



# TPC and matching efficiencies from track embedding

*On behalf of Truls M. Larsen*

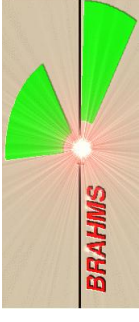
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BRAHMS Collaboration Meeting, BNL, 6th–8th December 2002

# Overview



- Efficiencies, the Oslo way
- Software that even Granny could use
- Status: Results and plots
- Future plans and prospects

# The algorithm



- Main idea: Take a real event and embed a simulated track at the sequence level. Reconstruct the event and see if the inserted track is found.
- Implementation:
- Read raw event, get vertex, trigger etc.
- Find a GEANT track from the desired particle species, at the same vertex position
- Check that this particle is reconstructible
- Digitize GEANT track with New and Improved digitization parameters
- **BrTpcAddSeqModule** adds the raw and digitized TPC sequences together
- Do track reconstruction on the digitized, the raw and the embedded event. Both *local tracks* in the TPCs and *Matched* tracks through the magnet.

# The algorithm



- **Geometry and magnetic fields** from the database are used to make geant tracks.
- **Efficiency calculation** is done like this:
- The *relative overlap* of the digitized track with all the tracks in the added event is found.
- Make a cylinder around track with radius of 0.4 cm. Relative overlap = the fraction of the volume of this cylinder that overlaps with the GEANT track. Criterion: **0.6**
- Efficiency as function of: particle species, transverse momentum, rapidity, centrality, number of tracks, number of hits in the TPCs...
- The efficiency takes the matching into account (unlike the acceptance).

# Current status



- Output: FFS/MRS efficiency for tracking + matching
- $y-p_T$  distributions, ready to be combined with acceptance maps
- Details such as eff. for each TPC is also readily available
- *Cool! How do I get these results?*

# BEAT: Main application



## Brahms Efficiency Analysis Tool

BEAT: BraG Script

Use These Detectors

TPM1  T1  Trigger 1  Trigger 2

TPM2  T2  Trigger 3  Trigger 4

MRS  FFS  Trigger 5  Trigger 6

MRS angle:    
 FFS angle:  8

Max/min vx, pos:  20   
  BB Vertex  ZDC Vertex

Choose Trigger and Vertex cut

Trigger 1  Trigger 2

Trigger 3  Trigger 4

Trigger 5  Trigger 6

Trigger 7  Trigger 8

Set File Names

Raw data directory:  /direct/brahms+data06/truism/raw

Geant directory:  ec/brahms+data06/truism/cdat/run5573

Geo file name:

Mag file name:

Match Param file:  /main/parameters/offset300\_6000/FFS

Output file dir:  /direct/brahms+data06/truism/reco

Output histos dir:  /direct/brahms+data06/truism/beatmain/histos

File Details

Run Number:  5573   
 Seq start number:  0

Tot # Sequences:  4   
 Tot # geant files:  20

Particle type:  kaons   
 Floating P I

Events to analyse:  200000   
 Estimated eff:

Check existence of files/dirs...

BEAT: BraG Script

Brag Info

Brag particle number:  11

Momentum:  2.0 - 6.0

Run number:  5548

Number of vertices:  20

Max/Min vertex pos:  20

Use Gaussian in vx bins  Use Flat dist. in vx bins

Use MRS  Use FFS

Output directory:  /direct/brahms+data06/truism/cdat/run554

Geant Particle Number Info:

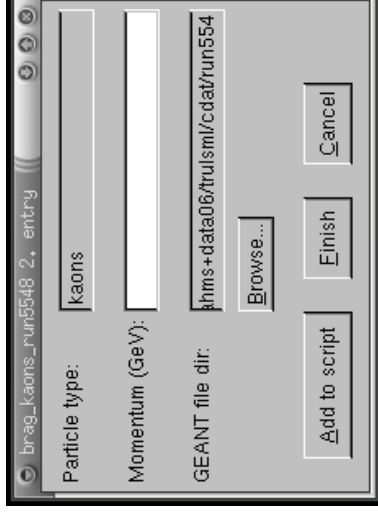
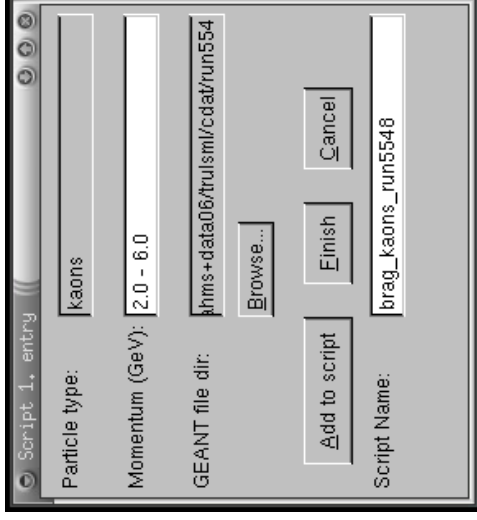
Particle	No.	Mass(MeV)	Ch.	Life time(sec)
Gamma	1	0	0	stable
Positron	2	0.000511	1	stable
Electron	3	0.000511	-1	stable
Neutrino	4	0	0	stable
Muon +	5	0.105658	1	2.197 +10^-6
Muon -	6	0.105658	-1	2.197 +10^-6
Pion 0	7	0.134976	0	8.4 +10^-17
Pion +	8	0.139570	1	2.603 +10^-8
Pion -	9	0.139570	-1	2.603 +10^-8
Kaon 0 Long	10	0.497672	0	5.17 +10^-8
Kaon +	11	0.493677	1	1.237 +10^-8
Kaon -	12	0.493677	-1	1.237 +10^-8
Neutron	13	0.939566	0	887.0
Proton	14	0.938272	1	stable
Antiproton	15	0.938272	-1	stable
Kaon 0 short	16	0.497672	0	8.926 +10^-11

Check existence of files/dirs...

# BEAT: Generate scripts



## Brahms Efficiency Analysis Tool



Software very soon available in *brahms\_app/tml\_app*

# Still too complicated?

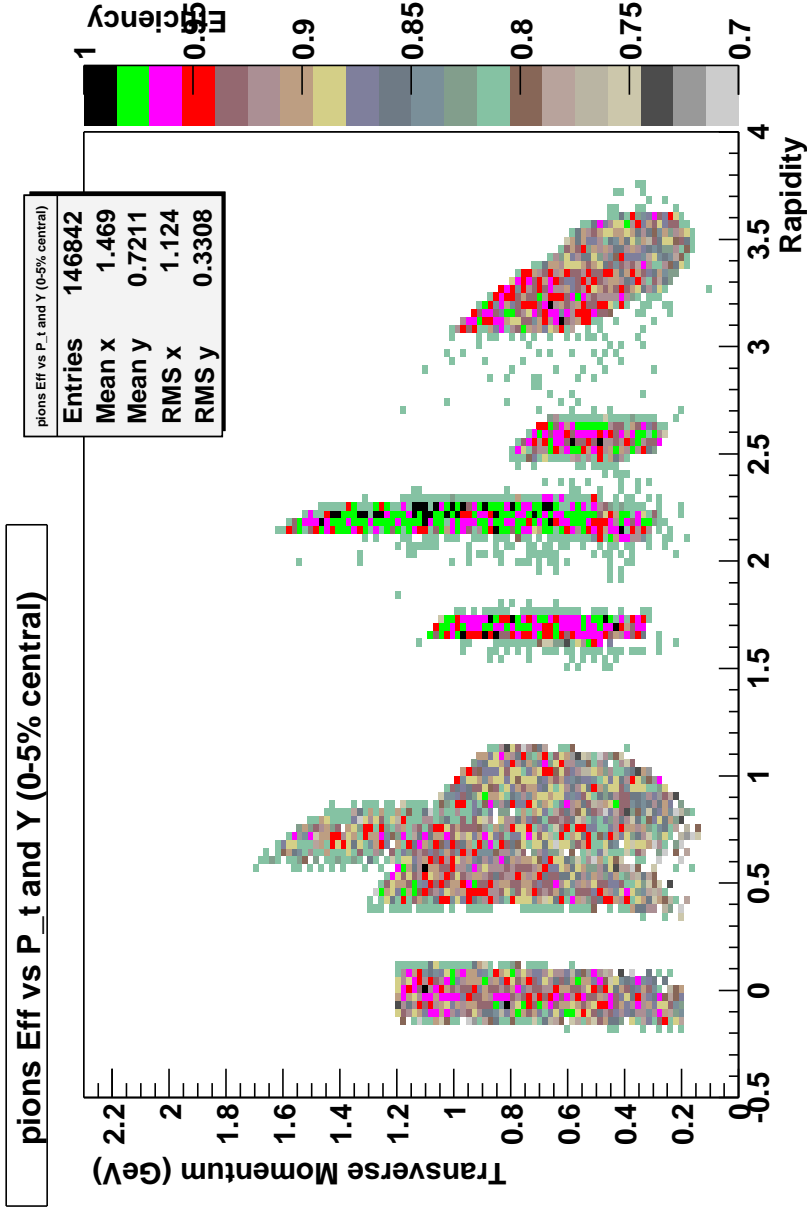


Soon and very soon we'll make available a set of files with efficiency maps in the same format as the acceptance files.

Maybe even write an  
EfficiencyManager?

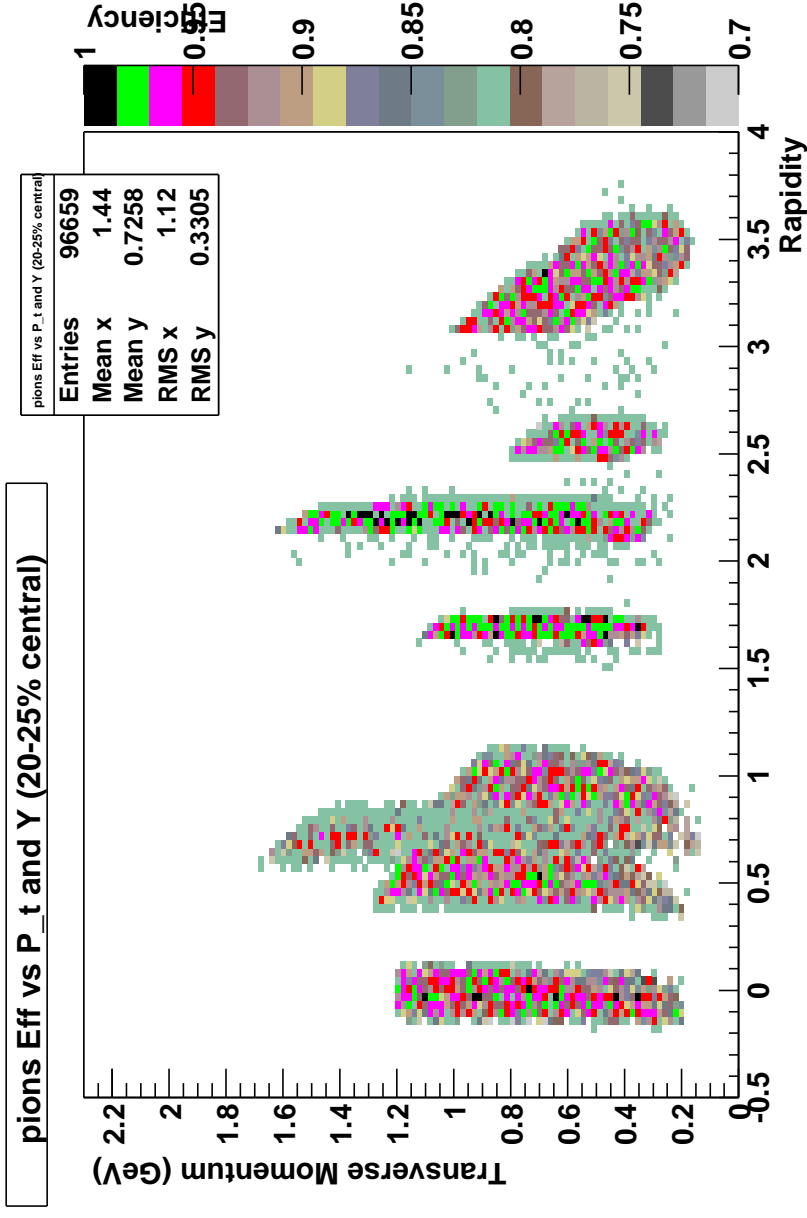


# Efficiency maps: $\pi$



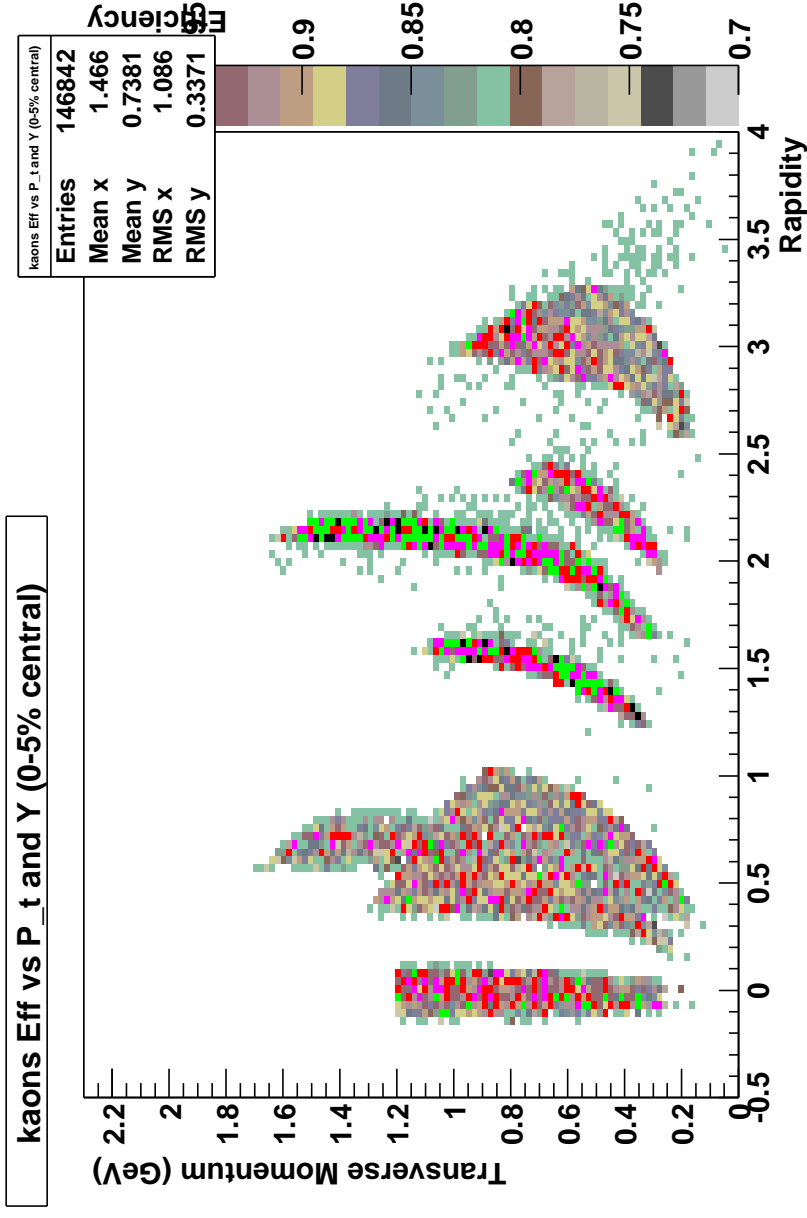
Angle	3.0°	8.0°	12.0°	20.0°	40.0°	60.0°	90.0°
Run	5548	5573	5677	5713	5508	5642	5713

# Efficiency maps: $\pi$



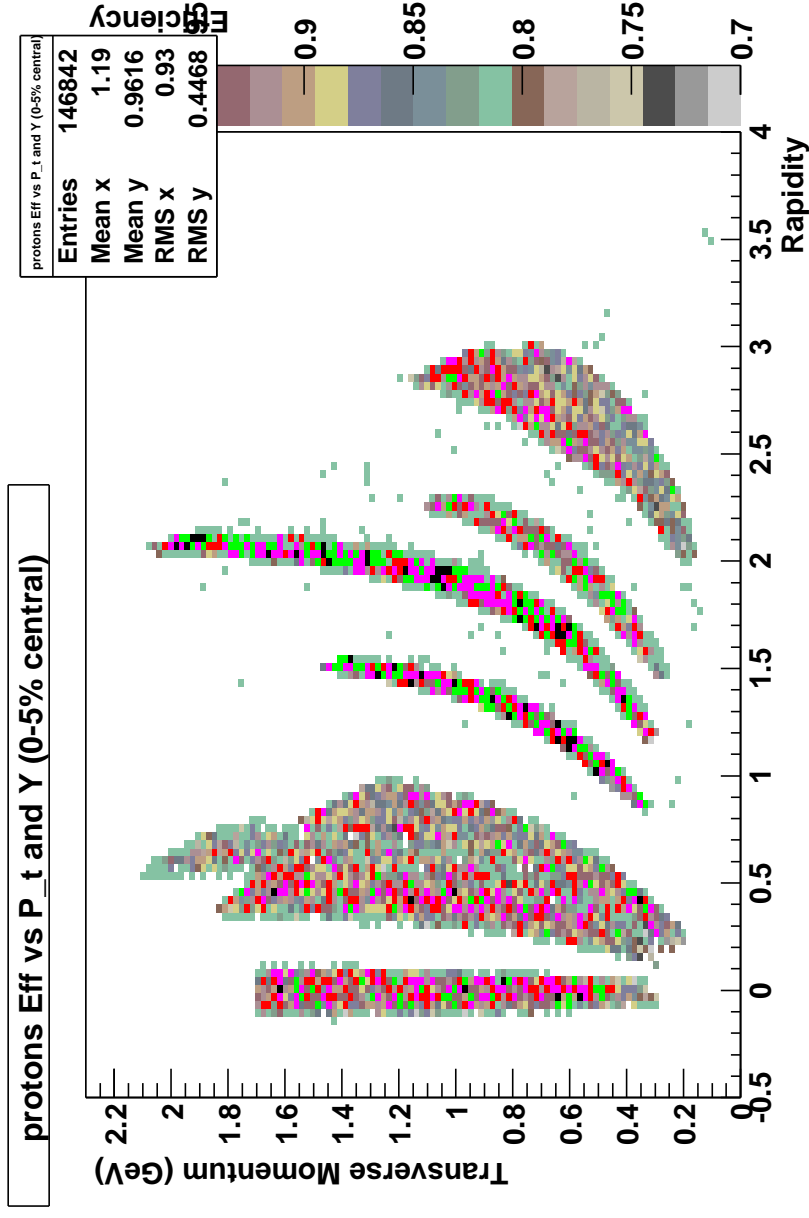
Angle	3.0°	8.0°	12.0°	20.0°	40.0°	60.0°	90.0°
Run	5548	5573	5677	5713	5508	5642	5713

# Efficiency maps: $K$



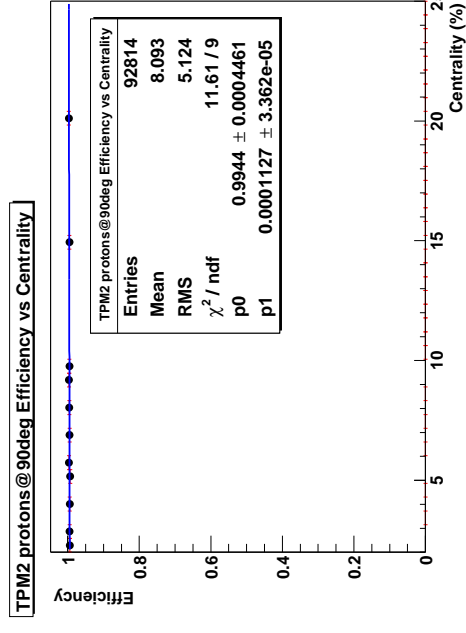
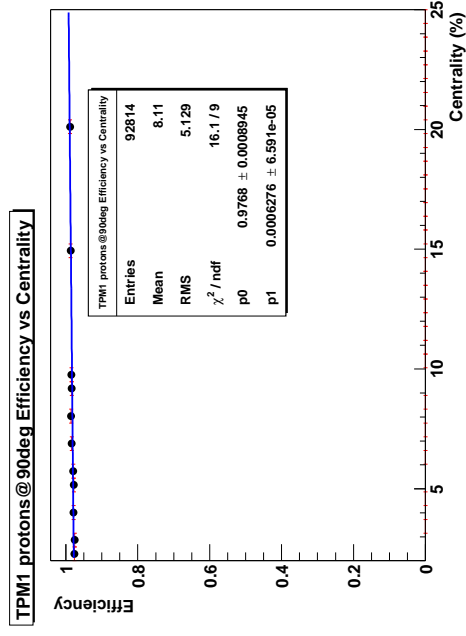
Angle	3.0°	8.0°	12.0°	20.0°	40.0°	60.0°	90.0°
Run	5548	5573	5677	5713	5508	5642	5713

# Efficiency maps: $p$



Angle	3.0°	8.0°	12.0°	20.0°	40.0°	60.0°	90.0°
Run	5548	5573	5677	5713	5508	5642	5713

# Individual TPCs, MRS

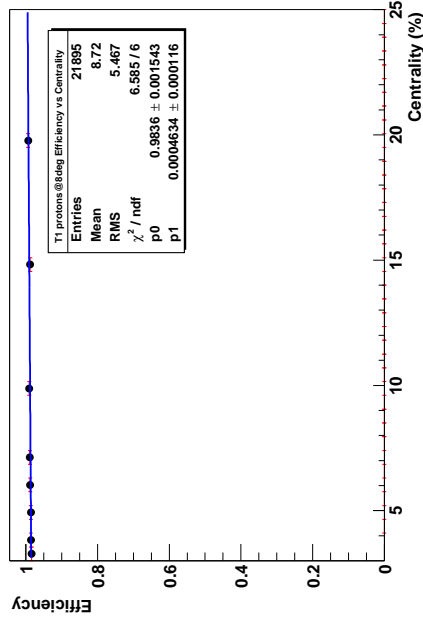


More: Look in *trulsm1/beatmain/histos*

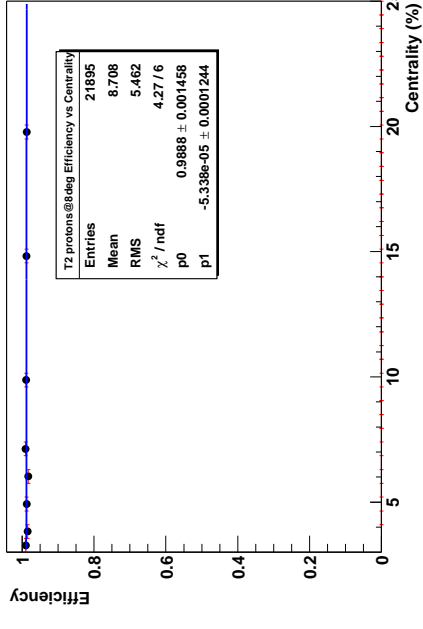
# Individual TPCs, FS



T1 protons@8deg Efficiency vs Centrality

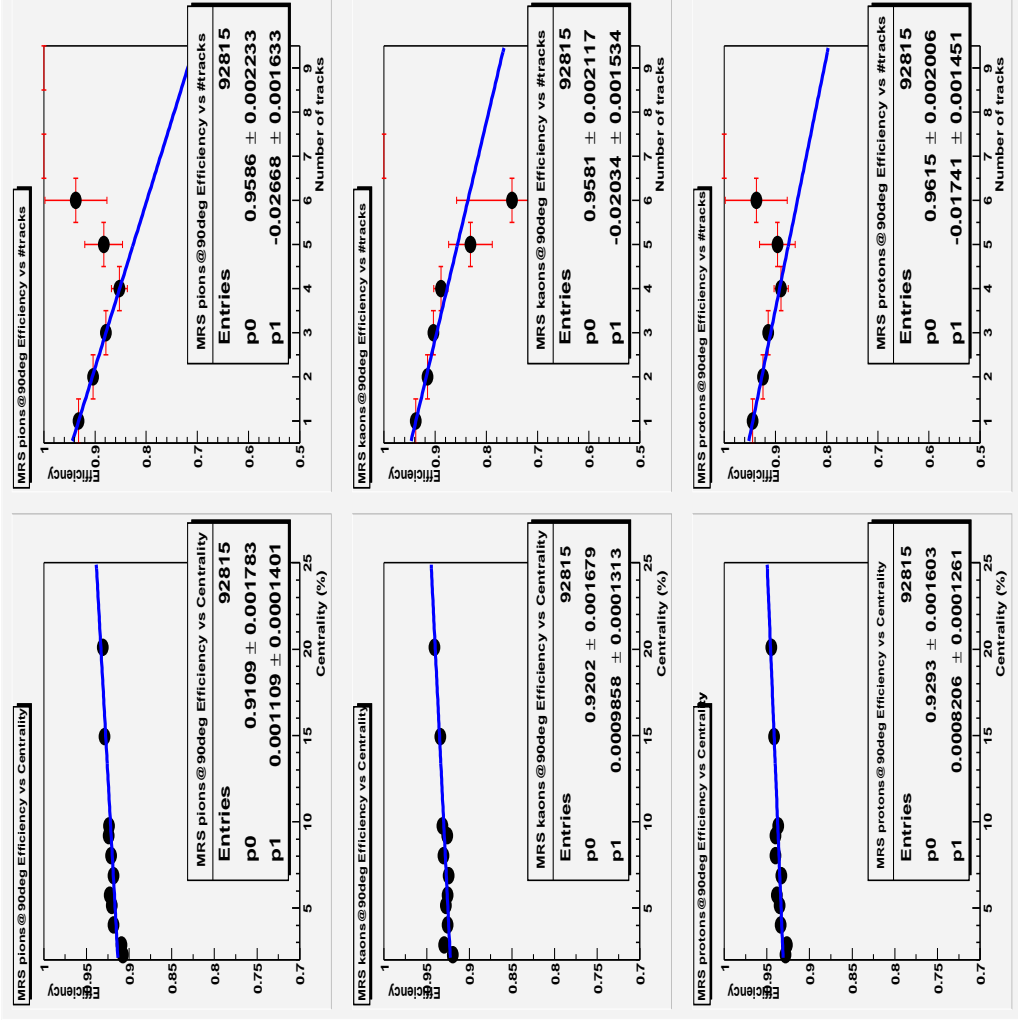


T2 protons@8deg Efficiency vs Centrality

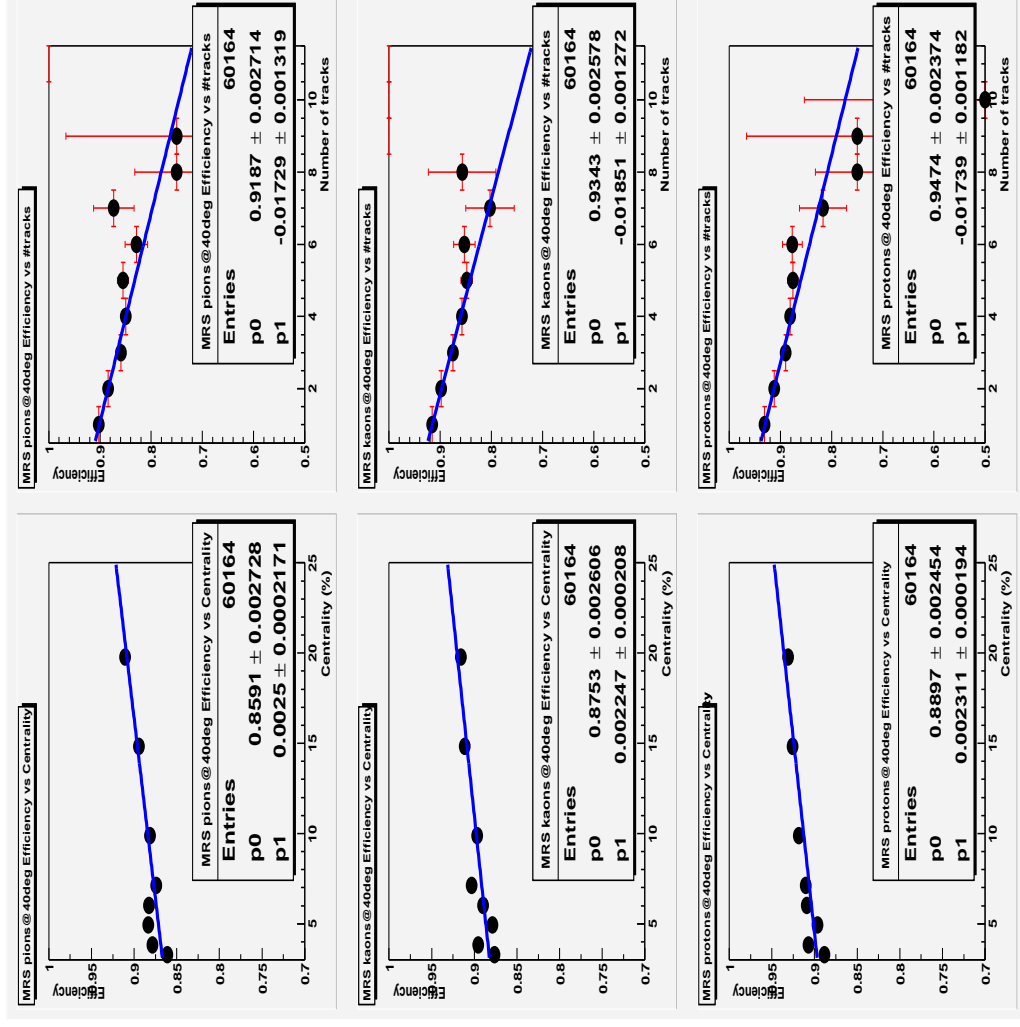


More: Look in *tru1sm1/beatmain/histos*

# Tracking + matching, MRS, 90°

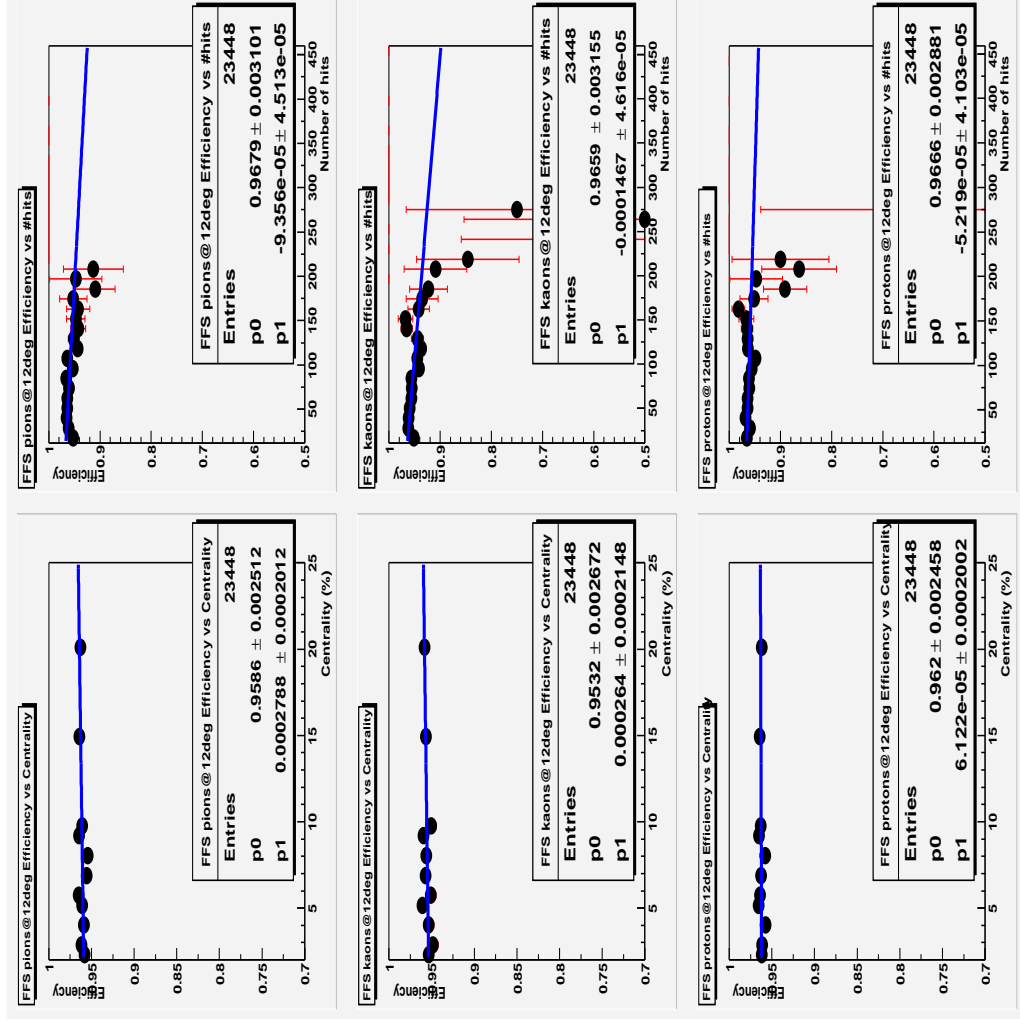


# Tracking + matching, MRS, 40°

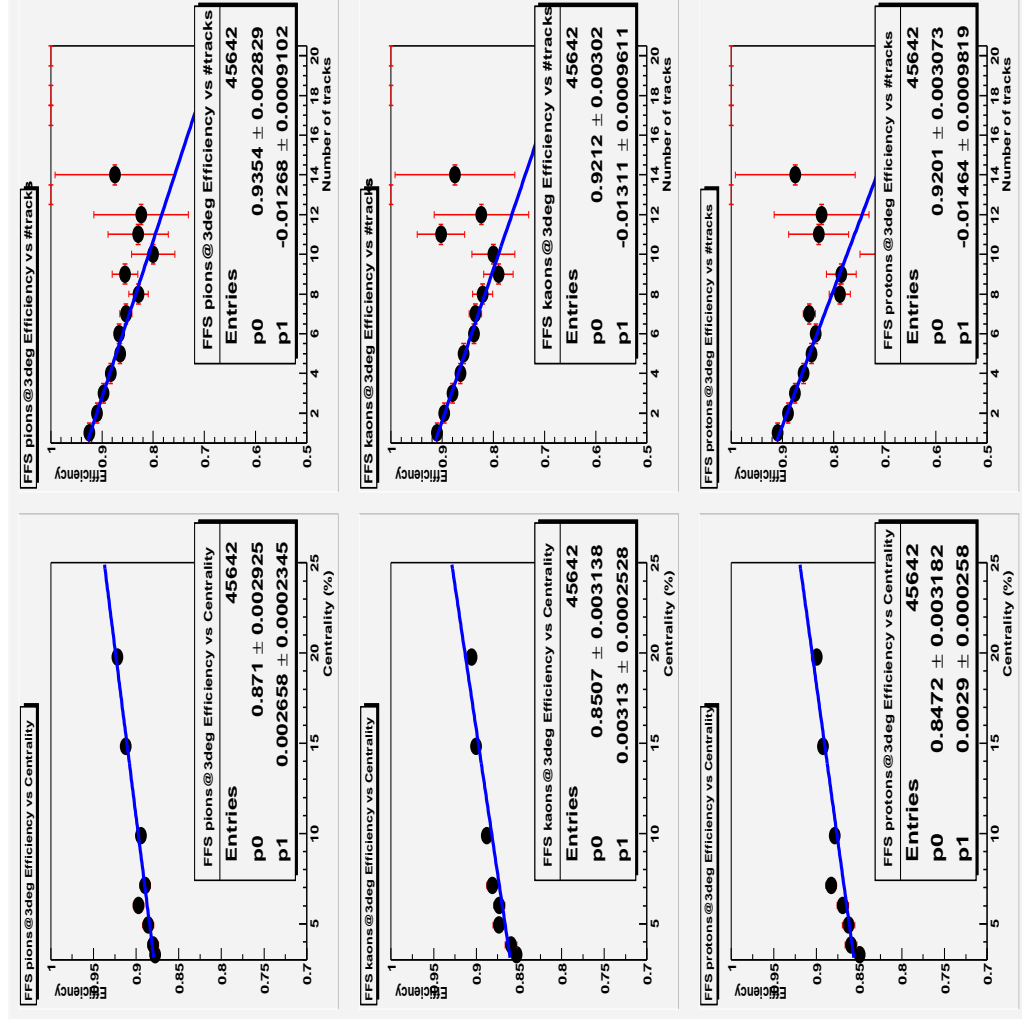




# Tracking + matching, FFS, 12°



# Tracking + matching, FFS, 3°



# The future



- Truls is busy writing his thesis, for details please stay tuned for that document
- This (probably) includes a proper comparison to Pawels results
- We'd like to include TOF efficiency as well, but are not sure about the digitization parameters, offsets etc.
- Homework: Send letter to NFR (Norwegian Research Council) urging them to grant Truls a PhD scholarship!