Database and Alignment Plans

02-12-2020

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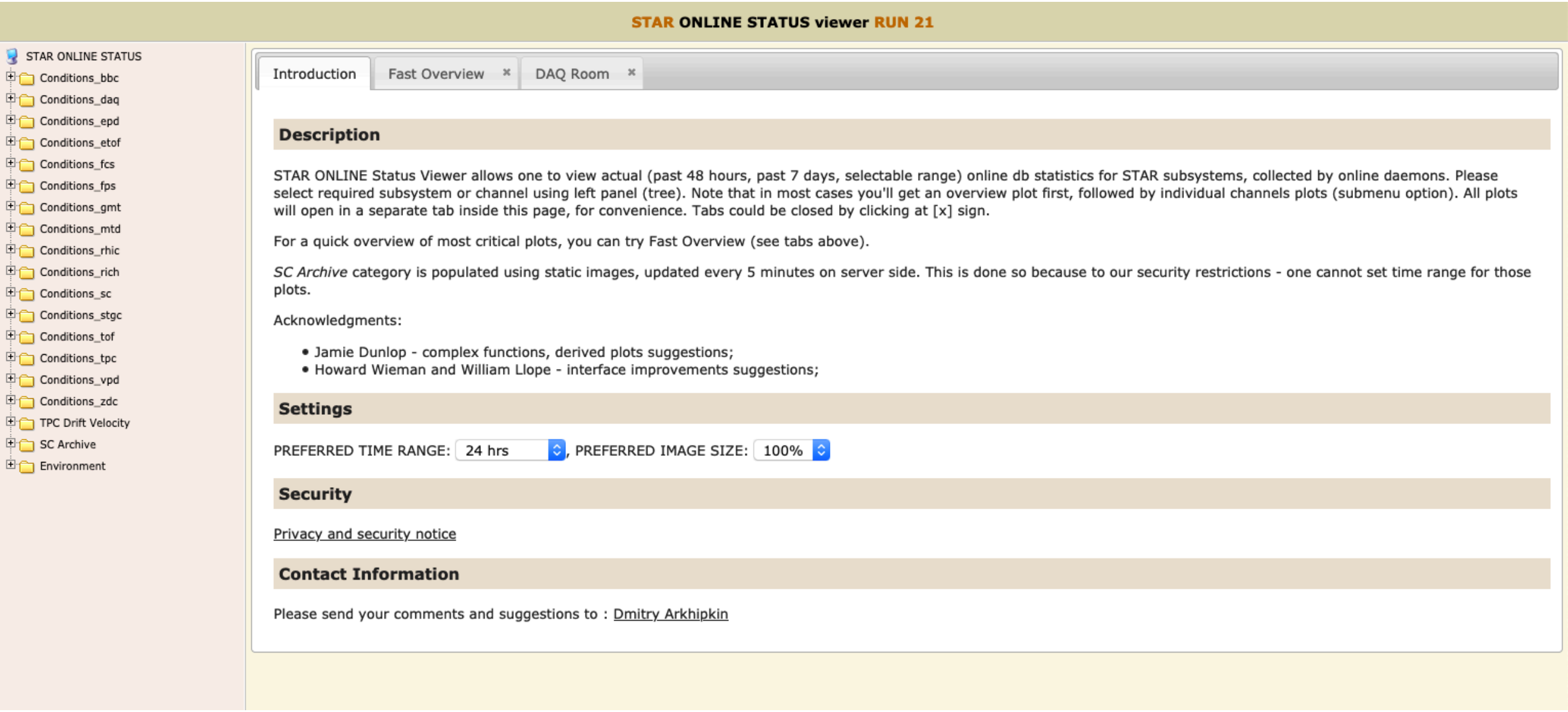
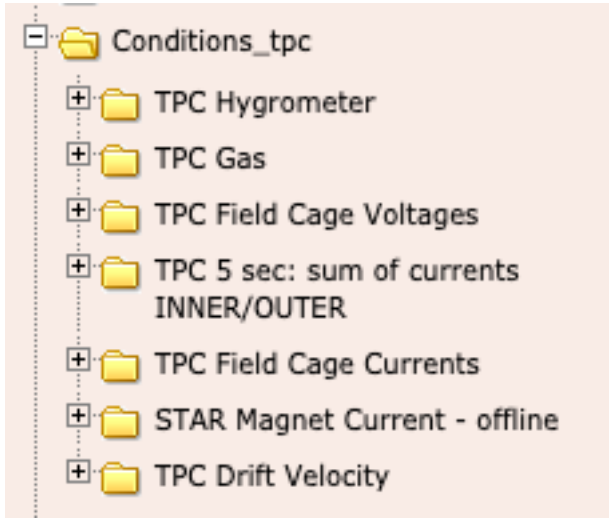
Online Database

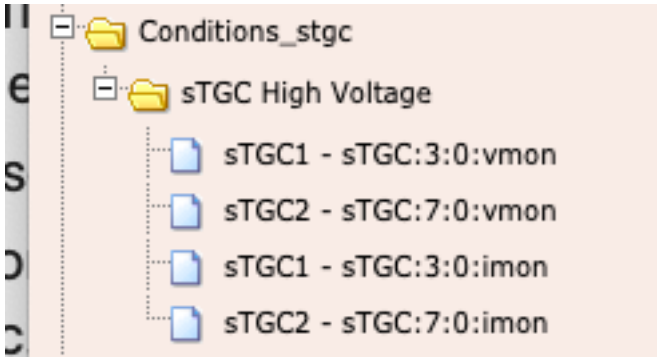


TPC example & Existing sTGC + FCS



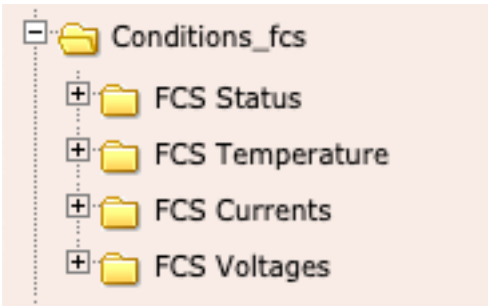
Electronics:
- TPC currents
- Voltages

Gas:
- TPC Gas (many flow meters and gas pressures)
- Hygrometer (Temp, dew point, humidity)



Electronics:
- Voltage
- Current

Gas:
- None yet



Electronics:
- Voltage
- Current
- Temperature
- LV status

What is needed

- FTT (sTGC)
  - Voltage, current, & gas (x4 modules x4 disks)
  - Flow meters or other global gas diagnostics
  - If I understand Jeff's framework, the will be saved here into online DB
  - Efficiency would be viewable in online DB or shift plots
  - Note TPC records drift velocity – a similarly computed value
  - Status flags
- FST
  - Nothing in Online DB yet
  - Voltages + Currents
  - Status flags?
- FCS : anything more is needed?

Offline Database

- Primary uses
  - Offline calibration & reconstruction parameters
  - Geometry maps

- I was involved with most of TOF and eTOF calibration procedures.

STAR DB Browser

Database structure : Calibrations_etof

Table Name	Last entryTime	Index Field(s)	Records
NodeRelation	2019-12-16 18:48:26	ParentID NodeID BranchID ConfigID	14
Nodes	2019-12-16 18:47:36	name versionKey	15
etofCalibParam	2021-02-01 13:36:20	nodeID elementID beginTime flavor deactive	11
etofDetResolution	2021-02-01 13:36:23	nodeID elementID beginTime flavor deactive	4
etofDigiSlewCorr	2021-02-01 13:36:25	nodeID elementID beginTime flavor deactive	6
etofDigiTimeCorr	2021-02-01 13:36:28	nodeID elementID beginTime flavor deactive	9
etofDigiTotCorr	2021-02-01 13:36:31	nodeID elementID beginTime flavor deactive	7
etofHitParam	2021-02-01 13:36:33	nodeID elementID beginTime flavor deactive	4
etofMatchParam	2021-02-01 13:36:37	nodeID elementID beginTime flavor deactive	6
etofPulserTimeDiffGbtx	2021-02-01 13:36:39	nodeID elementID beginTime flavor deactive	4
etofPulserTotPeak	2021-02-01 13:36:41	nodeID elementID beginTime flavor deactive	4
etofResetTimeCorr	2021-02-01 13:36:43	nodeID elementID beginTime flavor deactive	50
etofSignalVelocity	2021-02-01 13:36:44	nodeID elementID beginTime flavor deactive	4
etofSimEfficiency	2021-02-01 13:36:47	nodeID elementID beginTime flavor deactive	4
etofStatusMap	2021-02-01 13:36:50	nodeID elementID beginTime flavor deactive	5
etofTimingWindow	2021-02-01 13:36:52	nodeID elementID beginTime flavor deactive	7
schema	N/A		32
structure	2019-12-16 18:46:08	name ID	14

Database Pros / Cons

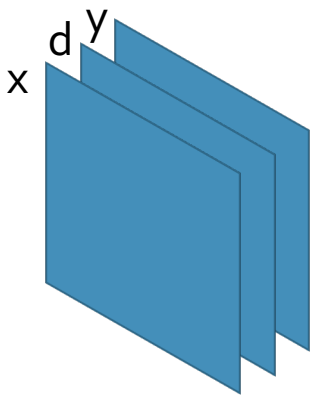
- Pros
  - Timestamped (history)
  - Can be modified
  - Provides authoritative information (single source)
  - Accessible outside RCF (in docker containers, PDSF etc.)
- Cons
  - Rigid schema (table structure) – hard to change
  - Not efficient for large data
  - Significant work to setup table
  - Tables must be updated for every year / Run (Species + energy, not “run”)

What should go in offline DB?

- Mapping tables if they are likely to change
- Status tables
  - Automate if possible
  - Fine granularity better – improves realisticness of simulation
- Calibration parameters
  - Computed geometry alignment variables
  - Computed time alignments
- Detailed simulation parameters for mirroring data
  - E.g. for sTGC we may have cluster parameters per (x,y,D)/module/disk
  - Parameters for realistic representation of signals from electronics (if their status changes due to gains, etc from one Run to next)
- Question for Tonko: Can DAQ PCs read from Online and/or Offline DB?

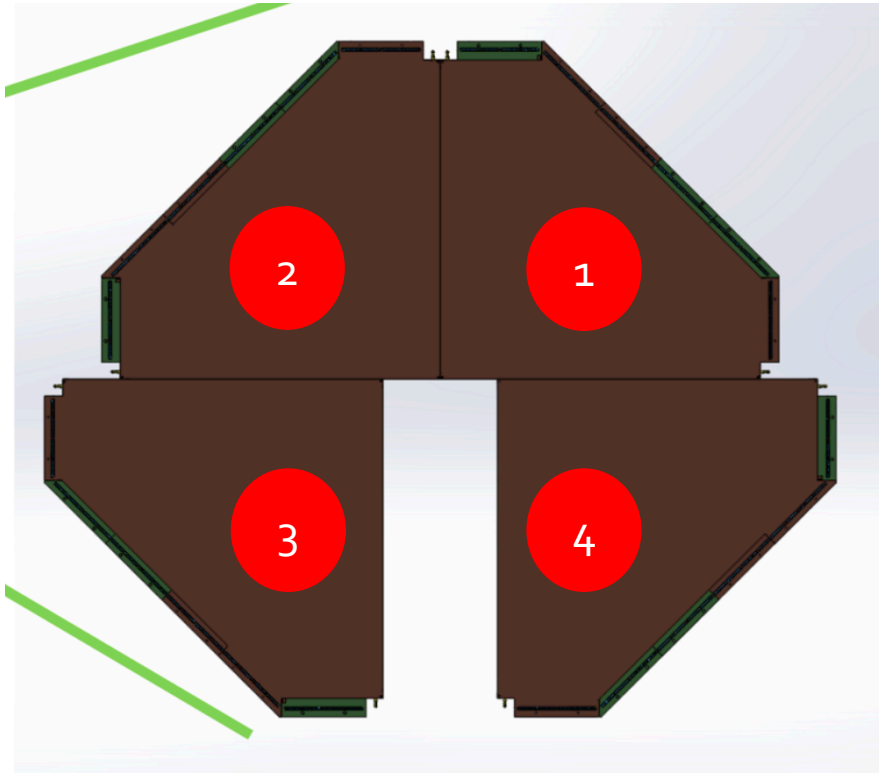
Preliminary Alignment Plan

- Precision alignment of forward systems
  - Combination of internal(local) + global alignments



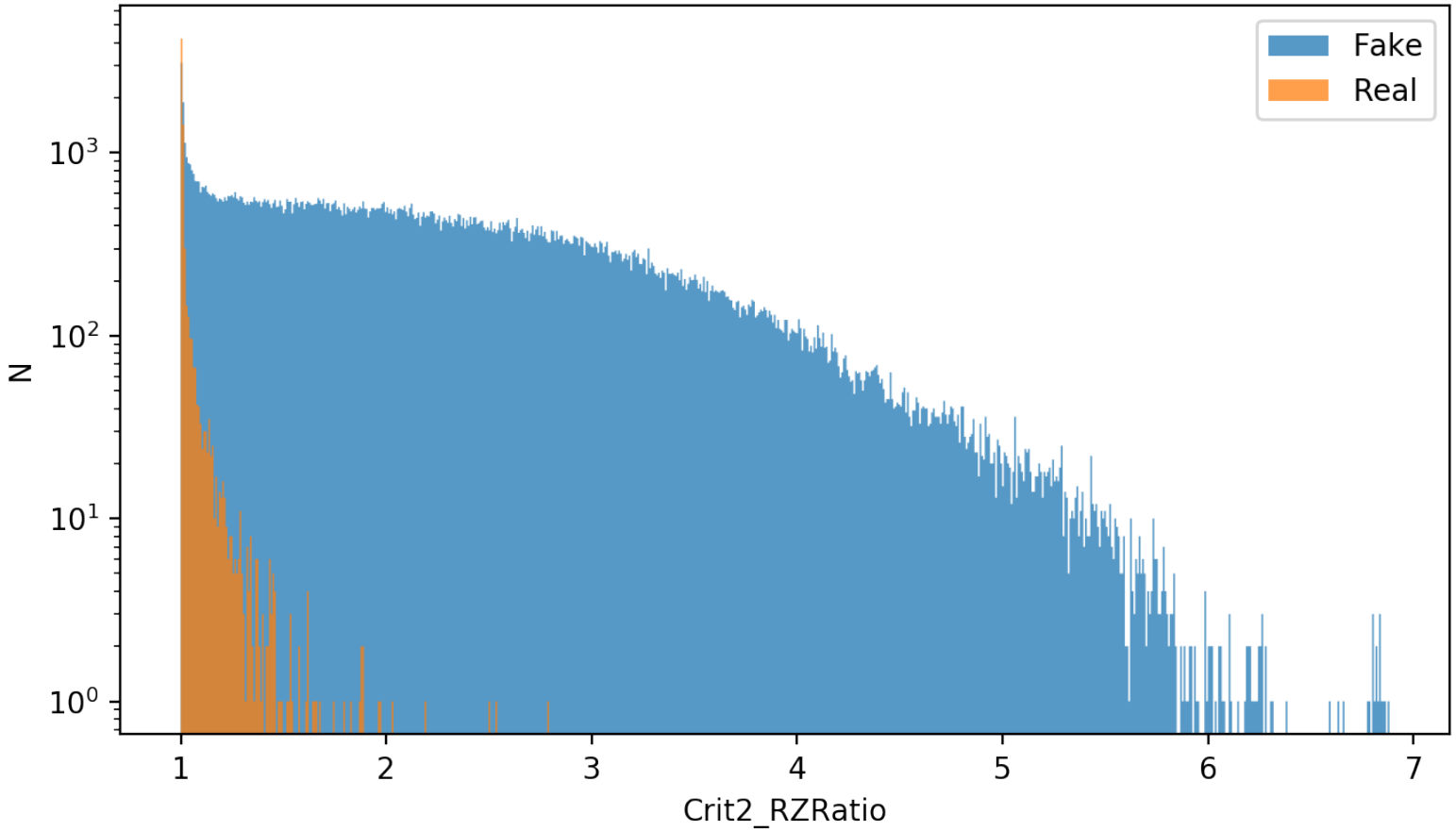
sTGC Example:

- Internal alignment
  - X / d / Y correspondence
  - Module to module :
    - Translation: dx, dy, (dz?)
    - Rotation : αz
- Global Alignment
  - Translation: dx, dy, dz
  - Rotation : $\alpha x, \alpha y$



Global Tracking Alignment

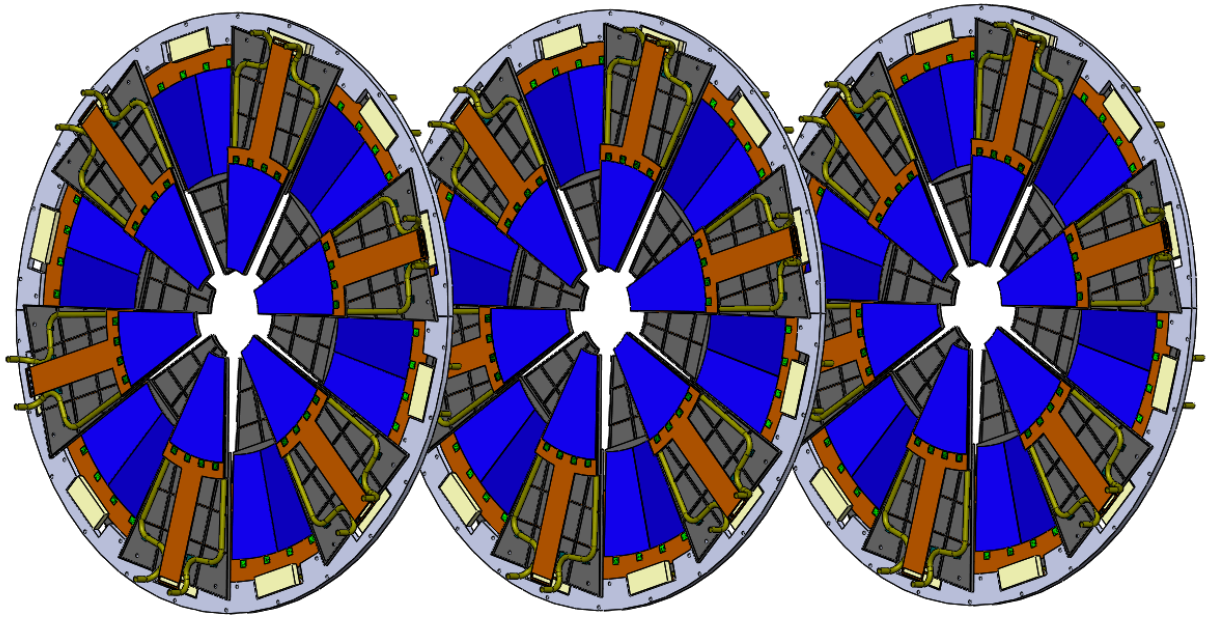
- sTGC global alignment can be determined **iteratively**
- Optimize on straight-line correspondence of hits (in $r - z$)
- sTGC to FST alignment will be challenging

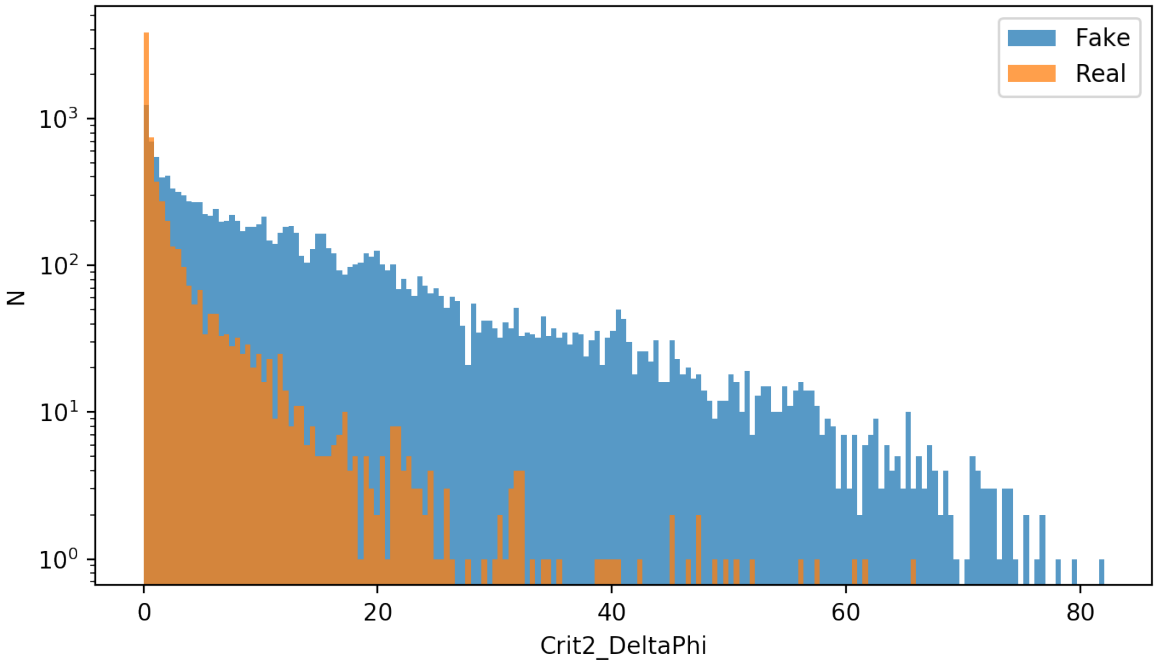


FST Alignment

- Internal alignment
  - Inner to outer sector
  - Translation: $dr\ d\phi$
  - Rotation: αz (local)
- Disk to disk & sTGC
  - Translations: dx, dy, dz
  - Rotations: $\alpha z, \alpha y, \alpha x$

- FST has precision $d\phi$ – optimize track seed Delta phi
- For both internal and global alignment





Alignment to FCS

- Use same technique as TPC track -> TOF matching
- Allow the FCS geometry to float (global translation)
- Project tracks to high quality clusters
  - Calculate dx, dy, dz from track projection vs. measured FCS position
- Iterative approach

Calibration dataset

- For tracking cosmic rays passing through FWD detectors would be ideal
- Important considerations
  - How to trigger on clean cosmics
  - Field on / field off
  - Statistics required for precision calibration
- Low multiplicity events may also be helpful
- Maybe use TPC + EPD/VPD/ZDC to select low mult events
- Calibrate tracking / FCS matching in these low mult events

Summary

- Online Database : For running / real-time parameters
  - Electronics: voltages, currents, status
  - Gas systems: Flow rates, pressures, etc.
  - Temperature and humidity
- Offline Database : For calibration, simulation, reconstruction
  - Each system will need a StXXXDbMaker
  - Setting up tables is involved (will cover at later time) so give thought to what should go into
  - Most necessary for things that change for each species / energy etc.
- Alignment
  - Geometry alignment through iterative procedure
  - Need cosmic / low mult data – think about trigger / event selection