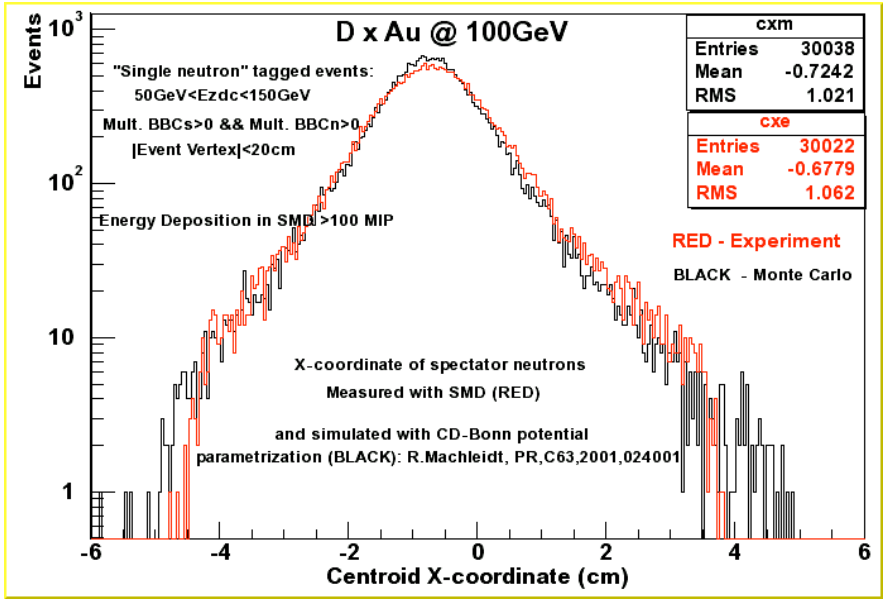
- Example from dAu
- ZDC provides ref.
- Singles like lumi rates




-Under optimal conditions singles are 5-10% background

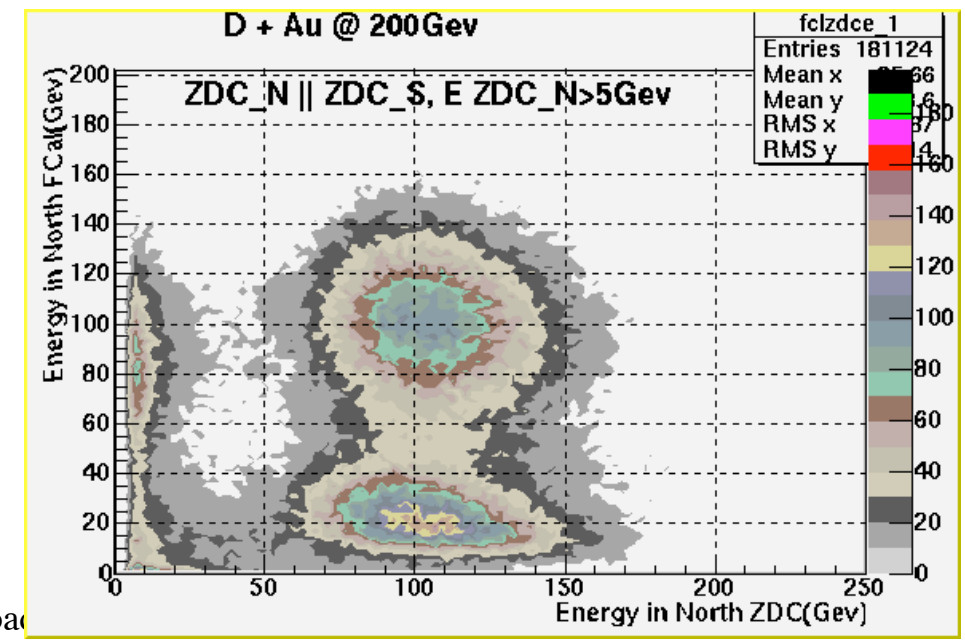
-ZDC can be used to measure this

# Example from d+Au analysis of deuteron dissociation

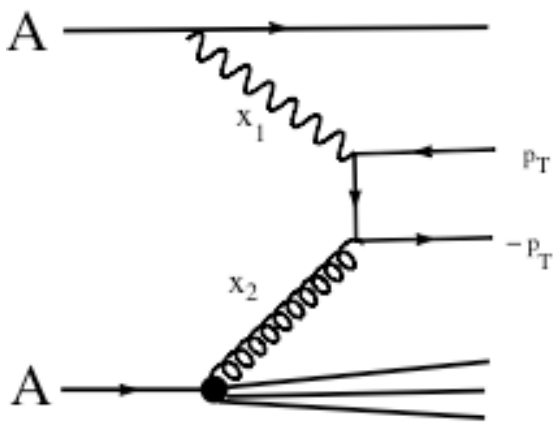



~$p_t^x$ measured from neutron Impact in SMD

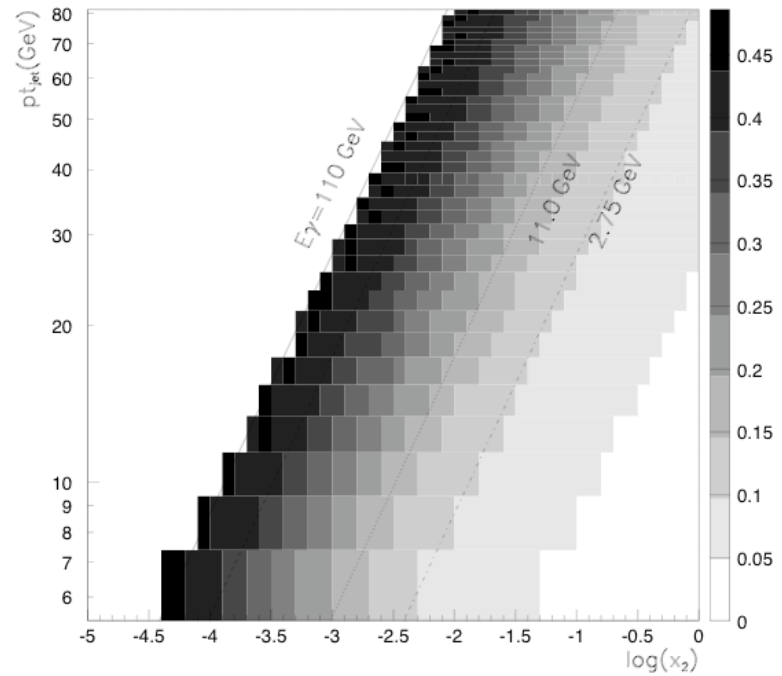
Clear signal for d+Au-> n+p+Au ZDC vs. fCal



# Trigger : tagging in UPC



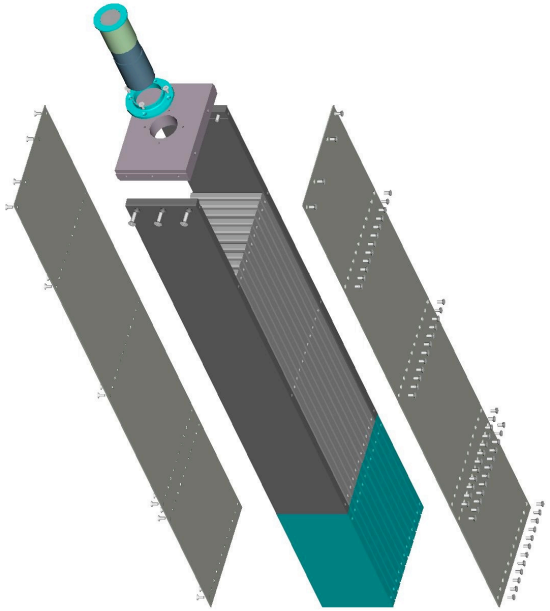

Hard photoproduction
Of di-jets, b-bbar
+ diffractive



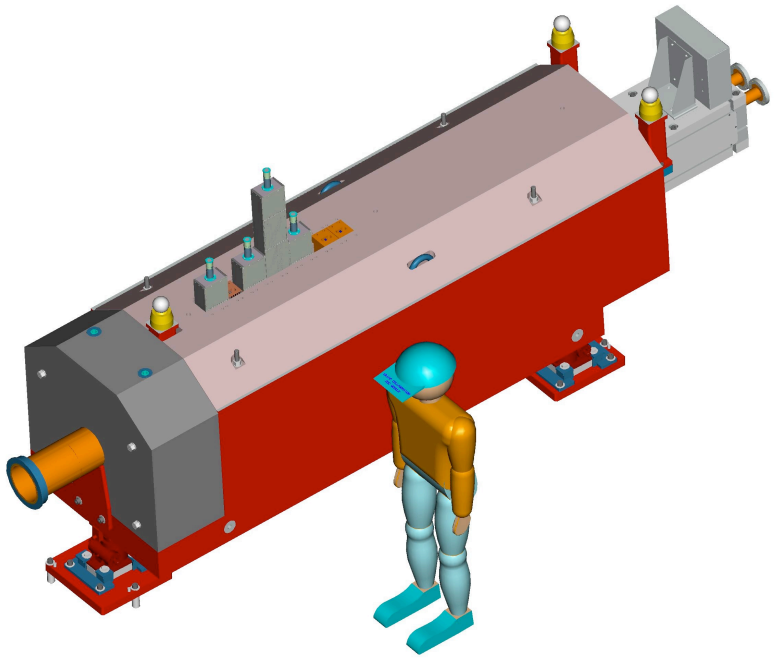

- Probability for double tag ~0.5
- at highest energies

# ZDC module design Completed

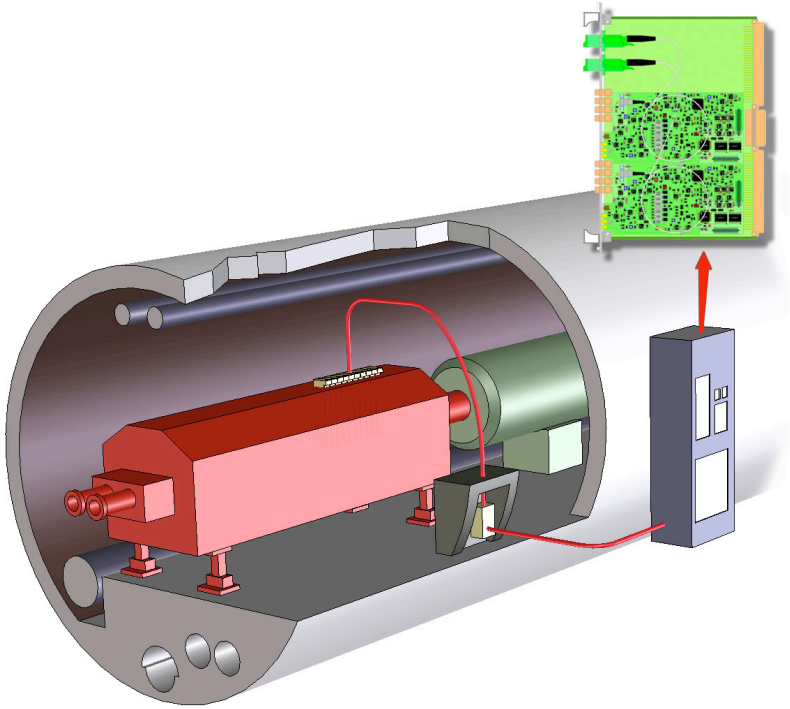
- Driven by
  - Rad hardness
  - TAN compatibility
- Tungsten/Quartz fiber
- Fast mesh dynode PMT
- Construction started



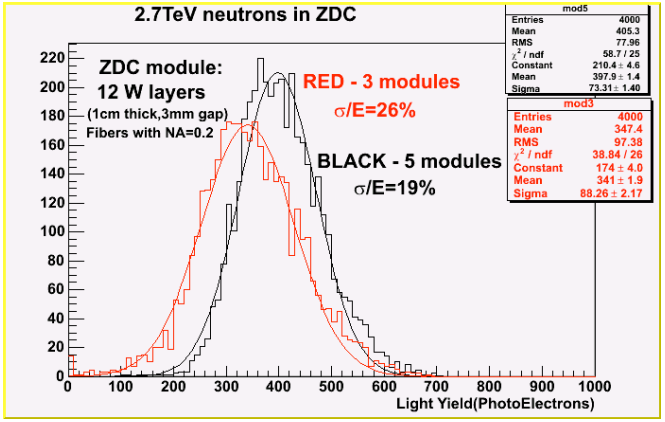
# Integration with Lumi chamber

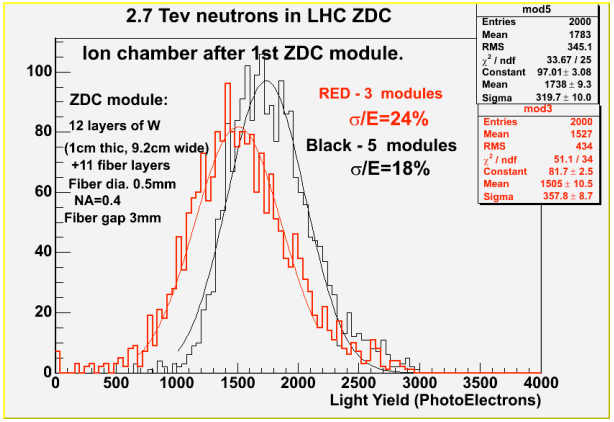


- Chamber after 1st module
- Electrical services, handling coordinated with LARP



# Full response simulation with lumi

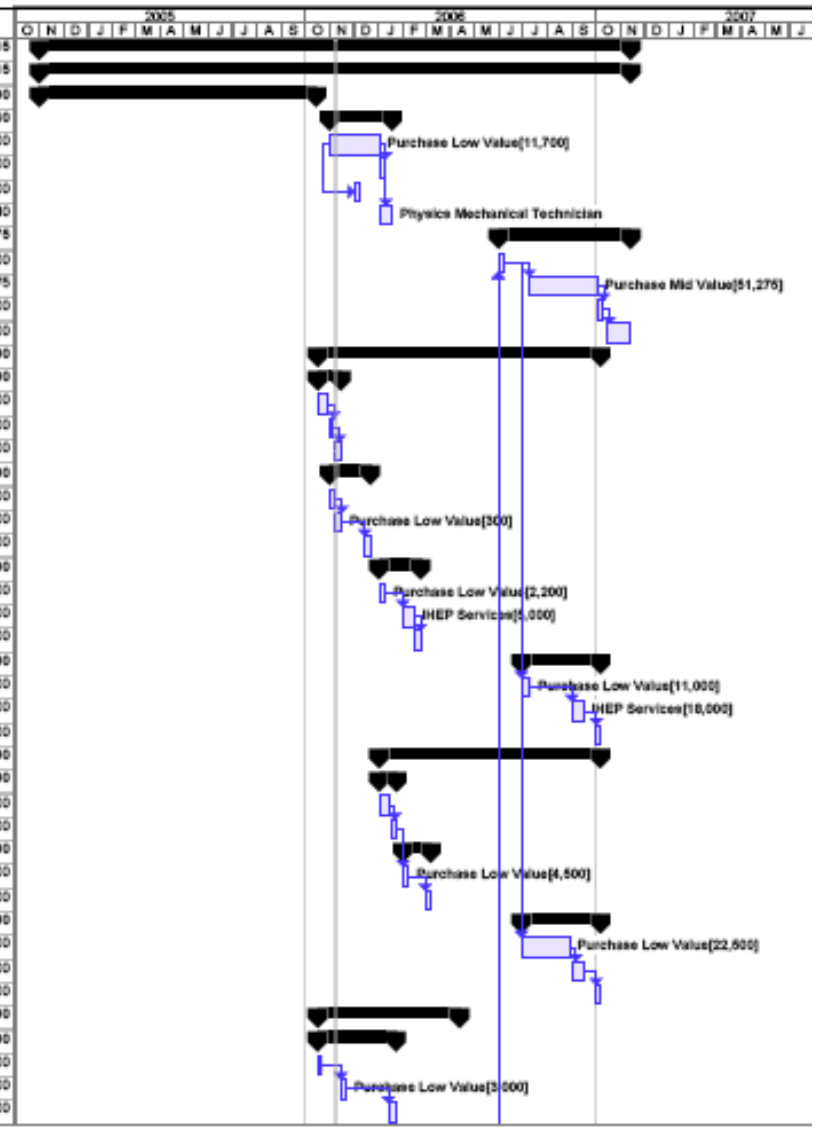



- Response for si-si quartz fiber (NA=0.2)
- Same for hard-clad (NA=0.4)

# Design began ~ 1yr. ago, 1st module construction started

| ID | WBS | Task Name | % Complete | Duration | Start | Finish | Cost |
|---|---|---|---|---|---|---|---|
| 1 | | Project Summary | 12% | 510 days? | Mon 11/1/04 | Mon 11/13/06 | $214,168.15 |
| 2 | 1.1 | ZDC Mech Structure | 20% | 510 days | Mon 11/1/04 | Mon 11/13/06 | $78,318.15 |
| 3 | 1.1.1 | Module Design | 80% | 241.5 days | Mon 11/1/04 | Fri 10/14/05 | $0.00 |
| 10 | 1.1.2 | Produce, Assem.(proto) | 0% | 50 days | Tue 11/1/05 | Wed 1/18/06 | $20,377.40 |
| 11 | 1.1.2.1 | Order Prototype | 0% | 5 wks | Tue 11/1/05 | Mon 1/2/06 | $14,391.00 |
| 12 | 1.1.2.2 | Prototype Delivery | 0% | 1 wk | Mon 1/2/06 | Tue 1/10/06 | $0.00 |
| 13 | 1.1.2.3 | Fabricate Top-plate Details | 0% | 1 wk | Fri 12/2/05 | Thu 12/8/05 | $0.00 |
| 14 | 1.1.2.4 | Assemble with Fibers | 0% | 2 wks | Mon 1/2/06 | Wed 1/18/06 | $5,986.40 |
| 15 | 1.1.3 | Complete Assembly & Test | 0% | 114 days | Thu 6/1/06 | Mon 11/13/06 | $57,940.75 |
| 16 | 1.1.3.1 | Final Design Review | 0% | 1 wk | Thu 6/1/06 | Wed 6/7/06 | $0.00 |
| 17 | 1.1.3.2 | Place Order with Starck | 0% | 12 wks | Mon 7/10/06 | Mon 10/2/06 | $57,940.75 |
| 18 | 1.1.3.3 | Deliver Five Production Modules to BNL | 0% | 1 wk | Tue 10/3/06 | Mon 10/9/06 | $0.00 |
| 19 | 1.1.3.4 | Assemble with Fibers | 0% | 4 wks | Mon 10/16/06 | Mon 11/13/06 | $0.00 |
| 20 | 1.2 | Optical Fibre System | 0% | 243.5 days | Mon 10/17/05 | Fri 10/6/06 | $39,605.00 |
| 21 | 1.2.1 | Fiber Selection | 0% | 20 days | Mon 10/17/05 | Mon 11/14/05 | $0.00 |
| 22 | 1.2.1.1 | Samples from SEDI, Ceramoptec, Polymicro | 0% | 2 wks | Mon 10/17/05 | Fri 10/28/05 | $0.00 |
| 23 | 1.2.1.2 | Test Unjacketed Fiber | 0% | 1 wk | Mon 10/31/05 | Fri 11/4/05 | $0.00 |
| 24 | 1.2.1.3 | Quote from Vendors for Prototype | 0% | 1 wk | Mon 11/7/05 | Mon 11/14/05 | $0.00 |
| 25 | 1.2.2 | Ribbon Fabrication R&D | 0% | 34 days | Tue 11/1/05 | Wed 12/21/05 | $369.00 |
| 26 | 1.2.2.1 | Test Fabrication Adhesives | 0% | 1 wk | Tue 11/1/05 | Mon 11/7/05 | $0.00 |
| 27 | 1.2.2.2 | Purchase 200 Meter Test Fiber | 0% | 1 wk | Tue 11/8/05 | Tue 11/15/05 | $369.00 |
| 28 | 1.2.2.3 | Fabricate Test Ribbons | 0% | 1 wk | Thu 12/15/05 | Wed 12/21/05 | $0.00 |
| 29 | 1.2.3 | Prototype Module Fiber | 0% | 35 days | Mon 1/2/06 | Wed 2/22/06 | $7,706.00 |
| 30 | 1.2.3.1 | Purchase 1,500 Meters of Fiber | 0% | 1 wk | Mon 1/2/06 | Mon 1/9/06 | $2,706.00 |
| 31 | 1.2.3.2 | Fabricate 12 Ribbon Layers | 0% | 2 wks | Wed 2/1/06 | Tue 2/14/06 | $5,000.00 |
| 32 | 1.2.3.3 | Assemble & Polish | 0% | 1 wk | Wed 2/15/06 | Wed 2/22/06 | $0.00 |
| 33 | 1.2.4 | Production Fibers | 0% | 66 days | Fri 6/30/06 | Fri 10/6/06 | $31,530.00 |
| 34 | 1.2.4.1 | Purchase 7,500 Meters of Fiber | 0% | 1 wk | Fri 6/30/06 | Mon 7/10/06 | $13,530.00 |
| 35 | 1.2.4.2 | Fabricate Ribbon Layers | 0% | 2 wks | Fri 9/1/06 | Fri 9/15/06 | $18,000.00 |
| 36 | 1.2.4.3 | Assemble 5 Production Modules | 0% | 1 wk | Mon 10/2/06 | Fri 10/6/06 | $0.00 |
| 37 | 1.3 | PMT System | 0% | 193 days | Mon 1/2/06 | Fri 10/6/06 | $33,210.00 |
| 38 | 1.3.1 | PMT Selection | 0% | 14 days | Mon 1/2/06 | Mon 1/23/06 | $0.00 |
| 39 | 1.3.1.1 | Review Fiber Parameters | 0% | 9 days | Mon 1/2/06 | Fri 1/13/06 | $0.00 |
| 40 | 1.3.1.2 | Select Photo Multiplier Tube (PMT) | 0% | 1 wk | Tue 1/17/06 | Mon 1/23/06 | $0.00 |
| 41 | 1.3.2 | PMT Prototype Purchase | 0% | 24 days | Wed 2/1/06 | Tue 3/7/06 | $5,535.00 |
| 42 | 1.3.2.1 | Order 1st PMT | 0% | 1 wk | Wed 2/1/06 | Tue 2/7/06 | $5,535.00 |
| 43 | 1.3.2.2 | PMT Delivery | 0% | 1 wk | Wed 3/1/06 | Tue 3/7/06 | $0.00 |
| 44 | 1.3.3 | Full PMT Oder | 0% | 66 days | Fri 6/30/06 | Fri 10/6/06 | $27,675.00 |
| 45 | 1.3.3.1 | Purchase 5 Production PMT's | 0% | 5 wks | Fri 6/30/06 | Mon 8/28/06 | $27,675.00 |
| 46 | 1.3.3.2 | PMT Production Delivery | 0% | 2 wks | Fri 9/1/06 | Fri 9/15/06 | $0.00 |
| 47 | 1.3.3.3 | Measure Gain Characteristics | 0% | 1 wk | Mon 10/2/06 | Fri 10/6/06 | $0.00 |
| 48 | 1.4 | Light Flasher | 0% | 120.5 days? | Mon 10/17/05 | Wed 4/12/06 | $9,840.00 |
| 49 | 1.4.1 | Design and Test | 0% | 64 days | Mon 10/17/05 | Mon 1/23/06 | $3,690.00 |
| 50 | 1.4.1.1 | Select Flasher Components | 0% | 1 wk | Mon 10/17/05 | Fri 10/21/05 | $0.00 |
| 51 | 1.4.1.2 | Purchase Led + Pulse Generator | 0% | 1 wk | Tue 11/15/05 | Mon 11/21/05 | $3,690.00 |
| 52 | 1.4.1.3 | Install in RHIC Beam Test | 0% | 1 wk | Fri 1/13/06 | Mon 1/23/06 | $0.00 |



# Project Status

- Collaboration of NP (BNL+IHEP +Dubna?) and High Energy (Yale) groups
- Division of responsibilities (mechanical fab., optical system, T/DAQ in process)
- Completion of 1st module initiated as BNL capital eqpt. Project
- LHC compatibility reviewed last spring

# Status (continued)

- Next step(H.G.) formal presentation to ATLAS management- next couple months
- RHIC beam test integrated with LHC lumi monitor (Run 6)
- LARP to fund Electronics integration in beam instrumentation ($65k)
- Total project cost ~$273k including estimate of burden